Ο καταμερισμός της εργασίας

The Division of Labour

Ανθολογία από κλασικά κείμενα σε διάφορες γλώσσες για τις εργασίες σας

An anthology of classical texts in various languages for your essays

Βασισμένο στα/ Based on

Guang-Zhen Sun (ed.), *Readings in the Economics of the Division of Labor: The Classical Tradition,* World Scientific, Singapore, 2005.

Peter Grownewegen, "Division of Labour", *The New Palgrave*, 1987.

Karl Marx, *Das Kapital*, vol. 1, 1867

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Ξενοφῶντος Κύρου παιδεία

[4] ἐτίμα δὲ καὶ τῶν οἰκετῶν ἀπὸ τῆς τραπέζης ὁπότε τινὰ ἐπαινέσειε: καὶ τὸν πάντα δὲ σῖτον τῶν οἰκετῶν ἐπὶ τὴν αὐτοῦ τράπεζαν ἐπετίθετο, οἰόμενος ὥσπερ καὶ τοῖς κυσὶν ἐμποιεῖν τινα καὶ τοῦτο εὔνοιαν. εἰ δὲ καὶ θεραπεύεσθαί τινα βούλοιτο τῶν φίλων ὑπὸ πολλῶν, καὶ τούτοις ἔπεμπεν ἀπὸ τραπέζης: καὶ νῦν γὰρ ἔτι οἷς ἂν ὁρῶσι πεμπόμενα ἀπὸ τῆς βασιλέως τραπέζης, τούτους πάντες μᾶλλον θεραπεύουσι, νομίζοντες αὐτοὺς ἐντίμους εἶναι καὶ ἱκανοὺς διαπράττειν, ἤν τι δέωνται. ἔτι δὲ καὶ οὐ τούτων μόνον ἕνεκα τῶν εἰρημένων εὐφραίνει τὰ πεμπόμενα παρὰ βασιλέως, ἀλλὰ τῷ ὄντι καὶ ἡδονῇ πολὺ διαφέρει τὰ ἀπὸ τῆς βασιλέως τραπέζης.
[5] καὶ τοῦτο μέντοι οὕτως ἔχειν οὐδέν τι θαυμαστόν: ὥσπερ γὰρ καὶ αἱ ἄλλαι τέχναι διαφερόντως ἐν ταῖς μεγάλαις πόλεσιν ἐξειργασμέναι εἰσί, κατὰ τὸν αὐτὸν τρόπον καὶ τὰ παρὰ βασιλεῖ σῖτα πολὺ διαφερόντως ἐκπεπόνηται. ἐν μὲν γὰρ ταῖς μικραῖς πόλεσιν οἱ αὐτοὶ ποιοῦσι κλίνην, θύραν, ἄροτρον, τράπεζαν, πολλάκις δ' ὁ αὐτὸς οὗτος καὶ οἰκοδομεῖ, καὶ ἀγαπᾷ ἢν καὶ οὕτως ἱκανοὺς αὐτὸν τρέφειν ἐργοδότας λαμβάνῃ: ἀδύνατον οὖν πολλὰ τεχνώμενον ἄνθρωπον πάντα καλῶς ποιεῖν. ἐν δὲ ταῖς μεγάλαις πόλεσι διὰ τὸ πολλοὺς ἑκάστου δεῖσθαι ἀρκεῖ καὶ μία ἑκάστῳ τέχνη εἰς τὸ τρέφεσθαι: πολλάκις δὲ οὐδ' ὅλη μία: ἀλλ' ὑποδήματα ποιεῖ ὁ μὲν ἀνδρεῖα, ὁ δὲ γυναικεῖα: ἔστι δὲ ἔνθα καὶ ὑποδήματα ὁ μὲν νευρορραφῶν μόνον τρέφεται, ὁ δὲ σχίζων, ὁ δὲ χιτῶνας μόνον συντέμνων, ὁ δέ γε τούτων οὐδὲν ποιῶν ἀλλὰ συντιθεὶς ταῦτα. ἀνάγκη οὖν τὸν ἐν βραχυτάτῳ διατρίβοντα ἔργῳ τοῦτον καὶ ἄριστα δὴ ἠναγκάσθαι τοῦτο ποιεῖν.
[6] τὸ αὐτὸ δὲ τοῦτο πέπονθε καὶ τὰ ἀμφὶ τὴν δίαιταν. ᾧ μὲν γὰρ ὁ αὐτὸς κλίνην στρώννυσι, τράπεζαν κοσμεῖ, μάττει, ὄψα ἄλλοτε ἀλλοῖα ποιεῖ, ἀνάγκη οἶμαι τούτῳ, ὡς ἂν ἕκαστον προχωρῇ, οὕτως ἔχειν: ὅπου δὲ ἱκανὸν ἔργον ἑνὶ ἕψειν κρέα, ἄλλῳ ὀπτᾶν, ἄλλῳ δὲ ἰχθὺν ἕψειν, ἄλλῳ ὀπτᾶν, ἄλλῳ ἄρτους ποιεῖν, καὶ μηδὲ τούτους παντοδαπούς, ἀλλ' ἀρκεῖ ἂν ἓν εἶδος εὐδοκιμοῦν παρέχῃ, ἀνάγκη οἶμαι καὶ ταῦτα οὕτω ποιούμενα πολὺ διαφερόντως ἐξειργάσθαι ἕκαστον.

Xenophon, *Cyropaedia*, 8.2.4-6

[4] He used also to honour with presents from his table any one of his servants whom he took occasion to commend; and he had all of his servants' food served from his own table, for he thought that this would implant in them a certain amount of good-will, just as it does in dogs. And if he wished to have any one of his friends courted by the multitude, to such a one he would send presents from his table. And that device proved effective; for even to this day everybody pays more diligent court to those to whom they see things sent from the royal table; for they think that such persons must be in high favour and in a position to secure for them anything they may want. Moreover, it is not for these reasons only that that which is sent by the king gives delight, but the food that is sent from the king's board really is much superior in the gratification also that it gives.
[5] That this, however, should be so is no marvel. For just as all other arts are developed to superior excellence in large cities, in that same way the food at the king's palace is also elaborately prepared with superior excellence. For in small towns the same workman makes chairs and doors and plows and tables, and often this same artisan builds houses, and even so he is thankful if he can only find employment enough to support him. And it is, of course, impossible for a man of many trades to be proficient in all of them. In large cities, on the other hand, inasmuch as many people

have demands to make upon each branch of industry, one trade alone, and very often even less than a whole trade, is enough to support a man: one man, for instance, makes shoes for men, and another for women; and there are places even where one man earns a living by only stitching shoes, another by cutting them out, another by sewing the uppers together, while there is another who performs none of these operations but only assembles the parts. It follows, therefore, as a matter of course, that he who devotes himself to a very highly specialized line of work is bound to do it in the best possible manner.

[6] Exactly the same thing holds true also in reference to the kitchen: in any establishment where one and the same man arranges the dining couches, lays the table, bakes the bread, prepares now one sort of dish and now another, he must necessarily have things go as they may; but where it is all one man can do to stew meats and another to roast them, for one man to boil fish and another to bake them, for another to make bread and not every sort at that, but where it suffices if he makes one kind that has a high reputation—everything that is prepared in such a kitchen will, I think, necessarily be worked out with superior excellence.

Xenophon. *Xenophon in Seven Volumes*, 5 and 6. Walter Miller. Harvard University Press, Cambridge, MA; William Heinemann, Ltd., London. 1914.

Ξενοφών, Οικονομικός 7.10-43

Ξενοφῶντος Οἰκονομικὸς

[10] καὶ ὁ Ἰσχόμαχος ἀπεκρίνατο: τί δ'; ἔφη, ὦ Σώκρατες, ἐπεὶ ἤδη μοι χειροήθης ἦν καὶ ἐτετιθάσευτο ὥστε διαλέγεσθαι, ἠρόμην αὐτὴν ὧδέ πως: εἰπέ μοι, ὦ γύναι, ἆρα ἤδη κατενόησας τίνος ποτὲ ἕνεκα ἐγώ τε σὲ ἔλαβον καὶ οἱ σοὶ γονεῖς ἔδοσάν σε ἐμοί; [11] ὅτι μὲν γὰρ οὐκ ἀπορία ἦν μεθ' ὅτου ἄλλου ἐκαθεύδομεν ἄν, οἶδ' ὅτι καὶ σοὶ καταφανὲς τοῦτ' ἐστί. βουλευόμενος δ' ἔγωγε ὑπὲρ ἐμοῦ καὶ οἱ σοὶ γονεῖς ὑπὲρ σοῦ τίν' ἂν κοινωνὸν βέλτιστον οἴκου τε καὶ τέκνων λάβοιμεν, ἐγώ τε σὲ ἐξελεξάμην καὶ οἱ σοὶ γονεῖς, ὡς ἐοίκασιν, ἐκ τῶν δυνατῶν ἐμέ. [12] τέκνα μὲν οὖν ἂν θεός ποτε διδῷ ἡμῖν γενέσθαι, τότε βουλευσόμεθα περὶ αὐτῶν ὅπως ὅτι βέλτιστα παιδεύσομεν αὐτά: κοινὸν γὰρ ἡμῖν καὶ τοῦτο ἀγαθόν, συμμάχων καὶ γηροβοσκῶν ὅτι βελτίστων τυγχάνειν: [13] νῦν δὲ δὴ οἶκος ἡμῖν ὅδε κοινός ἐστιν. ἐγώ τε γὰρ ὅσα μοι ἔστιν ἅπαντα εἰς τὸ κοινὸν ἀποφαίνω, σύ τε ὅσα ἠνέγκω πάντα εἰς τὸ κοινὸν κατέθηκας. καὶ οὐ τοῦτο δεῖ λογίζεσθαι, πότερος ἄρα ἀριθμῷ πλείω συμβέβληται ἡμῶν, ἀλλ' ἐκεῖνο εὖ εἰδέναι, ὅτι ὁπότερος ἂν ἡμῶν βελτίων κοινωνὸς ᾖ, οὗτος τὰ πλείονος ἄξια συμβάλλεται. [14] ἀπεκρίνατο δέ μοι, ὦ Σώκρατες, πρὸς ταῦτα ἡ γυνή: τί δ' ἂν ἐγώ σοι, ἔφη, δυναίμην συμπρᾶξαι; τίς δὲ ἡ ἐμὴ δύναμις; ἀλλ' ἐν σοὶ πάντα ἐστίν: ἐμὸν δ' ἔφησεν ἡ μήτηρ ἔργον εἶναι σωφρονεῖν. [15] ναὶ μὰ Δί', ἔφην ἐγώ, ὦ γύναι, καὶ γὰρ ἐμοὶ ὁ πατήρ. ἀλλὰ σωφρόνων τοί ἐστι καὶ ἀνδρὸς καὶ γυναικὸς οὕτω ποιεῖν, ὅπως τά τε ὄντα ὡς βέλτιστα ἕξει καὶ ἄλλα ὅτι πλεῖστα ἐκ τοῦ καλοῦ τε καὶ δικαίου προσγενήσεται. [16] καὶ τί δή, ἔφη, ὁρᾷς, ἡ γυνή, ὅ τι ἂν ἐγὼ ποιοῦσα συναύξοιμι τὸν οἶκον; ναὶ μὰ Δί', ἔφην ἐγώ, ἅ τε οἱ θεοὶ ἔφυσάν σε δύνασθαι καὶ ὁ νόμος συνεπαινεῖ, ταῦτα πειρῶ ὡς βέλτιστα ποιεῖν. [17] καὶ τί δὴ ταῦτ' ἐστιν; ἔφη ἐκείνη. οἶμαι μὲν ἔγωγε, ἔφην, οὐ τὰ ἐλαχίστου ἄξια, εἰ μή πέρ γε καὶ ἡ ἐν τῷ σμήνει ἡγεμὼν μέλιττα ἐπ' ἐλαχίστου ἀξίοις ἔργοις ἐφέστηκεν. [18] ἐμοὶ γάρ τοι, ἔφη φάναι, καὶ οἱ θεοί, ὦ γύναι, δοκοῦσι πολὺ διεσκεμμένως μάλιστα τὸ ζεῦγος τοῦτο συντεθεικέναι ὃ καλεῖται θῆλυ καὶ ἄρρεν, ὅπως ὅτι ὠφελιμώτατον ᾖ αὐτῷ εἰς τὴν κοινωνίαν. [19] πρῶτον μὲν γὰρ τοῦ μὴ ἐκλιπεῖν ζῴων γένη τοῦτο τὸ ζεῦγος κεῖται μετ' ἀλλήλων τεκνοποιούμενον, ἔπειτα τὸ γηροβοσκοὺς κεκτῆσθαι ἑαυτοῖς ἐκ τούτου τοῦ ζεύγους τοῖς γοῦν ἀνθρώποις πορίζεται: ἔπειτα δὲ καὶ ἡ δίαιτα τοῖς ἀνθρώποις οὐχ ὥσπερ τοῖς κτήνεσίν ἐστιν ἐν ὑπαίθρῳ, ἀλλὰ στεγῶν δεῖται δῆλον ὅτι. [20] δεῖ μέντοι τοῖς μέλλουσιν ἀνθρώποις ἕξειν ὅ τι εἰσφέρωσιν εἰς τὸ στεγνὸν τοῦ ἐργασομένου τὰς ἐν τῷ ὑπαίθρῳ ἐργασίας. καὶ γὰρ νεατὸς καὶ σπόρος καὶ φυτεία καὶ νομαὶ ὑπαίθρια ταῦτα πάντα ἔργα ἐστίν: ἐκ τούτων δὲ τὰ ἐπιτήδεια γίγνεται. [21] δεῖ δ' αὖ, ἐπειδὰν ταῦτα εἰσενεχθῇ εἰς τὸ στεγνόν, καὶ τοῦ σώσοντος ταῦτα καὶ τοῦ ἐργασομένου δ' ἃ τῶν στεγνῶν ἔργα δεόμενά ἐστι. στεγνῶν δὲ δεῖται καὶ ἡ τῶν νεογνῶν τέκνων παιδοτροφία, στεγνῶν δὲ καὶ αἱ ἐκ τοῦ καρποῦ σιτοποιίαι δέονται: ὡσαύτως δὲ καὶ ἡ τῆς ἐσθῆτος ἐκ τῶν ἐρίων ἐργασία. [22] ἐπεὶ δ' ἀμφότερα ταῦτα καὶ ἔργων καὶ ἐπιμελείας δεῖται τά τε ἔνδον καὶ τὰ ἔξω, καὶ τὴν φύσιν, φάναι, εὐθὺς παρεσκεύασεν ὁ θεός, ὡς ἐμοὶ δοκεῖ, τὴν μὲν τῆς γυναικὸς ἐπὶ τὰ ἔνδον ἔργα καὶ ἐπιμελήματα, ‹τὴν δὲ τοῦ ἀνδρὸς ἐπὶ τὰ ἔξω›. [23] ῥίγη μὲν γὰρ καὶ θάλπη καὶ ὁδοιπορίας καὶ στρατείας τοῦ ἀνδρὸς τὸ σῶμα καὶ τὴν ψυχὴν μᾶλλον δύνασθαι καρτερεῖν κατεσκεύασεν: ὥστε τὰ ἔξω ἐπέταξεν αὐτῷ ἔργα: τῇ δὲ γυναικὶ ἧττον τὸ σῶμα δυνατὸν πρὸς ταῦτα φύσας τὰ ἔνδον ἔργα αὐτῇ, φάναι ἔφη, προστάξαι μοι δοκεῖ ὁ θεός. [24] εἰδὼς δὲ ὅτι τῇ γυναικὶ καὶ ἐνέφυσε καὶ προσέταξε τὴν τῶν νεογνῶν τέκνων τροφήν, καὶ τοῦ στέργειν τὰ νεογνὰ βρέφη πλέον αὐτῇ ἐδάσατο ἢ τῷ ἀνδρί. [25] ἐπεὶ δὲ καὶ τὸ φυλάττειν τὰ εἰσενεχθέντα τῇ γυναικὶ προσέταξε, γιγνώσκων ὁ θεὸς ὅτι πρὸς τὸ φυλάττειν οὐ κάκιόν ἐστι φοβερὰν εἶναι τὴν ψυχὴν πλέον μέρος καὶ τοῦ φόβου ἐδάσατο τῇ γυναικὶ ἢ τῷ ἀνδρί. εἰδὼς δὲ ὅτι καὶ ἀρήγειν αὖ δεήσει, ἐάν τις ἀδικῇ, τὸν τὰ ἔξω ἔργα ἔχοντα, τούτῳ αὖ πλέον μέρος τοῦ θράσους ἐδάσατο. [26] ὅτι δ' ἀμφοτέρους δεῖ καὶ διδόναι καὶ λαμβάνειν, τὴν μνήμην καὶ τὴν ἐπιμέλειαν εἰς τὸ μέσον ἀμφοτέροις κατέθηκεν. ὥστε οὐκ ἂν ἔχοις διελεῖν πότερα τὸ ἔθνος τὸ θῆλυ ἢ τὸ ἄρρεν τούτων πλεονεκτεῖ. [27] καὶ τὸ ἐγκρατεῖς δὲ εἶναι ὧν δεῖ εἰς τὸ μέσον ἀμφοτέροις κατέθηκε, καὶ ἐξουσίαν ἐποίησεν ὁ θεὸς ὁπότερος ἂν ᾖ βελτίων, εἴθ' ὁ ἀνὴρ εἴθ' ἡ γυνή, τοῦτον καὶ πλέον φέρεσθαι τούτου τοῦ ἀγαθοῦ. [28] διὰ δὲ τὸ τὴν φύσιν μὴ πρὸς πάντα ταὐτὰ ἀμφοτέρων εὖ πεφυκέναι, διὰ τοῦτο καὶ δέονται μᾶλλον ἀλλήλων καὶ τὸ ζεῦγος ὠφελιμώτερον ἑαυτῷ γεγένηται, ἃ τὸ ἕτερον

ἐλλείπεται τὸ ἕτερον δυνάμενον. [29] ταῦτα δέ, ἔφην, δεῖ ἡμᾶς, ὦ γύναι, εἰδότας, ἃ ἑκατέρῳ ἡμῶν προστέτακται ὑπὸ τοῦ θεοῦ, πειρᾶσθαι ὅπως ὡς βέλτιστα τὰ προσήκοντα ἑκάτερον ἡμῶν διαπράττεσθαι. [30] συνεπαινεῖ δέ, ἔφη φάναι, καὶ ὁ νόμος αὐτά, συζευγνὺς ἄνδρα καὶ γυναῖκα: καὶ κοινωνοὺς ὥσπερ τῶν τέκνων ὁ θεὸς ἐποίησεν, οὕτω καὶ ὁ νόμος ‹τοῦ οἴκου› κοινωνοὺς καθίστησι. καὶ καλὰ δὲ εἶναι ὁ νόμος ἀποδείκνυσιν ‹ἃ› καὶ ὁ θεὸς ἔφυσεν ἑκάτερον μᾶλλον δύνασθαι. τῇ μὲν γὰρ γυναικὶ κάλλιον ἔνδον μένειν ἢ θυραυλεῖν, τῷ δὲ ἀνδρὶ αἴσχιον ἔνδον μένειν ἢ τῶν ἔξω ἐπιμελεῖσθαι. [31] εἰ δέ τις παρ᾽ ἃ ὁ θεὸς ἔφυσε ποιεῖ, ἴσως τι καὶ ἀτακτῶν τοὺς θεοὺς οὐ λήθει καὶ δίκην δίδωσιν ἀμελῶν τῶν ἔργων τῶν ἑαυτοῦ ἢ πράττων τὰ τῆς γυναικὸς ἔργα. [32] δοκεῖ δέ μοι, ἔφην, καὶ ἡ τῶν μελιττῶν ἡγεμὼν τοιαῦτα ἔργα ὑπὸ τοῦ θεοῦ προστεταγμένα διαπονεῖσθαι. καὶ ποῖα δή, ἔφη ἐκείνη, ἔργα ἔχουσα ἡ τῶν μελιττῶν ἡγεμὼν ἐξομοιοῦται τοῖς ἔργοις οἷς ἐμὲ δεῖ πράττειν; [33] ὅτι, ἔφην ἐγώ, ἐκείνη γε ἐν τῷ σμήνει μένουσα οὐκ ἐᾷ ἀργοὺς τὰς μελίττας εἶναι, ἀλλ᾽ ἃς μὲν δεῖ ἔξω ἐργάζεσθαι ἐκπέμπει ἐπὶ τὸ ἔργον, καὶ ἃ ἂν αὐτῶν ἑκάστη εἰσφέρῃ οἶδέ τε καὶ δέχεται, καὶ σῴζει ταῦτα ἔστ᾽ ἂν δέῃ χρῆσθαι. ἐπειδὰν δὲ ἡ ὥρα τοῦ χρῆσθαι ἥκῃ, διανέμει τὸ δίκαιον ἑκάστῃ. [34] καὶ ἐπὶ τοῖς ἔνδον δ᾽ ἐξυφαινομένοις κηρίοις ἐφέστηκεν, ὡς καλῶς καὶ ταχέως ὑφαίνηται, καὶ τοῦ γιγνομένου τόκου ἐπιμελεῖται ὡς ἐκτρέφηται: ἐπειδὰν δὲ ἐκτραφῇ καὶ ἀξιοεργοὶ οἱ νεοττοὶ γένωνται, ἀποικίζει αὐτοὺς σὺν τῶν ἐπιγόνων τινὶ ἡγεμόνι. [35] ᾗ καὶ ἐμὲ οὖν, ἔφη ἡ γυνή, δεήσει ταῦτα ποιεῖν; δεήσει μέντοι σε, ἔφην ἐγώ, ἔνδον τε μένειν καὶ οἷς μὲν ἂν ἔξω τὸ ἔργον ᾖ τῶν οἰκετῶν, τούτους συνεκπέμπειν, οἷς δ᾽ ἂν ἔνδον ἔργον ἐργαστέον, [36] τούτων σοι ἐπιστατητέον, καὶ τά τε εἰσφερόμενα ἀποδεκτέον καὶ ἃ μὲν ἂν αὐτῶν δέῃ δαπανᾶν σοὶ διανεμητέον, ἃ δ᾽ ἂν περιττεύειν δέῃ, προνοητέον καὶ φυλακτέον ὅπως μὴ ἡ εἰς τὸν ἐνιαυτὸν κειμένη δαπάνη εἰς τὸν μῆνα δαπανᾶται. καὶ ὅταν ἔρια εἰσενεχθῇ σοι, ἐπιμελητέον ὅπως οἷς δεῖ ἱμάτια γίγνηται. καὶ ὅ γε ξηρὸς σῖτος ὅπως καλῶς ἐδώδιμος γίγνηται ἐπιμελητέον. [37] ἓν μέντοι τῶν σοὶ προσηκόντων, ἔφην ἐγώ, ἐπιμελημάτων ἴσως ἀχαριστότερον δόξει εἶναι, ὅτι, ὃς ἂν κάμνῃ τῶν οἰκετῶν, τούτων σοι ἐπιμελητέον πάντων ὅπως θεραπεύηται. νὴ Δί᾽, ἔφη ἡ γυνή, ἐπιχαριτώτατον μὲν οὖν, ἂν μέλλωσί γε οἱ καλῶς θεραπευθέντες χάριν εἴσεσθαι καὶ εὐνούστεροι ἢ πρόσθεν ἔσεσθαι. [38] καὶ ἐγώ, ἔφη ὁ Ἰσχόμαχος, ἀγασθεὶς αὐτῆς τὴν ἀπόκρισιν εἶπον: ἆρά γε, ὦ γύναι, διὰ τοιαύτας τινὰς προνοίας καὶ τῆς ἐν τῷ σμήνει ἡγεμόνος αἱ μέλιτται οὕτω διατίθενται πρὸς αὐτήν, ὥστε, ὅταν ἐκείνη ἐκλίπῃ, οὐδεμία οἴεται τῶν μελιττῶν ἀπολειπτέον εἶναι, ἀλλ᾽ ἕπονται πᾶσαι; [39] καὶ ἡ γυνή μοι ἀπεκρίνατο: θαυμάζοιμ᾽ ἄν, ἔφη, εἰ μὴ πρὸς σὲ μᾶλλον τείνοι τὰ τοῦ ἡγεμόνος ἔργα ἢ πρὸς ἐμέ. ἡ γὰρ ἐμὴ φυλακὴ τῶν ἔνδον καὶ διανομὴ γελοία τις ἄν, οἶμαι, φαίνοιτο, εἰ μὴ σύγε ἐπιμελοῖο ὅπως ἔξωθέν τι εἰσφέροιτο. [40] γελοία δ᾽ αὖ, ἔφην ἐγώ, ἡ ἐμὴ εἰσφορὰ φαίνοιτ᾽ ἄν, εἰ μὴ εἴη ὅστις τὰ εἰσενεχθέντα σῴζοι. οὐχ ὁρᾷς, ἔφην ἐγώ, οἱ εἰς τὸν τετρημένον πίθον ἀντλεῖν λεγόμενοι ὡς οἰκτίρονται, ὅτι μάτην πονεῖν δοκοῦσι; νὴ Δί᾽, ἔφη ἡ γυνή, καὶ γὰρ τλήμονές εἰσιν, εἰ τοῦτό γε ποιοῦσιν. [41] ἄλλαι δέ τοι, ἔφην ἐγώ, ἴδιαι ἐπιμέλειαι, ὦ γύναι, ἡδεῖαί σοι γίγνονται, ὁπόταν ἀνεπιστήμονα ταλασίας λαβοῦσα ἐπιστήμονα ποιήσῃς καὶ διπλασίου σοι ἀξία γένηται, καὶ ὁπόταν ἀνεπιστήμονα ταμιείας καὶ διακονίας παραλαβοῦσα ἐπιστήμονα καὶ πιστὴν καὶ διακονικὴν ποιησαμένη παντὸς ἀξίαν ἔχῃς, καὶ ὁπόταν τοὺς μὲν σώφρονάς τε καὶ ὠφελίμους τῷ σῷ οἴκῳ ἐξῇ σοι εὖ ποιῆσαι, ἐὰν δέ τις πονηρὸς φαίνηται, ἐξῇ σοι κολάσαι: [42] τὸ δὲ πάντων ἥδιστον, ἐὰν βελτίων ἐμοῦ φανῇς, καὶ ἐμὲ σὸν θεράποντα ποιήσῃ, καὶ μὴ δέῃ σε φοβεῖσθαι μὴ προϊούσης τῆς ἡλικίας ἀτιμοτέρα ἐν τῷ οἴκῳ γένῃ, ἀλλὰ πιστεύῃς ὅτι πρεσβυτέρα γιγνομένη ὅσῳ ἂν καὶ ἐμοὶ κοινωνὸς καὶ παισὶν οἴκου φύλαξ ἀμείνων γίγνῃ, τοσούτῳ καὶ τιμιωτέρα ἐν τῷ οἴκῳ ἔσει. [43] τὰ γὰρ καλά τε κἀγαθά, ἐγὼ ἔφην, οὐ διὰ τὰς ὡραιότητας, ἀλλὰ διὰ τὰς ἀρετὰς εἰς τὸν βίον τοῖς ἀνθρώποις ἐπαύξεται. τοιαῦτα μέν, ὦ Σώκρατες, δοκῶ μεμνῆσθαι αὐτῇ τὰ πρῶτα διαλεχθείς.

Oeconomicus, 7.10-43.

[10] “‘Well, Socrates, as soon as I found her docile and sufficiently domesticated to carry on conversation, I questioned her to this effect:

“‘“‘Tell me, dear, have you realised for what reason I took you and your parents gave you to me? [11] For it is obvious to you, I am sure, that we should have had no difficulty in finding someone else to share our beds. But I for myself and your parents for you considered who was the best partner of home and children that we could get. My choice fell on you, and your parents, it appears, chose me as the best they could find. [12] Now if God grants us children, we will then think out how we shall best train them. For one of the blessings in which we shall share is the acquisition of the very best of allies and the very best of support in old age; but at present we share in this our home. [13] For I am paying into the common stock all that I have, and you have put in all that you brought with you. And we are not to reckon up which of us has actually contributed the greater amount, but we should know of a surety that the one who proves the better partner makes the more valuable contribution.” [14]

“‘My wife's answer was as follows, Socrates: “How can I possibly help you? What power have I? Nay, all depends on you. My duty, as my mother told me, is to be discreet.”
[15] “‘“‘Yes, of course, dear,” I said, “my father said the same to me. But discretion both in a man and a woman, means acting in such a manner that their possessions shall be in the best condition possible, and that as much as possible shall be added to them by fair and honourable means.”
[16] “‘“‘And what do you see that I can possibly do to help in the improvement of our property?” asked my wife.

“‘“‘Why,” said I, “of course you must try to do as well as possible what the gods made you capable of doing and the law sanctions.”

“‘“‘And pray, what is that?” said she.

[17] “‘“‘Things of no small moment, I fancy,” replied I, “unless, indeed, the tasks over which the queen bee in the hive presides are of small moment. [18] For it seems to me, dear, that the gods with great discernment have coupled together male and female, as they are called, chiefly in order that they may form a perfect partnership in mutual service. [19] For, in the first place, that the various species of living creatures may not fail, they are joined in wedlock for the production of children. Secondly, offspring to support them in old age is provided by this union, to human beings, at any rate. Thirdly, human beings live not in the open air, like beasts, but obviously need shelter. [20] Nevertheless, those who mean to win store to fill the covered place, have need of someone to work at the open-air occupations; since ploughing, sowing, planting and grazing are all such open-air employments; and these supply the needful food. [21] Then again, as soon as this is stored in the covered place, then there is need of someone to keep it and to work at the things that must be done under cover. Cover is needed for the nursing of the infants; cover is needed for the making of the corn into bread, and likewise for the manufacture of clothes from the wool. [22] And since both the indoor and the outdoor tasks demand labour and attention, God from the first adapted the woman's nature, I think, to the indoor and man's to the outdoor tasks and cares.

[23] “‘‘‘For he made the man's body and mind more capable of enduring cold and heat, and journeys and campaigns; and therefore imposed on him the outdoor tasks. To the woman, since he has made her body less capable of such endurance, I take it that God has assigned the indoor tasks. [24] And knowing that he had created in the woman and had imposed on her the nourishment of the infants, he meted out to her a larger portion of affection for new-born babes than to the man. [25] And since he imposed on the woman the protection of the stores also, knowing that for protection a fearful disposition is no disadvantage, God meted out a larger share of fear to the woman than to the man; and knowing that he who deals with the outdoor tasks will have to be their defender against any wrong-doer, he meted out to him again a larger share of courage. [26] But because both must give and take, he granted to both impartially memory and attention; and so you could not distinguish whether the male or the female sex has the larger share of these. [27] And God also gave to both impartially the power to practise due self-control, and gave authority to whichever is the better—whether it be the man or the woman—to win a larger portion of the good that comes from it. [28] And just because both have not the same aptitudes, they have the more need of each other, and each member of the pair is the more useful to the other, the one being competent where the other is deficient.

[29] “‘‘‘Now since we know, dear, what duties have been assigned to each of us by God, we must endeavour, each of us, to do the duties allotted to us as well as possible. [30] The law, moreover, approves of them, for it joins together man and woman. And as God has made them partners in their children, so the law appoints them partners in the home. And besides, the law declares those tasks to be honourable for each of them wherein God has made the one to excel the other. Thus, to be woman it is more honourable to stay indoors than to abide in the fields, but to the man it is unseemly rather to stay indoors than to attend to the work outside. [31] If a man acts contrary to the nature God has given him, possibly his defiance is detected by the gods and he is punished for neglecting his own work, or meddling with his wife's. [32] I think that the queen bee is busy about just such other tasks appointed by God.”1

“‘‘‘And pray,” said she, “how do the queen bee's tasks resemble those that I have to do?”

[33] “‘‘‘How? she stays in the hive,” I answered, “and does not suffer the bees to be idle; but those whose duty it is to work outside she sends forth to their work; and whatever each of them brings in, she knows and receives it, and keeps it till it is wanted. And when the time is come to use it, she portions out the just share to each. [34] She likewise presides over the weaving of the combs in the hive, that they may be well and quickly woven, and cares for the brood of little ones, that it be duly reared up. And when the young bees have been duly reared and are fit for work, she sends them forth to found a colony, with a leader to guide the young adventurers.” [35]

“‘‘‘Then shall I too have to do these things?” said my wife.

“‘‘‘Indeed you will,” said I; “your duty will be to remain indoors and send out those servants whose work is outside, and superintend those who are to work indoors, and to receive the incomings, [36] and distribute so much of them as must be spent, and watch over so much as is to be kept in store, and take care that the sum laid by for a

year be not spent in a month. And when wool is brought to you, you must see that cloaks are made for those that want them. You must see too that the dry corn is in good condition for making food. [37] One of the duties that fall to you, however, will perhaps seem rather thankless: you will have to see that any servant who is ill is cared for."

"""'Oh no," cried my wife, "it will be delightful, assuming that those who are well cared for are going to feel grateful and be more loyal than before." [38]

"""'Why, my dear," cried I, delighted with her answer, "what makes the bees so devoted to their leader in the hive, that when she forsakes it, they all follow her, and not one thinks of staying behind? Is it not the result of some such thoughtful acts on her part?"

[39] """'It would surprise me," answered my wife, "if the leader's activities did not concern you more than me. For my care of the goods indoors and my management would look rather ridiculous, I fancy, if you did not see that something is gathered in from outside."

[40] """'And my ingathering would look ridiculous," I countered, "if there were not someone to keep what is gathered in. Don't you see how they who 'draw water in a leaky jar,' as the saying goes, are pitied, because they seem to labour in vain?"

"""'Of course," she said, "for they are indeed in a miserable plight if they do that."

[41] """'But I assure you, dear, there are other duties peculiar to you that are pleasant to perform. It is delightful to teach spinning to a maid who had no knowledge of it when you received her, and to double her worth to you: to take in hand a girl who is ignorant of housekeeping and service, and after teaching her and making her trustworthy and serviceable to find her worth any amount: to have the power of rewarding the discreet and useful members of your household, and of punishing anyone who turns out to be a rogue. [42] But the pleasantest experience of all is to prove yourself better than I am, to make me your servant; and, so far from having cause to fear that as you grow older you may be less honoured in the household, to feel confident that with advancing years, the better partner you prove to me and the better housewife to our children, the greater will be the honour paid to you in our home. [43] For it is not through outward comeliness that the sum of things good and beautiful is increased in the world, but by the daily practice of the virtues."

"'Such was the tenor of my earliest talks with her, Socrates, so far as I can recall them.'"

Xenophon. *Xenophon in Seven Volumes,* 4. Harvard University Press, Cambridge, MA; William Heinemann, Ltd., London. 1979.

Πλάτων (429–347 π.Χ)
Πολιτεία

Πλάτωνος Πολιτεία 369b-374e

369b]

γίγνεται τοίνυν, ἦν δ' ἐγώ, πόλις, ὡς ἐγῷμαι, ἐπειδὴ τυγχάνει ἡμῶν ἕκαστος οὐκ αὐτάρκης, ἀλλὰ πολλῶν ‹ὢν› ἐνδεής: ἢ τίν' οἴει ἀρχὴν ἄλλην πόλιν οἰκίζειν;

οὐδεμίαν, ἦ δ' ὅς.

369c]
οὕτω δὴ ἄρα παραλαμβάνων ἄλλος ἄλλον, ἐπ' ἄλλου, τὸν δ' ἐπ' ἄλλου χρείᾳ, πολλῶν δεόμενοι, πολλοὺς εἰς μίαν οἴκησιν ἀγείραντες κοινωνούς τε καὶ βοηθούς, ταύτῃ τῇ συνοικίᾳ ἐθέμεθα πόλιν ὄνομα: ἦ γάρ;

πάνυ μὲν οὖν.

μεταδίδωσι δὴ ἄλλος ἄλλῳ, εἴ τι μεταδίδωσιν, ἢ μεταλαμβάνει, οἰόμενος αὐτῷ ἄμεινον εἶναι;

πάνυ γε.

ἴθι δή, ἦν δ' ἐγώ, τῷ λόγῳ ἐξ ἀρχῆς ποιῶμεν πόλιν: ποιήσει δὲ αὐτήν, ὡς ἔοικεν, ἡ ἡμετέρα χρεία.

πῶς δ' οὔ;

369d]
ἀλλὰ μὴν πρώτη γε καὶ μεγίστη τῶν χρειῶν ἡ τῆς τροφῆς παρασκευὴ τοῦ εἶναί τε καὶ ζῆν ἕνεκα.

παντάπασί γε.

δευτέρα δὴ οἰκήσεως, τρίτη δὲ ἐσθῆτος καὶ τῶν τοιούτων.

ἔστι ταῦτα.

φέρε δή, ἦν δ' ἐγώ, πῶς ἡ πόλις ἀρκέσει ἐπὶ τοσαύτην παρασκευήν; ἄλλο τι γεωργὸς μὲν εἷς, ὁ δὲ οἰκοδόμος, ἄλλος δέ τις ὑφάντης; ἢ καὶ σκυτοτόμον αὐτόσε προσθήσομεν ἤ τιν' ἄλλον τῶν περὶ τὸ σῶμα θεραπευτήν;

πάνυ γε.

εἴη δ' ἂν ἥ γε ἀναγκαιοτάτη πόλις ἐκ τεττάρων ἢ πέντε ἀνδρῶν.
369e]
φαίνεται.

τί δὴ οὖν; ἕνα ἕκαστον τούτων δεῖ τὸ αὑτοῦ ἔργον ἅπασι κοινὸν κατατιθέναι, οἷον τὸν γεωργὸν ἕνα ὄντα παρασκευάζειν σιτία τέτταρσιν καὶ τετραπλάσιον χρόνον τε καὶ πόνον ἀναλίσκειν ἐπὶ σίτου παρασκευῇ καὶ ἄλλοις κοινωνεῖν, ἢ ἀμελήσαντα ἑαυτῷ μόνον τέταρτον μέρος ποιεῖν τούτου τοῦ

370a] σίτου ἐν τετάρτῳ μέρει τοῦ χρόνου, τὰ δὲ τρία, τὸ μὲν ἐπὶ τῇ τῆς οἰκίας παρασκευῇ διατρίβειν, τὸ δὲ ἱματίου, τὸ δὲ ὑποδημάτων, καὶ μὴ ἄλλοις κοινωνοῦντα πράγματα ἔχειν, ἀλλ᾽ αὐτὸν δι᾽ αὑτὸν τὰ αὑτοῦ πράττειν;
καὶ ὁ Ἀδείμαντος ἔφη: ἀλλ᾽ ἴσως, ὦ Σώκρατες, οὕτω ῥᾷον ἢ 'κείνως.

οὐδέν, ἦν δ᾽ ἐγώ, μὰ Δία ἄτοπον. ἐννοῶ γὰρ καὶ αὐτὸς εἰπόντος σοῦ, ὅτι πρῶτον μὲν ἡμῶν φύεται ἕκαστος οὐ πάνυ [370b] ὅμοιος ἑκάστῳ, ἀλλὰ διαφέρων τὴν φύσιν, ἄλλος ἐπ᾽ ἄλλου ἔργου πράξει. ἢ οὐ δοκεῖ σοι;

ἔμοιγε.

τί δέ; πότερον κάλλιον πράττοι ἄν τις εἷς ὢν πολλὰς τέχνας ἐργαζόμενος, ἢ ὅταν μίαν εἷς;

ὅταν, ἦ δ᾽ ὅς, εἷς μίαν.

ἀλλὰ μὴν οἶμαι καὶ τόδε δῆλον, ὡς, ἐάν τίς τινος παρῇ ἔργου καιρόν, διόλλυται.

δῆλον γάρ.

οὐ γὰρ οἶμαι ἐθέλει τὸ πραττόμενον τὴν τοῦ πράττοντος σχολὴν περιμένειν, ἀλλ᾽ ἀνάγκη τὸν πράττοντα τῷ πραττομένῳ [370c] ἐπακολουθεῖν μὴ ἐν παρέργου μέρει.

ἀνάγκη.

ἐκ δὴ τούτων πλείω τε ἕκαστα γίγνεται καὶ κάλλιον καὶ ῥᾷον, ὅταν εἷς ἓν κατὰ φύσιν καὶ ἐν καιρῷ, σχολὴν τῶν ἄλλων ἄγων, πράττῃ.

παντάπασι μὲν οὖν.

πλειόνων δή, ὦ Ἀδείμαντε, δεῖ πολιτῶν ἢ τεττάρων ἐπὶ τὰς παρασκευὰς ὧν ἐλέγομεν. ὁ γὰρ γεωργός, ὡς ἔοικεν, οὐκ αὐτὸς ποιήσεται ἑαυτῷ τὸ ἄροτρον, εἰ μέλλει καλὸν εἶναι, [370d] οὐδὲ σμινύην, οὐδὲ τἆλλα ὄργανα ὅσα περὶ γεωργίαν. οὐδ᾽ αὖ ὁ οἰκοδόμος: πολλῶν δὲ καὶ τούτῳ δεῖ. ὡσαύτως δ᾽ ὁ ὑφάντης τε καὶ ὁ σκυτοτόμος: ἢ οὔ;

ἀληθῆ.

τέκτονες δὴ καὶ χαλκῆς καὶ τοιοῦτοί τινες πολλοὶ δημιουργοί, κοινωνοὶ ἡμῖν τοῦ πολιχνίου γιγνόμενοι, συχνὸν αὐτὸ ποιοῦσιν.

πάνυ μὲν οὖν.

ἀλλ᾽ οὐκ ἄν πω πάνυ γε μέγα τι εἴη, εἰ αὐτοῖς βουκόλους τε καὶ ποιμένας τούς τε ἄλλους νομέας προσθεῖμεν, ἵνα οἵ τε [370e] γεωργοὶ ἐπὶ τὸ ἀροῦν ἔχοιεν βοῦς, οἵ τε οἰκοδόμοι πρὸς τὰς ἀγωγὰς μετὰ τῶν γεωργῶν χρῆσθαι ὑποζυγίοις, ὑφάνται δὲ καὶ σκυτοτόμοι δέρμασίν τε καὶ ἐρίοις.

οὐδέ γε, ἦ δ᾽ ὅς, σμικρὰ πόλις ἂν εἴη ἔχουσα πάντα ταῦτα.

ἀλλὰ μήν, ἦν δ᾽ ἐγώ, κατοικίσαι γε αὐτὴν τὴν πόλιν εἰς τοιοῦτον τόπον οὗ ἐπεισαγωγίμων μὴ δεήσεται, σχεδόν τι ἀδύνατον.

ἀδύνατον γάρ.

προσδεήσει ἄρα ἔτι καὶ ἄλλων, οἳ ἐξ ἄλλης πόλεως αὐτῇ κομιοῦσιν ὧν δεῖται.

δεήσει.

καὶ μὴν κενὸς ἂν ἴῃ ὁ διάκονος, μηδὲν ἄγων ὧν ἐκεῖνοι
371a] δέονται παρ᾽ ὧν ἂν κομίζωνται ὧν ἂν αὐτοῖς χρεία, κενὸς ἄπεισιν. ἦ γάρ;
δοκεῖ μοι.

δεῖ δὴ τὰ οἴκοι μὴ μόνον ἑαυτοῖς ποιεῖν ἱκανά, ἀλλὰ καὶ οἷα καὶ ὅσα ἐκείνοις ὧν ἂν δέωνται.

δεῖ γάρ.

πλειόνων δὴ γεωργῶν τε καὶ τῶν ἄλλων δημιουργῶν δεῖ ἡμῖν τῇ πόλει.

πλειόνων γάρ.

καὶ δὴ καὶ τῶν ἄλλων διακόνων που τῶν τε εἰσαξόντων καὶ ἐξαξόντων ἕκαστα. οὗτοι δέ εἰσιν ἔμποροι: ἦ γάρ;

ναί.

καὶ ἐμπόρων δὴ δεησόμεθα.

πάνυ γε.

καὶ ἐὰν μέν γε κατὰ θάλατταν ἡ ἐμπορία γίγνηται, συχνῶν [371β] καὶ ἄλλων προσδεήσεται τῶν ἐπιστημόνων τῆς περὶ τὴν θάλατταν ἐργασίας.

συχνῶν μέντοι.

τί δὲ δή; ἐν αὐτῇ τῇ πόλει πῶς ἀλλήλοις μεταδώσουσιν ὧν ἂν ἕκαστοι ἐργάζωνται; ὧν δὴ ἕνεκα καὶ κοινωνίαν ποιησάμενοι πόλιν ᾠκίσαμεν.

δῆλον δή, ἦ δ᾽ ὅς, ὅτι πωλοῦντες καὶ ὠνούμενοι.

ἀγορὰ δὴ ἡμῖν καὶ νόμισμα σύμβολον τῆς ἀλλαγῆς ἕνεκα γενήσεται ἐκ τούτου.

πάνυ μὲν οὖν. [371ξ]

ἂν οὖν κομίσας ὁ γεωργὸς εἰς τὴν ἀγοράν τι ὧν ποιεῖ, ἢ τις ἄλλος τῶν δημιουργῶν, μὴ εἰς τὸν αὐτὸν χρόνον ἥκῃ τοῖς δεομένοις τὰ παρ᾽ αὐτοῦ ἀλλάξασθαι, ἀργήσει τῆς αὐτοῦ δημιουργίας καθήμενος ἐν ἀγορᾷ;

οὐδαμῶς, ἦ δ᾽ ὅς, ἀλλὰ εἰσὶν οἳ τοῦτο ὁρῶντες ἑαυτοὺς ἐπὶ τὴν διακονίαν τάττουσιν ταύτην, ἐν μὲν ταῖς ὀρθῶς οἰκουμέναις πόλεσι σχεδόν τι οἱ ἀσθενέστατοι τὰ σώματα καὶ ἀχρεῖοί τι ἄλλο ἔργον πράττειν. αὐτοῦ γὰρ δεῖ μένοντας [371δ] αὐτοὺς περὶ τὴν ἀγορὰν τὰ μὲν ἀντ᾽ ἀργυρίου ἀλλάξασθαι τοῖς τι δεομένοις ἀποδόσθαι, τοῖς δὲ ἀντὶ αὖ ἀργυρίου διαλλάττειν ὅσοι τι δέονται πρίασθαι.

αὕτη ἄρα, ἦν δ᾽ ἐγώ, ἡ χρεία καπήλων ἡμῖν γένεσιν ἐμποιεῖ τῇ πόλει. ἢ οὐ καπήλους καλοῦμεν τοὺς πρὸς ὠνήν τε καὶ πρᾶσιν διακονοῦντας ἱδρυμένους ἐν ἀγορᾷ, τοὺς δὲ πλανήτας ἐπὶ τὰς πόλεις ἐμπόρους;

πάνυ μὲν οὖν. [371ε]

ἔτι δή τινες, ὡς ἐγῷμαι, εἰσὶ καὶ ἄλλοι διάκονοι, οἳ ἂν τὰ μὲν τῆς διανοίας μὴ πάνυ ἀξιοκοινώνητοι ὦσιν, τὴν δὲ τοῦ σώματος ἰσχὺν ἱκανὴν ἐπὶ τοὺς πόνους ἔχωσιν: οἳ δὴ πωλοῦντες τὴν τῆς ἰσχύος χρείαν, τὴν τιμὴν ταύτην μισθὸν καλοῦντες, κέκληνται, ὡς ἐγῷμαι, μισθωτοί: ἦ γάρ;

πάνυ μὲν οὖν.

πλήρωμα δὴ πόλεώς εἰσιν, ὡς ἔοικε, καὶ μισθωτοί.

δοκεῖ μοι.

ἆρ᾽ οὖν, ὦ Ἀδείμαντε, ἤδη ἡμῖν ηὔξηται ἡ πόλις, ὥστ᾽ εἶναι τελέα;

ἴσως.

ποῦ οὖν ἄν ποτε ἐν αὐτῇ εἴη ἥ τε δικαιοσύνη καὶ ἡ ἀδικία; καὶ τίνι ἅμα ἐγγενομένη ὧν ἐσκέμμεθα;
372a]
ἐγὼ μέν, ἔφη, οὐκ ἐννοῶ, ὦ Σώκρατες, εἰ μή που ἐν αὐτῶν τούτων χρείᾳ τινὶ τῇ πρὸς ἀλλήλους.

ἀλλ᾽ ἴσως, ἦν δ᾽ ἐγώ, καλῶς λέγεις: καὶ σκεπτέον γε καὶ οὐκ ἀποκνητέον.

πρῶτον οὖν σκεψώμεθα τίνα τρόπον διαιτήσονται οἱ οὕτω παρεσκευασμένοι. ἄλλο τι ἢ σῖτόν τε ποιοῦντες καὶ οἶνον καὶ ἱμάτια καὶ ὑποδήματα; καὶ οἰκοδομησάμενοι οἰκίας, θέρους μὲν τὰ πολλὰ γυμνοί τε καὶ ἀνυπόδητοι ἐργάσονται, τοῦ δὲ [372β] χειμῶνος ἠμφιεσμένοι τε καὶ ὑποδεδεμένοι ἱκανῶς: θρέψονται δὲ ἐκ μὲν τῶν κριθῶν ἄλφιτα σκευαζόμενοι, ἐκ δὲ τῶν πυρῶν ἄλευρα, τὰ μὲν πέψαντες, τὰ δὲ μάξαντες, μάζας γενναίας καὶ ἄρτους ἐπὶ κάλαμόν τινα παραβαλλόμενοι ἢ φύλλα καθαρά, κατακλινέντες ἐπὶ στιβάδων ἐστρωμένων μίλακί τε καὶ μυρρίναις, εὐωχήσονται αὐτοί τε καὶ τὰ παιδία, ἐπιπίνοντες τοῦ οἴνου, ἐστεφανωμένοι καὶ ὑμνοῦντες τοὺς θεούς, ἡδέως συνόντες ἀλλήλοις, οὐχ ὑπὲρ τὴν οὐσίαν ποιούμενοι [372ξ] τοὺς παῖδας, εὐλαβούμενοι πενίαν ἢ πόλεμον.

καὶ ὁ Γλαύκων ὑπολαβών, Ἄνευ ὄψου, ἔφη, ὡς ἔοικας, ποιεῖς τοὺς ἄνδρας ἑστιωμένους.

ἀληθῆ, ἦν δ᾽ ἐγώ, λέγεις. ἐπελαθόμην ὅτι καὶ ὄψον ἕξουσιν, ἅλας τε δῆλον ὅτι καὶ ἐλάας καὶ τυρόν, καὶ βολβοὺς καὶ λάχανά γε, οἷα δὴ ἐν ἀγροῖς ἑψήματα, ἑψήσονται. καὶ τραγήματά που παραθήσομεν αὐτοῖς τῶν τε σύκων καὶ ἐρεβίνθων καὶ κυάμων, καὶ μύρτα καὶ φηγοὺς σποδιοῦσιν [372δ] πρὸς τὸ πῦρ, μετρίως ὑποπίνοντες: καὶ οὕτω διάγοντες τὸν βίον ἐν εἰρήνῃ μετὰ ὑγιείας, ὡς εἰκός, γηραιοὶ τελευτῶντες ἄλλον τοιοῦτον βίον τοῖς ἐκγόνοις παραδώσουσιν.

καὶ ὅς, εἰ δὲ ὑῶν πόλιν, ὦ Σώκρατες, ἔφη, κατεσκεύαζες, τί ἂν αὐτὰς ἄλλο ἢ ταῦτα ἐχόρταζες;

ἀλλὰ πῶς χρή, ἦν δ᾽ ἐγώ, ὦ Γλαύκων;

ἅπερ νομίζεται, ἔφη: ἐπί τε κλινῶν κατακεῖσθαι οἶμαι τοὺς μέλλοντας μὴ ταλαιπωρεῖσθαι, καὶ ἀπὸ τραπεζῶν [372ε] δειπνεῖν, καὶ ὄψα ἅπερ καὶ οἱ νῦν ἔχουσι καὶ τραγήματα.

εἶεν, ἦν δ᾽ ἐγώ: μανθάνω. οὐ πόλιν, ὡς ἔοικε, σκοποῦμεν μόνον ὅπως γίγνεται, ἀλλὰ καὶ τρυφῶσαν πόλιν. ἴσως οὖν οὐδὲ κακῶς ἔχει: σκοποῦντες γὰρ καὶ τοιαύτην τάχ᾽ ἂν κατίδοιμεν τήν τε δικαιοσύνην καὶ ἀδικίαν ὅπῃ ποτὲ ταῖς πόλεσιν ἐμφύονται. ἡ μὲν οὖν ἀληθινὴ πόλις

δοκεῖ μοι εἶναι ἣν διεληλύθαμεν, ὥσπερ ὑγιής τις: εἰ δ' αὖ βούλεσθε, καὶ φλεγμαίνουσαν πόλιν θεωρήσωμεν: οὐδὲν ἀποκωλύει.
373a] ταῦτα γὰρ δή τισιν, ὡς δοκεῖ, οὐκ ἐξαρκέσει, οὐδὲ αὕτη ἡ δίαιτα, ἀλλὰ κλῖναί τε προσέσονται καὶ τράπεζαι καὶ τἆλλα σκεύη, καὶ ὄψα δὴ καὶ μύρα καὶ θυμιάματα καὶ ἑταῖραι καὶ πέμματα, καὶ ἕκαστα τούτων παντοδαπά. καὶ δὴ καὶ ἃ τὸ πρῶτον ἐλέγομεν οὐκέτι τἀναγκαῖα θετέον, οἰκίας τε καὶ ἱμάτια καὶ ὑποδήματα, ἀλλὰ τήν τε ζωγραφίαν κινητέον καὶ τὴν ποικιλίαν, καὶ χρυσὸν καὶ ἐλέφαντα καὶ πάντα τὰ τοιαῦτα κτητέον. ἦ γάρ; [373β]
ναί, ἔφη.

οὐκοῦν μείζονά τε αὖ τὴν πόλιν δεῖ ποιεῖν: ἐκείνη γὰρ ἡ ὑγιεινὴ οὐκέτι ἱκανή, ἀλλ' ἤδη ὄγκου ἐμπληστέα καὶ πλήθους, ἃ οὐκέτι τοῦ ἀναγκαίου ἕνεκά ἐστιν ἐν ταῖς πόλεσιν, οἷον οἵ τε θηρευταὶ πάντες οἵ τε μιμηταί, πολλοὶ μὲν οἱ περὶ τὰ σχήματά τε καὶ χρώματα, πολλοὶ δὲ οἱ περὶ μουσικήν, ποιηταί τε καὶ τούτων ὑπηρέται, ῥαψῳδοί, ὑποκριταί, χορευταί, ἐργολάβοι, σκευῶν τε παντοδαπῶν δημιουργοί, τῶν τε ἄλλων [373ξ] καὶ τῶν περὶ τὸν γυναικεῖον κόσμον. καὶ δὴ καὶ διακόνων πλειόνων δεησόμεθα: ἢ οὐ δοκεῖ δεήσειν παιδαγωγῶν, τιτθῶν, τροφῶν, κομμωτριῶν, κουρέων, καὶ αὖ ὀψοποιῶν τε καὶ μαγείρων; ἔτι δὲ καὶ συβωτῶν προσδεησόμεθα: τοῦτο γὰρ ἡμῖν ἐν τῇ προτέρᾳ πόλει οὐκ ἐνῆν—ἔδει γὰρ οὐδέν—ἐν δὲ ταύτῃ καὶ τούτου προσδεήσει. δεήσει δὲ καὶ τῶν ἄλλων βοσκημάτων παμπόλλων, εἴ τις αὐτὰ ἔδεται: ἦ γάρ;

πῶς γὰρ οὔ; [373δ]

οὐκοῦν καὶ ἰατρῶν ἐν χρείαις ἐσόμεθα πολὺ μᾶλλον οὕτω διαιτώμενοι ἢ ὡς τὸ πρότερον;

πολύ γε.

καὶ ἡ χώρα γέ που, ἡ τότε ἱκανὴ τρέφειν τοὺς τότε, σμικρὰ δὴ ἐξ ἱκανῆς ἔσται. ἢ πῶς λέγομεν;

οὕτως, ἔφη.

οὐκοῦν τῆς τῶν πλησίον χώρας ἡμῖν ἀποτμητέον, εἰ μέλλομεν ἱκανὴν ἕξειν νέμειν τε καὶ ἀροῦν, καὶ ἐκείνοις αὖ τῆς ἡμετέρας, ἐὰν καὶ ἐκεῖνοι ἀφῶσιν αὐτοὺς ἐπὶ χρημάτων κτῆσιν ἄπειρον, ὑπερβάντες τὸν τῶν ἀναγκαίων ὅρον; [373ε]

πολλὴ ἀνάγκη, ἔφη, ὦ Σώκρατες.

πολεμήσομεν δὴ τὸ μετὰ τοῦτο, ὦ Γλαύκων; ἢ πῶς ἔσται;

οὕτως, ἔφη.

καὶ μηδέν γέ πω λέγωμεν, ἦν δ' ἐγώ, μήτ' εἴ τι κακὸν μήτ' εἰ ἀγαθὸν ὁ πόλεμος ἐργάζεται, ἀλλὰ τοσοῦτον μόνον, ὅτι πολέμου αὖ γένεσιν ηὑρήκαμεν, ἐξ ὧν μάλιστα ταῖς πόλεσιν καὶ ἰδίᾳ καὶ δημοσίᾳ κακὰ γίγνεται, ὅταν γίγνηται.

πάνυ μὲν οὖν.

ἔτι δή, ὦ φίλε, μείζονος τῆς πόλεως δεῖ οὔ τι σμικρῷ,
374a] ἀλλ' ὅλῳ στρατοπέδῳ, ὃ ἐξελθὸν ὑπὲρ τῆς οὐσίας ἁπάσης καὶ ὑπὲρ ὧν νυνδὴ ἐλέγομεν διαμαχεῖται τοῖς ἐπιοῦσιν.
τί δέ; ἦ δ' ὅς: αὐτοὶ οὐχ ἱκανοί;

οὔκ, εἰ σύ γε, ἦν δ' ἐγώ, καὶ ἡμεῖς ἅπαντες ὡμολογήσαμεν καλῶς, ἡνίκα ἐπλάττομεν τὴν πόλιν: ὡμολογοῦμεν δέ που, εἰ μέμνησαι, ἀδύνατον ἕνα πολλὰς καλῶς ἐργάζεσθαι τέχνας.

ἀληθῆ λέγεις, ἔφη. [374β]

τί οὖν; ἦν δ' ἐγώ: ἡ περὶ τὸν πόλεμον ἀγωνία οὐ τεχνικὴ δοκεῖ εἶναι;

καὶ μάλα, ἔφη.

ἦ οὖν τι σκυτικῆς δεῖ μᾶλλον κήδεσθαι ἢ πολεμικῆς;

οὐδαμῶς.

ἀλλ' ἄρα τὸν μὲν σκυτοτόμον διεκωλύομεν μήτε γεωργὸν ἐπιχειρεῖν εἶναι ἅμα μήτε ὑφάντην μήτε οἰκοδόμον ἀλλὰ σκυτοτόμον, ἵνα δὴ ἡμῖν τὸ τῆς σκυτικῆς ἔργον καλῶς γίγνοιτο, καὶ τῶν ἄλλων ἑνὶ ἑκάστῳ ὡσαύτως ἓν ἀπεδίδομεν, πρὸς ὃ ἐπεφύκει ἕκαστος καὶ ἐφ' ᾧ ἔμελλε τῶν ἄλλων [374ξ] σχολὴν ἄγων διὰ βίου αὐτὸ ἐργαζόμενος οὐ παριεὶς τοὺς καιροὺς καλῶς ἀπεργάσεσθαι: τὰ δὲ δὴ περὶ τὸν πόλεμον πότερον οὐ περὶ πλείστου ἐστὶν εὖ ἀπεργασθέντα; ἢ οὕτω ῥᾴδιον, ὥστε καὶ γεωργῶν τις ἅμα πολεμικὸς ἔσται καὶ σκυτοτομῶν καὶ ἄλλην τέχνην ἡντινοῦν ἐργαζόμενος, πεττευτικὸς δὲ ἢ κυβευτικὸς ἱκανῶς οὐδ' ἂν εἷς γένοιτο μὴ αὐτὸ τοῦτο ἐκ παιδὸς ἐπιτηδεύων, ἀλλὰ παρέργῳ χρώμενος; [374δ] καὶ ἀσπίδα μὲν λαβὼν ἤ τι ἄλλο τῶν πολεμικῶν ὅπλων τε καὶ ὀργάνων αὐθημερὸν ὁπλιτικῆς ἤ τινος ἄλλης μάχης τῶν κατὰ πόλεμον ἱκανὸς ἔσται ἀγωνιστής, τῶν δὲ ἄλλων ὀργάνων οὐδὲν οὐδένα δημιουργὸν οὐδὲ ἀθλητὴν ληφθὲν ποιήσει, οὐδ' ἔσται χρήσιμον τῷ μήτε τὴν ἐπιστήμην ἑκάστου λαβόντι μήτε τὴν μελέτην ἱκανὴν παρασχομένῳ;

πολλοῦ γὰρ ἄν, ἦ δ' ὅς, τὰ ὄργανα ἦν ἄξια.

οὐκοῦν, ἦν δ' ἐγώ, ὅσῳ μέγιστον τὸ τῶν φυλάκων ἔργον, [374ε] τοσούτῳ σχολῆς τε τῶν ἄλλων πλείστης ἂν εἴη καὶ αὖ τέχνης τε καὶ ἐπιμελείας μεγίστης δεόμενον.

οἶμαι ἔγωγε, ἦ δ' ὅς.

ἆρ' οὖν οὐ καὶ φύσεως ἐπιτηδείας εἰς αὐτὸ τὸ ἐπιτήδευμα;

πῶς δ' οὔ;

ἡμέτερον δὴ ἔργον ἂν εἴη, ὡς ἔοικεν, εἴπερ οἷοί τ' ἐσμέν, ἐκλέξασθαι τίνες τε καὶ ποῖαι φύσεις ἐπιτήδειαι εἰς πόλεως φυλακήν.

ἡμέτερον μέντοι.

μὰ Δία, ἦν δ' ἐγώ, οὐκ ἄρα φαῦλον πρᾶγμα ἠράμεθα: ὅμως δὲ οὐκ ἀποδειλιατέον, ὅσον γ' ἂν δύναμις παρείκῃ

Plato, *Republic***,** 369b-374e

369b] “Much more.” “Shall we try it, then, and go through with it? I fancy it is no slight task. Reflect, then.” “We have reflected, ” said Adeimantus; “proceed and don't refuse.”

“The origin of the city, then,” said I, “in my opinion, is to be found in the fact that we do not severally suffice for our own needs, but each of us lacks many things. Do you think any other principle establishes the state?” “No other,” said he. “As a result of this,

369c] then, one man calling in another for one service and another for another, we, being in need of many things, gather many into one place of abode as associates and helpers, and to this dwelling together we give the name city or state, do we not?” “By all means.” “And between one man and another there is an interchange of giving, if it so happens, and taking, because each supposes this to be better for himself.” “Certainly.” “Come, then, let us create a city from the beginning, in our theory. Its real creator, as it appears, will be our needs.” “Obviously.”

[369d] “Now the first and chief of our needs is the provision of food for existence and life.” “Assuredly.” “The second is housing and the third is raiment and that sort of thing.” “That is so.” “Tell me, then,” said I, “how our city will suffice for the provision of all these things. Will there not be a farmer for one, and a builder, and then again a weaver? And shall we add thereto a cobbler and some other purveyor for the needs of body?” “Certainly.” “The indispensable minimum of a city, then, would consist of four or [369e] five men.” “Apparently.” “What of this, then? Shall each of these contribute his work for the common use of all? I mean shall the farmer, who is one, provide food for four and spend fourfold time and toil on the production of food and share it with the others, or shall he take no thought for them and provide a fourth portion [370a] of the food for himself alone in a quarter of the time and employ the other three-quarters, the one in the provision of a house, the other of a garment, the other of shoes, and not have the bother of associating with other people, but, himself for himself, mind his own affairs?” And Adeimantus said, “But, perhaps, Socrates, the former way is easier.” “It would not, by Zeus, be at all strange,” said I; “for now that you have mentioned it, it occurs to me myself that, to begin with, our several natures are not [370b] all alike but different. One man is naturally fitted for one task, and another for another. Don't you think so?” “I do.” “Again, would one man do better working at many tasks or one at one?” “One at one,” he said. “And, furthermore, this, I fancy, is obvious—that if one lets slip the right season, the favorable moment in any task, the work is spoiled.” “Obvious.” “That, I take it, is because the business will not wait upon the leisure of the workman, but the workman must [370c] attend to it as his main affair, and not as a by-work.” “He must indeed.” “The result, then, is that more things are produced, and better and more easily when one man performs one task according to his nature, at the right moment, and at leisure from other occupations.” “By all means.” “Then, Adeimantus, we need more than four citizens for the provision of the things we have mentioned. For the farmer, it appears, will not make his own plough if it is to be a good one, [370d] nor his hoe, nor his other agricultural implements, nor will the builder, who also needs many; and similarly the weaver and cobbler.” “True.” “Carpenters, then, and smiths and many

similar craftsmen, associating themselves with our hamlet, will enlarge it considerably." "Certainly." "Yet it still wouldn't be very large even if we should add to them neat-herds and shepherds and other herders, [370e] so that the farmers might have cattle for ploughing, and the builders oxen to use with the farmers for transportation, and the weavers and cobblers hides and fleeces for their use." "It wouldn't be a small city, either, if it had all these." "But further," said I, "it is practically impossible to establish the city in a region where it will not need imports." "It is." "There will be a further need, then, of those who will bring in from some other city what it requires." "There will." "And again, if our servitor goes forth empty-handed, not taking with him any of the things needed by those
371a] from whom they procure what they themselves require, he will come back with empty hands, will he not?" "I think so." "Then their home production must not merely suffice for themselves but in quality and quantity meet the needs of those of whom they have need." "It must." "So our city will require more farmers and other craftsmen." "Yes, more." "And also of other ministrants who are to export and import the merchandise. These are traders, are they not? " "Yes." "We shall also need traders, then." "Assuredly." "And if the trading is carried on by sea, [371b] we shall need quite a number of others who are expert in maritime business." "Quite a number."
"But again, within the city itself how will they share with one another the products of their labor? This was the very purpose of our association and establishment of a state." "Obviously," he said, "by buying and selling." "A market-place, then, and money as a token for the purpose of exchange will be the result of this." [371c] "By all means." "If, then, the farmer or any other craftsman taking his products to the market-place does not arrive at the same time with those who desire to exchange with him, is he to sit idle in the market-place and lose time from his own work?" "By no means," he said, "but there are men who see this need and appoint themselves for this service—in well-conducted cities they are generally those who are weakest2 in body and those who are useless for any other task. They must wait there in the agora [371d] and exchange money for goods with those who wish to sell, and goods for money with as many as desire to buy." "This need, then," said I, "creates the class of shopkeepers in our city. Or is not shopkeepers the name we give to those who, planted in the agora, serve us in buying and selling, while we call those who roam from city to city merchants?" "Certainly." "And there are, furthermore, I believe, other servitors who in the things of the mind [371e] are not altogether worthy of our fellowship, but whose strength of body is sufficient for toil; so they, selling the use of this strength and calling the price wages, are designated, I believe, wage-earners, are they not?" "Certainly." "Wage-earners, then, it seems, are the complement that helps to fill up the state." "I think so." "Has our city, then, Adeimantus, reached its full growth and is it complete?" "Perhaps." "Where, then, can justice and injustice be found in it? And along with which of the constituents that we have considered does it come into the state?" [372a] "I cannot conceive, Socrates," he said, "unless it be in some need that those very constituents have of one another." "Perhaps that is a good suggestion," said I; "we must examine it and not hold back. First of all, then, let us consider what will be the manner of life of men thus provided. Will they not make bread and wine and garments and shoes? And they will build themselves houses and carry on their work in summer for the most part unclad and unshod and in winter clothed and [372b] shod sufficiently? And for their nourishment they will provide meal from their barley and flour from their wheat, and kneading and cooking these they will serve noble cakes and loaves on some arrangement of reeds or clean leaves, and, reclined on rustic beds strewn with bryony and myrtle, they will feast with their children, drinking of their

wine thereto, garlanded and singing hymns to the gods in pleasant fellowship, not begetting offspring beyond their means [372c] lest they fall into poverty or war?"
Here Glaucon broke in: "No relishes apparently," he said, "for the men you describe as feasting." "True" said I; "I forgot that they will also have relishes—salt, of course, and olives and cheese and onions and greens, the sort of things they boil in the country, they will boil up together. But for dessert we will serve them figs and chickpeas and beans, [372d] and they will toast myrtle-berries and acorns before the fire, washing them down with moderate potations and so, living in peace and health, they will probably die in old age and hand on a like life to their offspring." And he said, "If you were founding a city of pigs, Socrates, what other fodder than this would you provide?" "Why, what would you have, Glaucon?" said I. "What is customary," he replied; "They must recline on couches, I presume, if they are not to be uncomfortable, [372e] and dine from tables and have made dishes and sweetmeats such as are now in use." "Good," said I, "I understand. It is not merely the origin of a city, it seems, that we are considering but the origin of a luxurious city. Perhaps that isn't such a bad suggestion, either. For by observation of such a city it may be we could discern the origin of justice and injustice in states. The true state I believe to be the one we have described—the healthy state, as it were. But if it is your pleasure that we contemplate also a fevered state, there is nothing to hinder.
373a] For there are some, it appears, who will not be contented with this sort of fare or with this way of life; but couches will have to be added thereto and tables and other furniture, yes, and relishes and myrrh and incense and girls and cakes—all sorts of all of them. And the requirements we first mentioned, houses and garments and shoes, will no longer be confined to necessities, but we must set painting to work and embroidery, and procure gold and ivory and similar adornments, must we not?" [373b] "Yes," he said. "Then we shall have to enlarge the city again. For that healthy state is no longer sufficient, but we must proceed to swell out its bulk and fill it up with a multitude of things that exceed the requirements of necessity in states, as, for example, the entire class of huntsmen, and the imitators, many of them occupied with figures and colors and many with music—the poets and their assistants, rhapsodists, actors, chorus-dancers, contractors —and [373c] the manufacturers of all kinds of articles, especially those that have to do with women's adornment. And so we shall also want more servitors. Don't you think that we shall need tutors, nurses wet and dry, beauty-shop ladies, barbers and yet again cooks and chefs? And we shall have need, further, of swineherds; there were none of these creatures in our former city, for we had no need of them, but in this city there will be this further need; and we shall also require other cattle in great numbers if they are to be eaten, [373d] shall we not?" "Yes." "Doctors, too, are something whose services we shall be much more likely to require if we live thus than as before?" "Much."
"And the territory, I presume, that was then sufficient to feed the then population, from being adequate will become too small. Is that so or not?" "It is." "Then we shall have to cut out a cantle of our neighbor's land if we are to have enough for pasture and ploughing, and they in turn of ours if they too abandon themselves to the unlimited acquisition of wealth, [373e] disregarding the limit set by our necessary wants." "Inevitably, Socrates." "We shall go to war as the next step, Glaucon—or what will happen?" "What you say," he said. "And we are not yet to speak," said I, "of any evil or good effect of war, but only to affirm that we have further discovered the origin of war, namely, from those things from which the greatest disasters, public and private, come to states when they come." "Certainly." "Then, my friend, we must still further enlarge our city [374a] by no small increment, but by a whole army, that

will march forth and fight it out with assailants in defence of all our wealth and the luxuries we have just described." "How so?" he said; "are the citizens themselves not sufficient for it?" "Not if you," said I, "and we all were right in the admission we made when we were molding our city. We surely agreed, if you remember, that it is impossible for one man to do the work of many arts well." "True," he said. "Well, then," said I, [374b] "don't you think that the business of fighting is an art and a profession?" "It is indeed," he said. "Should our concern be greater, then, for the cobbler's art than for the art of war?" "By no means." "Can we suppose, then, that while we were at pains to prevent the cobbler from attempting to be at the same time a farmer, a weaver, or a builder instead of just a cobbler, to the end that3 we might have the cobbler's business well done, and similarly assigned to each and every one man one occupation, for which he was fit and naturally adapted and at which he was to work all his days, [374c] at leisure from other pursuits and not letting slip the right moments for doing the work well, and that yet we are in doubt whether the right accomplishment of the business of war is not of supreme moment? Is it so easy5 that a man who is cultivating the soil will be at the same time a soldier and one who is practising cobbling or any other trade, though no man in the world could make himself a competent expert at draughts or the dice who did not practise that and nothing else from childhood but treated it as an occasional business? And are we to believe that a man who [374d] takes in hand a shield or any other instrument of war springs up on that very day a competent combatant in heavy armor or in any other form of warfare—though no other tool will make a man be an artist or an athlete by his taking it in hand, nor will it be of any service to those who have neither acquired the science of it nor sufficiently practised themselves in its use?" "Great indeed," he said, "would be the value of tools in that case."
"Then," said I, "in the same degree that the task of our guardians is the greatest of all, [374e] it would require more leisure than any other business and the greatest science and training." "I think so," said he. "Does it not also require a nature adapted to that very pursuit?" "Of course." "It becomes our task, then, it seems, if we are able, to select which and what kind of natures are suited for the guardianship of a state." "Yes, ours." "Upon my word," said I, "it is no light task that we have taken upon ourselves. But we must not faint

Plato. *Plato in Twelve Volumes*, Vols. 5 & 6 translated by Paul Shorey. Cambridge, MA, Harvard University Press; London, William Heinemann Ltd. 1969.

Διόδωρος Σικελιώτης 1ος αι. π.Χ.

Ιστορική Βιβλιοθήκη, I.1.74

ἔστι δ' ἕτερα συντάγματα τῆς πολιτείας τρία, τό τε τῶν νομέων καὶ τὸ τῶν γεωργῶν, ἔτι δὲ τὸ τῶν τεχνιτῶν. οἱ μὲν οὖν γεωργοὶ μικροῦ τινος τὴν καρποφόρον γῆν τὴν παρὰ τοῦ βασιλέως καὶ τῶν ἱερέων καὶ τῶν μαχίμων μισθούμενοι διατελοῦσι τὸν πάντα χρόνον περὶ τὴν ἐργασίαν ὄντες τῆς χώρας: ἐκ νηπίου δὲ συντρεφόμενοι ταῖς γεωργικαῖς ἐπιμελείαις πολὺ προέχουσι τῶν παρὰ τοῖς ἄλλοις ἔθνεσι γεωργῶν ταῖς ἐμπειρίαις: [2] καὶ γὰρ τὴν τῆς γῆς φύσιν καὶ τὴν τῶν ὑδάτων ἐπίρρυσιν, ἔτι δὲ τοὺς καιροὺς τοῦ τε σπόρου καὶ τοῦ θερισμοῦ καὶ τῆς ἄλλης τῶν καρπῶν συγκομιδῆς ἀκριβέστατα πάντων γινώσκουσι, τὰ μὲν ἐκ τῆς τῶν προγόνων παρατηρήσεως μαθόντες, τὰ δ' ἐκ τῆς ἰδίας πείρας διδαχθέντες. [3] ὁ δ' αὐτὸς λόγος ἐστὶ καὶ περὶ τῶν νομέων, οἳ τὴν τῶν θρεμμάτων ἐπιμέλειαν ἐκ πατέρων ὥσπερ κληρονομίας νόμῳ παραλαμβάνοντες ἐν βίῳ κτηνοτρόφῳ διατελοῦσι πάντα τὸν τοῦ ζῆν χρόνον, [4] καὶ πολλὰ μὲν παρὰ τῶν προγόνων πρὸς θεραπείαν καὶ διατροφὴν ἀρίστην τῶν βοσκομένων παρειλήφασιν, οὐκ ὀλίγα δ' αὐτοὶ διὰ τὸν εἰς ταῦτα ζῆλον προσευρίσκουσι, καὶ τὸ θαυμασιώτατον, διὰ τὴν ὑπερβολὴν τῆς εἰς ταῦτα σπουδῆς οἵ τε ὀρνιθοτρόφοι καὶ οἱ χηνοβοσκοὶ χωρὶς τῆς παρὰ τοῖς ἄλλοις ἀνθρώποις ἐκ φύσεως συντελουμένης γενέσεως τῶν εἰρημένων ζῴων αὐτοὶ διὰ τῆς ἰδίας φιλοτεχνίας ἀμύθητον πλῆθος ὀρνέων ἀθροίζουσιν: [5] οὐ γὰρ ἐπῳάζουσι διὰ τῶν ὀρνίθων, ἀλλ' αὐτοὶ παραδόξως χειρουργοῦντες τῇ συνέσει καὶ φιλοτεχνίᾳ τῆς φυσικῆς ἐνεργείας οὐκ ἀπολείπονται. [6] ἀλλὰ μὴν καὶ τὰς τέχνας ἰδεῖν ἔστι παρὰ τοῖς Αἰγυπτίοις μάλιστα διαπεπονημένας καὶ πρὸς τὸ καθῆκον τέλος διηκριβωμένας: παρὰ μόνοις γὰρ τούτοις οἱ δημιουργοὶ πάντες οὔτ' ἐργασίας ἄλλης οὔτε πολιτικῆς τάξεως μεταλαμβάνειν ἐῶνται πλὴν τῆς ἐκ τῶν νόμων ὡρισμένης καὶ παρὰ τῶν γονέων παραδεδομένης, ὥστε μήτε διδασκάλου φθόνον μήτε πολιτικοὺς περισπασμοὺς μήτ' ἄλλο μηδὲν ἐμποδίζειν αὐτῶν τὴν εἰς ταῦτα σπουδήν. [7] παρὰ μὲν γὰρ τοῖς ἄλλοις ἰδεῖν ἔστι τοὺς τεχνίτας περὶ πολλὰ τῇ διανοίᾳ περισπωμένους καὶ διὰ τὴν πλεονεξίαν μὴ μένοντας τὸ παράπαν ἐπὶ τῆς ἰδίας ἐργασίας: οἱ μὲν γὰρ ἐφάπτονται γεωργίας, οἱ δ' ἐμπορίας κοινωνοῦσιν, οἱ δὲ δυοῖν ἢ τριῶν τεχνῶν ἀντέχονται, πλεῖστοι δ' ἐν ταῖς δημοκρατουμέναις πόλεσιν εἰς τὰς ἐκκλησίας συντρέχοντες τὴν μὲν πολιτείαν λυμαίνονται, τὸ δὲ λυσιτελὲς περιποιοῦνται παρὰ τῶν μισθοδοτούντων: παρὰ δὲ τοῖς Αἰγυπτίοις, εἴ τις τῶν τεχνιτῶν μετάσχοι τῆς πολιτείας ἢ τέχνας πλείους ἐργάζοιτο, μεγάλαις περιπίπτει τιμωρίαις. [8] τὴν μὲν οὖν διαίρεσιν τῆς πολιτείας καὶ τὴν τῆς ἰδίας τάξεως ἐπιμέλειαν διὰ προγόνων τοιαύτην ἔσχον οἱ τὸ παλαιὸν τὴν Αἴγυπτον κατοικοῦντες.

Diodori Bibliotheca Historica, Vol 1-2. Diodorus Siculus. Immanel Bekker. Ludwig Dindorf. Friedrich Vogel. in aedibus B. G. Teubneri. Leipzig. 1888-1890.

Diodorus Siculus, 1st c. B.C.
Bibliotheca Historica, I.1.74
The Library of History of Diodorus Siculus, Loeb Classical Library, 1933
http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Diodorus_Siculus/home.html

There are three other classes of free citizens, namely, the herdsmen, the husbandmen, and the artisans. Now the husbandmen rent on moderate terms the arable land held by the king and the priests and the warriors, and spend their entire time in tilling the soil; and since from very infancy they are brought up in connection with the various tasks of farming, they are far more experienced in such matters than the husbandmen of any other nation; [2] for of all mankind they acquire the most exact knowledge of the nature of the soil, the use of water in irrigation, the times of sowing and reaping, and the harvesting of crops in general, some details of which they have learned from the observations of their ancestors and others in the school of their own experience. [3] And what has been said applies equally well to the herdsmen, who receive the care of animals from their fathers as if by a law of inheritance, and follow a pastoral life all the days of their existence. [4] They have received, it is true, much from their ancestors relative to the best care and feeding of grazing animals, but to this they add not a little by reason of their own interest in such matters; and the most astonishing fact is that, by reason of their unusual application to such matters, the men who have charge of poultry and geese, in addition to producing them in the natural way known to all mankind, raise them by their own hands, by virtue of a skill peculiar to them, in numbers beyond telling; [5] for they do not use the birds for hatching the eggs, but, in effecting this themselves artificially by their own wit and skill in an astounding manner, they are not surpassed by the operations of nature.

[6] Furthermore, one may see that the crafts also among the Egyptians are very diligently cultivated and brought to their proper development; for they are the only people where all the craftsmen are forbidden to follow any other occupation or belong to any other class of citizens than those stipulated by the laws and handed down to them from their parents, the result being that neither ill-will towards a teacher nor political distractions nor any other thing interferes with their interest in their work. [7] For whereas among all other peoples it can be observed that the artisans are distracted in mind by many things, and through the desire to advance themselves do not stick exclusively to their own occupation; for some try their hands at agriculture, some dabble in trade, and some cling to two or three crafts, and in states having a democratic form of government vast numbers of them, trooping to the meetings of the Assembly, ruin the work of the government, while they make a profit for themselves at the expense of others who pay them their wage, yet among the Egyptians if any artisan should take part in public affairs or pursue several crafts he is severely punished.

[8] Such, then, were the divisions of the citizens, maintained by the early inhabitants of Egypt, and their devotion to their own class which they inherited from their ancestors.

William Petty (1623-1687)

Political Arithmetick (approx. 1676, pub. 1690) in Sir William Petty, *The Economic Writings of Sir William Petty, together with The Observations upon Bills of Mortality, more probably by Captain John Graunt*, ed. Charles Henry Hull (Cambridge University Press, 1899), vol. 1

Political Arithmetick,

OR

A DISCOURSE

Concerning,

The Extent and Value of Lands, People, Buildings; Husbandry, Manufacture, Commerce, Fishery, Artizans, Seamen, Soldiers; Publick Revenues, Interest, Taxes, Superlucration, Registries, Banks; Valuation of Men, Increasing of Seamen, of Militia's, Harbours, Situation, Shipping, Power at Sea, *&c.* As the same relates to every Country in general, but more particularly to the Territories of His Majesty of *Great Britain*, and his Neighbours of *Holland*, *Zealand*, and *France*[1].

By Sir *WILLIAM PETTY*,
Late Fellow of the *Royal Society*.

London, Printed for *Robert Clavel* at the *Peacock*, and *Hen. Mortlock* at the *Phœnix* in St. *Paul's* Church-yard. 1690.

[1] The long descriptive title was probably supplied by Lord Shelburne; neither the Southwell, the Rawlinson, nor the Sloane MS. has it. In line six 'Manufacture' should be 'Manufactures,' an 's' has dropped out.

[19] Commodities[1], || but are Wealth at all times, and all places: Whereas abundance of Wine, Corn, Fowls, Flesh, *&c.* are Riches but *hic & nunc*, so as the raising of such Commodities, and the following of such Trade, which does store the Country with Gold, Silver, Jewels, *&c.* is profitable before others. But the Labour of Seamen, and Freight of Ships, is always of the nature of an Exported Commodity, the overplus whereof, above what is Imported, brings home mony, *&c.*

Reasons why the *Hollanders* Sail for less Freight.

5. Those who have the command of the Sea Trade, may Work at easier Freight with more profit, than others at greater: for as Cloth must be cheaper made, when one Cards, another Spins, another Weaves, another Draws, another Dresses, another Presses and Packs; than when all the Operations above-mentioned, were clumsily performed by the same hand; so those who command the Trade of Shipping, can build long slight Ships for carrying Masts, Fir-Timber, Boards, Balks, *&c.* And short ones for Lead, Iron, Stones *&c.* One sort of Vessels to Trade at Ports where they need never lie a ground, others where they must jump upon the [20] Sand || twice every twelve hours; One sort of Vessels, and way of manning in time of Peace, and[2] cheap gross Goods, another for War and precious Commodities; One sort of Vessels for the turbulent Sea, another for Inland Waters and Rivers; One sort of Vessels, and Rigging, where haste is requisite for the Maidenhead of a Market, another where $\frac{1}{5}$ or $\frac{1}{4}$ part of the time makes no matter. One sort of Masting and Rigging for long Voyages, another for Coasting. One sort of Vessels for Fishing, another for Trade. One sort for War for this or that Country, another for Burthen only. Some for Oars, some for Poles, some for Sails, and some for draught by Men or Horses, some for the Northern Navigations amongst Ice, and some for the South against Worms, *&c.*[3] And this I take to be the chief of several Reasons, why the *Hollanders* can go at less Freight than

[1] S, 'nor so mutable as other Comodityes' inserted by Petty.

[2] 1691, 'and for,' cf. errata.

[3] On Petty's experiments in shipbuilding and his writings on the subject see Introduction, part III. and Fitzmaurice, 109—115, 256, 266, *et passim*.

their Neighbours, *viz.* because they can afford a particular sort of Vessels for each particular Trade.

I have shewn how Situation hath given them Shipping, and how Shipping hath given them in effect all other ‖ Trade, and how Foreign Traffick must give them as much [21] Manufacture as they can manage themselves, and as for the overplus, make the rest of the World but as Workmen to their Shops. It now remains to shew the effects of their Policy, superstructed upon these natural advantages, and not as some think upon the excess of their Understandings. The Policy of *Holland.*

I have omitted to mention the *Hollanders* were one hundred years since, a poor and oppressed People, living in a Country naturally cold[1] and unpleasant: and were withal persecuted for their Heterodoxy in Religion

From hence it necessarily follows, that this People must Labour hard, and set all hands to Work: Rich and Poor, Young and Old, must study the Art of Number, Weight, and Measure; must fare hard, provide for Impotents, and for Orphans, out of hope to make profit by their Labours: must punish the Lazy by Labour, and not by cripling them[2]: I say, all these particulars, said to be the subtile excogitations of the *Hollanders*, seem to me, but what could not almost have been otherwise. ‖

Liberty of Conscience, Registry of Conveyances, small [22] Customs, Banks, Lumbards, and Law Merchant, rise all from the same Spring, and tend to the same Sea; as for lowness of Interest, it is also a necessary effect of all the premisses, and not the Fruit of their contrivance.

Wherefore we shall only shew in particular the efficacy of each, and first of Liberty of Conscience; but before I enter upon these, I shall mention a Practice almost forgotten, (whether it referreth to Trade or Policy is not material,) which is, the *Hollanders* undermasting, and sailing such of their Shipping, as carry cheap and gross Goods, and whose Sale doth not depend much upon Season. Undermasting of Ships.

It is to be noted, that of two equal and like Vessels, if

[1] S, R, 1691 insert 'moist,' cf. errata.

[2] S, '& not by cripling them' inserted by Petty.

William Petty (1623-1687)

"Another Essay in Political Arithmetick, Concerning the Growth of the City of London", 1682 in Sir William Petty, *The Economic Writings of Sir William Petty, together with The Observations upon Bills of Mortality, more probably by Captain John Graunt*, ed. Charles Henry Hull (Cambridge University Press, 1899), vol. 2

ANOTHER

ESSAY

IN

Political Arithmetick,

Concerning the Growth of the

CITY

OF

LONDON:

WITH THE

Measures, Periods, Causes, and Consequences thereof. 1682.

By Sir *William Petty*, Fellow of the *ROYAL SOCIETY.*

LONDON:

Printed by *H. H.* for *Mark Pardoe*, at the *Black Raven*, over against *Bedford-House*, in the Strand. 1683.

Methods, should produce *Uniformity* upon the discomposed understandings of about 8 Millions of Hearers.

4. As to the *Administration* of *Justice*. If in this great City shall dwell the Owners of all the Lands, and other Valuable things in *England*; If within it shall be all the *Traders*, & all the *Courts, Offices, Records, Juries*, and *Witnesses*; Then it follows, that *Justice* may be done with speed and ease.

5. As to the *Equality* and easie *Levying* of Taxes, It is too certain, That *London* hath at some time paid near half the Excise of *England*; and that the people pay || thrice as 36
much for the Hearths in *London* as those in the Countrey, in proportion to the People of each, and that the Charge of Collecting these Duties, have been about a sixth part of the Duty it self. Now, in this great City the Excise alone according to the present Laws, would not only be double to the whole Kingdom, but also more equal. And the Duty of Hearths of the said City, would exceed the present proceed of the whole Kingdom. And as for the *Customs*, we mention them not at present.

6. Whether more would be *gain'd* by *Foraign Commerce*[1].

The Gain which *England* makes by *Lead, Coals*, the Freight of Shipping, *&c.* may be the same, for ought I see, in both Cases. But the Gain which is made by *Manufactures*, will be greater, as the Manufacture it self is greater and better. For in so vast || a City *Manufactures* will beget one another, 37
and each *Manufacture* will be divided into as many parts as possible, whereby the Work of each *Artisan* will be simple and easie; As for Example. In the making of a *Watch*, If one Man shall make the *Wheels*, another the *Spring*, another shall Engrave the *Dial-plate*, and another shall make the *Cases*, then the *Watch* will be better and cheaper, than if the whole Work be put upon any one Man. And we also see that in *Towns*, and in the *Streets* of a great *Town*, where all the *Inhabitants* are almost of one Trade, the Commodity peculiar to those places is made better and cheaper than elsewhere. Moreover, when all sorts of Manufactures are

[1] 2d ed.; 'by commerce?'

Anonymous [i.e., Henry Martin, d. 1721]

Considerations upon the East-India trade, Printed for A. and J. Churchill, at the Black Swan in Pater-Noster-Row, London, MDCCI. [1701]
http://socserv.mcmaster.ca/econ/ugcm/3ll3/martyn/index.html

Considerations

ON THE

EAST-INDIA TRADE;

Wherein all the OBJECTIONS to that TRADE, with relation,

I. To the Exportation of BULLION, for Manufactures consumed in *England:*

II. To the Loss of Employment for our own Hands:

III. To the Abatement of Rents:

ARE FULLY ANSWER'D.

With a Comparison of the EAST-INDIA and FISHING TRADES.

LONDON:

Printed for J. ROBERTS, near the *Oxford Arms*, in *Warwick-Lane*. MDCCI.

tures. Of equal Labour in one and the same Country, the price will not be very different; and therefore, if the *East-India* Trade shall oblige Men to work cheaper in some kind of Manufactures, this very thing will have an influence upon others. Or thus, the *East-India* Trade will put an end to many of our *English* Manufactures; the Men that were imploy'd in these, will betake themselves to others, the most plain and easie; or to the single Parts of other Manufactures of most variety, because the plainest work is soonest learn'd: By the increase of Labourers, the price of work will be abated; and thus the *East-India* Trade must needs abate the price of *English* Manufactures.

and consequently by increasing their Vent,

If the price of *English* Manufactures shall be abated, more People will be enabled to buy in the former Markets, the abatement of the price will pay for the Carriage into new Markets. Thus of Cloth, perhaps a Yard may be sold abroad for Ten Shillings, it were as easie to sell two if a fifth part of that price might be abated. It is certain, that more Stockings are sold since the Framework has reduc'd the price. For the same reason that more of the cheaper labour of Engines can be sold than of the dearer labour of Hands, more of *Indian* than of the dearer *English* Manufactures; for the very same, the cheaper *English* Manufactures can be sold, the more will be sold: Wherefore the *East-India* Trade by abating the price, must increase the vent of *English* Manufactures.

and consequently by increasing the Manufactures,

Again, The more *English* Manufactures can be sold, the more of them will be made; consequently, the *East-India* Trade by increasing the vent, will also increase the *English* Manufactures.

makes more work for the People.

Lastly, More People will be imploy'd to make Two hundred Yards of Cloth to produce as many Bushels of Wheat, to procure from the *East-Indies* as many pieces of Callicoe, and so of other things, than to procure

but half the quantity of these things; more People are imploy'd to make a greater than a less quantity of Manufactures: Wherefore the *East-India* Trade, by causing an increase of our Manufactures, is the most likely way to increase the imployment of the People.

CHAP. XII.

By being the cause of the Invention of Arts and Engines, of order and regularity in our Manufactures, the East-India *Trade, without abating the Wages of Labourers, abates the price of Manufactures.*

It is objected, that by abating the price of Manufactures, Wages must be abated,

BUT if the Labourer was afraid that the importation of *East-India* Manufactures wou'd lessen his imployment, he will not be better pleas'd that to increase the same, the price of *English* Manufactures shou'd be abated. For by this, the price of Labour, that is Wages, will be abated.

consequently the Labourer must work more for the same things.

And consequently, the Labourer will be oblig'd to work more for Wages enough to buy the same conveniences of Life. For, tho' there is a mixture of Labour with these things, tho' the price of Labour is a part of the price of the conveniences of Life, tho' by the abatement of Wages the price of these things is also abated, yet the price of the conveniences of Life is not so much abated as the Wages which are to buy them. This might be prov'd by Reason; but an Example will serve instead of Demonstration. Suppose that a third part of the price of Labour, a third part of every Man's Wages is abated, then my Wages of Ten Shillings for Ten days Labour, are abated to Six Shillings and Eight Pence: Again, Of a yard of Cloth of the price of Ten Shillings, a part of the price is the price of Labour by which the same was wrought, per-

haps One Shilling is the price of Wool, Nine Shillings the price of Labour bestow'd upon it; by abatement of a third part of the price of Labour, the price of Wool is not abated, the price of the Manufacture is abated to Six Shillings; and thus the price of the Cloth is reduc'd to Seven Shillings: With my Wages of Ten Shillings for Ten Days labour, I was able to buy a Yard of Cloth of the price of Ten Shillings; but with the Wages of Six Shillings and Eight Pence for Ten Days labour, I am not able to buy the Yard of Cloth of the price of Seven Shillings, I must be oblig'd to work more than Ten Days for Wages enough to buy the Yard of Cloth; and therefore, if the *East-India* Trade shall abate the Wages of the Labourer, he will be oblig'd to work more for Wages enough to buy the same things.

Also, his share of Things must be less-sen'd.

Again, By abatement of the price of Labour, the Labourer's share of things is lessen'd; there is a mixture of Labour with all the conveniences of Life: As of a piece of Cloth, a great part of the price is the price of Labour by which the same is made, the Labourer's share of the Cloth is as much in proportion to the whole Cloth as the price of Labour is in proportion to the whole price; then, if the *East-India* Trade shall abate the price of Labour without abating the rest of the value of Things, it will render the price of Labour less in proportion to the whole price of Things, it will consequently abate the Labourer's share of Things. Then he will have no reason to be pleas'd with the *East-India* Trade, if to increase the imployment of the People, it must abate the price of Manufactures.

Wages are not abated.

I am very ready to believe, that the *East-India* Trade by the importation of cheaper, must needs reduce the price of *English* Manufactures; nevertheless it is Matter of Fact, that the Wages of Men are not abated.

As much Wages are given to the Plough-man, to the Sea-man, to the Weaver, to all kinds of Labourers as ever heretofore; so that the *East-India* Trade by reducing the price of Manufactures, has not yet abated Wages.

The East-India *Trade the cause of doing things with Arts, and Engines, and more Regularity.*

That this thing may not seem a Paradox, the *East-India* Trade may be the cause of doing things with less Labour, and then tho' Wages shou'd not, the price of Manufactures might be abated. If things shall be done with less labour, the price of it must be less tho' the Wages of Men shou'd be as high as ever. Thus a Ship is navigated with a great number of Hands at very great charge; if by being undermasted and spreading less Canvass the same shou'd be navigated by two-thirds of that number, so as the difference of Speed shall be very inconsiderable, the Ship wou'd be navigated with less charge, tho' the Wages of Sea-men shou'd be as high as ever. In like manner of any *English* Manufacture perform'd by so many Hands, and in so long a time, the price is proportionable, if by the invention of an Engine, or by greater order and regularity of the Work, the same shall be done by two-thirds of that number of Hands, or in two-thirds of that time; the labour will be less, the price of it will be also less, tho' the Wages of Men shou'd be as high as ever. And therefore, if the *East-India* Trade shall be the cause of doing the same things with less labour, it may without abating any Man's Wages abate the price of Manufactures.

Engines without abating Wages, abate the price of Manufactures;

Arts, and Mills, and Engines, which save the labour of Hands, are ways of doing things with less labour, and consequently with labour of less price, tho' the Wages of Men imploy'd to do them shou'd not be abated. The *East-India* Trade procures things with less and cheaper labour than would be necessary to

make the like in *England;* it is therefore very likely to be the cause of the invention of Arts, and Mills, and Engines, to save the labour of Hands in other Manufactures. Such things are successively invented to do a great deal of work with little labour of Hands; they are the effects of Necessity and Emulation; every Man must be still inventing himself, or be still advancing to farther perfection upon the invention of other Men; if my Neighbour by doing much with little labour, can sell cheap, I must contrive to sell as cheap as he. So that every Art, Trade, or Engine, doing work with labour of fewer Hands, and consequently cheaper, begets in others a kind of Necessity and Emulation, either of using the same Art, Trade, or Engine, or of inventing something like it, that every Man may be upon the square, that no man may be able to undersel his Neighbour. And thus the *East-India* Trade by procuring things with less, and consequently cheaper labour, is a very likely way of forcing Men upon the invention of Arts and Engines, by which other things may be also done with less and cheaper labour, and therefore may abate the price of Manufactures, tho' the Wages of Men should not be abated.

And so does Order and Regularity

Again, The *East-India* Trade is no unlikely way to introduce more Artists, more Order and Regularity into our *English* Manufactures, it must put an end to such of them as are most useless and unprofitable; the People imploy'd in these will betake themselves to others, to others the most plain and easie, or to the single Parts of other Manufactures of most variety; for plain and easie work is soonest learn'd, and Men are more perfect and expeditious in it; And thus the *East-India* Trade may be the cause of applying proper Parts of Works of great variety to single and proper Artists, of not leaving too much to be perform'd by the skill of

single Persons; and this is what is meant by introducing greater Order and Regularity into our *English* Manufactures.

Cloth; The more variety of Artists to every Manufacture, the less is left to the skill of single Persons; the greater the Order and Regularity of every Work, the same must needs be done in less time, the Labour must be less, and consequently the price of Labour less, tho' Wages shou'd not be abated. Thus a piece of Cloth is made by many Artists; one Cards and Spins, another makes the Loom, another Weaves, another Dyes, another dresses the Cloth; and thus to proper Artists proper Parts of the Work are still assign'd; the Weaver must needs be more skilful and expeditious at weaving, if that shall be his constant and whole imployment, than if the same Weaver is also to Card and Spin, and make the Loom, and Weave, and Dress, and Dye the Cloth. So the Spinner, the Fuller, the Dyer or Cloth-worker, must needs be more skilful and expeditious at his proper business, which shall be his whole and constant imployment, than any Man can be at the same work, whose skill shall be pusled and confounded with variety of other business.

Watches; A Watch is a work of great variety, and 'tis possible for one Artist to make all the several Parts, and at last to join them altogether; but if the Demand of Watches shou'd become so very great as to find constant imployment for as many Persons as there are Parts in a Watch, if to every one shall be assign'd his proper and constant work, if one shall have nothing else to make but Cases, another Weels, another Pins, another Screws, and several others their proper Parts; and lastly, if it shall be the constant and only imployment of one to join these several Parts together, this Man must needs be more skilful and expeditious in the composition of these several Parts, than the same Man cou'd be if he were

also to be imploy'd in the Manufacture of all these Parts. And so the Maker of the Pins, or Wheels, or Screws, or other Parts, must needs be more perfect and expeditious at his proper work, if he shall have nothing else to pusle and confound his skill, than if he is also to be imploy'd in all the variety of a Watch.

Ships made with more Order and Regularity, are cheaper.

But of all things to be perform'd by the labour of Man, perhaps there is not more variety in any thing than in a Ship: The Manufacture of the Keel, the Ribbs, the Planks, the Beams, the Shrouds, the Masts, the Sails, almost thousands of other Parts, together with the composition of these several Parts, require as much variety of skill. And still as the Sizes and Dimensions of Ships differ, the skill in the Manufacture of the several Parts, and again in the Composition of them, must needs be different; it is one kind of skill to make the Keel, or Ribbs, or Planks, or Beams, or Rudders, or other Parts of a Ship of One hundred Tons, and another to make the same Parts of a Ship of Five hundred; and in the same manner, the composition of Parts of different Scantlings and Dimensions must needs be different. Wherefore, if the Demand of Shipping shall be so very great, as to make constant imployment for as many several Artists as there are several different Parts of Ships of different dimensions, if to every one shall be assign'd his proper work, if one Man shall be always and only imploy'd in the Manufacture of Keels of one and the same dimensions, another of Ribbs, another of Beams, another Rudders, and several others of several other Parts, certainly the Keel, the Ribbs, the Beams, the Rudders, or other Parts, must needs be better done and with greater expedition, by any Artist whose whole and constant imployment shall be the Manufacture of that single Part, than if he is also to work upon different Parts or different Scantlings. Thus the greater the Order and Regularity of every Work,

the more any Manufacture of much variety shall be distributed and assign'd to different Artists, the same must needs be better done and with greater expedition, with less loss of time and labour; the Labour must be less, and consequently the price of Labour less, tho' Wages shou'd continue still as high as ever. And therefore the *East-India* Trade, if it is the cause that greater Order and Regularity is introduc'd into every Work, that Manufactures of much variety are distributed and assign'd to proper Artists, that things are done in less time and consequently with less labour, then without abating the Wages of the Labourer, it may well abate the price of Labour.

The *East-India* Trade, whether by setting forward the invention of Arts and Engines to save the labour of Hands, or by introducing greater Order and Regularity into our *English* Manufactures, or by whatsoever other means, lessens the price of Labour. However, Wages are not abated; wherefore, without reducing Wages, this Trade abates the price of Labour, and therefore of Manufactures.

The *East-India* Trade abates only the price of Manufactures, not the Wages of the Labourer; then he is able to buy more Manufactures, more conveniences of Life with the same Labour; he is not obliged to labour more for Wages enough to buy the same things.

Lastly, If Wages are not abated, if only the price of things is abated, the Labourer's share of the conveniences of Life may well be lessen'd without any inconvenience, without taking from the share of the Labourer, but by adding to the share of other People: And this is no hurt to any Man. Among the wild *Indians* of *America*, almost every thing is the Labourer's, ninety nine Parts of an hundred are to be put upon the account of Labour: In *England*, perhaps the Labourer has not two thirds of all the conveniences of Life, but

then the plenty of these things is so much greater here, that a King of *India* is not so well lodg'd, and fed, and cloath'd, as a Day-labourer of *England*.

Thus, without any Objection, without abating the Wages of any Man, without any inconvenience to the Labourer, the *East-India* Trade, by abating the price of Manufactures, increases their Vent; by increasing the Vent increases the Manufactures; by increasing the Manufactures makes more imployment for the People.

CHAP. XIII.

The East-India *Trade is the most likely way to set on foot new Manufactures for imployment of the People.*

THE *East-India* Trade is the most likely way not only to increase the business in the former Manufactures, it is also the way to introduce new Manufactures, new Imployments, into *England*, by creating a greater plenty of Money for this purpose; the greater the plenty shall be of Money, the same will be less likely to be hoarded, less likely to lye still; wanton Purses will be always open to build, beautifie, and improve the Kingdom; Shipping and Navigation will every day increase, new Trades will be discover'd.

Trade will be driven so very close, till as little is to be gain'd by it as is the present Interest of Money; and as Money shall every day be drawn out of Trade, to lye at Interest, to purchace Lands, the value of these will rise, the interest of Money will fall, till at last Land shall become too dear for Purchasers, till too little is to be gain'd at Interest; and thus the restless Treasure will be driven into Trade again.

When the plenty of Money shall become as great as among any of our Neighbours, some of their Manufactures may be attempted; perhaps this is the way to

carry on the Fishing-Trade in *England*: For this, in vain, Corporations have been projected, Incouragements have been given; Money is not drug enough in *England*; more is to be gain'd at present, by letting it out to Interest, by imploying the same in every other Trade: Corporations will not be contented more than private Persons to trade to loss, or to manage a less profitable Trade, while more profit is to be made of any other. The price of Labour is not enough abated; there is not a sufficient plenty of Money in *England* to do the thing; as soon as we shall have enough of this, private Persons will be able to carry on the Trade; there can be no need of Incouragements, no need of Corporations.

Then the *East-India* Trade, by doing more work with fewer Hands, by increasing our Superfluities, by increasing our Exportations, by making more Returns of Bullion into *England*, by increasing our Money, is the most likely means to set on foot new Imployments for the People.

The *East-India* Trade, by inlarging the business of the old, by setting on foot new, Manufactures, is the most likely way to make most imployment for the People; however, it deprives the People of no Manufacture which can be thought profitable to the Kingdom; and it were altogether as well that the People shou'd stand still, as that they shou'd be imploy'd to no profit. And this is what may be answer'd to the Labourer's Objection against the *East-India* Trade, the destruction of *English* Manufactures, and the loss of his Imployment.

Bernard Mandeville (1670-1733)

The Fable of the Bees or Private Vices, Publick Benefits, 1729. [With a Commentary Critical, Historical, and Explanatory by F.B. Kaye, Claarendon, Oxford, 1924 (Indianapolis: Liberty Fund, 1988)], vol. 1, pp. 356-8, vol. 2, 284.

THE FABLE OF THE BEES: OR, *Private Vices, Publick Benefits.*

By

BERNARD MANDEVILLE.

With a Commentary

Critical, Historical, and Explanatory by

F. B. KAYE

The First Volume

OXFORD:

At the Clarendon Press

MDCCCCXXIV

required to make a large Society: And it is folly to imagine that Great and Wealthy Nations can subsist, and be at once Powerful and Polite without.

I protest against Popery as much as ever *Luther* and [a] *Calvin* did, or Queen *Elizabeth* herself, but I believe from my Heart, that the Reformation has scarce been more Instrumental in rend'ring the Kingdoms and States that have embraced it, flourishing beyond other Nations, than the silly and capricious Invention of Hoop'd and Quilted Petticoats. But if this should be denied me by the Enemies of Priestly Power, at least I am sure that, bar the great [b] Men who have fought for and against that Lay-Man's Blessing, it has from its first beginning to this Day not employ'd so many Hands, honest industrious labouring Hands, as the abominable improvement on Female Luxury I named has done in few Years. Religion is one thing and Trade is another. He that gives most Trouble to thousands of his Neighbours, and invents the most operose Manufactures is, right or wrong, the greatest Friend to the Society.

What a Bustle is there to be made in several Parts of the World, before a fine Scarlet or crimson Cloth can be produced, what Multiplicity of Trades and Artificers must be employ'd! Not only such as are obvious, as Wool-combers, Spinners, the Weaver, the
[412] Cloth-|worker, the Scourer, the Dyer, the Setter, the Drawer and the Packer; but others that are more remote and might seem foreign to it; as the Millwright, the Pewterer and the Chymist, which yet are all necessary as well as a great Number of other Handicrafts to have the Tools, Utensils and other Implements belonging to the Trades already named: But all these things are done at home, and may be perform'd without extraordinary Fatigue or Danger; the most frightful Prospect is left behind, when we reflect on the Toil and Hazard that are to be undergone

[a] or *23–29* [b] Brave *23*; brave *24*

abroad, the vast Seas we are to go over, the different Climates we are to endure, and the several Nations we must be obliged to for their Assistance. *Spain* alone it is true might furnish us with Wool to make the finest Cloth; but what Skill and Pains, what Experience and Ingenuity are required to Dye it of those Beautiful Colours! How widely are the Drugs and other Ingredients dispers'd thro' the Universe that are to meet in one Kettle! Allum indeed we have of our own; Argol we might have from the *Rhine*, and Vitriol from *Hungary*; all this is in *Europe*; but then for Saltpetre in quantity we are forc'd to go as far as the *East-Indies*. Cochenille, unknown to the Ancients, is not much nearer to us, tho' in a quite different part of the Earth: we buy it 'tis true from the *Spaniards*; but not being their Product they are forc'd to fetch it for us from the remotest Corner of the New World in the *West-Indies*.[a] While | so many [413] Sailors are broiling in the Sun and sweltered with Heat in the *East* and *West* of us, another set of them are freezing in the *North* to fetch Potashes from *Russia*.[1]

When we are thoroughly acquainted with all the Variety of Toil and Labour, the Hardships and Calamities that must be undergone to compass the End I speak of, and we consider the vast Risques and Perils that are run in those Voyages, and that few of them are ever made but at the Expence, not only of the Health and Welfare, but even the Lives of many: When we are acquainted with, I say, and duly consider the things I named, it is scarce possible to conceive a Tyrant so inhuman and void of Shame, that beholding things in the same View, he should exact such terrible Services from his Innocent Slaves; and at the same time dare to own, that he did it for no other

[a] *East-Indies 25–32*

[1] The *Spectator*, no. 69, for 19 May 1711, shows some literary resemblances to this paragraph, but Addison has made little attempt to deduce economic principles.

Reason, than the Satisfaction a Man receives from having a Garment made of Scarlet or Crimson Cloth. But to what Height of Luxury must a Nation be arrived, where not only the King's Officers, but likewise his Guards, even the private Soldiers should have such impudent Desires!

But if we turn the Prospect, and look on all those Labours as so many voluntary Actions, belonging to different Callings and Occupations that Men are brought up to for a Livelihood, and in which every one Works for himself, how much soever he may seem to Labour for others: If we consider, that even the
[414] Sailors | who undergo the greatest Hardships, as soon as one Voyage is ended, even after Ship-wrack,[a] are looking out and solliciting for Employment in another: If we consider, I say, and look on these things in another View, we shall find that the Labour of the Poor is so far from being a Burthen and an Imposition upon them; that to have Employment is a Blessing, which in their Addresses to Heaven they pray for, and to procure it for the generality of them is the greatest Care of every Legislature.

As Children and even Infants are the Apes of others, so all Youth have an ardent desire of being Men and Women, and become often ridiculous by their impatient Endeavours to appear what every body sees they are not; all large Societies are not a little indebted to this Folly for the Perpetuity or at least long Continuance of Trades once Established. What Pains will young People take, and what Violence will they not commit upon themselves, to attain to insignificant and often blameable Qualifications, which for want of Judgment and Experience they admire in others, that are Superior to them in Age! This fondness of Imitation makes them accustom themselves by degrees to the Use of things that were Irksome, if not intolerable to them at first, till they know not how to leave

[a] Ship-wrack] a Ship-wreck *23*

THE FABLE OF THE BEES.

PART II.

By the AUTHOR of the Firſt.

Opinionum enim Commenta delet dies; Naturæ judicia confirmat. Cicero de Nat. Deor. Lib. 2.

LONDON,
Printed: And Sold by J. ROBERTS in *Warwick-Lane*. MDCCXXIX.

receiv'd from the muscular Strength exerted in the Act of Leaping. See a thousand Boys, as well as Men, jump, and they'll all make use of this Stratagem: but you won't find one of them, that does it knowingly for that Reason. What I have said of this Stratagem made use of in Leaping, I desire you would apply to the Doctrine of good Manners, which is taught and practised by Millions, who never thought on the Origin of Politeness, or so much as knew the real Benefit it is of to Society. The most crafty and designing will every where be the first, that for Interest-sake will learn to conceal this Passion of Pride, and in a little time no body will shew the least Symptom of it, whilst he is asking Favours, or stands in need of Help.

Hor. That rational Creatures should do all this, without thinking or knowing what they were about, is inconceivable. Bodily Motion is one thing, and the Exercise of the Understanding is another; and therefore agreeable Postures, a graceful Mein, an easy Carriage, and a genteel outward Behaviour, in general, may be learn'd and contracted perhaps without much Thought; but good Manners are to be observ'd every where, in speaking, writing, and ordering Actions to be perform'd by others.

Cleo. To Men who never turn'd their Thoughts that way, it certainly is almost in-|conceivable to [149] what prodigious Height, from next to nothing, some Arts may be and have been raised by human Industry and Application, by the uninterrupted Labour, and joint Experience of many Ages, tho' none but Men of ordinary Capacity should ever be employ'd in them. What a Noble as well as Beautiful, what a glorious Machine is a First-Rate Man of War, when she is under Sail, well rigg'd, and well mann'd! As in Bulk and Weight it is vastly superior to any other moveable Body of human Invention, so there is no other that has an equal Variety of differently surprizing

Contrivances to boast of. There are many Sets of Hands in the Nation, that, not wanting proper Materials, would be able in less than half a Year to produce, fit out, and navigate a First-Rate: yet it is certain, that this Task would be impracticable, if it was not divided and subdivided into a great Variety of different Labours;[1] and it is as certain, that none of these Labours require any other, than working Men of ordinary Capacities.

Hor. What would you infer from this?

Cleo. That we often ascribe to the Excellency of Man's Genius, and the Depth of his Penetration, what is in Reality owing to length of Time, and the Experience of many Generations, all of them very little differing from one another in natural Parts and Sagacity. And to know what it must have cost to
[150] bring that Art of making Ships[2] for | different Pur-

[1] Allusions to division of labour were common throughout antiquity (see Trever, *History of Greek Economic Thought*, Chicago, 1916), but rarely accompanied with much consciousness of the economic implications of the fact. Plato's *Republic* 369–71 and 433 A and Xenophon's *Cyropaedia* VIII. ii. 5–6 are perhaps the most analytical. In modern times, Petty is the earliest author whom I have found to develop the consequences of this division fully enough to deserve being credited with what we now term the division of labour theory. In his *Political Arithmetick* (published 1690, but written and circulated in manuscript long before) there is a definite statement of the division of labour theory (*Economic Writings*, ed. Hull, 1899, i. 260); and an equally clear exposition will be found in his *Another Essay in Political Arithmetick*, 1683 (*Economic Writings* ii. 473). The anonymous *Considerations on the East-India Trade*, 1701, contains a still more definite statement of the theory, together with a very able elaboration of it (see *Select Collection of Early English Tracts on Commerce*, ed. Political Economy Club, 1856, pp. 591–3). Compare, also, the slighter anticipation by Locke (*Of Civil Government* II. v. 43) and by Simon Clement (*Discourse of the General Notions of Money*, ed. 1695, ch. 1).—For the influence of Mandeville in giving currency to the division of labour theory see above, i. CXXXIV–CXXXV.

[2] The anonymous author of *Considerations on the East-India Trade*, who had anticipated Mandeville in 1701 in the exposition of the division of labour theory, also used ship-construction to illustrate his point (see *Select Collection of Early English Tracts*

poses, to the Perfection in which it is now, we are only to consider in the first place; that many considerable Improvements have been made in it within these fifty years and less; and in the Second, that the Inhabitants of this Island did build and make use of Ships eighteen hundred Years ago, and that from that time to this, they have never been without.

Hor. Which all together make a strong Proof of the slow Progress that Art has made, to be what it is.

Cleo. The Chevalier *Reneau* has wrote a Book, in which he shews the Mechanism of Sailing, and accounts mathematically for every thing that belongs to the working and steering of a Ship.[1] I am persuaded, that neither the first Inventors of Ships and Sailing, or those, who have made Improvements since in any Part of them, ever dream'd of those Reasons, any more than now the rudest and most illiterate of the vulgar do, when they are made Sailors, which Time and Practice will do in Spight of their Teeth. We have thousands of them, that were first haul'd on board and detain'd against their Wills, and yet in less than three Years time knew every Rope and every Pully in the Ship, and without the least Scrap of Mathematicks had learn'd the Management, as well as Use of them, much better than the greatest Mathematician could have done in all his Life-time, if he had ne-|ver been at [151]
Sea. The Book I mention'd, among other curious Things, demonstrates what Angle the Rudder must make with the Keel, to render its Influence upon the Ship the most powerful. This has its Merit; but a Lad of Fifteen, who has serv'd a Year of his Time on board of a Hoy, knows every thing that is useful in this Demonstration practically. Seeing the Poop always answering the Motion of the Helm, he only minds the latter, without making the least Reflection

on Commerce, ed. Political Economy Club, 1856, p. 592).

[1] See the *Théorie de la Manœuvre des Vaisseaux*, Paris, 1689, by Bernard Renau d'Éliçagaray (1652–1719), a leading designer of vessels and naval commander.

on the Rudder, 'till in a Year or two more his Knowledge in sailing, and Capacity of steering his Vessel become so habitual to him, that he guides her as he does his own Body, by Instinct, tho' he is half a-sleep, or thinking on quite another thing.

Hor. If, as you said, and which I now believe to be true, the People, who first invented, and afterwards improved upon Ships and Sailing, never dream'd of those Reasons of Monsieur *Reneau*, it is impossible, that they should have acted from them, as Motives that induced them *a priori*, to put their Inventions and Improvements in practice, with Knowledge and Design; which, I suppose, is what you intended to prove.

Cleo. It is; and I verily believe, not only that the raw Beginners, who made the first Essays in either Art, good Manners as well as Sailing, were ignorant of the true Cause, the real Foundation those Arts are
[152] built upon in | Nature; but likewise that, even now both Arts are brought to great Perfection, the greatest Part of those that are most expert, and daily making Improvements in them, know as little of the *Rationale* of them, as their Predecessors did at first: tho' I believe at the same time Monsieur *Reneau*'s Reasons to be very just, and yours as good as his; that is, I believe, that there is as much Truth and Solidity in your accounting for the Origin of good Manners, as there is in his for the Management of Ships. They are very seldom the same Sort of People, those that invent Arts, and Improvements in them, and those that enquire into the Reason of Things: this latter is most commonly practis'd by such, as are idle and indolent, that are fond of Retirement, hate Business, and take delight in Speculation: whereas none succeed oftener in the first, than active, stirring, and laborious Men, such as will put their Hand to the Plough, try Experiments, and give all their Attention to what they are about.

Hor. It is commonly imagin'd, that speculative Men are best at Invention of all sorts.

Cleo. Yet it is a Mistake. Soap-boyling, Grain-

dying, and other Trades and Mysteries, are from mean Beginnings brought to great Perfection; but the many Improvements, that can be remembred to have been made in them, have for the Generality been owing to Persons, who either were brought up to, or | had long practis'd and been conversant in those [153] Trades, and not to great Proficients in Chymistry or other Parts of Philosophy, whom one would naturally expect those Things from. In some of these Arts, especially Grain or Scarlet-dying, there are Processes really astonishing; and by the Mixture of various Ingredients, by Fire and Fermentation, several Operations are perform'd, which the most sagacious Naturalist cannot account for by any System yet known; a certain Sign, that they were not invented by reasoning *a Priori*. When once the Generality begin to conceal the high Value they have for themselves, Men must become more tolerable to one another. Now new Improvements must be made every Day, 'till some of them grow impudent enough, not only to deny the high Value they have for themselves, but likewise to pretend that they have greater Value for others, than they have for themselves.[1] This will bring in Complaisance, and now Flattery will rush in upon them like a Torrent. As soon as they are arrived at this Pitch of Insincerity, they will find the Benefit of it, and teach it their Children. The Passion of Shame is so general, and so early discover'd in all human Creatures, that no Nation can be so stupid, as to be long without observing and making use of it accordingly. The same may be said of the Credulity of Infants, which is very inviting to many good Purposes. The Knowledge of | Parents is communicated [154] to their Off-spring, and every one's Experience in Life, being added to what he learn'd in his Youth, every Generation after this must be better taught than the

[1] Cf. Esprit, *La Fausseté des Vertus Humaines* (1678) i. 449: '. . . il [man] a porté sa fausseté au comble de l'impudence lors qu'il a osé dire qu'il est desinteressé. . . .'

preceding; by which Means, in two or three Centuries, good Manners must be brought to great Perfection.

Hor. When they are thus far advanced, it is easy to conceive the rest: For Improvements, I suppose, are made in good Manners, as they are in all other Arts and Sciences. But to commence from Savages, Men I believe would make but a small Progress in good Manners the first three hundred Years. The *Romans*, who had a much better Beginning, had been a Nation above six Centuries, and were almost Masters of the World, before they could be said to be a polite People. What I am most astonish'd at, and which I am now convinc'd of, is, that the Basis of all this Machinery is Pride. Another thing I wonder at is, that you chose to speak of a Nation, that enter'd upon good Manners before they had any Notions of Virtue or Religion, which I believe there never was in the World.

Cleo. Pardon me, *Horatio*; I have no where insinuated that they had none, but I had no reason to mention them. In the first place, you ask'd my Opinion concerning the use of Politeness in this World, abstract from the Considerations of a future
[155] State: Secondly, | the Art of good Manners has nothing to do with Virtue or Religion, tho' it seldom clashes with either. It is a Science that is ever built on the same steady Principle in our Nature, whatever the Age or the Climate may be, in which it is practis'd.

Hor. How can any thing be said not to clash with Virtue or Religion, that has nothing to do with either, and consequently disclaims both?

Cleo. This I confess seems to be a Paradox; yet it is true. The Doctrine of good Manners teaches Men to speak well of all Virtues, but requires no more of them in any Age, or Country, than the outward Appearance of those in Fashion. And as to Sacred Matters, it is every where satisfied with a[a] seeming Conformity in outward Worship; for all the Religions

[a] a *om.* 30

in the Universe are equally agreeable to good Manners, where they are national; and pray what Opinion must we say a Teacher to be of, to whom all Opinions are probable alike? All the Precepts of good Manners throughout the World have the same Tendency, and are no more than the various Methods of making ourselves acceptable to others, with as little Prejudice to ourselves as is possible: by which Artifice we assist one another in the Enjoyments of Life, and refining upon Pleasure; and every individual Person is rendred more happy by it, in the Fruition of all the good Things he can purchase, than he | could have been [156] without such Behaviour. I mean happy, in the Sense of the Voluptuous. Let us look back on old *Greece*, the *Roman* Empire, or the great Eastern Nations, that flourish'd before them, and we shall find, that Luxury and Politeness ever grew up together, and were never enjoy'd asunder: that Comfort and Delight upon Earth have always employ'd the Wishes of the *Beau Monde*; and that, as their chief Study and greatest Sollicitude, to outward Appearance, have ever been directed to obtain Happiness in this World, so what would become of them in the next seems, to the naked Eye, always to have been the least of their Concern.

Hor. I thank you for your Lecture: you have satisfied me in several Things, which I had intended to ask: but you have said some others, that I must have time to consider; after which I am resolved to wait upon you again, for I begin to believe, that concerning the Knowledge of ourselves most Books are either very defective or very deceitful.

Cleo. There is not a more copious nor a more faithful Volume than human Nature, to those who will diligently peruse it; and I sincerely believe, that I have discover'd nothing to you, which, if you had thought of it with Attention, you would not have found out yourself. But I shall never be better pleas'd with myself, than when I can contribute to any Entertainment you shall think diverting.

Peace, and make it spread. No number of Men, when once they enjoy Quiet, and no Man needs to fear his Neighbour, will be long without learning to divide and subdivide their Labour.

Hor. I don't understand you.

Cleo. Man, as I have hinted before, naturally loves to imitate what he sees others do, which is the reason that savage People all do the same thing: This hinders them from meliorating their Condition, though they are always wishing for it: But if one will wholly apply himself to the making of Bows and Arrows, whilst [336] another provides Food, a | third builds Huts, a fourth makes Garments, and a fifth Utensils, they not only become useful to one another, but the Callings and Employments themselves will in the same Number of Years receive much greater Improvements, than if all had been promiscuously follow'd by every one of the Five.

Hor. I believe you are perfectly right there; and the truth of what you say is in nothing so conspicuous, as it is in Watch-making, which is come to a higher degree of Perfection, than it would have been arrived at yet, if the whole had always remain'd the Employment of one Person; and I am persuaded, that even the Plenty we have of Clocks and Watches, as well as the Exactness and Beauty they may be made of, are chiefly owing to the Division that has been made of that Art into many Branches.

Cleo. The use of Letters must likewise very much improve Speech it self, which before that time cannot but be very barren and precarious.

Hor. I am glad to hear you mention Speech again: I would not interrupt you, when you named it once before:[1] Pray what Language did your wild Couple speak, when first they met?

Cleo. From what I have said already it is evident, that they could have had none at all; at least, that is • my Opinion.

• is] it is *29–30*

[1] Cf. *Fable* ii. 190–1.

Francis Hutcheson (1670-1746)

A System of Moral Philosophy, R. & A. Foulis, Glasgow and Millar and Longman, London, 1755, vol. 1.

A SYSTEM OF MORAL PHILOSOPHY,

IN THREE BOOKS;

WRITTEN BY THE LATE

FRANCIS HUTCHESON, L. L. D.

PROFESSOR OF PHILOSOPHY

IN THE UNIVERSITY OF GLASGOW.

PUBLISHED FROM THE ORIGINAL MANUSCRIPT,

BY HIS SON FRANCIS HUTCHESON, M. D.

To which is prefixed

SOME ACCOUNT OF THE LIFE, WRITINGS, AND CHARACTER OF THE AUTHOR,

BY THE REVEREND WILLIAM LEECHMAN, D. D.

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M.DCC.LV.

hearts. Our reaſon by diſcovering to us the moral government of the *Deity*, and his perfections, preſents further motives to preſerve this ſubordination, both of the generous and intereſted kind: and a juſt conſideration of the circumſtances of mankind with reſpect to external things, will afford alſo new motives of ſecular intereſt to that ſame external conduct which theſe ſublimer principles excite us to, as we ſhall endeavour briefly to explain. CHAP. 4.

V. In the firſt place, 'tis obvious that for the ſupport of human life, to allay the painful cravings of the appetites, and to afford any of thoſe agreeable external enjoyments which our nature is capable of, a great many external things are requiſite; ſuch as food, cloathing, habitations, many utenſils, and various furniture, which cannot be obtained without a great deal of art and labour, and the friendly aids of our fellows.

Solitude miſerable and indigent.

Again, 'tis plain that a man in abſolute ſolitude, tho' he were of mature ſtrength, and fully inſtructed in all our arts of life, could ſcarcely procure to himſelf the bare neceſſaries of life, even in the beſt ſoils or climates; much leſs could he procure any grateful conveniencies. One uninſtructed in the arts of life, tho' he had full ſtrength, would be ſtill more incapable of ſubſiſting in ſolitude: and it would be abſolutely impoſſible, without a miracle, that one could ſubſiſt in this condition from his infancy. And ſuppoſe that food, raiment, ſhelter, and the means of ſenſual pleaſure, were ſupplied by a miracle; yet a life in ſo-

Book II. litude must be full of fears and dangers. Suppose farther all these dangers removed; yet in solitude there could be no exercise for many of the natural powers and instincts of our species; no love, or social joys, or communication of pleasure, or esteem, or mirth. The contrary dispositions of soul must grow upon a man in this unnatural state, a sullen melancholy, and discontent, which must make life intolerable. This subject is abundantly explained by almost all authors upon the law of nature.

The mutual aids of a few in a small family, may procure most of the necessaries of life, and diminish dangers, and afford room for some social joys as well as finer pleasures. The same advantages could still be obtained more effectually and copiously by the mutual assistance of a few such families living in one neighbourhood, as they could execute more operose designs for the common good of all; and would furnish more joyful exercises of our social dispositions.

The advantages of society.

Nay 'tis well known that the produce of the labours of any given number, twenty, for instance, in providing the necessaries or conveniences of life, shall be much greater by assigning to one, a certain sort of work of one kind, in which he will soon acquire skill and dexterity, and to another assigning work of a different kind, than if each one of the twenty were obliged to employ himself, by turns, in all the different sorts of labour requisite for his subsistence, without sufficient dexterity in any. In the former method each procures a great quantity of goods of one kind, and

can exchange a part of it for ſuch goods obtained by the labours of others as he ſhall ſtand in need of. One grows expert in tillage, another in paſture and breeding cattle, a third in maſonry, a fourth in the chace, a fifth in iron-works, a ſixth in the arts of the loom, and ſo on throughout the reſt. Thus all are ſupplied by means of barter with the works of complete artiſts. In the other method ſcarce any one could be dextrous and skilful in any one ſort of labour. CHAP. 4.

The advantages of large ſocieties.

Again ſome works of the higheſt uſe to multitudes can be effectually executed by the joint labours of many, which the ſeparate labours of the ſame number could never have executed. The joint force of many can repel dangers ariſing from ſavage beaſts or bands of robbers, which might have been fatal to many individuals were they ſeparately to encounter them. The joint labours of twenty men will cultivate foreſts, or drain marſhes, for farms to each one, and provide houſes for habitation, and incloſures for their flocks, much ſooner than the ſeparate labours of the ſame number. By concert, and alternate relief, they can keep a perpetual watch, which without concert they could not accompliſh.

Larger aſſociations may further enlarge our means of enjoyment, and give more extenſive and delightful exerciſe to our powers of every kind. The inventions, experience, and arts of multitudes are communicated; knowledge is increaſed, and ſocial affections more diffuſed. Larger ſocieties have force to execute greater deſigns of more laſting and extenſive ad-

BOOK II. vantage.* These considerations abundantly shew the necessity of living in society, and obtaining the aid of our fellows, for our very subsistence; and the great convenience of larger associations of men for the improvement of life, and the increase of all our enjoyments.

Good offices must be mutual, and much self-government.

But 'tis obvious that we cannot expect the friendly aids of our fellows, without, on our part, we be ready to good offices, and restrain all the selfish passions which may arise upon any interfering interests so that they shall not be injurious to others. Much thought and caution is requisite to find out such rules of conduct in society as shall most effectually secure the general interest, and promote peace and a mutual good understanding. Whatever generous principles there are in our nature, yet they are not alone, there are likeways many angry passions to which we are subject upon apprehension of injury intended, or executed; and all these powers by which men can so effectually give mutual aid, and do good offices, may be also employed, upon provocation, to the detriment of their fellows. Provoking of others by injury must generally be imprudent conduct in point of self-interest, as well as matter of remorse and self-condemnation. No man can be tolerably assured that his force or art shall be superior to that of those who may be roused to oppose him; multitudes conceive a just indignation against any unjust violence, and are

* See this whole subject beautifully explained in the second book of *Cicero de Officiis*.

Adam Ferguson (1723-1816)

An Essay on the History of Civil Society, T. Cadell, London and J. Bell, Edinburgh, 1782, 5th edition [1st edition 1767].

AN ESSAY ON THE HISTORY OF CIVIL SOCIETY.

By ADAM FERGUSON, LL.D.
Professor of Moral Philosophy in the University of EDINBURGH.

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M DCC LXXXII.

PART FOURTH.

Of CONSEQUENCES that reſult from the Advancement of CIVIL and COMMERCIAL ARTS.

SECTION I.

Of the Separation of Arts and Profeſſions.

IT is evident, that, however urged by a ſenſe of neceſſity, and a deſire of convenience, or favoured by any advantages of ſituation and policy, a people can make no great progreſs in cultivating the arts of life, until they have ſeparated, and committed to different perſons, the ſeveral taſks which require a peculiar ſkill and attention. The ſavage, or the barbarian, who muſt build and plant, and fabricate for himſelf, prefers, in the interval of great alarms and fatigues, the enjoyments of ſloth to the improvement of his fortune: he is, perhaps, by the diverſity of his wants, diſcouraged from induſtry; or, by his divided attention, prevented from acquiring ſkill in the management of any particular ſubject.

THE

THE enjoyment of peace, however, and the proſpect of being able to exchange one commodity for another, turns, by degrees, the hunter and the warrior into a tradeſman and a merchant. The accidents which diſtribute the means of ſubſiſtence unequally, inclination, and favourable opportunities, aſſign the different occupations of men; and a ſenſe of utility leads them, without end, to ſubdivide their profeſſions.

THE artiſt finds, that the more he can confine his attention to a particular part of any work, his productions are the more perfect, and grow under his hands in the greater quantities. Every undertaker in manufacture finds, that the more he can ſubdivide the taſks of his workmen, and the more hands he can employ on ſeparate articles, the more are his expences diminiſhed, and his profits increaſed. The conſumer too requires, in every kind of commodity, a workmanſhip more perfect than hands employed on a variety of ſubjects can produce; and the progreſs of commerce is but a continued ſubdiviſion of the mechanical arts.

EVERY craft may engroſs the whole of a man's attention, and has a myſtery which muſt be ſtudied or learned by a regular apprenticeſhip. Nations of tradeſmen come to conſiſt of members, who, beyond their own particular trade, are ignorant of all human affairs, and who may contribute

tribute to the preſervation and enlargement of their common-wealth, without making its intereſt an object of their regard or attention. Every individual is diſtinguiſhed by his calling, and has a place to which he is fitted. The ſavage, who knows no diſtinction but that of his merit, of his ſex, or of his ſpecies, and to whom his community is the ſovereign object of affection, is aſtoniſhed to find, that in a ſcene of this nature, his being a man does not qualify him for any ſtation whatever: he flies to the woods with amazement, diſtaſte, and averſion.

By the ſeparation of arts and profeſſions, the ſources of wealth are laid open; every ſpecies of material is wrought up to the greateſt perfection, and every commodity is produced in the greateſt abundance. The ſtate may eſtimate its profits and its revenues by the number of its people. It may procure, by its treaſure, that national conſideration and power, which the ſavage maintains at the expence of his blood.

The advantage gained in the inferior branches of manufacture by the ſeparation of their parts, ſeem to be equalled by thoſe which ariſe from a ſimilar device in the higher departments of policy and war. The ſoldier is relieved from every care but that of his ſervice; ſtateſmen divide the buſineſs of civil government into ſhares; and the ſervants of the public, in every office, without be-

ing ſkilful in the affairs of ſtate, may ſucceed, by obſerving forms which are already eſtabliſhed on the experience of others. They are made, like the parts of an engine, to concur to a purpoſe, without any concert of their own: and equally blind with the trader to any general combination, they unite with him, in furniſhing to the ſtate its reſources, its conduct, and its force.

The artifices of the beaver, the ant, and the bee, are aſcribed to the wiſdom of nature. Thoſe of poliſhed nations are aſcribed to themſelves, and are ſuppoſed to indicate a capacity ſuperior to that of rude minds. But the eſtabliſhments of men, like thoſe of every animal, are ſuggeſted by nature, and are the reſult of inſtinct, directed by the variety of ſituations in which mankind are placed. Thoſe eſtabliſhments aroſe from ſucceſſive improvements that were made, without any ſenſe of their general effect; and they bring human affairs to a ſtate of complication, which the greateſt reach of capacity with which human nature was ever adorned, could not have projected; nor even when the whole is carried into execution, can it be comprehended in its full extent.

Who could anticipate, or even enumerate, the ſeparate occupations and profeſſions by which the members of any commercial ſtate are diſtinguiſhed; the variety of devices which are practiſed in ſeparate

ſeparate cells, and which the artiſt, attentive to his own affair, has invented, to abridge or to facilitate his ſeparate taſk? In coming to this mighty end, every generation, compared to its predeceſſors, may have appeared to be ingenious; compared to its followers, may have appeared to be dull: And human ingenuity, whatever heights it may have gained in a ſucceſſion of ages, continues to move with an equal pace, and to creep in making the laſt, as well as the firſt, ſtep of commercial or civil improvement.

It may even be doubted, whether the meaſure of national capacity increaſes with the advancement of arts. Many mechanical arts, indeed, require no capacity; they ſucceed beſt under a total ſuppreſſion of ſentiment and reaſon; and ignorance is the mother of induſtry as well as of ſuperſtition. Reflection and fancy are ſubject to err; but a habit of moving the hand, or the foot, is independent of either. Manufactures, accordingly, proſper moſt, where the mind is leaſt conſulted, and where the workſhop may, without any great effort of imagination, be conſidered as an engine, the parts of which are men.

The foreſt has been felled by the ſavage without the uſe of the axe, and weights have been raiſed without the aid of the mechanical powers. The merit of the inventor, in every branch, probably deſerves a preference to that of the per-

former; and he who invented a tool, or could work without its aſſiſtance, deſerved the praiſe of ingenuity in a much higher degree than the mere artiſt, who, by its aſſiſtance, produces a ſuperior work.

But if many parts in the practice of every art, and in the detail of every department, require no abilities, or actually tend to contract and to limit the views of the mind, there are others which lead to general reflections, and to enlargement of thought. Even in manufacture, the genius of the maſter, perhaps, is cultivated, while that of the inferior workman lies waſte. The ſtateſman may have a wide comprehenſion of human affairs, while the tools he employs are ignorant of the ſyſtem in which they are themſelves combined. The general officer may be a great proficient in the knowledge of war, while the ſkill of the ſoldier is confined to a few motions of the hand and the foot. The former may have gained what the latter has loſt; and being occupied in the conduct of diſciplined armies, may practiſe on a larger ſcale all the arts of preſervation, of deception, and of ſtratagem, which the ſavage exerts in leading a ſmall party, or merely in defending himſelf.

The practitioner of every art and profeſſion may afford matter of general ſpeculation to the man of ſcience; and thinking itſelf, in this age of ſeparations, may become a peculiar craft. In the

the buſtle of civil purſuits and occupations, men appear in variety of lights, and ſuggeſt matter of inquiry and fancy, by which converſation is enlivened, and greatly enlarged. The productions of ingenuity are brought to the market; and men are willing to pay for whatever has a tendency to inform or amuſe. By this means the idle, as well as the buſy, contribute to forward the progreſs of arts, and beſtow on poliſhed nations that air of ſuperior ingenuity, under which they appear to have gained the ends that were purſued by the ſavage in his foreſt, knowledge, order, and wealth.

Denis Diderot (1713-1784)

« Art », *Encyclopédie*, 1751, vol. 1
http://encyclopedie.uchicago.edu/

mes. Il renferme une très-grande quantité de bâtimens civils deſtinés tant pour les atteliers des différentes ſortes d'ouvriers employés dans la fabrique des vaiſſeaux, que pour les magaſins des armemens & déſarmemens. Pour s'en faire une idée juſte, il faut voir le plan d'un *arſénal* de marine aux *figures de Marine*, *Planche VII.* (*Z*)

ARSENIC, ſ. m. (*Hiſt. nat. & chim.*) ce mot eſt dérivé d'ἄρρην ou ἄρσην, *homme* ou plûtôt *mâle*, & de νικάω, *je vaincs*, *je tue*, faiſant alluſion à ſa qualité vénéneuſe. *Dans l'hiſtoire naturelle* c'eſt une ſubſtance minérale, peſante, volatile, & qui ne s'enflamme pas, qui donne une blancheur aux métaux qui ſont en fuſion; elle eſt extrêmement cauſtique & corroſive aux animaux, de ſorte qu'elle eſt pour eux un poiſon violent. *Voyez* FOSSILE, CORROSIF, *&c.*

On met l'*arſénic* dans la claſſe des ſoufres. *Voyez* SOUFRE. Il y a différentes eſpeces d'*arſenic*, ſavoir le *jaune*, le *rouge*, & le *cryſtallin*, ou le *blanc*.

Il y a de l'*arſénic rouge* naturel; il y a auſſi de l'*arſenic jaune* naturel, qu'on appelle *orpiment*; l'*arſénic* jaune peut avoir différentes teintes, comme un jaune d'or, un jaune rougeâtre, un jaune verd, *&c.*

Le ſoufre & l'*arſénic* ont entr'eux beaucoup de ſympathie, & le ſoufre donne de la couleur à l'*arſenic*, en quelque petite quantité qu'il y ſoit joint.

Quelques-uns croyent que l'orpiment contient quelque portion d'or, mais en ſi petite quantité que ce n'eſt pas la peine de l'en ſéparer. *V.* ORPIMENT & SANDARAQUE.

On peut tirer du cobalt l'*arſenic* blanc & jaune. M. Krieg, dans les *Tranſactions philoſoph. n°* 293. nous en a donné la méthode ainſi qu'on la pratique en Hongrie. Le cobalt étant mis en poudre, la partie ſablonneuſe & légere étant ôtée par le moyen d'un courant d'eau, on met ce qui reſte dans le fourneau, dont la flamme paſſant par-deſſus la poudre emporte avec elle la partie arſenicale en forme de fumée, laquelle étant reçûe par une cheminée, & de-là portée dans un canal de brique étroit, s'attache dans ſa route aux côtés, & on l'en ratiſſe ſous la forme d'une poudre blanchâtre ou jaunâtre; de ce qui reſte du cobalt, on en fait le bleu d'émail. *Voyez* BLEU D'ÉMAIL.

La plus petite quantité d'*arſenic cryſtallin* mêlée avec quelque métal, le rend friable & détruit abſolument ſa malléabilité. C'eſt pourquoi les raffineurs ne craignent rien tant que l'*arſenic* dans leurs métaux; & il n'y auroit rien de ſi avantageux pour eux, en cas que l'on pût l'obtenir, qu'un menſtrue qui abſorberoit l'*arſenic*, ou qui agiroit uniquement ſur lui; car alors leurs métaux ſeroient aiſément purifiés ſans perdre aucune de leurs parties, ſans s'évaporer. On a trouvé ce moyen-là en France: il conſiſte à ajoûter un peu de fer auquel s'attache l'*arſenic*, qui quitte alors les métaux parfaits. C'eſt à M. Groſſe qu'on doit cette découverte.

L'*arſenic* même en petite quantité, change le cuivre en un argent beau en apparence. Pluſieurs perſonnes ont tâché de perfectionner cette invention, ou de renchérir ſur cette idée dans le deſſein de faire de l'argent, mais inutilement, parce que l'on ne pouvoit jamais l'amener au point de ſoûtenir le marteau ou d'être malléable: il ne reſte pas ſur la coupelle, & il verdit. Il y a eu des perſonnes pendues pour avoir monnoyé des pieces de ce faux argent, & elles l'ont bien mérité. Le cuivre eſt plus difficile à blanchir que le fer par l'*arſenic*.

Les Chimiſtes nous donnent pluſieurs préparations d'*arſenic*; elles tendent toutes à émouſſer ou détruire à force d'ablutions & de ſublimations les ſels corroſifs dont il abonde, & à transformer l'*arſenic* en une medecine ſûre, ainſi qu'on le fait à l'égard du ſublimé; tels ſont le rubis d'*arſenic*, *&c.* mais cela n'en vaut pas la peine; & quelque choſe que l'on puiſſe faire, on ne pourroit jamais en faire uſage intérieurement ſous aucune forme; il conſerve toûjours ſa propriété de poiſon mortel. Quand la fumée de l'*arſenic* entre dans les poumons, elle tue ſubitement; & plus il eſt ſublimé, dit Boerhaave, plus il devient aigre.

Le beurre & le lait de vache pris en grande quantité ſont de bons antidotes contre l'*arſenic*.

Le régule d'*arſenic* eſt la partie la plus fixe & la plus compacte de ce minéral: on le prépare en le mêlant avec des cendres à ſavon & du ſavon, laiſſant fondre le tout que l'on jette dans un mortier; alors la partie la plus peſante tombe au fond, & c'eſt le *régule d'arſenic*, c'eſt-à-dire l'*arſenic*, auquel on a donné le principe huileux qui lui manquoit pour être en forme métallique. *Voyez* RÉGULE.

L'huile cauſtique d'*arſénic* eſt une liqueur butyreuſe, ſemblable au beurre d'antimoine; c'eſt une préparation d'*arſenic* & de ſublimé corroſif. Elle ſert à ronger les chairs ſpongieuſes, à nettoyer ou exfolier les os cariés, *&c.* (*M*)

* ARSENOTHELES, ſ. m. pl. ou *hermaphrodites*, Ariſtote donne ce nom aux animaux qu'il conjecture avoir les deux ſexes. *Voyez* HERMAPHRODITE.

*ARSINOÉ, (*Géog. anc. & Myth.*) ville d'Egypte ſituée près du lac Mœris, où l'on avoit un grand reſpect pour les crocodiles; on les nourriſſoit avec ſoin; on les embaumoit après leur mort, & on les enterroit dans les lieux ſoûterrains du labyrinthe.

ARSIS, ſ. f. *terme de Grammaire ou plûtôt de Proſodie*; c'eſt l'élevation de la voix quand on commence à lire un vers. Ce mot vient du Grec αἴρω, *tollo*, j'éleve. Cette élevation eſt ſuivie de l'abaiſſement de la voix, & c'eſt ce qui s'appelle *theſis*, θέσις, *depoſitio*, *remiſſio*. Par exemple, en déclamant cet hémiſtiche du premier vers de l'Enéide de Virgile, *Arma virumque cano*, on ſent qu'on éleve d'abord la voix, & qu'on l'abaiſſe enſuite.

Par *arſis* & *theſis*, on entend communément la diviſion proportionnelle d'un pié métrique, faite par la main ou le pié de celui qui bat la meſure.

En meſurant la quantité dans la déclamation des mots, d'abord on hauſſe la main, enſuite on l'abaiſſe. Le tems que l'on employe à hauſſer la main eſt appellé *arſis*, & la partie du tems qui eſt meſuré en baiſſant la main, eſt appellée *theſis*; ces meſures étoient fort connues & fort en uſage chez les Anciens. *Voyez Terentianus Maurus*; Diomede, *lib. III. Mar. Victorinus*, *lib. I. art. gramm.* & Mart. Capella, *lib. IX. pag. 328.* (*F*)

On dit *en Muſique*, qu'un chant, un contre-point, une fugue, ſont *per theſin* quand les notes deſcendent de l'aigu au grave, & *per arſin* quand les notes montent du grave à l'aigu. Fugue *per arſin & theſin*, eſt celle que nous appellons aujourd'hui *fugue renverſée* ou *contre-fugue*, lorſque la réponſe ſe fait en ſens contraire, c'eſt-à-dire, en deſcendant ſi la guide a monté, ou en montant ſi elle a deſcendu. *Voyez* CONTRE-FUGUE, GUIDE. (*S*)

ART, ſ. m. (*Ordre encyclop. Entendement. Mémoire. Hiſtoire de la Nature. Hiſtoire de la nature employée. Art.*) terme abſtrait & métaphyſique. On a commencé par faire des obſervations ſur la nature, le ſervice, l'emploi, les qualités des êtres & de leurs ſymboles; puis on a donné le nom de *ſcience* ou d'*art* ou de *diſcipline* en général, au centre ou point de réunion auquel on a rapporté les obſervations qu'on avoit faites, pour en former un ſyſtème ou de regles ou d'inſtrumens, & de regles tendant à un même but; car voilà ce que c'eſt que *diſcipline* en général. Exemple. On a réflechi ſur l'uſage & l'emploi des mots, & l'on a inventé enſuite le mot *Grammaire*. *Grammaire* eſt le nom d'un ſyſtème d'inſtrumens & de regles ré-

latifs à un objet déterminé ; & cet objet eſt le ſon articulé, les ſignes de la parole, l'expreſſion de la penſée, & tout ce qui y a rapport ; il en eſt de même des autres Sciences ou *Arts*. *Voyez* ABSTRACTION.

Origine des Sciences & des Arts. C'eſt l'induſtrie de l'homme appliquée aux productions de la Nature ou par ſes beſoins, ou par ſon luxe, ou par ſon amuſement, ou par ſa curioſité, *&c.* qui a donné naiſſance aux Sciences & aux *Arts ;* & ces points de réunion de nos différentes réflexions ont reçû les dénominations de *Science* & d'*Art*, ſelon la nature de leurs objets *formels*, comme diſent les Logiciens. *Voyez* OBJET. Si l'objet s'exécute, la collection & la diſpoſition technique des regles ſelon leſquelles il s'exécute, s'appellent *Art.* Si l'objet eſt contemplé ſeulement ſous différentes faces, la collection & la diſpoſition technique des obſervations relatives à cet objet s'appellent *Science :* ainſi la *Métaphyſique* eſt une Science, & la *Morale* eſt un *Art.* Il en eſt de même de la Théologie & de la Pyrotechnie.

Spéculation & pratique d'un Art. Il eſt évident par ce qui précede, que tout *Art* a ſa ſpéculation & ſa pratique : ſa ſpéculation, qui n'eſt autre choſe que la connoiſſance inopérative des regles de l'*Art :* ſa pratique, qui n'eſt que l'uſage habituel & non réfléchi des mêmes regles. Il eſt difficile, pour ne pas dire impoſſible, de pouſſer loin la pratique ſans la ſpéculation, & réciproquement de bien poſſéder la ſpéculation ſans la pratique. Il y a dans tout *Art* un grand nombre de circonſtances relatives à la matiere, aux inſtrumens, & à la manœuvre que l'uſage ſeul apprend. C'eſt à la pratique à préſenter les difficultés & à donner les phénomenes ; & c'eſt à la ſpéculation à expliquer les phénomenes & à lever les difficultés : d'où il s'enſuit qu'il n'y a guere qu'un Artiſte ſachant raiſonner, qui puiſſe bien parler de ſon *Art.*

Diſtribution des Arts en libéraux & en méchaniques. En examinant les productions des *Arts*, on s'eſt apperçû que les unes étoient plus l'ouvrage de l'eſprit que de la main, & qu'au contraire d'autres étoient plus l'ouvrage de la main que de l'eſprit. Telle eſt *en partie* l'origine de la prééminence que l'on a accordée à certains *Arts* ſur d'autres, & de la diſtribution qu'on a faite des *Arts* en *Arts libéraux* & en *Arts méchaniques.* Cette diſtinction, quoique bien fondée, a produit un mauvais effet, en aviliſſant des gens très-eſtimables & très-utiles, & en fortifiant en nous je ne ſai quelle pareſſe naturelle, qui ne nous portoit déjà que trop à croire, que donner une application conſtante & ſuivie à des expériences & à des objets particuliers, ſenſibles & materiels, c'étoit déroger à la dignité de l'eſprit humain ; & que de pratiquer, ou même d'étudier les *Arts méchaniques*, c'étoit s'abbaiſſer à des choſes dont la recherche eſt laborieuſe, la méditation ignoble, l'expoſition difficile, le commerce déshonorant, le nombre inépuiſable, & la valeur minutielle. *Minui majeſtatem mentis humanæ, ſi in experimentis & rebus particularibus*, &c. Bac. *nov. org.* Préjugé qui tendoit à remplir les villes d'orgueilleux raiſonneurs, & de contemplateurs inutiles, & les campagnes de petits tyrans ignorans, oiſifs & dédaigneux. Ce n'eſt pas ainſi qu'ont penſé Bacon, un des premiers génies de l'Angleterre ; Colbert, un des plus grands miniſtres de la France ; enfin les bons eſprits & les hommes ſages de tous les tems. Bacon regardoit l'hiſtoire des *Arts méchaniques* comme la branche la plus importante de la vraie Philoſophie ; il n'avoit donc garde d'en mépriſer la pratique. Colbert regardoit l'induſtrie des peuples & l'établiſſement des manufactures, comme la richeſſe la plus ſûre d'un royaume. Au jugement de ceux qui ont aujourd'hui des idées ſaines de la valeur des choſes, celui qui peupla la France de graveurs, de peintres, de ſculpteurs & d'artiſtes en tout genre ; qui ſurprit aux Anglois la machine à faire des bas, les velours aux Génois, les glaces aux Vénitiens, ne fit guere moins pour l'état, que ceux qui battirent ſes ennemis, & leur enleverent leurs places fortes ; & aux yeux du philoſophe, il y a peut-être plus de mérite réel à avoir fait naître les le Bruns, les le Sueurs & les Audrans ; peindre & graver les batailles d'Alexandre, & exécuter en tapiſſerie les victoires de nos généraux, qu'il n'y en a à les avoir remportées. Mettez dans un des côtés de la balance les avantages réels des Sciences les plus ſublimes, & des *Arts* les plus honorés, & dans l'autre côté ceux des *Arts méchaniques*, & vous trouverez que l'eſtime qu'on a faite des uns, & celle qu'on a faite des autres, n'ont pas été diſtribuées dans le juſte rapport de ces avantages, & qu'on a bien plus loüé les hommes occupés à faire croire que nous étions heureux, que les hommes occupés à faire que nous le fuſſions en effet. Quelle biſarrerie dans nos jugemens ! nous exigeons qu'on s'occupe utilement, & nous mépriſons les hommes utiles.

But des Arts en général. L'homme n'eſt que le miniſtre ou l'interprete de la nature : il n'entend & ne fait qu'autant qu'il a de connoiſſance, ou expérimentale ou réfléchie, des êtres qui l'environnent. Sa main nue, quelque robuſte, infatigable & ſouple qu'elle ſoit, ne peut ſuffire qu'à un petit nombre d'effets : elle n'acheve de grandes choſes qu'à l'aide des inſtrumens & des regles ; il en faut dire autant de l'entendement. Les inſtrumens & les regles ſont comme des muſcles ſurajoûtés aux bras, & des reſſorts acceſſoires à ceux de l'eſprit. Le but de tout *Art* en général, ou de tout ſyſtême d'inſtrumens & de regles conſpirant à une même fin, eſt d'imprimer certaines formes déterminées ſur une baſe donnée par la nature ; & cette baſe eſt, ou la matiere, ou l'eſprit, ou quelque fonction de l'ame, ou quelque production de la nature. Dans les *Arts méchaniques*, auxquels je m'attacherai d'autant plus ici, que les Auteurs en ont moins parlé, *le pouvoir de l'homme ſe réduit à rapprocher ou à éloigner les corps naturels. L'homme peut tout ou ne peut rien, ſelon que ce rapprochement ou cet éloignement eſt ou n'eſt pas poſſible.* (*V. nov. org.*)

Projet d'un traité général des Arts méchaniques. Souvent l'on ignore l'origine d'un *Art méchanique*, ou l'on n'a que des connoiſſances vagues ſur ſes progrès : voilà les ſuites naturelles du mépris qu'on a eu dans tous les tems & chez toutes les nations ſavantes & belliqueuſes, pour ceux qui s'y ſont livrés. Dans ces occaſions, il faut recourir à des ſuppoſitions philoſophiques, partir de quelqu'hypotheſe vraiſſemblable, de quelqu'événement premier & fortuit, & s'avancer de-là juſqu'où l'*Art* a été pouſſé. Je m'explique par un exemple que j'emprunterai plus volontiers des *Arts méchaniques*, qui ſont moins connus, que des *Arts libéraux*, qu'on a préſentés ſous mille formes différentes. Si l'on ignoroit l'origine & les progrès de la *Verrerie* ou de la *Papeterie*, que feroit un philoſophe qui ſe propoſeroit d'écrire l'hiſtoire de ces *Arts ?* Il ſuppoſeroit qu'un morceau de linge eſt tombé par haſard dans un vaiſſeau plein d'eau ; qu'il y a ſéjourné aſſez long-tems pour s'y diſſoudre ; & qu'au lieu de trouver au fond du vaiſſeau, quand il a été vuide, un morceau de linge, on n'a plus apperçû qu'une eſpece de ſédiment, dont on auroit eu bien de la peine à reconnoître la nature, ſans quelques filamens qui reſtoient, & qui indiquoient que la matiere premiere de ce ſédiment avoit été auparavant ſous la forme de linge. Quant à la *Verrerie*, il ſuppoſeroit que les premieres habitations ſolides que les hommes ſe ſoient conſtruites, étoient de terre cuite ou de brique : or il eſt impoſſible de faire cuire de la brique à grand feu, qu'il

ne s'en vitrifie quelque partie ; c'eſt ſous cette forme que le verre s'eſt préſenté la premiere fois. Mais quelle diſtance immenſe de cette écaille ſale & verdâtre, juſqu'à la matiere tranſparente & pure des glaces? *&c.* Voilà cependant l'expérience fortuite, ou quelqu'autre ſemblable, de laquelle le philoſophe partira pour arriver juſqu'où l'*Art* de la Verrerie eſt maintenant parvenu.

Avantages de cette méthode. En s'y prenant ainſi, les progrès d'un *Art* ſeroient expoſés d'une maniere plus inſtructive & plus claire, que par ſon hiſtoire véritable, quand on la ſauroit. Les obſtacles qu'on auroit eu à ſurmonter pour le perfectionner ſe préſenteroient dans un ordre entierement naturel, & l'explication ſynthétique des démarches ſucceſſives de l'*Art* en faciliteroit l'intelligence aux eſprits les plus ordinaires, & mettroit les Artiſtes ſur la voie qu'ils auroient à ſuivre pour approcher davantage de la perfection.

Ordre qu'il faudroit ſuivre dans un pareil traité. Quant à l'ordre qu'il faudroit ſuivre dans un pareil traité, je crois que le plus avantageux ſeroit de rappeller les *Arts* aux productions de la nature. Une énumération exacte de ces productions donneroit naiſſance à bien des *Arts* inconnus. Un grand nombre d'autres naîtroient d'un examen circonſtancié des différentes faces ſous leſquelles la même production peut être conſidérée. La premiere de ces conditions demande une connoiſſance très-étendue de l'hiſtoire de la nature ; & la ſeconde, une très-grande dialectique. Un traité des *Arts*, tel que je le conçois, n'eſt donc pas l'ouvrage d'un homme ordinaire. Qu'on n'aille pas s'imaginer que ce ſont ici des idées vaines que je propoſe, & que je promets aux hommes des découvertes chimériques. Après avoir remarqué avec un philoſophe que je ne me laſſe point de loüer, parce que je ne me ſuis jamais laſſé de le lire, que l'hiſtoire de la nature eſt incomplete ſans celle des *Arts* : & après avoir invité les naturaliſtes à couronner leur travail ſur les regnes des végétaux, des minéraux, des animaux, *&c.* par les expériences des *Arts méchaniques*, dont la connoiſſance importe beaucoup plus à la vraie Philoſophie ; j'oſerai ajoûter à ſon exemple : *Ergo rem quam ago, non opinionem, ſed opus eſſe ; eamque non ſectæ alicujus, aut placiti, ſed utilitatis eſſe & amplitudinis immenſæ fundamenta.* Ce n'eſt point ici un ſyſtême : ce ne ſont point les fantaiſies d'un homme ; ce ſont les déciſions de l'expérience & de la raiſon, & les fondemens d'un édifice immenſe ; & quiconque penſera différemment, cherchera à rétrécir la ſphere de nos connoiſſances, & à décourager les eſprits. Nous devons au haſard un grand nombre de connoiſſances ; il nous en a préſenté de fort importantes que nous ne cherchions pas : eſt-il à préſumer que nous ne trouverons rien, quand nous ajoûterons nos efforts à ſon caprice, & que nous mettrons de l'ordre & de la méthode dans nos recherches? Si nous poſſédons à préſent des ſecrets qu'on n'eſpéroit point auparavant ; & s'il nous eſt permis de tirer des conjectures du paſſé, pourquoi l'avenir ne nous réſerveroit-il pas des richeſſes ſur leſquelles nous ne comptons guere aujourd'hui? Si l'on eût dit, il y a quelques ſiecles, à ces gens qui meſurent la poſſibilité des choſes ſur la portée de leur génie, & qui n'imaginent rien au-delà de ce qu'ils connoiſſent, qu'il eſt une pouſſiere qui briſe les rochers, qui renverſe les murailles les plus épaiſſes à des diſtances étonnantes, qui renfermée au poids de quelques livres dans les entrailles profondes de la terre, les ſecoüe, ſe fait jour à travers les maſſes énormes qui la couvrent, & peut ouvrir un gouffre dans lequel une ville entiere diſparoîtroit ; ils n'auroient pas manqué de comparer ces effets à l'action des roues, des poulies, des leviers, des contrepoids, & des autres machines connues, & de prononcer qu'une pareille pouſſiere eſt chimérique ; & qu'il n'y a que la foudre ou la cauſe qui produit les tremblemens de terre, & dont le méchaniſme eſt inimitable, qui ſoit capable de ces prodiges effrayans. C'eſt ainſi que le grand philoſophe parloit à ſon ſiecle, & à tous les ſiecles à venir. Combien (ajoûterons-nous à ſon exemple) le projet de la machine à élever l'eau par le feu, telle qu'on l'exécuta la premiere fois à Londres, n'auroit-il pas occaſionné de mauvais raiſonnemens, ſur-tout ſi l'auteur de la machine avoit eu la modeſtie de ſe donner pour un homme peu verſé dans les méchaniques? S'il n'y avoit au monde que de pareils eſtimateurs des inventions, il ne ſe feroit ni grandes ni petites choſes. Que ceux donc qui ſe hâtent de prononcer ſur des ouvrages qui n'impliquent aucune contradiction, qui ne ſont quelquefois que des additions très-légeres à des machines connues, & qui ne demandent tout au plus qu'un habile ouvrier ; que ceux, dis-je, qui ſont aſſez bornés pour juger que ces ouvrages ſont impoſſibles, ſachent qu'eux-mêmes ne ſont pas aſſez inſtruits pour faire des ſouhaits convenables. C'eſt le chancelier Bacon qui le leur dit : *qui ſumptâ*, ou ce qui eſt encore moins pardonnable, *qui neglectâ ex his quæ præſto ſunt conjecturâ, ea aut impoſſibilia, aut minus veriſimilia, putet ; eum ſcire debere ſe non ſatis doctum, ne ad optandum quidem commode & appoſite eſſe.*

Autre motif de recherche. Mais ce qui doit encore nous encourager dans nos recherches, & nous déterminer à regarder avec attention autour de nous, ce ſont les ſiecles qui ſe ſont écoulés ſans que les hommes ſe ſoient apperçûs des choſes importantes qu'ils avoient, pour ainſi dire, ſous les yeux. Tel eſt l'*Art* d'imprimer, celui de graver. Que la condition de l'eſprit humain eſt biſarre ! *S'agit-il de découvrir, il ſe défie de ſa force, il s'embarraſſe dans les difficultés qu'il ſe fait ; les choſes lui paroiſſent impoſſibles à trouver : ſont-elles trouvées ? il ne conçoit plus comment il a fallu les chercher ſi long-tems, & il a pitié de lui-même.*

Différence ſinguliere entre les machines. Après avoir propoſé mes idées ſur un traité philoſophique des *Arts* en général, je vais paſſer à quelques obſervations utiles ſur la maniere de traiter certains *Arts* méchaniques en particulier. On employe quelquefois une machine très-compoſée pour produire un effet aſſez ſimple en apparence ; & d'autres fois une machine très-ſimple en effet ſuffit pour produire une action fort compoſée : dans le premier cas, l'effet à produire étant conçu facilement, & la connoiſſance qu'on en aura n'embarraſſant point l'eſprit, & ne chargeant point la mémoire, on commencera par l'annoncer, & l'on paſſera enſuite à la deſcription de la machine : dans le ſecond cas au contraire, il eſt plus à propos de deſcendre de la deſcription de la machine à la connoiſſance de l'effet. L'effet d'une horloge eſt de diviſer le tems en parties égales, à l'aide d'une aiguille qui ſe meut uniformément & très-lentement ſur un plan ponctué. Si donc je montre une horloge à quelqu'un à qui cette machine étoit inconnue, je l'inſtruirai d'abord de ſon effet, & j'en viendrai enſuite au méchaniſme. Je me garderai bien de ſuivre la même voie avec celui qui me demandera ce que c'eſt qu'une maille de bas, ce que c'eſt que du drap, du droguet, du velours, du ſatin. Je commencerai ici par le détail de métiers qui ſervent à ces ouvrages. Le développement de la machine, quand il eſt clair, en fait ſentir l'effet tout-d'un-coup ; ce qui ſeroit peut-être impoſſible ſans ce préliminaire. Pour ſe convaincre de la vérité de ces obſervations, qu'on tâche de définir exactement ce que c'eſt que de la *gaze*, ſans ſuppoſer aucune notion de la machine du Gazier.

De la Géométrie des Arts. On m'accordera ſans pei-

ne qu'il y a peu d'Artiſtes, à qui les élémens des Mathématiques ne ſoient néceſſaires : mais un paradoxe dont la vérité ne ſe préſentera pas d'abord, c'eſt que ces élémens leur ſeroient nuiſibles en pluſieurs occaſions, ſi une multitude de connoiſſances phyſiques n'en corrigeoient les préceptes dans la pratique ; connoiſſances des lieux, des poſitions, des figures irrégulieres, des matieres, de leurs qualités, de l'élaſticité, de la roideur, des frottemens, de la conſiſtance, de la durée, des effets de l'air, de l'eau, du froid, de la chaleur, de la ſechereſſe, *&c.* il eſt évident que les élémens de la Géométrie de l'Académie, ne ſont que les plus ſimples & les moins compoſés d'entre ceux de la Géométrie des boutiques. Il n'y a pas un levier dans la nature, tel que celui que Varignon ſuppoſe dans ſes propoſitions ; il n'y a pas un levier dans la nature dont toutes les conditions puiſſent entrer en calcul. Entre ces conditions il y en a, & en grand nombre, & de très-eſſentielles dans l'uſage, qu'on ne peut même ſoûmettre à cette partie du calcul qui s'étend juſqu'aux différences les plus inſenſibles des quantités, quand elles ſont apprétiables ; d'où il arrive que celui qui n'a que la Géométrie intellectuelle, eſt ordinairement un homme aſſez mal adroit ; & qu'un Artiſte qui n'a que la Géométrie expérimentale, eſt un ouvrier très-borné. Mais il eſt, ce me ſemble, d'expérience qu'un Artiſte ſe paſſe plus facilement de la Géométrie intellectuelle, qu'un homme, quel qu'il ſoit, d'une certaine Géométrie expérimentale. Toute la matiere des frottemens eſt reſtée malgré les calculs, une affaire de Mathématique expérimentale & manouvriere. Cependant juſqu'où cette connoiſſance ſeule ne s'étend-elle pas ? Combien de mauvaiſes machines, ne nous ſont-elles pas propoſées tous les jours par des gens qui ſe ſont imaginés que les leviers, les roues, les poulies, les cables, agiſſent dans une machine comme ſur un papier ; & qui, faute d'avoir mis la main à l'œuvre, n'ont jamais ſû la différence des effets d'une machine même, ou de ſon profil ? Une ſeconde obſervation que nous ajoûterons ici, puiſqu'elle eſt amenée par le ſujet, c'eſt qu'il y a des machines qui réuſſiſſent en petit, & qui ne réuſſiſſent point en grand ; & réciproquement d'autres qui réuſſiſſent en grand, & qui ne réuſſiroient pas en petit. Il faut, je crois, mettre du nombre de ces dernieres toutes celles dont l'effet dépend principalement d'une peſanteur conſidérable des parties mêmes qui les compoſent, ou de la violence de la réaction d'un fluide, ou de quelque volume conſidérable de matiere élaſtique à laquelle ces machines doivent être appliquées : exécutez-les en petit, le poids des parties ſe réduit à rien ; la réaction du fluide n'a preſque plus de lieu ; les puiſſances ſur leſquelles on avoit compté diſparoiſſent ; & la machine manque ſon effet. Mais s'il y a, relativement aux dimenſions des machines, un point, s'il eſt permis de parler ainſi, un terme où elle ne produit plus d'effet, il y en a un autre en-delà ou en-deçà duquel elle ne produit pas le plus grand effet dont ſon méchaniſme étoit capable. Toute machine a, ſelon la maniere de dire des Géometres, un *maximum* de dimenſions ; de même que dans ſa conſtruction, chaque partie conſidérée par rapport au plus parfait méchaniſme de cette partie, eſt d'une dimenſion déterminée par les autres parties ; la matiere entiere eſt d'une dimenſion déterminée, relativement à ſon méchaniſme le plus parfait, par la matiere dont elle eſt compoſée, l'uſage qu'on en veut tirer, & une infinité d'autres cauſes. Mais quel eſt, demandera-t-on, ce terme dans les dimenſions d'une machine, au-delà ou en-deçà duquel elle eſt ou trop grande ou trop petite ? Quelle eſt la dimenſion véritable & abſolue d'une montre excellente, d'un moulin parfait, du vaiſſeau conſtruit le mieux qu'il eſt poſſible ? C'eſt à la Géométrie expérimentale & manouvriere de pluſieurs ſiecles, aidée de la Géométrie intellectuelle la plus déliée, à donner une ſolution approchée de ces problèmes ; & je ſuis convaincu qu'il eſt impoſſible d'obtenir quelque choſe de ſatisfaiſant là-deſſus de ces Géométries ſéparées, & très-difficile, de ces Géométries réunies.

De la langue des Arts. J'ai trouvé la langue des *Arts* très-imparfaite par deux cauſes ; la diſette des mots propres, & l'abondance des ſynonymes. Il y a des outils qui ont pluſieurs noms différens ; d'autres n'ont au contraire que le nom générique, *engin*, *machine*, ſans aucune addition qui les ſpécifie : quelquefois la moindre petite différence ſuffit aux Artiſtes pour abandonner le nom générique & inventer des noms particuliers ; d'autres fois, un outil ſingulier par ſa forme & ſon uſage, ou n'a point de nom, ou porte le nom d'un autre outil avec lequel il n'a rien de commun. Il ſeroit à ſouhaiter qu'on eût plus d'égard à l'analogie des formes & des uſages. Les Géometres n'ont pas autant de noms qu'ils ont de figures : mais dans la langue des *Arts*, un marteau, une tenaille, une auge, une pelle, *&c.* ont preſque autant de dénominations qu'il y a d'*Arts*. La langue change en grande partie d'une manufacture à une autre. Cependant je ſuis convaincu que les manœuvres les plus ſingulieres, & les machines les plus compoſées, s'expliqueroient avec un aſſez petit nombre de termes familiers & connus, ſi on prenoit le parti de n'employer des termes d'*Art*, que quand ils offriroient des idées particulieres. Ne doit-on pas être convaincu de ce que j'avance, quand on conſidere que les machines compoſées ne ſont que des combinaiſons des machines ſimples ; que les machines ſimples ſont en petit nombre ; & que dans l'expoſition d'une manœuvre quelconque, tous les mouvemens ſont réductibles, ſans aucune erreur conſidérable, au mouvement rectiligne & au mouvement circulaire ? Il ſeroit donc à ſouhaiter qu'un bon Logicien à qui les *Arts* ſeroient familiers, entreprît des élémens de la *grammaire des Arts*. Le premier pas qu'il auroit à faire, ce ſeroit de fixer la valeur des correlatifs, *grand*, *gros*, *moyen*, *mince*, *épais*, *foible*, *petit*, *léger*, *peſant*, &c. Pour cet effet il faudroit chercher une meſure conſtante dans la nature, ou évaluer la grandeur, la groſſeur & la force moyenne de l'homme, & y rapporter toutes les expreſſions indéterminées de quantité, ou du moins former des tables auxquelles on inviteroit les Artiſtes à conformer leurs langues. Le ſecond pas, ce ſeroit de déterminer ſur la différence & ſur la reſſemblance des formes & des uſages d'un inſtrument & d'un autre inſtrument, d'une manœuvre & d'une autre manœuvre, quand il faudroit leur laiſſer un même nom & leur donner des noms différens. Je ne doute point que celui qui entreprendra cet ouvrage, ne trouve moins de termes nouveaux à introduire, que de ſynonymes à bannir ; & plus de difficulté à bien définir des choſes communes, telles que *grace* en Peinture, *nœud* en Paſſementerie, *creux* en pluſieurs *Arts*, qu'à expliquer les machines les plus compliquées. C'eſt le défaut de définitions exactes, & la multitude, & non la diverſité des mouvemens dans les manœuvres, qui rendent les choſes des *Arts* difficiles à dire clairement. Il n'y a de remede au ſecond inconvénient, que de ſe familiariſer avec les objets : ils en valent bien la peine, ſoit qu'on les conſidere par les avantages qu'on en tire, ou par l'honneur qu'ils font à l'eſprit humain. Dans quel ſyſtème de Phyſique ou de Métaphyſique remarque-t-on plus d'intelligence, de ſagacité, de conſéquence, que dans les machines à filer l'or, faire des bas, & dans les métiers de Paſſementiers, de Gaziers, de Drapiers ou d'ouvriers en ſoie ? Quelle démonſtration de Mathématique eſt plus compliquée que le méchaniſme de certaines horloges, ou que les différentes opérations par

leſquelles on fait paſſer ou l'écorce du chanvre, ou la coque du ver, avant que d'en obtenir un fil qu'on puiſſe employer à l'ouvrage ? Quelle projection plus belle, plus délicate & plus ſinguliere que celle d'un deſſein ſur les cordes d'un ſample, & des cordes du ſample ſur les fils d'une chaîne ? qu'a-t-on imaginé en quelque genre que ce ſoit, qui montre plus de ſubtilité que le chiner des velours ? Je n'aurois jamais fait ſi je m'impoſois la tâche de parcourir toutes les merveilles qui frapperont dans les manufactures ceux qui n'y porteront pas des yeux prevenus, ou des yeux ſtupides.

Je m'arrêterai avec le philoſophe Anglois à trois inventions, dont les anciens n'ont point eu connoiſſance, & dont à la honte de l'hiſtoire & de la poëſie modernes, les noms des inventeurs ſont preſque ignorés : je veux parler de l'*Art* d'imprimer, de la découverte de la poudre à canon, & de la propriété de l'aiguille aimantée. Quelle révolution ces découvertes n'ont-elles pas occaſionnée dans la république des Lettres, dans l'*Art* militaire, & dans la Marine ? L'aiguille aimantée a conduit nos vaiſſeaux juſqu'aux régions les plus ignorées ; les caracteres typographiques ont établi une correſpondance de lumieres entre les ſavans de tous les lieux & de tous les tems à venir ; & la poudre à canon a fait naître tous ces chefs-d'œuvres d'architecture qui défendent nos frontieres & celles de nos ennemis : ces trois *Arts* ont preſque changé la face de la terre.

Rendons enfin aux Artiſtes la juſtice qui leur eſt dûe. Les *Arts libéraux* ſe ſont aſſez chantés eux-mêmes ; ils pourroient employer maintenant ce qu'ils ont de voix à célébrer les *Arts méchaniques*. C'eſt aux *Arts libéraux* à tirer les *Arts méchaniques* de l'aviliſſement où le préjugé les a tenus ſi long-tems ; c'eſt à la protection des rois à les garantir d'une indigence où ils languiſſent encore. Les Artiſans ſe font crus mépriſables, parce qu'on les a mépriſés ; apprenons-leur à mieux penſer d'eux-mêmes : c'eſt le ſeul moyen d'en obtenir des productions plus parfaites. Qu'il ſorte du ſein des Académies quelqu'homme qui deſcende dans les atteliers, qui y recueille les phénomenes des *Arts*, & qui nous les expoſe dans un ouvrage qui détermine les Artiſtes à lire, les Philoſophes à penſer utilement, & les Grands à faire enfin un uſage utile de leur autorité & de leurs récompenſes.

Un avis que nous oſerons donner aux ſavans, c'eſt de pratiquer ce qu'ils nous enſeignent eux-mêmes, qu'on ne doit pas juger des choſes avec trop de précipitation, ni proſcrire une invention comme inutile, parce qu'elle n'aura pas dans ſon origine tous les avantages qu'on pourroit en exiger. Montagne, cet homme d'ailleurs ſi philoſophe, ne rougiroit-il pas s'il revenoit parmi nous, d'avoir écrit, *que les armes à feu ſont de ſi peu d'effet, ſauf l'étonnement des oreilles, à quoi chacun eſt déformais apprivoiſé, qu'il eſpere qu'on en quittera l'uſage*. N'auroit-il pas montré plus de ſageſſe à encourager les arquebuſiers de ſon tems à ſubſtituer à la meche & au roüet quelque machine qui répondît à l'activité de la poudre, & plus de ſagacité à prédire que cette machine s'inventeroit un jour ? Mettez Bacon à la place de Montagne, & vous verrez ce premier conſidérer en philoſophe la nature de l'agent, & prophétiſer, s'il m'eſt permis de le dire, les grenades, les mines, les canons, les bombes, & tout l'appareil de la Pyrothecnie militaire. Mais Montagne n'eſt pas le ſeul philoſophe qui ait porté ſur la poſſibilité ou l'impoſſibilité des machines, un jugement précipité. Deſcartes, ce génie extraordinaire né pour égarer & pour conduire, & d'autres qui valoient bien l'auteur des *Eſſais*, n'ont-ils pas prononcé que le miroir d'Archimede étoit une fable ? cependant ce miroir eſt expoſé à la vûe de tous les ſavans au Jardin du Roi, & les effets qu'il y opere entre les mains de M. de Buffon qui l'a retrouvé, ne nous permettent plus de douter de ceux qu'il opéroit ſur les murs de Syracuſe entre les mains d'Archimede. De ſi grands exemples ſuffiſent pour nous rendre circonſpects.

Nous invitons les Artiſtes à prendre de leur côté conſeil des ſavans, & à ne pas laiſſer périr avec eux les découvertes qu'ils feront. Qu'ils ſachent que c'eſt ſe rendre coupable d'un larcin envers la ſociété, que de renfermer un ſecret utile ; & qu'il n'eſt pas moins vil de préférer en ces occaſions l'intérêt d'un ſeul à l'intérêt de tous, qu'en cent autres où ils ne balanceroient pas eux-mêmes à prononcer. S'ils ſe rendent communicatifs, on les débarraſſera de pluſieurs préjugés, & ſur-tout de celui où ils ſont preſque tous, que leur *Art* a acquis le dernier degré de perfection. Leur peu de lumieres les expoſe ſouvent à rejetter ſur la nature des choſes, un défaut qui n'eſt qu'en eux-mêmes. Les obſtacles leur paroiſſent invincibles dès qu'ils ignorent les moyens de les vaincre. Qu'ils faſſent des expériences ; que dans ces expériences chacun y mette du ſien ; que l'Artiſte y ſoit pour la main-d'œuvre ; l'Académicien pour les lumieres & les conſeils, & l'homme opulent pour le prix des matieres, des peines & du tems ; & bientôt nos *Arts* & nos manufactures auront ſur celles des étrangers toute la ſupériorité que nous deſirons.

De la ſupériorité d'une manufacture ſur une autre. Mais ce qui donnera la ſupériorité à une manufacture ſur une autre, ce ſera ſur-tout la bonté des matieres qu'on y employera, jointe à la célérité du travail & à la perfection de l'ouvrage. Quant à la bonté des matieres, c'eſt une affaire d'inſpection. Pour la célérité du travail & la perfection de l'ouvrage, elles dépendent entierement de la multitude des ouvriers raſſemblés. Lorſqu'une manufacture eſt nombreuſe, chaque opération occupe un homme différent. Tel ouvrier ne fait & ne fera de ſa vie qu'une ſeule & unique choſe ; tel autre, une autre choſe : d'où il arrive que chacune s'exécute bien & promptement, & que l'ouvrage le mieux fait eſt encore celui qu'on a à meilleur marché. D'ailleurs le goût & la façon ſe perfectionnent néceſſairement entre un grand nombre d'ouvriers, parce qu'il eſt difficile qu'il ne s'en rencontre quelques-uns capables de réfléchir, de combiner, & de trouver enfin le ſeul moyen qui puiſſe les mettre au-deſſus de leurs ſemblables ; le moyen ou d'épargner la matiere, ou d'allonger le tems, ou de ſurfaire l'induſtrie, ſoit par une machine nouvelle, ſoit par une manœuvre plus commode. Si les manufactures étrangeres ne l'emportent pas ſur nos manufactures de Lyon, ce n'eſt pas qu'on ignore ailleurs comment on travaille-là ; on a par-tout les mêmes métiers, les mêmes ſoies, & à peu près les mêmes pratiques : mais ce n'eſt qu'à Lyon qu'il y a 30000 ouvriers raſſemblés & s'occupant tous de l'emploi de la même matiere. Nous pourrions encore allonger cet article : mais ce que nous venons de dire, joint à ce qu'on trouvera dans notre Diſcours préliminaire, ſuffira pour ceux qui ſavent penſer, & nous n'en aurions jamais aſſez dit pour les autres. On y rencontrera peut-être des endroits d'une métaphyſique un peu forte : mais il étoit impoſſible que cela fût autrement. Nous avions à parler de ce qui concerne l'*Art* en général ; nos propoſitions devoient donc être générales : mais le bon ſens dit, qu'une propoſition eſt d'autant plus abſtraite, qu'elle eſt plus générale, l'abſtraction conſiſtant à étendre une vérité en écartant de ſon énonciation les termes qui la particulariſent. Si nous avions pû épargner ces épines au lecteur, nous nous ſerions épargné bien du travail à nous-mêmes.

ART DES ESPRITS, *ou* ART ANGÉLIQUE, moyen ſuperſtitieux pour acquérir la connoiſſance de tout ce qu'on veut ſavoir avec le ſecours de ſon ange gardien, ou de quelqu'autre bon ange. On diſtingue

ART, (Ordre encycl. Entend. Memoire, Hist. de la nat. , Hist de la nat. employe, Art.) [Original Class: Art] [Author: Diderot2] {Machine Class: Métaphysique} (Page 1:713)
http://artflx.uchicago.edu/cgi-bin/philologic/getobject.pl?c.0:3094.encyclopedie0311

ART, s. m. (*Ordre encyclop. Entendement. Mémoire. Histoire de la Nature. Histoire de la nature employée. Art.*) terme abstrait & métaphysique. On a commencé par faire des observations sur la nature, le service, l'emploi, les qualités des êtres & de leurs symboles; puis on a donné le nom de science ou d'art ou de discipline en général, au centre ou point de réunion auquel on a rapporté les observations qu'on avoit faites, pour en former un système ou de regles ou d'instrumens, & de regles tendant à un même but; car voilà ce que c'est que discipline en général. Exemple. On a réflechi sur l'usage & l'emploi des mots, & l'on a inventé ensuite le mot Grammaire. Grammaire est le nom d'un système d'instrumens & de regles rélatifs -- 1:714 -- à un objet déterminé; & cet objet est le son articulé, les signes de la parole, l'expression de la pensée, & tout ce qui y a rapport; il en est de même des autres Sciences ou Arts. Voyez Abstraction. [….]

De la supériorité d'une manufacture sur une autre. Mais ce qui donnera la supériorité à une manufacture sur une autre, ce sera sur - tout la bonté des matieres qu'on y employera, jointe à la célérité du travail & à la perfection de l'ouvrage. Quant à la bonté des matieres, c'est une affaire d'inspection. Pour la célérité du travail & la perfection de l'ouvrage, elles dépendent entierement de la multitude des ouvriers rassemblés. Lorsqu'une manufacture est nombreuse, chaque opération occupe un homme différent. Tel ouvrier ne fait & ne fera de sa vie qu'une seule & unique chose; tel autre, une autre chose: d'où il arrive que chacune s'exécute bien & promptement, & que l'ouvrage le mieux fait est encore celui qu'on a à meilleur marché. D'ailleurs le goût & la façon se perfectionnent nécessairement entre un grand nombre d'ouvriers, parce qu'il est difficile qu'il ne s'en rencontre quelques - uns capables de réfléchir, de combiner, & de trouver enfin le seul moyen qui puisse les mettre au - dessus de leurs semblables; le moyen ou d'épargner la matiere, ou d'allonger le tems, ou de surfaire l'industrie, soit par une machine nouvelle, soit par une manoeuvre plus commode. Si les manufactures étrangeres ne l'emportent pas sur nos manufactures de Lyon, ce n'est pas qu'on ignore ailleurs comment on travaille - là, on a par - tout les mêmes métiers, les mêmes soies, & à peu près les mêmes pratiques: mais ce n'est qu'à Lyon qu'il y a 30000 ouvriers rassemblés & s'occupant tous de l'emploi de la même matiere. Nous pourrions encore allonger cet article: mais ce que nous venons de dire, joint à ce qu'on trouvera dans notre Discours préliminaire, suffira pour ceux qui savent penser, & nous n'en aurions jamais assez dit pour les autres. On y rencontrera peut - être des endroits d'une métaphysique un peu forte: mais il étoit impossible que cela fût autrement. Nous avions à parler de ce qui concerne l'Art en général; nos propositions devoient donc être générales: mais le bon sens dit, qu'une proposition est d'autant plus abstraite, qu'elle est plus générale, l'abstraction consistant à étendre une vérité en écartant de son énonciation les termes qui la particularisent. Si nous avions pû épargner ces épines au lecteur, nous nous serions épargné bien du travail à nous - mêmes.

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In this article Diderot discusses one of the most important parts of the Encyclopédie *, the description of the arts, or of trades and industry.* [1] *The eighteenth-century editors considered the article of such importance that it was published separately in January 1751, before the publication of the first volume of the Encyclopédie, together with a letter to the Jesuit Father Berthier, editor of the* Mémoires de Trévoux *, who had criticized Diderot's advance* Prospectus *. The extent to which Diderot borrowed from Francis Bacon in this article is analyzed by R. Loyalty Cru in* Diderot as a Disciple of English Thought *(New York: Columbia University Press, 1913), pp. 245–255. See also: Herbert Dieckmann, "The Influence of Francis Bacon on Diderot's* Interprétation de la nature *," The Romanic Review , XXXIV (1943), esp. 327–330. [Translator note]*

Art. Abstract metaphysical term. Men began by collecting observations on the nature, function, use and qualities of beings and their symbols. Then they gave the name of science or art to the center or focal point to which they linked the observations they had made, in order to create a system of instruments, or of rules which were all directed toward the same object. That is the most general meaning of art. To give an example: Men reflected on the usage and function of words and subsequently invented the word "grammar." Grammar is the name of a system of instruments and rules that relate to a specific object; this object is articulated sound. The same is true of the other arts and sciences. *See* Abstraction.

Origin of the arts and sciences . In pursuit of his needs, luxury, amusement, satisfaction of curiosity, or other objectives, man applied his industriousness to the products of nature and thus created the arts and sciences. The focal points of our different reflections have been called "science" or "art" according to the nature of their "formal" objects, to use the language of logic. *See* Object. If the object leads to action, we give the name of "art" to the compendium of the rules governing its use and to their technical order. If the object is merely contemplated under different aspects, the compendium and technical order of the observations concerning this object are called "science." Thus metaphysics is a science and ethics is an art. The same is true of theology and pyrotechnics.

Speculative and practical aspects of an art . From the preceding it is evident that every art has its speculative and its practical aspect: the former consists in knowing the principles of an art, without their being applied, the latter in their habitual and unthinking application. It is difficult if not impossible to go far in the practice of an art without speculation, and, conversely, to have a thorough knowledge of the speculative aspects of an art without being versed in its practice. In every art there are many particulars concerning its material, its instruments, and its application which can only be learned through practice. It is the function of practice to present difficulties and phenomena, while speculation must explain the phenomena and solve the difficulties. Consequently, only an artist who can think logically can talk well about his art.

Division of the arts into liberal and mechanical arts . When men examined the products of the arts, they realized that some were primarily created by the mind, others by the hands. This is *part* of the cause for the pre-eminence that some arts have been accorded over others, and of the distinction between liberal and mechanical arts. This distinction, although it is quite justified, has led to bad consequences because it has given a low name to people who are very worthy and useful, and encouraged us in a certain natural laziness. We are all too inclined to believe that it is beneath the dignity of the human spirit to apply oneself diligently and continuously to specific and concrete experiments and objects, and that our mind forfeits its dignity when it descends to the study, let alone the practice, of the mechanical arts; the mind here stoops to questions in which research is laborious, reflection inglorious, and exposition difficult; such questions are dishonorable to deal with, countless in number, and of scarcely any value. *Minui majestatem mentis humanae, si in experimentis et rebus particularibus, etc.* (Bacon, *Novum Organum*).[2] This prejudice has tended to fill the cities with useless spectators and with proud men engaged in idle speculation, and the countryside with petty tyrants who are ignorant, lazy, and disdainful. Such was not the thinking of Bacon, one of the foremost geniuses of England, nor of Colbert, one of the greatest ministers of France, nor, in a word, of the right-thinking and sensible men of all times. Bacon considered the history of the mechanical arts the most important branch of true philosophy; therefore he certainly did not scorn its practice. Colbert considered the

industry of the people and the founding of manufactures the most reliable resource of a kingdom. In the opinion of those who today can discern true worth, the state benefited no less from a man who filled France with engravers, painters, sculptors, and artists of all types, who wrested from the English the secret of the machine for producing hosiery, from the Genoese their velvet, from the Venetians their mirrors, than it benefited from those who vanquished the enemies of France and took their fortresses. In the eyes of a philosopher a sovereign may deserve more praise if he has encouraged men like Le Brun, Le Sueur, and Audran,[3] if he has had the battles of Alexander painted and engraved, and the victories of our generals represented in tapestry, than he would for having gained those victories. Place on one side of the scales the actual advantages of the most sublime sciences and the most honored arts, and on the other side the advantages of the mechanical arts, and you will find that esteem has not been accorded to the one and to the other in just proportion to the benefits they bring. You will discover that far more praise has been heaped on those men who spend their time making us believe that we are happy, than on those who actually bring us happiness. How strangely we judge! We expect everyone to pass his time in a useful manner, and we disdain useful men.

General purpose of the arts. Man is only the minister or interpreter of nature: he can only understand or act insofar as he has knowledge of the beings that surround him, either by means of experiment or reflection. His bare hand can only achieve a small number of effects, however robust, tireless, and supple it may be; it succeeds in great enterprises only with the help of instruments and rules. The same is true of the understanding. It is as if instruments and rules provided additional muscles for the arms, and additional energy for the mind. The general purpose of any art, or of any system of instruments and rules concurring toward the same end, is to impress specific forms onto the basic element provided by nature. This element can be either matter, or spirit, or some function of the soul, or some product of nature. However, I shall devote most of my attention to the mechanical arts, particularly because other authors have written little about them. In these arts *man's power is limited to moving natural objects closer or farther away. Man is capable of everything or nothing, depending on whether it is or is not possible to bring objects closer or move them farther away* (see Bacon, *Novum Organum*).

A project for a general treatise on the mechanical arts. Often we do not know the origin of a mechanical art or have only vague information on its progress. That is the natural consequence of the scorn in which those who engage in these arts have been held at all times and in every learned or warlike nation. In such a situation we must have recourse to philosophic suppositions, begin from some probable hypothesis, from some first fortuitous event, and proceed from there until we reach the point to which the art has advanced. I shall explain this by an example, and I prefer to take it from the mechanical arts, which are not so well known, rather than from the liberal arts which have been described in a thousand different ways. If the origin and

progress of glassmaking or papermaking were unknown, what would a philosopher do if he intended to write the history of these arts? He would suppose that a piece of cloth had accidentally fallen into a container filled with water and had remained in it long enough to dissolve, so that when the container was emptied it was found to have in it, instead of a piece of cloth, only a kind of sediment. It would have been difficult to determine the nature of that sediment, had it not been for a few remaining filaments which indicated that the original matter of the sediment had been cloth. As far as glassmaking is concerned, he would suppose that the first solid dwellings built by men were made of baked clay or brick. Now it is impossible to burn brick in a strong fire without some part of it vitrifying, and it is in this form that glass first occurred. But how far removed this dirty greenish shard is from the pure, transparent matter used in windows, etc.! Yet this or a similar fortuitous happening is the starting point from which the philosopher will proceed to the present state of glassmaking.

Advantages of this method. By this procedure the progress of an art would be presented in a clearer and more instructive manner than by its true history, if that were known. The difficulties that had to be overcome to improve the art would occur in an entirely natural order, the synthetic explanation of its successive steps would render it comprehensible even for very average minds, and this would divert artists onto the path leading to perfection.

The order that would have to be followed in such a treatise. As for the order that would have to be followed in such a treatise, I believe that it would be most advantageous to link the arts to the products of nature. An exact enumeration of these products would give rise to many arts that are as yet unknown. A detailed examination of the different aspects from which the same product can be studied would lead to the discovery of still other arts. The first of these possibilities demands a very extensive knowledge of natural history and the second, great dialectical ability. Consequently, a treatise on the arts, as I envisage it, cannot be the work of an ordinary man. Let no one imagine that I am engaged in idle speculation and that the discoveries I promise are mere figments of my imagination. I have already pointed out that the history of nature is incomplete without the history of the arts, and here I echo a philosopher [Bacon] whom I never tire of praising because I never tire of reading him. I have already suggested to the naturalists that they perfect their studies of the vegetable, mineral, and animal kingdoms by including the experiments of the mechanical arts, a branch of knowledge much more important for true philosophy. Now I shall dare to add with him: *Ergo rem quam ago, non opinionem, sed opus esse; eamque non sectae alicujus, aut placiti, sed utilitatis esse et amplitudinis immensae fundamenta* .[4] We are not dealing here with a philosophical system nor with the whims of one man, but with the decrees of experience and of reason and the foundation of an immense edifice. Whoever thinks otherwise seeks to limit the sphere of our knowledge and to discourage men's minds. We owe to chance very important discoveries we did not actively seek. Should we assume that we will not find anything if we add our efforts to the whims of

chance and introduce order and method into our research? If we now possess secrets that men formerly did not hope to uncover, and if we may conjecture from the experience of the past, why should the future not hold riches for us that we can scarcely count on today? If, a few centuries ago, anyone had said to those people who measure possibilities by the reach of their genius and who do not imagine anything beyond what they already know, that there exists a dust that breaks rocks and overthrows the thickest walls from an unbelievable distance, that a few pounds of this dust, enclosed in the depths of the earth, shake the earth, make their way through the enormous mass that covers them, and open up an abyss large enough to contain an entire city, these people would certainly have compared such effects to the action of wheels, pulleys, levers, counterweights, and other known machines; they would have declared that such a dust is a mere figment of the imagination and that only lightning, or the cause that produces earthquakes by means of an inimitable mechanism, can produce such fearful prodigies. Thus we may conclude that the great philosopher spoke to his century and to all the centuries to come. We may ask, as he would have done, how much erroneous speculation would have been occasioned by the project of raising water by fire, as was carried out for the first time in London,[5] especially if the inventor of the machine would have modestly presented himself as a man little versed in mechanics? If this were the only attitude toward inventions nothing either great or small would be produced. Men who render hasty judgments upon inventions that do not deviate from established practice and sometimes are merely slight modifications of familiar machines, requiring at most a skillful worker to carry them out, men, I repeat, who are so narrow-minded that they judge these inventions to be impossible, should know that they themselves are not learned enough to formulate appropriate aspirations. The chancellor Bacon tells them so: *Qui sumpta* , or what is even more inexcusable, *qui neglecta ex his quae praesto sunt conjectura, ea aut impossibilia, aut minus verisimilia, putet; eum scire debere se non satis doctum, ne ad optandum quidem commode et apposite esse* .[6]

Another reason for carrying on research. We ought also to be encouraged in our research and prompted to look attentively around us, since so many centuries have gone by without men becoming aware of important things which they had, so to speak, right before their eyes, such as the arts of printing and engraving. How strange is the condition of the human mind! *During the act of discovery it mistrusts its strength, it becomes entangled in self-created difficulties and what it seeks seems impossible to find. Once the discovery is made, the mind no longer conceives why it was necessary to seek so long, and feels sorry for its inadequacy*.

Remarkable differences between machines. Having now set forth my ideas concerning a philosophic treatise on the arts in general, I am going to continue with some useful remarks on the manner of treating certain mechanical arts individually. Sometimes we use a very complex machine to produce an effect that appears quite simple; at other times a machine that is really very simple produces by itself a very complex

action. In the first case one must begin by stating the effect to be produced, since it is easily grasped and will not burden one's memory with knowledge nor confuse one's mind. The description of the machine will then follow. In the second case, on the contrary, it is more to the point to go from the description of the machine to knowledge of its effect. The effect of a clock is to divide time into equal parts with the aid of a needle that moves evenly and very slowly on a marked surface. If then I show a clock to someone who does not know this machine, I will first explain its effects and will then deal with its mechanism. I shall certainly not proceed in the same manner with someone who asks me what a stocking-stitch is, or cloth, or drugget, or velvet, or satin. Here I would begin with a detailed description of the frames on which these materials are produced. If the construction of the machine is clear, its effect is grasped all at once, something that might be impossible without this preliminary explanation. Anyone who would like to convince himself of the truth of these remarks should try to define exactly what gauze is, without presupposing any knowledge of the machine of the gauze-maker.

Of the geometry of the arts. Everyone will readily agree that there are few artists who can dispense with the elements of mathematics. Yet here we have a paradox, although its truth is not immediately obvious: in many situations knowledge of these elements would actually hamper an artist if, in practice, the precepts of mathematics were not corrected by an extensive knowledge of physical circumstances; such as location, position, irregular figures, materials and their qualities, elasticity, rigidity, friction, consistency, duration, as well as the effects of air, water, cold, heat, dryness, and so forth. It is clear that the elements of academic geometry constitute only the simplest and least complex elements of workshop geometry. There exists not one lever in nature that is the same as the one which Varignon presupposes in his propositions; [7] there exists not one lever in nature whose factors can all be calculated. Among these factors we find a great number, some of them very essential in practice, which cannot even be subjected to the mathematical operations by which we determine the slightest discernible differences of quantity. Hence a man who knows only theoretical geometry is usually not skillful, and an artist who knows only experimental geometry is very limited as a worker. But, in my opinion, experience shows us that it is easier for an artist to get along without theoretical geometry than for any man to get along without some experimental geometry. In spite of calculus the entire subject of friction has remained the province of experimental and practical mathematics. It is remarkable how far we can go with only this mathematics. How many bad machines are suggested every day by men who imagine that levers, wheels, pulleys, and cables perform in a machine as they do on paper! Because they have taken part in practical work, they have never learned the difference between the effects of the machine itself and of its section. We will add a second observation since the subject suggests it: there are machines that are successful on a small scale but not on a large scale. Of some others the opposite is true. I believe that the latter should include all the machines whose effect depends principally on the considerable weight of their component parts, on the force of reaction in a fluid, or on a great volume of elastic matter upon which these machines have to act. If one constructs them on a small

scale, the weight of the parts is reduced to nothing, the reaction of the fluid is almost nonexistent, the forces on which one has counted disappear and the machine is ineffective. However, just as there is a point, if we may use the term, a limit that stands in relation to the size of the machine, where it ceases to be effective, there is another below or beyond which the potential of its mechanism does not produce its maximum effect. Every machine has, in the language of geometry, a *maximum* size. When we consider each part in relation to its most perfect functioning, it has a size that is determined by the other parts. Similarly, from the point of view of its most perfect functioning, the whole has a size determined by the machine, by its intended use, and by an infinity of other matters. But where, you will ask, is the limit in the dimensions of a machine, beyond or below which it is either too large or too small? Which is the actual and absolute size of an excellent watch, a perfect mill, or a ship of the best possible construction? To give us an approximate solution to these problems, we need the experimental and practical geometry of several centuries, assisted by the most subtle theoretical geometry, I am convinced that it is impossible to obtain any satisfactory result when these types of geometry are kept separate, and that it is very difficult to do so even when they are combined.

Of the language of the arts. I have found the language of the arts to be very imperfect for two reasons: the scarcity of proper nomenclature and the frequency of synonyms. Some tools have several different names while others have only the generic name "engine" or "machine," without any additional name to distinguish them. At times an insignificant difference is enough to make artists invent specific names to substitute for the generic name. At other times a tool that is distinctive because of its form and use either has no name or is given the name of another tool with which it has nothing in common. One would wish for more attention to analogy of form and use. Geometers do not have as many names as they have figures, but in the arts a hammer, a pair of tongs, a bucket, a shovel, etc., have almost as many names as there are arts. A good part of the language changes from manufacture to manufacture. Yet I am convinced that the most unusual operations and the most complex machines could be explained by a rather small number of familiar, well-known terms, if it were decided to use technical terms only when they communicate a distinctive idea. What I am saying must carry conviction for anyone who considers that complex machines are only combinations of simple machines, that there are few simple machines, and that in the description of any operation all the movements can be reduced, without any significant error, to rectilinear and circular movements. It would be desirable if a good logician, well versed in the arts, undertook to describe the elements of a "grammar of the arts." For a first step he would have to determine the value of the correlatives "big," "large," "average," "thin," "thick," "slight," "small," "light," "heavy," etc. For this purpose one must seek a constant measure in nature or evaluate the height, width, and average force of man, and relate to it all indeterminate expressions of quantity, or at the least set up tables to which artists would be asked to make their language conform. The second step would be to decide on the differences and similarities between the form and the use of one instrument and another, between one operation and another, in order to determine when these should keep the same name and when they should be given different names. I do not doubt that anyone who undertakes

this task will find it necessary to eliminate synonyms rather than to introduce new terms. I am also sure that it is more difficult to give a good definition of common terms, such as "elegance" in painting, "knot" in trimming, "hollow" in several arts, than it is to explain the most complicated machines. It is the lack of precise definitions and the great number, not the diversity, of movements in various operations that makes it difficult to speak clearly about the arts. The only remedy for the second problem is to familiarize oneself with the objects: they are well worth the trouble whether we think of the advantages they bring us or of the fact that they do honor to the human mind. In what physical or metaphysical system do we find more intelligence, discernment, and consistency than in the machines for drawing gold or making stockings, and in the frames of the braid-makers, the gauzemakers, the drapers, or the silk workers? What mathematical demonstration is more complicated than the mechanism of certain clocks or the different operations to which we submit the fiber of hemp or the chrysalis of the silkworm before obtaining a thread with which we can weave? What projection is more beautiful, more subtle, and more unusual than the projection of a design onto the threads of a simple and from there onto the threads of a warp? What can conceivably be more subtle than the art of shadowing velvet? I could never enumerate all the marvels that amaze anyone who looks at factories, unless his eyes are closed by prejudice or stupidity.

I shall follow the example of the English philosopher and mention three inventions that were unknown to the ancients. It is to the shame of modern history and poetry that the names of their inventors are scarcely known. I am speaking of the art of printing, the discovery of gunpowder, and the properties of the magnetic needle. What a revolution these discoveries have brought about in the republic of letters, in military art, and in seafaring! The magnetic needle has led our ships to the most remote regions, typographic characters have created enlightened communication between learned men of all countries and all future time, and gunpowder has occasioned all the architectural masterpieces that defend our frontiers as well as those of our enemies; these three arts have almost transformed the face of the earth.

Let us finally render artists the justice that is their due. The liberal arts have sung their own praise long enough; they should now raise their voice in praise of the mechanical arts. The liberal arts must free the mechanical arts from the degradation in which these have so long been held by prejudice, while royal protection must save them from the indigent state in which they still languish. The artisans have thought they deserved disdain because they were in fact disdained; let us teach them to think better of themselves, only then can we obtain more perfect products from them! We would wish that from the halls of the academies there would emerge a man who would go into the workshops, record everything noteworthy about the arts, and set it forth in a work that would induce the artists to read, the philosophers to think usefully, and the nobles to begin exercising their authority and their munificence in a useful manner.

If we may give some advice to learned men, we would suggest that they practice what they teach, namely not to judge too hastily nor to condemn an invention as useless because in its early stages it does not bring all the advantages that could be expected of it. If Montaigne, who in other ways was so much of a philosopher, returned among us, he would blush to have written

that "firearms are so little effective, except in deafening our ears—to which everyone has become accustomed" that he hopes they will drop out of use. [8] Would he not have shown greater wisdom if he had encouraged the harquebusiers of his time to replace the match and wheellock by some machine activated by gunpowder? And would he not have shown more perspicacity if he had predicted that one day such a machine would be invented? Imagine Bacon in the place of Montaigne: you would see him study the nature of the agent and prophesy, if I may say so—grenades, mines, cannons, bombs, and the entire apparatus of military pyrotechnics. However, Montaigne is not the only philosopher who decided too hastily whether a machine is possible or impossible. Descartes, that extraordinary genius who was born both to confuse and to lead men, and many others, who were certainly the equals of the author of the *Essais*, maintained that the mirror of Archimedes was a fiction. Yet this mirror is exhibited in the *Jardin du Roi* for all learned men to see. M. Buffon, who rediscovered it, is using it so successfully that we can no longer doubt the results which Archimedes is supposed to have achieved with it, on the walls of Syracuse. [9] Such great examples suffice to render us circumspect.

On the other hand we invite the artists to take counsel with learned men and not to allow their discoveries to perish with them. The artists should know that to lock up a useful secret is to render oneself guilty of theft from society. It is just as despicable to prefer the interest of one individual to the common welfare in this case as in a hundred others where the artists themselves would not hesitate to decide for the common good. If they communicate their discoveries they will be freed of several preconceptions and especially of the illusion, which almost all of them hold, that their art has reached its ultimate perfection. Because they have so little learning they are often inclined to blame the nature of things for a defect that exists only in themselves. Obstacles seem insuperable to them whenever they do not know the means of overcoming them. Let them carry out experiments and let everyone make his contribution to these experiments: the artist should contribute his work, the academician his knowledge and advice, the rich man the cost of materials, labor, and time; soon our arts and our manufactures will be as superior as we could wish to those of other countries.

Of the superiority of one process of manufacture over another . But the superiority of one process over another will depend primarily on the quality of the materials used, together with the speed of work and the perfection of workmanship. The quality of the materials must be assured by inspection. As for the speed of work and the perfection of workmanship, they depend only on the number of workers brought together. When a process of manufacture employs many workers, each operation will be the responsibility of a different man. A particular workman will spend his lifetime performing one single operation; hence each operation is carried out quickly and well, and moreover the best-made product is also the cheapest. It is also true that when a great number of workers are assembled, taste and workmanship necessarily improve because there will be some who are able to reflect, put facts together, and discover the only way to surpass their fellow workers: they must economize on materials, make better use of time, or excel in inventiveness. This they can do by introducing either a new machine or a more practical process. If foreign industry does not surpass our manufacture in Lyon, it is not

because our processes are unknown elsewhere; everywhere we find the same looms, the same silks, and more or less the same practices, but only in Lyon are there thirty thousand workers assembled, all working on the manufacture of the same material.

We could make this article even longer, but what we have already said suffices for those readers who know how to think, and we could never write an article long enough for the others. Perhaps in some places people will find our metaphysics too daring, but that was inevitable. We had to speak of art in general and, consequently, had to deal in generalizations. Good sense tells us, however, that the more general a proposition the more abstract it is, since abstraction consists in extending a truth by eliminating from its statement terms that particularize it. If only we could have spared the reader these thorny passages, we would have spared ourselves a great deal of work.

Notes

1. [Much of this description has recently been reproduced by Charles C. Gillispie. See Bibliography, p. xl.]

2. [Diderot is here referring to Book I, Aphorism LXXXIII: "... the dignity of the human mind is lowered by long and frequent intercourse with experiments and particulars, which are the objects of sense, and confined to matter; especially since such matters generally require labor in investigation, are mean subjects for meditation, harsh in discourse, unproductive in practice, infinite in number, and delicate in their subtlety. Hence we have seen the true path not only deserted, but intercepted and blocked up, experience being rejected with disgust, and not merely neglected or improperly applied."]

3. [Charles le Brun (1619–1690) and Eustache le Sueur (1617-1655) were painters, Gérard Audran (1640–1703), an engraver who made engravings of many of their paintings.]

4. [Francis Bacon, *Cogitata et Visa* , in *The Works of Francis Bacon* , ed. James Spedding (Boston: Taggard and Tompkins, 1863), VII, 140: "Therefore I am not dealing with opinion but with actual performance, and this provides the foundations, not of any sect or school, but rather of great utility and further development."]

5. [The steam engine patented by Capt. Thomas Savery in 1698.]

6. [*Cogitata et Visa* (*The Works of Francis Bacon*, VII, 135). Diderot paraphrases this quotation in the preceding sentence.]

7. [Pierre Varignon (1654-1722), a famous mathematician, member of the Academy of Sciences, and author of a treatise on mechanics, *Nouvelle mécanique ou statique* (1725).]

8. [Michel de Montaigne, *Essais*, Bk. I, chap. 48, "Des Destries."]

9. [Diderot is referring to the story that Archimedes invented a burning mirror which destroyed the ships of the Romans when they besieged Syracuse. Buffon reconstructed such a mirror in 1747 in the *Jardin du Roi*, the botanical garden in Paris, known today as the *Jardin des Plantes* .]

« Épingle », *Encyclopédie*, Vol. 5 (1755)

Il y a le muſcle *épineux* du dos, le grand *épineux* du dos, les *épineux* du cou, les *interépineux* du cou. *Voyez* VERTEBRE.

Sur l'omoplate & ſur la partie ſupérieure de l'humérus, on remarque le *ſus-épineux* & le *ſous-épineux*. *Voyez* OMOPLATE.

L'*artere épineuſe* eſt une branche de la maxillaire interne, *voyez* MAXILLAIRE. (*L*)

EPINGLE, ſ. f. (*Art. Méchaniq.*) petit inſtrument de métal, droit & pointu par un bout, qui ſert d'attache amovible au linge & aux étoffes, pour fixer les différens plis qu'on leur donne à la toilette, à l'ouvrage, & dans les emballages.

L'*épingle* eſt de tous les ouvrages méchaniques le plus mince, le plus commun, le moins prétieux, & cependant un de ceux qui demandent peut-être le plus de combinaiſons: d'où il réſulte que l'art, ainſi que la nature étale ſes prodiges dans les petits objets, & que l'induſtrie eſt auſſi bornée dans ſes vûes, qu'admirable dans ſes reſſources; car une *épingle* éprouve dix-huit opérations avant d'entrer dans le commerce.

1°. *On jaunit le fil de laiton:* il arrive de Suede ou de Hambourg, en bottes de 25 à 28 livres chacune, pliées en cercle comme un collier, d'où on les appelle auſſi *torques*, & toutes noires de la forge: on les fait bouillir dans une chaudiere d'eau avec de la gravelle ou lie de vin blanc, environ une livre par botte. Un ouvrier les feſſe à force de bras ſur un billot de bois, avant de les faire bouillir: après une heure de feu, on les trempe dans un baquet d'eau fraîche, & on les rebat encore, obſervant de tremper & de battre alternativement. Ainſi dérouillées & aſſouplies, l'ouvrier replie le fil de laiton ébauché au-tour de ſon bras; d'où il paſſe au tirage, après avoir ſéché au feu ou au ſoleil.

2°. *On tire le fil à la bobille:* cette opération ſe fait ſur un banc ou établi, qui eſt une groſſe table de bois en quarré, longue & fort épaiſſe. *Voyez au bas de la Pl. I. fig. 4.* Le fil s'entortille autour d'un moulinet ou devidoir 1, ou ſix branches enchâſſées dans deux planches plates & rondes, celle d'en-bas plus grande que celle d'en-haut. Ce devidoir tourne ſur un pivot qui le traverſe au centre: vers l'autre extrémité eſt une filiere 3; c'eſt une piece de fonte d'un pié & demi de long, & d'un pouce d'épaiſſeur ſur deux de largeur, percée à cent douze trous égaux: mais comme elle eſt d'une matiere malléable, on peut élargir ou diminuer les trous, ſelon la groſſeur où l'on veut réduire le fil à tirer. On ſe ſert pour cela d'un poinçon 7: après avoir battu la filiere à coups de marteau 11, & bouché ſes trous avec un poliſſoir ſur un chantier 13, on la fixe avec des coins entre deux crampons 44 de fer, panchée 3 au niveau de l'endroit de la bobille où le fil doit tourner. L'ouvrier ayant appetiſſé la pointe du fil avec une lime, ſur un petit quarré de bois 12 qu'il appelle *étibeau*, il le fait paſſer par le trou de la filiere, & le tire d'abord avec des bequettes ou tenailles plates en dedans, & mordantes comme une lime (car elles ont des dents), juſqu'à ce qu'il puiſſe l'accrocher à la bobille par un ou deux petits anneaux de fer. La bobille eſt un cylindre de bois 2, fixé autour d'un arbre de fer qui le traverſe au centre par la baſe, elle tourne au moyen d'une manivelle de fer, attachée à la bobille par une patte 10 avec un manche mobile de bois ou de corne. L'ouvrier (*fig. 4. vignette de la Pl. I.*) prend le manche à deux mains, & tourne en frotant de tems en tems le fil à l'huile avec un pinceau ou un linge, afin de le rendre plus coulant autour de la bobille. Avant de paſſer le fil dans le trou de la filiere, on ſe ſert d'une jauge pour déterminer la meſure: la jauge eſt un fil d'archal (*VIII. fig. 5. au bas de la même Planche*) qui ſe replie en ſerpentant. Elle a douze portes, ſix de chaque côté; ce ſont les points par où le fil d'archal ſe rapproche le plus: elles ſervent à fixer la groſſeur où l'ouvrier doit reduire ſon fil, ſelon l'eſpece des *épingles* qu'il veut faire.

3°. *On dreſſe le fil*, (*Pl. II. fig. 2. vignette*). Sur une groſſe table à deux ou trois piés, eſt un moulinet autour duquel on met le fil qui ſort de la bobille. A un pié de diſtance eſt un engin *d*, c'eſt-à-dire un morceau de bois plat & quarré fixé ſur la table, & garni de ſept à huit clous ſans tête, placés de ſuite, mais à deux diſtances, de façon à former une équerre curviligne. *Voyez dans la figure 17, au bas de la même Planche*, le moulinet *G*, & l'engin avec les clous *HK*. Le dreſſeur fait paſſer le fil à-travers ces clous, devant le premier, derriere le ſecond, *&c.* de façon qu'il prend une ligne droite, dont il ne peut s'écarter, à moins que les clous ne plient de côté ou d'autre; mais alors on les redreſſe avec un marteau. Cette opération eſt d'autant plus délicate, que le moindre défaut rend le fil tors & inutile. Le dreſſeur ſaiſit le fil avec des tenailles tranchantes, & recule en-arriere à la diſtance de 18 piés environ; puis il revient *cueillir ſa dreſſée*, c'eſt-à-dire trancher ſon fil avec les tenailles, pour commencer une ſeconde dreſſée de la même longueur.

4°. *On coupe la dreſſée.* L'ouvrier prend une boîte ou meſure de bois traverſée ou terminée par une petite plaque de fer. Cette boîte a différens numeros, ſelon les diverſes eſpeces d'*épingles;* il ajuſte ſa boîte à la dreſſée, & la coupe avec des tenailles tranchantes appellées *triquoiſes*, en autant de tronçons ou parties aliquotes, qu'elle contient de fois la longueur de la meſure, prenant 10 à 12 dreſſées à-la-fois; puis il met les tronçons dans une écuelle de bois, *g*, *fig. 3. vignette de la même Planche.*

5°. *On empointe.* Un homme (*fig. 6. même vign.*) tourne une grande roue de bois, telle qu'on en voit chez les Couteliers, autour de laquelle eſt une corde de chanvre ou de boyau, aboutiſſant à la noix d'un arbre qui porte une meule dentelée. Cette meule eſt enchâſſée dans un billot de bois, *f*, quarré & creux par le milieu. L'empointeur (*figure 5.*) ſe place les jambes repliées en croix contre les cuiſſes, ſur une ſellette en pente devant la meule; prend une *tenaillée*, c'eſt-à-dire 12 à 15 tronçons à-la-fois; les place entre les deux index & les pouces, l'un au-deſſus de l'autre (*fig. 16. au bas de la même Planche*); applique les tronçons rangés en ligne ſur la meule; tire en baiſſant, & les faiſant tourner au moyen des deux pouces qu'il avance & retire alternativement, afin que la pointe aille en s'arrondiſſant: c'eſt ainſi qu'il empointe les deux extrémités des tronçons l'une après l'autre.

6°. *On repaſſe*, c'eſt à-dire que la même opération ſe répete ſur une meule voiſine (*fig. 7 & 8. vignette de la même Planche*), plus douce que la premiere, afin d'affiler les pointes qui ne ſont qu'ébauchées. C'eſt en quoi les *épingles* de Laigle & des autres villes de Normandie, ſont préférables à celles de Bordeaux, où l'on ne donne qu'une façon à la pointe. Les meules ſont d'un fer bien trempé, d'un demi-pié de diametre environ: elles ſont couvertes de dents tout-autour, qu'on a taillées avec un ciſeau ſur des lignes droites tracées au compas. On remet les meules au feu, quand elles ſont uſées; on polit la ſurface à la lime, & l'on y taille de nouvelles dents. L'axe des meules eſt un fuſeau de fer, dont les extrémités pointues entrent dans deux tapons du bois le plus dur, qui ſervent de pivots ou de ſoûtien à la meule. L'empointeur appuie plus ou moins legerement, ſelon que ſa pointe eſt avancée.

7°. *On coupe les tronçons.* Le coupeur prend une boîte de fer (*fig. 15. au bas de la ſeconde Planche*); il

ajuſte les tronçons en pointes dans cette boîte, & les aſſujettit avec une croſſe *n* ſur un métier de bois *m*, revêtu d'une chauſſe de cuir *ll*, qui s'attache autour de la cuiſſe avec des courroies *k k*. L'ouvrier aſſis par terre, étend une jambe & replie l'autre, enſorte que le pié de celle-ci donne contre le jarret de la jambe étendue. Dans cette poſture, la cuiſſe de la jambe repliée lui ſert de reſſort pour mouvoir la branche inférieure des grands ciſeaux avec leſquels il tranche les tronçons. Ces boîtes qui ſervent à déterminer la meſure de chaque *épingle*, comme les boîtes de bois fixent la meſure des tronçons, ont environ trois pouces de longueur ſur deux de large, avec une ſéparation vers le milieu, & ſont revêtues ſur les côtés de deux bords dans leſquels on trouve la place du pouce, afin d'alligner les tronçons. Les pointes appuient ſur la baſe du quarré que forme la boîte, & par-là même ſont expoſées à s'émouſſer, quoiqu'elles ne preſſent pas fortement contre le fer. On coupe les tronçons par douzaines, arrangés comme on les voit au bas de la même Planche (*fig. 21. 19. p. r. s.*); & on les diviſe en deux, en trois ou en quatre, ſelon le nombre des *épingles* qu'ils contiennent. Les extrémités qui débordent hors du niveau, s'appellent *hanſes*, & le coupeur les tranche dans la ſituation déjà décrite, & que la *fig. 4. de la même Planche* achevera de rendre intelligible.

8°. *On tourne les têtes.* Sur le haut bout d'une table panchée, eſt un roüet (*fig. 9. au milieu de la ſeconde Planche*), dont la corde aboutit à une noix de bois placée à l'autre extrémité de la table, & fixée ſur des pivots enfoncés dans la table. Au bout de cette noix eſt une broche ou tuyau de fer enchâſſé dans la noix. Cette broche eſt percée par le bout, & creuſée environ d'un pouce; elle eſt percée au-deſſus d'un ſecond trou ſemblable à l'embouchure du flageolet. C'eſt par ces deux trous voiſins qu'on fait d'abord paſſer le moule des têtes, pour l'attacher autour de la broche. Ce moule, *a*, n'eſt autre choſe qu'un fil de laiton plus ou moins gros, à proportion de la groſſeur des têtes qu'on veut faire, mais toûjours plus gros que les *épingles* à qui ces têtes conviendront. Le fil des têtes, plus mince que l'*épingle*, eſt en botte autour du moulinet *b*, planté ſur un pivot enfoncé dans un pié-d'eſtal. Le tourneur ou faiſeur de têtes prend une *porte*, c'eſt-à-dire un morceau de bois long de ſix pouces, ſur trois de circonférence. Au-deſſus eſt un diametre, ou une ligne creuſée dans le bois par le moule qui ſe trouve trop gêné entre deux *épingles* ſans tête placées à chaque extrémité, & l'anneau de fer fiché dans le centre. C'eſt par cet anneau, qui eſt proprement la porte, que paſſe le fil à tête, & de-là dans la broche par les trous indiqués, pour être accroché au bec. Le tourneur ſaiſit la porte à poing fermé, fait paſſer le fil à tête entre l'index & le doigt du milieu; enſorte qu'il coupe le moule à angles droits: il tourne le roüet d'une main; & le fil que le moulinet laiſſe aller, s'entortille autour du moule à meſure que l'ouvrier recule. Le moule rempli ou couvert à la longueur de cinq à ſix piés environ, on détache le fil de la broche; on le tire, & il vous reſte à la main une chaîne de têtes ſemblable à ces cordons d'or dont on borde quelquefois les chapeaux.

9°. *On coupe les têtes.* Un homme aſſis par terre (*fig. 10. au milieu de la même Planche*), les jambes croiſées en-deſſous, prend une douzaine de ces cordons à tête *n* (*fig. 8. Pl. III.*); il a des ciſeaux, *o*, camards ou ſans pointe, dont la branche ſupérieure ſe termine par une eſpece de crochet qui porte ſur la branche inférieure, afin que les doigts ne ſoient point foulés: car il ne fait que ſaiſir la branche ſupérieure, & la preſſer contre l'inférieure; au moyen de quoi il coupe les têtes, obſervant de ne jamais couper plus ou moins de deux tours de fil: car la tête eſt manquée, quand elle excede ou n'atteint pas ces limites. Cette opération eſt d'autant plus difficile, qu'il n'y a que l'habitude de l'œil ou de la main qui puiſſe aſſujettir l'ouvrier à cette regle; cependant il ne coupe pas moins de 12 mille têtes par heure.

10°. *On amollit les têtes*, Il ne faut pour cela que les faire rougir ſur un braſier, dans une cueiller de fer pareille à celle des Fondeurs d'étain ou de plomb, afin qu'elles ſoient plus ſouples au frappage, & qu'elles s'accrochent mieux autour des hanſes.

11°. *On frappe les têtes.* Le métier qui ſert à cette opération, eſt compoſé d'une table *o* (*fig. 12. au milieu de la Pl. III.*) ou billot quarré ou triangulaire qui en fait la baſe, de deux montans ou piliers de bois *ff*, liés enſemble par une traverſe *tt*. Dans un de ces montans, plus haut que l'autre environ de demi-pié, paſſe une baſcule *d* ou levier, qui vient répondre par une de ſes extrémités *c* au milieu de la traverſe des montans, & s'attache par une corde ou chaînette à une barre *b*, qui ſort par le milieu de la traverſe d'un contre-poids *a*. Ce levier répond de l'autre bout *e*, par une corde, à une planche ou marchette *f*, fixée à terre ou au plancher par un crampon & un anneau. Dans cette eſpece de caſe ſont deux branches ou broches de fer *x x* paralleles aux montans, plantées ſur la baſe du métier, & enchâſſées dans la traverſe d'en-haut avec des coins. Sous le contre-poids eſt une ſeconde traverſe de fer qui vient s'accrocher aux deux broches *y y*, pour fixer le contre-poids, de façon qu'il ne puiſſe s'écarter à droite ou à gauche du point ſur lequel il doit tomber. Ce contre-poids *a*, qu'on nomme *peſée*, eſt un maſſif de plomb ſphérique ou cylindrique, peſant 10 à 11 livres; il contient un eſquibot de fer, dans lequel eſt enchâſſé un outil ou canon d'acier, au point *z*. Cet outil eſt percé d'une *auche*, c'eſt-à-dire d'une cavité hémiſphérique qui enchâſſe la tête de l'*épingle*: au-deſſous eſt une enclume ſurmontée d'un outil enchâſſé, pareil au ſupérieur, & percé d'une auche toute ſemblable, à laquelle conduit une petite ligne creuſée dans l'outil pour placer le corps de l'*épingle*, qui caſſeroit faute de cette précaution. Ces deux auches ou têtoirs ſervent à ſerrer à-la-fois les deux parties de la tête; ce qui s'appelle *enclorre*. On les forme avec des poinçons, tels qu'on en voit un dans la *figure* déſignée; ce qui s'appelle *enhaucher*. Le frappeur aſſis ſur une ſellette (*o, figure 12. & 13. Pl. II. au milieu*), a devant lui trois écuelles de bois ou poches de cuir, dont l'une (*z, figure 2. Pl. III.*) eſt pleine de hanſes empointées; l'autre (*o, o, fig. 18. au bas de la même Planche*) eſt pleine de têtes; & la troiſieme (*z, 3. 10. figure précédemment citée*) ſert à mettre les *épingles* entêtées. Tandis que d'une main il enfile les *épingles* dans les têtes, ce qu'on appelle *brocher*, de l'autre il *enrhune* ou place la tête dans les auches, & du pié il fait joüer le contre-poids, au moyen de la marchette qu'il frappe à coups redoublés, obſervant de tourner l'*épingle* dans les têtoirs, pour bien frapper la tête de tous les côtés. Il y a des métiers à pluſieurs places, tels qu'on en voit un à trois (*fig. 12. & 13. Planche II.*) C'eſt la même machine multipliée ſur une ſeule baſe.

12°. *On jaunit les épingles.* On employe à cet uſage de la gravelle qu'on fait bouillir avec les *épingles* dans l'eau pendant un certain tems, juſqu'à ce que les têtes noircies au feu reprennent la couleur naturelle du laiton.

13°. *On blanchit les épingles.* Comme on a beſoin pour cette opération, de plaques d'étain, voici la maniere de les mouler.

On dreſſe un établi (*figure 6. Pl. III. vignette*), formé de deux ou trois planches bien unies, de ſept à huit piés de long ſur deux de large; on étend par-

deſſus une couverture de laine, qu'on revêt d'un coutis bien tendu, & attaché avec des clous. Un ouvrier tient un moule ou chaſſis de bois, qui forme un quarré long de deux piés ſur deux pouces d'épaiſſeur, à trois côtés, ou plûtôt deux côtés & la baſe. Le chaſſis appliqué ſur une extrémité de l'établi, on prend quelques cueillerées de l'étain fondu dans une chaudiere *m*, qu'on verſe ſur ce lit, & qui ſe trouve arrêté par le chaſſis. Cette lame d'étain a deux pouces de profondeur; & comme les plaques ne doivent avoir que deux lignes d'épaiſſeur environ, on la laiſſe étendre ſur l'établi qui eſt en pente, en reculant doucement avec le chaſſis, que l'étain liquide ſuit toûjours, juſqu'à ce qu'il ait pris ſur le coutis. Quand il eſt refroidi, on leve toute la coulée, qui ſe détache d'elle-même, & on la partage en *diſques* ou plaques tracées au compas, de ſeize pouces de diametre chacune. Venons au blanchiſſage.

Pour cent livres d'*épingles* qu'on blanchit à-la-fois, on jette dans une chaudiere (*fig. 14. Pl. III. vers le bas de la Planche*), ſix ſeaux d'eau de huit pots chacun, où l'on répand trois livres de *gravelle* ou lie de vin blanc. Sur une plaque d'étain qui peſe une livre à-peu-près, on met environ deux livres *d'épingles*; qu'on prend à poignée ſans les peſer, & qu'on étend ſur la plaque (*figure 15*), afin qu'elles s'étament mieux: les bords de la plaque ſont relevés tout-autour, de peur que les *épingles* ne tombent. On met ainſi pluſieurs plaques garnies l'une ſur l'autre, enſorte que chaque lit d'*épingles* ſe trouve toûjours entre deux plaques. Un certain nombre de ces plaques forme ce qu'on appelle *une portée* (*fig. 10. 10.*) qu'un ouvrier met dans la chaudiere, au moyen d'une croix de fer en ſautoir (*fig. 3. 3. 1. 14.*) ſuſpendue par des fils d'archal ou de laiton (*figure 2.*) Ces fils débordent hors de la chaudiere, afin de pouvoir retirer les portées: chaque portée eſt ſéparée des autres par une plaque plus forte. Il faut que l'eau bouille avec la gravelle & les *épingles* pendant quatre heures. La gravelle ſert à détacher les parties d'étain, qui s'attachent enſuite à l'*épingle*. Telle eſt la diviſibilité de l'étain, qu'il ne perd que quatre onces ſur cent livres d'*épingles*; ainſi l'opération de couler les plaques ne revient qu'après dix-huit mois d'intervalle. L'étain dont on ſe ſert en Angleterre, eſt du plus pur & très-bien calciné; auſſi les *épingles* y ſont-elles très-blanches. Celles de Bordeaux ont encore un avantage ſur celles-ci pour l'éclat & la durée de la blancheur, parce qu'on y mêle du tartre dans le blanchiſſage.

14°. *On éteint les épingles*, c'eſt-à-dire qu'on les lave dans un baquet d'eau fraîche (*fig. 1. Pl. III.*) ſuſpendu en l'air ſur un bâton, ou par des anſes attachées à des crochets avec des cordes qu'on appelle *la branloire*; on les ſecoue en balotant le baquet de côté & d'autre, pour ſéparer la gravelle qui tombe au fond, & purifier l'étamage.

15°. *On ſeche les épingles*. Il n'y a qu'à les mêler avec du ſon bien gros & bien ſec, dans des ſacs de cuir que deux hommes agitent chacun par un bout (*5. fig. 4.*); ou bien on les met dans un auget *o* ou boîte de bois qui va en retréciſſant, & finit par une ouverture d'où les *épingles* coulent dans un barril foncé (*B. fig. 2.*) qu'on appelle *frotoire*. A la place de la bonde eſt un trou de ſix pouces quarré, qui s'ouvre & ſe ferme par une porte de bois doublée de papier, afin que les *épingles* & le ſon ne s'arrêtent ou ne tombent pas en tournant. Cette porte mobile eſt enchâſſée entre deux liteaux, le long deſquels elle monte & deſcend, comme les chaſſis de certaines fenêtres ſans volet; enſorte qu'elle ferme preſque hermétiquement ce barril ſuſpendu ſur deux montans, & traverſé d'un axe; il ſe tourne avec un manche ou une manivelle à chaque bout, ou à un ſeul.

16°. *On vanne les épingles*, c'eſt-à-dire qu'on en ſépare le ſon. Cette opération ſe fait dans un plat de bois d'environ deux piés & demi de circonférence, où l'on ſecoue les *épingles*, comme dans un crible ou dans un van à blé; ou bien on les met dans une groſſe cruche de terre (*d. figure 3*), d'où on les fait couler; & tandis que les *épingles* tombent, le vent emporte le ſon, qui ſert pluſieurs fois, pourvû qu'on le reſſeche au four ou au ſoleil, car le plus uſé ſe trouve le meilleur.

17°. *On pique les papiers*. Après qu'on les a pliés en pluſieurs doubles, qui forment autant d'étages de 40 à 50 *épingles* chacun, juſqu'à la concurrence d'un demi-millier, on prend un poinçon ou peigne de fer à 20 ou 25 dents, d'où il tire le nom de *quarteron*; & d'un ſeul coup de marteau qu'on frappe ſur une élévation qui ſe trouve au dos du peigne, dans le centre, voilà la place faite à un quarteron d'*épingles*. Les demi-milliers ſont diviſés en deux colonnes, dont chacune contient 10 ou 12 rangs d'*épingles*. Outre ces papiers, il y en a dont on empaquete les demi-milliers par ſixains ou dixains, qui contiennent 6 ou 10 milliers. Ces papiers ſont marqués en rouge, à la marque de l'ouvrier qui fait les *épingles*, ou plûtôt du marchand qui les fait faire, & les débite en gros.

18°. *On boute les épingles*. C'eſt les placer dans le papier. On les prend à poignée, on les range par douzaine à-la-fois: il le faut bien, pour bouter juſqu'à 36 milliers d'*épingles* par jour; encore ne gagne-t-on, quand on y excelle, que trois ſous: auſſi cet ouvrage reſte entre les mains des enfans, qui gagnent deux liards pour 6 milliers qu'ils en peuvent bouter dans un jour.

On diſtingue l'eſpece & le prix des *épingles* par les numeros, qui varient avec la longueur & la groſſeur. Tel eſt l'ordre des numeros: 3. 4. 5. 6. 7. 8. 9. 10. 12. 14. 17. 18. 20. 22. 24. 26. 30. 36. celles qui ſont au-deſſus s'appellent *houſeaux*, eſpece d'*épingles* jaunes dont le millier ſe compte à la livre: il y a des milliers d'une livre, de deux & de trois. Le fil de laiton arrive de Suede en bottes de trois groſſeurs: celles de la premiere groſſeur ſervent à faire les houſeaux & les drapieres; la *drapiere* eſt une *épingle* groſſe & courte, que les Drapiers emploient à emballer leurs étoffes, ou à les attacher en double: la ſeconde groſſeur s'employe aux *épingles* moyennes, c'eſt-à-dire depuis le n°. 20 juſqu'au n°. 10; & la troiſieme groſſeur, depuis le n°. 10 juſqu'au n°. 3, qui eſt le camion ou la demoiſelle; & pour en venir à ce point de fineſſe, le fil n'a beſoin de paſſer que cinq à ſix fois par la filiere, tant il eſt ductile.

Il y a des *épingles* de fer qui paſſent par les mêmes épreuves que celles de laiton, excepté qu'au lieu de les blanchir, on les teint quelquefois en noir, pour le deuil ou pour les cheveux; & qu'au lieu de les empointer, on en fait à double tête pour ce dernier uſage: mais les têtes ſont toûjours de laiton. La façon même de les blanchir eſt particuliere; on y employe une poudre compoſée de ſel ammoniac, d'étain commun, & d'étain de glace ou de vif-argent, qu'on fait bouillir avec les *épingles* dans un pot de fer.

Voici la maniere de préparer le fer pour le réduire en fil d'*épingle*, ou la deſcription d'une allemanderie qu'on voit à Laigle en Normandie, à 30 lieues de Paris. Il y a d'abord une grande roue à palettes, que l'eau fait tourner comme celle des moulins à blé. L'arbre de cette roue eſt d'environ 24 piés de long ſur 18 pouces de diametre: il eſt armé vers les deux extrémités de coins ou cames, placés tout-au-tour, les uns, vers le côté de la roue, acérés d'acier au nombre de 16, larges de 4 pouces, épais d'un pouce

& demi, enfoncés dans l'arbre d'un demi-pié, & ſaillans de 4 pouces; les autres, placés à l'oppoſite ſont de bois, au nombre de 8, épais de 3 pouces, larges de 6, enfoncés de 8, & ſaillans de 8 auſſi: à 3 ou 4 piés de l'arbre, ſur une ligne parallele, eſt une poutre de la même longueur, large de 2 piés, épaiſſe d'un pié & demi: elle porte ſur quatre piliers ou montans de bois qui la traverſent, deux à chaque extrémité, vis-à-vis les cames, à 2 piés & demi de diſtance l'une de l'autre; ils ſont enchâſſés dans la poutre, & taillés de façon que la poutre appuie deſſus vers le milieu, & ſe trouve fixée en-haut par des coins de bois qui traverſent les montans. Entre les deux premiers piliers, c'eſt-à-dire du côté de la grande roue, eſt un levier de bois qu'on appelle le *manche du marteau*, de 10 piés de long, & d'un pié quarré en groſſeur, ſoûtenu par un axe ou heſſe de fer qui le traverſe par le milieu, & va s'appuyer ſur deux brigues de fonte cloüées aux montans. Ce manche eſt armé de cercles de fer, & d'une plaque ou ſemelle de fer auſſi, ſur laquelle portent les coins ou cames de fer, qui la foulent en baſcule à meſure que la roue tourne. L'autre bout du levier eſt armé d'un marteau ou martinet de fer acéré d'acier, peſant 40 livres, avec un bec d'environ 8 pouces de long ſur 2 de large ou d'épaiſſeur; ſa ſurface ou ſa baſe eſt convexe; il tombe de la hauteur de demi-pié ſur une enclume qui eſt au-deſſous. Cette enclume de fer ſaillante d'environ 6 pouces, eſt enchâſſée dans un ſabot de fonte de 15 pouces de largeur & autant d'épaiſſeur, ſur 20 de longueur. Le ſabot eſt lui-même enchâſſé à la profondeur de 6 pouces, dans un billot de bois de 3 piés de diametre, armé d'un cercle de fer, enfoncé dans la terre de 3 piés ſur des pilotis de 3 à 4 piés de long, & ſaillant d'un pié hors de la terre. De l'autre côté eſt un ouvrage pareil à celui-ci, excepté que le manche n'eſt point de cercles ni d'une ſemelle de fer, que le marteau de fonte peſe 280 livres, avec une enclume de même matiere & d'un poids égal, l'une & l'autre à ſurface plate.

La roue qui fait marcher les deux marteaux, fait aller auſſi le ſoufflet de la forge, & voici comment. A l'extrémité de l'arbre oppoſée à la roue, eſt un tourillon de fer fiché dans l'arbre. Ce tourillon entre dans une *nille* ou manivelle de fer, ſemblable à celles dont on ſe ſert pour monter les poids d'une horloge ou d'un tourne-broche. Le manche de la nille entre dans *le branle*, c'eſt-à-dire une piece de bois longue & mince, ſuſpendue par une traverſe ou cheville de fer à un morceau de bois fourchu. Cette fourche eſt clouée par la queue à un *pouillerot* ou petit madrier de bois, qui monte & deſcend au moyen d'un axe mobile dans ſes pivots; mais ces pivots ſont fixés eux-mêmes dans la muraille voiſine, ou à la charpente de la forge. Vers le milieu du poüillerot eſt une autre fourche, au bout de laquelle eſt un ſecond branle de 18 piés de long. Ce branle placé horiſontalement, eſt ſuſpendu par une troiſieme fourche, qui eſt attachée à un pouillerot ſemblable au premier, & qui ſoûtient la quatrieme fourche d'où pend la chaine du ſoufflet, & tout joüe à proportion que la nille tourne avec la roue.

Le fer qui vient des groſſes forges en lingots ou en barres, eſt d'abord rougi au feu & paſſe ſous le gros marteau qui l'amoindrit, le ſcie, le ſoude, le courroye lorſqu'il eſt pailleux, & lui donne enfin une meilleure qualité. De-là il paſſe ſous le martinet. Un ouvrier eſt aſſis ſur une bancelle ou planche accrochée par un anneau à un des piliers ou montans cités plus haut, & ſuſpendue par une branloire ou chaîne de fer, à une poutre qui ſoûtient le toît de la forge, enſorte qu'elle eſt mobile. Un autre ouvrier met les barres à la forge, & les donne toutes rouges à celui qui eſt près du martinet. Celui-ci les préſente & les tourne à chaque coup de marteau, tantôt à droite tantôt à gauche, & d'une ſeule chaude, dans l'eſpace de trois minutes, d'une barre de fer longue de 2 piés & groſſe de 2 pouces quarrés l'on tire une verge de 6 piés de long, ou plûtôt une verge de 4 piés & de 2 lignes de diametre, le ſurplus reſtant en barre, car la verge n'en a pris que 2 pouces quarrés. C'eſt afin que la barre puiſſe s'allonger que la bancelle eſt mobile, enſorte que l'ouvrier avance ou recule ſelon le beſoin. La verge ſort de ſes mains machée ſur tous ſes angles par la convexité du martinet. De la forge les verges paſſent à une trifilerie à l'eau, *voyez les articles* FORGES GROSSES & TRIFILERIES. En voici une à bras (*fig. 1. Pl. I.*) compoſée d'un banc, ſur lequel eſt une filiere en-travers, avec une tenaille en forme de ciſeaux, dont les branches ſont priſes par un *chaînon* ou cercle de fer armé d'un crochet qui va aboutir à une baſcule que l'ouvrier foule à force de bras.

La perfection de l'*épingle* conſiſte dans la roideur ou plûtôt la dureté du laiton, dans la blancheur de l'étamage, dans la tournure des têtes, & la fineſſe des pointes: il ſeroit à ſouhaiter que cette façon fût une des dernieres; car la pointe s'émouſſe dans les épreuves par où paſſe l'*épingle* au ſortir de la meule: on pourroit du moins les tenir toûjours dans des poches de cuir ou dans le ſon.

Cet *article* eſt de M. DELAIRE, qui décrivoit la fabrication de l'*épingle* dans les atteliers même des ouvriers, ſur nos deſſeins, tandis qu'il faiſoit imprimer à Paris ſon analyſe de la philoſophie ſublime & profonde du chancelier Bacon; ouvrage qui joint à la deſcription précédente, prouvera qu'un bon eſprit peut quelquefois, avec le même ſuccès, & s'élever aux contemplations les plus hautes de la Philoſophie, & deſcendre aux détails de la méchanique la plus minutieuſe. Au reſte ceux qui connoîtront un peu les vûes que le philoſophe anglois avoit en compoſant ſes ouvrages, ne ſeront pas étonnés de voir ſon diſciple paſſer ſans dédain de la recherche des lois générales de la nature, à l'emploi le moins important de ſes productions.

ÉPINGLES, ſ. m. pl. (*Juriſprud.*) que les auteurs comprennent ſous le terme de *jocalia* ou *monilia*, ſont un préſent de quelques bijoux, ou même d'une ſomme d'argent, que l'acquéreur d'un immeuble donne quelquefois à la femme ou aux filles du vendeur, pour les engager à conſentir à la vente. Les *épingles* ſont pour les femmes, ce que le pot-de-vin eſt pour le vendeur; mais elles ne ſont point cenſées faire partie du prix, parce que le vendeur n'en profite pas directement; elles ſont regardées comme des préſens faits volontairement à un tiers, & indépendans des conventions, enſorte qu'elles n'entrent point dans la compoſition du prix pour la fixation des droits d'inſinuation & centieme denier, ni des droits ſeigneuriaux, à moins que le préſent ne fût exceſſif, & qu'il n'y eût une fraude évidente.

Mais elles ſont cenſées faire partie des loyaux coûts, pourvû qu'elles ſoient mentionnées & liquidées par le contrat, auquel cas le retrayant féodal ou lignager eſt tenu de les rendre à l'acquéreur. *Voy.* Buridan, *ſur la coûtume de Vermandois, article 236.* & Billecoq, *tr. des fiefs, p. 136 & 444.* (*A*)

Cens en épingles; j'ai vû une déclaration paſſée à la ſeigneurie de Gif, le 19 Octobre 1713, où le cenſitaire ſe chargeoit pour un arpent, entr'autres choſes, de portion d'un *cent d'épingles* dû ſur 13 arpens. (*A*)

Délit d'épingle. Sauval, *en ſes antiquités de Paris, tom. II. p. 594*, dit, qu'en 1445 une inſigne larronneſſe dont on ignore le pays, mais qui n'étoit ni de Paris, ni des environs, ni peut-être même de France, creva les deux yeux à un enfant de deux

« Épinglier », *Encylopédie*, 1765

Recueil de planches, sur les sciences, les arts libéraux et les arts mechaniques : avec leur explication, Troisième livraison, Briasson/David/LeBreton, Paris, 1765

RECUEIL
DE PLANCHES,
SUR
LES SCIENCES,
LES ARTS LIBÉRAUX,
ET
LES ARTS MÉCHANIQUES,
AVEC LEUR EXPLICATION.

TROISIEME LIVRAISON, *298 Planches.*

A PARIS,
Chez { BRIASSON, *rue Saint Jacques, à la Science.*
DAVID, *rue d'Enfer S. Michel.*
LE BRETON, premier Imprimeur ordinaire du Roy, *rue de la Harpe.*

M. DCC. LXV.
AVEC APPROBATION ET PRIVILEGE DU ROY.

EPINGLIER,

CONTENANT TROIS PLANCHES, DONT DEUX DOUBLES.

Deſcription de la façon dont on fabrique les épingles à Laigle en Normandie.

IL y a deux ſortes d'épingles; l'une qui eſt faite avec du cuivre nommé *laiton* ou *laton*, & l'autre avec du fil-de-fer; la premiere eſt beaucoup plus utile & plus en uſage que la derniere, & c'eſt de cette ſorte d'épingle dont on va parler.

Le cuivre dont on fabrique ces épingles, ſe tire de Suede ou d'Allemagne en gros fil, que l'on réduit à Laigle à la groſſeur dont on a beſoin pour chaque ſorte d'épingle, en le faiſant paſſer par différens trous de filiere, au moyen d'une machine que l'on nomme *buche à dégroſſir*, & d'une autre nommée *bobille*. On ne parlera point ici de la façon dont ces opérations ſe font, parce qu'il en a été fait une deſcription particuliere.

On ſuppoſe donc le fil réduit à la groſſeur convenable, & tel qu'il ſort de deſſus la bobille en paquets d'environ ſix pouces de diametre. On commence par dreſſer ce fil de la façon ſuivante.

Le dreſſeur prend un paquet de fil de laiton (*Pl. II. fig.* 2.) qu'il poſe ſur le tourniquet G, & dont il fait paſſer le bout entre les clous, & de la façon figurée par le plan de l'engin, (*fig.* 17. *n.* 2. *Pl. II.*). Il tient ce bout avec des tenailles ordinaires, & le tire en courant ſur un eſpace d'environ cinq toiſes de longueur planchéié; il quitte ce bout & revient à l'engin où il coupe le fil, après quoi il recommence la même opération, & ce ſucceſſivement juſqu'à la fin de la botte de fil.

Cette fonction paroît bien ſimple; & ſi cependant elle eſt la plus difficile à pratiquer de toutes les autres: tout l'art conſiſte à placer ſix clous ſur une planche d'environ huit pouces de long ſur ſix de large, (*fig.* 17. *n.* 2. *Pl. II.*) que l'on nomme *engin*, de telle ſorte que l'eſpace du vuide entre les trois premiers ſoit exactement de l'épaiſſeur de chaque ſorte de fil que l'on dreſſe en ligne droite, & que les autres clous puiſſent faire prendre au fil une certaine ligne courbe qui doit changer ſuivant les différentes groſſeurs & premieres courbures de ce fil, & dont la conſtruction ſeule donneroit bien de l'ouvrage aux théoriciens.

L'intervalle de ces clous doit auſſi être différent pour chaque groſſeur de fil; & la *fig.* 17. *Pl. II.* repréſente la grandeur au naturel & la poſition de ces ſix clous, telle qu'elle doit être pour dreſſer le fil propre à faire les épingles, n°. 10, dont l'eſpace eſt de deux pouces quatre lignes, celle pour les épingles du n°. 6. eſt de quatre pouces, & ainſi à proportion des autres groſſeurs en augmentant d'une ligne au-deſſus du n°. 10, & en diminuant d'autant au-deſſous.

Les dreſſeurs mêmes, ouvriers qui ſont journellement dans l'uſage de poſer ces clous, manquent ſouvent de le faire dans les proportions convenables, & pour lors le fil n'eſt pas parfaitement droit, ou eſt ſi courbe qu'ils ſont obligés de recommencer l'opération; mais comme ces différens ouvriers travaillent tous à leur tâche, le fabriquant n'y perd rien.

L'on voit qu'il faut un engin différent pour chaque ſorte de fil, à l'exception néanmoins que lorſque ce fil eſt un peu mou, un même engin peut ſervir à deux groſſeurs peu différentes l'une de l'autre.

L'ouvrier peut dreſſer dix toiſes de longueur de fil par minute, gros ou menu, qui ſont ſix cens toiſes par heure; & comme il parcourt le double de cet eſpace pour revenir à l'engin, lorſqu'il a dreſſé un bout, il ſuit que ce dreſſeur parcourt douze cens toiſes ou une demi-lieue par heure.

Lorſqu'il y a une botte du poids d'environ vingt-cinq livres de dreſſé, l'ouvrier en prend le bout du côté de l'engin, ſur lequel il frappe, pour que les bouts grands & petits, ne ſe ſurpaſſent pas les uns les autres, & il lie le tout avec un bout de fil de laiton; il attache enſuite à ſa cuiſſe gauche proche le genou la chauſſe (*fig.* 21. *n.* 2. *Pl. II.*). Il s'aſſied à terre, ayant la jambe droite ployée de façon que le bout du pié ſoit ſous ſa cuiſſe gauche, ce qui donne une eſpece de reſſort à ſon genouil & qui eſt néceſſaire pour couper ce fil avec la force (*fig.* 12. *Pl. II.*) dont il met le bout du bras le plus long (& qui eſt plat, ainſi qu'il ſe voit au profil joignant) ſous ſon jarret droit; enſuite il coupe ce fil de la longueur de trois ou quatre épingles, que l'on nomme *tronçons*, en mettant la cueillée ou poignée de fil, liée ainſi qu'il eſt dit ci-devant, ſur la chauſſe (*fig.* 21. *n.* 12. *Pl. II.*), & la ſerrant avec la croſſe de fer *n* entre les crampons *r*, *s*, de telle ſorte qu'elle excede d'environ un pouce la longueur de trois ou quatre épingles auxquelles le fil eſt deſtiné. L'on met enſuite une boîte de fer (*fig.* 10. *Pl. II.* & *n.* 19. *fig.* 21. *même Pl.*) au bout de la cueuillée dont la longueur eſt ici de quatre pouces neuf lignes pour la longueur de trois épingles du n°. 20, ou de quatre du n°. 12, laquelle le dreſſeur tient bien ferme de la main gauche; & de la droite il coupe la cueuillée à environ quatre lignes de cette boîtée, pour ſuppléer à ce dont les épingles ſont raccourcies en leur faiſant la pointe, & ce avec la force ſuſdite, en appuyant ſur le bras le plus court. Il met cette partie coupée dans une ſebille, & après avoir ôté la croſſette *n*, *fig.* 21. *n.* 2. il recule le lien de la cueuillée, & l'avance ſur la chauſſe en recommençant l'opération précédente juſqu'à ſon bout. Et pour cette dreſſée de cinq toiſes de longueur dans la boîte ci-devant dite de quatre pouces neuf lignes, l'ouvrier a employé vingt-deux minutes de tems, & ainſi des autres, proportionnément à la raiſon inverſe de leur longueur.

Pour dreſſer le fil des différentes groſſeurs & couper les tronçons, le dreſſeur a un ſol de la douzaine d'épingles, compoſée de douze milliers, & il fournit le treizieme millier pardeſſus le marché, pour les défectueuſes.

Un ouvrier peut en faire de la ſorte huit ou dix douzaines par jour, & gagner par conſéquent huit ou dix ſols.

L'engin, le tourniquet, & la table qui les porte, peuvent valoir 6 liv.

La chauſſe coûte 4 liv.

La force, que l'on nomme auſſi *ciſeaux* ou *ciſailles*, coûte 3 liv. 10 ſ.

Et chaque boîte à couper les tronçons coûte 10 ſ.

Le dreſſeur remet enſuite ces tronçons à l'empointeur qui fait la pointe à chaque bout avec la meule repréſentée par la *fig.* 5. de la *vignette*, & la *fig.* 16. *bas de la Pl. II.* compoſée d'une grande roue de cinq piés & demie de diametre, dont les jantes ſont recreuſées d'un pouce en auget pour tenir la corde, laquelle roue a ſa manivelle de treize pouces de longueur, & eſt portée ſur deux poteaux de charpente, ainſi qu'il eſt figuré par le deſſein. A ſeize de diſtance de milieu en milieu, eſt une eſpece de billot contenant dix-huit pouces en quarré par bas, quinze pouces par le haut, lequel eſt recreuſé, ainſi qu'il ſe voit. Dans la *fig.* 16 eſt repréſentée la meule deſſinée plus en grand au-deſſous, laquelle eſt de fer trempé, & a ſix pouces de diametre ſur un pouce huit lignes d'épaiſſeur, avec un œil de deux pouces neuf lignes dans le milieu. La ſurface de cette meule eſt taillée un peu obliquement. Dans l'œil l'on place une eſpece de couronne de bois ou tampon quarré en-dedans pour y placer le fuſeau d'acier de huit pouces dix lignes de long & ſept lignes de gros en quarré portant à deux pouces deux

lignes de l'un des bouts, la petite roue ou noix, de huit lignes de diametre dans le milieu sur quatorze lignes de large.

Il est essentiel que la meule soit bien en équilibre autour du fuseau; & pour l'y placer, l'on observe de faire l'œil du tampon de bois d'environ cinq lignes de diametre de plus que la grosseur du fuseau qui doit y être placé, & d'en garnir l'intervalle avec des cartes dont on remet ou on ajoute une suffisante quantité jusqu'à ce qu'ayant fait tourner le tout obliquement, en appuyant le bout du fuseau contre un endroit fixe, & tenant l'autre bout avec la main, on s'apperçoive que la meule continue de tourner sur son axe du côté où elle a été mise en mouvement, sans retrograder de l'autre côté. Les ouvriers emploient quelquefois beaucoup de tems à cette opération, & l'on connoîtra ci-après qu'il est très-nécessaire d'observer cet équilibre.

On pose ensuite l'axe & la meule dans la situation représentée par la *fig.* 1. *Pl. II.* contre deux morceaux de bois, que l'on avance ou recule autant qu'il est nécessaire, après quoi on les arrête fixement au moyen des coins de bois.

La corde qui fait tourner cette meule, est de peau de mouton, & elle passe sur la grande roue & sur la petite fixée au fuseau ou essieu, auquel la meule étant arrêtée fixement, elle doit tourner avec le fuseau.

Audevant de l'ouverture du billot (*fig.* 5. *& 5. vign. Pl. II.*) & de la meule, est un petit chassis d'un carreau de verre, & qui sert à empêcher que les parties de cuivre qui se détachent de l'épingle en faisant la pointe, & qui sont renvoyées avec vîtesse de tous côtés par la meule, ne sautent aux yeux de l'empointeur.

Au bas de la *fig.* 1. *Pl. II.* est une plaque de tôle ou fer blanc, nommé *aperçoir*, & qui est attaché fixement avec un clou à chaque coin, dont l'usage sera expliqué ci-après.

La roue à empointer, compris le billot & la corde, coûte 36 liv.

Le fuseau d'acier pour porter la meule, pese deux livres & coûte 3 liv.

La meule pese quinze livres, & coûte 6 liv. à raison de 8 sols la livre.

Lorsque les hacheures ou retailles de la roue sont usées, il en coûte 8 sols pour les refaire; mais auparavant cette meule peut empointer environ trente douzaines de milliers d'épingles.

Pour faire la pointe aux épingles, nous avons dit précédemment, que le dresseur remet à l'empointeur les tronçons de la longueur de trois ou quatre épingles suivant leur sorte; celui-ci met le tout dans une sebille, & s'assied sur un coussin les jambes croisées; il prend une pincée d'environ vingt-cinq tronçons de grosses épingles, ou quarante de petites, ce qu'il nomme *tenaillée* qu'il tient avec le pouce de l'index de chaque main; après quoi il pose cette tenaillée contre l'aperçoir pour égaler les pointes, & dans cette situation il présente sa tenaillée contre la meule qui est mise en mouvement par le tourneur appliqué à la manivelle de la grande roue. L'empointeur, en posant sa tenaillée contre la meule, la tourne du pouce & du gros doigt de la main gauche, & l'appuie du pouce de la main droite contre la meule; il retourne ensuite sa tenaillée pour faire la pointe à l'autre bout, il remet le tout dans une autre sebille, & prend une autre tenaillée pour recommencer la même opération.

Il y a à côté de la précédente roue à empointer une pareille roue égale en toute chose à la précédente, à l'exception de la meule qui n'a que quatre pouces de diametre, un pouce & demi d'épaisseur; l'œil ou vuide dans le milieu, n'a que deux pouces de diametre, & les hachures de cette derniere meule sont plus fines. Elle pese huit livres, & le fuseau & le reste est pareil à la précédente : l'ouvrier qui y est appliqué, se nomme *repasseur*, & a également son tourneur.

L'empointeur remet ces tronçons ou épingles au repasseur lorsqu'il en a empointé une certaine quantité; & celui-ci fait la même opération que l'empointeur en repassant les pointes sur sa meule par tenaillée, laquelle étant hachée plus près que la précédente, les pointes y sont adoucies & perfectionnées.

L'empointeur d'épingles peut empointer quinze douzaines de milliers d'épingles grosses & petites, dans un jour, compris le treizieme en sus pour le déchet, & il a 15 den par douzaine de milliers, en sorte qu'il pourroit gagner 18 sols par jour s'il étoit fourni d'une suffisante quantité d'épingles; mais les meilleurs fabriquans de Laigle ne débitent par jour qu'environ sept ou huit douzaines de milliers d'épingles, ce qui n'est que la moitié de la quantité susdite; cet empointeur pourroit travailler pour deux fabriquans, & dans ce cas gagner environ ses 18 sols par jour, ce qui est le prix le plus avantageux des autres ouvriers qui travaillent à la même fabrication; mais aussi leur santé est bien alterée de la limaille & poussiere du laiton qu'ils respirent en faisant leurs fonctions, le carreau de vitre, *&c.* mentionné ci-devant, ne pouvant tout-au-plus que leur garantir la vue des parties les plus grossieres de cette poudre.

Le tourneur de la roue de l'empointeur a 1 *s.* 9 *d.* de la douzaine de milliers, compris le treizieme en sus, ce qui paroît être un meilleur prix que celui de l'empointeur qui n'a que 15 den. mais ce tourneur gagne cependant la moitié moins, parce qu'il est obligé en outre de battre le papier qui sert à envelopper les épingles, & de les laver avant de les faire blanchir, ainsi qu'il sera expliqué dans son lieu.

Ce tourneur fait faire à la manivelle environ quarante-cinq tours par minute, & à la grande roue par conséquent autant; cette roue a cinq piés quatre pouces de diametre, déduction faite d'un enfoncement d'un pouce à chaque bout. La petite roue ou noix a huit lignes de diametre dans le fond de son renfoncement, & comme elle est mue par la même corde qui passe sur la grande roue précédente; la vîtesse de cette petite roue doit être à celle de la grande dans la raison inverse du diametre de l'une au diametre de l'autre, ou comme 96 est à 1; c'est-à-dire, qu'elle fera quatre-vingt-seize tours, pendant que la grande n'en fera qu'un, ou comme cette grande en fait quarante-cinq par minute, la petite roue ou la meule même qui y est fixée, feront chacune pendant le même tems quatre mille trois cens vingt tours. Cette meule ayant six pouces de diametre & dix huit pouces un septieme de circonférence, qui étant multiplié par quatre mille trois cens vingt tours qu'elle fait en une minute, qui font pendant une heure soixante-cinq mille trois cens quatorze toises deux septiemes, ou bien vingt-sept lieues & cinq cens quatorze toises, à raison de deux mille quatre cens par lieue.

En supposant d'après Guillaume Derham (*Théologie physique, troisieme édition, page* 39) la vîtesse d'un boulet de canon de cinq cens dix verges de Londres en deux secondes & demie, ce qui revient à cinq cens soixante & quatorze piés de roi par seconde, la verge étant de trois piés de Londres, & le rapport de ce pié au pié de roi étant comme 15 à $16 + \frac{1}{100}$, on aura pour la vîtesse du même boulet pendant une heure trois cens quarante-quatre mille quatre cens toises; d'où il suit que celle de la meule à apointer mentionnée ci-dessus, est presque la cinquieme partie de cette prodigieuse vîtesse du boulet de canon.

Si la meule ne se trouvoit pas dans un parfait équilibre autour de son axe ou fuseau, il est facile de présumer qu'avec une aussi grande vîtesse elle agiteroit l'air de façon à procurer un grand bruit, & c'est ce qui arrive effectivement; mais lorsque cette meule est bien en équilibre, il ne résulte aucun bruit de son mouvement, ni par conséquent de résistance de la part de l'air.

Le repasseur gagne 1 sol par douzaine de milliers d'épingles, y compris le treizieme en sus : il en fait une pareille quantité que l'empointeur, ainsi il gagne par conséquent un cinquieme de moins que lui.

Le tourneur de la roue à repasser gagne le même prix que le repasseur.

En sortant des mains du repasseur, les tronçons sont donnés au coupeur qui les réduit en hanse, en les coupant d'une longueur d'épingle à chaque bout, lorsque les tronçons sont de la longueur de quatre épingles; & en ne coupant qu'une longueur d'épingle lorsqu'ils ne

ſont que de trois longueurs, cette fonction ſe fait avec la chauſſe & les ciſeaux, de la même façon qu'il a été expliqué pour les tronçons, & ce coupeur ſe ſert de boîtes de différentes grandeurs, ſuivant la ſorte des épingles, leſquelles ſont numérotées d'un pareil numéro à celui dont on ſe ſert pour exprimer chaque eſpece d'épingles pour plus grande facilité. La *fig.* 10, *Pl. II.* repréſente le plan & le profil de l'une de ces boîtes dont un côté numéroté XIV. a ſeize lignes de large & treize de long, ſert aux epingles des num. XIV. & XV. & l'autre numéroté XVII. qui a dix-huit lignes de large ſur quinze de long, ſert auſſi pour les épingles des n°. XVI. & XVII.

Lorſque des tronçons de trois longueurs d'épingle on en a coupé une épingle, il en reſte deux dont une a la pointe faite; l'on fait enſuite la pointe à l'autre, & on la repaſſe de la façon expliquée ci-devant; après quoi le coupeur coupe une épingle des deux ſuſdites à ſa longueur exacte, ſuivant la boîte qui lui convient. Et comme nous avons marqué précédemment que les tronçons ont été coupés environ quatre lignes trop longs, la meule ne raccourciſſant pas les épingles de leur longueur en faiſant les pointes; ces dernieres épingles ſe trouvent un peu plus longues, & même inégales entr'elles, parce qu'en faiſant la pointe, la meule en uſe quelquefois plus des unes que des autres; & pour les réduire toutes à la longueur convenable, le coupeur met la pointe dans le fond de la boîte à hanſe, & coupe l'excédent du côté de la tête, exactement d'après le bord de cette boîte.

Des tronçons de quatre épingles l'on en coupe une épingle à chaque bout, ainſi que nous l'avons dit ci-devant; après quoi on fait les pointes à chaque bout des hanſes de deux longueurs d'épingles reſtantes; le coupeur les reprend enſuite & fait la même opération qui vient d'être expliquée pour les hanſes de deux longueurs de deux épingles.

Pour couper les hanſes de différentes groſſeurs, l'ouvrier gagne 9 den. de la douzaine de milliers d'épingles, compris le treizieme en ſus. Il peut en couper ordinairement trois douzaines de milliers par heure, & en forçant un peu le travail, juſqu'à quatre douzaines de milliers; en ſorte qu'en moins de trois heures de travail il peut couper les ſept à huit douzaines de milliers que fabriquent ordinairement par jour les meilleurs marchands de Laigle, ce qui ne ſuffit pas pour les occuper toute la journée; au moyen dequoi un coupeur peut ſuffire à deux ou trois fabriquans; & il peut gagner environ quinze ſols par jour. Les ciſeaux forment à ces coupeurs un calus de chair morne à la main droite, qui eſt épais d'un doigt, & leur eſt même utile pour cette fonction.

Lorſque ces épingles ont été coupées de longueur, on prépare du fil, ainſi qu'il ſuit, pour faire les têtes.

Il y a un rouet à cet uſage (*Pl. II. fig.* 18.) compoſé d'une roue qu'on ne voit pas dans la *fig.* de deux piés huit pouces de diametre avec ſa manivelle de ſix pouces de longueur, d'une noix 1, repréſentée plus en grand au-deſſous (*fig.* 20), laquelle a trois lignes de diametre dans le milieu, & dix-huit lignes de longueur, au milieu de laquelle paſſe une broche de fer *af*, qui lui eſt fixe, laquelle a huit pouces de longueur, & eſt percée par le bout *a*. Cette broche paſſe au-travers de deux nerfs de bœufs qui ſont attachés fixement à une tête de bois *e* (*fig.* 18.) laquelle a trois pouces trois lignes de large ſur cinq de haut, avec une queue *d* de ſix pouces de longueur que l'on paſſe dans une mortaiſe de la planche ou table du rouet 7, 7, (*même fig.*) où elle eſt arrêtée fixement avec des coins. On paſſe une corde à boyau ſur la grande roue & la noix; & on la ſerre ou lâche au moyen d'un coin 5, (*fig.* 18.) que l'on pouſſe plus ou moins ſous le morceau de bois 4 attaché fixement & d'équerre au bas de la tête *e*.

On attache fixement au bout de la broche *af* (*fig.* 20. *Pl. II.*) un fil de laiton un peu plus gros que la ſorte d'épingle dont on veut faire les têtes, & qui ſe nomme *moule*; enſuite on paſſe le laiton pour faire la tête & qui eſt très-fin dans la porte *b* (*fig.* 14 & 20.), dont le plan eſt au-deſſus & plus en grand à côté; on le fait paſſer enſuite obliquement contre l'une des épingles *q*. Enſuite on paſſe ce fil de tête au-travers du trou de la broche ſans l'y attacher. Le même ouvrier tenant ce bois de la porte de ſa main gauche proche la broche, & qui ſoutient le fil de tête contre le moule, tourne avec ſon autre main la manivelle du rouet, en retirant ſa main gauche le long du moule, à meſure que le fil de la tête ſe devide autour, ſuivant le plus ou moins de viteſſe avec laquelle il tourne la manivelle, ce qui forme une ligne ſpirale adhérente & contiguë au moule. Ce fil ſe devide ſur un tourniquet monté ſur un pié qui eſt auprès; & pour ſoutenir le moule, on met un bâton fourchu par enhaut porté ſur un pié ambulant.

On continue ainſi de tourner la manivelle juſqu'à ce que l'ouvrier ait étendu les bras autant qu'il le peut, ce qui eſt la meſure de chaque moulée, & peut avoir cinq à ſix piés ſuivant la grandeur de l'ouvrier; enſuite de quoi il coupe le fil de tête, met la moulée à part, & le moule étant toujours attaché fixement à la broche, il recommence la premiere opération ſuſdite; ce fil ainſi tors, reſſemble aux bords de chapeaux, nommés *ragots*, leſquels ſont faits de la même façon avec du fil d'argent. L'on emploie le meilleur fil de laiton pour les têtes; & lorſqu'il y a une certaine quantité de moulées de faite, le même ouvrier les coupe pour faire les têtes de la façon ſuivante.

Cet ouvrier s'aſſied à terre ou ſur une ſellette baſſe en croiſant les jambes comme un tailleur, ayant une peau liée autour de lui, attachée ſur une autre ſellette qui eſt devant lui pour recevoir les têtes, il tient de la main droite le ciſeau repréſenté par la *fig.* 11. *Pl. II.* dont il met le bout du bras le plus long qui eſt plat, ainſi qu'il ſe voit par le profil joignant, ſous ſon jarret, comme pour couper les tronçons & hanſes ci-devant dits, quoiqu'il ne ſoit pas aſſis de-même. De la main gauche il tient ſa tranche de têtes compoſée de douze moulées, dont il égaliſe le bout contre les ciſeaux en commençant; enſuite il donne environ douze coups de ciſeau de ſuite, en ne coupant à chacun que deux pas ou cercles des moulées qui ſont néceſſaires pour faire les têtes, ce qui eſt très-difficile & demande une grande expérience, attendu la viteſſe avec laquelle ces coups de ciſeaux ſont donnés, qui eſt d'environ ſoixante & dix par minute; & auſſi le nombre des moulées qui ſont coupées à chaque coup: les têtes qui ſe trouvent avoir plus ou moins de deux cercles, ne peuvent être employées, ce qui oblige d'autant plus l'ouvrier à acquérir la préciſion requiſe: enſuite il égaliſe comme auparavant ces moulées contre les ciſeaux, & donne de rechef environ douze autres coups de ciſeaux, & ainſi de ſuite juſqu'au bout de la tranche de tête: ce qui eſt encore plus merveilleux, c'eſt qu'il y a des ouvriers ſi expérimentés qu'ils coupent ſans ſe reprendre & de ſuite la tranche entiere.

L'ouvrier peut, comme on l'a déja dit, donner ſoixante dix coups de ciſeaux par minute, c'eſt par heure quatre mille deux cens; & comme il coupe douze moulées à chaque coup de ciſeau, cet ouvrier peut couper cinquante mille quatre cens têtes de menues épingles en une heure (les groſſes étant plus difficiles), ce qui feroit néanmoins un travail forcé, parce qu'il n'eſt point déduit de tems pour les repriſes dans ce calcul; mais en y ayant égard, un ouvrier peut communément couper trente milliers par heure, groſſes & menues l'une dans l'autre, il ne pourroit pas même continuer ſur ce pié toute la journée, parce que la vue fatigue beaucoup à cette fonction, mais il peut en couper quinze douzaines de milliers, groſſes & menues, par jour.

L'ouvrier a 3 den. pour tourner une douzaine de milliers de têtes, & 9 den. pour les couper ſéparément; & comme il peut en couper quinze douzaines par jour, ainſi qu'il eſt dit ci-devant, il gagneroit 11 ſ. 3 den. Il ne peut faire que douze douzaines par jour, de têtes & couper, ce qui revient à 12 ſols.

Le rouet coûte 4 liv. avec la porte, & les ciſeaux autant.

Lorſque les moulées pour faire les têtes ont été coupées, on en met deux ou trois livres peſant dans une cuillere de fer, & qui contient dix à douze douzaines

de milliers de têtes du numéro VIII. Enſuite on met la cuillere couverte de charbon ſur le feu pendant une demi-heure de tems; & lorſque le tout eſt refroidi, on frappe la tête de l'épingle avec la machine repréſentée *Pl. III. fig. 13. & fig. 12. n. 2.* dont le plan eſt *fig. 18. même Pl.* laquelle a ſix pans ou places ſemblables pour y employer un pareil nombre d'ouvriers à-la-fois. Le tout eſt porté ſur un billot de bois ou tronc d'arbre, de trois piés neuf pouces de diametre & ſeize pouces de haut, élevé d'un pié au-deſſus du plancher par trois piés. Deſſus ſont ſix poteaux poſés aux angles, & retournés ſur deux pouces de largeur à chaque face, ſur dix-huit lignes d'épaiſſeur & dix-ſept pouces de hauteur. A treize pouces & demi au-deſſus du billot ſont aſſemblées les traverſes de même épaiſſeur que les poteaux ſur quinze lignes de hauteur, leſquels ſont percés aux endroits convenables pour paſſer des broches de fer de ſix lignes de gros & ſeize pouces de longueur, dont le haut eſt arrêté fixement dans les précédens trous avec des coins, & le bas qui eſt diminué en pointe, porte ſur des plaques ou eſpeces de crapaudines de plomb fondues dans des trous faits dans le billot, de deux pouces en quarré ſur ſix lignes d'épaiſſeur. Le milieu des mêmes traverſes eſt percé pour paſſer l'aiguille de fer ou outibot de douze pouces & demi de longueur, & ſix lignes de gros, lequel eſt percé par-enhaut pour paſſer la corde qui eſt attachée au levier. Le bas de l'outibot a dix-huit lignes de long & un pouce en quarré de gros, dont le deſſous eſt percé de ſix lignes en quarré ſur neuf lignes de profondeur. Cet outibot eſt quarré par-enbas ſur quatre pouces de hauteur, dans lequel paſſe une traverſe ou meiſe de fer, laquelle a neuf pouces neuf lignes de long, neuf lignes de large & trois d'épaiſſeur : les deux bouts ſont percés pour paſſer les broches de fer, & l'on obſerve deux à trois lignes de vuide au pourtour pour y placer du parchemin coupé par bande, & huilé pour que la traverſe monte & deſcende facilement le long des broches de fer. Deſſus cette traverſe on met un poids de plomb percé dans ſon milieu pour paſſer la tige de l'outibot lequel a quatre pouces de diametre par le haut & trois pouces de hauteur. On met auſſi un peu de parchemin entre ce poids & la traverſe, pour les rendre plus adhérens l'un à l'autre. Dans la partie recreuſée au-bas de l'outibot on met un poinçon d'acier lequel a dix lignes de long ſur ſix lignes de gros par le milieu, & cinq lignes en quarré par les bouts, ſur leſquels ſont recreuſes des trous de la groſſeur des têtes que l'on veut faire. Sous cet outibot eſt poſé un canon de fer lequel a ſeize lignes de long ſur quinze lignes de gros en quarré que l'on enfonce dans le billot; le deſſus de ce canon eſt percé d'un trou de ſix lignes en quarré ſur autant de profondeur.

Dans ce canon on place une enclume d'acier d'un pouce de hauteur, quatre lignes de groſſeur en quarré par le bas & ſept lignes par le haut, ſur lequel ſont gravés quatre trous de différentes grandeurs pour former les têtes d'épingles. La corde qui paſſe par le trou du haut de l'outibot, eſt attachée ſur un bras de levier de bois, de deux pouces de gros, à un endroit diſtant du point d'appui de ſept pouces & demi. Proche l'autre bout eſt la corde qui répond à la puiſſance à onze pouces de diſtance dudit point d'appui. Au bas de cette corde eſt un bout de planche de dix pouces de long ſur ſix de large, attaché par l'autre bout avec un bout de corde à un piquet. A chaque place il y a deux planches, de chacune un pié de long & ſix pouces de large, clouées au billot, de façon que ces planches puiſſent ſe mouvoir autour de ces clous pour accotter les bras des ouvriers. Au-devant de chaque place eſt une calotte de chapeau nommé *planche*, de ſix pouces de long ſur quatre de large & deux pouces de hauteur, d'abord arrêtée fixement au billot & qui ſert à mettre les hanſes & épingles. Du côté intérieur eſt un cercle ou enclos nommé *parc*, lequel eſt fait d'un demi-cercle, ayant pour corde ou diametre toute l'étendue de la face de chaque pan entre les poteaux. Ce parc ſert à recevoir les épingles, à meſure que les têtes en ſont frappées. Au milieu du billot eſt un chandelier qui ſert à éclairer toutes les places. Sur ledit billot ſont deux poteaux diamétralement oppoſés, de deux pouces de groſſeur, leſquels ſont bien ſerrés contre les ſolives du plancher ſupérieur pour bien affermir le billot & empêcher que les coups continuels des poinçons ſur les enclumes ne l'ébranlent.

La cuillere de fer pour faire cuire les têtes, coûte 15 ſ. le plomb & les autres machines de chaque place de la machine à frapper les têtes, valent 8 liv. le billot 12 liv. ce qui fait pour le tout enſemble 60 liv. 15 ſols.

Pour faire la tête, l'ouvrier s'aſſied ſur une ſelſette ou billot de bois à trois piés, de quinze pouces de hauteur. Du pié droit qu'il poſe ſur la planchette, en alongeant la jambe il leve le plomb au moyen du levier, & frappe à petits coups, après avoir auparavant placé le bout de l'épingle de la main droite, avec une tête dans l'un des trous de l'enclume, ſur lequel répond directement un pareil trou du poinçon dans lequel cette tête eſt frappée de cinq à ſix coups. Sa forme ſpirale lui donne la facilité de ſe ſerrer autour de l'épingle aſſez conſidérablement pour n'en pouvoir être ôtée qu'avec peine; après quoi le frappeur laiſſe tomber cette épingle dans le parc. Pendant qu'il frappe une tête, il a la main gauche dans la calotte ou planche avec laquelle il prend une hanſe ou épingle ſans tête, il en pouſſe la pointe dans une grande quantité de têtes qui ſont dans un coin de la même planche où il ne peut manquer d'en enfiler une ou pluſieurs; il prend cette épingle de la main droite, en faiſant ſortir d'un coup de doigt les têtes qu'il auroit pu enfiler de trop; & en la mettant dans le trou de l'enclume (le plomb étant levé) il l'attire juſqu'à ce que cette tête ait coulé juſqu'au bout de l'épingle; & pour lors il recommence à frapper cinq ou ſix coups de poinçon ſur l'enclume, ainſi qu'il eſt dit ci-devant, & il recommence la même opération, ce qui ſe fait ſans remuer les coudes qui ſont accottés, ainſi que nous avons dit précédemment.

Lorſque les trous de l'enclume & du poinçon ne répondent pas préciſément l'un ſur l'autre, la tête ne peut être bien faite, & il eſt aſſez difficile de rencontrer cette préciſion; on le fait cependant avec un peu d'attention en éloignant ou rapprochant les broches, qui étant pointues & portées ſur les crapaudines de plomb, y forment différens petits trous où on peut les placer en levant un peu le poids, après quoi le chaſſis ne peut ſe déranger.

Pour frapper la tête d'une groſſe épingle, il faut des coups plus forts que pour une petite; & à cet effet l'on rapproche la corde qui eſt ſur le levier un peu plus près du centre de mouvement au point d'appui, ce qui donne la facilité d'élever le poids un peu plus haut, en rend l'impulſion ſur l'enclume plus forte, mais d'un autre côté l'ouvrier a un plus grand effort à ſurmonter avec le pié.

Un homme peut frapper vingt têtes d'épingles groſſes ou petites par minute; & comme il frappe cinq à ſix coups ſur chaque tête; le tout produit cent ou cent vingt coups; & un frappeur fait communément un millier de têtes par heure & dix à douze milliers par jour, non compris le treizieme en-ſus pour les défectueuſes.

Les frappeurs gagnent deux prix différens, ſavoir, 9 ſols de la douzaine de milliers, compris le treizieme en-ſus, pour frapper les têtes de groſſes épingles, depuis le numéro XXII. juſqu'au numéro XIV. & 8 ſols pour les épingles au-deſſous, ce qui produit 7 à 8 ſols par jour, ſur quoi les entêteurs ſont obligés de ſe fournir de poinçon & d'enclume, qui coûtent enſemble 10 ſols; de les faire regraver lorſque l'on change de groſſeur d'épingle, ce qui revient à environ 2 ſols par mois, comme auſſi de frotter, faire ſécher & de vanner les épingles, ainſi qu'il ſera expliqué ci-après.

Lorſque les entêteurs reportent leurs épingles au fabriquant, on les peſe pour tenir compte aux ouvriers de chaque place, de ce qui leur eſt dû par douzaine; après quoi on met une trentaine de livres peſant d'épingles qui ſont dix douzaines du numéro X. & environ quatre douzaines du numéro XX. dans un baquet,

quet avec un ſeau d'eau, dans laquelle on a fait bouillir pendant une demi-heure à gros bouillons une demi-livre de tartre-de-vin : ce baquet a vingt-un pouces de diametre par le haut & quatorze pouces de hauteur, avec une anſe de fer & un crampon au haut ſuſpendu à une piece de bois ſtable ; un homme remue le tout pendant une demi-heure ſans relâche, en tenant le baquet à deux mains, l'une au bord de deſſus, & l'autre aux peignes d'en-bas, ce qui jaunit & décraſſe l'épingle. Enſuite on jette l'eau, & on en remet deux ou trois fois juſqu'à ce que l'on connoiſſe par la netteté de l'eau que les épingles auront été bien décraſſées ; cette derniere opération dure environ un quart-d'heure, & elle eſt faite ainſi que la précédente par le tourneur de la roue de l'empointeur, ainſi qu'il a été dit dans ſon lieu.

Ce baquet coûte 5 liv. avec ſa ferrure.

Enſuite on jette l'eau pour bien égoutter les épingles qui ſont pour lors jaunes, & on les fait blanchir de la façon ſuivante.

On met un demi-pouce d'épaiſſeur d'épingles ſur les plaques rondes d'étain le plus fin d'Angleterre de ſeize pouces de diametre ; l'on poſe les plaques l'une ſur l'autre au nombre de vingt ſur une croiſée ou gril de fer où ſont attachées quatre cordes, en obſervant de mettre la même ſorte d'épingles enſemble ; deux hommes portent ces plaques dans une chaudiere de cuivre rouge qui a été miſe auparavant ſur le feu, laquelle a dix-huit pouces de diametre & deux piés & demi de hauteur ; l'on continue de mettre pluſieurs de ces croiſées de fer, chargées chacune de vingt plats juſqu'à la hauteur du bord de la chaudiere, en obſervant de mettre dehors les bouts des cordes attachées aux croiſées qui portent ces plats ; l'on emplit enſuite cette chaudiere de l'eau la plus claire que l'on peut avoir avec quatre livres de tartre-de-vin le plus blanc & le meilleur ; on laiſſe le tout bouillir enſemble pendant quatre heures de tems à gros bouillons ; enſuite quatre hommes enlevent la chaudiere de deſſus le feu avec deux galons ou leviers de bois qu'ils paſſent dans des crochets mis aux boucles de fer qui ſont de chaque côté au haut de la chaudiere, & on retire les croiſées avec leurs cordes que l'on met ſéparément dans un baquet d'eau fraîche & nette. En retirant les plaques d'étain, & ne mettant enſemble que les mêmes ſortes d'épingles, on les lave bien ; après quoi on verſe l'eau des baquets, & on met les épingles de chacun ſur une ſerpiliere de groſſe toile : cette fonction a été faite par le jauniſſeur qui eſt auſſi le tourneur de la roue à empointer.

Enſuite les entêteurs d'épingles ſont tenus, ſur le prix ci-devant dit, de frotter & faire ſécher les épingles ; ce qui ſe fait en mettant environ quatorze livres d'une même ſorte avec du ſon dans un ſac de cuir compoſé de deux peaux de mouton couſues enſemble, à quoi ſont employés deux hommes pendant un quart-d'heure, qui tiennnent chacun le bout du ſac & ſe renvoient les épingles mutuellement environ cinq cens coups à chaque bout du ſac à frotter, ce qui fait mille coups en tout. Ce ſac a trois piés de long, dix-huit pouces de large par un bout, & dix par l'autre.

Enſuite on met ſix ou ſept livres peſant d'épingles dans un plat de bois de dix-huit pouces de diametre & trois pouces & demi de profondeur, nommé *plat à vanner*, dans lequel on vanne les épingles pour en faire ſortir le ſon, lorſqu'elles ſont ſéches ; un demi-quart-d'heure ſuffit pour faire cette fonction, & ce ſont pareillement les entêteurs qui le font ſur les prix ci-devant dits.

Les plaques d'étain peſent chacune une livre & demie, & coûtent vingt-huit ſols la livre en lingots, que les marchands de Laigle fondent eux-mêmes : il en faut une ſoixantaine pour emplir la chaudiere, cette chaudiere coûte 80 liv.

La gravelle ou tartre-de-vin ſe tire de la Rochelle, de la Saintonge, de Château-du-Loir, *&c.* & coûte, rendu à Laigle, 25 liv. le cent peſant de cent quatre livres.

Lorſque les épingles ont été vannées, on en met chaque ſorte dans des demi-boiſſeaux ou quarts ; on les donne aux bouteuſes qui les placent dans les papiers.

Ces papiers ſont percés avec une eſpece de peigne de fer dont les dents ſont d'acier, & repréſenté par la *fig.* 7. *Pl. III.* que l'on nomme *quarteron*.

Il y en a de différens, ſuivant les ſortes d'épingles : celui d'un pouce neuf lignes de longueur, deux pouces de hauteur, avec un manche ou queue d'un pouce ſur ſix lignes, ſur lequel on frappe avec le marteau repréſenté par la *fig.* 8. Ce quarteron convient aux épingles des numéros VIII. & IX. Il coûte 1 liv. 5 ſols ; le marteau en coûte 12. Ce ſont les bouteuſes qui ſe fourniſſent de ces outils : elles peuvent percer douze douzaines de milliers de trous par jour, gros ou menus.

Une bonne bouteuſe peut placer ou bouter dans les papiers quatre douzaines de milliers d'épingles par jour, & une bouteuſe ordinaire deux douzaines de milliers, groſſes & petites : elles ont 1 ſol par douzaine de milliers pour cette opération.

Elles ſont auſſi chargées d'éplucher les épingles pour rebuter les défectueuſes ; & pour percer le papier, bouter les épingles & les éplucher, elles ont 2 ſols 6 den. par douzaine de milliers, groſſes & petites. Les plus fortes ouvrieres gagnent 4 ſols par jour à ces trois fonctions, n'en faiſant que deux douzaines de milliers ; & les enfans de ſix à huit ans, qui peuvent y être employés, attendu la facilité de l'opération, peuvent gagner 1 ſol par jour pour bouter ſeulement.

Ces bouteuſes font auſſi, dans leur marché, l'empreinte ou la marque des marchands ſur les papiers : elles en font un millier par heure, en frappant du plat de la main la feuille de papier ſur la planche qui eſt fixée ſur une table, & ſur laquelle elles mettent la couleur d'ocre en détrempe avec une groſſe broſſe.

Les dimenſions des outils & machines précédentes, relativement aux deſſeins, ſont conformes aux outils & machines, ſur leſquels ces obſervations ont été faites, & il eſt facile de connoître ce que l'on peut y changer.

On peut préſentement ſavoir le prix auquel les épingles reviennent aux fabriquans, & par la connoiſſance du prix de ceux qui les vendent, ſavoir en quoi conſiſte leur bénéfice. Pour mettre en état de faire ces calculs : voici un détail qui concerne la ſorte d'épingle numérotée VI. dont la longueur eſt de neuf lignes.

Le douzain ou les douze milliers dudit numéro VI, peſe une livre neuf onces ſix gros ſans papier, & on a vu par le mémoire de la façon dont on prépare le fil pour le réduire aux différentes groſſeurs convenables à la fabriquation des épingles, que celui qui a paſſé par neuf trous, revient à trente-un ſol trois den. la livre, ce qui produit, pour une livre neuf onces ſix gros . . . . . liv. 2 s. 9 d. 7

Pour dreſſer & couper les tronçons.	1		
Empointer.	1	3	
Tourneur de la roue à empointer.	1	9	
Repaſſer la pointe.	1		
Tourneur de la roue à repaſſer.	1		
Couper les hanſes.		9	
Tourner le fil de la tête des épingles.		3	
Couper ce fil ou les moulées.		9	
Le marchand fait cuire les têtes, dont la dépenſe pour le feu eſt eſtimée.		3	
Pour frapper la tête des épingles.		8	
Pour décraſſer & jaunir les épingles, une demi-livre de tartre pour dix douzaines, & le feu eſtimé, non compris le tems des ouvriers qui eſt employé dans les prix précédens. . .	1		
Pour faire blanchir les épingles, le tartre & le feu ſont eſtimés	1		
Pour placer & bouter les épingles dans le papier	1		
Pour le papier ſur lequel les épingles ſont piquées, la main de papier peſe une livre, & coûte 6 ſols. Il entre cinq onces trois gros de papier pour la douzaine de milliers deſdites épingles, qui valent audit prix		2	
Les outils & faux frais eſtimés		4	
Total du prix de la douzaine de milliers d'épingles du numéro VI.	3	7	3

Ces épingles ſe vendent communément 4 liv. la douzaine de milliers à Laigle. Ainſi le profit ſeroit de 12 ſ. 9 den. ou de près du cinquieme.

Pour connoître plus particulierement ces détails, on a joint à ces mémoires la table ci-après, qui comprend le poids des épingles ſans papier, le poids du papier, le prix auquel elles doivent revenir aux fabriquans, celui qu'ils le vendent, & le bénéfice qu'ils doivent y faire.

TABLE pour une douzaine de milliers d'épingles.

Numéro des épingles.	Leur longueur.	Poids ſans papier.	Poids du papier.	Total.	Prix auquel elles reviennent aux fabriquans.	Prix qu'ils les vendent.	Bénéfice.
	lignes.	livres. onces. gros.	onces. gros.	livres. onces. gros.	livres. ſols. deniers.	livres. ſols.	liv. ſols. den.
V.	8	14 7	4	1 2 7	2 8 6	3	11 6
VI.	9	1 9 6	5 3	1 15 1	3 7 3	4	12 9
VII.	10	2 5 4	6	2 11 4	4 4 7	5	15 5
VIII.	11	2 11 2	6 4	3 1 6	4 18 10	6	1 1 2
X.	11 1/2	3	8	3 8	5 6	6 10	1 4
XII.	12 1/2	3 6 4	10	4 4	5 12 1	7	1 7 11
XIV.	13	3 12 4	11 0 18	4 7 4 18	6 3 11	8	1 16 1
XVII.	14	4 6 5	11	5 1 6	6 17 4	9	2 2 8
XX.	15	5 1	12	5 13	7 15 6	10 10	2 14 6
XXII.	16	5 11 6	13	6 8 6	8 14 2	12	3 5 10

Les poids & prix des épingles de chaque numéro ſont un peu différens, ſuivant les fabriquans qui les font. Mais cette table peut toujours en faire connoître la proportion: on y voit que ces marchands gagnent plus ſur les groſſes épingles que ſur les menues; le bénéfice pouvant être pour un marchand qui en débiteroit ſix douzaines de milliers par jour, de 19 liv. 15 ſ. & ſeulement de 3 liv. 9 ſols pour les plus petites, ce qui fait 11 liv. 12 ſols du prix moyen par jour.

Les outils & machines précédentes & qui ſuffiſent pour la fabriquation des épingles, reviennent à 380 liv.

Ce mémoire nous a été communiqué par M. Perronet, a qui nous avons beaucoup d'autres obligations.

PLANCHE Ire.

Fig. 1. Ouvrier qui feſſe les torques de fil de laiton.
2. Ouvrier qui les lave.
3. Ouvrier qui replie le fil déroulé autour de ſon bras.
4. Ouvrier qui tire le fil à la bobille.

Bas de la Planche.

Repréſentation de tout l'affutage de la bobille.
5. Plan du même affutage.
8. Jauge.

PLANCHE II.

La *fig.* 1. A repréſente l'élévation antérieure du billot dans lequel la meule eſt placée.
m, la meule.
b d, le fuſeau.
e, la noix.
a b, *d e*, barreaux quarrés de bois, que l'on fixe avec des coins dans les faces latérales du billot, & dans les extrémités deſquels les pointes du fuſeau ſe placent: on voit en *f* une plaque de tôle, contre laquelle l'empointeur frappe les hampes qu'il veut empointer avant de les préſenter à l'action de la meule, ainſi que la *fig.* 16 le fait voir. On voit à côté en B la coupe par la ligne A *f* où l'on voit comment le billot eſt recreuſé quarrément pour placer la meule *m n o* qui tourne dans l'ordre de ces lettres, & en entonnoir *g h k l* pour laiſſer paſſer la corde ſans fin qui communique le mouvement de la roue à la meule. On voit ce billot en perſpective dans la vignette.
q p, profil du chaſſis.

La *fig.* 2. repréſente le dreſſeur tenant avec des tenailles *a*, un fil *a b* qui ſort de deſſus le tourniquet G, paſſe entre les clous de l'engin *d* où il ſe redreſſe. Le dreſſeur tire ce fil auſſi long que la longueur du lieu peut le lui permettre, le coupe près de l'engin: on voit à ſes piés pluſieurs dreſſées *x y*.

Fig. 3. Coupeur de dreſſées; il diviſe la dreſſée *g s* en tronçons auſſi longs que la boîte *fig.* 15, & les met dans la ſebile *g* qui eſt à côté de lui.
4. Coupeur de tronçons; celui-ci diviſe les tronçons en longeurs de trois ou quatre épingles: il a ſur la cuiſſe de la jambe étendue, la chauſſe repréſentée *fig.* 21, & deux ſebilles à ſes côtés, une pour les tronçons que le coupeur de dreſſées lui a remis, & l'autre pour les épingles qu'il en ſépare. Ces deux ouvriers ſe ſervent de la ciſaille repréſentée *fig.* 12, au bas de la Planche.
5. Empointeur aſſis, les jambes croiſées devant le billot, ſur une ſellette inclinée: il préſente les parties de tronçons que l'ouvrier, *fig.* 4. a coupés, & qui ſont contenus dans la ſebille *a*, à l'action de la meule pour y faire la pointe, & qu'il met enſuite dans la ſebille *b*. On voit devant lui le chaſſis de verre qui garantit ſes yeux de la limaille que la meule élance de tous côtés.
6. Tourneur de roue de l'empointeur.
7. Repaſſeur: il prend dans la ſebille *c* les épingles auxquelles l'empointeur a fait la pointe: il perfectionne cette pointe ſur une meule plus douce, les met enſuite dans la ſebille *d*, d'où elles paſſent entre les mains des ouvriers qui y mettent les têtes.
8. Tourneur de roue du repaſſeur.
9. Tourneur de têtes. Son rouet. *c a*, le moule autour duquel le fil de tête s'enroule à meſure qu'il ſe développe de deſſus le tourniquet *b*.
10. Profil & plan d'une boîte de fer ſervant à l'ouvrier, *fig.* 4. à couper les tronçons en longueurs d'une ou de pluſieurs épingles. Il y a des boîtes de différentes longueurs pour les différentes ſortes d'épingles. *Voyez* auſſi la *fig.* 21: 19. eſt la boîte en perſpective.
11. Ciſeaux ou ciſailles ſervant au coupeur de têtes, *fig.* 8. *Pl. III.*
12. Ciſailles ſervant au coupeur de dreſſées & au coupeur de tronçons: *fig.* 3. & 4. Extrémité de la plus longue branche terminée en palette ſe place ſous le jarret de la jambe droite qui eſt pliée.
13. Repréſente dans la grandeur véritable la poſition des ſix clous 1, 2, 3, 4, 5, 6. qui compoſent l'engin propre à dreſſer le fil deſtiné à faire les épingles du numéro X. Le fil entre entre les clous par le coté *b*, & ſort par le côté *a*.
14. Repréſente la porte *b e*, dans laquelle paſſe le fil de tête *f c*. L'ouvrier, *fig.* 9. tient cette porte à pleine main, & s'en ſert pour conduire le fil de tête le long du moule *c a*, en allant de *c* vers *a*. *c b*, partie du moule déja entouré du fil de tête. *d*, épingle qui empêche le moule de s'écarter de la porte: on voit à côté le plan en grand de la poignée.
15. Profil & plan de la boîte dont ſe ſert l'ouvrier,

fig. 3. pour couper les dreſſées en tronçons.

Fig. 16. Profil de la meule où on voit comment l'empointeur ou le repaſſeur préſentent les épingles S à la ſurface de la meule *m*; *b d*, le fuſeau; *c*, la noix ſur laquelle paſſe la corde ſans fin qui vient des roues, *fig.* 6 & 8, qui ont cinq piés & demi de diametre.

16. n°. 2. Plan de la meule M. *pq*, tampon de bois qui remplit l'œil de la meule: il eſt percé au centre d'un trou quarré, pour recevoir le fuſeau. Ces deux *figures* ſont ſur une échelle doubles, c'eſt-à-dire, qu'un pié de l'échelle qui eſt au-deſſous ne doit être compté que pour ſix pouces.

Fig. 17. Profil de la table qui porte l'engin, vûe en perſpective dans la vignette. G le tourniquet. HK l'engin.

La *fig.* 17, n°. 2, eſt le plan des mêmes objets.

18. Profil de l'extrémité inférieure du rouet à tourner les têtes, *fig.* 9 de la vignette. *e d*, la tête ou poupée. 6. clé qui l'aſſujettit ſur le banc du rouet. 4. taſſeau de la poupée ſous laquelle on force le coin 5, pour donner plus ou moins de bandé à la corde, qui après avoir paſſé ſur la noix, va paſſer ſur la roue du rouet, laquelle a deux piés huit pouces de diametre. 11. morceaux de nerfs de bœufs dans leſquels paſſe la broche de fer *f c* de la *fig.* ſuivante.

20. Élévation de la tête du rouet, vûe du côté de la roue. *e d*, tête ou poupée; la queue *d* eſt traverſée par la clé 6. 4 le taſſeau. 5 le coin. *f c*, broche qui paſſe dans les deux nerfs de bœuf 3, 1: cette broche porte la noix 2 de trois lignes de diametre: cettte broche porte le moule *c a*, ſur lequel s'enveloppe le fil de tête conduit par la porte *b c*.

21. Perſpective de la chauſſe, que le coupeur de tronçons attache ſur ſa cuiſſe & ſur laquelle il fixe les tronçons qu'il veut couper au moyen de la croſſe *n* qui paſſe dans les brides *s r*. Il préſente la boîte 19, dont la profondeur regle celle des épingles, & il tranche avec les ciſailles, *fig.* 12. *m p*, la queue de la chauſſe qui eſt tournée du côté du genou, & ſert à empêcher qu'elle ne ſe renverſe lorſque l'ouvrier pouſſe la boîte 19 contre les tronçons. *k k*, courroies de cuir ſervant à attacher la chauſſe ſur la cuiſſe gauche.

21. n°. 2. Élévation & profil de la chauſſe. *l l*, couſſins qui garniſſent la partie de la chauſſe qui s'applique ſur la cuiſſe. (*D*)

Tous ces deſſeins ſont exactement conformes aux machines dont on fait uſage à Laigle en Normandie. Les dimenſions qu'on a obmiſes, ſe retrouveront facilement par le ſecours des échelles qui ſont au-bas de chaque Planche.

PLANCHE III.

La *Fig.* 1. repréſente le jauniſſeur d'épingles, qui agite les épingles dans un baquet ſuſpendu à une piece de bois fixe. Ce baquet a vingt-un pouces de diametre par le haut, & quatorze pouces de hauteur: on y met une trentaine de livres peſant d'épingles & un ſeau d'eau dans laquelle on a fait bouillir pendant une demi-heure à gros bouillons, une demi-livre de tartre. L'ouvrier balance ce baquet à deux mains, dont une eſt placée aux bords de deſſus, & l'autre aux peignes d'en-bas, juſqu'à ce que les épingles ſoient décraſſées, & que leurs têtes ſoient reblanchies: ce baquet ſert auſſi à éteindre les épingles.

2. Ouvrier qui ſeche les épingles dans le barril foncé B, qu'on appelle *frotoir*, dans lequel on les a introduites avec du ſon.

3. Ouvrier qui vanne les épingles.

4. & 5. Deux ouvriers qui ſechent les épingles après qu'elles ſont ſorties du blanchiment: ce qui ſe fait en mettant environ quatorze livres peſant d'une ſeule ſorte avec du ſon dans un ſac de cuir compoſé de deux peaux de mouton couſues enſemble. Ces deux ouvriers ſe renvoient alternativement les épingles contenues dans le ſac à frotter, où étant ainſi agitées avec le ſon, elles ſont bientôt ſeches.

Fig. 6. Ouvrier qui coule l'étain ſur le coutil pour le réduire en plaques. Il verſe dans le chaſſis avec une cuillere l'étain fondu qu'il a puiſé dans la chaudiere *m*.

7. Ouvrier qui fait recuire les têtes d'épingles dans la cuillere *n*, dont le manche terminé comme un chenet, ſoutient la cuillere, ce qui diſpenſe l'ouvrier de ce ſoin.

8. Ouvrier qui coupe les têtes: cette figure eſt mal-à-propos citée comme appartenant à la planche *II.* Cet ouvrier tient de la main gauche une douzaine de moulées *o n*, qu'il tranche avec les ciſeaux camards repréſentés par la *fig.* 11, *pl. II.* Les têtes ſont reçues dans un tablier de peau attaché à ſa ceinture & à une eſpece de ſellette qu'il a devant lui; il les met enſuite dans une ſebille que l'on voit à côté.

9. Repréſente la table où l'on coupe au compas les plaques d'étain dont on ſe ſert pour blanchir les épingles, & qui doivent entrer dans la chaudiere, *fig.* 14.

10. Repréſente ce qu'on appelle une portée compoſée d'une vingtaine de plaques d'étain de ſeize pouces de diametre, ſur chacune deſquelles on met environ deux livres peſant d'épingles après qu'elles ſont ſorties des mains du jauniſſeur. Ces plaques ont un rebord d'environ ſix lignes de haut pour empêcher les épingles de tomber: le tout eſt porté par une croix de fer 1, 2, 3, 14, qu'on voit au bas de la Planche. On empile dans la chaudiere autant de portées qu'elle en peut contenir.

11. Repréſente deux bâtons de bois, au milieu deſquels eſt une boucle paſſée dans un anneau. Ces bâtons ſervent à enlever la chaudiere deſtinée au blanchiment, que l'on voit à côté, en paſſant les crochets dont elle eſt armée dans les anneaux de ces bâtons: on voit mieux un de ces crochets dans la *fig.* 14.

12. & 13. Deux Frappeurs qui mettent les têtes aux épingles. Ces figures ſont mal-à-propos citées comme appartenant à la *planche II.* La *fig.* 12, n°. 2. au *bas de la planche*, & les *fig.* 17, 18, & 19 ſont toutes relatives au même objet. La *fig.* 18. eſt le plan du métier à ſix places, ABCDEF pour ſix frappeurs. C'eſt un billot de bois ou tronc d'arbre, de trois piés neuf pouces de diametre & ſeize pouces de haut, ſur lequel ſont élevés ſix poteaux *s s s*, *s t*, *s t*, *fig.* 12, *n.* 2, aſſemblés par les traverſes *t t*, dans leſquelles paſſent les broches *x x* & l'outibot *b c*. Les broches terminées en pointes repoſent par leur partie inférieure ſur des plaques de plomb 5, 7, place B, *fig.* 18, encaſtrées dans des creux 1, 3, place A, pratiqués dans le billot. L'outibot eſt guidé par la moiſe de fer *y y*, en ſorte que le poinçon Z dont ſon extrémité inférieure eſt armée, tombe juſte ſur l'enclume 6, places B & C, dont la queue entre dans le trou 2, place A. L'entêteur, aſſis à ſa place, les coudes appuyés ſur les barres de bois G H, prend dans la poche ou calotte *o o*, places E, F, qu'il a devant lui, une hampe ou corps d'épingle placé en Z, comme on voit place D, & la pouſſe dans un grand nombre de têtes placées en *o*, où elle ne peut manquer d'en enfiler une ou pluſieurs. Il place enſuite l'épingle chargée d'une ſeule tête ſur l'enclume 6; & lâchant le pié de deſſus la marchette *g f*, *fig.* 12. *n.* 2, le poids *a* dont l'outibot eſt chargé, le fait deſcendre ſur l'enclume & comprime la tête autour de l'épingle, qui après qu'elle eſt façonnée, eſt jettée dans l'eſpace 3, 10, place D ou Z, place C, *fig.* 18.

14. Chaudiere à blanchir de cuivre rouge, de dix-huit pouces de diametre & deux piés & demi de hauteur.

15. Partie d'une portée empilée ſur la premiere, & deſtinée à entrer dans la chaudiere.

16. Repréſente le plan de la moiſe *y y* qui guide le mouvement vertical de l'outibot. On voit par cette *figure* deſſinée, ainſi que les deux ſuivantes, ſur une échelle quadruple de celle qui eſt ſur la planche, que les broches *x x* de ſix lignes de gros, ne rem-

pliſſent pas exactement les trous dans leſquelles elles paſſent. On laiſſe un vuide de deux ou trois lignes que l'on remplit de parchemin huilé pour faciliter le mouvement de la moiſe le long des broches : on met auſſi du parchemin dans le trou de la traverſe par lequel paſſe la tige de l'outibot.

Fig. 17. Repréſente en grand l'outibot ſur l'échelle quadruple, c'eſt-à-dire, que quatre piés ne ſont compte que pour un. On voit en *Z* comment la partie inférieure eſt recreuſée ſur neuf lignes de profondeur & ſix en quarré pour recevoir le poinçon *y z* de ſix lignes en quarré, & dix lignes de long réduit à cinq lignes en quarré par les extrémités. A côté en *x* eſt le plan du poinçon, le long des quatre rives duquel ſont des cavités hémiſphériques, dans une deſquelles la tête de l'épingle ſe forme : ces cavités ſont faites avec le poinçon émouſſé que l'on voit de l'autre côté de l'outibot.

18. *Voyez* ci-deſſus, *fig.* 12.

Fig. 19. Repréſente le canon & l'enclume deſſinée ſur l'échelle quadruple. *a c*, l'enclume : *c*, le canon qui la reçoit, & qui eſt recreuſé, comme les lignes ponctuées le font voir, de ſix lignes en quarré, ſur autant de profondeur. Ce canon dont la queue *y* entre dans le trou 2, place *b*, *fig.* 18, reçoit l'enclume *a c*, d'un pouce de long, ſur ſept lignes en quarré par le haut & quatre lignes par le bas : la face ſupérieure a quatre cavités hémiſphériques comme le poinçon, ainſi qu'on peut voir par le plan *y* qui eſt à côté. Ces cavités communiquent à des gouttieres dans leſquelles le corps de l'épingle trouve place.

20. Repréſente le poinçon ou peigne avec lequel on pique les papiers dans leſquels on place les épingles apres qu'elles ſont achevées. On voit au-deſſous le profil du même poinçon, & la maniere dont le papier eſt plié en pluſieurs doubles quand on le pique.

fig. 4.

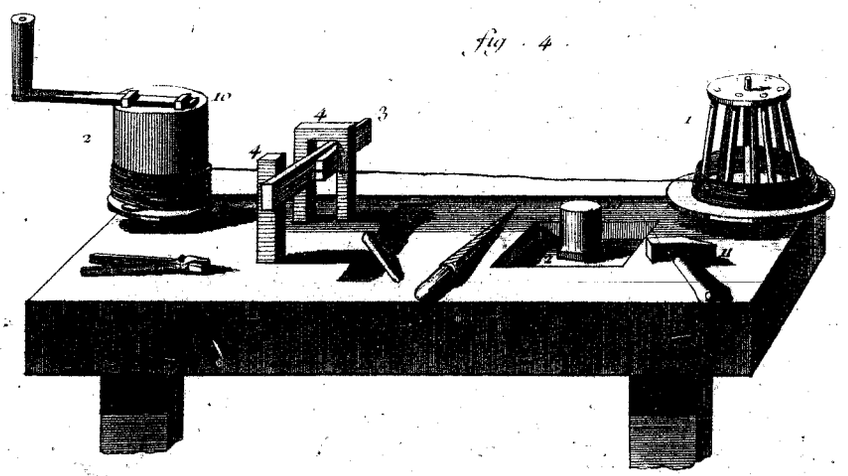


fig. 5.

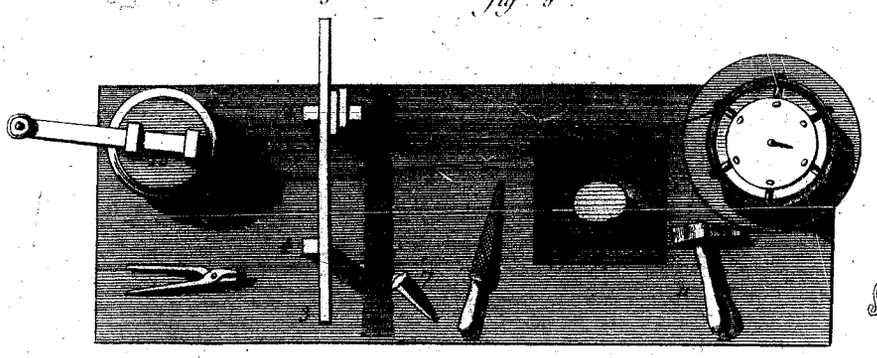
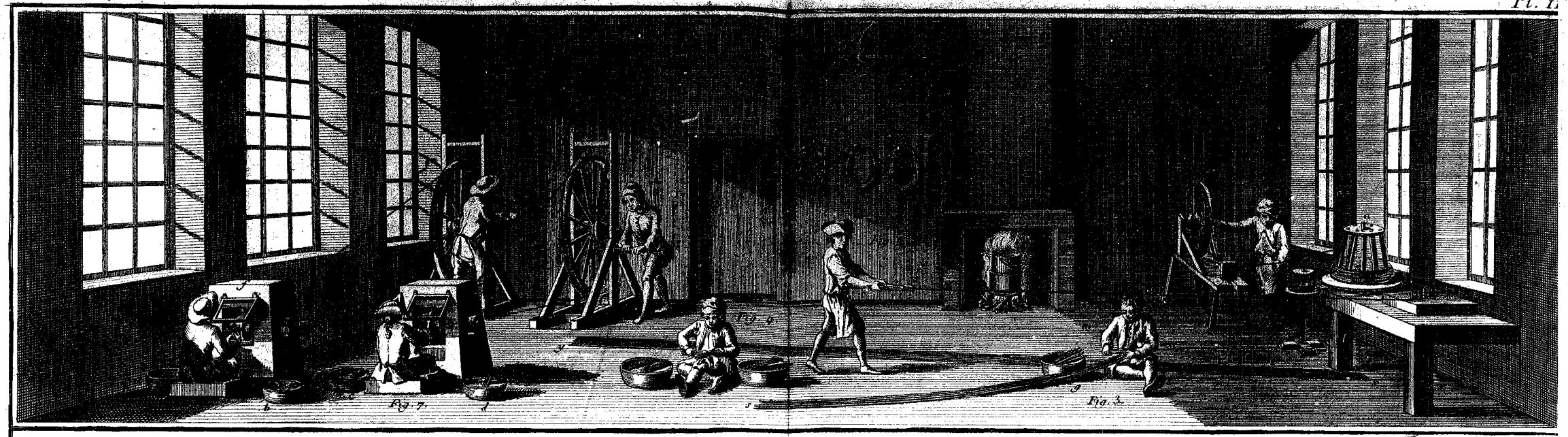
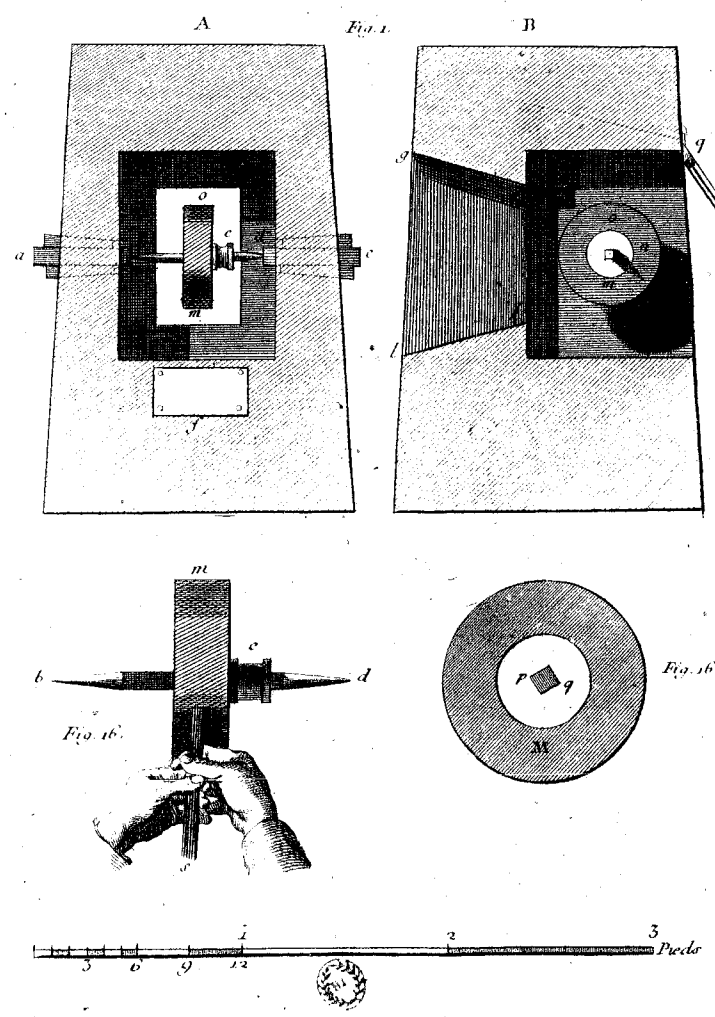


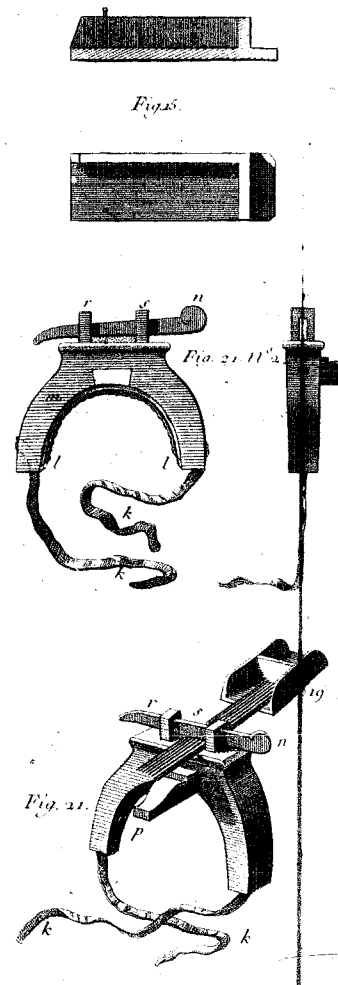
fig. VIII.

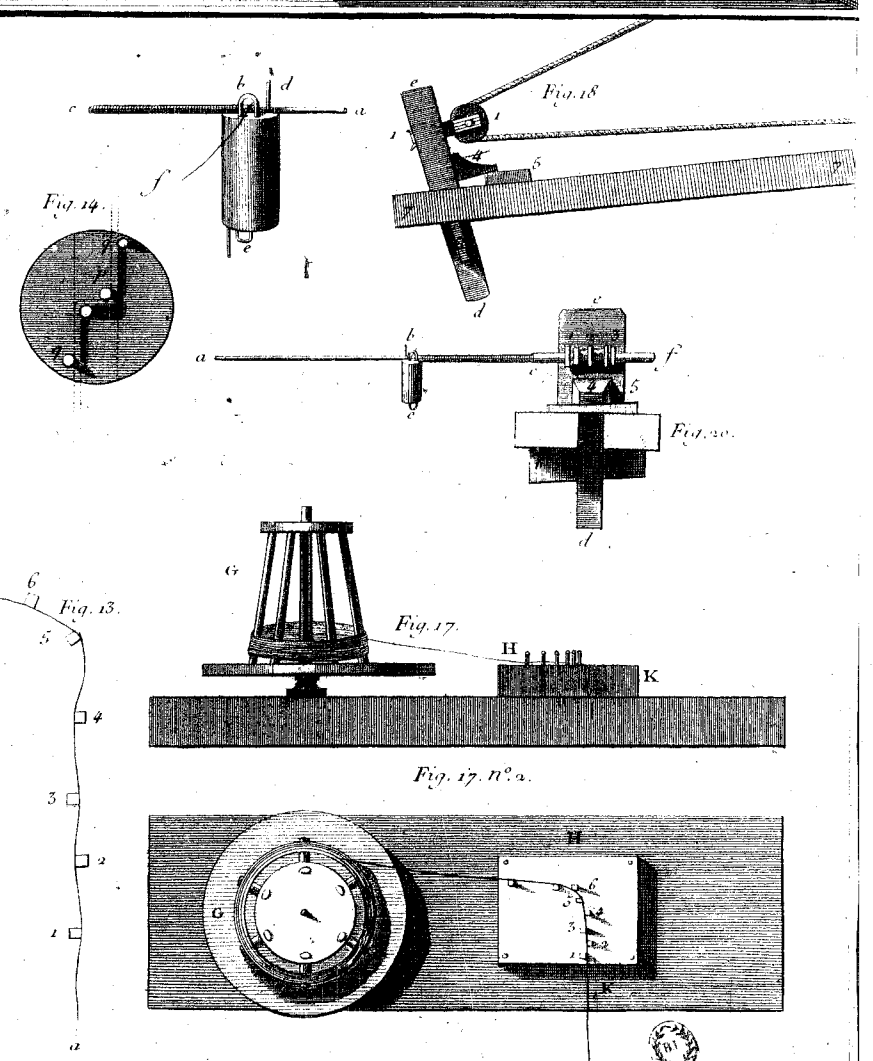
Goussier Del. Prevost Sculp.

Epinglier.





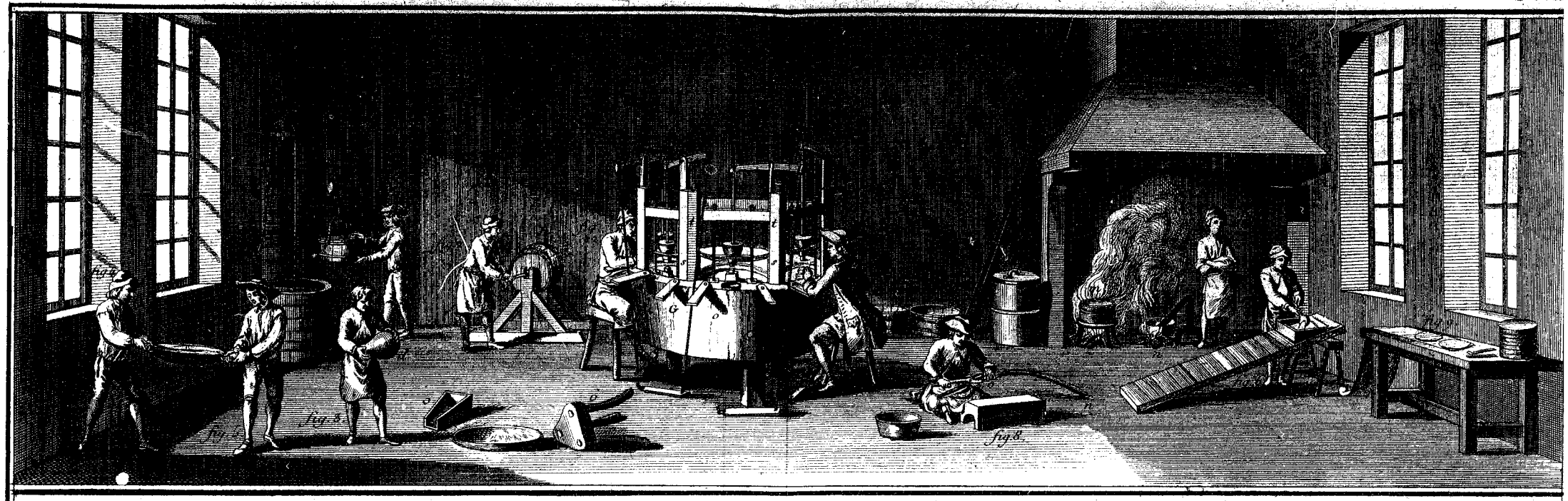


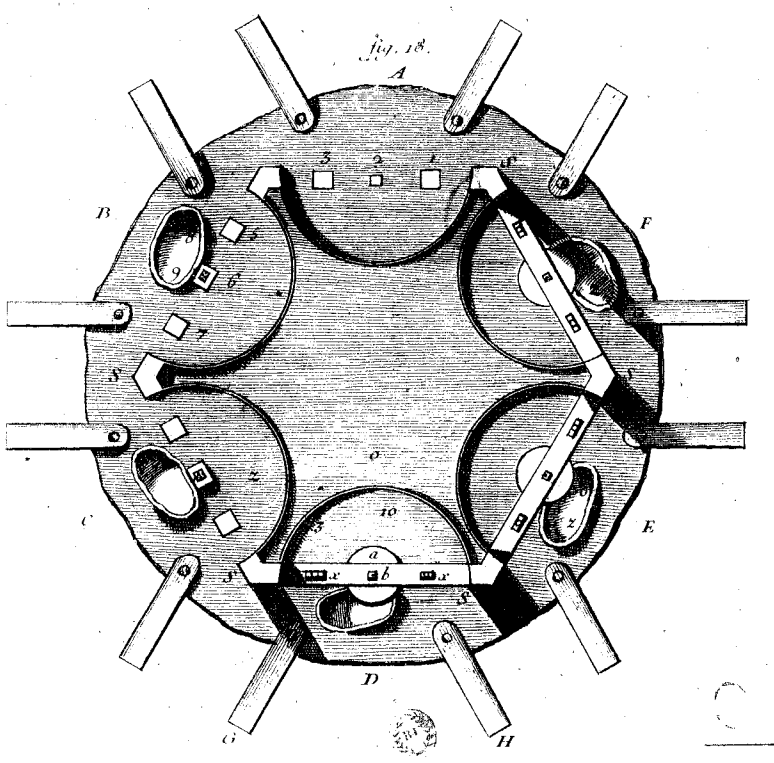


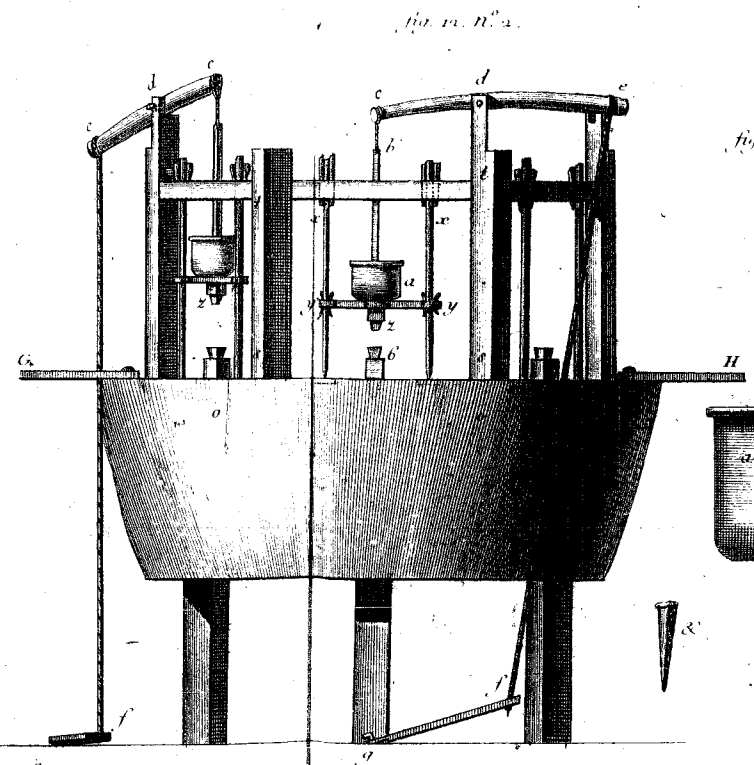
Gouaver Del.

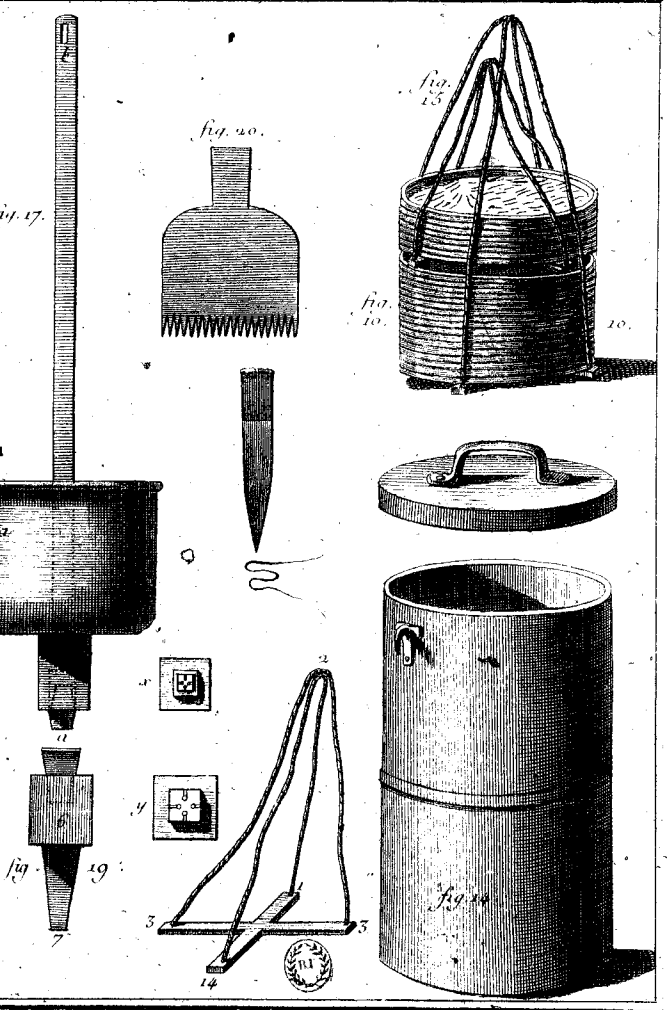
Defehrt Scul

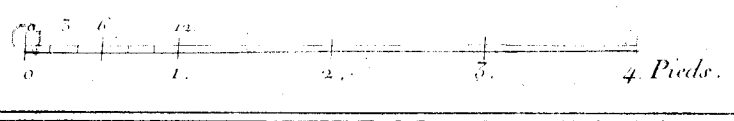
Epinglier.











Gouvenor Del.

Prevost Sculp.

Epinglier.

Anne Robert Jacques Turgot (1727-1781)

« Lettre à Madame de Graffigny sur les lettres peruviennes » (1751), *Œuvres de Mr. Turgot, ministre d'État*, tome neuvième, Delance, Paris, 1810.

ŒUVRES

DE

Mr. TURGOT,

MINISTRE D'ÉTAT,

Précédées et accompagnées de MÉMOIRES *et de* NOTES *sur sa Vie, son Administration et ses Ouvrages.*

Bonum virum facilè crederes, magnum libenter.
TACITE.

TOME NEUVIÈME.

PARIS,

DE L'IMPRIMERIE DE DELANCE.

1810.

A MADAME DE GRAFFIGNY,

Sur les Lettres Péruviennes.

Les observations suivantes ont été adressées en 1751 à Madame de *Graffigny* qui, rendant justice à la sagacité et au goût délicat de M. *Turgot*, l'avait prié de lui donner son opinion sur le manuscrit des *Lettres Péruviennes* avant qu'elle le fit imprimer. — On verra que ce n'était pas la première fois qu'elle demandait ses conseils. — Mais ce qui pourra surprendre davantage est le grand nombre d'idées sur l'éducation, conformes à celles de *Rousseau*, que M. *Turgot* ne devait qu'à lui-même, et qui étaient devenues doctrine dans son esprit dix ans avant la publication d'Émile. — C'est encore une chose remarquable dans cet écrit, que la liaison des principes de l'Homme d'État propre à gouverner un Empire avec ceux de l'Homme de Lettres dissertant sur la composition d'un roman. Cela ne viendrait-il point de ce que les succès mérités et durables de l'un et de l'autre tiennent à la connaissance et au sentiment du vrai, du juste, du bon, du beau, de l'honnête ?

MADAME,

JE ferai donc encore une fois auprès de vous le rôle de donneur d'avis; ce n'est pas sans rire un peu de moi-même; mais vous le voulez, et le plaisir de vous obéir passe de beaucoup le ridicule de vous conseiller.

J'ai relu la Péruvienne. *Zilia* est une bien digne sœur de *Cénie :* je suis, comme Henri IV, pour le dernier que j'ai entendu.

J'aimerois beaucoup mieux me faire honneur d'y découvrir à chaque instant les beautés nouvelles que je suis toujours étonné de n'y avoir pas encore admirées, que de m'amuser à en faire de mauvaises critiques. Mais vous ne demandez pas des éloges, ainsi je dois renoncer à me contenter.

Je réserve, suivant ce que vous m'avez fait l'honneur de me dire, les critiques de détail pour les dernières, et je commence par vous communiquer les additions que j'imagine qu'on pourroit faire à l'ouvrage. Vous m'avez paru goûter la principale qui est de montrer Zilia françoise, après nous l'avoir fait voir Péruvienne; Zilia jugeant, non plus suivant ses préjugés, mais comparant ses préjugés et les nôtres; de lui faire envisager les objets sous un nouveau point de vue; de lui faire remarquer combien elle avoit tort d'être étonnée de la pluspart des choses; de lui faire détailler les causes de ces mesures tirées de l'antique constitution du gouvernement, et tenant à la distribution des conditions, ainsi qu'aux progrès des connoissances.

Cette distribution des conditions est un ar-

ticle bien important et bien facile à justifier, en montrant sa nécessité et son utilité. — Sa nécessité, parce que les hommes ne sont point nés égaux; parce que leurs forces, leur esprit, leurs passions romproient toujours entre eux l'équilibre momentané que les loix pourroient y mettre; parce que tous les hommes naissent dans un état de foiblesse qui les rend dépendans de leurs parens et qui forme entre eux des liens indissolubles. Les familles inégales en capacité et en force ont redoublé les causes d'inégalité; les guerres des sauvages ont supposé un chef. — Que seroit la société sans cette inégalité des conditions? Chacun seroit réduit au nécessaire, ou plustôt il y auroit beaucoup de gens qui n'en seroient point assurés. On ne peut labourer sans avoir des instrumens et le moyen de vivre jusqu'à la récolte. Ceux qui n'ont pas eu l'intelligence, ou l'occasion, d'en acquérir n'ont pas le droit d'en priver celui qui les a mérités, gagnés, obtenus par son travail. Si les paresseux et les ignorans dépouilloient les laborieux et les habiles, tous les travaux seroient découragés, la misère seroit générale. Il est plus juste et plus utile pour tous que ceux qui ont manqué ou d'esprit, ou de bonheur, prêtent leurs bras à ceux qui savent les employer, qui peuvent d'avance leur donner

un salaire et leur garantir une part dans les produits futurs. Leur subsistance alors est assurée, mais leur dépendance aussi. Il n'est pas injuste que celui qui a inventé un travail productif et qui a fourni à ses coopérateurs les alimens et les outils nécessaires pour l'exécuter, qui n'a fait avec eux pour cela que des contrats libres, se réserve la meilleure part, que pour prix de ses avances il ait moins de peine et plus de loisir. Ce loisir le met à portée de réfléchir davantage, d'augmenter encore ses lumières; et ce qu'il peut économiser sur la part équitablement meilleure qu'il doit avoir dans les produits accroît ses capitaux, son pouvoir de faire d'autres entreprises.

Ainsi l'inégalité naîtroit et s'augmenteroit même chez les peuples les plus vertueux et les plus moraux. Elle peut avoir, elle a eu le plus souvent beaucoup d'autres causes : et l'on y retomberoit par tous les moyens qu'on voudroit employer pour en sortir. — Mais elle n'est point un mal; elle est un bonheur pour les hommes, un bienfait de celui qui a pesé avec autant de bonté que de sagesse tous les élémens qui entrent dans la composition du cœur humain. — Où en seroit la société si la chose n'étoit pas ainsi, et si chacun labouroit son petit champ? — Il faudroit que lui-même aussi bâtit sa maison, fit ses habits. Chacun

seroit réduit à lui seul et aux seules productions du petit terrein qui l'environneroit. De quoi vivroit l'habitant des terres qui ne produisent point de bled? Qui est-ce qui transporteroit les productions d'un pays à l'autre? Le moindre paysan jouit d'une foule de commodités rassemblées souvent de climats forts éloignés. Je prends le plus mal équipé: mille mains, peut-être cent mille ont travaillé pour lui. — La distribution des professions amène nécessairement l'inégalité des conditions. Sans elle, qui perfectionnera les arts utiles? Qui secourra les infirmes? Qui étendra les lumières de l'esprit? Qui pourra donner aux hommes et aux nations cette éducation tant particulière que générale qui forme les mœurs? Qui jugera paisiblement les querelles ? Qui donnera un frein à la férocité des uns, un appui à la foiblesse des autres? — Liberté!... je le dis en soupirant, les hommes ne sont peut-être pas dignes de toi! — Egalité! ils te désireroient, mais ils ne peuvent t'atteindre!

Que *Zilia* pèse encore les avantages réciproques du sauvage et de l'homme policé. Préférer les sauvages est une déclamation ridicule. Qu'elle la réfute; qu'elle montre que les vices que nous regardons comme amenés par la politesse sont l'appanage du cœur humain; que

Anne Robert Jacques Turgot (1727-1781)

"On Some Social Questions, Including the Education of the Young", [Lettre to Madame de Graffigny], *The Turgot Collection: Writings, Speeches, and Letters ofAnne Robert Jacques Turgot, Baron de Laune*, Edited by David Gordon, Ludwig von Mises Institute, Auburn, Alabama, 2011, pp. 419-421.
http://mises.org/document/6298/The-Turgot-Collection-Writings-Speeches-and-Letters-of-Anne-Robert-Jacques-Turgot-Baron-de-Laune

CHAPTER 16

On Some Social Questions, Including the Education of the Young

Addressed to Madame de Graffigny

I have again read the *Lettres péruviennes*.[1] Zilia is a quite worthy sister of Cénie. I am like Henri Quatre, for the last one I have heard. I would indeed prefer the constantly discovering new beauties (which I am always astonished not to have already admired) to amusing myself by making poor criticisms. But you do not wish praise, and I must renounce gratifying myself.

In obedience to the request you have honored me by making, I begin by suggesting the additions which I imagine might be made to the work. You seem to me to approve of the principal of these, which would be to show Zilia as Frenchwoman, after having shown her as Peruvian; to show Zilia judging no longer according to her prejudices, but comparing her prejudices with our own, making her regard objects from a new point of view, making her remark how far she has *been* wrong in being astonished at so many things, and making her search out the causes of those arrangements, derived from the ancient constitution of government, bearing upon the distribution of social conditions as well as on the progress of knowledge.

The distribution of conditions is a very important feature in the social state, and one very easy to justify by showing its necessity and

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Written 1751.

[1] Madame de Graffigny, born 1695, published between 1745 and 1758, the year of her death, several romances and plays. The *Lettres d'une Péruvienne,* of 1747, was her greatest success, and went through many editions.

its utility. Its necessity, because men are not born equal, because their strength, their mind, their passions, would constantly disturb the equilibrium which laws might attempt to set, because all men are born in a state of feebleness, which renders them dependent on their parents, and which forms between them indissoluble ties. Families unequal in capacity and in strength redoubled the causes of inequality; the wars of savages required a chief. What would society have been without this inequality of conditions? Each would have been reduced to a life concerning itself merely with necessities, and there would be many to whom even these would not be assured. One cannot labor at the soil without having utensils and the means of sustenance until the harvest. Those who have not had the intelligence or the opportunity to acquire these means have not the right to deprive of them him who has earned and won them by his work. If the idle and the ignorant robbed the laborious and the skilful, all work would be discouraged, misery would become general. It is more just and more useful for all that those who are deficient in mind or in good fortune should lend their strength to others who can employ them, who can, in advance, give them wages, and thus guarantee them a share of the future products. Their subsistence then is assured, but so is their dependence. It is not unjust that he who has invented a productive work, and who has supplied to his co-operators the sustenance and the instruments necessary to execute it, who has made with them, in that, only a free contract, should reserve for himself the better part, and, for the price of his advances, should have less hard work and more leisure. This leisure enables him to reflect more, and still further to increase his mental resources. What he can save from the portion, equitably greater, which he will have of the products, increases his capital and his power to undertake new enterprises. Thus inequality will arise, and will increase, even among the most capable and most moral peoples.... It is not an evil, it is a blessing for mankind: where would society be if every man labored only at his own little field? It would be necessary for him also to build his own house, to make his own clothes. The work of each would be limited to himself and to the productions of the little piece of ground surrounding him. How would the inhabitant of

the land which did not produce wheat manage to live? Who would transport the products of one country to another? The humblest peasant now enjoys many commodities gathered often from distant countries. A thousand hands, perhaps a hundred thousand hands, have worked for him. The distribution of employments necessarily leads to the inequality of conditions. Without it who would perfect the useful arts? Who would succour the infirm? Who would spread the light of the miner? Who would give to men and to nations that education, particular as well as general, which forms their manners? Who would decide peacefully men's quarrels? Who would check the ferocity of some men, or support the feebleness of others? Liberty! I say it in a sigh, men are perhaps not worthy of thee! Equality! they desire thee, but they cannot attain to thee!

Let your Zilia weigh again the relative advantages of the savage and of the civilized man. To prefer the condition of the savage is a ridiculous declamation. Let her refute it, let her show that the vices which we regard as produced by civilization are the appanage of the human heart; that he who has no gold may be as avaricious as he who has it, because, in all circumstances, men have the hunger for property, the right to preserve it, the avidity which actuates them to accumulate its products. But let not Zilia be unjust; let her, at the same time, unfold the compensations, unequal indeed but still real, belonging to the condition of uncivilized people. Let her show that our arbitrary institutions too often lead us away from Nature; that we have been the dupes of our own progress, that the savage, without knowing how to consult Nature, knows often how to follow her.

Let Zilia criticize, above all, the method of our education; let her criticize our pedantry, for it is in that today that our education consists. Our teaching is applied quite against the grain of Nature. See the "Rudiments." We begin by wishing to cram into the heads of children a perfect crowd of the most abstract ideas. We deluge them with words which can offer to them no meaning, because the meaning of words can only be presented along with ideas, and these ideas can come only by degrees, by proceeding from sensible objects. Then we suppress their imagination, we keep from their view the objects by which Nature gives to the savage the first notion of all

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Réflexions sur la formation & la distribution des richesses, par Mr. X. *Ephémérides du citoyen ou bibliothèque raisonnée des sciences morales et politiques*. Paris, Lacombe, 1769, tomes XI & XII.
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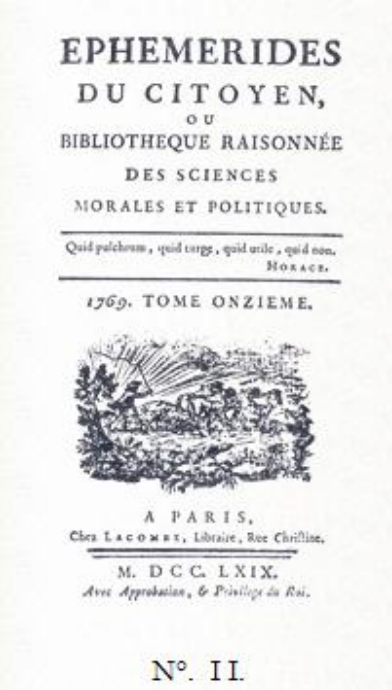

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Quid pulchrum, quid turpe, quid utile, quid non.
HORACE.

1769. TOME ONZIEME.

A PARIS,
Chez LACOMBE, Libraire, Rue Christine.

M. DCC. LXIX.
Avec Approbation, & Privilege du Roi.

N°. II.

RÉFLEXIONS sur la formation & la distribution des richesses, par Mr. X.

§. PREMIER

Impossibilité du Commerce dans la supposition d'un partage égal des terres,ou chaque homme n'auroit que ce qu'il lui faudroit pour se nourrir.

Si la terre étoit tellement distribuée entre tous les habitants d'un pays, que chacun en eût précisément la quantité nécessaire pour se nourrir, & rien de plus; il est évident que, tous étant égaux, aucun ne voudroit travailler pour autrui. Personne aussi n'auroit de quoi payer le travail d'un autre; car chacun, n'ayant de terre que ce qu'il en faudroit pour produire sa subsistance, consommeroit

tout ce qu'il auroit recueilli, & n'auroit rien qu'il pût échanger contre le travail des autres.

§. I I.

L'hypothèse ci-dessus n'a jamais existé, & n'auroit pu subsister. La diversité des terreins & la multiplicité des besoins amenent l'échange des productions de la terre contre d'autres productions.

Cette hypothèse n'a jamais pu exister, parceque les terres ont été cultivées avant d'être partagées; la culture même ayant été le seul motif du partage & de la loi qui assure à chacun sa propriété. Or, les premiers qui ont cultivé, ont probablement cultivé autant de terrein que leurs forces le permettoient et, par conséquent, plus qu'il n'en falloit pour les nourrir.

Quand cet état auroit pu exister, il n'auroit pu être durable; chacun ne tirant de son champ que sa subsistance, & n'ayant pas de quoi payer le travail des autres, ne pourroit subvenir à ses autres besoins, du logement, du vête-

ment, &c que par son propre travail; ce qui seroit à peu-près impossible, *toute terre ne produisant pas* tout, à beaucoup près.

Celui dont la terre ne seroit propre qu'aux grains, & ne produiroit ni coton, ni chanvre, manqueroit de toile pour s'habiller. L'autre auroit une terre propre au coton, qui ne produiroit pas de grains. Tel autre manqueroit de bois pour se chauffer, tandis que tel autre manqueroit de grains pour se nourrir. Bientôt l'expérience apprendroit à chacun quelle est l'espece de production à laquelle sa terre seroit la plus propre; & il se borneroit à la cultiver, afin de se procurer les choses dont il manqueroit, par la voie de l'échange avec ses

voisins; qui, ayant fait de leur côté les mêmes réflexions, auroient cultivé la denrée la plus propre à leur champ & abandonné la culture de toutes les autres.

§. I I I.

Les productions de la terre exigent des préparations longues & difficiles, pour être rendues propres aux besoins de l'homme.

Les denrées que la terre produit pour satisfaire aux différents besoins de l'homme, ne peuvent y servir, pour la plus grande partie, dans l'état où la nature les donne; elles ont besoin de subir différents changements & d'être préparées par l'art. Il faut convertir le froment en farine & en pain; tanner ou passer les cuirs; filer les laines, les cotons; tirer la soie des cocons, rouir, teiller, filer les chanvres & les lins; en former ensuite différents tissus; & puis les tailler, les coudre pour en faire des vêtements, des chaussures, &c. Si le même homme qui fait produire à sa terre ces différentes choses, & qui les emploie à ses besoins,

étoit obligé de leur faire subir toutes ces préparations intermédiaires, il est certain qu'il réussiroit fort mal. La plus grande partie de ces préparations exige des soins, une attention, une longue expérience, qui ne s'acquiert qu'en travaillant de suite & sur une grande quantité de matieres. Prenons pour exemple la préparation des cuirs : quel laboureur pourroit suivre tous les détails nécessaires pour cette opération, qui dure plusieurs mois, & quelquefois plusieurs années ? S'il le pouvoit, le pourroit-il sur un seul cuir ? Quelle perte de tems, de place, de matieres, qui auroient pu servir en même tems, ou successivement à tanner une grande quantité de cuir ! Mais

quand il réussiroit à tanner un cuir tout seul, il ne lui faut qu'une paire de souliers; que feroit il du reste ? Tuera-t-il un boeuf pour avoir cette paire de souliers? Coupera-t-il un arbre pour se

faire une paire de sabots ? On peut dire la même chose de tous les autres besoins de chaque homme, qui, s'il étoit réduit à son champ & à son travail, consumeroit beaucoup de tems & de peine pour être fort mal équipé à tous égards, & cultiveroit très mal son terrein.

§. I V.

La nécessité des préparations amene l'échange des productions contre le travail.

Le même motif qui a établi l'échange de denrée à denrée, entre les Cultivateurs de terreins de diverse nature, a donc dû amener aussi l'échange de la denrée contre le travail entre les Cultivateurs & une autre partie de la société, qui aura préféré l'occupation de préparer & de mettre en œuvre les productions de la terre à celle de les faire naître. Tout le monde gagnoit à

cet arrangement, car chacun en se livrant à un seul genre de travail y réussissoit beaucoup mieux. Le Laboureur tiroit de son champ la plus grande quantité de productions possible & se procuroit bien plus facilement tous ses autres besoins par l'échange de son superflu, qu'il ne l'eût fait par son travail Le Cordonnier, en faisant des souliers pour le Laboureur, s'approprioit une partie de la récolte de celui-ci. Chaque ouvrier travailloit pour les besoins des ouvriers de tous les autres genres, qui, de leur côté, travailloient tous pour lui.

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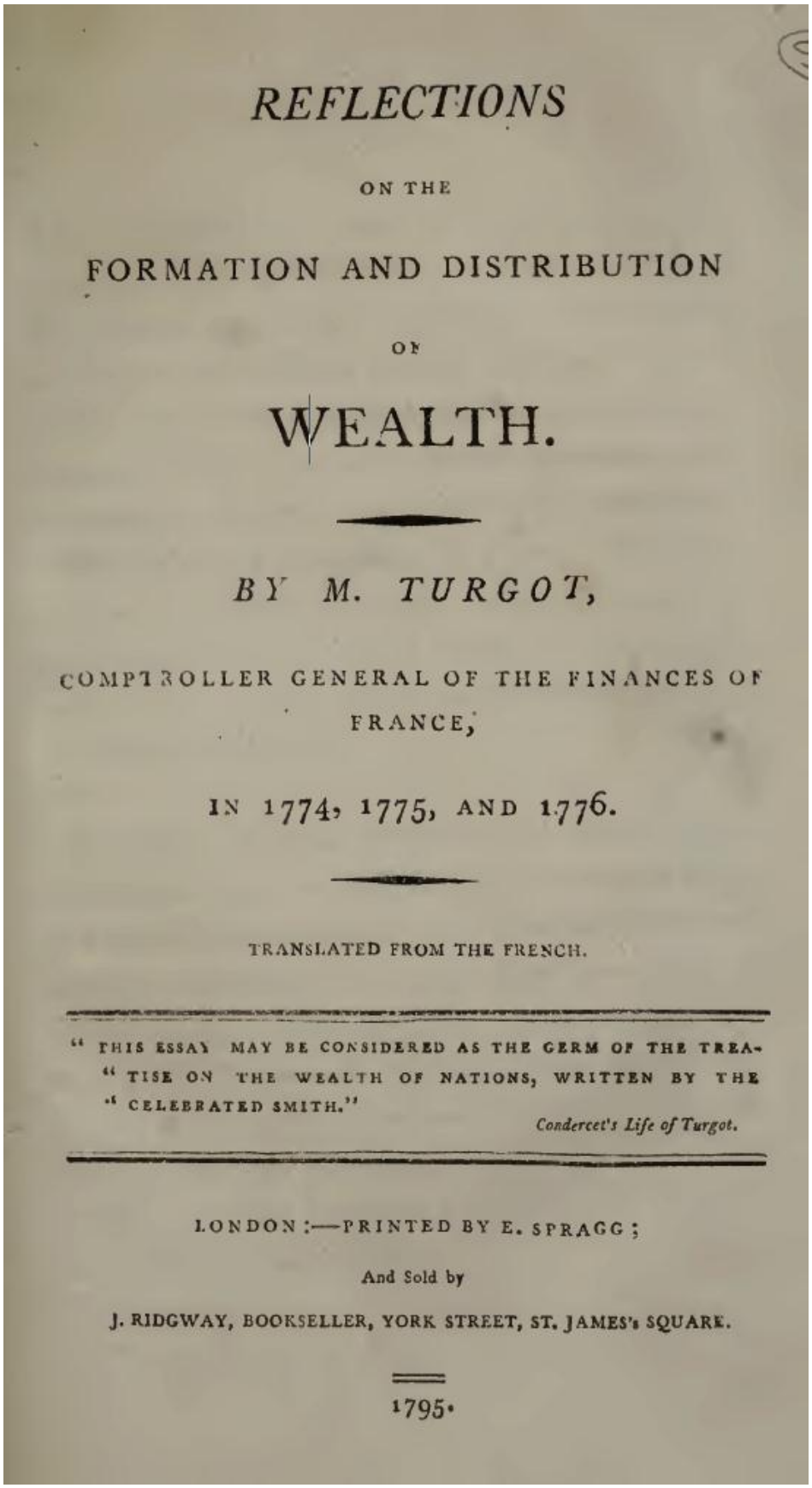
§. L.

L'usage de l'argent a beaucoup facilité la séparation des divers travaux entre les différents Membres de la Société.

Plus l'argent tenoit lieu de tout, plus chacun pouvoit, en se livrant uniquement à l'espece de culture ou d'industrie qu'il avoit choisie, se débarrasser de tout soin pour subvenir à ses autres besoins, & ne penser qu'à se procurer le plus d'argent qu'il pourroit par la vente de ses fruits ou de son travail, bien sûr, avec cet argent, d'avoir tout le reste. C'est ainsi que l'usage de l'argent a prodigieusement hâté les progrès de la Société.

Anne Robert Jacques Turgot (1727-1781)
Reflections on the Formation and Distribution of Wealth, Spragg, London, 1795.



REFLECTIONS

ON THE

FORMATION AND DISTRIBUTION

OF

WEALTH.

BY M. TURGOT,

COMPTROLLER GENERAL OF THE FINANCES OF FRANCE,

IN 1774, 1775, AND 1776.

TRANSLATED FROM THE FRENCH.

" THIS ESSAY MAY BE CONSIDERED AS THE GERM OF THE TREA-
" TISE ON THE WEALTH OF NATIONS, WRITTEN BY THE
" CELEBRATED SMITH."

Condercet's Life of Turgot.

LONDON:—PRINTED BY E. SPRAGG;

And Sold by

J. RIDGWAY, BOOKSELLER, YORK STREET, ST. JAMES's SQUARE.

1795.

REFLECTIONS

ON THE

FORMATION AND DISTRIBUTION

OF

WEALTH.

Oſtendent terris hunc tantùm, fata. Æn. 6.

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§ 1. *The impoſſibility of the exiſtence of Commerce upon the ſuppoſition of an equal diviſion of lands, where every man ſhould poſſeſs only what is neceſſary for his own ſupport.*

IF the land was divided among all the inhabitants of a country, ſo that each of them poſſeſſed preciſely the quantity neceſſary for his ſupport, and nothing more; it is evident that all of them being equal, no one would work for another. Neither would any of them poſſeſs wherewith to pay another for his labour, for each perſon

having only such a quantity of land as was necessary to produce a subsistence, would consume all he should gather, and would not have any thing to give in exchange for the labour of others.

§ 2. *The above hypothesis neither has existed nor could continue. The diversity of soils and multiplicity of wants, compel an exchange of the productions of the earth, against other productions.*

This hypothesis never can have existed, because the earth has been cultivated before it has been divided; the cultivation itself having been the only motive for a division, and for that law which secures to every one his property. For the first persons who have employed themselves in cultivation, have probably worked as much land as their strength would permit, and consequently more than was necessary for their own nourishment.

If this state could have existed, it could not possibly be durable; each one gathering from his field only a subsistence, and not having wherewith to pay others for their labour, would not be enabled

abled to ſupply his other wants of lodging, cloathing, &c. &c. except by the labour of his hands, which would be nearly impoſſible, as every ſoil does not produce every material.

The man whoſe land was only fit to produce grain, and would neither bring forth cotton or flax, would want linen to cloath him. Another would have ground proper for cotton, which would not yield grain. One would want wood for his fire, and another be deſtitute of corn to ſupport him. Experience would ſoon teach every one what ſpecies of productions his land was beſt adapted to, and he would confine himſelf to the cultivation of it; in order to procure himſelf thoſe things he ſtood in need of, by an exchange with his neighbours, who, having on their part acquired the ſame experience, would have cultivated thoſe productions which were beſt ſuited to their fields, and would have abandoned the cultivation of any other.

§ 3. *The productions of the earth require long and difficult preparations, before they are rendered fit to ſupply the wants of men.*

The productions which the earth ſupplies to ſatisfy the different wants of man, will not, for the moſt part, adminiſter to thoſe wants, in the ſtate nature affords them; it is neceſſary they ſhould undergo different operations, and be prepared by art. Wheat muſt be converted into flour, then into bread; hides muſt be dreſſed or tanned; wool and cotton muſt be ſpun; ſilk muſt be taken from the cod; hemp and flax muſt be ſoaked, peeled, ſpun, and wove into different textures; then cut and ſewed together again to make garments, &c. If the ſame man who cultives on his own land theſe different articles, and who raiſes them to ſupply his wants, was obliged to perform all the intermediate operations himſelf, it is certain he would ſucceed very badly. The greater part of theſe preparations require care, attention, and a long experience; all which are only to be acquired by progreſſive labour, and that on a great quantity of materials. Let us refer, for example, to the preparation of hides: what labourer can purſue all the particular things neceſſary to thoſe operations, which continue ſeveral months, ſometimes ſeveral years? If he is able to do it, can he do it with a ſingle hide? What a loſs of time,

time, of room, and of materials, which might be employed, either at the ſame time or ſucceſſively, to tan a large quantity of ſkins! But ſhould he even ſucceed in tanning a ſingle ſkin, and wants one pair of ſhoes, what will he do with the remainder? Will he kill an ox to make this pair of ſhoes? Will he cut down a tree to make a pair of wooden ſhoes? We may ſay the ſame thing of every other want of every other man, who, if he was reduced to his field, and the labour of his own hands, would waſte much time, take much trouble, be very badly equipped in every reſpect and would alſo cultivate his lands very ill.

§ 4. *The neceſſity of theſe preparations, bring on the exchange of productions for labour.*

The ſame motive which has eſtabliſhed the exchange of commodity for commodity, between the cultivators of lands of different natures, has alſo neceſſarily brought on the exchange of commodities for labour, between the cultivators and another portion of ſociety, who ſhall have preferred the occupation of preparing and completing the productions of the earth, to the cultiva-

tion

tion of it. Every one profits by this arrangement, for every one attaching himſelf to a peculiar ſpecies of labour, ſucceeds much better therein. The huſbandman draws from his field the greateſt quantity it is able to produce, and procures to himſelf, with greater facility, all the other objects of his wants, by an exchange of his ſuperflux, than he could have done by his own labour. The ſhoemaker, by making ſhoes for the huſbandman, ſecures to himſelf a portion of the harveſt of the latter. Every workman labours for the wants of the workmen of every other trade, who, on their ſide, toil alſo for him.

§ 5. *Pre-eminence of the huſbandman who produces, over the artificer who prepares. The huſbandman is the firſt mover in the circulation of labour: it is he who cauſes the earth to produce the wages of every artificer.*

It muſt, however, be obſerved that the huſbandman, furniſhing every one with the moſt important and the moſt conſiderable objects of their conſumption (I mean their food, and the materials of almoſt all manufactures) has the advantage

other values which are actually in commerce. It is not possible to investigate these different causes, or to unfold their effects, without entering into very extensive and very difficult details, which I shall decline in this discussion.

§ 47. *The use of payments in money, has given room for the distinction of seller and buyer.*

In proportion as mankind became familiarized to the custom of valuing all things in silver, of exchanging all their superfluous commodities for silver, and of not parting with that money but for things which are useful or agreeable to them at the moment, they become accustomed to consider the exchanges of commerce in a different point of view. They have made a distinction of two persons, the buyer and the seller: the seller is him who gives commodities for money; and the buyer is him who gives money for commodities.

§ 48. *The use of money has much facilitated the separation of different labours among the different orders of society.*

The

The more money becomes a univerſal medium, the more every one is enabled, by devoting himſelf ſolely to that ſpecies of cultivation and induſtry, of which he has made choice, to diveſt himſelf intirely of every thought for his other wants, and only to think of providing the moſt money he can, by the ſale of his fruits or his labour, being ſure with that money to poſſeſs all the reſt. It is thus, that the uſe of money has prodigiouſly haſtened the progreſs of ſociety.

§ 49. *Of the exceſs of annual produce accumulated to form capitals.*

As ſoon as men are found, whoſe property in land aſſures them an annual revenue more than ſufficient to ſatisfy all their wants, among them there are ſome, who, either uneaſy reſpecting the future, or, perhaps, only provident, lay by a portion of what they gather every year, either with a view to guard againſt poſſible accidents, or to augment their enjoyments. When the commodities they have gathered are difficult to preſerve, they ought to procure themſelves in exchange, ſuch objects of a more durable nature, and ſuch

Adam Smith (1723-1790)

An Inquiry into the Nature and Causes of the Wealth of Nations, Vol. I, ed. R. H. Campbell and A. S. Skinner, vol. II of the Glasgow Edition of the Works and Correspondence of Adam Smith, Liberty Fund, Indianapolis, 1981. 1st edition 1776.

[Click on the underlined links below]

Cesare Beccaria (1738-1794)

Elementi di economiia pubblica, P. Custodi (ed.), *Scrittori classici italiani di economica politica*, *parte moderna*, tomo XI, G. G. Destefanis, Milan 1804.

SCRITTORI CLASSICI

ITALIANI

DI

ECONOMIA POLITICA.

PARTE MODERNA

Tomo XI.

MILANO

Nella Stamperia e Fonderia di G. G. Destefanis

a S. Zeno, N.° 534.

MDCCCIV.

ELEMENTI

DI

ECONOMIA PUBBLICA

DI

CESARE BECCARIA

MILANESE.

INEDITI.

scema e si toglie la riproduzione, e la terra ritorna qual' era incolta e deserta.

§. 9.

Frattanto che da queste famiglie, ossia che da questa nostra idea di nazione prosperamente tutte le dette cose si fanno, ecco nascere necessariamente le arti e la diversità delle occupazioni degli uomini. Ciascuno prova coll'esperienza, che applicando la mano e l'ingegno sempre allo stesso genere di opere e di prodotti, egli più facili, più abbondanti e migliori ne trova i risultati, di quello che se ciascuno isolatamente le cose tutte a se necessarie soltanto facesse: onde altri pascono le pecore, altri ne cardano le lane, altri le tessono; chi coltiva biade, chi ne fa il pane, chi veste, chi fabbrica agli agricoltori e lavoranti, crescendo e concatenandosi le arti, e dividendosi in tal maniera per la comune e privata utilità gli uomini in varie classi e condizioni. Ognuno può vedere nella succennata opera di Goguet le diverse gradazioni de' progressi fatti dal genere umano, dal raccogliere le spontanee produzioni della terra al coltivarle, e dal rozzo uso di

quelle al prepararle e modificarle con tanti diversi ed ingegnosi artifizj.

§. 10.

Il lavoro degli uomini non vi sarebbe se non vi fossero cose da lavorare, nè le cose da lavorare vi sarebbero se la terra non le producesse. La mano dell'uomo modifica e dispone i corpi, cioè ne avvicina o ne allontana in diverse guise le parti; ma un atomo di materia non vi cresce fra le dita, se la terra e quello spirito di vita che circola nelle sue viscere non lo produce. Ma perchè l'uomo lavori, egli deve avere prima di tutto la materia da lavorare, indi vivere e procacciarsi le cose necessarie, anzi fino ad un certo segno le comode all'uso della sua vita durante tutto il tempo del lavoro, senza di che egli non lo farebbe altrimenti, ma invece attenderebbe a procacciarsi quelle cose che altri non gli darebbono. Quindi risulta che ogni valore che si dà ad un lavoro qualunque, sarà composto del valore della materia prima e del salario che si dà per il comodo sostentamento di quello che lavora questa materia prima. In qual pro-

Melchiorre Gioja (1767-1829)
Nuovo prospetto delle scienze economiche; seria prima teorie, tomo primo, produzione delle ricchezze, Gio. Pirotta, Milan, 1815.

NUOVO PROSPETTO
DELLE
SCIENZE ECONOMICHE
OSSIA

SOMMA TOTALE DELLE IDEE TEORICHE E PRATICHE
IN OGNI RAMO D' AMMINISTRAZIONE
PRIVATA E PUBBLICA,

DIVISE IN ALTRETTANTE CLASSI,

UNITE IN SISTEMA RAGIONATO E GENERALE

DA MELCHIORRE GIOJA

AUTORE DELLE TAVOLE STATISTICHE.

SERIE PRIMA
TEORIE.

TOMO PRIMO
PRODUZIONE DELLE RICCHEZZE.

MILANO

Presso Gio. Pirotta in Santa Radegonda.

Aprile 1815.

valli sono riuniti sotto la stessa muta. Al contrario il cavallo che tira da sè solo

1.° Può essere nella vera linea del tiro,

2.° Conserva un moto uniforme,

3.° Non è strascinato dall' emulazione, non forzato oltre misura dalla vivacità del suo vicino, nè sopraccaricato dalla sua inazione.

CAPO IV.

DIVISIONE DE' TRAVAGLI.

§ 1. DIMOSTRAZIONE DEL PRINCIPIO.

È noto che uno sciame d' api contiene

1.° La regina che attende alla propagazione della specie e sorveglia i travagli,

2.° I maschi destinati alla fecondazione della regina,

3.° Le api lavoratrici, alcune delle quali vanno a raccorre cera che serve alla costruzione delle cellette, altre miele che abbisogna principalmente nella cattiva stagione. Queste costruiscono le cellette che vengono pulite e perfezionate da quelle, altre stendono un cereo coperchio sul miele che sarà necessario nel verno ....

Questa repubblica presenta un' idea della *divisione de' travagli*, di cui Smith ha esagerato i vantaggi, attribuendo a questo principio ciò che in gran parte debbesi attribuire alle macchine (1). Si conosce facilmente que-

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(1) *Beccaria aveva accennato pria di Smith i vantaggi che dalla divisione de' travagli risultano nella produzione delle ricchezze. Ne' suoi elementi d' economia pubblica letti in Milano nel* 1769 *egli dice:* » *Ciascuno prova coll' e-* » *sperienza, che applicando la mano e l' ingegno sempre allo stesso genere* » *di opere e di prodotti, egli più facili, più abbondanti e migliori ne trova* » *i risultati, di quello che se ciascuno isolatamente le cose tutte a sè necessa-* » *rie soltanto facesse: onde altri pascono le pecore, altri ne cardano la lana,* » *altri la tessono; chi coltiva biade, chi ne fa il pane, chi veste, chi fab-* » *brica agli agricoltori e lavoranti, crescendo e concatenandosi le arti, e di-* » *videndosi in tal maniera per la comune e privata utilità gli uomini in varie* » *classi e condizioni «. (Tomo I. p.* 28.)

Malgrado questo cenno di Beccaria, il suddetto principio può essere ri-

sta esagerazione, esaminando l' esempio da esso addotto, cioè la fabbrica delle spille, nella quale i travagli sono divisi in 18 a 20 serie diverse, a ciascuna delle quali resta applicata una classe d' operai. Distruggete difatti la filiera che assottiglia l' ottone, la forbice che lo taglia, la molla che ne aguzza le punte, la macchinetta con cui s' accomoda il pomolo... e vedrete ciascuna specie di questi lavori ridursi a zero.

Ma siccome misurare una casa non è lo stesso che distruggerla, quindi dichiarando esagerata l' influenza dell' accennato principio, non ho in animo di negarne i moltiplici vantaggi.

Senza pretendere d' indovinare in quale modo la divisione de' travagli cominciò e si distese, addurrò le cause che la rendono necessaria.

1.° Partendo dall' idea generale degli *agenti naturali*, si scorge che una situazione alpestre ed abbondante di pascoli chiamò i lavori *pastorali*; un terreno friabile, piano, ridondante di rigagnoli diede luogo ai lavori *agrarj*; le miniere ne' monti sterili ed improprj alla pastorizia e all' agricoltura, riunirono i lavori *minerali* esclusivamente.

Dall' idea degli agenti naturali risulta un' altra causa di divisione ne' travagli. Difatti i rapporti tra lo sviluppo de' semi e le vicende atmosferiche sono tali che quelli non possono svolgersi, se i lavori non accadono nelle epoche di queste. Quindi, da una parte i lavori agrarj non ammettendo dilazione, dall' altra non ammettendo dilazione i primi bisogni, fu

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guardato come proprietà di Smith, perchè egli ne sviluppò le basi e ne fece tutte le applicazioni.

Lauderdale ha voluto torre a Smith l' onore dell' invenzione, osservando che da Xenofonte sino ai nostri giorni è stata preconizzata la destrezza, che l' uomo acquista in un' arte qualunque, allorchè si limita al solo esercizio di essa.

» *La prevenzione per questa idea, egli dice, giunse a tal punto che ser-*
» *vì di motivo alle leggi d' alcuni Stati. Dominava in essi la persuasione che*
» *non solamente l' operaio eseguiva un travaglio più perfetto, quando applicava*
» *la sua attenzione ad un oggetto unico, ma che diveniva anco più abile ad*
» *eseguire quello che sin dall' infanzia aveva avuto sott' occhio. Dopo questo*
» *principio le professioni divennero ereditarie in Egitto, in alcune parti del-*
» *l' India, al Perù. Ma gli inconvenienti di questo sistema saltano agli oc-*
» *chi con tale evidenza, che generalmente ne è stata rigettata l' idea «. (Re-*
cherches sur la nature et l' origine de la richesse publique pag. 214-216.)

Ma può ben essere nociva la legge che vuole ereditarj i mestieri nelle famiglie, senza che cessino i vantaggi della divisione de' travagli; e l' esagerazione d' un principio non è certamente il punto da cui debba partire il critico per censurarlo.

forza che mentre l' agricoltore zappava, arava, seminava, mieteva, il muratore gli accomodasse la casa, il calzolajo le scarpe, il sarto l'abito ....

2.° Partendo dall' idea di *travagli più o meno faticosi*, e di *costituzioni fisiche più o meno deboli*, si ravvisa che, siccome la *debolezza* non sarebbe riuscita ove riusciva la *forza*, e non conveniva a questa l' occuparsi nei travagli disimpegnati da quella, quindi dovettero gli uni contentarsi dei lavori che venivano lasciati loro dagli altri. Ciò che dico della forza, s'applichi alla *destrezza*, essendo certo che questi, supposta eguale la forza, non possono in egual tempo riuscire in que' lavori, in cui riescono quelli con tutta facilità. Siano quindi come segue, a foggia d' esempio, i

DIVERSI LAVORI SOCIALI RICHIEDENTI ABILITA' DIVERSE, E RISPETTIVI GUADAGNI.

ELEMENTI DI CONFRONTO	PERSONE					
	Pietro	Paolo	Martino	Michele	Luigi	Giovanni
Specie di lavori	*A*	*B*	*C*	*D*	*E*	*F*
Tempo per addestrarvisi, anni . .	1	2	3	4	5	6
Capitale per addestrarvisi . . lir.	100	200	300	400	500	600
Capitale per esercitarli . . . . »	10	20	30	40	50	60
Guadagno giornaliero . . . . »	1	2	3	4	5	6
Guadagno annuo in giorni 230 . »	230	460	690	920	1150	1380

Egli è evidente che a Giovanni abile ne' lavori *F* non conviene occuparsi di nissun altro lavoro; che Luigi destro ne' lavori *E* perderebbe, appigliandosi ai lavori *D*; che Martino perito ne' lavori *C* farebbe male i suoi conti, eseguendo i lavori *B* od *A* .... Dunque la diversa forza o destrezza voluta dai diversi lavori, e le diverse abilità di cui sono dotati gli individui, dovevano necessariamente introdurre una divisione e riparto nelle loro occupazioni (1).

(1) *Se la custodia degli animali al pascolo venisse eseguita dagli uomini, mancherebbero le braccia pe' faticosi lavori dell' agricoltura, e non resterebbe occupazione pe' ragazzi per le donne pe' vecchi.*

L' estirpazione delle erbe parassite nelle risaie si fa eseguire con economia

3.° Partendo dall' idea de' *capitali* necessarj pe' diversi lavori, e che sono supposti come 60 per *F*, 50 per *E*, 40 per *D* ... è facile conchiudere, che mentre le persone ricche possono appigliarsi a tutta la somma de' lavori sociali, le persone povere non possono appigliarsi che ad una parte; e che le prime ristringeranno volontariamente la loro libertà, cioè s' appiglieranno ai lavori richiedenti maggiori capitali per due ragioni

I. Perchè essendo minore la concorrenza, saranno maggiori i lucri,

II. Perchè la vanità del ricco gli vieta ogni contatto rapporto affinità associazione analogia colla miseria.

4.° Smith che ha tanto esagerato i vantaggi della divisione de' travagli, e i suoi commentatori che hanno ripetuto le sue idee, non hanno veduto che l' esercizio promiscuo de' lavori richiederebbe occupazione e ristagno inutile d' immensi capitali, ristagno che si risparmia colla divisione de' travagli. Difatti supponete che Pietro, Paolo, Martino .... come nell' antecedente tabella, invece di limitarsi ai loro rispettivi lavori *A*, *B*, *C* ..., si occupino di tutti promiscuamente: in questa supposizione sarà necessario che tutti siano forniti delle rispettive macchine; se per esempio tutti volessero torchiare l' olio necessario al loro consumo, converrebbe che la società possedesse tanti torchj quanti fossero i cittadini, torchj che lavorerebbero per un paio d' ore, e rimarrebbero inerti in tutto il restante dell' anno; dite lo stesso di tutte le altre macchine ed utensigli necessarj alle varie arti e manifatture. All' opposto quando i lavori sono divisi, basta un torchio per 4,000 persone, un mangano per 5,000, un forno per 6,000 .... Dunque più cresce la civilizzazione, più debbono suddividersi i travagli.

Se poi oltre i capitali necessarj per *eseguire* i lavori, si contano anco i capitali necessarj per *addestrarvisi* (V. pag. 38), di modo che Pietro, Paolo, Martino ... debbano spendere ciascuno lire 100 per prepararsi ai lavori *A*,

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dalle giovanette, perchè da una parte inabili a' lavori più lucrosi, dall' altra leggiere di corpo non premono troppo il fondo umido entro cui lavorano.

Un uomo d' una costituzione non troppo robusta maneggerà facilmente la spola e l' ago, ma non potrebbe resistere agli ardori d' una fornace o al fumo d' una carbonaia.

Vi sono delle persone che abbondano di forza fisica e mancano o scarseggiano di forza intellettuale; esse possono trasportare un bue come Milone Crotoniate, ma non adoperare il compasso come Archimede, o il pennello come Fidia.

200 per *B*, 300 per *C*... (V. la tabella alla pag. 100), mentre da una parte crescerà a dismisura il capitale consunto nel *noviziato*, dall' altra s' accosterà a zero il prodotto. Difatti supponendo che la vita media giunga agli anni 30, supponendo che l' uomo verso gli anni 8 s' applichi ai primi lavori, onde conseguire fruttifera abilità, risulta che le suddette persone volendo esercitare promiscuamente i lavori *A*, *B*, *C*, *D*, *E*, *F*, dovrebbero consumare anni 21 senza frutto, i quali uniti agli otto di prima età oziosa giungerebbero a 29, così ciascuna generazione non darebbe frutto che per un anno, a norma degli elementi dell' ipotesi. Sarebbe quindi come segue lo

STATO DE' CAPITALI, SECONDO CHE I TRAVAGLI SONO DIVISI O PROMISCUI.

MEMBRI della SOCIETA'.	CAPITALI NECESSARJ NELLA SUPPOSIZIONE DI LAVORI				OSSERVAZIONI.
	PROMISCUI		DIVISI		
	per noviziato.	per esercizio.	per noviziato.	per esercizio.	
Pietro	2100	210	100	10	Vedi gli elementi del calcolo nella tabella posta alla pag. 100.
Paolo	2100	210	200	20	
Martino	2100	210	300	30	
Michele	2100	210	400	40	
Luigi	2100	210	500	50	
Giovanni . . .	2100	210	600	60	
	13,860.		2310.		

5.° L' esperienza fece presto conoscere che l' applicazione costante ad un solo genere d' industria scemava la fatica ai lavoranti, ed accresceva perfezione all' opera; ella è questa l' ultima ragione, per cui i travagli si suddivisero tra i varj membri della società.

Allorchè ciascuno applicato ad un genere particolare d' industria somministrò agli altri ciò che faceva meglio di essi, ricevendo ciò che essi facevano meglio di lui, si sentì il vantaggio di produrre al di là del proprio bisogno, cioè più di quello che potevasi consumare; così sorse il desiderio e s' ottennero i mezzi di produrre un superfluo a sè stesso, ma necessario agli altri. Pria della divisione de' travagli l' aumento per esem-

pio del selvaggiume procurava occasione di riposo per molti giorni, dopo la divisione presentò l'occasione di cambj ossia di piaceri, cioè spinta alla produzione.

Dopo avere additate le principali cause che a mio giudizio introdussero la *divisione de' travagli*, non devo ommettere che il celebre Smith le ridusse ad una sola; se bene o male, ne giudichi il lettore: ecco il testo:

» Cette division du travail, de laquelle découlent tant d'avantages, » ne doit pas être regardée, dans son origine, comme l'effet d'une sagesse » humaine qui ait prévu et qui ait eu pour but cette opulence générale » qui en est le résultat: elle est la conséquence nécessaire, quoique lente » et graduelle, d'un certain penchant naturel à tous les hommes qui ne » se proposent pas des vues d'utilité aussi étendues; c'est *ce penchant à* » *trafiquer, à faire des trocs et des échanges d'une chose pour une autre.*

» Il n'est pas de mon sujet d'examiner si ce penchant est un de ces » premiers principes de la nature humaine, des quels on ne peut rendre » aucune raison ultérieure, ou bien, comme il paraît plus probable, s'il » est une consequence nécessaire de l'usage du raisonnement et de la pa- » role. Il est commun à tous les hommes, et *on ne l'aperçoit pas dans au-* » *cune autre espèce d'animaux, pour lesquels ce genre de contrat est aussi in-* » *connu que tous les autres* (1) «.

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(1) *Recherches sur la nature et les causes des richesses des nations tom. I.er pag.* 29. — » *Ma la giornaliera sperienza, dice Darwin, non ci fa* » *ella vedere ch' eglino (gli animali) formano contratti d' amicizia l'uno coll' al-* » *tro, ed anzi coll' uomo ancora? Quando i piccioli gatti giuocano coi piccioli* » *cani, non v' è egli forse un tacito contratto che l' uno non sarà per nuocere* » *all' altro? E il cane vostro favorito non aspetta egli da voi il giornaliero suo* » *alimento pei servigi prestati e l' attenzione dimostratavi? E così facendo non* » *fa egli un cambio dell' amor suo per voi, colla protezione vostra per lui?* » *Nella stessa maniera si fanno tutti i contratti tra uomini di cui gli uni non* » *intendono il linguaggio degli altri* «. *Zoonomia tom. I. pag.* 257-258.

SCOPI DELL' ECONOMIA.		IV. MEZZO D'ECONOMIA, NELL' AGRICOLTURA.
I. Scemare durante la produzione.	1.° La fatica.	1.° Esistendo nelle macchine una tendenza a conservare i movimenti ricevuti, vi debb' essere economia di forze nel continuare sino alla fine un solo lavoro, invece d' interromperlo e riprenderlo; e sì nelle bestie che negli stromenti e negli uomini si devono contare tanti momenti di forza distrutti, o tante reazioni contro le prime tendenze, quante sono le interruzioni.
	2.° Il tempo.	2.° Allorchè i portici le stalle le cassine i granai le cantine.... sono collocate confusamente e senza regola, si perde e forza e tempo considerabile in gite e ritorni inutili,
	3.° La materia prima.	3.° Con dispersione de' foraggi ed altre materie pel nodrimento del bestiame, rendendosi altronde difficile l' ispezione del proprietario od affittuario sugli agenti subalterni,
	4.° Lo spazio o i locali.	4.° Con dispendio immenso e inutile di locali, come si vede in quasi tutte le costruzioni rurali un poco antiche.
II. Accrescere ne' prodotti.	5.° La massa.	5.° La segatura de' fieni la potagione delle viti, la tosatura delle pecore, la coltivazione de' frutti e degli erbaggi, si eseguiscono con maggior prodotto e perfezione, se a particolari lavoratori vengono affidate.
	6.° La perfezione.	6.° Nella Svizzera e Norvegia, paesi di pastorizia vaccina, l' arte di falciare i foraggi è giunta al massimo grado della perfezione, al che influisce l' estremo bisogno di essi. Ne' grandi poderi il cavallante attende ai cavalli, il boaro ai buoi, il castaldo agli uomini ed al riparto de' lavori.
	7.° La durata.	7.° Attento costantemente l' agricoltore alle vicende atmosferiche che favoriscono o distruggono i prodotti agrarj, riesce talvolta a sottrarli a tempo alla futura pioggia, talvolta a preservarli dall' aridità con opportune irrigazioni.....
III. Produrre colla divisione de' travagli ciò che sarebbe impossibile all' uomo privo di essa.	8.°	8.° . . . . .

DIVISIONE DE' TRAVAGLI

NELLE ARTI.	NEL COMMERCIO.
1.° L'artista applicato ad un solo travaglio abitua la sua macchina a ripetere lo stesso movimento colla minima fatica, ed impara tutti i mezzi per economizzarne le forze.	1.° I mercanti per esempio di grano abituati a conoscerlo all'occhio al tatto al fiuto al suono, determinano, in un istante e senza tema d'ingannarsi, le qualità di quello che viene loro eventualmente presentato.
2.° Fermo sullo stesso lavoro non perde istanti nel trasportarsi da un sito all'altro, nell'assumere o deporre or questo or quello stromento, nel pulirsi le mani o munirsi di grembiale, nel richiamare le idee e disporsi all'esecuzione.	2.° Conoscendo i luoghi, in cui d'ordinario scarseggia e in cui abbonda, le vie per terra e per acqua per cui si suole trasportare, i tempi più contrarj e più favorevoli al trasporto, servono il pubblico colla massima celerità.
3.° Conoscitore delle qualità delle materie ed indole degli stromenti disperde o consuma meno quelle, guasta meno questi, ed è più pronto a conservare le une e gli altri e profittare degli avanzi.	3.° Avvezzi a farlo trasportare colla minima spesa, ad apprezzare i cali accidentali e l'influenza delle stagioni, a far uso di locali asciutti e convenienti, possono venderlo a prezzo minimo.
4.° Compensando coi prodotti d'un solo lavoro tutti gli altri prodotti, di cui abbisogna, è dispensato dall'eseguirli, dal possederne le macchine, quindi d'impiegare per esse corrispondenti locali.	4.° In generale sembra che le merci collocate ciascuna in casse o locali distinti, debbano occupare minimo spazio, perchè l'identità delle forme deve scemare i vuoti tra l'una e l'altra, eccettuate le sferiche.
5.° A misura che si estende la divisione de' travagli, crescono le eventualità d'occupare forze deboli che rimarrebbero inattive, e piccoli capitali che ristagnerebbero; da questo doppio impiego deve risultare aumento di prodotti.	5.° Occupato il mercante nel solo commercio de' grani acquista metodo talmente facile e pronto nella direzione e condotta del suo commercio, nella compra e vendita della sua mercanzia, che con capitale mediocre eseguisce il massimo numero d'affari.
6.° Gli storici osservano che i marinari Greci, i quali erano nel tempo stesso rematori e soldati, eseguivano male l'uno e l'altro mestiere. Le arti furono ritrovate imperfettissime al Perù, ove ogni Peruviano le esercitava indistintamente, se si eccettuano quelle di curiosità e d'ornato, nelle quali occupavansi particolari artefici.	6.° In Amsterdam Londra Parigi vi sono botteghe, in cui non si vende altro che thè, olio, aceto .... Così ciascuna di queste botteghe possiede delle suddette mercanzie assortimenti migliori che le altre destinate alla vendita di merci diverse.
7.° La cognizione distinta delle vicende cui soggiaciono le varie materie, facilita la scelta delle più resistenti alle cause distruttrici; *idem* la ripetuta pratica de' preservativi.	7.° I metodi preservativi più che in ogni altro debbonsi supporre in chi occupato d'un solo oggetto, trae il guadagno da esso solo.
8.° Senza la divisione de' travagli non sarebbe possibile portare molte arti a certo grado di perfezione.	8.° . . . . .

La divisione de' travagli, moltiplicando i prodotti con diminuzione della spesa, ne promove il basso prezzo. Opporsi alla divisione de' travagli è volere che la nazione compri per 10 ciò che potrebbe ottenere per 5. Un panatiere che volesse fabbricare non solamente il suo pane ma anco il suo cappello, intenderebbe male il suo interesse. Se il basso popolo riuscisse a far sparire le persone intermedie tra i produttori e i consumatori, si priverebbe de' vantaggi della divisione de' travagli, scemando nel tempo stesso i prodotti ed accrescendone i prezzi.

Ciononostante vi sono alcuni, che, per quanto riguarda il loro consumo, vogliono esercitare le funzioni del commerciante, affine di non pagare a questo gli ordinarj profitti della sua industria, protestando di volerli serbare per essi. L' avidità di costoro rende sovente erroneo il loro calcolo, giacchè la divisione de' travagli permette al mercante d' eseguire per essi queste operazioni con minore spesa. Calcolate difatti

1.° La pena che dovete subire,

2.° Il tempo che siete costretto a perdere,

3.° Le false spese, più considerabili quanto sono più piccole le compre,

4.° Gli errori dell' inesperienza, di cui sanno profittare i destri venditori,

E v' accorgerete che questa somma di perdite può portare il costo finale d' una merce al 5 al 6 al 10 per 100 di più di quello che sarebbesi pagato al commerciante.

§ 3. LIMITI ALLA DIVISIONE DE' TRAVAGLI.

1.° Non si possono cogliere i vantaggi della divisione de' travagli, allorchè non v' ha largo smercio. Dieci operai possono fabbricare 48m. spille in un giorno; ma ciò non può eseguirsi che là ove si consuma o si vende ciascun giorno un simile numero di spille; giacchè, acciò la divisione si estenda fin là, conviene che un solo operaio non s' occupi assolutamente che ad aguzzare le punte, mentre ciascuno degli altri s' impiega in altra operazione particolare. Se non abbisognassero che 24m. spille al giorno, farebbe d' uopo che ciascun operaio perdesse una parte della sua giornata, o che cambiasse d' occupazione; allora la *divisione* de' travagli non sarebbe più così grande. Questo principio trovasi comunemente in pratica nelle città, e assai di rado nelle campagne: nelle campagne il fabbricatore e il commerciante non potendo trarre da una

sola industria, bastante lucro per vivere, è costretto ad esercitarne due o tre alla volta (1).

2.° Non può esservi gran divisione di travagli nelle manifatture alcun poco costose, perchè sono scarsi i consumatori, perciò sono poco divisi i travagli sulle chincaglierie (2).

3.° Non è applicabile il detto principio agli oggetti che non possono portarsi a certa distanza con poca spesa per ritrovarvi de' consumatori.

4.° Ultimo ostacolo alla divisione de' travagli è la scarsezza de' capitali pel mantenimento degli operai, la compra delle materie prime, gli affitti di grandi locali, le spese per macchine costose....

§ 4. SCHIARIMENTI.

I. Lauderdale ha detto: *disons la verité, la division du travail contribue plus à la délicatesse qu'à la célérité de l'exécution.*

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(1) *Se in queste circostanze il fabbricatore s' ostinasse nella stessa specie di lavori, ne risulterebbe una somma maggiore della dimanda, e quindi altrettanti non valori.*

In un paese ricco e popoloso il vetturale, il mercante in grosso, il mercante mezzano, il mercante al minuto esercitano le differenti parti dell' industria commerciale con maggior perfezione ed economia, benchè guadagnino tutti. Nelle città grandi il dentista, l' oculista, il chirurgo, l' ostetricante sono personaggi distinti, perchè v' è occasione di operazioni distinte per ciascuno. In un villaggio lo stesso uomo è barbiere, medico, chirurgo, speziale, talora mercante di carta, di vino, di merci....

Il poco consumo ne' borghi e ne' villaggi non solamente costringe i mercanti ad accumularvi molte occupazioni, ma è anche insufficiente alla vendita costante di certe merci. Ve n' ha alcune che non si possono comprare se non se nei giorni di mercato o di fiera: in questo giorno si fa provvista di quanto in un mese consumasi o in un anno. Gli altri giorni il mercante va ad esercitare altrove il suo commercio, ovvero s' occupa d' altra faccenda. In un paese ricchissimo e popolatissimo i consumi sono estesi al punto che lo smercio d' un genere di mercanzia occupa una professione tutti i giorni della settimana. Le fiere e i mercanti appartengono ad uno stato tuttora molto distante dall' apice della prosperità pubblica, come il commercio per caravane indica uno stato poco esteso in relazioni commerciali.

Le esposte teorie indicano la ragione, per cui più i travagli sono divisi, più si compra a buon mercato; perciò una derrata proveniente dalla stessa distanza, si vende a più basso prezzo nelle città che ne' borghi, osservazione triviale che ci servirà in parte a confutare scrittori illustri nel seguente volume.

(2) *Al che concorre anco la loro varietà, che esclude l' azione uniforme delle macchine.*

Questa osservazione è falsa. Entrate in una stamperia e provatevi a distribuire nelle rispettive caselle i caratteri di cui è composta la parola *costantinopolitano*, e v' accorgerete che se voi impiegate più di 3 minuti primi, un ragazzo di stamperia non ne occuperà 3 secondi, il che equivale al guadagno del 60 per 100 in celerità.

Lo stesso scrittore sforzandosi di deprimere i vantaggi della divisione de' travagli, ha voluto attribuire tutta la perfezione de' lavori alle macchine. Ma nissun' arte ammette l' uso di sì poche macchine quanto la pittura, la scultura, la musica; cionnonostante queste arti sono più perfette delle altre.

II. Smith ha preteso che l' invenzione delle macchine debbasi attribuire alla divisione de' travagli.

La natura delle cose e l' esperienza dimostrano erronea questa proposizione. Difatti

1.° Acciò s' introduca la divisione de' travagli, è necessario un largo smercio. Ora questo non può succedere che negli Stati più o meno civilizzati; e consta altronde che le più necessarie operazioni anteriori alla civilizzazione suppongono l' uso delle macchine,

2.° Nell' agricoltura, al dire dello stesso Smith, non campeggia la divisione de' travagli; ora nell' agricoltura tutte le produzioni si ottengono col soccorso di qualche macchina,

3.° La divisione de' travagli tende a concentrare l' attenzione del lavorante sopra la più semplice operazione: ora questa abitudine sembra opposta al genio del meccanico, il quale per inventare una macchina abbisogna di abbracciare col suo pensiero e di combinare simultaneamente tutte le operazioni necessarie per condurre a perfezione una manifattura (1).

III. Lo stesso scrittore attribuisce alla divisione del travaglio tutte le altre invenzioni, idea erronea come l' antecedente. Difatti

1.° Nello sviluppo delle invenzioni non si può escludere affatto quella eventuale combinazione di circostanze, di cui noi non conosciamo la ragione, ed a cui sogliamo dare il nome di *caso* (*concursus causarum minime prævisus*).

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(1) *La divisione de' travagli, dando il massimo sviluppo ad una facoltà dell' uomo, tende a paralizzare tutte le altre, ed avvicinare l' operaio allo stato d' automa.*

2.° L' arte per esempio di salare e stagionare il pesce, che ha aumentata la massa de' commestibili, in conseguenza la ricchezza nazionale, non è certo dovuta alla divisione de' travagli. Quante migliorie non sonosi fatte a' nostri giorni nell' arte d' imbianchire, tingere, filare, tessere, egualmente che nella fusione del ferro e del rame? Ora traggono forse queste arti il minimo vantaggio dalla divisione del travaglio? — Nella VI parte di quest' opera addurrò le contraddizioni di Smith su di questo argomento.

CAPO V.

AMMASSI.

§ 1. DIMOSTRAZIONE DEL PRINCIPIO.

I castori, cui serve d' ordinario alimento la corteccia verde del salice, pioppo, ontano, ridotta a minuti pezzi, ne fanno ammassi in appositi magazzini, onde nodrirsene nel verno. Le ragioni di questi ammassi in tempi anteriori al momento del consumo, sono

1.° Continuazione del bisogno d' alimento nel tempo iemale, il quale essendo nullo per molte specie d' animali, atteso lo stato di torpore in cui cadono, gli scioglie dalla necessità degli ammassi,

2.° Impossibilità di ritrovare in quella stagione la corteccia bisognevole.

Le api hanno una ragione di più per fare ammassi, e si è

3.° Lo stato fisico del loro individuo, per cui non sarebbe possibile ad esse il fare le necessarie raccolte in tempo di pioggia di vento di freddo, anche nel caso che di quanto ad esse abbisogna, fosse coperta la campagna.

Nelle combinazioni umane i tre principj,

1.° *Bisogno* più o meno *costante* di certi oggetti,

2.° *Mancanza di circostanze esteriori* per ottenerli al momento del bisogno,

3.° *Impossibilità individuale* di procurarseli da sè stesso al momento suddetto,

Questi tre principj, dico, mostrano la necessità degli ammassi.

Senza ammassi provvisioni scorte capitali, qualunque sia il nome di cui si voglia far uso, nè l' agricoltore potrebbe alimentare i suoi animali, mentre il verno ingombra la campagna, nè l' artista travagliare nell' intermezzo tra la produzione e la vendita, nè il mercante servire il pub-

David Ricardo (1772-1823)

Principles of Political Economy [1st, 2nd and 3rd editions, 1817, 1819, 1821]

The Works and Correspondence of David Ricardo, ed. Piero Sraffa with the Collaboration of M.H. Dobb, Liberty Fund, Indianapolis, 2005 [Originally published: Cambridge: At the University Press for the Royal Economic Society, 1951–1973], Vol. 1, *Principles of Political Economy and Taxation* [1951].

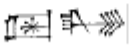
THE WORKS
AND CORRESPONDENCE OF

David Ricardo

Edited by Piero Sraffa
with the Collaboration of M. H. Dobb

VOLUME I

On the Principles of Political Economy and Taxation



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Foreign trade, then, though highly beneficial to a country, as it increases the amount and variety of the objects on which revenue may be expended, and affords, by the abundance and cheapness of commodities, incentives to saving, and to the accumulation of capital, has no tendency to raise the profits of stock, unless the commodities imported be of that description on which the wages of labour are expended.

The remarks which have been made respecting foreign trade, apply equally to home trade. The rate of profits is never increased by a better distribution of labour, by the invention of machinery, by the establishment of roads and canals, or by any means of abridging labour either in the manufacture or in the conveyance of goods. These are causes which operate on price, and never fail to be highly beneficial to consumers; since they enable them with the same labour, or with the value of the produce of the same labour, to obtain in exchange a greater quantity of the commodity to which the improvement is applied; but they have no effect whatever on profit. On the other hand, every diminution in the wages of labour raises profits, but produces no effect on the price of commodities. One is advantageous to all classes, for all classes are consumers; the other is beneficial only to producers; they gain more, but every thing remains at its former price. In the first case they get the same as before; but every thing on which their gains are expended, is diminished in exchangeable value.

The same rule which regulates the relative value of commodities in one country, does not regulate the relative value of the commodities exchanged between two or more countries.

Under a system of perfectly free commerce, each country naturally devotes its capital and labour to such employments as are most beneficial to each. This pursuit of individual advantage is admirably connected with the universal good of the

whole. By stimulating industry, by rewarding ingenuity, and by using most efficaciously the peculiar powers bestowed by nature, it distributes labour most effectively and most economically: while, by increasing the general mass of productions, it diffuses general benefit, and binds together by one common tie of interest and intercourse, the universal society of nations throughout the civilized world. It is this principle which determines that wine shall be made in France and Portugal, that corn shall be grown in America and Poland, and that hardware and other goods shall be manufactured in England.

In one and the same country, profits are, generally speaking, always on the same level; or differ only as the employment of capital may be more or less secure and agreeable. It is not so between different countries. If the profits of capital employed in Yorkshire, should exceed those of capital employed in London, capital would speedily move from London to Yorkshire, and an equality of profits would be effected; but if in consequence of the diminished rate of production in the lands of England, from the increase of capital and population, wages should rise, and profits fall, it would not follow that capital and population would necessarily move from England to Holland, or Spain, or Russia, where profits might be higher.

If Portugal had no commercial connexion with other countries, instead of employing a great part of her capital and industry in the production of wines, with which she purchases for her own use the cloth and hardware of other countries, she would be obliged to devote a part of that capital to the manufacture of those commodities, which she would thus obtain probably inferior in quality as well as quantity.

The quantity of wine which she shall give in exchange for the cloth of England, is not determined by the respective

quantities of labour devoted to the production of each, as it would be, if both commodities were manufactured in England, or both in Portugal.

England may be so circumstanced, that to produce the cloth may require the labour of 100 men for one year; and if she attempted to make the wine, it might require the labour of 120 men for the same time. England would therefore find it her interest to import wine, and to purchase it by the exportation of cloth.

To produce the wine in Portugal, might require only the labour of 80 men for one year, and to produce the cloth in the same country, might require the labour of 90 men for the same time. It would therefore be advantageous for her to export wine in exchange for cloth. This exchange might even take place, notwithstanding that the commodity imported by Portugal could be produced there with less labour than in England. Though she could make the cloth with the labour of 90 men, she would import it from a country where it required the labour of 100 men to produce it, because it would be advantageous to her rather to employ her capital in the production of wine, for which she would obtain more cloth from England, than she could produce by diverting a portion of her capital from the cultivation of vines to the manufacture of cloth.

Thus England would give the produce of the labour of 100 men, for the produce of the labour of 80. Such an exchange could not take place between the individuals of the same country. The labour of 100 Englishmen cannot be given for that of 80 Englishmen, but the produce of the labour of 100 Englishmen may be given for the produce of the labour of 80 Portuguese, 60 Russians, or 120 East Indians. The difference in this respect, between a single country and many, is easily accounted for, by considering the difficulty with which capital moves from one country to another, to seek a more profitable

employment, and the activity with which it invariably passes from one province to another in the same country.*

It would undoubtedly be advantageous to the capitalists of England, and to the consumers in both countries, that under such circumstances, the wine and the cloth should both be made in Portugal, and therefore that the capital and labour of England employed in making cloth, should be removed to Portugal for that purpose. In that case, the relative value of these commodities would be regulated by the same principle, as if one were the produce of Yorkshire, and the other of London: and in every other case, if capital freely flowed towards those countries where it could be most profitably employed, there could be no difference in the rate of profit, and no other difference in the real or labour price of commodities, than the additional quantity of labour required to convey them to the various markets where they were to be sold.

Experience, however, shews, that the fancied or real insecurity of capital, when not under the immediate control of its owner, together with the natural disinclination which every man has to quit the country of his birth and connexions, and intrust himself with all his habits fixed, to a strange government and new laws, check the emigration of capital. These feelings, which I should be sorry to see weakened, induce most

* It will appear then, that a country possessing very considerable advantages in machinery and skill, and which may therefore be enabled to manufacture commodities with much less labour than her neighbours, may, in return for such commodities, import a portion of the corn required for its consumption, even if its land were more fertile, and corn could be grown with less labour than in the country from which it was imported. Two men can both make shoes and hats, and one is superior to the other in both employments; but in making hats, he can only exceed his competitor by one-fifth or 20 per cent., and in making shoes he can excel him by one-third or 33 per cent.;—will it not be for the interest of both, that the superior man should employ himself exclusively in making shoes, and the inferior man in making hats?[1]

[1] Cp. A. Smith's taylor and shoemaker, Bk. IV, ch. ii; vol. I, p. 422.

men of property to be satisfied with a low rate of profits in their own country, rather than seek a more advantageous employment for their wealth in foreign nations.

Gold and silver having been chosen for the general medium of circulation, they are, by the competition of commerce, distributed in such proportions amongst the different countries of the world, as to accommodate themselves to the natural traffic which would take place if no such metals existed, and the trade between countries were purely a trade of barter.

Thus, cloth cannot be imported into Portugal, unless it sell there for more gold than it cost in the country from which it was imported; and wine cannot be imported into England, unless it will sell for more there than it cost in Portugal. If the trade were purely a trade of barter, it could only continue whilst England could make cloth so cheap as to obtain a greater quantity of wine with a given quantity of labour, by manufacturing cloth than by growing vines; and also whilst the industry of Portugal were attended by the reverse effects. Now suppose England to discover a process for making wine, so that it should become her interest rather to grow it than import it; she would naturally divert a portion of her capital from the foreign trade to the home trade; she would cease to manufacture cloth for exportation, and would grow wine for herself. The money price of these commodities would be regulated accordingly; wine would fall here while cloth continued at its former price, and in Portugal no alteration would take place in the price of either commodity. Cloth would continue for some time to be exported from this country, because its price would continue to be higher in Portugal than here; but money instead of wine would be given in exchange for it, till the accumulation of money here, and its diminution abroad, should so operate on the relative value of cloth in the two countries, that it would cease to be profitable to export it. If the improve-

Charles Babbage (1791-1871)

On the Economy of Machinery and Manufactures, Charles Knight, London, 1832, 2nd edition enlarged.

CHAP. XIX.

ON THE DIVISION OF LABOUR.

(213.) Perhaps the most important principle on which the economy of a manufacture depends, is the *division of labour* amongst the persons who perform the work. The first application of this principle must have been made in a very early stage of society; for it must soon have been apparent, that a larger number of comforts and conveniences could be acquired by each individual, if one man restricted his occupation to the art of making bows, another to that of building houses, a third boats, and so on. This division of labour into trades was not, however, the result of an opinion that the general riches of the community would be increased by such an arrangement; but it must have arisen from the circumstance of each individual so employed discovering that he himself could thus make a greater profit of his labour than by pursuing more varied occupations. Society must have made considerable advances before this principle could have been carried into the workshop; for it is only in countries which have attained a high degree of civilization, and in articles in which there is a great competition amongst the producers, that the most perfect system of the division of labour is to be observed. The various principles on which the advantages of this system depend, have been much

the subject of discussion amongst writers on Political Economy; but the relative importance of their influence does not appear, in all cases, to have been estimated with sufficient precision. It is my intention, in the first instance, to state shortly those principles, and then to point out what appears to me to have been omitted by those who have previously treated the subject.

(214.) 1. *Of the time required for learning.*—It will readily be admitted, that the portion of time occupied in the acquisition of any art will depend on the difficulty of its execution; and that the greater the number of distinct processes, the longer will be the time which the apprentice must employ in acquiring it. Five or seven years have been adopted, in a great many trades, as the time considered requisite for a lad to acquire a sufficient knowledge of his art, and to enable him to repay by his labour, during the latter portion of his time, the expense incurred by his master at its commencement. If, however, instead of learning *all* the different processes for making a needle, for instance, his attention be confined to one operation, the portion of time consumed unprofitably at the commencement of his apprenticeship will be small, and all the rest of it will be beneficial to his master: and, consequently, if there be any competition amongst the masters, the apprentice will be able to make better terms, and diminish the period of his servitude. Again, the facility of acquiring skill in a single process, and the early period of life at which it can be made a source of profit, will induce a greater number of parents to bring up their children to it; and from this circumstance also, the number

of workmen being increased, the wages will soon fall.

(215.) 2. *Of waste of materials in learning.*—A certain quantity of material will, in all cases, be consumed unprofitably, or spoiled by every person who learns an art; and as he applies himself to each new process, he will waste some of the raw material, or of the partly manufactured commodity. But if each man commit this waste in acquiring successively every process, the quantity of waste will be much greater than if each person confine his attention to one process; in this view of the subject, therefore, the division of labour will diminish the price of production.

(216.) 3. Another advantage resulting from the division of labour is, *the saving of that portion of time which is always lost in changing from one occupation to another.* When the human hand, or the human head, has been for some time occupied in any kind of work, it cannot instantly change its employment with full effect. The muscles of the limbs employed have acquired a flexibility during their exertion, and those not in action a stiffness during rest, which renders every change slow and unequal in the commencement. Long habit also produces in the muscles exercised a capacity for enduring fatigue to a much greater degree than they could support under other circumstances. A similar result seems to take place in any change of mental exertion; the attention bestowed on the new subject not being so perfect at first as it becomes after some exercise.

(217.) 4. *Change of Tools.*—The employment of

different tools in the successive processes is another cause of the loss of time in changing from one operation to another. If these tools are simple, and the change is not frequent, the loss of time is not considerable; but in many processes of the arts the tools are of great delicacy, requiring accurate adjustment every time they are used; and in many cases the time employed in adjusting bears a large proportion to that employed in using the tool. The sliding-rest, the dividing and the drilling-engine, are of this kind; and hence, in manufactories of sufficient extent, it is found to be good economy to keep one machine constantly employed in one kind of work: one lathe, for example, having a screw motion to its sliding-rest along the whole length of its bed, is kept constantly making cylinders; another, having a motion for equalizing the velocity of the work at the point at which it passes the tool, is kept for facing surfaces; whilst a third is constantly employed in cutting wheels.

(218.) 5. *Skill acquired by frequent repetition of the same processes.*—The constant repetition of the same process necessarily produces in the workman a degree of excellence and rapidity in his particular department, which is never possessed by a person who is obliged to execute many different processes. This rapidity is still further increased from the circumstance that most of the operations in factories, where the division of labour is carried to a considerable extent, are paid for as piece-work. It is difficult to estimate in numbers the effect of this cause upon production. In nail-making, Adam Smith has stated, that it is almost three to one; for, he

observes, that a smith accustomed to make nails, but whose whole business has not been that of a nailer, can make only from eight hundred to a thousand per day; whilst a lad who had never exercised any other trade, can make upwards of two thousand three hundred a day.

(219.) In different trades, the economy of production arising from the last-mentioned cause will necessarily be different. The case of nail-making is, perhaps, rather an extreme one. It must, however, be observed, that, in one sense, this is not a permanent source of advantage; for, though it acts at the commencement of an establishment, yet every month adds to the skill of the workmen; and at the end of three or four years they will not be very far behind those who have never practised any other branch of their art. Upon an occasion when a large issue of bank-notes was required, a clerk at the Bank of England signed his name, consisting of seven letters, including the initial of his Christian name, five thousand three hundred times during eleven working hours, besides arranging the notes he had signed in parcels of fifty each.

(220.) 6. *The division of labour suggests the contrivance of tools and machinery to execute its processes.*—When each process, by which any article is produced, is the sole occupation of one individual, his whole attention being devoted to a very limited and simple operation, improvements in the form of his tools, or in the mode of using them, are much more likely to occur to his mind, than if it were distracted by a greater variety of circumstances. Such an improvement in the tool is generally the first step

towards a machine. If a piece of metal is to be cut in a lathe, for example, there is one particular angle at which the cutting-tool must be held to insure the cleanest cut; and it is quite natural that the idea of fixing the tool at that angle should present itself to an intelligent workman. The necessity of moving the tool slowly, and in a direction parallel to itself, would suggest the use of a screw, and thus arises the sliding-rest. It was probably the idea of mounting a chisel in a frame, to prevent its cutting too deeply, which gave rise to the common carpenter's plane. In cases where a blow from a hammer is employed, experience teaches the proper force required. The transition from the hammer held in the hand to one mounted upon an axis, and lifted regularly to a certain height by some mechanical contrivance, requires perhaps a greater degree of invention than those just instanced; yet it is not difficult to perceive, that, if the hammer always falls from the same height, its effect must be always the same.

(221.) When each process has been reduced to the use of some simple tool, the union of all these tools, actuated by one moving power, constitutes a machine. In contriving tools and simplifying processes, the operative workmen are, perhaps, most successful; but it requires far other habits to combine into one machine these scattered arts. A previous education as a workman in the peculiar trade, is undoubtedly a valuable preliminary; but in order to make such combinations with any reasonable expectation of success, an extensive knowledge of machinery, and the power of making mechanical drawings, are essentially

requisite. These accomplishments are now much more common than they were formerly; and their absence was, perhaps, one of the causes of the multitude of failures in the early history of many of our manufactures.

(222.) Such are the principles usually assigned as the causes of the advantage resulting from the division of labour. As in the view I have taken of the question, the most important and influential cause has been altogether unnoticed, I shall re-state those principles in the words of Adam Smith: "The great "increase in the quantity of work, which, in conse- "quence of the division of labour, the same number "of people are capable of performing, is owing to "three different circumstances: first, to the increase "of dexterity in every particular workman; secondly, "to the saving of time, which is commonly lost in "passing from one species of work to another; and, "lastly, to the invention of a great number of ma- "chines which facilitate and abridge labour, and "enable one man to do the work of many." Now, although all these are important causes, and each has its influence on the result; yet it appears to me, that any explanation of the cheapness of manufactured articles, as consequent upon the division of labour, would be incomplete if the following principle were omitted to be stated.

That the master manufacturer, by dividing the work to be executed into different processes, each requiring different degrees of skill or of force, can purchase exactly that precise quantity of both which is necessary for each process; whereas, if the whole work were executed by one workman, that person must possess

*sufficient skill to perform the most difficult, and sufficient strength to execute the most laborious, of the operations into which the art is divided.**

(223.) As the clear apprehension of this principle, upon which a great part of the economy arising from the division of labour depends, is of considerable importance, it may be desirable to point out its precise and numerical application in some specific manufacture. The art of making needles is, perhaps, that which I should have selected for this illustration, as comprehending a very large number of processes remarkably different in their nature; but the less difficult art of pin-making, has some claim to attention, from its having been used by Adam Smith; and I am confirmed in the choice of it, by the circumstance of our possessing a very accurate and minute description of that art, as practised in France above half a century ago.

(224.) *Pin-making.*—In the manufacture of pins in England the following processes are employed :—

1. *Wire-drawing.*—(*a.*) The brass wire used for making pins is purchased by the manufacturer in coils of about twenty-two inches in diameter, each weighing about thirty-six pounds. (*b.*) The coils are wound off into smaller ones of about six inches in diameter, and between one and two pounds' weight. (*c.*) The diameter of this wire is now reduced, by

* I have already stated that this principle presented itself to me after a personal examination of a number of manufactories and workshops devoted to different purposes; but I have since found that it had been distinctly pointed out, in the work of Gioja, *Nuovo Prospetto delle Scienze Economiche*, 6 tom. 4to. Milano, 1815, tom. i. capo iv.

drawing it repeatedly through holes in steel plates, until it becomes of the size required for the sort of pins intended to be made. During this process the wire is hardened, and in order to prevent its breaking, it must be annealed two or three times, according to the diminution of diameter required. (*d.*) The coils are then soaked in sulphuric acid, largely diluted with water, in order to clean them, and are then beaten on stone, for the purpose of removing any oxidated coating which may adhere to them. These operations are usually performed by men, who draw and clean from thirty to thirty-six pounds of wire a day. They are paid at the rate of five farthings per pound, and generally earn about 3*s.* 6*d.* per day.

M. Perronnet made some experiments on the extension the wire undergoes in passing through each hole: he took a piece of thick Swedish brass wire, and found

	Feet	In.
Its length to be before drawing	3	8
After passing the first hole	5	5
——————— second hole	7	2
——————— third hole	7	8

It was now annealed, and the length became

After passing the fourth hole	10	8
——————— fifth hole	13	1
——————— sixth hole.....	16	8
And finally, after passing through six other holes	144	0

The holes through which the wire was drawn were not, in this experiment, of regularly decreasing diameter: it is extremely difficult to make such

holes, and still more to preserve them in their original dimensions.

(225.) 2. *Straightening the Wire.*—The coil of wire now passes into the hands of a woman, assisted by a boy or girl. A few nails, or iron pins, not quite in a line, are fixed into one end of a wooden table about twenty feet in length; the end of the wire is passed alternately between these nails, and is then pulled to the other end of the table. The object of this process is to straighten the wire, which had acquired a considerable curvature in the small coils in which it had been wound. The length thus straightened is cut off, and the remainder of the coil is drawn into similar lengths. About seven nails or pins are employed in straightening the wire, and their adjustment is a matter of some nicety. It seems, that by passing the wire between the first three nails or pins, a bend is produced in an opposite direction to that which the wire had in the coil; this bend, by passing the next two nails, is reduced to another less curved in the first direction, and so on till the curve of the wire may at last be confounded with a straight line.

(226.) 3. *Pointing.*—(*a.*) A man next takes about three hundred of these straightened pieces in a parcel, and putting them into a gauge, cuts off from one end, by means of a pair of shears, moved by his foot, a portion equal in length to rather more than six pins. He continues this operation until the entire parcel is reduced into similar pieces. (*b.*) The next step is to sharpen the ends: for this purpose the operator sits before a *steel mill*, which is kept rapidly revolving: it consists of a cylinder about six inches in

diameter, and two and a half inches broad, faced with steel, which is cut in the manner of a file. Another cylinder is fixed on the same axis at a few inches distant; the file on the edge of which is of a finer kind, and is used for finishing off the points. The workman now takes up a parcel of the wires between the finger and thumb of each hand, and presses the ends obliquely on the mill, taking care with his fingers and thumbs to make each wire slowly revolve upon its axis. Having thus pointed all the pieces at one end, he reverses them, and performs the same operation on the other. This process requires considerable skill, but it is not unhealthy; whilst the similar process in needle-making is remarkably destructive of health. (*c.*) The pieces now pointed at both ends, are next placed in gauges, and the pointed ends are cut off, by means of shears, to the proper length of which the pins are to be made. The remaining portions of the wire are now equal to about four pins in length, and are again pointed at each end, and their lengths again cut off. This process is repeated a third time, and the small portion of wire left in the middle is thrown amongst the waste, to be melted along with the dust arising from the sharpening. It is usual for a man, his wife, and a child, to join in performing these processes; and they are paid at the rate of five farthings per pound. They can point from thirty-four to thirty-six and a half pounds per day, and gain from 6*s.* 6*d.* to 7*s.*, which may be apportioned thus; 5*s.* 6*d.* the man, 1*s.* the woman, 6*d.* to the boy or girl.

(227.) 4. *Twisting and Cutting the Heads.*—The next process is making the heads. For this purpose

(*a.*) a boy takes a piece of wire, of the same diameter as the pin to be headed, which he fixes on an axis that can be made to revolve rapidly by means of a wheel and strap connected with it. This wire is called the mould. He then takes a smaller wire, which having passed through an eye in a small tool held in his left hand, he fixes close to the bottom of the mould. The mould is now made to revolve rapidly by means of the right hand, and the smaller wire coils round it until it has covered the whole length of the mould. The boy now cuts the end of the spiral connected with the foot of the mould, and draws it off. (*b.*) When a sufficient quantity of *heading* is thus made, a man takes from thirteen to twenty of these spirals in his left hand, between his thumb and three outer fingers: these he places in such a manner that two turns of the spiral shall be beyond the upper edge of a pair of shears, and with the forefinger of the same hand he feels that only two turns do so project. With his right hand he closes the shears; and the two turns of the spiral being cut off, drop into a basin; the position of the forefinger preventing the heads from flying about when cut off. The workmen who cut the heads are usually paid at the rate of $2\frac{1}{2}d.$ to $3d.$ per pound for large heads, but a higher price is given for the smaller heading. Out of this they pay the boy who spins the spiral; he receives from $4d.$ to $6d.$ a day. A good workman can cut from six to about thirty pounds of heading per day, according to its size.

(228.) 5. *Heading.* The process of fixing the head on the body of the pin is usually executed by women and children. Each operator sits before

a small steel stake, having a cavity, into which one half of the intended head will fit; immediately above is a steel die, having a corresponding cavity for the other half of the head: this latter die can be raised by a pedal moved by the foot. The weight of the hammer is from seven to ten pounds, and it falls through a very small space, perhaps from one to two inches. The cavities in the centre of these dies are connected with the edge of a small grove, to admit of the body of the pin, which is thus prevented from being flattened by the blow of the die. (*a.*) The operator with his left hand dips the pointed end of the body of a pin into a tray of heads; having passed the point through one of them, he carries it along to the other end with the fore-finger. He now takes the pin in the right hand, and places the head in the cavity of the stake, and, lifting the die with his foot, allows it to fall on the head. This blow tightens the head on the shank, which is then turned round, and the head receives three or four blows on different parts of its circumference. The women and children who fix the heads are paid at the rate of 1*s.* 6*d.* for every twenty thousand. A skilful operator can with great exertion do twenty thousand per day; but from ten to fifteen thousand is the usual quantity: children head a much smaller number; varying, of course, with the degree of their skill. About one per cent. of the pins are spoiled in the process; these are picked out afterwards by women, and are reserved, along with the waste from other processes, for the melting-pot. The die in which the heads are struck is varied in form according to the fashion of the time; but the repeated blows to which it is subject render

it necessary that it should be repaired after it has been used for about thirty pounds of pins.

(229.) 6. *Tinning.* The pins are now fit to be tinned, a process which is usually executed by a man, assisted by his wife, or by a lad. The quantity of pins operated upon at this stage is usually fifty-six pounds. (*a.*) They are first placed in a pickle, in order to remove any grease or dirt from their surface, and also to render them rough, which facilitates the adherence of the tin with which they are to be covered. (*b.*) They are then placed in a boiler full of a solution of tartar in water, in which they are mixed with a quantity of tin in small grains. In this they are generally kept boiling for about two hours and a half, and are then removed into a tub of water into which some bran has been thrown, for the purpose of washing off the acid liquor. (*c.*) They are then taken out, and, being placed in wooden trays, are well shaken in dry bran: this removes any water adhering to them; and by giving the wooden tray a peculiar kind of motion, the pins are thrown up, and the bran gradually flies off, and leaves them behind in the tray. The man who pickles and tins the pins usually gets one penny per pound for the work, and employs himself, during the boiling of one batch of pins, in drying those previously tinned. He can earn about 9*s.* per day; but out of this he pays about 3*s.* for his assistant.

(230.) 7. *Papering.* The pins come from the tinner in wooden bowls, with the points projecting in all directions: the arranging of pins side by side in paper is generally performed by women. (*a.*) A woman takes up some, and places them on a comb,

and shaking them, some of the pins fall back into the bowl, and the rest, being caught by their heads, are detained between the teeth of the comb. (*b.*) Having thus arranged them in a parallel direction, she fixes the requisite number between two pieces of iron, having twenty-five small grooves, at equal distances; (*c.*) and having previously doubled the paper, she presses it against the points of the pins until they have passed through the two folds which are to retain them. The pins are then relieved from the grasp of the tool, and the process is repeated. A woman gains about 1*s.* 6*d.* per day by papering; but children are sometimes employed, who earn from 6*d.* per day, and upwards.

(231.) Having thus generally described the various processes of pin-making, and having stated the usual cost of each, it will be convenient to present a tabular view of the time occupied by each process, and its cost, as well as the sums which can be earned by the persons who confine themselves solely to each process. As the rate of wages is itself fluctuating, and as the prices paid and quantities executed have been given only between certain limits, it is not to be expected that this table can represent the cost of each part of the work with the minutest accuracy, nor even that it shall accord perfectly with the prices above given: but it has been drawn up with some care, and will be quite sufficient to serve as the basis of those reasonings which it is meant to illustrate. A table nearly similar will be subjoined, which has been deduced from a statement of M. Perronet, respecting the art of pin-making in France, above seventy years ago.

English Manufacture.

(232.) Pins, "*Elevens*," 5,546 weigh one pound; "*one dozen*"=6,932 pins weigh twenty ounces, and require six ounces of paper.

NAME OF THE PROCESS.	Workmen.	Time for making 1 lb. of Pins.	Cost of making 1 lb. of Pins.	Workman earns per Day.		Price of making each Part of a single Pin, in Millionths of a Penny.
		Hours.	*Pence.*	*s.*	*d.*	
1. Drawing Wire (§ 224.)	Man . .	.3636	1.2500	3	3	225
2. Straightening wire (§ 225.)	Woman	.3000	.2840	1	0	51
	Girl . .	.3000	.1420	0	6	26
3. Pointing . . . (§ 226.)	Man . .	.3000	1.7750	5	3	319
4. Twisting and Cutting Heads . . . (§ 227.)	Boy . .	.0400	.0147	0	4½	3
	Man . .	.0400	.2103	5	4½	38
5. Heading . . . (§ 228.)	Woman	4.0000	5.0000	1	3	901
6. Tinning, or Whitening . . . . . (§ 229.)	Man . .	.1071	.6666	6	0	121
	Woman	.1071	.3333	3	0	60
7. Papering . . (§ 230.)	Woman	2.1314	3.1973	1	6	576
		7.6892	12.8732			2320

Number of Persons employed:—Men, 4; Women, 4; Children, 2. Total, 10.

French Manufacture.

(233.) Cost of 12,000 pins, No. 6, each being eight-tenths of an English inch in length,—as they were manufactured in France about 1760; with the cost of each operation: deduced from the observations and statement of M. Perronet.

NAME OF THE PROCESS.	Time for making Twelve Thousand Pins.	Cost of making Twelve Thousand Pins.	Workman usually earns per Day.	Expense of Tools and Materials.
	Hours.	*Pence.*	*Pence.*	*Pence.*
1. Wire	...	...	...	24.75
2. Straightening and Cutting	1.2	.5	4.5	...
3. Coarse Pointing	1.2	.625	10.0	...
3. Turning Wheel*	1.2	.875	7.0	...
3. Fine Pointing	.8	.5	9.375	...
3. Turning Wheel	1.2	.5	4.75	...
3. Cutting off pointed Ends	.6	.375	7.5	...
4. Turning Spiral	.5	.125	3.0	...
4. Cutting off Heads	.8	.375	5.625	...
4. Fuel to anneal ditto	...	...	...	.125
5. Heading	12.0	.333	4.25	...
6. Tartar for Cleaning	...	...	...	.5
6. Tartar for Whitening	...	...	...	.5
7. Papering	4.8	.5	2.0	...
Paper	...	...	...	1.0
Wear of Tools	...	...	...	2.0
	24.3	4.708		

(234.) It appears from the analysis we have given of the art of pin-making, that it occupies rather more than seven hours and a half of time, for ten different individuals working in succession on the same material, to convert it into a pound of pins; and that the total expense of their labour, each being paid in the

* The great expense of turning the wheel appears to have arisen from the person so occupied being unemployed during half his time, whilst the pointer went to another manufactory.

joint ratio of his skill and of the time he is employed, amounts very nearly to 1*s.* 1*d.* But from an examination of the first of these tables, it appears that the wages earned by the persons employed vary from 4½*d.* per day up to 6*s.*, and consequently the skill which is required for their respective employments may be measured by those sums. Now it is evident, that if one person were required to make the whole pound of pins, he must have skill enough to earn about 5*s.* 3*d.* per day, whilst he is pointing the wires or cutting off the heads from the spiral coils,—and 6*s.* when he is whitening the pins; which three operations together would occupy little more than the seventeenth part of his time. It is also apparent, that during more than one half of his time he must be earning only 1*s.* 3*d.* per day, in putting on the heads; although his skill, if properly employed, would, in the same time, produce nearly five times as much. If, therefore, we were to employ, for all the processes, the man who whitens the pins, and who earns 6*s.* per day, even supposing that he could make the pound of pins in an equally short time, yet we must pay him for his time 46.14 pence, or about 3*s.* 10*d.* *The pins would therefore cost, in making, three times and three quarters as much as they now do by the application of the division of labour.*

The higher the skill required of the workman in any one process of a manufacture, and the smaller the time during which it is employed, so much the greater will be the advantage of separating that process from the rest, and devoting one person's attention entirely to it. Had we selected the art of needle-

making as our illustration, the economy arising from the division of labour would have been still more striking; for the process of tempering the needles requires great skill, attention, and experience, and although from three to four thousand are tempered at once, the workman is paid a very high rate of wages. In another process of the same manufacture, dry-pointing, which also is executed with great rapidity, the wages earned by the workman reach from 7*s.* to 12*s.*, 15*s.*, and even, in some instances, to 20*s.* per day; whilst other processes are carried on by children paid at the rate of 6*d.* per day.

(235.) Some further reflections suggested by the preceding analysis, will be reserved until we have placed before the reader a brief description of a machine for making pins, invented by an American. It is highly ingenious in point of contrivance, and, in respect to its economical principles, will furnish a strong and interesting contrast with the manufacture of pins by the human hand. In this machine a coil of brass wire is placed on an axis; one end of this wire is drawn by a pair of rollers through a small hole in a plate of steel, and is held there by a forceps. As soon as the machine is put in action,—

1. The forceps draws the wire on to a distance equal in length to one pin: a cutting edge of steel then descends close to the hole through which the wire entered, and severs the piece drawn out.

2. The forceps holding the piece thus separated moves on, till it brings the wire to the centre of the *chuck* of a small lathe, which opens to receive it. Whilst the forceps is returning to fetch another piece

of wire, the lathe revolves rapidly, and grinds the projecting end of the wire upon a steel mill, which advances towards it.

3. After this first or coarse pointing, the lathe stops, and another forceps takes hold of the half-pointed pin, (which is instantly released by the opening of the *chuck*,) and conveys it to a similar *chuck* of an adjacent lathe, which receives it, and finishes the pointing on a finer steel mill.

4. This mill again stops, and another forceps removes the pointed pin into a pair of strong steel clams, having a small groove in them by which they hold the pin very firmly. A part of this groove, which terminates at that edge of the steel clams which is intended to form the head of the pin, is made conical. A small round steel punch is now driven forcibly against the end of the wire thus clamped, and the head of the pin is partially formed by compressing the wire into the conical cavity.

5. Another pair of forceps now removes the pin to another pair of clams, and the head of the pin is completed by a blow from a second punch, the end of which is slightly concave. Each pair of forceps returns as soon as it has delivered its burden; and thus there are always five pieces of wire at the same moment in different stages of advance towards a finished pin.

The pins so formed are received in a tray, and whitened and papered in the usual manner. About sixty pins can thus be made by this machine in one minute; but each process occupies exactly the same time.

(236.) In order to judge of the value of such a

machine, compared with hand-labour, it would be necessary to ascertain :—1. The defects to which pins so made are liable. 2. Their advantages, if any, over those made in the usual way. 3. The prime cost of the machine for making them. 4. The expense of keeping it in repair. 5. The expense of moving the machine and of attending to it.

1. Pins made by the machine are more likely to bend, because the head being punched up, the wire must be in a soft state to admit of that operation. 2. Pins made by the machine are better than common ones, because they are not subject to losing their heads. 3. With respect to the prime cost of a machine, it would be very much reduced if a large number should be required. 4. With regard to its wear and tear, experience only can decide : but it may be remarked, that the steel clams or dies in which the heads are punched up, will wear quickly unless the wire has been softened by annealing ; and that if softened, the bodies of the pins will bend too readily. Such an inconvenience might be remedied, either by making the machine spin the heads and fix them on, or by annealing only that end of the wire which is to become the head of the pin : but this would cause a delay between the operations, since the brass is too brittle, while heated, to bear a blow without crumbling. 5. On comparing the time occupied by the machine with that stated in the analysis, we find that, except in the heading, the human hand is more rapid. Three thousand six hundred pins are pointed by the machine in one hour, whilst a man can point fifteen thousand six hundred in the same time. But in the process of heading, the rapidity of the machine is

two and a half times that of the human hand. It must, however, be observed, that the grinding in the machine does not require the application of a force equal to that of one man ; for all the processes are executed at once by the machine, and a single labourer can easily work it.

CHAP. XX.

ON THE DIVISION OF MENTAL LABOUR.

(237.) We have already mentioned what may, perhaps, appear paradoxical to some of our readers, —that the division of labour can be applied with equal success to mental as to mechanical operations, and that it ensures in both the same economy of time. A short account of its practical application, in the most extensive series of calculations ever executed, will offer an interesting illustration of this fact, whilst at the same time it will afford an occasion for shewing that the arrangements which ought to regulate the interior economy of a manufactory, are founded on principles of deeper root than may have been supposed, and are capable of being usefully employed in preparing the road to some of the sublimest investigations of the human mind.

(238.) In the midst of that excitement which accompanied the Revolution of France and the succeeding wars, the ambition of the nation, unexhausted by its fatal passion for military renown, was at the same time directed to some of the nobler and more permanent triumphs which mark the era of a people's greatness,—and which receive the applause of posterity long after their conquests have been wrested from them, or even when their existence as a nation may be told only by the page of history.

Amongst their enterprises of science, the French government was desirous of producing a series of mathematical tables, to facilitate the application of the decimal system which they had so recently adopted. They directed, therefore, their mathematicians to construct such tables, on the most extensive scale. Their most distinguished philosophers, responding fully to the call of their country, invented new methods for this laborious task; and a work, completely answering the large demands of the government, was produced in a remarkably short period of time. M. Prony, to whom the superintendence of this great undertaking was confided, in speaking of its commencement, observes: "*Je m'y* " *livrai avec toute l'ardeur dont j'étois capable, et je* " *m'occupai d'abord du plan général de l'exécution.* " *Toutes les conditions que j'avois à remplir nécessi-* " *toient l'emploi d'un grand nombre de calculateurs;* " *et il me vint bientôt à la pensée d'appliquer à la* " *confection de ces Tables* la division du travail, *dont* " *les Arts de Commerce tirent un parti si avantageux* " *pour réunir à la perfection de main-d'œuvre* " *l'économie de la dépense et du temps.*" The circumstance which gave rise to this singular application of the principle of *the division of labour* is so interesting, that no apology is necessary for introducing it from a small pamphlet printed at Paris a few years since, when a proposition was made by the English to the French government, that the two countries should print these tables at their joint expense.

(239.) The origin of the idea is related in the following extract:—

"C'est à un chapitre d'un ouvrage Anglais,* justement célèbre, (I.) qu'est probablement due l'existence de l'ouvrage dont le gouvernement Britannique veut faire jouir le monde savant:—

"Voici l'anecdote: M. de Prony s'était engagé, avec les comités de gouvernement, à composer pour *la division centesimale du cercle, des tables logarithmiques et trigonometriques, qui, non seulement ne laissassent rien à desirer quant à l'exactitude, mais qui formassent le monument de calcul le plus vaste et le plus imposant qui eût jamais été exécuté, ou même conçu.* Les logarithmes des nombres de 1 à 200,000 formaient à ce travail un supplement nécessaire et exigé. Il fut aisé à M. de Prony de s'assurer que même en s'associant trois ou quatre habiles co-operateurs, la plus grande durée presumable de sa vie, ne lui suffirai pas pour remplir ses engagements. Il était occcupé de cette fâcheuse pensée lorsque, se trouvant devant la boutique d'un marchand de livres, il apperçut la belle edition Anglaise de Smith, donnée a Londres en 1776; il ouvrit le livre au hazard, et tomba sur le premier chapitre, qui traite de *la division du travail,* et où la fabrication des épingles est citée pour exemple. A peine avait-il parcouru les premières pages, que, par une espèce d'inspiration, il conçut l'expédient de mettre ses logarithmes en *manufacture* comme les épingles. Il faisait, en ce moment, à l'école polytechnique, des leçons sur une partie d'analyse liée à ce genre de travail, *la methode des differences,* et ses applications à *l'interpolation.* Il alla passer quelques jours à la campagne, et revint à Paris avec le plan de *fabrication,* qui a été suivi dans l'exécution. Il rassembla deux ateliers, qui faisaient séparément les mêmes calculs, et se servaient de vérification reciproque."†

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* *An Enquiry into the Nature and Causes of the Wealth of Nations,* by Adam Smith.

† Note sur la publication, proposée par le gouvernement

(240.) The ancient methods of computing tables were altogether inapplicable to such a proceeding. M. Prony, therefore, wishing to avail himself of all the talent of his country in devising new methods, formed the first section of those who were to take part in this enterprise out of five or six of the most eminent mathematicians in France.

First Section.—The duty of this first section was to investigate, amongst the various analytical expressions which could be found for the same function, that which was most readily adapted to simple numerical calculation by many individuals employed at the same time. This section had little or nothing to do with the actual numerical work. When its labours were concluded, the formulæ on the use of which it had decided, were delivered to the second section.

Second Section.—This section consisted of seven or eight persons of considerable acquaintance with mathematics: and their duty was to convert into numbers the formulæ put into their hands by the first section,—an operation of great labour; and then to deliver out these formulæ to the members of the third section, and receive from them the finished calculations. The members of this second section had certain means of verifying the calculations without the necessity of repeating, or even of examining, the whole of the work done by the third section.

Third Section. — The members of this section, whose number varied from sixty to eighty, received certain numbers from the second section, and, using nothing more than simple addition and subtraction,

Anglais des grands tables logarithmiques et trigonometriques de M. de Prony.—De l'imprimerie de F. Didot, Dec. 1, 1820. p. 7.

they returned to that section the tables in a finished state. It is remarkable that nine-tenths of this class had no knowledge of arithmetic beyond the two first rules which they were thus called upon to exercise, and that these persons were usually found more correct in their calculations, than those who possessed a more extensive knowledge of the subject.

(241.) When it is stated that the tables thus computed occupy seventeen large folio volumes, some idea may perhaps be formed of the labour. From that part executed by the third class, which may almost be termed mechanical, requiring the least knowledge and by far the greatest exertions, the first class were entirely exempt. Such labour can always be purchased at an easy rate. The duties of the second class, although requiring considerable skill in arithmetical operations, were yet in some measure relieved by the higher interest naturally felt in those more difficult operations. The exertions of the first class are not likely to require, upon another occasion, so much skill and labour as they did upon the first attempt to introduce such a method; but when the completion of a calculating-engine shall have produced a substitute for the whole of the third section of computers, the attention of analysts will naturally be directed to simplifying its application, by a new discussion of the methods of converting analytical formulæ into numbers.

(242.) The proceeding of M. Prony, in this celebrated system of calculation, much resembles that of a skilful person about to construct a cotton or silk-mill, or any similar establishment. Having, by his own genius, or through the aid of his friends,

found that some improved machinery may be successfully applied to his pursuit, he makes drawings of his plans of the machinery, and may himself be considered as constituting the first section. He next requires the assistance of operative engineers capable of executing the machinery he has designed, some of whom should understand the nature of the processes to be carried on; and these constitute his second section. When a sufficient number of machines have been made, a multitude of other persons, possessed of a lower degree of skill, must be employed in using them; these form the third section: but their work, and the just performance of the machines, must be still superintended by the second class.

(243.) As the possibility of performing arithmetical calculations by machinery may appear to non-mathematical readers to be rather too large a postulate, and as it is connected with the subject of the *division of labour*, I shall here endeavour, in a few lines, to give some slight perception of the manner in which this can be done,—and thus to remove a small portion of the veil which covers that apparent mystery.

(244.) *That nearly all tables of numbers which follow any law, however complicated, may be formed, to a greater or less extent, solely by the proper arrangement of the successive addition and subtraction of numbers befitting each table*, is a general principle which can be demonstrated to those only who are well acquainted with mathematics; but the mind, even of the reader who is but very slightly acquainted with that science, will readily conceive that it is not impossible, by attending to the following example.

The subjoined table is the beginning of one in

very extensive use, which has been printed and reprinted very frequently in many countries, and is called *a Table of Square Numbers.*

Terms of the Table.	A. Table.	B. First Difference.	C. Second Difference.
1	1		
		3	
2	4		2
		5	
3	9		2
		7	
4	16		2
		9	
5	25		2
		11	
6	36		2
		13	
7	49		

Any number in the table, column A, may be obtained, by multiplying the number which expresses the distance of that term from the commencement of the table by itself; thus, 25 is the fifth term from the beginning of the table, and 5 multiplied by itself, or by 5, is equal to 25. Let us now subtract each term of this table from the next succeeding term, and place the results in another column (B), which may be called first-difference column. If we again subtract each term of this first difference from the succeeding term, we find the result is always the number 2, (column C;) and that the same number will always recur in that column, which may be called the second-difference, will appear to any person who

takes the trouble to carry on the table a few terms further. Now when once this is admitted, it is quite clear that, provided the first term (1) of the Table, the first term (3) of the first differences, and the first term (2) of the second or constant difference, are originally given, we can continue the table of square numbers to any extent, merely by simple addition:—for the series of first differences may be formed by repeatedly adding the constant difference (2) to (3) the first number in column B, and we then have the series of numbers, 3, 5, 7, &c.: and again, by successively adding each of these to the first number (1) of the table, we produce the square numbers.

(245.) Having thus, I hope, thrown some light upon the theoretical part of the question, I shall endeavour to shew that the mechanical execution of such an engine, as would produce this series of numbers, is not so far removed from that of ordinary machinery as might be conceived. Let the reader imagine three clocks, placed on a table side by side, each having only one hand, and each having a thousand divisions instead of twelve hours marked on the face; and every time a string is pulled, let them strike on a bell the numbers of the divisions to which their hands point. Let him further suppose that two of the clocks, for the sake of distinction called B and C, have some mechanism by which the clock C advances the hand of the clock B one division, for each stroke it makes upon its own bell; and let the clock B by a similar contrivance advance the hand of the clock A one division, for each stroke it makes on its own bell. With such an arrange-

ment, having set the hand of the clock A to the division I., that of B to III., and that of C to II., let the reader imagine the repeating parts of the clocks to be set in motion continually in the following order: viz.—pull the string of clock A; pull the string of clock B; pull the string of clock C.

The table on the following page will thus express the series of movements and their results.

TABLE.

Repetitions of Process.	Movements.	Clock A. Hand set to I.	Clock B. Hand set to III.	Clock C. Hand set to II.
			First difference.	Second difference.
1	Pull A.	A. strikes 1	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 3 divisions . .	B. strikes 3	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
2	Pull A.	A. strikes 4	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 5 divisions . .	B. strikes 5	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
3	Pull A.	A. strikes 9	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 7 divisions . .	B. strikes 7	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
4	Pull A.	A. strikes 16	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 9 divisions . .	B. strikes 9	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
5	Pull A.	A. strikes 25	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 11 divisions .	B. strikes 11	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2
6	Pull A.	A. strikes 36	. . . . .	. . . .
	— B.	The hand is advanced (by B.) 13 divisions .	B. strikes 13	. . . .
	— C.	. . . . .	The hand is advanced (by C.) 2 divisions . .	C. strikes 2

If now only those divisions struck or pointed at by the clock A be attended to and written down, it will be found that they produce the series of the squares of the natural numbers. Such a series could, of course, be carried by this mechanism only so far as the numbers which can be expressed by three figures; but this may be sufficient to give some idea of the construction,—and was, in fact, the point to which the first model of the calculating-engine, now in progress, extended.

(246.) We have seen, then, that the effect of the *division of labour*, both in mechanical and in mental operations, is, that it enables us to purchase and apply to each process precisely that quantity of skill and knowledge which is required for it: we avoid employing any part of the time of a man who can get eight or ten shillings a day by his skill in tempering needles, in turning a wheel, which can be done for sixpence a day; and we equally avoid the loss arising from the employment of an accomplished mathematician in performing the lowest processes of arithmetic.

(247.) The *division of labour* cannot be successfully practised unless there exists a great demand for its produce; and it requires a large capital to be employed in those arts in which it is used. In watchmaking it has been carried, perhaps, to the greatest extent. It was stated in evidence before a committee of the House of Commons, that there are a hundred and two distinct branches of this art, to each of which a boy may be put apprentice; and that he only learns his master's department, and is unable, after his apprenticeship has expired,

without subsequent instruction, to work at any other branch. The watch-finisher, whose business is to put together the scattered parts, is the only one, out of the hundred and two persons, who can work in any other department than his own.

(248*.) In one of the most difficult arts, that of Mining, great improvements have resulted from the judicious distribution of the duties; and under the arrangements which have gradually been introduced, the whole system of the mine and its government is now placed under the control of the following officers.

1. A Manager, who has the general knowledge of all that is to be done, and who may be assisted by one or more skilful persons.

2. Underground Captains direct the proper mining operations and govern the working miners.

3. The Purser and Book-keeper manage the accounts.

4. The Engineer erects the engines, and superintends the men who work them.

5. A chief Pitman has charge of the pumps and the apparatus of the shafts.

6. A Surface-captain, with assistants, receives the ores raised, and directs the dressing department, the object of which is to render them marketable.

7. The head Carpenter superintends *many* constructions.

8. The foreman of the Smiths regulates iron-work and tools.

9. A Materials-man selects, purchases, receives and delivers all articles required.

10. The Roper has charge of ropes and cordage of all sorts.

Andrew Ure (1778-1857)

The Philosophy of Manufactures; or, an exposition of the scientific, moral, and commercial economy of the factory system of Great Britain, Charles Knight, London, 1835.

THE

PHILOSOPHY OF MANUFACTURES:

OR,

AN EXPOSITION

OF THE

SCIENTIFIC, MORAL, AND COMMERCIAL ECONOMY

OF THE

FACTORY SYSTEM

OF

Great Britain.

By ANDREW URE, M.D., F.R.S.,

M.G.S., M.A.S. Lon., M. Acad. N.S. Philad.,
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&c. &c. &c.

LONDON:
CHARLES KNIGHT, LUDGATE-STREET.

MDCCCXXXV.

of people still lying "in the region and shadow of death."

When Adam Smith wrote his immortal elements of economics, automatic machinery being hardly known, he was properly led to regard the division of labour as the grand principle of manufacturing improvement; and he showed, in the example of pin-making, how each handicraftsman, being thereby enabled to perfect himself by practice in one point, became a quicker and cheaper workman. In each branch of manufacture he saw that some parts were, on that principle, of easy execution, like the cutting of pin wires into uniform lengths, and some were comparatively difficult, like the formation and fixation of their heads; and therefore he concluded that to each a workman of appropriate value and cost was naturally assigned. This appropriation forms the very essence of the division of labour, and has been constantly made since the origin of society. The ploughman, with powerful hand and skilful eye, has been always hired at high wages to form the furrow, and the ploughboy at low wages, to lead the team. But what was in Dr. Smith's time a topic of useful illustration, cannot now be used without risk of misleading the public mind as to the right principle of manufacturing industry. In fact, the division, or rather adaptation of labour to the different talents of men, is little thought of in factory employment. On the contrary, wherever a process requires peculiar dexterity and steadiness of hand, it is withdrawn as soon as possible from the *cunning* workman, who is prone to irregularities of many kinds, and it is placed in charge of a peculiar mechanism, so self-regulating, that a child may superintend it. Thus,—to

take an example from the spinning of cotton—the first operation in delicacy and importance, is that of laying the fibres truly parallel in the spongy slivers, and the next is that of drawing these out into slender spongy cords, called rovings, with the least possible twist; both being perfectly uniform throughout their total length. To execute either of these processes tolerably by a hand-wheel, would require a degree of skill not to be met with in one artisan out of a hundred. But fine yarn could not be made in factory-spinning except by taking these steps, nor was it ever made by machinery till Arkwright's sagacity contrived them. Moderately good yarn may be spun indeed on the *hand-wheel* without any drawings at all, and with even indifferent rovings, because the thread, under the two-fold action of twisting and extension, has a tendency to equalize itself.

The principle of the factory system then is, to substitute mechanical science for hand skill, and the partition of a process into its essential constituents, for the division or graduation of labour among artisans. On the handicraft plan, labour more or less skilled, was usually the most expensive element of production—*Materiam superabat opus;* but on the automatic plan, skilled labour gets progressively superseded, and will, eventually, be replaced by mere overlookers of machines.

By the infirmity of human nature it happens, that the more skilful the workman, the more self-willed and intractable he is apt to become, and, of course, the less fit a component of a mechanical system, in which, by occasional irregularities, he may do great damage to the whole. The grand object therefore of the modern manufacturer is, through the union of capital and

science, to reduce the task of his work-people to the exercise of vigilance and dexterity,—faculties, when concentred to one process, speedily brought to perfection in the young. In the infancy of mechanical engineering, a machine-factory displayed the division of labour in manifold gradations—the file, the drill, the lathe, having each its different workmen in the order of skill: but the dexterous hands of the filer and driller are now superseded by the planing, the key-groove cutting, and the drilling-machines; and those of the iron and brass turners, by the self-acting slide-lathe. Mr. Anthony Strutt, who conducts the mechanical department of the great cotton factories of Belper and Milford, has so thoroughly departed from the old routine of the schools, that he will employ no man who has learned his craft by regular apprenticeship; but in contempt, as it were, of the division of labour principle, he sets a ploughboy to turn a shaft of perhaps several tons weight, and never has reason to repent his preference, because he infuses into the turning apparatus a precision of action, equal, if not superior, to the skill of the most experienced journeyman.

An eminent mechanician in Manchester told me, that he does not choose to make any steam-engines at present, because with his existing means, he would need to resort to the old principle of the division of labour, so fruitful of jealousies and strikes among workmen; but he intends to prosecute that branch of business whenever he has prepared suitable arrangements on the equalization of labour, or automatic plan. On the graduation system, a man must serve an apprenticeship of many years before his hand and eye become skilled enough for certain mechanical feats;

but on the system of decomposing a process into its constituents, and embodying each part in an automatic machine, a person of common care and capacity may be entrusted with any of the said elementary parts after a short probation, and may be transferred from one to another, on any emergency, at the discretion of the master. Such translations are utterly at variance with the old practice of the division of labour, which fixed one man to shaping the head of a pin, and another to sharpening its point, with most irksome and spirit-wasting uniformity, for a whole life.

It was indeed a subject of regret to observe how frequently the workman's eminence, in any craft, had to be purchased by the sacrifice of his health and comfort. To one unvaried operation, which required unremitting dexterity and diligence, his hand and eye were constantly on the strain, or if they were suffered to swerve from their task for a time, considerable loss ensued, either to the employer, or the operative, according as the work was done by the day or by the piece. But on the equalization plan of self-acting machines, the operative needs to call his faculties only into agreeable exercise; he is seldom harassed with anxiety or fatigue, and may find many leisure moments for either amusement or meditation, without detriment to his master's interests or his own. As his business consists in tending the work of a well regulated mechanism, he can learn it in a short period; and when he transfers his services from one machine to another, he varies his task, and enlarges his views, by thinking on those general combinations which result from his and his companions' labours. Thus, that cramping of the faculties, that narrowing of the mind,

that stunting of the frame, which were ascribed, and not unjustly, by moral writers, to the division of labour, cannot, in common circumstances, occur under the equable distribution of industry. How superior in vigour and intelligence are the factory mechanics in Lancashire, where the latter system of labour prevails, to the handicraft artisans of London, who, to a great extent, continue slaves to the former! The one set is familiar with almost every physico-mechanical combination, while the other seldom knows anything beyond the pin-head sphere of his daily task.

It is, in fact, the constant aim and tendency of every improvement in machinery to supersede human labour altogether, or to diminish its cost, by substituting the industry of women and children for that of men; or that of ordinary labourers, for trained artisans. In most of the water-twist, or throstle cotton mills, the spinning is entirely managed by females of sixteen years and upwards. The effect of substituting the self-acting mule for the common mule, is to discharge the greater part of the men spinners, and to retain adolescents and children. The proprietor of a factory near Stockport states, in evidence to the commissioners, that by such substitution, he would save 50*l.* a week in wages, in consequence of dispensing with nearly forty male spinners, at about 25*s.* of wages each. This tendency to employ merely children with watchful eyes and nimble fingers, instead of journeymen of long experience, shows how the scholastic dogma of the division of labour into degrees of skill has been exploded by our enlightened manufacturers.

They are, in truth, much better acquainted with the general economy of the arts, and better qualified to

Improvements in machinery have a three-fold bearing:—

1st. They make it possible to fabricate some articles which, but for them, could not be fabricated at all.

2d. They enable an operative to turn out a greater quantity of work than he could before,—time, labour, and quality of work remaining constant.

3d. They effect a substitution of labour comparatively unskilled, for that which is more skilled.

The introduction of new machines into any manufacture, with the effect of superseding hand labour, is tempered by the system of patents, which maintains them for a certain time at a monopoly price, and thereby obstructs their rapid multiplication. Did we admit the principles on which the use of particular self-acting mechanisms is objected to by workmen, we should not be able, in any case, to define the limits of their application. Had parliament acted on such principles sixty years ago, none of our manufactures could have attained to their present state of profitable employment to either masters or men. The immediate causes of their vast augmentation may be ascribed, under the blessing of Providence, to the general spirit of industry and enterprize among a free and an enlightened people, left to the unrestrained exercise of their talents in the employment of a vast capital, pushing to the utmost the principle of the analysis of labour, summoning to their service all the resources of scientific research and mechanical ingenuity; and finally, availing themselves of all the benefits to be derived from visiting foreign countries, not only in order to form new and confirm old commercial connexions, but to obtain an intimate knowledge of the wants, the tastes, the habits, the dis-

Edward Gibbon Wakefield (1796-1862)

"Commentary" in Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations with a Commentary by the Author of "England and America" in six* [i.e., four] *volumes*, Vol. 1, Charles Knight, London 1835

AN INQUIRY

INTO

THE NATURE AND CAUSES

OF THE

WEALTH OF NATIONS,

BY

ADAM SMITH, LL.D.

WITH A COMMENTARY,

BY THE

AUTHOR OF "ENGLAND AND AMERICA."

(i.e. E. G. Wakefield)

IN ~~SIX~~ four VOLUMES.

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MDCCCXXXV.

NOTE

On Chapter I. Book I.

This is, beyond all comparison, the most popular chapter in the *Wealth of Nations*: no part of the work has been so often reprinted in English, or translated into so many foreign languages; no part of it is so commonly read by children, or so well remembered by them. The perfect truth of the whole of the doctrine which it teaches, has never been questioned; and, what is more, it has been supposed, by all writers on the principles of political economy since the time of Adam Smith, to contain nearly the whole truth on the most important branch of that science, namely, the *production* of wealth. Nevertheless, a careful examination of it will perhaps show, that, as a description of the cause of the "greatest improvements in the productive powers of labour," it is not only very deficient, but also full of error. By first observing the errors of this chapter, we shall the more readily perceive in what respects it is defective.

The use of the same term in different senses, or of different terms in the same sense, is *primâ facie* evidence that a writer is not thoroughly acquainted

with his subject. Both kinds of oversight occur frequently in this chapter. To explain them would be more easy than it is, if, as I have ventured to say in the Preface, the meaning of the commonest terms used in treating of political economy, were not still unsettled.

No one will deny, however, that there is a wide difference between an operation, work, or business, which is performed by labour, and the labour which performs it. The muscular exertion by which a house is built, is not the same thing as the operation of building a house; the operation of making a pin is something entirely distinct from the muscular exertion by means of which the pin is made. These different things are, over and over again, confounded by Adam Smith. To establish this position, it will be sufficient to mark a number of instances in which he expresses by some other term than "division of labour," what he generally employs that term to express.

"The important *business* of making a pin is, in this manner, divided into about eighteen *distinct operations*."

"The separation of different *trades* and *employments* from one another."

"How many different *trades* are employed [pursued] in each branch of the linen and woollen manufactures."

"So complete a separation of one *business* from another."

"It is impossible to separate so entirely the *busi-*

ness of the grazier from that of the corn-farmer, as the *trade* of the carpenter is commonly separated from that of the smith."

"Philosophy or speculation becomes, like every other *employment*, the principal or sole *trade* or *occupation* of a particular class of citizens. Like every other *employment*, too, it is subdivided into a great number of different branches."

"The subdivision of *employment* in philosophy, as well as in every other *business*, improves dexterity and saves time."

In all these instances, and not a few more, division is said to take place, not, as the writer says elsewhere, in the labour which performs operations, but in the operations which are performed by labour. The impropriety of using terms so dissimilar, to express the same meaning, is obvious enough; but this is not a dispute about terms merely, as will be seen by the following curious remarks; curious, that is, as appearing in a treatise on the *division* of labour.

"Observe the accommodation of the most common artificer or day-labourer in a civilized and thriving country, and you will perceive that the *number of people* of whose industry a part, though but a small part, has been employed in procuring him this accommodation, *exceeds all computation*. The woollen coat, for example, which covers the day-labourer, as coarse and rough as it may appear, is the produce of the *joint labour* of a great multitude of workmen." . . "Without

the assistance and *co-operation of many thousands*, the very meanest person in a civilized country could not be provided, even according to, what we very falsely imagine, the easy and simple manner in which he is commonly accommodated."

Here, then, labour is said to be united, as in fact it is whenever employments are divided. Nature has divided labour into single pairs of hands. The greatest division of labour takes place amongst those exceedingly barbarous savages who never help each other, who work separately from each other; and division of employments, with all its great results, depends altogether on combination of labour, or co-operation. Such important consequences spring from this principle, that it deserves the most ample illustration.

"Suppose," says Dr. Whately, "a number of travellers proceeding through some nearly desert country, such as many parts of America, and journeying together in a kind of cafila or caravan for the sake of mutual security: when they came to a halting-place for the night, they would not fail to make some kind of extemporaneous arrangement, that some should unlade and fodder the cattle, while others should fetch fire-wood from the nearest thicket, and others water from the spring: some, in the meantime, would be occupied in pitching tents, or erecting sheds of boughs; others in preparing food for the whole party; while some, again, with their arms in readiness, would be posted as centinels, in suitable spots, to watch that the rest might not be

surprised by bands of robbers. It would be evident to them that, but for such an arrangement, each man would have to go to the spring for water, and to the wood for fuel; would have to prepare his own meal with almost as much trouble as it costs to dress food for the whole, and would have to perform all these tasks encumbered by his arms, and on the watch for a hostile attack."

All this would be evident to them; they would perceive, in short, the great utility of separating the different occupations required for their ease and safety. But in order that the travellers should thus apportion those different occupations amongst their whole body, it would be necessary that they should first combine their labour by agreeing to travel together, and to help each other on the way. If each of them had travelled alone, each man's labour would have been separated or divided, not only from that of all the others, but again amongst the several occupations of going to the wood for fire, and to the spring for water, &c.: if the labour of the travellers had been so divided, there could not have been any, the slightest division of their employments. In like manner, the division of employments which takes place in a pin-factory, results from, and is wholly dependent on, the union, generally under one roof, of all the labour by which the pins are made. Though no entire pin be made by any one person, each pin is the produce of many persons' united labour; many persons whose labour is united, in order that the whole operation which it is to perform,

may be separated into distinct parts, and easily apportioned amongst the workmen. It appears, therefore, not only that "division of labour" is a most improper term as commonly used; not only that this is the proper term for expressing a state of things under which what is commonly expressed by it—namely, division of employments—cannot possibly take place; but that all writers on political economy, from Adam Smith downwards, while treating of the "causes of improvement in the productive powers of labour," have overlooked a principle of first-rate importance.

This principle is, that all improvements in the productive powers of labour, including division of employments, depend upon co-operation.

Co-operation appears to be of two distinct kinds: first, such co-operation as takes place when several persons help each other in the same employment; secondly, such co-operation as takes place when several persons help each other in different employments. These may be termed simple co-operation, and complex co-operation. It will be seen presently, that, until men help each other in simple operations, they cannot well help each other in operations which consist of several parts.

The advantage of simple co-operation is illustrated by the case of two greyhounds running together, which, it is said, will kill more hares than four greyhounds running separately. In a vast number of simple operations performed by human exertion, it is quite obvious that two men working together

will do more than four, or four times four men, each of whom should work alone. In the lifting of heavy weights, for example, in the felling of trees, in the sawing of timber, in the gathering of much hay or corn during a short period of fine weather, in draining a large extent of land during the short season when such a work may be properly conducted, in the pulling of ropes on board ship, in the rowing of large boats, in some mining operations, in the erection of a scaffolding for building, and in the breaking of stones for the repair of a road, so that the whole of the road shall always be kept in good order; in all these simple operations, and thousands more, it is absolutely necessary that many persons should work together, at the same time, in the same place, and in the same way. The savages of New Holland never help each other, even in the most simple operations; and their condition is hardly superior, in some respects it is inferior, to that of the wild animals which they now and then catch. Let any one imagine that the labourers of England should suddenly desist from helping each other in simple employments, and he will see at once the prodigious advantages of simple co-operation. In a countless number of employments, the produce of labour is, up to a certain point, in proportion to such mutual assistance amongst the workmen. This is the first step in social improvement. A single person, working entirely by himself, either in hunting, or in cultivating the earth, will not, it seems plain, obtain more food than what he requires for his own sub-

sistence: several persons combining their labour, in the most simple operations either of the chace or of agriculture, will obtain more food than they require; they will obtain a surplus produce, which surplus produce may either be used as capital for the employment of more labourers, whereby the produce, in proportion to the hands at work, will be still further increased; or it may be given in exchange for some other kind of produce, provided always that some other body of workmen have combined their labour, and have so obtained, of some other kind of produce, more than they require for themselves. This possession of capital, and this power of exchanging, both of them being strictly dependent on the greater productiveness of labour arising from simple co-operation, constitute the second step in social improvement. One body of men having combined their labour to raise more food than they require, another body of men are induced to combine their labour for the purpose of producing more clothes than they require, and, with those surplus clothes, buying the surplus food of the other body of labourers; while, if both bodies together have produced more food and clothes than they both require, both bodies obtain, by means of exchange, a proper capital for setting more labourers to work in their respective occupations. What is true of two bodies of men, applies to any number of bodies, however great the difference in their occupations; and thus we perceive, that the division of employments, the power of exchanging, and the possession

of a capital as well, depend on the combination of labour in simple operations.

The use of capital, and not the power, but the act of exchanging, and further the division of employments, are still dependent on something else than simple co-operation; they are all dependent also upon arrangements, agreements, concert, or combination, of a general kind, in which the whole society takes a part, and which, for want of a better expression, may be termed complex co-operation.

When a body of men raise more food than they want, and employ that surplus food as capital, paying it in wages to other labourers, those other labourers act in concert or combination with those capitalists: it is only by means of concert or co-operation, that the body who raise more food than they want, can exchange with the body who raise more clothes than they want; and if the two bodies were separated, either by distance or disinclination —unless the two bodies should virtually form themselves into one, for the common object of raising enough food and clothes for the whole—they could not divide into two distinct parts the whole operation of producing a sufficient quantity of food and clothes. The division of pursuits, then, into the management of capital, and such occupations as are carried on by muscular exertion, all division of employments, and all exchanges, result from co-operation amongst men; not only simple co-operation, which first raises capital, and surplus produce for exchange, but also complex co-operation, which

enables the rich man to employ his capital, and the poor one to consume it, and which includes all the means over and above surplus produce, for practising exchange, and division of employments amongst different bodies of men.

Before we proceed to the practical conclusions which may be drawn from this principle, it seems right to notice an important distinction between simple and complex co-operation. Of the former, one is always conscious at the time of practising it: it is obvious to the most ignorant and vulgar eye. Of the latter, but a very few of the vast numbers who practise it are in any degree conscious. The cause of this distinction is easily seen. When several men are employed in lifting the same weight, or pulling the same rope, at the same time, and in the same place, there can be no sort of doubt that they co-operate with each other; the fact is impressed on the mind by the mere sense of sight: but when several men, or bodies of men, are employed at different times and places, and in different pursuits, their co-operation with each other, though it may be quite as certain, is not so readily perceived as in the other case: in order to perceive it, a complex operation of the mind is required. And here, perhaps, we may discover the occasion of Adam Smith's error in confounding division of labour with division of employments, which are really incompatible with one another. The division of employments, he says, " is commonly supposed to be carried farthest in some very trifling manufactures

not, perhaps, that it really is carried farther in them than in others of more importance; but in those trifling manufactures which are destined to supply the small wants of but a small number of people, the whole number of workmen must necessarily be small; and those employed in every different branch of the work can often be collected into the same workhouse, and placed at once under the view of the spectator. In those great manufactures, on the contrary, which are destined to supply the great wants of the great body of the people, every different branch employs so great a number of workmen, that it is impossible to collect them all into the same workhouse. We can seldom see more, at one time, than those employed in one single branch. Though in such manufactures, therefore, the work may really be divided into a much greater number of parts, than in those of a more trifling nature, the division is not near so obvious, and has accordingly been much less observed." If the division of employments had been equally plain under all circumstances, Adam Smith would never, probably, have called it division of labour: he would not have done so, assuredly, if the complex co-operation which, by the aid of exchange, gives rise to the division of employments, had been as obvious as simple co-operation, which originally provides surplus produce for exchange. But, be that as it may, there is this analogy between division of employments and complex co-operation, that both are most easily perceived when the labourers who practise them work in the

same place; and are not to be perceived without more careful examination, when the labourers who practise them work in different places. In a pin-factory, where ten men produce forty-eight thousand pins in a day, the co-operation of those ten labourers is as evident as the division into separate parts of the whole business performed by their united labour. The co-operation, on the contrary, which takes place between those pin-makers and the labourers who provide them with metal, tools, fire, clothes, and food, is not to be discovered without reflection; and it would, moreover, be a hard task for the most enlightened philosopher to reckon the immense number of persons who co-operate before a single pin can be made and brought to market. "The woollen coat," says Adam Smith, "which covers the day-labourer, as coarse and rough as it may appear, is the produce of the joint labour of a great multitude of workmen." Joint or united labour is another word for co-operation. If, "without the assistance and co-operation of many thousands, the very meanest person in a civilized country could not be provided, even according to, what we very falsely imagine, the very easy and simple manner in which he is commonly accommodated," who shall venture to form an estimate of the number of people who combine their labour before the inhabitants of a city in Europe, at the present time, are supplied with all the useful and agreeable objects which they enjoy? The degree of combination of labour, or co-operation, which is requisite for supplying a city

with food alone, has been pointed out by Dr. Whately, with his usual felicity. "Let any one," says he, "propose to himself the problem of supplying with daily provisions of all kinds such a city as our metropolis, containing above a million of inhabitants. * * * * * Now let any one consider the problem in all its bearings, reflecting on the enormous and fluctuating number of persons to be fed—the immense quantity and variety of provisions to be furnished, the importance of a convenient distribution of them, and the necessity of husbanding them discreetly; and then let him reflect on the anxious toil which such a task would impose on a board of the most experienced and intelligent commissioners, who, after all, would be able to discharge their office but very inadequately. Yet this object is accomplished far better than it could be by any effort of human wisdom, through the agency of men who think each of nothing but his more immediate interest—who, with that object in view, perform their respective parts with cheerful zeal, and COMBINE *unconsciously* to employ the wisest means for effecting an object, the vastness of which it would bewilder them even to contemplate." They are not more conscious of dividing into many distinct parts the whole employment of providing a city with provisions, than they are of co-operating for the purpose of such division; but neither the combination of labour, nor the division of employments, is less certain for being hidden from ignorant and vulgar observers.

It is now time to notice some of the most im-

portant practical conclusions which may be drawn from the principle of co-operation.

1. The inhabitants of England, it may be presumed, obtain more and better food than the inhabitants of France; yet all the food of England is said to be raised by the labour of less than one-third of the people, while more than two-thirds of the people of France are supposed to be engaged in raising food for the whole. If it be so, then, in France, only three people are supported by the labour of two cultivators, while, in England, the labour of two cultivators supports six people; English agriculture is twice as productive as French agriculture. To what are we to attribute this remarkable difference? It has been attributed, and with much appearance of truth, to the French law of division, which, at the death of a French proprietor, separates his land into properties as numerous as his children, and which has thus established, in the greater part of France, a system of agriculture resembling that which is practised in the greater part of Ireland, where agricultural industry does not appear to be more productive than it is in France. In both countries, the greater part of the land is divided into very small farms, or rather separate fields. But this division of the land into small holdings does not in any degree affect its natural fertility; nay, the soils of France and Ireland are considered to be more fertile than the soil of England. In what way, then,—by what process is it, that this division of the land into a great number of small

holdings, has so injurious an effect on the productiveness of agricultural labour in Ireland and France? By means, it would appear, of dividing the greater part of the agricultural labour of those countries into fractions as numerous as the labourers. A small cultivator in France, like a cottier in Ireland, works by himself, or at most with no other assistance than that of his children. Not only is his labour separated from that of all other workmen, but it is necessarily divided again amongst the several employments, few though they be, which must be pursued before the scanty wants of his family can be supplied: he practises the very reverse of the two great causes of improvement in the productiveness of labour, which are—combination of labour and division of employments; he divides labour into the smallest fraction into which it can be divided, viz., a single pair of hands; and he combines as many different employments as he has time to engage in. Only a portion of his labour is bestowed on agriculture; so that he wants the skill of one, the whole of whose labour is applied, by means of the division of employments, to a single object; and that portion of his unskilful labour, never being assisted by the labour of any other person, is always as weak as possible. The result is, that he produces but little, if any more food, than is sufficient for the support of his own family, even according to the miserable way in which such families are generally supported.

In England, on the other hand, the greater part

of the land is held in such large pieces, that the cultivation of each piece requires the employment of a considerable number of hands. On an English farm, speaking generally, many labourers help each other, not only in those simple operations where all the work is alike, but in those complex ones which admit of division of employments. On an English farm, therefore, labour is applied, not only with the maximum of power, but also with the maximum of skill; and the quantity of food raised consequently is, in proportion to the number of labourers, as great as our present knowledge of agriculture permits. It is by means of co-operation, one cannot repeat it too often, that the agricultural labour of England is twice as productive as that of France or Ireland; or, to reverse the proposition, it is by means of a minute division of labour that the agricultural labour of France or Ireland is but half as productive as that of England.

Two-thirds of the people of France or Ireland being engaged in agriculture, only one-third is set free, as it were, to engage in other occupations; whereas in England, all the food of the people being produced by one-third of their number, two-thirds of the people may be occupied in pursuits not agricultural. The obvious superiority of England to France or Ireland, in respect to general wealth, is thus satisfactorily explained. This consideration also explains by what process it is, that the foreign commerce of England,—her power of exchanging objects of home production for useful or agreeable

objects which are produced in distant countries,—is so very much greater, having regard to numbers in each country, than that of Ireland or France.

But what are the useful conclusions that we are here to draw from observing in France some of the bad effects of division of labour, and in England some of the admirable effects of co-operation? They are, in the first place, that a constant misapplication of the term "division of labour" seems to have kept out of sight a more important principle than that of the division of employments; and that the sooner we can learn to use the term "division of labour" in its proper sense, the sooner shall we perceive all the value of the principle of co-operation. Secondly, that in one respect, at least, it is in the power, and seems to be within the province of legislation, to interfere with the operations of political economy; in so far, that is, as to prevent or correct the hurtful effects on the production of national wealth, which arise from a minute subdivision of landed property, whether held in fee or on lease.

2. The division of landed property, or any other cause that produces a minute subdivision of labour, tends to check the intellectual and moral improvement of the people who are subject to it. When a man is not in any degree assisted by other men, he cannot live except by cultivating the earth: if the whole labour of a society were divided into fractions as numerous as the people, all the people must necessarily be producers of food, since there would be combination of labour, or co-operation, if any one

should produce food for another. There never was a society, probably, which had advanced beyond the hunting state, and yet subsisted without any co-operation amongst its members; but there are large masses of people, in different parts of the world, whose mode of holding land tends to make every one of them a cultivator. In a great part of France, such is the tendency of the law of division; and the mode of letting land in Ireland has a similar tendency. In Turkey, and in many parts of China, the laws relating to property in land, or some other cause or causes, produce a similar result. Now, wherever this tendency exists, a large proportion of the people are necessarily engaged in the very same pursuits; each labourer, or at most, each labourer's family, cultivates the ground with a view to obtaining food for each family, and pursues some other occupations which are alike, or nearly alike, for all the families. All the people, it follows, are, or rather would be, under this extreme supposition, precisely like one another: in actual cases, it is only a very large proportion of the people who are precisely like one another. But as the number of people who follow occupations different from those of the majority, and different from each other, bears a small proportion to the majority, the whole people may be said to be, what it is obvious that the majority must be, extremely monotonous. As knowledge comes by comparison, and the means of comparison are in proportion to variety, a monotonous people are necessarily dull and ignorant.

"Though," says Adam Smith, "in a rude state of society there is a good deal of variety in the occupations of every individual, there is not a great deal in those of the whole society. Every man does, or is capable of doing, almost everything which any other man does, or is capable of doing. Every man has a considerable degree of knowledge, ingenuity, and invention, but scarce any man has a great degree. The degree, however, which is commonly possessed, is generally sufficient for conducting the whole simple business of society. In a civilized state, on the contrary, though there is little variety in the occupations of the greater part of individuals, there is an almost infinite variety in those of the whole community. These varied occupations present an almost infinite variety of objects to the contemplation of those few who, being attached to no particular occupation themselves, have leisure and inclination to examine the occupations of other people. The contemplation of so great a variety of objects necessarily exercises their minds in endless comparisons and combinations, and renders their understandings in an extraordinary degree both acute and comprehensive." Reverse the picture: observe the state of society in which there is but little variety of occupation or of character, and we see a people who are ignorant, torpid, and stagnant. "The population of that country," says Mr. Birkbeck in his *Tour in France*, "seems to be arranged thus:—A town depends for subsistence on the lands immediately around it: the cultivators individually

have not much to spare; because, as their husbandry is a sort of gardening, it requires a large country population, and has, in proportion, a less superfluity of produce. Thus is formed a numerous but poor country population. The cultivator receives payment for his surplus produce in sous, and he expends only sous. The tradesman is on a par with the farmer: as they receive, so they expend; and thus fifty thousand persons may inhabit a district, with a town of ten thousand inhabitants in the centre of it, bartering the superfluity of the country for the arts and manufactures of the town. Poor from generation to generation, and growing continually poorer as they increase in numbers; in the country, by the division and subdivision of property; in the town, by the subdivision of trades and professions.* Such a people, instead of proceeding from the necessaries to the comforts of life, and then to the luxuries, as is the order of things in England, are rather retrograde than progressive. There is no advancement in French society; no improvement, nor hope of it." Monotony, ignorance, and stagnation, are, in like manner, the characteristics of the great majority of the people in Ireland, Turkey, and China. In all those countries, as well

* This is a mistake. The town's people grow poorer in consequence of the increasing poverty of the country people. The greater the surplus produce of agricultural labour, the greater is the subdivision of trades and professions in towns. The mistake would not have been made, probably, if the term "division of labour" had never been used to express division of employments.

as France, the greater part of society consists of a mere multiplication of one grower of food. Such monotonous, ignorant, and stagnant masses, in which whatever affects one man affects all in the same way, are well suited to be governed by one central, and, as regards them, wholly irresponsible authority. At the present time, a single man leads or governs the greater part of the Irish people,—those of them who are precisely like each other,—as if he held them all by one unbroken string. The facility with which the central and irresponsible governments of China, Turkey, and France, are carried on, as well as the passionate but unreasoning love of equality which, in Turkey and France, at least, seems to be not inconsistent with a slavish respect for the worst kind of authority, may be traced, it would appear, to the operation of causes in political economy. Here is one proof amongst many, that political economy is not, as it has been termed by a modern poet and novelist of reputation, a "material science:" it is a science which relates to the intellectual and moral condition of nations, as well as to their physical enjoyments; to philosophy in general, as well as to the useful arts; to the state of literature, as well as of manufactures; to the character of men and of governments, as well as to objects of a purely material kind. This is the useful conclusion that may be drawn from the above inquiry; for if it were generally admitted to be true, the first chapter in the book of science would be given to political economy.

3. In a great part of Europe at the present time, and more especially in England, the poorer order of people, who everywhere compose the great majority, are dissatisfied with their condition, and, having learned to communicate with each other by means of reading, are occupied with projects for making that condition better. Amongst these projects is the very old one of an agrarian law, the new ones of spade husbandry, the allotment system, and home colonies, and the very curious scheme of Mr. Robert Owen. Against all of these proposals, the principle of combination of labour furnishes a conclusive argument.

Divide mankind, says the proposer of an agrarian law, into the smallest possible fractions; let every man have his little bit of land; make a nation of gardeners, a vast multiplication of one gardener, without surplus produce, exchange, intercourse, or any other stimulant to mental or even bodily exertion; a poor, monotonous, and stagnant people; a nation of precisely similar vegetables, of mere potato-growers, or, one might almost say, of potatoes.

England, say the advocates of spade-husbandry and the allotment system, would support thrice her actual population, if every one who desired it should obtain a small allotment of land. And this is quite true; as the quantity of potatoes grown in England might be multiplied a thousandfold, if, in England, nothing were grown but potatoes. But then, not to mention what would happen when there was a failure of the potato crop, the English would be a

nation of potato-growers, all alike poor and barbarous; thoroughly Irish; or worse, for in Ireland there is some variety. The French, with their allotment system, are becoming a nation of potato-growers; one family of potato-growers multiplied by about eight millions. Cut up all mankind, exclaims Mr. Robert Owen, into small distinct societies, amongst which there shall be no exchange or intercourse; each member of each of which societies shall again divide his labour amongst several employments; all the members employing themselves by turns in the most dissimilar occupations; now digging, then teaching, then mending a shoe; now weaving, then printing, and next killing a pig: let each member of each society be like all the other members, and all the societies like each other. And this has been called a co-operative system. It is not, indeed, so thoroughly separative, as the schemes for giving land to every one; but the essence of Mr. Owen's scheme is the division of labour; the separation of all mankind into distinct though very large families, and the division of the labour of each member of those families amongst many different occupations. In a great part of Ireland, every cottier's family, being independent of all the others, is a small "co-operative society," in the sense of Mr. Owen. Divide and pauperize; divide and stupify; separate mankind enough, and they will be, all alike, poor, ignorant, torpid, and pusillanimous. When, on the other hand, we reflect, that there is a strict, though not evident combination of labour, for the purpose of dividing employments, between the growers of

cotton in America and the weavers of cotton at Manchester, and that the cotton could not be grown and woven without the evident co-operation of many hands in every cotton field, and of many hands in every factory; when we consider that all the wealth of the world, over and above the food sufficient to maintain the producers of food, results from simple combination of labour in works which one man cannot perform, and from complex combination of labour in works which are susceptible of being divided into parts, it will be seen that society improves in proportion as the principle of co-operation obtains more and more force, and that all schemes for dividing labour tend to drive us back into a state of barbarism. In the principle of co-operation we find a complete argument against all schemes for dividing land into small portions, or for dividing men into small societies; and this is, at the present time, a conclusion of great practical value.

4. In that early stage of society, when the number of people is very scanty in proportion to land, when there is far more land than suffices for the support of all the people, and every one, therefore, may readily obtain some land of his own, if every one indulges a propensity to own and cultivate land, as has generally been the case, all the labour of the community must be divided into fractions equal to the number of families. Under such a state of things, there could be little or no surplus produce, scarce any division of employments, and little or no exchange. What then would happen? Such a society would make no progress in wealth, unless it should hit

upon some method of combining the labour of many hands in those operations, at least, which one man cannot perform. But we suppose that no one member of this society is willing to work in combination with any other member, because all of them are engaged in cultivating their own separate pieces of land. No one of them can persuade any of the others to work along with him. But some of them are stronger than others; and where persuasion fails, they can use force. He who could not entice others to work with him, now compels them to work for him; slavery is established, and, together with that monstrous evil, the great advantage of combination of labour. However shocking the means, the end obtained was good; more productive labour; surplus produce; the accumulation of capital, and the division of employments; and exchange, not only amongst each body of workmen, but amongst the different bodies. All nations, or nearly all, accordingly, have undergone the state of slavery, sometimes making slaves of the people of the country, sometimes obtaining slaves by means either of purchase from other nations, or of war; and it is equally remarkable that wherever population has increased so as to render land scarce, so as to provide for the combination of free labour, slavery has either assumed a very mild form, or has been wholly abolished. It is also remarkable that slavery was revived in America by nations which had lately abolished it in Europe. Bodies of emigrants from Spain, England, and other European countries, set-

tled in America, and took possession, in every case, of such a quantity of land, that there was enough, and more than enough, for all the settlers. With such abundance of land that every one could readily obtain a piece for himself, there would have been little combination of labour amongst those people, if they had not obtained slaves who might be compelled to help each other. All of those bodies of settlers did obtain slaves of one sort or other; either red men, the natives of the country, or black men purchased in Africa, or criminals transported from Europe, or Europeans not criminals, who were kidnapped and sold like the black natives of Africa. In America, no commodity of which the production requires the constant employment of many hands in the same work, or admits of much division of employments, such as rice, cotton, tobacco, and sugar, has ever been raised in large quantities except by the combined labour of slaves. The colonizers of America, our feudal ancestors, and the Jews of old, had one and the same motive for permitting the institution of slavery. In Europe, except in those parts where land is still extremely cheap, that motive has ceased to operate; but in America, where land is nearly as cheap as ever, the number of slaves continues to increase as fast as the number of freemen. In the United States of North America alone, the number of slaves is computed to be two millions, which number, supposing each slave to be worth upon the average sixty pounds, represents a money value of one hundred and twenty million pounds

sterling. The principle of co-operation explains the origin of slavery, the abolition of slavery in some countries, and the steady progress which slavery is making in others.

This opinion is so very different from one recently expressed by a well-known writer on political economy, that I am tempted to examine his view of the subject.

"*Origin of Slavery.*—A great deal of learning has been employed in tracing the history of slavery, though the subject is still far from being exhausted. It seems most probable, that it originally grew out of a state of war. In rude uncivilized communities, where the passion of revenge acquires a strength unknown in more advanced states of society, captives taken in war are adjudged to belong to the victors, who may either put them to the sword or reduce them to a state of servitude. In antiquity, the ideas of war and slavery are inseparable. Probably, in very remote ages, prisoners were most commonly put to death; but the selfish gradually predominated over the more passionate feelings, and for many ages it was usual to reduce them to the condition of slaves; being either sold by their captors, or employed by them as they might think fit. 'Jure gentium,' says Justinian, 'servi nostri sunt, qui ab hostibus capiuntur*.'"

War was a means, though only one means, let us observe, of obtaining slaves; but what was the

* Professor McCulloch. *Dictionary of Commerce*, p. 960.

motive for employing that means to that end? And the serfship of our ancestors, did that "originally grow out of a state of war"? And what had war to do with the breeding of slaves amongst the ancients? Is it by a state of war that the whites of the North American slave-states are induced to breed slaves, so as to increase the whole number of slaves at the rate of about sixty thousand a-year, and that others are induced to buy that increase for about three million six hundred thousand pounds sterling a-year? During a period of eighty-six years, six hundred and ten thousand African slaves have been imported into the island of Jamaica alone; and recently, during three years, one hundred and fifty thousand negroes are said to have been transported from Africa to Brazil: was it the African wars in which those slaves were made prisoners, that caused this supply of labour for the Jamaica and Brazilian planters? or did the urgent want of labourers in Jamaica and Brazil cause the wars in Africa? In ancient times the cases are without end, wherein a state of war "originally grew out" of the desire to obtain slaves for use or sale. A good part of the commerce of the states of ancient Greece, and of the colonies which they planted in Sicily and Asia Minor, consisted of a slave-trade. As for Justinian, if he had explained the object of the international law of slavery, instead of merely stating what the law was, he might have been quoted to some sort of purpose. But at all events, Professor McCulloch may well say, that this subject is far from being exhausted. He has writ-

ten at great length on the evils which result from the minute division of landed property in France: if he had ascertained in what way, by what process it is, that the minute division of property in land renders labour weak and unproductive; if he had seen that the grand evil of a minute division of land, is a minute division of labour, and that in countries where land is very cheap, free labour is apt to be minutely divided, but is more readily combined as land becomes dearer, he would not, probably, have been at a loss to account for the origin, the total or partial abolition, and the actual progress of slavery in different parts of the world.

Supposing it to be true that great cheapness of land, by enabling every freeman to obtain land of his own, furnishes a motive for establishing and maintaining slavery, for the sake of the manifold advantages which are derived from combination of labour, then, from the above inquiry, we may draw this important conclusion: that in countries where land is very cheap, slavery, though it may be legally abolished, will not be replaced by the combined labour of freemen, unless means be found to enhance the price of land. If the negroes of the British West Indies, as soon as they shall be set entirely free, are permitted to divide their labour in the cultivation of separate pieces of ground, as numerous as the labourers, all, or nearly all, the production of those countries, over and above what supports the producers, must necessarily cease; and we shall only have substituted eight hundred thousand savages

for the same number of slaves. In the United States, the great cheapness of land which gives occasion to slavery,—which causes a steady increase of the number of slaves, in equal proportion to the increase of freemen wanting to employ combined labour,—arises from the very low price at which Congress disposes of new land in the western wilderness. The means then by which to prevent the abolition of slavery in the West Indies from putting an end to the surplus production of those countries, and the means of abolishing slavery in the United States, without putting an end to employments which require the constant and combined labour of many hands; the means to both of these very useful ends, are to be found in the principle of co-operation.

Those who have gone along with me in condemning Adam Smith's misapplication of the term "division of labour," will see that this is an error which runs through the present chapter, except when it is interrupted by the use of other terms to express what he generally means by that improper one. Thus the chapter displays the further error of confusion. It is to the confusion of ideas on the subject introduced by these errors, that we must attribute the author's oversight in neglecting to lay a foundation for his beautiful illustrations of the principle of division of employments, and to point out the real evils of division of labour. In the two next chapters, indeed, he endeavours to show that the

division of employments arises from a certain propensity in men to exchange one thing for another, and he proves that division of employments is limited by the extent of the market; but all this leaves untouched the principle of co-operation; of that combination of means for a common end, which provides surplus produce for exchange, opens the way for the division of employments, and causes surplus produce, when still further increased by that division of employments, to be exchanged at market. Not obtaining a clear sight of this good principle, it was but natural that our author, with all his sagacity, should fail to perceive the bad effects which the division of labour sometimes occasions to very advanced societies. Such are the main points in which the present chapter seems to be defective as a disquisition on the causes of "the greatest improvement in the productive powers of labour." The deficiency has not, as far as I know, been supplied by any writer on the *production* of wealth; but it must be carefully supplied before we have anything like a perfect treatise on that branch of political economy*.

* Mr. Poulett Scrope, in his recent work, on the '*Principles of Political Economy*,' while he acknowledges the principle of combination, yet retains the word division, so as to produce an almost ludicrous contradiction of terms. "The first essential," he says, "towards production is labour. To play its part efficiently in this great business, the labour of individuals must be *combined*, or, in other words, the labour required for producing certain results must be *divided* among several individuals. * * * The system of the *division of labour* might be equally called the *combination of labour*, since

its effect is the co-operation of many labourers to produce a common result."

There is no such reason for using division and combination as synonymous terms; for co-operation is not the effect of, but actually *is*, combination of labour. This is a good example of the confusion of ideas produced by the habit of calling division of employments "division of labour." In what follows, however, the idea of combination is most happily expressed.

"In fact, wherever this system (division of employments) has made any considerable progress, the society assumes emphatically a co-operative character. Every member is dependent on the aid of others in everything that he does, and for everything that he enjoys. The ploughman cannot turn a furrow without the help of the wheelwright and smith; these can do nothing without that of the timber and iron merchant, the miner, and the smelter. These again must be assisted by the rope-maker, the powder-manufacturer, the engineer, the carrier, and several others; while all depend upon the baker, the mealman, the butcher, the farmer, the grazier, &c. for their supplies of food, and on the tailor, the cotton and cloth weavers, the flax and wool grower, the importer of cotton, &c. for their clothing. All society is, in fact, one closely woven web of mutual dependence, in which every individual fibre gains in strength and utility from its entwinement with the rest."

It will now be seen, that the object with which the word "employments" has been inserted after the word "labour," wherever the term "division of labour" occurs in the text, is to prevent the student in political economy from falling, at the very outset of his career, into a most mischievous confusion of ideas. If, throughout the text, the term "division of employments" were substituted for "division of labour," this chapter would be perfect as a treatise on the former subject, and would be defective only as wanting some explanation of the evils which result from division of labour.

NOTE

On Chapter II. Book I.

The highly ingenious illustrations of the alleged principle, which it is the object of this chapter to establish, have kept out of view some considerations from which it will appear that, in truth, there is no such principle; that division of employments does not arise from a mere trucking propensity in man, but from certain human peculiarities which give occasion to exchange itself.

The wants of every inferior animal are extremely limited. No inferior animal wants more than food and shelter; the quantity and kind of food, and the kind of shelter, being always the same with respect to each race of animals. Bees never want anything more than a hole to live in, and honey to live upon; birds are always content with berries or insects for food, and the same sort of nest for bringing forth their young; fish, cattle, and dogs, do not even require shelter, but their only want is supplied when they obtain as much food as satisfies their hunger. The wants of man, on the contrary, are unlimited. When a man has obtained, of any one thing, or of a number of things, as much as he can himself con-

sume, he desires to possess more, as the means of procuring, what an inferior animal never wants, leisure, distinction, and command over the affections and wills of his fellow-creatures. The wants of man differ also from those of the inferior animals in the infinite variety of objects which they embrace. The wants, or rather appetites, of an inferior animal, being always limited, not only with respect to the quantity of any object desired, but also to one, or at most two or three different objects, are supplied by the operation of an unvarying instinct, which may be termed a propensity; but the wants of man being unlimited, both as to the quantity and diversity of objects desired, and extending to objects which cannot be produced but in different and often very distant places, could not be supplied, unless the productive power of his labour were susceptible of being augmented, both in force and in variety, according to the increase of those wants.

There are many ways in which the produce of human labour may be increased either in quantity or in variety. The most striking of those means are, first, simple and obvious co-operation, as when several men assist each other in doing that which one man cannot do; secondly, the accumulation of capital; thirdly, the invention of tools; fourthly, the taming of wild animals, and the use of them in works of production; fifthly, that complex, and not obvious co-operation, which allows of division of employments and exchange, two other means of augmenting both the quantity and the variety of

the produce of human labour. By the possession of faculties which are peculiar to mankind, such as speech, reason, and invention, men are enabled to adopt all these methods of gratifying a propensity, if so it may be called, which is also peculiar to man; a disposition to procure, not only a variety of objects for the consumption of the individual, but also more than the individual can consume, of a variety of objects, the possession of which excites the admiration, or gives command over the affections and wills of other men.

Some of these means are independent of all the others; some are steps to the employment of others; it is only when in conjunction, that some can be employed with effect. Simple and obvious co-operation, for example, which takes place amongst ants and bees, may be carried on by itself; complex co-operation is an indispensable step, both to division of employments and to exchange; division of employments would be of no use without exchange, and exchange would never be practised without division of employments. But the greater or less dependence of some of these means upon others does not give to any of them the rank of an original cause. Admit that there can be no exchange without some sort of division of employments, still it does not follow that division of employments is the cause of exchange: though there be no division of employments without exchange, it does not follow that exchange is the cause of division of employments. The pin-maker, the baker, and the brewer exchange different

objects; but if we may say that their motive for dividing into three distinct parts the whole work of producing a certain quantity of pins, bread, and beer, is a propensity to exchange different objects, we may also say, that they exchange different objects in order to indulge a propensity for pursuing different occupations. The wine-growers of Portugal, and the makers of hard-ware at Birmingham, separate into distinct parts the whole work of producing wine and hard-ware, and exchange those different productions for one another; but it does not appear that they are moved so to do by a propensity either to pursue different occupations, or to exchange different productions: each party is moved by a desire to obtain two different objects, both of which neither party could procure with so little labour as, when the whole work is divided, suffices to produce both of those objects for both parties. Nay, there are very many cases in which a desire for some object could not be indulged, at whatever cost of labour, without division of employments and exchange. Let us suppose it possible that the nail-makers of Warwickshire should produce port wine as well as nails, still they could not produce tea: their desire for tea could not be gratified except by means of a division of employments and exchange, however little obvious that division, and however roundabout and complicated that exchange, between themselves and the growers of tea in China. Exchange, then, seems to have been adopted by men, not from any propensity to truck and barter, but as

one means, amongst many, of augmenting the quantity and the variety of the produce of labour. The same account precisely may be given of the division of employments.

If the division of employments were the necessary consequence, as Adam Smith represents it to be, of an instinct common to all men, the wealth of all nations would be equal in proportion, and at all times the same. But some nations are very much richer than others; and national wealth decreases at one time, and increases at another. The supposed propensity to truck and barter affords no explanation of the different degrees of wealth enjoyed by various nations, and by the same nation at different times: whereas a complete explanation of these differences is to be found in the principle that man's peculiar wants and faculties concur in giving occasion to the adoption of several means, of which the division of employments is one, and exchange another, for increasing the quantity and the variety of the produce of labour. Acknowledging this principle, we see the effect of laws, and, let us add, of wars and revolutions, upon industry; how the sure and quiet possession of the produce of labour strengthens the desire for obtaining more and more of that produce; how obstacles to exchange, interposed by war, or by ignorant power, cramp one of the chief means by which labour is rendered more productive; and how the discovery of America, and of such new objects of desire as sugar, cotton, and tobacco, has changed

the face of the greater part of Europe. From this principle we may also draw a conclusion, which would be wholly shut out by the supposition, that the only object of men in dividing their employments, is to gratify a trucking disposition; the conclusion, that the productive powers, and therefore the enjoyments of mankind, are susceptible of indefinite augmentation.* The next chapter relates to one of the circumstances on which the increase of those powers and enjoyments closely depends.

* It is only the multiplication of the *kinds* of wants, which renders the passion for wealth unlimited. The wants of savages, for example, are confined to a few of the most necessary articles, such as food and clothing; and of these they have not a sufficiency. Supposing, however, for a moment, that the catalogue of their wants could remain invariable, it is not difficult to conceive the means by which their existing wants might be fully gratified. They might be fed to satiety, and clothed to satiety; and thus (all new wants being excluded by the hypothesis) the final sum of the wealth would be reached, and all further production would be useless. The same would be true of more civilized societies, were their wants in like manner limited to any determinate number. If no books of any other description had ever been wanted, than such as existed at the time when printing was invented, this art might soon have multiplied copies to a degree fully adequate to the supply of all. The same is true of every other particular commodity; and thus it is the *infinite variety of wants*, and of the *kinds* of commodities necessary to their gratification, which alone renders the passion for wealth indefinite and insatiable.—*Lecture on the Notion of Value;* by the Rev. W. F. Lloyd.

NOTE

On Chapter III. Book I.

In this chapter, Adam Smith, though without being aware of it, recognizes and illustrates the principle of combination of labour.

A village affords no market for labour in the employment of carrying goods, because a porter could not there find any one willing and able to join with him in a division of employments. In a town, he finds a market for his labour; that is, he finds one or more persons willing and able to join with him in a division of employments. A town is only a concentration of villages; a more striking example than a village of that combination of labour which is indispensable to the division of employments.

Why do not "such situations as the lone houses of very small villages which are scattered about in so desert a country as the Highlands of Scotland," afford a market for labour in the separate employments of the butcher, baker, brewer, smith, carpenter, and mason? Because, it seems evident, the people are so much separated from each other by distance, that the combination of their labour for a more perfect division of employments than takes

place amongst them, is quite impossible. Their labour being divided by the separation of the workmen, each workman combines as many operations as he has time for, after raising the means of his own subsistence. Their employments are not divided, because their labour is.

Water-carriage is so very advantageous, only because it gives opportunity for combination of labour and division of employments amongst those who reside in distant places. The term "division of labour," let us repeat once more, and for the last time, really expresses a state of things which precludes division of employments.

The proposition at the head of this chapter, however true and important, does not express all the influence which belongs to the power of exchanging. The increased dexterity, the saving of time, and the invention of machines, which result from division of employments, though the greatest, are not the only improvements in the productive powers of labour. Labour is more or less productive in proportion to the energy of the labourers, as well as in proportion to the extent to which employments are divided. Some nations excel others quite as much in the energy with which they work, as in the division of their employments. Some are what we call industrious; some remarkable for their laziness; and this difference in the energy of labour often occurs between people who inhabit different parts of the same country. In whatever employment, an Eng-

lishman will, speaking generally, work twice as hard as a Portuguese, and for a much greater number of hours in the course of a week. The inhabitants of the north of France are allowed to be much more industrious than those of the south. If we may speak of England and Ireland as the same country, every one who has compared the habits of the Irish and English peasantry with respect to industry, must have observed another example of different degrees of energy in the labour of the same people. Such differences in the energy of labour,—in the spirit with which work is performed, and the time devoted to labour,—are evidently one cause, and a very important one, of the different degrees of wealth in different countries, and in different parts of the same country.

This energy of labour appears to be limited, quite as much as the division of employments, by the power of exchanging. The means of mere subsistence may generally be provided with a very moderate degree of exertion. Why, then, does any one ever exceed that moderate degree of exertion which is sufficient to maintain him? No one ever does so, except with a view to obtaining some object or objects over and above the means of subsistence. But such objects can generally be obtained no otherwise than by means of exchange. In order to obtain them, he who has produced enough for his own subsistence, must produce something more, so as to have the means of purchasing those other objects. But unless those other objects have been produced, and

are pretty sure to be brought to market, he who has produced enough for his own subsistence has no motive for producing more; he has no motive for making any exertion beyond what suffices to maintain him. The energy of labour, therefore, without regard to the division of employments, is limited by the power of exchanging. "The apathy and languor," says Professor Mc Culloch*, "that exist in a rude state of society have been universally remarked. But these uniformly give place to activity and enterprise, according as man is rendered familiar with new objects, and is inspired with a desire to obtain them. An individual might, with comparatively little exertion, furnish himself with an abundant supply of the commodities essential to his subsistence; and if he had no desire to obtain others, or if that desire, however strong, *could not be gratified*, it would be folly to suppose that he should be laborious, inventive, and enterprising." The Irish peasant, while living among peasants like himself, who are all engaged in the very same mode of production, has but small opportunities of exchanging the surplus produce of his labour, supposing that he should raise any. He therefore produces no more than is required for his own family, and is remarkable for his "apathy and languor." He goes to London, finds himself in the midst of a vast market, where labour, or the produce of labour, may be readily exchanged for a great variety of objects, and

* *Dictionary of Commerce.*

immediately becomes one of the most laborious of human beings. The labour of an Irish coal-heaver or paviour in London, whose labour, when he was without the means of exchanging, did but just suffice to maintain his family, would, if applied to agriculture, produce enough for the maintenance of perhaps half-a-dozen families.

The energy of labour as well as the division of employments, — the wealth of individuals and of nations,—being limited by the power of exchanging, a question of the greatest interest occurs: what are the circumstances on which the power of exchanging chiefly depends?

The power of exchanging seems to depend upon a great number of circumstances. Adam Smith has noticed only two of them, viz., the facilities afforded by water-carriage, and by the use of money. No other writer, as far as I know, has noticed all of them. A sufficient notice of all of them, supposing that they have all been discovered, would almost convert this commentary into, what I am far from intending it to be, a treatise on the principles of political economy. A profound thinker and powerful reasoner attaches so much importance to those circumstances, that he has proposed to call the science of political economy the *Science of Exchanges**. Let us hope that he may yet employ his great talents in giving an account of all those circumstances.

* Dr. Whately. See his *Introductory Lectures on Political Economy.*

Meanwhile, one of them appears to exert so peculiar and vast an influence on the production of wealth, that I am tempted to seize this opportunity for saying a few words concerning it.

Human labour is engaged in two grand classes of employments; those which relate to the means of subsistence, and those which promote enjoyments over and above the means of subsistence. If all the objects enjoyed by mankind were divided into two classes,—those which are indispensable to existence, and those which are not,—the list of comforts and luxuries would be found much more numerous than the list of necessaries; and the same result would be obtained by a comparison of the two classes of employments. Moreover, a great, if not the greater part of the exchanges which take place in the world, consist of the exchange of objects which are indispensable to existence, for those which are not. Now, a very brief inquiry will show that the production of all comforts and luxuries, the pursuit of all the different employments concerned in that production, and all the exchanges of necessary objects for objects which are not necessary, wholly depend on the productiveness of labour in employments which relate to the means of subsistence.

Before any one can engage in the production of comforts or luxuries, he must be assured of the means of subsistence. If no one of those who are engaged in raising food, could produce more than enough for his own family, nothing beyond the means of subsistence could be anywhere produced.

It is the surplus produce of agriculture, beyond what maintains the producers, that provides the means of subsistence for persons not engaged in agriculture. What proportion, therefore, of the people in any society shall engage in employments which relate to comforts and luxuries, depends upon the productiveness of agricultural industry. One-third of the people of England, it has been already observed, raise food for the whole; so that two-thirds are set free to engage in other occupations; while, in France, only one-third can engage in employments which relate to comforts and luxuries, because two-thirds are occupied in raising food for the whole number. In Portugal, it has been reckoned, four-fifths of the people are engaged in agriculture: if so, only one-fifth remains to engage in other pursuits. The superiority of the English over the French and Portuguese with respect to the power of exchanging, obviously arises from the greater productiveness of their agriculture.

The productiveness of agriculture appears to depend upon two different circumstances; upon the natural fertility of soil and climate, and upon the degree of skill with which labour is applied to agriculture. With a very unfruitful soil and climate, the utmost skill will not raise a large surplus produce; nor will the most fruitful soil and climate yield a large surplus produce to very unskilful labour. Good examples of these extreme cases are furnished by the smallness of the produce, in proportion to the number of labourers, raised by very skil-

ful labour on the poorest soils of England, and the smallness of the produce, always in proportion to the number of labourers, raised by very unskilful, because much divided labour, on the rich virgin soils of Canada. But these extreme cases are noticed only for the purpose of showing that, in every case, the nature of the soil and climate from which a society derive their means of subsistence, and the degree of skill with which they apply their labour to agriculture, must, taken together, determine the extent of their power to engage in the production of comforts and luxuries, and, therefore, in great measure, the extent of their power of exchanging. It is by means of superior skill in the application of labour to agriculture, that England enjoys a greater power of exchanging than Portugal or France. On the other hand, the influence of soil and climate affords perhaps, a better explanation than that which has been given by Adam Smith, of the early improvement of Egypt, Bengal, and some provinces of China, and of the barbarous and uncivilized state, in all ages of the world, of the parched interior of Africa, and the frozen regions of the north of Asia.

Soil and climate are beyond the control of man; but not so the degree of skill with which labour is applied to agriculture. In France and Ireland, certain tenures of land tend, as we have seen already, to prevent that simple combination of labour, and that complex combination of labour for division of employments, to which England owes her great superiority in agriculture. The produce of agriculture,

in proportion to the hands at work, is greatly augmented by a complete separation of that employment from all other employments, and a division of that employment into many distinct parts. Considering the influence on the power of exchanging, of the proportion between the produce of agriculture and the number of hands at work, it would seem to follow that the converse of the proposition at the head of this chapter is not less true than the proposition itself; that while division of employments is limited by the extent of the market, the extent of the market is, in great measure, at least, limited by the division of employments.

Adam Smith, himself, would not have objected to this conclusion; for in his chapter on what he calls the division of labour, he says, "It is the great multiplication of the productions of all the different arts, *in consequence of* the division of labour, which occasions, in a well-governed society, that universal opulence which extends itself to the lowest ranks of the people. Every workman has a great quantity of his own work to dispose of beyond what he himself has occasion for; and every other workman being exactly in the same situation, he is *enabled to exchange* a great quantity of his own goods for a great quantity, or, what comes to the same thing, for the price of a great quantity of theirs. He *supplies them abundantly* with what they have occasion for, and they *accommodate him as amply* with what he has occasion for, and a general plenty diffuses itself through all the ranks of the society."

There is nothing contradictory in the conclusion thus supported by Adam Smith. As, in walking, the use of either leg depends on the use of the other, so, in political economy, the division of employments and the power of exchanging are mutually dependent means of increasing human enjoyments. At the same time, however, it must be confessed, that the power of exchanging has not been thoroughly analyzed by any writer on the subject. Of what elements that complex power is composed, and by what circumstances it is apt to be increased or diminished; these are questions which would occupy much space in a complete treatise on the principles of political economy.*

* The influence of the productiveness of agriculture on the power of exchanging, is thus forcibly described by Dr. Chalmers :—" Here, however, we cannot refrain from observing the connexion which obtains between the state of the soil, and the state of human society. Had no ground yielded more in return for the labour expended on it, than the food of the cultivators and their secondaries, the existence of one and all of the human race would have been spent in mere labour. Every man would have been doomed to a life of unremitting toil for his bodily subsistence; and none could have been supported in a state of leisure, either for idleness or for other employments than those of husbandry, and such coarser manufactures as serve to provide society with the secondary necessaries of existence. The species would have risen but a few degrees, whether physical or moral, above the condition of mere savages. It is just because of a fertility in the earth, by which it yields a surplus produce over and above the food of direct and secondary labourers, that we can command the services of a disposable population, who, in return for their

maintenance, minister to the proprietors of this surplus all the higher comforts and elegancies of life. It is precisely to this surplus that we owe it, that society is provided with more than a coarse and bare supply for the necessities of animal nature. It is the original fund out of which are paid the expenses of art, and science, and civilization, and luxury, and law, and defence, and all, in short, that contributes to strengthen and to adorn the commonwealth. Without this surplus, we should have had but an agrarian population,—consisting of husbandmen, and those few homely and rustic artificers, who, scattered in hamlets over the land, would have given their secondary services to the whole population. It marks an interesting connexion between the capabilities of the soil and the condition of social life, that to this surplus we stand indispensably indebted for our crowded cities, our thousand manufactories for the supply of comforts and refinements to society, our wide and diversified commerce, our armies of protection, our schools and colleges of education, our halls of legislation and justice, even our altars of piety and temple services."

In this passage, the productiveness of agriculture is supposed to be in proportion to the natural fertility of land; a supposition contradicted by what happens in Canada and the United States, where the land is much richer, but the disposable population much smaller than in England. The cause of a large disposable population is great productiveness of agriculture; but the chief cause of the superior productiveness of agriculture seems to be not the superior natural fertility of land, but the superior power of agricultural industry, arising from greater combination of labour and division of employments.

John Stuart Mill (1806-1873)

Principles of Political Economy [1848]

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Principles of Political Economy

with Some of Their Applications to Social Philosophy

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CHAPTER VIII

Of Co-operation, or the Combination of Labour

§ 1. [*Combination of Labour a principal cause of superior productiveness*] In the enumeration of the circumstances which promote the productiveness of labour, we have left one untouched, which, because of its importance, and of the many topics of discussion which it involves, requires to be treated apart. This is, co-operation, or the combined action of numbers. Of this great aid to production, a single department, known by the name of Division of Labour, has engaged a large share of the attention of political economists; most deservedly indeed, but to the exclusion of other cases and exemplifications of the same comprehensive law. Mr. Wakefield was, I believe, the first to point out, that a part of the subject had, with injurious effect, been mistaken for the whole; that a more fundamental principle lies beneath that of the division of labour, and comprehends it.

Co-operation, he observes,* is "of two distinct kinds: first, such co-operation as takes place when several persons help each other in the same employment; secondly, such co-operation as takes place when several persons help each other in different employments. These may be termed Simple Co-operation and Complex Co-operation.

"The advantage of simple co-operation is illustrated by the case of two greyhounds running together, which, it is said, will kill more hares than four greyhounds running separately. In a vast number of simple operations performed by human exertion, it is quite obvious that two men working together will do more than four, or four times four men, each of whom should work alone. In the lifting of heavy weights, for example, in the felling of trees, in the sawing of timber, in the gathering of much hay or corn during a short period of fine weather, in draining a large extent of land during the short season when such a work may be properly conducted,

*Note to Wakefield's edition of Adam Smith, vol. i. p. 26[–8]. [Smith, Adam. *An Inquiry into the Nature and Causes of the Wealth of Nations*. With a Commentary by the Author of "England and America" [E. G. Wakefield]. 6 vols. London: Knight, 1835.]

in the pulling of ropes on board ship, in the rowing of large boats, in some mining operations, in the erection of a scaffolding for building, and in the breaking of stones for the repair of a road, so that the whole of the road shall always be kept in good order: in all these simple operations, and thousands more, it is absolutely necessary that many persons should work together, at the same time, in the same place, and in the same way. The savages of New Holland never help each other, even in the most simple operations; and their condition is hardly superior, in some respects it is inferior, to that of the wild animals which they now and then catch. Let any one imagine that the labourers of England should suddenly desist from helping each other in simple employments, and he will see at once the prodigious advantages of simple co-operation. In a countless number of employments, the produce of labour is, up to a certain point, in proportion to such mutual assistance amongst the workmen. This is the first step in social improvement." The second is, when "one body of men having combined their labour to raise more food than they require, another body of men are induced to combine their labour for the purpose of producing more clothes than they require, and with those surplus clothes buying the surplus food of the other body of labourers; while, if both bodies together have produced more food and clothes than they both require, both bodies obtain, by means of exchange, a proper capital for setting more labourers to work in their respective occupations." To simple co-operation is thus superadded what Mr. Wakefield terms Complex Co-operation. The one is the combination of several labourers to help each other in the same set of operations; the other is the combination of several labourers to help one another by a division of operations.

There is "an important distinction between simple and complex co-operation. Of the former, one is always conscious at the time of practising it: it is obvious to the most ignorant and vulgar eye. Of the latter, but a very few of the vast numbers who practise it are in any degree conscious. The cause of this distinction is easily seen. When several men are employed in lifting the same weight, or pulling the same rope, at the same time, and in the same place, there can be no sort of doubt that they co-operate with each other; the fact is impressed on the mind by the mere sense of sight; but when several men, or bodies of men, are employed at different times and places, and in different pursuits, their co-operation with each other, though it may be quite as certain, is not so readily perceived as in the other case: in order to perceive it, a complex operation of the mind is required."[*]

In the present state of society the breeding and feeding of sheep is the occupation of one set of people, dressing the wool to prepare it for

[**Wealth of Nations*, ed. Wakefield, I, 30.]

the spinner is that of another, spinning it into thread of a third, weaving the thread into broadcloth of a fourth, dyeing the cloth of a fifth, making it into a coat of a sixth, without counting the multitude of carriers, merchants, factors, and retailers, put in requisition at the successive stages of this progress. All these persons, without knowledge of one another or previous understanding, co-operate in the production of the ultimate result, a coat. But these are far from being all who co-operate in it; for each of these persons requires food, and many other articles of consumption, and unless he could have relied that other people would produce these for him, he could not have devoted his whole time to one step in the succession of operations which produces one single commodity, a coat. Every person who took part in producing food or erecting houses for this series of producers, has, however unconsciously on his part, combined his labour with theirs. It is by a real, though unexpressed, concert, "that the body who raise more food than they want, can exchange with the body who raise more clothes than they want; and if the two bodies were separated, either by distance or disinclination—unless the two bodies should virtually form themselves into one, for the common object of raising enough food and clothes for the whole—they could not divide into two distinct parts the whole operation of producing a sufficient quantity of food and clothes."[*]

§ 2. [*Effects of separation of employments analyzed*] The influence exercised on production by the separation of employments, is more fundamental than, from the mode in which the subject is usually treated, a reader might be induced to suppose. It is not merely that when the production of different things becomes the sole or principal occupation of different persons, a much greater quantity of each kind of article is produced. The truth is much beyond this. Without some separation of employments, very few things would be produced at all.

Suppose a set of persons, or a number of families, all employed [a]precisely in[a] the same manner; each family settled on a piece of its own land, on which it grows by its labour the food required for its own sustenance, and as there are no persons to buy any surplus produce where all are producers, each family [b]has to[b] produce within itself whatever other articles it consumes. In such circumstances, if the soil was tolerably fertile, and population did not tread too closely on the heels of subsistence, there would be, no doubt, some kind of domestic manufactures; clothing for the family might perhaps be spun and woven within it, by the labour probably of the women (a first step in the separation of employments); and a dwelling of some sort would be erected and kept in repair by their united labour.

[**Wealth of Nations*, ed. Wakefield, I, 29.]

[a–a]MS, 48, 49, 52, 57 in precisely [b–b]MS must

But beyond simple food (precarious, too, from the variations of the seasons), coarse clothing, and very imperfect lodging, it would be scarcely possible that the family should produce anything more. They would, in general, require their utmost exertions to accomplish so much. Their power even of extracting food from the soil would be kept within narrow limits by the quality of their tools, which would necessarily be of the most wretched description. To do almost anything in the way of producing for themselves articles of convenience or luxury, would require too much time, and, in many cases, their presence in a different place. Very few kinds of industry, therefore, would exist; and that which did exist, namely the production of necessaries, would be extremely inefficient, not solely from imperfect implements, but because, when the ground and the domestic industry fed by it had been made to supply the necessaries of a single family in tolerable abundance, there would be little motive, while the numbers of the family remained the same, to make either the land or the labour produce more.

But suppose an event to occur, which would amount to a revolution in the circumstances of this little settlement. Suppose that a company of artificers, provided with tools, and with food sufficient to maintain them [c]for[c] a year, arrive in the country and establish themselves in the midst of the population. These new settlers occupy themselves in producing articles of use or ornament adapted to the taste of a simple people; and before their food is exhausted they have produced these in considerable quantity, and are ready to exchange them for more food. The economical position of the landed population is now most materially altered. They have an opportunity given them of acquiring comforts and luxuries. Things which, while they depended solely on their own labour, they never could have obtained, because they could not have produced, are now accessible to them if they can succeed in producing an additional quantity of food and necessaries. They are thus incited to increase the productiveness of their industry. Among the conveniences for the first time made accessible to them, better tools are probably one: and apart from this, they have a motive to labour more assiduously, and [d]to[d] adopt contrivances for making their labour more effectual. By these means they will generally succeed in compelling their land to produce, not only food for themselves, but a surplus for the new comers, wherewith to buy from them the products of their industry. The new settlers constitute what is called a *market* for surplus agricultural produce: and their arrival has enriched the settlement not only by the manufactured [e]article[e] which they produce, but by the food which would not have been produced unless they had been there to consume it.

[c–c]+48, 49, 52, 57, 62, 65, 71
[d–d]+57, 62, 65, 71
[e–e]MS, 48, 49, 52, 57, 62 articles

There is no inconsistency between this doctrine, and the [f]proposition we before maintained[f], that a market for commodities does not constitute employment for labour.* The labour of the agriculturists was already provided with employment; they are not indebted to the demand of the new comers for being able to maintain themselves. What that demand does for them is, to call their labour into increased vigour and efficiency; to stimulate them, by new motives, to new exertions. Neither do the new comers owe their maintenance and employment to the demand of the agriculturists: with a year's subsistence in store, they could have settled side by side with the former inhabitants, and produced a similar scanty stock of food and necessaries. Nevertheless we see of what supreme importance to the productiveness of the labour of producers, is the existence of other producers within reach, employed in a different kind of industry. The power of exchanging the products of one kind of labour for those of another, is a condition, but for which, there would almost always be a smaller quantity of labour altogether. When a new market is opened for any product of industry, and a greater quantity of the article is consequently produced, the increased production is not always obtained at the expense of some other product; it is often a new creation, the result of labour which would otherwise have remained unexerted; or of assistance rendered to labour by improvements or by modes of co-operation to which recourse would not have been had if an inducement had not been offered for raising a larger produce.

§ 3. [*Combination of labour between town and country*] From these considerations it appears that a country will seldom have a productive agriculture, unless it has a large town population, or the only available substitute, a large export trade in agricultural produce to supply a population elsewhere. I use the phrase town population for shortness, to imply a population non-agricultural; which will generally be collected in towns or large villages, for the sake of combination of labour. The application of this truth by Mr. Wakefield to the theory of colonization, has excited much attention, and is doubtless destined to excite much more. It is one of those great practical discoveries, which, once made, appears so obvious that the merit of making them seems less than it is. Mr. Wakefield was the first to point out that the mode of planting new settlements, then commonly practised—setting down a number of families side by side, each on its piece of land, [a] all employing themselves in exactly the same manner,—though [b]in[b] favourable circumstances it may assure to those families a rude

*Supra, pp. 78–88.

[f–f]MS, 48, 49, 52, 57 principle we have laid down
[a]MS, 48, 49, 52, 57 and [b–b]MS, 48 under

abundance of mere necessaries, can never be other than unfavourable to great production or rapid growth: and his system consists of arrangements for securing that every colony shall have from the first a town population bearing due proportion to its agricultural, and that the cultivators of the soil shall not be so widely scattered as to be deprived by distance, of the benefit of that town population as a market for their produce. The principle on which the scheme is founded, does not depend on any theory respecting the [c]superior[c] productiveness of land held in large portions, and cultivated by hired labour. Supposing it true that land yields the greatest produce when divided into small properties and cultivated by peasant proprietors, a town population [d]will[d] be just as necessary to induce those proprietors to raise that larger produce: and if they were too far from the nearest seat of non-agricultural industry to use it as a market for disposing of their surplus, and thereby supplying their other wants, neither that surplus nor any equivalent for it would, generally speaking, be produced.

It is, above all, the deficiency of town population which limits the productiveness of the industry of a country like India. The agriculture of India is conducted entirely on the system of small holdings. There is, however, a considerable amount of combination of labour. The village institutions and customs, which are the real framework of Indian society, make provision for joint action in the cases in which it is seen to be necessary; or where they fail to do so, the government (when tolerably well administered) steps in, and by an outlay from the revenue, executes by combined labour the tanks, embankments, and works of irrigation, which are indispensable. The implements and processes of agriculture are however so wretched, that the produce of the soil, in spite of great natural fertility and a climate highly favourable to vegetation, is miserably small: and the land might be made to yield food in abundance for many more than the present number of inhabitants, without departing from the system of small holdings. But to this the stimulus is wanting, which a large town population, connected with the rural districts by easy and unexpensive means of communication, would afford. That town population, again, does not grow up, because the few wants and unaspiring spirit of the cultivators (joined until lately with great insecurity of property, from military and fiscal rapacity) prevent them from attempting to become consumers of town produce. In these circumstances the best chance of an early development of the productive resources of India, consists in the [e] rapid growth of its export of agricultural produce (cotton, indigo, sugar, coffee, &c.) to the markets of Europe. The producers of these articles are consumers of food

[c–c]48 inferior [*printer's error?*]
[d–d]MS, 48, 49, 52, 57, 62, 65 would
[e]MS, 48, 49 now

supplied by their fellow-agriculturists in India; and the market thus opened for surplus food will, if accompanied by good government, raise up by degrees more extended wants and desires, directed either towards European commodities, or towards things which will require for their production in India a larger manufacturing population.

§ 4. [*The higher degrees of the division of labour*] Thus far of the separation of employments, a form of the combination of labour without which there cannot be the first rudiments of industrial civilization. But when this separation is thoroughly established; when it has become the general practice for each producer to supply many others with one commodity, and to be supplied by others with most of the things which he consumes; reasons not less real, though less imperative, invite to a further extension of the same principle. It is found that the productive power of labour is increased by carrying the separation further and further; by breaking down more and more every process of industry into parts, so that each labourer shall confine himself to an ever smaller number of simple operations. And thus, in time, arise those remarkable cases of what is called the division of labour, with which all readers on subjects of this nature are familiar. Adam Smith's illustration from pin-making, though so well known, is so much to the point, that I will venture once more to transcribe it. "The business of making a pin is divided into about eighteen distinct operations. [a] One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on, is a peculiar business; to whiten the pins is another; it is even a trade by itself to put them into the paper. . . . . I have seen a small manufactory where ten men only were employed, and where some of them, consequently, performed two or three distinct operations. But though they were very poor, and therefore but indifferently accommodated with the necessary machinery, they could, when they exerted themselves, make among them about twelve pounds of pins in a day. There are in a pound upwards of four thousand pins of a middling size. Those ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day. Each person, therefore, making a tenth part of forty-eight thousand pins, might be considered as making four thousand eight hundred pins in a day. But if they had all wrought separately and independently, and without any of them having been educated to this peculiar business, they certainly could not each of them have made twenty, perhaps not one pin in a day."[*]

[* *Wealth of Nations*, ed. Wakefield, I, 8.]

[a]MS [*ellipsis indicated by*] . .

M. Say furnishes a still stronger example of the effects of division of labour—from a not very important branch of industry certainly, the manufacture of playing cards. "It is said by those engaged in the business, that each card, that is, a piece of pasteboard of the size of the hand, before being ready for sale, does not undergo fewer than seventy [b] operations,* every one of which might be the occupation of a distinct class of workmen. And if there are not seventy classes of work-people in each card manufactory, it is because the division of labour is not carried so far as it might be; because the same workman is charged with two, three, or four distinct operations. The influence of this distribution of [c]employment[c] is immense. I have seen a card manufactory where thirty workmen produced daily fifteen thousand five hundred cards, being above five hundred cards for each labourer; and it may be presumed that if each of these workmen were obliged to perform all the operations himself, even supposing him a practised hand, he would not perhaps complete two cards in a day: and the thirty workmen, instead of fifteen thousand five hundred cards, would make only sixty."[*]

* "Ce ne sont point les mêmes ouvriers qui préparent le papier dont on fait les cartes, ni les couleurs dont on les empreint; et en ne fesant attention qu'au seul emploi de ces matières, nous trouverons qu'un jeu de cartes est le résultat de plusieurs opérations dont chacune occupe une série distincte d'ouvriers et [Source, MS d'ouvriers ou] d'ouvrières qui s'appliquent toujours à la même opération. Ce sont des personnes différentes, et toujours les mêmes, qui épluchent les bouchons et grosseurs qui se trouvent dans le papier et nuiraient à l'égalité d'épaisseur; les mêmes qui collent ensemble les trois feuilles de papier dont se compose le carton et qui le mettent en presse; [Source, MS, 48, 49, 52, 57 presse; les mêmes qui colorent le coté destiné à former le dos des cartes;] les mêmes qui impriment en noir le dessin des figures; d'autres ouvriers impriment les couleurs des mêmes figures; d'autres font sécher au réchaud les cartons une fois qu'ils sont imprimés; d'autres s'occupent de les lisser dessus et dessous. C'est une occupation particulière que de les couper d'égale dimension; c'en est une autre de les assembler pour en former des jeux; une autre encore d'imprimer les enveloppes des jeux, et une autre encore de les envelopper; sans compter les fonctions des personnes chargées des ventes et des achats, de payer les ouvriers et de tenir les écritures."—Say, *Cours d'Economie Politique*, vol. i. p. 340[–1]. [Say, Jean-Baptiste. *Cours complet d'économie politique pratique; ouvrage destiné à mettre sous les yeux des hommes d'état, des propriétaires fonciers et des capitalistes, des savans, des agriculteurs, des manufacturiers, des négocians, et en général de tous les citoyens, l'économie des sociétés.* Tome premier. Paris: Rapilly, 1828.]

It is a remarkable proof of the economy of labour occasioned by this minute division of occupations, that an article, the production of which is the result of such a multitude of manual operations, can be sold for a trifling sum.

[**Translated from* ibid., I, 341.]

[b]Source, MS different

[c–c]Source, MS, 48, 49, 52, 57, 62 employments

In watchmaking, as Mr. Babbage observes, "it was stated in evidence before a Committee of the House of Commons, that there are a hundred and two distinct branches of this art, to each of which a boy may be put apprentice; and that he only learns his master's department, and is unable, after his apprenticeship has expired, without subsequent instruction, to work at any other branch. The watch-finisher, whose business [d]it[d] is to put together the scattered parts, is the only one, out of the hundred and two persons, who can work in any other department than his own."*

§ 5. [*Analysis of the advantages of the division of labour*] The causes of the increased efficiency given to labour by the division of employments are some of them too familiar to require specification; but it is worth while to attempt a complete enumeration of them. By Adam Smith they are reduced to three. "First, the increase of dexterity in every particular workman; secondly, the saving of the time which is commonly lost in passing from one species of work to another; and lastly, the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many."[*]

Of these, the increase of dexterity of the individual workman is the most obvious and universal. It does not follow that because a thing has been done oftener it will be done better. That depends on the intelligence of the workman, and on the degree in which his mind works along with his hands. But it will be done more easily. The organs themselves acquire greater power: the muscles employed grow stronger by frequent exercise, the sinews more pliant, and the mental powers more efficient, and less sensible of fatigue. What can be done easily has at least a better chance of being done well, and is sure to be done more expeditiously. What was at first done slowly comes to be done quickly; what was at first done slowly with accuracy is at last done quickly with equal accuracy. This is as true of mental operations as of bodily. Even a child, after much practice, sums up a column of figures with a rapidity which resembles intuition. The act of speaking any language, of reading fluently, of playing music at sight, are cases as remarkable as they are familiar. Among bodily acts, dancing, gymnastic exercises, ease and brilliancy of execution on a musical instrument, are examples of the rapidity and facility acquired by repetition. In simpler manual operations the effect is of course still sooner produced. "The rapidity," Adam Smith observes, "with which some of the operations of certain manufactures are performed, exceeds what the human hand could, by those who had never seen them, be supposed capable of

*_Economy of Machinery and Manufactures_, 3rd Edition, p. 201[–2].
[*_Wealth of Nations_, ed. Wakefield, I, 12–3.]

[d–d] +48, 49, 52, 57, 62, 65, 71

acquiring."* This skill is, naturally, attained after shorter practice, in proportion as the division of labour is more minute; and will not be attained in the same degree at all, if the workman has a greater variety of operations to execute than allows of a sufficiently frequent repetition of each. The advantage is not confined to the greater efficiency ultimately attained, but includes also the diminished loss of time, and waste of material, in learning the art. "A certain quantity of material," says Mr. Babbage,† "will in all cases be consumed unprofitably, or spoiled, by every person who learns an art; and as he applies himself to each new process, he will waste some of the raw material, or of the partly manufactured commodity. But if each man commit this waste in acquiring successively every process, the quantity of waste will be much greater than if each person confine his attention to one process." And in general each will be much sooner qualified to execute his one process, if he be not distracted while learning it, by the necessity of [a]learning[a] others.

The second advantage enumerated by Adam Smith as arising from the division of labour, is one on which I cannot help thinking that more stress is laid by him and others than it deserves. To do full justice to his opinion, I will quote his own exposition of it. "The advantage which is gained by saving the time commonly lost in passing from one sort of work to another, is much greater than we should at first view be apt to imagine it. It is impossible to pass very quickly from one kind of work to another, that is carried on in a different place, and with quite different tools. A country weaver, who cultivates a small farm, must lose a good deal of time in passing from his loom to the field, and from the field to his loom. When the two trades can be carried on in the same workhouse, the loss of time is no doubt much less. It is even in this case, however, very considerable. A man commonly saunters a little in turning his hand from one sort of employment to another. When he first begins the new work, he is seldom very

*[*Ibid.*, I, 14.] [49] "In astronomical observations, the senses of the operator are rendered so acute by habit, that he can estimate differences of time to the tenth of a second; and adjust his measuring instrument to graduations of which five thousand occupy only an inch. It is the same throughout the commonest processes of manufacture. A child who fastens on the heads of pins will repeat an operation requiring several distinct motions of the muscles one hundred times a minute for several successive hours. In a recent Manchester paper it was stated that a peculiar sort of twist or 'gimp,' which cost three shillings making when first introduced, was now manufactured for one penny; and this not, as usually, by the invention of a new machine, but solely through the increased dexterity of the workman."—*Edinburgh Review* for January 1849, p. 81 ["The Progress of Mechanical Invention." *Edinburgh Review*, LXXXIX (Jan., 1849)].

†Page 171.

[a–a]MS, 48, 49, 52 acquiring

keen and hearty; his mind, as they say, does not go to it, and for some time he rather trifles than applies to good purpose. The habit of sauntering and of indolent careless application, which is naturally, or rather necessarily acquired by every country workman who is obliged to change his work and his tools every half hour, and to apply his hand in twenty different ways almost every day of his life, renders him almost always slothful and lazy, and incapable of any vigorous application even on the most pressing occasions."[*] This is surely a most exaggerated description of the inefficiency of country labour, where it has any adequate motive to exertion. Few workmen change their work and their tools oftener than a gardener; is he usually incapable of vigorous application? Many of the higher description of artisans have to perform a great multiplicity of operations with a variety of tools. They do not execute each of these with the rapidity with which a factory workman performs his single operation; but they are, except in a merely manual sense, more skilful labourers, and in all senses whatever more energetic.

Mr. Babbage, following in the track of Adam Smith, says, "When the human hand, or the human head, has been for some time occupied in any kind of work, it cannot instantly change its employment with full effect. The muscles of the limbs employed have acquired a flexibility during their exertion, and those not in action a stiffness during rest, which renders every change slow and unequal in the commencement. Long habit also produces in the muscles exercised a capacity for enduring fatigue to a much greater degree than they could support under other circumstances. A similar result seems to take place in any change of mental exertion; the attention bestowed on the new subject not being so perfect at first as it becomes after some exercise. The employment of different tools in the successive processes, is another cause of the loss of time in changing from one operation to another. If these tools are simple, and the change is not frequent, the loss of time is not considerable; but in many processes of the arts, the tools are of great delicacy, requiring accurate adjustment every time they are used; and in many cases, the time employed in adjusting bears a large proportion to that employed in using the tool. The sliding-rest, the dividing and the drilling engine are of this kind: and hence, in manufactories of sufficient extent, it is found to be good economy to keep one machine constantly employed in one kind of work: one lathe, for example, having a screw motion to its sliding-rest along the whole length of its bed, is kept constantly making cylinders; another, having a motion for equalizing the velocity of the work at the point at which it passes the tool, is kept for facing surfaces; whilst a third is constantly employed in cutting wheels."[†]

[*_Wealth of Nations_, ed. Wakefield, I, 14–5.]
[†Babbage, pp. 171–2.]

I am very far from implying that these different considerations are of no weight; but I think there are counter-considerations which are overlooked. If one kind of muscular or mental labour is different from another, for that very reason it is to some extent a rest from that other; and if the greatest vigour is not at once obtained in the second occupation, neither could the first have been indefinitely prolonged without some relaxation of energy. It is a matter of common experience that a change of occupation will often afford relief where complete repose would otherwise be necessary, and that a person can work many more hours without fatigue at a succession of occupations, than if confined during the whole time to one. Different occupations employ different muscles, or different [b]energies[b] of the mind, some of which rest and are refreshed while others work. Bodily labour itself rests from mental, and conversely. [c]The[c] variety itself has an invigorating effect on what, for want of a more philosophical appellation, we must term the animal spirits; so important to the efficiency of all work not mechanical, and not unimportant even to that. The comparative weight due to these considerations is different with different individuals; some are more fitted than others for persistency in one occupation, and less fit for change; they require longer to get the steam up (to use a metaphor now common); the irksomeness of setting to work lasts longer, and it requires more time to bring their faculties into full play, and therefore when this is once done, they do not like to leave off, but go on long without intermission, even to the injury of their health. Temperament has something to do with these differences. There are people whose faculties seem by nature to come slowly into action, and to accomplish little until they have been a long time employed. Others, again, get into action rapidly, but cannot, without exhaustion, continue long. In this, however, as in most other things, though natural differences are something, habit is much more. The habit of passing rapidly from one occupation to another may be acquired, like other habits, by early cultivation; and when it is acquired, there is none of the sauntering which Adam Smith speaks of, after each change; no want of energy and interest, but the workman comes to each part of his occupation with a freshness and a spirit which he does not retain if he persists in any one part (unless in case of unusual excitement) beyond the length of time to which he is accustomed. Women are usually (at least in their present social circumstances) of far greater versatility than men; and the present topic is an instance among multitudes, how little the ideas and experience of women have yet counted for, in forming the opinions of mankind. There are few women who would not reject the idea that work is made vigorous by being protracted, and is inefficient for some time after changing to a new thing. Even in this case, habit, I believe, much more than nature, is

[b–b]MS, 48, 49, 52, 57 faculties [c–c]MS, 48, 49 Even the

the cause of the difference. The occupations of nine out of every ten men are special, those of nine out of every ten women general, embracing a multitude of details, each of which requires very little time. Women are in the constant practice of passing quickly from one manual, and still more from one mental operation to another, which therefore rarely costs them either effort or loss of time, while a man's occupation generally consists in working steadily for a long time at one thing, or one very limited class of things. But the situations are sometimes reversed, and with them the characters. Women are not found less efficient than men for the uniformity of factory work, or they would not so generally be employed for it; and a man who has cultivated the habit of turning his hand to many things, far from being the slothful and lazy person described by Adam Smith, is usually remarkably lively and active. It is [d]true, however,[d] that change of occupation may be too frequent even for the most versatile. Incessant variety is even more fatiguing than perpetual sameness.

The third advantage attributed by Adam Smith to the division of labour, is, to a certain extent, real. Inventions tending to save labour in a particular operation, are more likely to occur to any one in proportion as his thoughts are intensely directed to that occupation, and continually employed upon it. A person is not so likely to make practical improvements in one department of things, whose attention is very much diverted to others. But, in this, much more depends on general intelligence and habitual activity of mind, than on exclusiveness of occupation; and if that exclusiveness is carried to a degree unfavourable to the cultivation of intelligence, there will be more lost in this kind of advantage, than gained. We may add, that whatever may be the cause of making inventions, when they are once made, the increased efficiency of labour is owing to the invention itself, and not to the division of labour.

The greatest advantage (next to the [e] dexterity of the workmen) derived from the minute division of labour which takes place in modern manufacturing industry, is [f] one not mentioned by Adam Smith, but to which attention has been drawn by Mr. Babbage; the more economical distribution of labour, by classing the work-people according to their capacity. Different parts of the same series of operations require unequal degrees of skill and bodily strength; and those who have skill enough for the most difficult, or strength enough for the hardest parts of the labour, are made much more useful by being employed solely in them; the operations [g]which everybody is capable of[g], being left to those who are fit for no others.

[d–d]MS , however, true
[e]MS increased
[f]MS, 48, 49 probably
[g–g]MS, 48, 49 of which inferior workmen are capable

Production is most efficient when the precise quantity of skill and strength, which is required for each part of the process, is employed in it, and no more. The operation of pin-making requires, it seems, in its different parts, such different degrees of skill, that the wages earned by the persons employed vary from fourpence halfpenny a day to six shillings; and if the workman who is paid at that highest rate had to perform the whole process, he would be working a part of his time with a waste per day equivalent to the difference between six shillings and fourpence halfpenny. Without reference to the loss sustained in quantity of work done, and supposing even that he could make a pound of pins in the same time in which ten workmen combining their labour can make ten pounds, Mr. Babbage computes that they would cost, in making, three times and three-quarters as much as they now do by [h]means[h] of the division of labour. In needle-making, he adds, the difference would be still greater, for in that, the scale of remuneration for different parts of the process varies from sixpence to twenty shillings a day.

To the advantage which consists in extracting the greatest possible amount of utility from skill, may be added the analogous one, of extracting the utmost possible utility from tools. "If any man," says an able writer,* "had all the tools which many different occupations require, at least three-fourths of them would constantly be idle and useless. It were clearly then better, were any society to exist where each man had all these tools, and alternately carried on each of these occupations, that the members of it should, if possible, divide them amongst them, each restricting himself to some particular employment. [i] The advantages of the change to the whole community, and therefore to every individual in it, are great. In the first place, the various implements being in constant employment, yield a better return for what has been laid out in procuring them. In consequence their owners can afford to have them of better quality and more complete construction. The result of both events is, that a larger provision is made for the future wants of the whole society."

§ 6. [*Limitations of the division of labour*] The division of labour, as all writers on the subject have remarked, is limited by the extent of the market. If, by the separation of pin-making into ten distinct employments, forty-eight thousand pins can be made in a day, this separation will only be advisable if the number of accessible consumers is such as to require,

*[*Statement of some New Principles on the subject of Political Economy [Exposing the Fallacies of the System of Free Trade, and of some other Doctrines mentioned in the "Wealth of Nations"]*, by John Rae, (Boston, U.S. [: Hilliard, Gray and Co., 1834]) p. 164[–5].

[h–h]MS the application [i]MS [*ellipsis indicated by*] . . .

every day, something like forty-eight thousand pins. If there is only a demand for twenty-four thousand, the division of labour can only be advantageously carried to the extent which will every day produce that smaller number. This, therefore, is a further mode in which an accession of demand for a commodity tends to increase the efficiency of the labour employed in its production. The extent of the market may be limited by several causes: too small a population; the population too scattered and distant to be easily accessible; deficiency of roads and water carriage; or, finally, the population too poor, that is, their collective labour too little effective, to admit of their being large consumers. Indolence, want of skill, and want of combination of labour, among those who would otherwise be buyers of a commodity, limit, therefore, the [a]practical[a] amount of combination of labour among its producers. In an early stage of civilization, when the demand of any particular locality was necessarily small, industry only flourished among those who by their command of the sea-coast or of a navigable river, could have the whole world, or all that part of it which lay on coasts or navigable rivers, as a market for their productions. The increase of the general riches of the world, when accompanied with freedom of commercial intercourse, improvements in navigation, and inland communication by roads, canals, or railways, tends to give increased productiveness to the labour of every nation in particular, by enabling each locality to supply with its special products so much larger a market, that a great extension of the division of labour in their production is an ordinary consequence.

The division of labour is also limited, in many cases, by the nature of the employment. Agriculture, for example, is not susceptible of so great a division of occupations as many branches of manufactures, because its different operations cannot possibly be simultaneous. One man cannot be always ploughing, another sowing, and another reaping. A workman who only practised one agricultural operation would be idle eleven months of the year. The same person may perform them all in succession, and have, in [b]most climates[b], a considerable amount of unoccupied time. [c] To execute a great agricultural improvement, it is often necessary that many labourers should work together; but in general, except the few whose business is superintendence, they all work in the same manner. A canal or a railway embankment cannot be made without a combination of many labourers; but they are all excavators, except the [d]engineers[d] and [e]a few[e] clerks.

[a–a]MS, 48, 49, 52, 57, 62, 65 practicable

[b–b]MS, 48, 49, 52, 57, 62 almost every climate

[c]MS, 48, 49, 52 The combination of labour, of which agricultural industry is susceptible, is chiefly that which Mr. Wakefield terms Simple Co-operation; many persons employed together in the same work.

[d–d]MS, 48, 49, 52, 57, 62 engineer

[e–e]MS, 48 his

CHAPTER IX

Of Production on a Large, and Production on a Small Scale

§ 1. [*Advantages of the large system of production in manufactures*] From the importance of combination of labour, it is an obvious conclusion, that there are many cases in which production is made much more effective by being conducted on a large scale. Whenever it is essential to the greatest efficiency of labour that many labourers should combine, even though only in the way of Simple Co-operation, the scale of the enterprise must be such as to bring many labourers together, and the capital must be large enough to maintain them. Still more needful is this when the nature of the employment allows, and the extent of the possible market encourages, a considerable division of labour. The larger the enterprise, the [a]farther[a] the division of labour may be carried. This is one of the principal causes of large manufactories. Even when no additional subdivision of the work would follow an enlargement of the operations, there will be good economy in enlarging them to the point at which every person to whom it is convenient to assign a special occupation, will have full employment in that occupation. This point is well illustrated by Mr. Babbage.*

"If machines be kept working through the twenty-four hours," (which is evidently the only economical mode of employing them,) "it is necessary that some person shall attend to admit the workmen at the time they relieve each other; and whether the porter or other [b]person[b] so employed admit one person or twenty, his rest will be equally disturbed. It will also be necessary occasionally to adjust or repair the machine; and this can be done much better by a workman accustomed to machine-making, than by the person who uses it. Now, since the good performance and the duration of machines depend, to a very great extent, upon correcting every shake or imperfection in their parts as soon as they appear, the prompt attention of a workman resident on the spot will considerably reduce the expenditure arising from the wear and tear of the machinery. But in the case of a single

*Page 214 et seqq. [Pp. 214–6.]

[a–a]MS, 48, 49, 52 further [b–b]Source, MS, 48, 49, 52, 57, 62 servant

lace-frame, or a single loom, this would be too expensive a plan. Here then arises another circumstance which tends to enlarge the extent of a factory. It ought to consist of such a number of machines as shall occupy the whole time of one workman in keeping them in order: if extended beyond that number, the same principle of economy would point out the necessity of doubling or tripling the number of machines, in order to employ the whole time of two or three skilful workmen.

"[c]When[c] one portion of the workman's labour consists in the exertion of mere physical force, as in weaving, and in many similar arts, it will soon occur to the manufacturer, that if that part were executed by a steam-engine, the same man might, in the case of weaving, attend to two or more looms at once: and, since we already suppose that one or more operative engineers have been employed, the number of looms may be so arranged that their time shall be fully occupied in keeping the steam-engine and the looms in order. [d]

"Pursuing the same principles, the manufactory becomes gradually so enlarged, that the expense of lighting during the night amounts to a considerable sum: and as there are already attached to the establishment persons who are up all night, and can therefore constantly attend to it, and also engineers to make and keep in repair any machinery, the addition of an apparatus for making gas to light the factory leads to a new extension, at the same time that it contributes, by diminishing the expense of lighting, and the risk of accidents from fire, to reduce the cost of manufacturing.

"Long before a factory has reached this extent, it will have been found necessary to establish an accountant's department, with clerks to pay the workmen, and to see that they arrive at their stated times; and this department must be in communication with the agents who purchase the raw produce, and with those who sell the manufactured article." It will cost these clerks and accountants little more time and trouble to pay a large number of workmen than a small number; to check the accounts of large transactions, than of small. If the business doubled itself, it would probably be necessary to increase, but certainly not to double, the number either of accountants, or of buying and selling agents. Every increase of business would enable the whole to be carried on with a [e]proportionately[e] smaller amount of labour.

As a general rule, the expenses of a business do not increase by any means proportionally to the quantity of business. Let us take as an example, a set of operations which we are accustomed to see carried on by one great establishment, that of the Post Office. Suppose that the business, let us say

[c–c]Source, MS, 48, 49, 52, 57 Where
[d]MS [*ellipsis indicated by*] . . . .
[e–e]MS, 48, 49, 52, 57, 62, 65 proportionally

only of the London letter-post, instead of being centralized in a single concern, were divided among five or six [f]competing companies[f]. Each of these would be obliged to maintain almost as large an establishment as is now sufficient for the whole. Since each must arrange for receiving and delivering letters in all parts of the town, each must send letter-carriers into every street, and almost every alley, and this too as many times in the day as is now done by the Post Office, if the service is to be as well performed. Each must have an office for receiving letters in every neighbourhood, with all subsidiary arrangements for collecting the letters from the different offices and re-distributing them. [g]To this must be added[g] the much greater number of superior officers who would be required to check and control the subordinates, implying not only a greater cost in salaries for such responsible officers, but the necessity, perhaps, of being satisfied in many instances with an inferior standard of qualification, and so failing in the object.

Whether or not the advantages obtained by operating on a large scale preponderate in any particular case over the more watchful attention, and greater regard to minor gains and losses, usually found in small establishments, can be ascertained, in a state of free competition, by an unfailing test. Wherever there are large and small establishments in the same business, that one of the two which in existing circumstances carries on the production at greatest advantage will be able to undersell the other. The power of permanently underselling can only[h], generally speaking,[h] be derived from increased effectiveness of labour; and this, when obtained by a more extended division of employment, or by a classification tending to a better economy of skill, always implies a greater produce from the same labour, and not merely the same produce from less labour: it increases not the surplus only, but the gross produce of industry. If an increased quantity of the particular article is not required, and [i] part of the labourers in consequence lose their employment, the capital which maintained and employed them is also set at liberty; and the general produce of the country is increased by some other application of their labour.

Another of the causes of large manufactories, however, is the introduction of processes requiring expensive machinery. Expensive machinery supposes a large capital; and is not resorted to except with the intention of producing, and the hope of selling, as much of the article as comes up to the full powers of the machine. For both these reasons, wherever costly machinery [j]is[j] used, the large system of production is inevitable. But the

[f–f]+48, 49, 52, 57, 62, 65, 71
[g–g]MS, 48, 49, 52, 57 I say nothing of
[h–h]+52, 57, 62, 65, 71
[i]MS, 48, 49 a
[j–j]MS, 48 are

power of underselling is not in this case so unerring a test as in the former, of the beneficial effect on the total production of the community. The power of underselling does not depend on the absolute increase of produce, but on its bearing an increased proportion to the expenses; which, as was shown in a former chapter,* it may do, consistently with even a diminution of the gross annual produce. By the adoption of machinery, a circulating capital, which was perpetually consumed and reproduced, has been converted into a fixed capital, requiring only a small annual expense to keep it up: and a much smaller produce will suffice for merely covering that expense, and replacing the remaining circulating capital of the producer. The machinery therefore [k]might[k] answer perfectly well to the manufacturer, and [l] enable him to undersell his competitors, though the effect on the production of the country [m]might[m] be not an increase but a diminution. It is true, the article will be sold cheaper, and therefore, of that single article, there will probably be not a smaller, but a greater quantity sold; since the loss to the community collectively has fallen upon the work-people, and they are not the principal customers, if customers at all, of most branches of manufacture. But though that particular branch of industry may extend itself, it will be by replenishing its diminished circulating capital from that of the community generally; and if the labourers employed in that department escape loss of employment, it is because the loss will spread itself over the labouring people at large. If any of them are reduced to the condition of unproductive labourers, supported by voluntary or legal charity, the gross produce of the country is to that extent permanently diminished, until the ordinary progress of accumulation makes it up; but if the condition of the labouring classes enables them to bear a temporary reduction of wages, and the superseded labourers become absorbed in other employments, their labour is still productive, and the breach in the gross produce of the community is repaired, though not the detriment to the labourers. I have restated this exposition, which has already been made in a former place, to impress more strongly the truth, that a mode of production does not of necessity increase the productive effect of the collective labour of a community, because it enables a particular commodity to be sold cheaper. The one consequence generally accompanies the other, but not necessarily. I will not here repeat the reasons I formerly gave, nor anticipate those which will be given more fully hereafter, for deeming the exception to be rather a case abstractedly possible, than one which is frequently realized in fact.

A considerable part of the saving of labour effected by substituting the

*Supra, chap. vi. p. 94.

[k–k]MS may
[l]MS may
[m–m]MS may

large system of production for the small, is the saving in the labour of the capitalists themselves. If a hundred producers with small capitals carry on separately the same business, the superintendence of each concern will probably require the whole attention of the person conducting it, sufficiently at least to hinder his time or thoughts from being disposable for anything else: while a single manufacturer possessing a capital equal to the sum of theirs, with ten or a dozen clerks, could conduct the whole of their amount of business, and have leisure too for other occupations. The small capitalist, it is true, generally combines with the business of direction some portion of the details, which the other leaves to his subordinates: the small farmer follows his own plough, the small tradesman serves in his own shop, the small weaver plies his own loom. But in this very union of functions there is, in a great proportion of cases, a want of economy. The principal in the concern is either wasting, in the routine of a business, qualities suitable for the direction of it, or he is only fit for the former, and then the latter will be ill done. I must observe, however, that I do not attach, to this saving of labour, the importance often ascribed to it. There is undoubtedly much more labour expended in the superintendence of many small capitals than in that of one large capital. For this labour however the small producers have generally a full compensation, in the feeling of being their own masters, and not servants of an employer. It may be said, that if they value this independence they will submit to pay a price for it, and to sell at the reduced rates occasioned by the competition of the great dealer or manufacturer. But they cannot always do this and continue to gain a living. They thus gradually disappear from society. After having consumed their little capital in prolonging the unsuccessful struggle, they either sink into the condition of hired labourers, or become dependent on others for support.

§ 2. [*Advantages and disadvantages of the joint-stock principle*] Production on a large scale is greatly promoted by the practice of forming a large capital by the combination of many small contributions; or, in other words, by the formation of joint stock companies. The [a]advantages[a] of the joint stock principle are numerous and important.

In the first place, many undertakings require an amount of capital beyond the means of the richest individual or private partnership. No individual could have made a railway from London to Liverpool; it is doubtful if any individual could even work the traffic on it, now when it is made. The government indeed could have done both; and in countries where the practice of co-operation is only in the earlier stages of its growth, the government can alone be looked to for any of [b]the[b] works for which a great combination of means is requisite; because it can obtain those means

[a–a]MS recommendations [b–b]MS, 48, 49, 52, 57, 62 those

by compulsory taxation, and is already accustomed to the conduct of large operations. For reasons, however, which are tolerably well known, and of which we shall treat fully hereafter, government agency for the conduct of industrial operations is generally one of the least eligible of resources, when any other is available.

Next, there are undertakings which individuals are not absolutely incapable of performing, but which they cannot perform on the scale and with the continuity which [c]are[c] ever more and more required by the exigencies of a society in an advancing state. Individuals are quite capable of despatching ships from England to any or every part of the world, to carry passengers and letters; the thing was done before joint stock companies [d]for the purpose[d] were heard of. But when, from the increase of population and transactions, as well as of means of payment, the public will no longer content themselves with occasional opportunities, but require the certainty that packets shall start regularly, for some places once or even twice a day, for others once a week, for others that a steam ship of [e]great[e] size and expensive construction shall depart on fixed days twice in each month, it is evident that to afford an assurance of keeping up with punctuality such a circle of costly operations, requires a much larger capital and a much larger staff of qualified subordinates than can be commanded by an individual capitalist. There are other cases, again, in which though the business might be perfectly well transacted with small or moderate capitals, the guarantee of a great subscribed stock is necessary or desirable as a security to the public for the fulfilment of pecuniary engagements. This is especially the case when the nature of the business requires that numbers of persons should be willing to trust the concern with their money: as in the business of banking, and that of insurance: to both of which the joint stock principle is eminently adapted. It is an instance of the folly and jobbery of the rulers of mankind, that until [f]a late period[f] the joint stock principle, as a general resort, was in this country interdicted by law to these two modes of business; to banking altogether, and to insurance in the department of sea risks; in order to bestow a lucrative monopoly on particular establishments which the government was pleased exceptionally to license, namely the Bank of England, and two insurance companies, the London and the Royal Exchange.

[g]Another advantage of joint stock or associated management, is its incident of publicity. This is not an invariable, but it is a natural consequence of the joint stock principle, and might be, as in some important cases it

[c-c]MS is
[d-d]+48, 49, 52, 57, 62, 65, 71
[e-e]MS enormous
[f-f]MS, 48, 49, 52, 57 very lately
[g-g]137+65, 71

already is, compulsory. In banking, insurance, and other businesses which depend wholly on confidence, publicity is a still more important element of success than a large subscribed capital. A heavy loss occurring in a private bank may be kept secret; even though it were of such magnitude as to cause the ruin of the concern, the banker may still carry it on for years, trying to retrieve its position, only to fall in the end with a greater crash: but this cannot so easily happen in the case of a joint stock company, whose accounts are published periodically. The accounts, even if cooked, still exercise some check; and the suspicions of shareholders, breaking out at the general meetings, put the public on their guard.[g]

These are some of the advantages of joint stock over individual management. But if we look to the other side of the question, we shall find that individual management has also [h]very great[h] advantages over joint stock. The chief of these is the much keener interest of the managers in the success of the undertaking.

The administration of a joint stock association is, in the main, administration by hired servants. Even the committee, or board of directors, who are supposed to superintend the management, and who do really appoint and remove the managers, have no pecuniary interest in the good working of the concern beyond the shares they individually hold, which are always a very small part of the capital of the association, and in general but a small part of the fortunes of the directors themselves; and the part they take in the management usually divides their time with many other occupations, of as great or greater importance to their own interest; the business being the principal concern of no one except those who are hired to carry it on. But experience shows, and proverbs, the expression of popular experience, attest, how inferior is the quality of hired [i]servants[i], compared with the ministration of those personally interested in the work, and how indispensable, when hired service must be employed, is "the master's eye" to watch over it.

The successful conduct of an industrial enterprise requires two quite distinct qualifications: fidelity, and zeal. The fidelity of the hired managers of a concern it is possible to secure. When their work admits of being reduced to a definite set of rules, the violation of these is a matter on which conscience cannot easily blind itself, and on which responsibility may be enforced by the loss of employment. But to carry on a great business successfully, requires a hundred things which, as they cannot be defined beforehand, it is impossible to convert into distinct and positive obligations. First and principally, it requires that the directing mind should be incessantly occupied with the subject; should be continually laying schemes by

[h–h]MS enormous
[i–i]MS, 48, 49, 52 service

which greater profit may be obtained, or expense saved. This intensity of interest in the subject it is seldom to be expected that any one should feel, who is conducting a business as the hired servant and for the profit of another. There are experiments in human [j]affairs which are[j] conclusive on the point. Look at the whole class of rulers, and ministers of state. The work they are entrusted with, is among the most interesting and exciting of all occupations; the personal share which they themselves reap of the national benefits or misfortunes which befal the state under their rule, is far from trifling, and the rewards and punishments which they may expect from public estimation are of the plain and palpable kind which are most keenly felt and most widely appreciated. Yet how rare a thing is it to find a statesman in whom mental indolence is not stronger than all these inducements. How infinitesimal is the proportion [k] who trouble themselves to form, or even to attend to, plans of public improvement, unless [l]when[l] it is made still more troublesome to them to remain inactive; or who have any other real desire than that of rubbing on, so as to escape general blame. On a smaller scale, all who have ever employed hired labour have had ample experience of the efforts made to give as little labour in exchange for the wages, as is compatible with not being turned off. The universal neglect by domestic servants of their employer's interests, wherever these are not protected by some fixed rule, is matter of common remark; unless where long continuance in the same service, and reciprocal good offices, have produced either personal attachment, or some feeling of a common interest.

Another of the disadvantages of joint stock concerns, which is in some degree common to all concerns on a large scale, is disregard of small gains and small savings. In the management of a great capital and great transactions, especially when the managers have not much interest in it of their own, small sums are apt to be counted for next to nothing; they never seem worth the care and trouble which it costs to attend to them, and the credit of liberality and openhandedness is cheaply bought by a disregard of such trifling considerations. But small profits and small expenses often repeated, amount to great gains and losses: and of this a large capitalist is often a sufficiently good calculator to be practically aware; and to arrange his business on a *system*, which if enforced by a sufficiently vigilant superintendence, precludes the possibility of the habitual waste, otherwise incident to a great business. But the managers of a joint stock concern seldom devote themselves sufficiently to the work, to enforce unremittingly, even if introduced, through every detail of the business, a really economical system.

From considerations of this nature, Adam Smith was led to enunciate as

[j–j]MS, 48, 49 nature which are quite
[k]MS of them
[l–l]+49, 52, 57, 62, 65, 71

a principle, that joint stock companies could never be expected to maintain themselves without an exclusive privilege, except in branches of business which, like banking, insurance, and some others, admit of being, in a considerable degree, reduced to fixed rules. This, however, is one of those over-statements of a true principle, often met with in Adam Smith. In his days there were few instances of joint stock companies which had been permanently successful without a monopoly, except the class of cases which he referred to; but since his time there have been many; and the regular increase both of the spirit of combination and of the ability to combine, will doubtless produce many more. Adam Smith fixed his observation too exclusively on the superior energy and more unremitting attention brought to a business in which the whole stake and the whole gain belong to the persons conducting it; and he overlooked various countervailing considerations which go a great way towards neutralizing even that great point of superiority.

Of these one of the most important is that which relates to the intellectual and active qualifications of the directing head. The stimulus of individual interest [m]is some security for[m] exertion, but [n] exertion is of little avail if the intelligence exerted is of an inferior order, which it must necessarily be in the majority of concerns carried on by the persons chiefly interested in them. Where the concern is large, and can afford a remuneration sufficient to attract a class of candidates superior to the common average, it is possible to select for the general management, and for all the skilled employments of a subordinate kind, persons of a degree of acquirement and cultivated intelligence which more than compensates for their inferior interest in the result. Their greater perspicacity enables them, with even a part of their minds, to see probabilities of advantage which never occur to the ordinary run of men by the continued exertion of the whole of theirs; [o]and their superior knowledge,[o] and [p] habitual rectitude of perception and of judgment, [q]guard[q] them against blunders, the [r]fear[r] of which would prevent the others from hazarding their interests in any attempt out of the ordinary routine.

It must [s]be further[s] remarked, that it is not a necessary consequence of joint stock management, that the persons employed, whether in superior or in subordinate offices, should be paid wholly by fixed salaries. There are modes of connecting more or less intimately the interest of the employés with the pecuniary success of the concern. There is a long series of intermediate positions, between working wholly on one's own account, and

[m–m]MS, 48, 49 secures the greatest amount of
[n]MS, 48, 49 that
[o–o]+57, 62, 65, 71
[p]MS, 48, 49, 52 their
[q–q]MS, 48, 49, 52 guards
[r–r]MS, 48, 49, 52, 57 apprehension
[s–s]MS, 48, 49 further be

working by the day, week, or year for an invariable payment. Even in the case of ordinary unskilled labour, there is such a thing as task-work, or working by the piece: and the superior efficiency of this is so well known, that judicious employers always resort to it when the work admits of being put out in definite portions, without the necessity of too troublesome a surveillance to guard against inferiority in the execution. In the case of the managers of joint stock companies, and of the superintending and controlling officers in many private establishments, it is a common enough practice to connect their pecuniary interest with the interest of their employers, by giving them part of their remuneration in the form of a percentage on the profits. The personal interest thus given to hired servants is not comparable in intensity to that of the owner of the capital; but it is sufficient to be a very material stimulus to zeal and carefulness, and, when added to the advantage of superior intelligence, often raises the quality of the service much above that which the generality of masters are capable of rendering to themselves. The ulterior extensions of which this principle of remuneration is susceptible, being of great social as well as economical importance, will be more particularly adverted to in a subsequent stage of the present inquiry.

As I have already remarked of large establishments generally, when compared with small ones, whenever competition is free its results will show whether individual or joint stock agency is best adapted to the particular case, since that which is most efficient and most economical will always in the end succeed in underselling the other.

§ 3. [*Conditions necessary for the large system of production*] The possibility of substituting the large system of production for the small, depends, of course, in the first place, on the extent of the market. The large system can only be advantageous when a large amount of business is to be done: it implies, therefore, either a populous and flourishing community, or a great opening for exportation. Again, this as well as every other change in the system of production is greatly favoured by a progressive condition of capital. It is chiefly when the capital of a country is receiving a great annual increase, that there is a large amount of capital seeking for investment: and a new enterprise is much sooner and more easily entered upon by new capital, than by withdrawing capital from existing employments. The change is also much facilitated by the existence of large capitals in few hands. It is true that the same amount of capital can be raised by bringing together many small sums. But this (besides that it is not equally well suited to all branches of industry) supposes a much greater degree of commercial confidence and enterprise diffused through the community, and belongs altogether to a more advanced stage of industrial progress.

In the countries in which there are the largest markets, the widest diffusion of commercial confidence and enterprise, the greatest annual increase of capital, and the greatest number of large capitals owned by individuals, there is a tendency to substitute more and more, in one branch of industry after another, large establishments for small ones. In England, the [a]chief[a] type of all these characteristics, there is [b]a perpetual growth not only[b] of large manufacturing establishments, but also, wherever a sufficient number of purchasers are assembled, of shops and warehouses for conducting retail business on a large scale. These are almost always able to undersell the smaller tradesmen, partly, it is understood, by means of division of labour, and the economy occasioned by limiting the employment of skilled agency to cases where skill is required; and partly, no doubt, by the saving of labour arising from the great scale of the transactions; as it costs no more time, and not much more exertion of mind, to make a large purchase, for example, than a small one, and very much less than to make a number of small ones.

With a view merely to production, and to the greatest efficiency of labour, this change is wholly beneficial. In some cases it is attended with drawbacks, rather social than economical, the nature of which has been already hinted at. But whatever disadvantages may be supposed to attend on the change from a small to a large system of production, they are not applicable to the change from a large to a still larger. When, in any employment, the régime of independent small producers has either never been possible, or has been superseded, and the system of many [c]work-people[c] under one management has become fully established, from that time any further enlargement in the scale of production is generally an unqualified benefit. It is obvious, for example, how great an economy of labour would be obtained if London were supplied by a single gas or water company instead of the existing plurality. While there are even as many as two, this implies double establishments of all sorts, when one only, with a small increase, could probably perform the whole operation equally well; double sets of machinery and works, when the whole of the gas or water required could generally be produced by one set only; even double sets of pipes, if the companies did not prevent this needless expense by agreeing upon a division of the territory. Were there only one establishment, it could make lower charges, consistently with obtaining the rate of profit now realized. But would it do so? Even if it did not, the community in the aggregate would still be a gainer: since the shareholders are [d]a[d] part of the community, and they

[a–a] MS, 48, 49 great
[b–b] MS, 48 not only a perpetual growth
[c–c] MS, 48, 49 workmen
[d–d] +57, 62, 65, 71

would obtain higher profits [e]while[e] the consumers paid only the same. It is, however, an error to suppose that the prices are [f]ever permanently[f] kept down by the competition of these companies. Where competitors are so few, they always [g]end by agreeing[g] not to compete. They may run a race of cheapness to ruin a new candidate, but as soon as he has established his footing they come to terms with him. When, therefore, a business of real public importance can only be carried on advantageously upon so large a scale as to render the liberty of competition almost illusory, it is an unthrifty dispensation of the public resources that several costly sets of arrangements should be kept up for the purpose of rendering to the community this one service. It is much better to treat it at once as a public function; and if it be not such as the government itself could beneficially undertake, it should be made over entire to the company or association which will perform it on the best terms for the public. In the case of railways, for example, no one can desire to see the enormous waste of capital and land (not to speak of increased nuisance) involved in the construction of a second railway to connect the same places already united by an existing one; while the two would not do the work better than it could be done by one, and after a short time [h]would probably[h] be amalgamated. Only one [i]such[i] line ought to be permitted, but the control over that line never ought to be parted with by the State, unless on a temporary concession, as in France; and the vested right which Parliament has allowed to be acquired by the existing companies, like all other proprietary rights which are opposed to public utility, is morally valid only as a claim to compensation.

§ 4. [*Large and small farming compared*] The question between the large and the small [a]systems[a] of production as applied to agriculture—between large and small farming, the *grande* and the *petite culture*—stands, in many respects, on different grounds from the general question between great and small industrial establishments. In its social aspect, and as an element in the Distribution of Wealth, this question will occupy us hereafter: but even as a question of production, the superiority of the large system in agriculture is by no means so clearly established as in manufactures.

I have already remarked, that the operations of agriculture are little susceptible of benefit from the division of labour. There is but little separation of employments even on the largest farm. The same persons may not in general attend to the live stock, to the marketing, and to the cultivation

[e–e]52, 57 when
[f–f]MS, 48, 49 really
[g–g]MS, 48, 49 agree
[h–h]MS, 48 they would certainly] 49 would certainly
[i–i]+52, 57, 62, 65, 71
[a–a]MS, 48, 49 system

of the soil; but much beyond that primary and simple classification the subdivision is not carried. The combination of labour of which agriculture is susceptible, is chiefly that which Mr. Wakefield terms Simple Co-operation; several persons helping one another in the same work, at the same time and place. But I confess it seems to me that this able writer attributes more importance to that kind of co-operation, in reference to agriculture properly so called, than it deserves. None of the common farming operations require much of it. There is no particular advantage in setting a [b]great[b] number of people to work together in ploughing or digging or sowing the same field, or even in mowing or reaping it unless time presses. A single family can generally supply all the combination of labour necessary for these purposes. And in the works in which an union of many efforts is really needed, there is seldom found any impracticability in obtaining it where farms are small.

The waste of productive power by subdivision of the land often amounts to a great evil, but this applies chiefly to a subdivision so minute, that the cultivators have not enough land to occupy their time. Up to that point the same principles which recommend large [c]manufactories[c] are applicable to agriculture. For the greatest productive efficiency, it is generally desirable (though even this proposition must be received with qualifications) that no family who have any land, should have less than they could cultivate, or than will fully employ their cattle and tools. These, however, are not the dimensions of large farms, but of what are reckoned in England very small ones. The large farmer has some advantage in the article of buildings. It does not cost so much to house a great number of cattle in one building, as to lodge them equally well in several buildings. There is also some advantage in implements. A small farmer is not so likely to possess expensive instruments. But the principal agricultural implements, even when of the best construction, are not expensive. It may not answer to a small farmer to own a threshing machine, for the small quantity of corn he has to thresh; but there is no reason why such a machine should not in every neighbourhood be owned in common, or provided by some person to whom the others pay a consideration for its use[d]; especially as, when worked by steam, they are so constructed as to be moveable[d].* The large farmer can

*[52] The observations in the text may hereafter require some degree of modification from inventions such as the steam plough and the reaping machine. The effect, however, of these improvements on the relative advantages of large and small farms, will not depend [52 will depend not] on the efficiency of the instruments, but on their costliness. I see no reason to expect that this will be such as to make them inaccessible to small farmers, or combinations of small farmers.

[b–b]+57, 62, 65, 71 [c–c]MS, 48 factories [d–d]+62, 65, 71

make some saving in cost of carriage. There is nearly as much trouble in carrying a small portion of produce to market, as a much greater produce; in bringing home a small, as a much larger quantity of [e]manures[e], and articles of daily consumption. There is also the greater cheapness of buying things in large quantities. These various advantages must count for something, but it does not seem that they ought to count for very much. In England, for some generations, there has been little experience of small farms; but in Ireland the experience has been ample, not merely under the worst but under the best management; and the highest Irish authorities may be cited in opposition to the opinion which on this subject commonly prevails in England. Mr. Blacker, for example, one of the most experienced agriculturists and successful improvers in the North of Ireland, whose experience [f]was[f] chiefly in the best cultivated, which are also the most minutely divided parts of the country, [g]was[g] of opinion, that tenants holding farms not exceeding from five to eight or ten acres, [h]could[h] live comfortably and pay as high a rent as any large farmer whatever. "I am firmly persuaded," (he says,*) "that the small farmer who holds his own plough and digs his own ground, if he follows a proper rotation of crops, and feeds his cattle in the house, can undersell the large farmer, or in other words can pay a rent which the other cannot afford; and in this I am confirmed by the opinion of many practical men who have well considered the subject. . . The English farmer of 700 to 800 acres is a kind of man approaching to what is known by the name of a gentleman farmer. He must have his horse to ride, and his gig, and perhaps an overseer to attend to his labourers; he certainly cannot superintend himself the labour going on in a farm of 800 acres." After a few other remarks, he adds, "Besides all these drawbacks, which the small farmer knows little about, there is the great expense of carting out the manure from the homestead to such a great distance, and again carting home the crop. A single horse will consume the produce of more land than would feed a small farmer and his wife and two children. And what is more than all, the large farmer says to his labourers, *go* to your work; but when the small farmer has occasion to hire them, he says, *come*; the intelligent reader will, I dare say, understand the difference."

One of the objections most urged against small farms is, that they do not and cannot maintain, proportionally to their extent, so great a number of cattle as large farms, and that this occasions such a deficiency of manure, that a soil much subdivided must always be impoverished. It will be found,

*Prize Essay on the Management of Landed Property in Ireland, by William Blacker, Esq. (1837,) [Dublin: Curry, 1834,] p. 23 [23n–24n].

[e–e]MS, 48, 49, 52, 57, 62 manure
[f–f]MS, 48, 49 lies
[g–g]MS, 48, 49 is
[h–h]MS, 48, 49 can

however, that subdivision only produces this effect when it throws the land into the hands of cultivators so poor as not to possess the amount of live stock suitable to the size of their farms. A small farm and a badly stocked farm are not synonymous. To make the comparison fairly, we must suppose the same amount of capital which is possessed by the large farmers to be disseminated among the small ones. When this condition, or even any approach to it, exists, and when stall feeding is practised (and stall feeding now begins to be considered good economy even on large farms), experience, far from bearing out the assertion that small farming is unfavourable to the multiplication of cattle, conclusively establishes the very reverse. The abundance of cattle, and copious use of manure, on the small farms of Flanders, are the most striking features in that Flemish agriculture which is the admiration of all competent judges, whether in England or on the Continent.*

* "The number of beasts fed on a farm of which the whole is arable land," (says the elaborate and intelligent treatise on Flemish Husbandry, from personal observation and the best sources, published in the Library of the Society for the Diffusion of Useful Knowledge,) "is surprising to those who are not acquainted with the mode in which the food is prepared for the cattle. A beast for every three acres of land is a common proportion, and in very small occupations where much spade husbandry is used, the proportion is still greater. [MS *ellipsis indicated by* . .] After comparing the accounts given in a variety of places and situations of the average quantity of milk which a cow gives when fed in the stall, the result is, that it greatly exceeds that of our best dairy farms, and the quantity of butter made from a given quantity of milk is also greater. [MS *ellipsis indicated by* . . .] It appears astonishing that the occupier of only ten or twelve acres of light arable land should be able to maintain four or five cows, but the fact is notorious in the Waes country." (pp. 59, 60.) [Rham, William Lewis. *Outlines of Flemish Husbandry*, in Burke, John L. (ed.) *British Husbandry*. Vol. III. London: Baldwin and Cradock, 1840.]

This subject is treated very intelligently in the work of [MS, 48 intelligently by] M. [MS M. Hippolite] Passy, [MS, 48 Passy, a distinguished politician and high economical authority, whose treatise] "Des Systêmes de Culture et de leur Influence sur l'Economie Sociale [Paris: Guillaumin, 1846]," [MS, 48 is one] one of the most impartial discussions, as between the two systems, which has yet appeared in France.

"Sans nul doute, c'est l'Angleterre qui, à superficie égale, nourrit le plus d'animaux; la Hollande et quelques parties de la Lombardie pourraient seules lui disputer cet avantage: mais est-ce là un résultat des formes de l'exploitation, et des circonstances de climat et de situation locale ne concourent-elles pas à le produire? C'est, à notre avis, ce qui ne saurait être contesté. En effet, quoiqu'on en ait dit, partout où la grande et la petite culture se rencontrent sur les mêmes points, c'est celle-ci qui, bien qu'elle ne puisse entretenir autant de moutons, possède, tout compensé, le plus grand nombre d'animaux producteurs d'engrais. Voici, par exemple, ce qui ressort des informations fournies par la Belgique.

"Les deux provinces où règne la plus petite culture sont celles d'Anvers et de la Flandre orientale, et elles possèdent en moyenne, par 100 hectares de terres

The disadvantage, when disadvantage there is, of small or rather of peasant farming, as compared with capitalist farming, must chiefly consist in inferiority of skill and knowledge; but it is not true, as a general fact, that such inferiority exists. Countries of small farms and peasant farming, Flanders and Italy, had a good agriculture many generations before England, and theirs is still, as a whole, probably the best agriculture in the world. [4] The empirical skill, which is the effect of daily and close observa-

cultivées, 74 bêtes bovines et 14 moutons. Les deux provinces où se trouvent les grandes fermes sont celles de Namur et du Hainaut, et elles n'ont en moyenne, pour 100 hectares de terres cultivées, que 30 bêtes bovines et 45 moutons. Or, en comptant, suivant l'usage, 10 moutons comme l'équivalent d'une tête de gros bétail, nous rencontrons d'un côté, 76 animaux servant à maintenir la fécondité du sol; de l'autre, moins de 35, différence à coup sûr énorme. (D'après les documents statistiques publiés par le Ministre de l'Intérieur, 3me publication officielle.) Il est à remarquer, au surplus, que le nombre des animaux n'est pas, dans la partie de la Belgique dont le sol est divisé en très-petites fermes, beaucoup moindre qu'en Angleterre. En l'évaluant dans cette dernière contrée à raison seulement du territoire en culture, il y existe, par centaine d'hectares, 65 bêtes à corne et près de 260 moutons, c.-à-d. l'équivalent de 91 des premiers, ou seulement 15 de plus que dans l'autre. Et encore est-il juste d'observer qu'en Belgique presque rien n'est perdu des engrais donnés par des animaux nourris à peu près toute l'année à l'étable, tandis qu'en Angleterre la pâture en plein air affaiblit considérablement les quantités qu'il devient possible de mettre entièrement à profit.

"Dans le département du Nord aussi, ce sont les arrondissements dont les fermes ont la moindre contenance qui entretiennent le plus d'animaux. Tandis que les arrondissements de Lille et de Hazebrouck, outre un plus grand nombre de chevaux, nourissent, l'un l'équivalent de 52 têtes de gros bétail, l'autre l'équivalent de 46; les arrondissements où les exploitations sont les plus grandes, ceux de Dunkerque et d'Avesnes, ne contiennent, le premier, que l'équivalent de 44 bêtes bovines, l'autre, que celui de 40. (D'après la Statistique de la France publiée par le Ministre du Commerce: *Agriculture*, t. i.)

"Pareilles recherches étendues sur d'autres points de la France offriraient des résultats analogues. S'il est vrai que dans la banlieue des villes, la petite culture s'abstienne de garder des animaux, au produit desquels elle supplée facilement par des achats d'engrais, il ne se peut que le genre de travail qui exige le plus de la terre ne soit pas celui qui en entretienne le plus activement la fertilité. Assurément il n'est pas donné aux petites fermes de posséder de nombreux troupeaux de moutons, et c'est un inconvénient; mais, en revanche, elles nourrissent plus de bêtes bovines que les grandes. C'est là une nécessité à laquelle elles ne sauraient se soustraire dans aucun des pays où les besoins de la consommation les ont appelées à fleurir; elles périraient si elles ne réussissaient pas à y satisfaire.

"Voici, au surplus, sur ce point des détails dont l'exactitude nous paraît pleinement attestée par l'excellence du travail où nous les avons puisés. Ces détails, contenus dans la statistique de la commune de Vensat (Puy de Dôme),

[4] MS Notwithstanding all that is said of the backwardness of French agriculture, there are some parts of France which can almost vie with them.

tion, peasant farmers often possess in an eminent degree. The traditional knowledge, for example, of the culture of the vine, possessed by the peasantry of the countries where the best wines are produced, is extraordinary. There is no doubt an absence of science, or at least of theory; and to some extent a deficiency of the spirit of improvement, so far as relates to the introduction of new processes. There is also a want of means to make experiments, which can seldom be made with advantage except by rich proprietors or capitalists. As for those systematic improvements which operate on a large tract of country at once (such as great works of draining or irrigation) or which for any other ʃreasonsʃ do really require large numbers of workmen combining their labour, these are not in general to be expected from small farmers, or even small proprietors, though combination among them for such purposes is by no means unexampled, and will become more common as their intelligence is more developed.

Against these disadvantages is to be placed, where the tenure of land is of the requisite kind, an ardour of industry absolutely unexampled in any other condition of agriculture. This is a subject on which the testimony of competent witnesses is unanimous. The working of the *petite culture*

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publiée récemment par M. le docteur Jusseraud, maire de la commune, sont d'autant plus précieux, qu'ils mettent dans tout leur jour la nature des changements que le développement de la petite culture a, dans le pays dont il s'agit, apportés au nombre et à l'espèce des animaux dont le produit en engrais soutient et accroît la fertilité des terres. Dans la commune de Vensat, qui comprend 1612 hectares divisés en 4600 parcelles appartenant à 591 propriétaires, le territoire exploité se compose de 1466 hectares. Or, en 1790, 17 fermes en occupaient les deux tiers et 20 autres tout le reste. Depuis lors, les cultures se sont morcelées, et maintenant leur petitesse est extrême. Quelle a été l'influence du changement sur la quantité des animaux? Une augmentation considérable. En 1790, la commune ne possédait qu'environ 300 bêtes à cornes, et de 1800 à 2000 bêtes à laine; aujourd'hui elle compte 676 des premières, et 533 seulement des secondes. Ainsi pour remplacer 1300 moutons elle a acquis 376 bœufs et vaches, et tout compensé, la somme des engrais s'est accrue dans la proportion de 490 à 729, ou de plus de 48 pour cent. Et encore est-il à remarquer que, plus forts et mieux nourris à présent, les animaux contribuent bien davantage à entretenir la fertilité des terres.

"Voilà ce que les faits nous apprennent sur ce point: il n'est donc pas vrai que la petite culture ne nourrisse pas autant d'animaux que les autres; loin de là, à conditions locales pareilles, c'est elle qui en possède le plus, et il ne devait pas être difficile de le présumer; car, du moment où c'est elle qui demande le plus aux terres, il faut bien qu'elle leur donne des soins d'autant plus réparateurs qu'elle en exige davantage. Que l'on prenne un à un les autres reproches; qu'on les examine à la clarté de faits bien appréciés, on s'appercevra bientôt qu'ils ne sauraient être mieux fondés, et qu'ils n'ont été formulés que parce qu'on a comparé l'état des cultures dans des contrées où les causes de la prospérité agricole n'agissaient pas avec la même énergie." (pp. 116–120.)

ʃ-ʃMS, 48, 49, 52, 62, 65 reason

cannot be fairly judged where the small cultivator is merely a tenant, and not even a tenant on fixed conditions, but ([k]as until lately in[k] Ireland) at a nominal rent greater than can be paid, and therefore practically at a varying rent always amounting to the utmost that can be paid. To understand the subject, it must be studied where the cultivator is the proprietor, or at least a *métayer* with a permanent tenure; where the labour he exerts to increase the produce and value of the land avails wholly, or at least partly, to his own benefit and that of his descendants. In another division of our subject, we shall discuss at some length the important subject of tenures of land, and I defer till then any citation of evidence on the marvellous industry of peasant proprietors. It may suffice here to appeal to the immense amount of gross produce which, even without a permanent tenure, English labourers generally obtain from their little allotments; a produce beyond comparison greater than a large farmer extracts, or would find it his interest to extract, from the same piece of land.

And this I take to be the true reason why large cultivation is generally most advantageous as a mere investment for profit. Land occupied by a large farmer is not[l], in one sense of the word,[l] farmed so highly. There is not nearly so much labour expended on it. This is not on account of any economy arising from combination of labour, but because, by employing less, a greater return is obtained in proportion to the outlay. It does not answer to any one to pay others for exerting all the labour which the peasant, or even the allotment-holder, gladly undergoes when the fruits are to be wholly reaped by himself. This labour, however, is not unproductive: it all adds to the gross produce. With anything like equality of skill and knowledge, the large farmer does not obtain nearly so much from the soil as the small proprietor, or the small farmer with adequate motives to exertion: but though his returns are less, the labour is less in a still greater degree, and as whatever labour *he* employs must be paid for, it does not suit his purpose to employ more.

But although the gross produce of the land is greatest, *cæteris paribus*, under small cultivation, and although, therefore, a country is able on that system to support a larger aggregate population, it is generally assumed by English writers that what is termed the net produce, that is, the surplus after feeding the cultivators, [m]must[m] be smaller; that therefore, the population disposable for all other purposes, for manufactures, for commerce and navigation, for national defence, for the promotion of knowledge, for the liberal professions, for the various functions of government, for the arts and literature, all of which are [n] dependent on this surplus for their existence as occupations, must be less numerous; and that the nation, therefore (waving all question as to the condition of the actual cultivators), must be

[k–k]MS, 48, 49, 52 as in] 57 as hitherto in
[l–l]+62, 65, 71 [m–m]MS *must* [n]MS, 48, 49 entirely

inferior in the principal elements of national power, and in many of those of general well-being. This, however, has been taken for granted much too readily. Undoubtedly the non-agricultural population will bear a less ratio to the agricultural, under small than under large cultivation. But that it will be less numerous absolutely, is by no means a consequence. If the total population, agricultural and non-agricultural, is greater, the non-agricultural portion may be more numerous in itself, and may yet be a smaller proportion of the whole. If the gross produce is larger, the net produce may be larger, and yet bear a smaller ratio to the gross produce. Yet even Mr. Wakefield sometimes °appears to confound° these distinct ideas. In France it is computed that two-thirds of the whole population are agricultural. In England, at most, one-third. Hence Mr. Wakefield infers, that "as in France only three people are supported by the labour of two cultivators, while in England the labour of two cultivators supports six people, English agriculture is twice as productive as French agriculture," owing to the superior efficiency of large farming through combination of labour. But in the first place, the facts themselves are overstated. The labour of two persons in England does not quite support six people, for there is not a little food imported from foreign countries, and from Ireland. In France, too, the labour of two cultivators does much more than supply the food of three persons. It provides the three persons, and occasionally foreigners, with flax, hemp, and to a certain extent with silk, oils, tobacco, and latterly sugar, which in England are wholly obtained from abroad; nearly all the timber used in France is of home growth, nearly all which is used in England is imported; the principal fuel of France is procured and brought to market by persons reckoned among agriculturists, in England by persons not so reckoned. I do not take into calculation hides and wool, these products being common to both countries, nor wine or brandy produced for home consumption, since England has a corresponding production of beer and spirits; but England has no material export of either article, and a great importation of the last, while France supplies wines and spirits to the whole world. I say nothing of fruit, eggs, and such minor ᵖarticles of agricultural produce, in which the export trade of France is enormousᵖ. But not to lay undue stress on these abatements, we will take the statement as it stands. Suppose that two persons, in England, do *bonâ fide* produce the food of six, while in France, for the same purpose, the labour of four is requisite. Does it follow that England must have a larger surplus for the support of a non-agricultural population? No; but merely that she can devote two-thirds of her whole produce to the purpose, instead of one-third. Suppose the produce to be twice as great, and the one-third will amount to as much as the two-thirds. The fact might be, that owing

°-°MS confounds
ᵖ-ᵖMS, 48, 49, 52, 57, 62 exportable articles of agricultural produce

to the greater quantity of labour employed on the French system, the same land would produce food for twelve persons which on the English system would only produce it for six: and if this were so, which would be quite consistent with the conditions of the hypothesis, then although the food for twelve was produced by the labour of eight, while the six were fed by the labour of only two, there would be the same number of hands disposable for other employment in the one country as in the other. I am not contending that the fact is so. I know that the gross produce per acre in France [q]as a whole (though not in its most improved districts)[q] averages much less than in England, and that, in proportion to the extent and fertility of the two countries, England has, in the sense we are now speaking of, much the largest disposable population. But the disproportion certainly is not [r]to be measured by Mr. Wakefield's simple criterion[r]. As well might it be said that agricultural labour in the United States, where, by [s]a late[s] census, four families in every five [t]appeared[t] to be engaged in agriculture, must be still more inefficient than in France.

The inferiority of French cultivation (which, taking the country as a whole, must be allowed to be real, though much exaggerated) is probably more owing to the lower general average of industrial skill and energy in that country, than to any special cause; and even if partly the effect of minute subdivision, it does not prove that small farming is disadvantageous, but only (what is undoubtedly the fact) that farms in France are very frequently *too* small, and, what is worse, broken up into an almost incredible number of patches or *parcelles*, most inconveniently dispersed and parted from one another.

As a question, not of gross, but of net produce, the comparative merits of the *grande* and the *petite culture*, especially when the small farmer is also the proprietor, cannot be looked upon as decided. It is a question on which good judges at present differ. The current of English opinion is in favour of large farms: on the Continent, the weight of authority seems to be on the other side. Professor Rau, of Heidelberg, the author of one of the most comprehensive and elaborate of extant treatises on political economy, and who has that large acquaintance with facts and authorities on his own subject, which generally characterises his countrymen, lays it down as a settled truth, that small or moderate-sized farms yield not only a larger gross but a larger net produce: though, he adds, it is desirable there should be some great proprietors, to lead the way in new improvements.*

*See pp. 352 and 353 [48, 49, 52, 57 335] of a French translation published at Brussels in 1839, by M. Fred. de Kemmeter, of Ghent. [Rau, C. H. *Traité d'économie nationale*. Trans. F. de Kemmeter, from the 3rd ed. Brussels: Hauman, 1839, pp. 332, 335.]

[q-q]+62, 65, 71
[r-r]MS, 48 nearly so great, as Mr. Wakefield's simple criterion would represent it
[s-s]MS, 48, 49 the last
[t-t]52, 57 appear

The most apparently impartial and discriminating judgment that I have met with is that of M. Passy, who (always speaking with reference to *net* produce) gives his verdict in favour of large farms for grain and forage; but, for the kinds of culture which require much labour and attention, places the advantage wholly on the side of small cultivation; including in this description, not only the vine and the olive, where a considerable amount of care and labour must be bestowed on each individual plant, but also roots, leguminous plants, and those which furnish the materials of manufactures. The small size, and consequent multiplication, of farms, according to all authorities, are extremely favourable to the abundance of many minor products of agriculture.*

It is evident that every labourer who extracts from the land more than his own food, and that of any family he may have, increases the means of supporting a non-agricultural population. Even if his surplus is no more than enough to buy "clothes", the labourers who make the clothes are a non-agricultural population, enabled to exist by food which he produces. Every agricultural family, therefore, which produces its own necessaries, adds to the net produce of agriculture; and so does every person born on the land, who by employing himself on it, adds more to its gross produce than the mere food which he eats. It is questionable whether, even in the most subdivided districts of Europe which are cultivated by the proprietors, the multiplication of hands on the soil has approached, or tends to approach, within a great distance of this limit. In France, though the subdivision is confessedly too great, there is proof positive that it is far from having reached the point at which it would begin to diminish the power of supporting a non-agricultural population. This is demonstrated by the great increase of the towns; which have of late increased in a much greater ratio than the population generally,† showing (unless the condition of the town labourers is becoming rapidly deteriorated, which there is no reason to believe) that even by the unfair and inapplicable test of proportions, the productiveness of agriculture must be on the increase. This, too, concurrently with the amplest evidence that in the more improved districts of France, and in some which, until lately, were among the unimproved, there is a considerably increased consumption of country produce by the country population itself.

*"Dans le département du Nord," says M. Passy, "une ferme de 20 hectares recueille en veaux, laitage, œufs, et volailles, parfois pour un millier de francs dans l'année; et, les frais défalqués, c'est l'équivalent d'une addition au produit net de 15 à 20 francs par hectare." *Des Systèmes de Culture*, p. 114[n].

†[57] During the interval between the census of 1851 and that of 1856, the increase of the population of Paris alone, exceeded the aggregate increase of all France; while nearly all the other large towns likewise showed [57, 62 show] an increase.

*-*MS him clothes] 48, 49 clothes for him

[v]Impressed with the conviction that, of all faults which can be committed by a scientific writer on political and social subjects, exaggeration, and [w]assertion[w] beyond the evidence, most require to be guarded against, I limited myself in the early editions of this work to the foregoing very moderate statements. I little knew how much stronger my language might have been without exceeding the truth, and how much the actual progress of French agriculture surpassed anything which I had at that time sufficient grounds to affirm. The investigations of that eminent authority on agricultural statistics, M. Léonce de Lavergne, undertaken by desire of the Academy of Moral and Political Sciences of the Institute of France, have led to the conclusion that since the Revolution of 1789, the total produce of French agriculture has doubled; profits and wages having both increased in about the same, and rent in a still greater ratio. M. de Lavergne, whose impartiality is one of his greatest merits, is, moreover, so far in this instance from the suspicion of having a case to make out, that he is labouring to show, not how much French agriculture has accomplished, but how much still remains for it to do. "We have required" (he says) "no less than seventy years to bring into cultivation two million hectares" (five million English acres) "of waste land, to suppress half our fallows, double our agricultural products, increase our population by 30 per cent, our wages by 100 per cent, our rent by 150 per cent. At this rate we shall require three quarters of a century more to arrive at the point which England has already attained."*

After this evidence, we have surely now heard the last of the incompatibility of small properties and small farms with agricultural improvement. The only question which remains open is one of degree; the comparative [x]rapidity[x] of agricultural improvement under the two systems; and it is the general opinion of those who are equally well acquainted with both, that improvement is greatest under a due admixture between them.[v]

In the present chapter, [y]I[y] do not enter on the question [z]between great[z] and small cultivation in any other respect than as a question of production, and of the efficiency of labour. We shall return to it hereafter as affecting the distribution of the produce, and the physical and social well-being of the cultivators themselves; in which aspects it deserves, and requires, a still more particular examination.

*[62] *Economie Rurale de la France depuis* 1789. Par M. Léonce de Lavergne [Louis Gabriel Léonce, Guilhaud de Lavergne], Membre de l'Institut et de la Société Centrale d'Agriculture de France. 2me éd. [Paris: Guillaumin, 1861,] p. 59.

[v–v]+62, 65, 71
[w–w]62 assertions
[x–x]62 *rapidity*
[y–y]MS, 48, 49, 52, 57, 62 we
[z–z]MS, 48 of great] 49 great

Karl Marx (1818-1883)

Das Kapital, vol. 1, 1867

Das Kapital. Band I, *Kritik der politischen Ökonomie, Erster Band, Buch I: Der Produktionsprozeß des Kapitals*, Karl Marx - Friedrich Engels, *Werke*, Band 23, Dietz Verlag, Berlin/DDR 1962.

Zwölftes Kapitel: Teilung der Arbeit und Manufaktur

Capital: A Critique of Political Economy, Volume I, *Book One: The Process of Production of Capital*, First published: in German in 1867; First English edition of 1887 (4th German edition changes included); Progress Publishers, Moscow, USSR. Translated: Samuel Moore and Edward Aveling, edited by Frederick Engels.

Chapter Fourteen: Division of Labour and Manufacture

Amasa Walker (1799-1875)

The Science of Wealth: A Manual of Political Economy, J. B. Lippincott, Philadelphia, 1872, 4th edition.

THE

SCIENCE OF WEALTH:

A MANUAL OF POLITICAL ECONOMY,

EMBRACING THE

LAWS OF TRADE CURRENCY AND FINANCE.

CONDENSED AND ARRANGED

FOR POPULAR READING

AND USE AS A TEXT-BOOK.

BY AMASA WALKER, LL.D.,

LATE LECTURER ON PUBLIC ECONOMY, AMHERST COLLEGE.

FOURTH EDITION.

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CONDITIONS OF THE HIGHEST PRODUCTION.

If labor, through some form, produces all wealth, we are led to inquire into the circumstances and conditions that increase or diminish the efficiency of this great force. That there are mighty variations as it appears in different countries, and even in adjacent communities, is so manifest as hardly to require mention or illustration.

If the wealth of any nation cannot be determined merely by the proportion of its population to that of the world, or of its territory to the general mass of the globe,—as it clearly cannot,—the question, Why? introduces us to the discussion of all those influences which directly or indirectly, immediately or remotely, make one to differ from another. These may be classed as follows:

DIVISION OF LABOR.
CO-OPERATION OF CAPITAL.
ECONOMIC CULTURE.

CHAPTER II.

DIVISION OF LABOR.

IN some countries, a man wishing for a chair goes into the forest, fells a tree, carries the timber to his workshop, forms the parts, and puts them together into a chair. It is a rude and imperfect article, but it has cost him the labor of two days.

In other communities, we find a chair, equally

serviceable and far more elegant, produced by the labor of half a day. Here one man cuts the timber, another transports to the mill, another saws it into suitable dimensions, another forms the legs, another the seat, another the back, another puts the parts together, while still another paints it. A great many chairs are produced by the combined labor of many individuals; and the result is, that one chair has the value of only half a day's labor. Three-fourths of the labor employed in the making of chairs is, then, liberated, to rest in idleness, or to apply itself to further production with still increasing results, as the desires which control efforts shall determine. We cannot be ignorant, that, in some communities, labor, when set free, does waste itself in idleness and frolic. But this is true chiefly of those in which leisure is bestowed, not by man's contrivance, but by the generosity of Nature.

But it may safely be assumed, that such an industrial genius in a people, as seeks to lessen present labor by the distribution of its several offices, will find fresh objects of desire. The very thoughtfulness and care, the social confidence, and mutuality of service, which are required to effect a division of labor, insure such a susceptibility to new industrial wants as shall necessitate the employment of all the labor so relieved.

The full discussion and illustration of this principle, which governs the use of labor saved, belongs to the third inquiry; viz., that of "Economic Culture." We have here, strictly, to show only how labor *is* saved by the division of employments. This forms the great fact of modern industrial civilization.

We shall find it the most important condition of production, multiplying all its powers faster than the soil multiplies the seed. Here is more of the explanation of wealth than can be found in all other inquiries. This force is being rapidly introduced into every department of industry, and will finally become as general as the nature of the different employments will admit. We do not find that it has yet reached its ultimate limit in any sphere of human activity.

What is the significance of division of labor, as expressed in the fewest words? It is, that each workman confine himself to a single operation. In this way all great and successful manufactures are carried on.

CHAPTER III.

THE ADVANTAGES OF DIVISION OF LABOR.

1st. It gives increased dexterity. All common observation testifies how rapid and accurate our motions become, when confined to a single operation. The powers of his body are in perfect discipline. They have learned their parts, and obey instantaneously and harmoniously. The more simple the movement assigned, the greater will be the efficiency of performance.

2d. It allows the workman a better knowledge of his business. This is to the mental powers what the first is to the bodily. It gives intellectual dexterity. The man has a mastery of his special operation. He

knows more about it than if he had two things to think of and care for. He becomes shrewd in every motion. He adapts his labor to the material; he discriminates between the qualities of that material. He meets the little difficulties of his work with more skill and less waste.

3d. It saves time, in passing from one work to another. In the making of a chair after the primitive fashion we have supposed, a great deal of time will be spent in passing from one part of it to another, from the place of one operation to that of another. It is not a loss alone of the time physically necessary in effecting the transition, but each operation will leave something to harass the mind in the other. During the first part, the attention will be distracted by what has just been left. During the last part, the attention will run on, anticipating what is to come. The shadow is cast both ways upon the mind.

4th. It facilitates the invention of tools and machines. If a treasure of gold or iron or oil is hid under the ground, the discoverer is more apt, other things being equal, to be the man who owns the land, and resides and works on it, than a casual visitor. So, if there is possibility of adapting foreign forces to the production of values, the inventor will, on the same condition, more probably be the workman than any one else; he is constantly engaged upon the operation; he desires, of course, to simplify it, since it is a law of mind to do as little work as possible for a certain result; he knows the wants of the subject; he knows all the capabilities of his material; he thinks about it all the time, and can

try an experiment without changing his place. Therefore, by the logic of Nature, he invents.

5th. It secures the better adaptation of physical and mental abilities. No consideration is more vital than this. The work which man finds to do, the efforts he has to make for satisfactions, however high his wants may rise, will be of the most various character, and require the most diverse powers. There are operations which demand great strength; others, rapid motion; others, good judgment; others, a mechanical eye; others, fidelity and trust; others, high intelligence and education. Such qualities, even those purely physical, are not found equally in all; nay, by the compensations of Nature, they are generally, though not necessarily, found apart. Therefore, unless work were divided according to the several qualities required, a deficiency in one would neutralize all the others, and exclude the workman from employment, or compel him to work at great disadvantage.

The extensive applications of this principle will occur to every mind. Each man finds the sphere of his highest usefulness as he is endowed by Nature. Those who are gifted with education and ingenuity devote all their time and energy to duties appropriate to such powers. They thus confer on others the advantage of their own gifts, and are themselves spared from drudgery and uncongenial labor. The poorest in qualifications, also, find a place in which they can produce within the great partnership of society. Women are enabled to undertake business of the most delicate and important character, to which their strength is sufficient; while children of

all ages take parts that would otherwise occupy men. The power saved or gained, by such an adaptation of talents to special branches of industry, is incalculable.

And not merely do all find in a proper division of labor their full occupation and fair reward, but the work of each is just as truly productive as that of any other. The boy who watches crows does as much at that business as the bravest and greatest of earth. He takes the place of some one who goes away to do a larger work.

6th. It increases the power of capital in production, tends to concentrate manufactures in large establishments, and reduce profits.

Supposing all men equally capable of carrying on independent business, which is not the case,—if we compare seven men each with a capital of $1,000 and one man with a capital of $7,000, we shall find the economical advantage greatly in favor of the latter. The former must do business on a small scale, and purchase materials in small quantities. The latter can buy at wholesale prices, can afford to go often to market, and to keep himself well informed, and will sell as well as buy to great advantage.

In addition to this, the large manufacturer can afford to work for a smaller rate of profit.

A single hatter, for example, who makes only $2,000 worth of hats, must secure 25 per cent. in order to have a net income of $500; while the man who can make $20,000 worth of hats will, if he realize only 12½ per cent., have an income of $2,500.*

* The shoe trade affords a conspicuous illustration in point. At the beginning of the present century it was almost wholly carried

We see from these illustrations why the great establishments drive smaller ones out of the market. A tendency to a reduction of profits is a natural consequence of this. Therefore, other things being equal, it is desirable that manufacturing establishments should be sufficiently large to secure all the advantages of concentrated capital, and effect the complete division of labor.

7th. It shortens apprenticeship.

Every art, trade, or profession must be preceded by an apprenticeship, more or less extended, according to what is necessary to be learned. A trade which, in order to be perfectly understood in all its parts, requires an apprenticeship of seven years,—if it be subdivided into seven different operations, may, it is evident, be obtained with as great a degree of perfection by an average, in each branch, of one year's service. Some of the parts may require more than one year, others less.

Now, we find this to be practically true; and the result is a great saving of time, and time is money.

For example:

Seven men serve seven years each to learn to make hats, —in all, a service of	49 years
Seven men serve one year each to learn to make a seventh of a hat, equal to	7 "
Saving of	42 years

on by individual mechanics working in small shops and requiring a "kit" costing but a few shillings. Now vast factories are erected, steam or other power applied, a large variety of labor-saving machinery introduced, and the business is carried upon a scale of surprising magnitude; one establishment in Massachusetts producing 6,000 pairs of boots and shoes *daily*. Of course a very small percentage of profits must give a great annual income.

in the mechanical education of every seven men employed in this manner.

Apply this principle to the manufacturers of Massachusetts, which has at least 75,000 skilled workmen, and suppose the apprenticeship to be seven years, we have—

75,000 at 7 years each	525,000 years
75,000 at 1 year each	75,000 "
Saving of	450,000 years

in one generation of skilled workmen.

If we suppose these years, saved from apprenticeship, to have an average value of $200, we have a saving of $90,000,000 *for each generation* of skilled workmen in Massachusetts.

The principle, under which this saving of time is made, cannot be disputed.

8th. It gives opportunity for greater social development, and increases the social power of labor.

This is immediately of moral interest; but it has important economic bearings. The principle itself is indisputable. Not only is the workman brought near his fellows, and, by such contact, stimulated to industry, to acquisition, to taste; not only does such association of purposes and means afford more of the instruments of intellectual advancement,—schools, lectures, churches, journals; not only does the close neighborhood of mind quicken and brighten all the faculties, teaching by example, and firing by controversy; but, by such association, workmen are brought nearer their employers, have a greater sympathy and co-operation, act intelligently and harmoniously as to their rights, and form a public opinion among themselves which has often been found a great power, economically and civilly.

CHAPTER IV.

LIMITATIONS TO THE DIVISION OF LABOR.

But the great principle of division of labor, so very beneficial in its operations, is yet limited by certain conditions, which it cannot disregard.

1st. When the principle has been so far applied that each operation has been made as simple and fully a unit as human ingenuity can devise. Beyond this, there is no division, but only *repetition.* Any attempt to refine the process so far as to give the workman less than one naturally complete motion of the body, will only embarrass and delay industry.

2d. When the concentration of capital has become so great that interested personal supervision cannot be brought to bear upon each department, and upon the whole enterprise, with sufficient intensity to insure efficiency and fidelity on the part of those employed, and harmony in the general conduct of the business. Beyond this point, the advantages derived from the power of concentration are neutralized. It may become mischievous. It is well that there should be limitations, because they prevent such aggregations of capital as would swallow up the whole industry of a state.

3d. Where the industry consists of an indefinite number of parts, yet the special circumstances will not allow each workman profitable employment in

a single operation,—for example, agriculture in most of its branches: first, from the fact that its operations cannot be sufficiently localized; and, second, from the necessities of the seasons. No department is capable of so much subdivision as this; yet, in practice, none experiences so little. In mining, the fisheries, and many incidental matters, it is effected to a considerable extent; but, in most of the parts of pure agriculture, it has very limited range.

Generally speaking, the farmer is a laborer of a thousand duties.

This fact alone does not account for the different productiveness of the manufacturing and the agricultural interests. In the nature of their objects, it is found that machinery must be applied to them in far different proportions. The mechanic arts, which can be localized to the highest degree of concentration, and made general to all seasons of the year, admit also of prodigious multiplication by artificial agents. From these considerations, we deduce the principle, that the value of agricultural products, as a class,—that is, their power in exchange for products other than agricultural,—will be constantly increasing. A bushel of corn, in 1820, would purchase only four yards of cotton cloth. In 1860, it would purchase ten yards of the same or better quality. This difference will continue to grow wider and wider as the mechanic arts advance; but not indefinitely, inasmuch as the materials of manufactures are always themselves of agricultural origin, and hence the depreciation of the price is limited.

We have thus far spoken of the division of labor as applied only to direct, material production, affect-

ing the laboring classes, and those immediately superintending them; but the principle has been extended to mental labor, as well as that which is simply muscular.

The recognition of professions and industrial classes is itself a tribute to the great principle of the division of labor; but it proceeds still further, to assign special functions, within those professions and classes, to individual members. Thus the law, when a sufficient concentration of legal labor is secured, branches into the departments of titles and conveyances, of insurance, of marine losses, forfeiture and salvage, of patents, of criminal jurisprudence, etc. In medicine, the eye, the ear, the skin, consumption, fevers, cancers, have each their own practitioners.

That science and skill are promoted by such subdivision, and that the immediate efficiency of professional labor is greatly increased thereby, cannot be intelligently questioned.

As any community advances to a higher civilization, specialties are more and more resorted to. Individuals, finding themselves peculiarly adapted by their talents and tastes to a particular calling, or having unusual advantages for the pursuit of it, give themselves up to that object. They concentrate upon it their thoughts, their time, and their resources. They excel. They know more, and can do better, in their chosen line than those about them. This gives them position and power. They are sought for, are looked to, because they have something that is wanted. No matter how humble his station, or how minute his field of investigation, if a man under-

stands something perfectly, his world—whether a hamlet or an empire or the race—will resort to him. He becomes a benefactor of society.

CHAPTER V.

THE DISADVANTAGES OF THE DIVISION OF LABOR.

1st. It tends to enervate the laborer, because it does not, as a general fact, give full activity and development to all the functions of the body.

In the material occupations, it is found that confinement to a single operation is often highly injurious. There are forms of labor which sufficiently exercise the several parts of the body. But there are those which require the constant fatiguing use of some member, to the injury of the rest of the body; others require a cramping posture that oppresses and disorders the vital organs; others still require the workman to poison his blood with unwholesome gases. In the great centres of capital and labor,—whether we regard the mill, or that larger mill, the city itself,—it is notorious that distortion, paralysis, and organic feebleness are more common than where labor is diffused, and the laborer changes his work and his place frequently.

That this will occur in the course of all manufacturing industry is probable. That it is inevitable does not so clearly appear. The sanitary arts keep even pace with the advance of machinery. The civil war in America developed astonishingly the re-

sources, which are at the command of government, to suppress malaria, and reform the habitations of disease. The growth of manly sports, and the cultivation of gymnastics for health's sake, are likely to work a great change for the better in the sanitary conditions of our people. Besides, a gradual reduction in the hours of labor is very certain to take place with the introduction of improved machinery. Once twelve hours constituted a day's work in the factories of New England. Eleven hours has since been adopted, and now, in many cases, ten hours constitute a day's work. A strong effort is being made to secure that number of hours as the maximum for all women and children. This is not only humane and just, but truly economical; since it cannot admit of a doubt that ten hours is the utmost limit at which the health and longevity of those classes can be preserved, while no small children, if allowed to work at all in factories, should be employed more than half a day.

Mechanical operations were formerly considered as disqualifying for military service; and even our modern philosophy has found in them a reason for the employment of mercenaries, and the maintenance of standing armies. But the great civil war just referred to exhibited the novel fact, that, beyond all dispute, the troops raised in agricultural districts are not so hardy in the privations and exposures of camp and field as those coming from the towns. This does not, however, imply a better state of health at home. It may be, that the latter class find, in the constant exercise and the out-door employment, just that *change* of habit and condition which they needed. All that is different from their usual course of life is

in the direction of more air and light and motion; while the agricultural laborers find no change except for the worse.

2d. This system, in some of its applications and in certain degrees of extension, does not give that full employment and expansion to all the powers of the mind which its normal development requires. This is obvious. The mind, if intensely devoted for a whole life to a single effort, and that perhaps of the most simple kind, cannot but be unfavorably affected. Unless counteracting influences are resorted to, it will undoubtedly be contracted and enervated.

To this liability are opposed three compensations:

a. The great communicativeness observable in such circumstances, the eager discussions, the free inquiry, the school, and the lyceum.

b. The saving principle that the employment of one member is, to a certain extent, the employment of all. The human faculties, mental and physical, are a knot. They interpenetrate so completely that it is impossible to move one without affecting the rest. The special use of one may develop it greatly; make it more strong and active than the others. But such a predominance is not distortion. Few minds are capable of even and temperate growth. In this principle resides the variety of human character. It may be questioned whether any but the most gifted can be educated in any other way so thoroughly and efficiently as by interested application to some single matter. Generalization and broad philosophy rouse the full powers of but few intellects. In the majority of cases, it will remain

true that intense, spirited, persistent labor directed to one point is better than the languid, nerveless, unspurred, rambling play of all the faculties.

Indeed, the argument against division of labor on this score would be better expressed by saying, that the constant repetition of single acts so far dispenses with thought, and even with consciousness, in the operation, that it makes man, in some sense, a machine. This is, to a considerable extent, true; the compensation being that it affords a greater opportunity for discussion and reflection, if the workman chooses to avail himself of the kind of mental leisure which is afforded by the monotony of his occupation.

c. The laborer is not all workman. While his special occupation provides for his subsistence, and endows him with energy, industry, and concentrativeness of mind and character, he has other hours and other duties, ample, if reasonably used, to compensate for all the evil mental effects of his continuous toil.

It will be observed, that it is only to the division of labor *beyond a certain point*, that the objections we have discussed have any application. A more ill-developed society, with more ill-developed members, could not be conceived than where this principle was not applied to all. In fact, there could be neither members nor society; but here and there a savage would bask in the summer sun, or hide himself in the storms of winter, in hopeless, helpless barbarism.

However we may speculate, *a priori*, on the consequences of dividing minutely the parts of labor, we

may perhaps get a stronger light and a better view by observing the mightiest experiment of industry ever known in the world,—that of England to-day. Nowhere are the natural advantages of agriculture more apparent; nowhere has manufacturing been more elaborated. Yet no person can be cognizant of the condition of the English population without being assured that the manufacturing, laboring class is far above the agricultural in intelligence, in independence of character, and obedience to law.

3d. It will follow, from what has been already urged, that division of labor, in its greatest extension, has a tendency, or at least there is found in it a liability, to lower the average of health, to shorten life, and prevent the natural increase of population.

All these results are found, on examination, more or less, but still above the general facts of the country, in all the great centres of manufacturing industry, where the full possibilities of the mechanic arts are realized by the intense subdivision of labor. This result can only be partially and confusedly shown by statistics: still enough can be extracted to assure us that there is a great loss of vital energy, whether or not it is necessary to such a state of industry.

The American average of life may be expressed nearly as follows:*

Cultivators of the earth	64 years.
Active mechanics out of shops	50 "
Active mechanics in shops	47½ "
Inactive mechanics in shops	41¾ "
Laborers, no special trades	45½ "

* Massachusetts Registration of Births, Deaths, and Marriages.

These statistics, accurately gathered and showing the results of many years, require correction in several particulars, if the real lesson of them is to be obtained. In the first place, two-thirds of the class of mechanics as presented here are engaged in such occupations as do not allow any very extended subdivision of the parts, so that the average of the great manufacturing establishments and their dependent cities would be found still more striking. In the second place, the agricultural occupations are continually making contribution to manufactures of their best blood and bone, renewing the natural waste of the mill and shop, and so interfering with the statistics of the subject. This element can neither be eliminated nor determined. So important is it at times, that Lowell appears on the tables as one of the healthiest cities of America. It is unquestionably true that much of the historical feebleness and mortality of such places has been avoided by more humane and intelligent precautions, by gymnastic sports and out door games, and by a better adaptation of all the conditions of production to the necessities of life and well being. But the great fact which accounts for this seeming healthfulness of a manufacturing city is the constant infusion of the fresh, vigorous, young blood of the country.

4th. The division of labor lessens the number of those who do business on their own account. The result of this, in agriculture, is to absorb the yeomanry into the class of those who labor by the day or month, with no interest in the land. The result in manufacturing is to subordinate hundreds of operatives to the control of a single will. This

has a threefold relation: *a.* To the formation of character. Something of independence and self-respect is unquestionably lost, so far as these depend on external conditions. Position and responsibility do foster and strengthen manliness and self-mastery. By the division of labor, the independence of each is sacrificed to the good of all. It will not be doubted, that, on the whole, it is desirable that it should be so; nor can it be denied that there are partial drawbacks, even in this plain tendency of civilization. It is the sacrifice man has to make in society, in industry, in government. *b.* To the fairness of remuneration. A very few now participate in the profits. The great bulk of workmen receive only wages, and that on temporary engagements. This disproportion may be excessive, and is likely to be where laws or institutions check enterprise, and discourage individual effort. In such cases, laborers are practically a herd of cattle, driven about from place to place, receiving bare subsistence, and unable to mend their condition. But, even if we come forward from the barbarous state to that in which the work of man has divided itself into numerous trades, each of these, however, yet remaining distinct, and compare this with the present state, in which trades have been repeatedly subdivided,—capital aggregate and labor subordinate,—we shall yet find that the share of the poorest laborer in the mighty product of our industry of to-day is greater than ever before. Augustus, says Arbuthnot, had neither glass to his windows nor a shirt to his back.

Thus much could be urged of the wretchedest

operatives on the earth; but, when we regard the condition of labor as it exists in nearly all the countries of the world, we shall quickly confess, that, though the laborer has given up his share of profits, he receives back, as wages, far more objects of desire than he could have obtained in the old way. *c.* To the steadiness of employment. By the attraction of labor to great centres, the fate of many laborers is made dependent on that of a few capitalists. This is a great fact, scientifically and historically. It must continue. It has issued, in the past, in the form of great industrial distresses, of a general suspension of *mechanical* labor from causes affecting only the *mercantile* credit of the employers, of frantic appeals for support, of laws in which government assumes the duty of providing work for its whole population, of riots and revolution. So far as this will occur in spite of prudence and careful management, it is the condition on which we have the advantages of division of labor.

Where capital is concentrated, it is stronger, protects itself better; and, of course, the workman shares in this power and immunity. Where the industry of thousands is controlled by the mind of one, it will be more intelligently and harmoniously administered, and with a larger view of the business. By such superiority of union in production (for that is synonymous with division of labor), the industry of a country is lifted clean over obstacles which individual enterprise could not pass,—is preserved amid storms that would shatter the feeble fabric of single hands.

But when the blow becomes so heavy as to shatter

even the great workshops of modern industry, and they come down, then truly the fall is great. The ruin is more complete than if the storm had prostrated a village of huts. The reservoir of gathered power has burst; the springs have long since been broken down; the wells been filled up; and there is no supply for immediate wants. Such a loss is repaired slowly. Independent has been discouraged by collective industry; the shop has been abandoned for the mill; each workman has learned only the fraction of a trade; no one can buy, make, and sell; no one dares to undertake any business, foreseeing that the corporation must rise again. For awhile, all is distress. It is only when the stately fabric of associated industry is reared again that plenty is known in the land.

We have discussed, somewhat at length, the relations which division of labor holds to the condition of the laborer, by depriving him of the opportunity to do business on his own account. Until recently, it has been supposed that the advantages of the principle could not practically be obtained without this defect; that capital could not be concentrated, and the trades perfected, without diminishing the independence and self-reliance of labor. But recent developments seem to be anticipating the objection. It is now a matter of common practice to admit the laborer to an interest in business,—a share in profits. This is done by merchants to their salesmen, by master-mechanics to their workmen, by ship-owners to their hands.

5th. This system, as it necessarily occasions the concentration of the laboring classes, and thus

affords opportunities for intercommunication, naturally gives rise to labor combinations and strikes, —a subject to be discussed hereafter.

We have passed through the discussion of the advantages, the limitations, and the disadvantages of the division of labor.

If, now, we inquire on which side the balance lies, there will be no question that it is in favor of the application and extension of the law. It appears as the great multiplying power of modern industry; it has made the difference between barbarism and civilization; it resides in man's being as the principle of help; it is the only name that savage nature fears.

CHAPTER VI.

THE CO-OPERATION OF CAPITAL.

This is the second grand condition, through which the productiveness of labor is increased.

We have before spoken of capital: we now proceed to define it strictly.

It is that portion of wealth employed in reproduction.

The distinction involved is an important one. All capital is wealth, but all wealth is not capital. Since it is recognized that human wants create others of their kind, and hence go on increasing in number and urgency, it is necessary that human efforts should find some force having a corresponding

Alfred Marshall (1842-1924)

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ECONOMICS

An introductory volume

BY

ALFRED MARSHALL

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CHAPTER VIII.

INDUSTRIAL ORGANIZATION.

IV, VIII, 1.

The doctrine that organization increases efficiency is old.

§ 1. WRITERS on social science from the time of Plato downwards have delighted to dwell on the increased efficiency which labour derives from organization. But in this, as in other cases, Adam Smith gave a new and larger significance to an old doctrine by the philosophic thoroughness with which he explained it, and the practical knowledge with which he illustrated it. After insisting on the advantages of the division of labour, and pointing out how they render it possible for increased numbers to live in comfort on a limited territory, he argued that the pressure of population on the means of subsistence tends to weed out those races who through want of organization or for any other cause are unable to turn to the best account the advantages of the place in which they live.

Biologists and economists have studied the influence which the struggle for survival exerts on organization.

Before Adam Smith's book had yet found many readers, biologists were already beginning to make great advances towards understanding the real nature of the differences in organization which separate the higher from the lower animals; and before two more generations had elapsed, Malthus' historical account of man's struggle for existence started Darwin on that inquiry as to the effects of the struggle for existence in the animal and vegetable world, which issued in his discovery of the selective influence constantly played by it. Since that time biology has more than repaid her debt; and economists have in their turn owed much to the many profound analogies which have been discovered between social and especially industrial

organization on the one side and the physical organization of the higher animals on the other. In a few cases indeed the apparent analogies disappeared on closer inquiry: but many of those which seemed at first sight most fanciful, have gradually been supplemented by others, and have at last established their claim to illustrate a fundamental unity of action between the laws of nature in the physical and in the moral world. This central unity is set forth in the general rule, to which there are not very many exceptions, that the development of the organism, whether social or physical, involves an increasing subdivision of functions between its separate parts on the one hand, and on the other a more intimate connection between them[1]. Each part gets to be less and less self-sufficient, to depend for its wellbeing more and more on other parts, so that any disorder in any part of a highly-developed organism will affect other parts also. IV, VIII, 1.

This increased subdivision of functions, or "differentiation," as it is called, manifests itself with regard to industry in such forms as the division of labour, and the development of specialized skill, knowledge and machinery: while "integration," that is, a growing intimacy and firmness of the connections between the separate parts of the industrial organism, shows itself in such forms as the increase of security of commercial credit, and of the means and habits of communication by sea and road, by railway and telegraph, by post and printing-press. Differentiation and Integration.

The doctrine that those organisms which are the most highly developed, in the sense in which we have just used the phrase, are those which are most likely to survive in the struggle for existence, is itself in process of development. It is not yet completely thought out either in its biological or its economic relations. But we may pass to consider the main bearings in economics of the law that the struggle for existence causes those organisms to multiply which are best fitted to derive benefit from their environment.

[1] See a brilliant paper by Häckel on *Arbeitstheilung in Menschen- und Thierleben* and Schaffle's *Bau und Leben des socialen Körpers.*

CHAPTER IX.

INDUSTRIAL ORGANIZATION, CONTINUED. DIVISION OF LABOUR. THE INFLUENCE OF MACHINERY.

IV, IX, 1.

The course of inquiry in this and the three following chapters.

§ 1. THE first condition of an efficient organization of industry is that it should keep everyone employed at such work as his abilities and training fit him to do well, and should equip him with the best machinery and other appliances for his work. We shall leave on one side for the present the distribution of work between those who carry out the details of production on the one hand, and those who manage its general arrangement and undertake its risk on the other; and confine ourselves to the division of labour between different classes of operatives, with special reference to the influence of machinery. In the following chapter we shall consider the reciprocal effects of division of labour and localization of industry; in a third chapter we shall inquire how far the advantages of division of labour depend upon the aggregation of large capitals into the hands of single individuals or firms, or, as is commonly said, on production on a large scale; and lastly, we shall examine the growing specialization of the work of business management.

Practice makes perfect.

Everyone is familiar with the fact that "practice makes perfect," that it enables an operation, which at first seemed difficult, to be done after a time with comparatively little exertion, and yet much better than before; and physiology in some measure explains this fact. For it gives reasons for believing that the change is due to the gradual growth of new habits of more or less "reflex" or automatic action.

Physiological explanation.

Perfectly reflex actions, such as that of breathing during sleep, are performed by the responsibility of the local nerve centres without any reference to the supreme central authority of the thinking power, which is supposed to reside in the cerebrum. But all deliberate movements require the attention of the chief central authority: it receives information from the nerve centres or local authorities and perhaps in some cases direct from the sentient nerves, and sends back detailed and complex instructions to the local authorities, or in some cases direct to the muscular nerves, and so co-ordinates their action as to bring about the required results[1]. IV, IX, 1.

The physiological basis of purely mental work is not yet well understood; but what little we do know of the growth of brain structure seems to indicate that practice in any kind Knowledge and intellectual ability.

[1] For instance, the first time a man attempts to skate he must give his whole attention to keeping his balance, his cerebrum has to exercise a direct control over every movement, and he has not much mental energy left for other things. But after a good deal of practice the action becomes semi-automatic, the local nerve centres undertake nearly all the work of regulating the muscles, the cerebrum is set free, and the man can carry on an independent train of thought; he can even alter his course to avoid an obstacle in his path, or to recover his balance after it has been disturbed by a slight unevenness, without in any way interrupting the course of his thoughts. It seems that the exercise of nerve force under the immediate direction of the thinking power residing in the cerebrum has gradually built up a set of connections, involving probably distinct physical change, between the nerves and nerve centres concerned; and these new connections may be regarded as a sort of capital of nerve force. There is probably something like an organized bureaucracy of the local nerve centres: the medulla, the spinal axis, and the larger ganglia generally acting the part of provincial authorities, and being able after a time to regulate the district and village authorities without troubling the supreme government. Very likely they send up messages as to what is going on: but if nothing much out of the way has happened, these are very little attended to. When however a new feat has to be accomplished, as for instance learning to skate backwards, the whole thinking force will be called into requisition for the time; and will now be able by aid of the special skating-organization of the nerves and nerve centres, which has been built up in ordinary skating, to do what would have been altogether impossible without such aid.

To take a higher instance: when an artist is painting at his best, his cerebrum is fully occupied with his work: his whole mental force is thrown into it, and the strain is too great to be kept up for a long time together. In a few hours of happy inspiration he may give utterance to thoughts that exert a perceptible influence on the character of coming generations. But his power of expression had been earned by numberless hours of plodding work in which he had gradually built up an intimate connection between eye and hand, sufficient to enable him to make good rough sketches of things with which he is tolerably familiar, even while he is engaged in an engrossing conversation and is scarcely conscious that he has a pencil in his hand.

IV, IX, 1. of thinking develops new connections between different parts of the brain. Anyhow we know for a fact that practice will enable a person to solve quickly, and without any considerable exertion, questions which he could have dealt with but very imperfectly a little while before, even by the greatest effort. The mind of the merchant, the lawyer, the physician, and the man of science, becomes gradually equipped with a store of knowledge and a faculty of intuition, which can be obtained in no other way than by the continual application of the best efforts of a powerful thinker for many years together to one more or less narrow class of questions. Of course the mind cannot work hard for many hours a day in one direction: and a hard-worked man will sometimes find recreation in work that does not belong to his business, but would be fatiguing enough to a person who had to do it all day long.

Change of activity often a form of relaxation.

Some social reformers have indeed maintained that those who do the most important brain work might do a fair share of manual work also, without diminishing their power of acquiring knowledge or thinking out hard questions. But experience seems to show that the best relief from overstrain is in occupations taken up to suit the mood of the moment and stopped when the mood is passed, that is, in what popular instinct classes as "relaxation." Any occupation which is so far business-like that a person must sometimes force himself by an effort of the will to go on with it, draws on his nervous force and is not perfect relaxation: and therefore it is not economical from the point of view of the community unless its value is sufficient to outweigh a considerable injury to his main work[1].

[1] J. S. Mill went so far as to maintain that his occupations at the India Office did not interfere with his pursuit of philosophical inquiries. But it seems probable that this diversion of his freshest powers lowered the quality of his best thought more than he was aware; and though it may have diminished but little his remarkable usefulness in his own generation, it probably affected very much his power of doing that kind of work which influences the course of thought in future generations. It was by husbanding every atom of his small physical strength that Darwin was enabled to do so much work of just that kind: and a social reformer who had succeeded in exploiting Darwin's leisure hours in useful work on behalf of the community, would have done a very bad piece of business for it.

§ 2. It is a difficult and unsettled question how far specialization should be carried in the highest branches of work. In science it seems to be a sound rule that the area of study should be broad during youth, and should gradually be narrowed as years go on. A medical man who has always given his attention exclusively to one class of diseases, may perhaps give less wise advice even in his special subject than another who, having learnt by wider experience to think of those diseases in relation to general health, gradually concentrates his study more and more on them, and accumulates a vast store of special experiences and subtle instincts. But there is no doubt that greatly increased efficiency can be attained through division of labour in those occupations in which there is much demand for mere manual skill.

In the higher grades of work extreme specialization does not always increase efficiency.

Adam Smith pointed out that a lad who had made nothing but nails all his life could make them twice as quickly as a first-rate smith who only took to nail-making occasionally. Anyone who has to perform exactly the same set of operations day after day on things of exactly the same shape, gradually learns to move his fingers exactly as they are wanted, by almost automatic action and with greater rapidity than would be possible if every movement had to wait for a deliberate instruction of the will. One familiar instance is seen in the tying of threads by children in a cotton-mill. Again, in a clothing or a boot factory, a person who sews, whether by hand or machinery, just the same seam on a piece of leather or cloth of just the same size, hour after hour, day after day, is able to do it with far less effort and far more quickly than a worker with much greater quickness of eye and hand, and of a much higher order of general skill, who was accustomed to make the whole of a coat or the whole of a boot[1].

But it is easy to acquire a high manual skill in a narrow range of work.

[1] The best and most expensive clothes are made by highly skilled and highly paid tailors, each of whom works right through first one garment and then another: while the cheapest and worst clothes are made for starvation wages by unskilled women who take the cloth to their own homes and do every part of the sewing themselves. But clothes of intermediate qualities are made in workshops or factories, in which the division and subdivision of labour are carried as far as the size of the staff will permit; and this method is rapidly gaining ground at both ends at the expense of the rival method. Lord Lauderdale (*Inquiry*, p. 282) quotes

IV, IX, 2.

The uniformity of many processes in the wood and metal trades.

Again, in the wood and the metal industries, if a man has to perform exactly the same operations over and over again on the same piece of material, he gets into the habit of holding it exactly in the way in which it is wanted, and of arranging the tools and other things which he has to handle in such positions that he is able to bring them to work on one another with the least possible loss of time and of force in the movements of his own body. Accustomed to find them always in the same position and to take them in the same order, his hands work in harmony with one another almost automatically: and with increased practice his expenditure of nervous force diminishes even more rapidly than his expenditure of muscular force.

The provinces of manual labour and machinery.

But when the action has thus been reduced to routine it has nearly arrived at the stage at which it can be taken over by machinery. The chief difficulty to be overcome is that of getting the machinery to hold the material firmly in exactly the position in which the machine tool can be brought to bear on it in the right way, and without wasting too much time in taking grip of it. But this can generally be contrived when it is worth while to spend some labour and expense on it; and then the whole operation can often be controlled by a worker who, sitting before a machine, takes with the left hand a piece of wood or metal from a heap and puts it in a socket, while with the right he draws down a lever, or in some other way sets the machine tool at work, and finally with his left hand throws on to another heap the material which has been cut or punched or drilled or planed exactly after a given pattern. It is in these industries especially that we find the reports of modern trades-unions to be full of complaints that unskilled labourers, and even their wives and children, are put to do work which used to require the skill and judgment of a trained mechanic, but

Xenophon's argument that the best work is done when each confines himself to one simple department, as when one man makes shoes for men, and another for women; or better when one man only sews shoes or garments, another cuts them out: the king's cooking is much better than anybody else's, because he has one cook who only boils, another who only roasts meat; one who only boils fish, another who only fries it: there is not one man to make all sorts of bread but a special man for special qualities.

which has been reduced to mere routine by the improvement of machinery and the ever-increasing minuteness of the subdivision of labour. IV, IX, 3.

§ 3. We are thus led to a general rule, the action of which is more prominent in some branches of manufacture than others, but which applies to all. It is, that any manufacturing operation that can be reduced to uniformity, so that exactly the same thing has to be done over and over again in the same way, is sure to be taken over sooner or later by machinery. There may be delays and difficulties; but if the work to be done by it is on a sufficient scale, money and inventive power will be spent without stint on the task till it is achieved[1]. The division of labour in relation to the growth of machinery

Thus the two movements of the improvement of machinery and the growing subdivision of labour have gone together and are in some measure connected. But the connection is not so close as is generally supposed. It is the largeness of markets, the increased demand for great numbers of things of the same kind, and in some cases of things made with great accuracy, that leads to subdivision of labour; the chief effect of the improvement of machinery is to cheapen and make more accurate the work which would anyhow have been subdivided. For instance, "in organizing the works at Soho, Boulton and Watt found it necessary to carry division of labour to the furthest practicable point. Machinery displaces purely manual skill,

[1] One great inventor is rumoured to have spent £300,000 on experiments relating to textile machinery, and his outlay is said to have been abundantly returned to him. Some of his inventions were of such a kind as can be made only by a man of genius; and however great the need, they must have waited till the right man was found for them. He charged not unreasonably £1000 as royalty for each of his combing machines; and a worsted manufacturer, being full of work, found it worth his while to buy an additional machine, and pay this extra charge for it, only six months before the expiry of the patent. But such cases are exceptional: as a rule, patented machines are not very dear. In some cases the economy of having them all produced at one place by special machinery has been so great that the patentee has found it to his advantage to sell them at a price lower than the old price of the inferior machines which they displaced: for that old price gave him so high a profit, that it was worth his while to lower the price still further in order to induce the use of the machines for new purposes and in new markets. In almost every trade many things are done by hand, though it is well known that they could easily be done by some adaptations of machines that are already in use in that or some other trade, and which are not made only because there would not as yet be enough employment for them to remunerate the trouble and expense of making them.

IV, IX, 4. There were no slide-lathes, planing machines or boring tools, such as now render mechanical accuracy of construction almost a matter of certainty. Everything depended on the individual mechanic's accuracy of hand and eye; yet mechanics generally were much less skilled then than they are now. The way in which Boulton and Watt contrived partially to get over the difficulty was to confine their workmen to special classes of work, and make them as expert in them as possible. By continued practice in handling the same tools and fabricating the same articles, they thus acquired great individual proficiency[1]." Thus machinery constantly supplants and renders unnecessary that purely manual skill, the attainment of which was, even up to Adam Smith's time, the chief advantage of division of labour. But this influence is more than countervailed by its tendency to increase the scale of manufactures and to make them more complex; and therefore to increase the opportunities for division of labour of all kinds, and especially in the matter of business management.

and thus diminishes some of the advantages of division of labour: but increases the scope for it.

§ 4. The powers of machinery to do work that requires too much accuracy to be done by hand are perhaps best seen in some branches of the metal industries in which the system of Interchangeable Parts is being rapidly developed. It is only after long training and with much care and labour that the hand can make one piece of metal accurately to resemble or to fit into another: and after all the accuracy is not perfect. But this is just the work which a well made machine can do most easily and most perfectly. For instance, if sowing and reaping machines had to be made by hand, their first cost would be very high; and when any part of them was broken, it could be replaced only at great cost by sending the machine back to the manufacturer or by bringing a highly skilled mechanic to the machine. But as it is, the manufacturer keeps in store many facsimiles of the broken part, which were made by the same machinery, and are therefore interchangeable with it. A farmer in the North-West of America, perhaps a hundred miles away from any good mechanic's shop, can yet use complicated machinery

Machine-made machinery is introducing the new era of Interchangeable Parts.

[1] Smiles' *Boulton and Watt*, pp. 170, 1.

with confidence; since he knows that by telegraphing the number of the machine and the number of any part of it which he has broken, he will get by the next train a new piece which he can himself fit into its place. The importance of this principle of interchangeable parts has been but recently grasped; there are however many signs that it will do more than any other to extend the use of machine-made machinery to every branch of production, including even domestic and agricultural work[1]. IV, IX, 4.

Illustration from the history of the watch-making trade.

The influences which machinery exerts over the character of modern industry are well illustrated in the manufacture of watches. Some years ago the chief seat of this business was in French Switzerland; where the subdivision of labour was carried far, though a great part of the work was done by a more or less scattered population. There were about fifty distinct branches of trade each of which did one small part of the work. In almost all of them a highly specialized manual skill was required, but very little judgment; the earnings were generally low, because the trade had been established too long for those in it to have anything like a monopoly, and there was no difficulty in bringing up to it any child with ordinary intelligence. But this industry is now yielding ground to the American system of making watches by machinery, which requires very little specialized manual skill. In fact the machinery is becoming every year more and more automatic, and is getting to require less and less assistance from the human hand. But the more delicate the machine's power, the greater is the judgment and carefulness which is called for from those who see after it. Take for instance a beautiful machine which feeds itself with steel wire at one end, and delivers at the other tiny screws of exquisite form; it displaces a great many operatives who had indeed acquired a very high and specialized manual skill, but who lived sedentary lives, straining their eyesight through microscopes, and finding in

Complex machinery increases the demand for judgment and general intelligence;

[1] The system owes its origin in great measure to Sir Joseph Whitworth's standard gauges; but it has been worked out with most enterprise and thoroughness in America. Standardization is most helpful in regard to things which are to be built up with others into complex machines, buildings, bridges, etc.

IV, IX, 4. their work very little scope for any faculty except a mere command over the use of their fingers. But the machine is intricate and costly, and the person who minds it must have an intelligence, and an energetic sense of responsibility, which go a long way towards making a fine character; and which, though more common than they were, are yet sufficiently rare to be able to earn a very high rate of pay. No doubt this is an extreme case; and the greater part of the work done in a watch factory is much simpler. But much of it requires higher faculties than the old system did, and those engaged in it earn on the average higher wages; at the same time it has already brought the price of a trustworthy watch within the range of the poorest classes of the community, and it is showing signs of being able soon to accomplish the very highest class of work[1].

and in some cases weakens the barriers that divide different trades.

Those who finish and put together the different parts of a watch must always have highly specialized skill: but most of the machines which are in use in a watch factory are not different in general character from those which are used in any other of the lighter metal trades: in fact many of them are mere modifications of the turning lathes and of the slotting, punching, drilling, planing, shaping, milling machines and a few others, which are familiar to all engineering trades. This is a good illustration of the fact that while there is a constantly increasing subdivision of labour, many of the lines of division between trades which are nominally distinct are becoming narrower and less difficult to be passed. In old times it would have been very small comfort to watch-makers, who happened to be suffering from a diminished demand for their wares, to be told that the gun-making trade was in want of extra hands; but most of the operatives in a watch factory would find machines very similar to those with which they were familiar, if they

[1] The perfection which the machinery has already attained is shown by the fact that at the Inventions Exhibition held in London in 1885, the representative of an American watch factory took to pieces fifty watches before some English representatives of the older system of manufacture, and after throwing the different parts into different heaps, asked them to select for him one piece from each heap in succession; he then set these pieces up in one of the watch-cases and handed them back a watch in perfect order.

strayed into a gun-making factory or sewing-machine factory, or a factory for making textile machinery. A watch factory with those who worked in it could be converted without any overwhelming loss into a sewing-machine factory: almost the only condition would be that in the new factory no one should be put to work which required a higher order of general intelligence, than that to which he was already accustomed. IV, IX, 5.

§ 5. The printing trade affords another instance of the way in which an improvement of machinery and an increase in the volume of production causes an elaborate subdivision of labour. Everyone is familiar with the pioneer newspaper editor of newly settled districts of America, who sets up the type of his articles as he composes them; and with the aid of a boy prints off his sheets and distributes them to his scattered neighbours. When however the mystery of printing was new, the printer had to do all this for himself, and in addition to make all his own appliances[1]. These are now provided for him by separate "subsidiary" trades, from whom even the printer in the backwoods can obtain everything that he wants to use. But in spite of the assistance which it thus gets from outside, a large printing establishment has to find room for many different classes of workers within its walls. To say nothing of those who organize and superintend the business, of those who do its office work and keep its stores, of the skilled "readers" who correct any errors that may have crept into the "proofs," of its engineers and repairers of machinery, of those who cast, and who correct and prepare its stereotype plates; of the warehousemen and the boys and girls who assist them, and several other minor classes; there are the two great groups of the compositors who set up the type, and the machinists and pressmen who print impressions from them. Each of these two groups is divided into many smaller groups, especially in the large Illustration from the printing trade. Instance of the multiplication in

[1] "The type-founder was probably the first to secede from the concern; then printers delegated to others the making of presses; afterwards the ink and the rollers found separate and distinct manufacturers; and there arose a class of persons who, though belonging to other trades, made printing appliances a speciality, such as printers' smiths, printers' joiners and printers' engineers" (Mr Southward in the Article on *Typography* in the *Encyclopædia Britannica*).

IV, IX, 5. modern industry of thin lines of division, which can be passed without great difficulty.

centres of the printing trade. In London, for instance, a minder who was accustomed to one class of machine, or a compositor who was accustomed to one class of work, if thrown out of employment would not willingly abandon the advantage of his specialized skill, and falling back on his general knowledge of the trade seek work at another kind of machine or in another class of work[1]. These barriers between minute subdivisions of a trade count for a great deal in many descriptions of the modern tendency towards specialization of industry; and to some extent rightly, because though many of them are so slight that a man thrown out of work in one subdivision could pass into one of its neighbours without any great loss of efficiency, yet he does not do so until he has tried for a while to get employment in his old lines; and therefore the barriers are as effective as stronger ones would be so far as the minor fluctuations of trade from week to week are concerned. But they are of an altogether different kind from the deep and broad partitions which divided one group of mediæval handicraftsmen from another, and which caused the lifelong suffering of the handloom-weavers when their trade had left them[2].

[1] For instance, Mr Southward tells us "a minder may understand only book machines or only news machines; he may know all about" machines that print from flat surfaces or those that print from cylinders; "or of cylinders he may know only one kind. Entirely novel machines create a new class of artisans. There are men perfectly competent to manage a Walter press who are ignorant how to work two-colour or fine book-work machines. In the compositor's department division of labour is carried out to a still minuter degree. An old-fashioned printer would set up indifferently a placard, a title-page, or a book. At the present day we have jobbing hands, book hands, and news hands, the word 'hand' suggesting the factory-like nature of the business. There are jobbing hands who confine themselves to posters. Book hands comprise those who set up the titles and those who set up the body of the work. Of these latter again, while one man composes, another, the 'maker-up,' arranges the pages."

[2] Let us follow still further the progress of machinery in supplanting manual labour in some directions and opening out new fields for its employment in others. Let us watch the process by which large editions of a great newspaper are set up and printed off in a few hours. To begin with, a good part of the type-setting is itself often done by a machine; but in any case the types are in the first instance on a plane surface, from which it is impossible to print very rapidly. The next step therefore is to make a papier-maché cast of them, which is bent on to a cylinder, and is then used as the mould from which a new metal plate is cast that fits the cylinders of the printing machine. Fixed on these it rotates alternately against the inking cylinders and the paper. The paper is arranged in a huge roll at the bottom of the machine and unrolls itself automatically, first against the damping cylinders and then against the printing cylinders, the first of which

In the printing trades, as in the watch trade, we see mechanical and scientific appliances attaining results that would be impossible without them; at the same time that they persistently take over work that used to require manual skill and dexterity, but not much judgment; while they leave for man's hand all those parts which do require the use of judgment, and open up all sorts of new occupations in which there is a great demand for it. Every improvement and cheapening of the printer's appliances increases the demand for the judgment and discretion and literary knowledge of the reader, for the skill and taste of those who know how to set up a good title-page, or how to make ready a sheet on which an engraving is to be printed, so that light and shade will be distributed properly. It increases the demand for the gifted and highly-trained artists who draw or engrave on wood and stone and metal, and for those who know how to give an accurate report in ten lines of the substance of a speech that occupied ten minutes—an intellectual feat the difficulty of which we underrate, because it is so frequently performed. And again, it tends to increase the work of photographers and electrotypers, and stereotypers, of the makers of printer's machinery, and many others who get a higher training and a higher income from their work than did those layers on and takers off, and those folders of newspapers who have found their work taken over by iron fingers and iron arms.

IV, IX, 6

Instance of the increased demand for faculties of a high order caused by machinery

§ 6. We may now pass to consider the effects which machinery has in relieving that excessive muscular strain which a few generations ago was the common lot of more than half the working men even in such a country as England. The most marvellous instances of the power of machinery are

Machinery relieves the strain on human muscles.

prints it on one side, and the second on the other: thence to the cutting cylinders, which cut it into equal lengths, and thence to the folding apparatus, which folds it ready for sale.

More recently the casting of the type has been brought under the new methods. The compositor plays on a keyboard like that of the type-writer, and the matrix of a corresponding letter goes into line: then after spacing out, molten lead is poured on the line of matrices, and a solid line of type is ready. And in a further development each letter is cast separately from its matrix; the machine reckons up the space taken by the letters, stops when there are enough for a line, divides out the free space equally into the requisite number of small spaces between the words; and finally casts the line. It is claimed that one compositor can work several such machines simultaneously in distant towns by electric currents.

IV, IX, 6. seen in large iron-works, and especially in those for making armour plates, where the force to be exerted is so great that man's muscles count for nothing, and where every movement, whether horizontal or vertical, has to be effected by hydraulic or steam force, and man stands by ready to govern the machinery and clear away ashes or perform some such secondary task.

Machinery of this class has increased our command over nature, but it has not directly altered the character of man's work very much; for that which it does he could not have done without it. But in other trades machinery has lightened man's labours. The house carpenters, for instance, make things of the same kind as those used by our forefathers, with much less toil for themselves. They now give themselves chiefly to those parts of the task which are most pleasant and most interesting; while in every country town and almost every village there are found steam mills for sawing, planing and moulding, which relieve them of that grievous fatigue which not very long ago used to make them prematurely old[1].

Machinery takes over sooner or later all monotonous work in manufacture.

New machinery, when just invented, generally requires a great deal of care and attention. But the work of its attendant is always being sifted; that which is uniform and monotonous is gradually taken over by the machine, which thus becomes steadily more and more automatic and self-acting; till at last there is nothing for the hand to do, but to supply the material at certain intervals and to take away the work when finished. There still remains the responsibility for seeing that the machinery is in good order and working smoothly; but even this task is often made light by the introduction of an automatic movement, which brings the machine to a stop the instant anything goes wrong.

[1] The jack-plane, used for making smooth large boards for floors and other purposes, used to cause heart disease, making carpenters as a rule old men by the time they were forty. Adam Smith tells us that "workmen, when they are liberally paid, are very apt to overwork themselves and to ruin their health and constitution in a few years. A carpenter in London, and in some other places, is not supposed to last in his utmost vigour above eight years....Almost every class of artificers is subject to some particular infirmity occasioned by excessive application to their peculiar species of work." *Wealth of Nations*, Book I. chapter VII.

IV, IX, 6.

Illustration from the textile industries.

Nothing could be more narrow or monotonous than the occupation of a weaver of plain stuffs in the old time. But now one woman will manage four or more looms, each of which does many times as much work in the course of the day as the old hand-loom did; and her work is much less monotonous and calls for much more judgment than his did. So that for every hundred yards of cloth that are woven, the purely monotonous work done by human beings is probably not a twentieth part of what it was[1].

It thus prevents monotony of work from involving monotony of life.

Facts of this kind are to be found in the recent history of many trades: and they are of great importance when we are considering the way in which the modern organization of industry is tending to narrow the scope of each person's work, and thereby to render it monotonous. For those trades in which the work is most subdivided are those in which the chief muscular strain is most certain to be taken off by machinery; and thus the chief evil of monotonous work is much diminished. As Roscher says, it is monotony of life much more than monotony of work that is to be dreaded: monotony of work is an evil of the first order only when it involves monotony of life. Now when a person's employment requires much physical exertion, he is fit for nothing after his work; and unless his mental faculties are called forth in his work, they have little chance of being developed at all. But the nervous force is not very much exhausted in the ordinary work of a factory, at all events where there is not excessive noise, and where the hours of labour are not too long. The social surroundings of factory life stimulate mental activity in and out of working hours; and many of those factory workers, whose occupations are seemingly the most monotonous, have considerable intelligence and mental resource[2].

[1] The efficiency of labour in weaving has been increased twelve-fold and that in spinning six-fold during the last seventy years. In the preceding seventy years the improvements in spinning had already increased the efficiency of labour two-hundred-fold (see Ellison's *Cotton Trade of Great Britain*, ch. IV. and V.).

[2] Perhaps the textile industries afford the best instance of work that used to be done by hand and is now done by machinery. They are especially prominent in England, where they give employment to nearly half a million males and more than half a million females, or more than one in ten of those persons who are earning independent incomes. The strain that is taken off human muscles in

IV, IX, 7.

It is true that the American agriculturist is an able man, and that his children rise rapidly in the world. But partly because land is plentiful, and he generally owns the farm that he cultivates, he has better social conditions than the English; he has always had to think for himself, and has long had to use and to repair complex machines. The English agricultural labourer has had many great disadvantages to contend with. Till recently he had little education; and he was in a great measure under a semi-feudal rule, which was not without its advantages, but which repressed enterprise and even in some degree self-respect. These narrowing causes are removed. He is now fairly well educated in youth. He learns to handle various machinery; he is less dependent on the good-will of any particular squire or group of farmers; and, since his work is more various, and educates intelligence more than the lowest grades of town work do, he is tending to rise both absolutely and relatively.

The economic use of specialized skill and machinery requires that they should be fully occupied.

§ 7. We must now proceed to consider what are the conditions under which the economies in production arising from division of labour can best be secured. It is obvious that the efficiency of specialized machinery or specialized skill is but one condition of its economic use; the other is that sufficient work should be found to keep it well employed. As Babbage pointed out, in a large factory

dealing even with those soft materials is shown by the fact that for every one of these million operatives there is used about one horse-power of steam, that is, about ten times as much as they would themselves exert if they were all strong men; and the history of these industries will serve to remind us that many of those who perform the more monotonous parts of manufacturing work are as a rule not skilled workers who have come down to it from a higher class of work, but unskilled workers who have risen to it. A great number of those who work in the Lancashire cotton-mills have come there from poverty-stricken districts of Ireland, while others are the descendants of paupers and people of weak physique, who were sent there in large numbers early in the last century from the most miserable conditions of life in the pôorest agricultural districts, where the labourers were fed and housed almost worse than the animals whom they tended. Again, when regret is expressed that the cotton factory hands of New England have not the high standard of culture which prevailed among them a century ago, we must remember that the descendants of those factory workers have moved up to higher and more responsible posts, and include many of the ablest and wealthiest of the citizens of America. Those who have taken their places are in the process of being raised; they are chiefly French Canadians and Irish, who though they may learn in their new homes some of the vices of civilization, are yet much better off and have on the whole better opportunities of developing the higher faculties of themselves and their children than they had in their old homes

"the master manufacturer by dividing the work to be executed into different processes, each requiring different degrees of skill or force, can purchase exactly that precise quantity of both which is necessary for each process; whereas if the whole work were executed by one workman that person must possess sufficient skill to perform the most difficult and sufficient strength to execute the most laborious of the operations into which the work is divided." The economy of production requires not only that each person should be employed constantly in a narrow range of work, but also that, when it is necessary for him to undertake different tasks, each of these tasks should be such as to call forth as much as possible of his skill and ability. Just in the same way the economy of machinery requires that a powerful turning-lathe when specially arranged for one class of work should be kept employed as long as possible on that work; and if there is occasion to employ it on other work, that should be such as to be worthy of the lathe, and not such as could have been done equally well by a much smaller machine. IV, IX, 7.

But the most economic use of man as an agent of production is wasteful if he is not himself developed by it.

Here then, so far as the economy of production goes, men and machines stand on much the same footing: but while machinery is a mere implement of production, man's welfare is also its ultimate aim. We have already been occupied with the question whether the human race as a whole gains by carrying to an extreme that specialization of function which causes all the most difficult work to be done by a few people: but we have now to consider it more nearly with special reference to the work of business management. The main drift of the next three chapters is to inquire what are the causes which make different forms of business management the fittest to profit by their environment, and the most likely to prevail over others; but it is well that meanwhile we should have in our minds the question, how far they are severally fitted to benefit their environment.

Many of those economies in the use of specialized skill and machinery which are commonly regarded as within the reach of very large establishments, do not depend on the size of individual factories. Some depend on the aggregate volume of production of the kind in the neighbourhood:

IV, IX, 7. while others again, especially those connected with the growth of knowledge and the progress of the arts, depend chiefly on the aggregate volume of production in the whole civilized world. And here we may introduce two technical terms.

External and internal economies.

We may divide the economies arising from an increase in the scale of production of any kind of goods, into two classes —firstly, those dependent on the general development of the industry; and, secondly, those dependent on the resources of the individual houses of business engaged in it, on their organization and the efficiency of their management. We may call the former *external economies*, and the latter *internal economies*. In the present chapter we have been chiefly discussing internal economies; but we now proceed to examine those very important external economies which can often be secured by the concentration of many small businesses of a similar character in particular localities: or, as is commonly said, by the localization of industry.

IV, XIII, 2. Thus a representative firm is in a sense an average firm. But there are many ways in which the term "average" might be interpreted in connection with a business. And a Representative firm is that particular sort of average firm, at which we need to look in order to see how far the economies, *internal and external*, of production on a large scale have extended generally in the industry and country in question. We cannot see this by looking at one or two firms taken at random: but we can see it fairly well by selecting, after a broad survey, a firm, whether in private or joint-stock management (or better still, more than one), that represents, to the best of our judgment, this particular average.

The general argument of the present Book shows that an increase in the aggregate volume of production of anything will generally increase the size, and therefore the internal economies possessed by such a representative firm; that it will always increase the external economies to which the firm has access; and thus will enable it to manufacture at a less proportionate cost of labour and sacrifice than before.

Laws of increasing return, In other words, we say broadly that while the part which nature plays in production shows a tendency to diminishing return, the part which man plays shows a tendency to increasing return. The *law of increasing return* may be worded thus:—An increase of labour and capital leads generally to improved organization, which increases the efficiency of the work of labour and capital.

Therefore in those industries which are not engaged in raising raw produce an increase of labour and capital generally gives a return increased more than in proportion; and further this improved organization tends to diminish or even override any increased resistance which nature may offer to raising increased amounts of raw produce. If the actions of the laws of increasing and diminishing return are balanced we have the *law of constant return*, and an increased produce is obtained by labour and sacrifice increased just in proportion.

and of constant return.

For the two tendencies towards increasing and diminishing

return press constantly against one another. In the production of wheat and wool, for instance, the latter tendency has almost exclusive sway in an old country, which cannot import freely. In turning the wheat into flour, or the wool into blankets, an increase in the aggregate volume of production brings some new economies, but not many; for the trades of grinding wheat and making blankets are already on so great a scale that any new economies that they may attain are more likely to be the result of new inventions than of improved organization. In a country however in which the blanket trade is but slightly developed, these latter may be important; and then it may happen that an increase in the aggregate production of blankets diminishes the proportionate difficulty of manufacturing by just as much as it increases that of raising the raw material. In that case the actions of the laws of diminishing and of increasing return would just neutralize one another; and blankets would conform to the law of constant return. But in most of the more delicate branches of manufacturing, where the cost of raw material counts for little, and in most of the modern transport industries the law of increasing return acts almost unopposed[1].

IV, XIII, 2. The straining of the tendencies towards increasing and diminishing return against one another.

Increasing Return is a relation between a quantity of effort and sacrifice on the one hand, and a quantity of product on the other. The quantities cannot be taken out exactly, because changing methods of production call for machinery, and for unskilled and skilled labour of new kinds and in new proportions. But, taking a broad view, we may perhaps say vaguely that the output of a certain amount of labour and capital in an industry has increased by perhaps a quarter or a third in the last twenty years. To measure outlay and output in terms of money is a tempting, but a dangerous resource: for a comparison of money outlay with

Increasing Return is a relation of quantities.

[1] In an article on "The variation of productive forces" in the *Quarterly Journal of Economics* 1902, Professor Bullock suggests that the term "Economy of Organization" should be substituted for Increasing Return. He shows clearly that the forces which make for Increasing Return are not of the same order as those that make for Diminishing Return: and there are undoubtedly cases in which it is better to emphasize this difference by describing causes rather than results, and contrasting Economy of Organization with the Inelasticity of Nature's response to intensive cultivation.

IV, XIII, 3. money returns is apt to slide into an estimate of the rate of profit on capital[1].

A rapid growth of population is an evil under some conditions,

§ 3. We may now sum up provisionally the relations of industrial expansion to social wellbeing. A rapid growth of population has often been accompanied by unhealthy and enervating habits of life in overcrowded towns. And sometimes it has started badly, outrunning the material resources of the people, causing them with imperfect appliances to make excessive demands on the soil; and so to call forth the stern action of the law of diminishing return as regards raw produce, without having the power of minimizing its effects. Having thus begun with poverty, an increase in numbers may go on to its too frequent consequences in that weakness of character which unfits a people for developing a highly organized industry.

but not under others.

These are serious perils: but yet it remains true that the collective efficiency of a people with a given average of individual strength and energy may increase more than in proportion to their numbers. If they can for a time escape from the pressure of the law of diminishing return by importing food and other raw produce on easy terms; if their wealth is not consumed in great wars, and increases at least as fast as their numbers; and if they avoid habits of life that would enfeeble them; then every increase in their numbers is likely *for the time* to be accompanied by a more than proportionate increase in their power of obtaining material goods. For it enables them to secure the many various economies of specialized skill and specialized machinery, of localized industries and production on a large scale: it enables them to have increased facilities of communication of all kinds; while the very closeness of their neighbourhood diminishes the expense of time and effort involved in every

[1] There is no general rule that industries which yield increasing returns show also rising profits No doubt a vigorous firm, which increases its scale of operations and obtains important (internal) economies which are peculiar to it, will show an increasing return and a rising rate of profit; because its increasing output will not materially affect the price of its produce. But profits tend to be low, as we shall see below (VI. VIII. 1, 2), in such industries as plain weaving, because their vast scale has enabled organization in production and marketing to be carried so far as to be almost dominated by routine.

sort of traffic between them, and gives them new opportunities of getting social enjoyments and the comforts and luxuries of culture in every form. No doubt deduction must be made for the growing difficulty of finding solitude and quiet and even fresh air: but there is in most cases some balance of good[1]. IV, XIII, 3.

Taking account of the fact that an increasing density of population generally brings with it access to new social enjoyments we may give a rather broader scope to this statement and say:—An increase of population accompanied by an equal increase in the material sources of enjoyment and aids to production is likely to lead to a more than proportionate increase in the aggregate income of enjoyment of all kinds; provided firstly, an adequate supply of raw produce can be obtained without great difficulty, and secondly there is no such overcrowding as causes physical and moral vigour to be impaired by the want of fresh air and light and of healthy and joyous recreation for the young.

The effects of a growth of numbers must be carefully distinguished from those of the growth of wealth by which it is generally accompanied.

The accumulated wealth of civilized countries is at present growing faster than the population: and though it may be true that the wealth per head would increase somewhat faster if the population did not increase quite so fast; yet as a matter of fact an increase of population is likely to continue to be accompanied by a more than proportionate increase of the material aids to production: and in England *at the present time*, with easy access to abundant foreign supplies of raw material, an increase of population is accompanied by a more than proportionate increase of the means of satisfying human wants other than the need for light, fresh air, etc. Much of this increase is however attributable not to the increase of industrial efficiency but to the increase of wealth by which it is accompanied: and therefore it does not necessarily benefit those who have no share in that wealth. And

[1] The Englishman Mill bursts into unwonted enthusiasm when speaking (*Political Economy*, Book IV. ch. VI. § 2) of the pleasures of wandering alone in beautiful scenery: and many American writers give fervid descriptions of the growing richness of human life as the backwoodsman finds neighbours settling around him, as the backwoods settlement developes into a village, the village into a town, and the town into a vast city. (See for instance Carey's *Principles of Social Science* and Henry George's *Progress and Poverty*.)

IV, XIII, 3. further, England's foreign supplies of raw produce may at any time be checked by changes in the trade regulations of other countries, and may be almost cut off by a great war, while the naval and military expenditure which would be necessary to make the country fairly secure against this last risk, would appreciably diminish the benefits that she derives from the action of the law of increasing return.

Carl Menger (1840-1921)

"On the Origins of Money", *Economic Journal*, vol. 2, 1892, pp. 239-255. From the Ludwig von Mises Institute.

Piero Sraffa (1898-1983)

"The Laws of Returns under Competitive Conditions", *Economic Journal*, Vol. 36, No. 144, 1926, pp. 535-550.

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THE LAWS OF RETURNS UNDER COMPETITIVE CONDITIONS [1]

A STRIKING feature of the present position of economic science is the almost unanimous agreement at which economists have arrived regarding the theory of competitive value, which is inspired by the fundamental symmetry existing between the forces of demand and those of supply, and is based upon the assumption that the essential causes determining the price of particular commodities may be simplified and grouped together so as to be represented by a pair of intersecting curves of collective demand and supply. This state of things is in such marked contrast with the controversies on the theory of value by which political economy was characterised during the past century, that it might almost be thought that from these clashes of thought the spark of an ultimate truth had at length been struck. Sceptics might perhaps think that the agreement in question is due, not so much to everyone being convinced, as to the indifference felt by the majority nowadays in regard to the theory of value—an indifference which is justified by the fact that this theory, more than any other part of economic theory, has lost much of its direct bearing upon practical politics, and particularly in regard to doctrines of social changes, which had formerly been conferred upon it by Ricardo and afterwards by Marx, and in opposition to them by the bourgeois economists. It has been transformed more and more into " an apparatus of the mind, a technique of thinking " which does not furnish any " settled conclusions immediately applicable to policy." [2] It is essentially a pedagogic instrument, somewhat like the study of the classics, and, unlike the study of the exact sciences and law, its purposes are exclusively those of training the mind, for which reason it is hardly apt to

[1] The opening pages of this article contain a summary of the conclusions of a paper on " Relazioni fra costo e quantita prodotta " published in Vol. II. of the *Annali di Economia.*

[2] Keynes: *Introduction to Cambridge Economic Handbooks.*

excite the passions of men, even academical men—a theory, in short, in respect to which it is not worth while departing from a tradition which is finally accepted. However this may be, the fact of the agreement remains.

In the tranquil view which the modern theory of value presents us there is one dark spot which disturbs the harmony of the whole. This is represented by the supply curve, based upon the laws of increasing and diminishing returns. That its foundations are less solid than those of the other portions of the structure is generally recognised. That they are actually so weak as to be unable to support the weight imposed upon them is a doubt which slumbers beneath the consciousness of many, but which most succeed in silently suppressing. From time to time someone is unable any longer to resist the pressure of his doubts and expresses them openly; then, in order to prevent the scandal spreading, he is promptly silenced, frequently with some concessions and partial admission of his objections, which, naturally, the theory had implicitly taken into account. And so, with the lapse of time, the qualifications, the restrictions and the exceptions have piled up, and have eaten up, if not all, certainly the greater part of the theory. If their aggregate effect is not at once apparent, this is because they are scattered about in footnotes and articles and carefully segregated from one another.

It is not the purpose of this article to add anything to the pile, but simply to attempt to co-ordinate certain materials, separating what is still alive from what is dead in the concept of the supply curve and of its effects on competitive price determination.

At present the laws of returns are of special importance owing to the part they play in the study of the problem of value. But they are naturally much older than the particular theory of value in which they are employed, and it is precisely from their secular age and their original applications that they derive both their prestige and their weakness in their modern application. We are disposed to accept the laws of returns as a matter of course, because we have before our eyes the great and indisputable services rendered by them when performing their ancient function, and we often neglect to ask ourselves whether the old barrels are still able to hold the new wine.

The law of diminishing returns has long been associated mainly with the problem of rent, and from this point of view the law as formulated by the classical economists with reference to land was entirely adequate. It had always been perfectly obvious that its

operation affected, not merely rent, but also the cost of the product; but this was not emphasised as a cause of variation in the relative price of the individual commodities produced, because the operation of diminishing returns increased in a like measure the cost of all. This remained true even when the English classical economists applied the law to the production of corn, for, as Marshall has shown, " the term ' corn ' was used by them as short for agricultural produce in general " (*Principles*, VI. i. 2, note).

The position occupied in classical economics by the law of increasing returns was much less prominent, as it was regarded merely as an important aspect of the division of labour, and thus rather as a result of general economic progress than of an increase in the scale of production.

The result was that in the original laws of returns the general idea of a functional connection between cost and quantity produced was not given a conspicuous place; it appears, in fact, to have been present in the minds of the classical economists much less prominently than was the connection between demand and demand price.

The development which has emphasised the former aspect of the laws of returns is comparatively recent. At the same time it has removed both laws from the positions which, according to the traditional partition of political economy, they used to occupy, one under the heading of " distribution " and the other under " production," and has transferred them to the chapter of " exchange-value "; there, merging them in the single " law of non-proportional returns," it has derived from them a law of supply in a market such as can be co-ordinated with the corresponding law of demand; and on the symmetry of these two opposite forces it has based the modern theory of value.

In order to reach this result it was found necessary to introduce certain modifications into the form of the two laws. Very little was necessary as regards the law of diminishing returns, which merely required to be generalised from the particular case of land to every case in which there existed a factor of production of which only a constant quantity was available. The law of increasing returns, however, had to be subjected to a much more radical transformation: the part played in it by the division of labour—now limited to the case of independent subsidiary factories coming into existence as the production of an industry increases—was greatly restricted; while consideration of that greater internal division of labour, which is rendered possible by an increase in the dimensions of an individual firm, was entirely

abandoned, as it was seen to be incompatible with competitive conditions. On the other hand, the importance of "external economies" was more and more emphasised—that is, of the advantage derived by individual producers from the growth, not of their own individual undertakings, but of the industry in its aggregate.

Even in their present form, however, the two laws have preserved the characteristic of originating from forces of profoundly diverse nature. Such heterogeneousness, while not constituting in itself an insurmountable obstacle when it is attempted to co-ordinate them and employ them conjointly in problems mainly relating, not to the causes, but to the effects of variations in cost, involves a fresh difficulty when it is sought to classify the various industries according as they belong to one or the other category. It is, in fact, in the very nature of the bases of the two laws that the wider the definition which we assume for "an industry"—that is, the more nearly it includes all the undertakings which employ a given *factor* of production, as, for example, agriculture or the iron industry—the more probable will it be that the forces which make for diminishing returns will play an important part in it; the more restrictive this definition—the more nearly it includes, therefore, only those undertakings which produce a given type of consumable *commodity*, as, for example, fruit or nails—the greater will be the probability that the forces which make for increasing returns will predominate in it. In its effects this difficulty is parallel to that which, as is well known, arises from the consideration of the element of time, whereby the shorter the period of time allowed for the adjustments, the greater is the likelihood of decreasing returns, while the longer that period is, the greater is the probability of increasing returns.

The really serious difficulties make their appearance when it is considered to what extent the supply curves based on the laws of returns satisfy the conditions necessary to enable them to be employed in the study of the equilibrium value of single commodities produced under competitive conditions. This point of view assumes that the conditions of production and the demand for a commodity can be considered, in respect to small variations, as being practically independent, both in regard to each other and in relation to the supply and demand of all other commodities. It is well known that such an assumption would not be illegitimate merely because the independence may not be absolutely perfect, as, in fact, it never can be; and a slight degree of interdependence may be overlooked without disadvantage if it applies to quantities

of the second order of smalls, as would be the case if the effect (for example, an increase of cost) of a variation in the industry which we propose to isolate were to react partially on the price of the products of other industries, and this latter effect were to influence the demand for the product of the first industry. But, of course, it is a very different matter, and the assumption becomes illegitimate, when a variation in the quantity produced by the industry under consideration sets up a force which acts directly, not merely upon its own costs, but also upon the costs of other industries; in such a case the conditions of the " particular equilibrium " which it was intended to isolate are upset, and it is no longer possible, without contradiction, to neglect collateral effects.

It unfortunately happens that it is precisely into this latter category that the applications of the laws of returns fall, in the great majority of cases. As regards diminishing returns, in fact, if in the production of a particular commodity a considerable part of a factor is employed, the total amount of which is fixed or can be increased only at a more than proportional cost, a small increase in the production of the commodity will necessitate a more intense utilisation of that factor, and this will affect in the same manner the cost of the commodity in question and the cost of the other commodities into the production of which that factor enters; and since commodities into the production of which a common special factor enters are frequently, to a certain extent, substitutes for one another (for example, various kinds of agricultural produce), the modification in their price will not be without appreciable effects upon demand in the industry concerned. If we next take an industry which employs only a small part of the " constant factor " (which appears more appropriate for the study of the particular equilibrium of a single industry), we find that a (small) increase in its production is generally met much more by drawing " marginal doses " of the constant factor from other industries than by intensifying its own utilisation of it; thus the increase in cost will be practically negligible, and anyhow it will still operate in a like degree upon all the industries of the group. Excluding these cases, and excluding—if we take a point of view embracing long periods—the numerous cases in which the quantity of a means of production may be regarded as being only temporarily fixed in respect to an unexpected demand, very little remains : the imposing structure of diminishing returns is available only for the study of that minute class of commodities in the production of which the whole of a factor of production is employed. Here, of course, by " a commodity " is to be under-

stood an article in regard to which it is possible to construct, or at least to conceive, a demand schedule which is tolerably homogeneous and independent of the conditions of supply, and not, as is frequently implied, a collection of diverse articles, such as agricultural products or ironware.

It is not by mere chance that, notwithstanding the profoundly diverse nature of the two laws of returns, the same difficulties also arise, in almost identical form, in connection with increasing returns. Here again we find that in reality the economies of production on a large scale are not suitable for the requirements of the supply curve : their field of action is either wider or more restricted than would be necessary. On the one hand, reductions in cost which are due to " those *external* economies which result from the general progress of industrial environment " to which Marshall refers (*Principles*, V. xi. 1) must, of course, be ignored, as they are clearly incompatible with the conditions of the particular equilibrium of a commodity. On the other hand, reductions in cost connected with an increase in a firm's scale of production, arising from internal economies or from the possibility of distributing the overhead charges over a larger number of product units, must be put aside as being incompatible with competitive conditions. The only economies which could be taken into consideration would be such as occupy an intermediate position between these two extremes; but it is just in the middle that nothing, or almost nothing, is to be found. Those economies which are external from the point of view of the individual firm, but internal as regards the industry in its aggregate, constitute precisely the class which is most seldom to be met with. As Marshall has said in the work in which he has intended to approach most closely the actual conditions of industry, " the economies of production on a large scale can seldom be allocated exactly to any one industry : they are in great measure attached to groups, often large groups, of correlated industries." [1] In any case, in so far as external economies of the kind in question exist, they are not likely to be called forth by *small* increases in production. Thus it appears that supply curves showing decreasing costs are not to be found more frequently than their opposite.

Reduced within such restricted limits, the supply schedule with variable costs cannot claim to be a general conception applicable to normal industries; it can prove a useful instrument only in regard to such exceptional industries as can reasonably satisfy its conditions. In normal cases the cost of production of

[1] *Industry and Trade*, p. 188.

commodities produced competitively—as we are not entitled to take into consideration the causes which may make it rise or fall—must be regarded as constant in respect of small variations in the quantity produced.[1] And so, as a simple way of approaching the problem of competitive value, the old and now obsolete theory which makes it dependent on the cost of production alone appears to hold its ground as the best available.

This first approximation, as far as it goes, is as important as it is useful: it emphasises the fundamental factor, namely, the predominant influence of cost of production in the determination of the normal value of commodities, while at the same time it does not lead us astray when we desire to study in greater detail the conditions under which exchange takes place in particular cases, for it does not conceal from us the fact that we cannot find the elements required for this purpose within the limits of its assumptions.

When we proceed to a further approximation, while keeping to the path of free competition, the complications do not arise gradually, as would be convenient; they present themselves simultaneously as a whole. If diminishing returns arising from a "constant factor" are taken into consideration, it becomes necessary to extend the field of investigation so as to examine the conditions of simultaneous equilibrium in numerous industries: a well-known conception, whose complexity, however, prevents it from bearing fruit, at least in the present state of our knowledge, which does not permit of even much simpler schemata being applied to the study of real conditions. If we pass to external economies, we find ourselves confronted by the same obstacle, and there is also the impossibility of confining within statical conditions the circumstances from which they originate.

[1] The absence of causes which tend to cause the cost either to increase or diminish appears to be the most obvious and plausible way from which constant costs can arise. But as these constitute the most dangerous enemy of the symmetry between demand and supply, those writers who accept this doctrine, in order to be able to relegate the constant costs to the category of theoretical limiting cases which in reality cannot exist, have persuaded themselves that they are something extremely complicated and improbable, since they "can only result from the accidental balancing of two opposite tendencies; the tendency to diminution of cost . . . and the tendency to increase of cost . . ." (Sidgwick, *Principles of Political Economy*, 1st ed., p. 207; to the same effect see, *e.g.*, Marshall, *Principles*, IV. xiii, 2, and *Palgrave's Dictionary*, *sub voce* Law of Constant Return). The dictum of Edgeworth, that "to treat *variables* as *constants* is the characteristic vice of the unmathematical economist," might to-day be reversed: the mathematical economists have gone so far in correcting this vice that they can no longer conceive of a constant except as the result of the compensation of two equal and opposite variables.

It is necessary, therefore, to abandon the path of free competition and turn in the opposite direction, namely, towards monopoly. Here we find a well-defined theory in which variations of cost connected with changes in the dimensions of the individual undertaking play an important part. Of course, when we are supplied with theories in respect to the two extreme cases of monopoly and competition as part of the equipment required in order to undertake the study of the actual conditions in the different industries, we are warned that these generally do not fit exactly one or other of the categories, but will be found scattered along the intermediate zone, and that the nature of an industry will approximate more closely to the monopolist or the competitive system according to its particular circumstances, such as whether the number of autonomous undertakings in it is larger or smaller, or whether or not they are bound together by partial agreements, etc. We are thus led to believe that when production is in the hands of a large number of concerns entirely independent of one another as regards control, the conclusions proper to competition may be applied even if the market in which the goods are exchanged is not absolutely perfect, for its imperfections are in general constituted by frictions which may simply retard or slightly modify the effects of the active forces of competition, but which the latter ultimately succeed in substantially overcoming. This view appears to be fundamentally inadmissible. Many of the obstacles which break up that unity of the market which is the essential condition of competition are not of the nature of "frictions," but are themselves active forces which produce permanent and even cumulative effects. They are frequently, moreover, endowed with sufficient stability to enable them to be made the subject of analysis based on statical assumptions.

Of these effects two, which are closely interconnected, are of special importance because they are to be found with great frequency in industries in which competitive conditions appear to prevail; and they also possess a special interest because, as they relate to certain of the most characteristic features of the theoretical conception of competition, they show how seldom it is for these conditions to be realised in their integrity, and how a slight divergence from them suffices to render the manner in which equilibrium is attained extremely similar to that peculiar to monopoly. These two points in which the theory of competition differs radically from the actual state of things which is most general are: first, the idea that the competing producer cannot deliberately affect the market prices, and that he may therefore

regard it as constant whatever the quantity of goods which he individually may throw on the market; second, the idea that each competing producer necessarily produces normally in circumstances of individual increasing costs.

Everyday experience shows that a very large number of undertakings—and the majority of those which produce manufactured consumers' goods—work under conditions of individual diminishing costs. Almost any producer of such goods, if he could rely upon the market in which he sells his products being prepared to take any quantity of them from him at the current price, without any trouble on his part except that of producing them, would extend his business enormously. It is not easy, in times of normal activity, to find an undertaking which systematically restricts its own production to an amount less than that which it could sell at the current price, and which is at the same time prevented by competition from exceeding that price. Business men, who regard themselves as being subject to competitive conditions, would consider absurd the assertion that the limit to their production is to be found in the internal conditions of production in their firm, which do not permit of the production of a greater quantity without an increase in cost. The chief obstacle against which they have to contend when they want gradually to increase their production does not lie in the cost of production—which, indeed, generally favours them in that direction—but in the difficulty of selling the larger quantity of goods without reducing the price, or without having to face increased marketing expenses. This necessity of reducing prices in order to sell a larger quantity of one's own product is only an aspect of the usual descending demand curve, with the difference that instead of concerning the whole of a commodity, whatever its origin, it relates only to the goods produced by a particular firm; and the marketing expenses necessary for the extension of its market are merely costly efforts (in the form of advertising, commercial travellers, facilities to customers, etc.) to increase the willingness of the market to buy from it—that is, to raise that demand curve artificially.

This method of regarding the matter appears the most natural, and that which adheres to the reality of things. No doubt it is possible, from the formal point of view, to reverse these relations and regard every purchaser as being perfectly indifferent in his choice between the different producers, provided the latter, in order to approach him, are prepared to incur marketing expenses varying greatly in different cases, and to reckon these increased

marketing expenses in the cost of production of each. In this way increasing individual costs can be obtained to any desired extent and a perfect market in which there is an unlimited demand, at current prices, for the products of each. But the question of allocating the marketing expenses cannot be decided from the point of view of formal correctness, for on that basis the two methods are equivalent; nor can it be decided according to the fact that these charges are actually paid by the purchaser or the seller, as this does not affect their incidence or their effects in any way. What is important is to ascertain how the various forces at work can be grouped in the most homogeneous manner, so that the influence of each of them on the equilibrium resulting from their opposition may be more readily estimated. From this point of view the second of the methods mentioned must be rejected, since it entirely conceals the effects which the circumstances from which the marketing expenses originate exercise in disturbing the unity of the market. It alters in a misleading way, moreover, the customary and well defined significance of the expression " cost of production," with the result of rendering it dependent upon elements quite extraneous to the conditions under which the production of a given undertaking takes place. It consequently misrepresents the manner in which the actual process of determining the price and the quantity produced by each undertaking is affected.

By adhering to the first point of view, therefore, we are led to ascribe the correct measure of importance to the chief obstacle which hinders the free play of competition, even where this appears to predominate, and which at the same time renders a stable equilibrium possible even when the supply curve for the products of each individual firm is descending—that is, the absence of indifference on the part of the buyers of goods as between the different producers. The causes of the preference shown by any group of buyers for a particular firm are of the most diverse nature, and may range from long custom, personal acquaintance, confidence in the quality of the product, proximity, knowledge of particular requirements and the possibility of obtaining credit, to the reputation of a trade-mark, or sign, or a name with high traditions, or to such special features of modelling or design in the product as—without constituting it a distinct commodity intended for the satisfaction of particular needs—have for their principal purpose that of distinguishing it from the products of other firms. What these and the many other possible reasons for preference have in common is that they are expressed in a willingness

(which may frequently be dictated by necessity) on the part of the group of buyers who constitute a firm's clientele to pay, if necessary, something extra in order to obtain the goods from a particular firm rather than from any other.

When each of the firms producing a commodity is in such a position the general market for the commodity is subdivided into a series of distinct markets. Any firm which endeavours to extend beyond its own market by invading those of its competitors must incur heavy marketing expenses in order to surmount the barriers by which they are surrounded; but, on the other hand, within its own market and under the protection of its own barrier each enjoys a privileged position whereby it obtains advantages which —if not in extent, at least in their nature—are equal to those enjoyed by the ordinary monopolist.

Nor is it necessary to stress the customary conception of monopoly to make this case fit into it. In it also, in fact, we find that the majority of the circumstances which affect the strength of a monopolist (such as the possession of unique natural resources, legal privileges, the control of a greater or less proportion of the total production, the existence of rival commodities, etc.) exercise their influence essentially by affecting the elasticity of the demand for the monopolised goods. Whatever the causes may be, this is the only decisive factor in estimating the degree of independence which a monopolist has in fixing prices: the less elastic the demand for his product, the greater is his hold on his market. The extreme case, which may properly be called "absolute monopoly," is that in which the elasticity of the demand for the products of a firm is equal to unity [1]; in that case, however much the monopolist raises his prices, the sums periodically expended in purchasing his goods are not even partially diverted into different channels of expenditure, and his price policy will not be affected at all by the fear of competition from other sources of supply. So soon as this elasticity increases, competition begins to make itself felt, and becomes ever more intense as the elasticity grows, until to infinite elasticity in the demand for the products of an individual undertaking a state of perfect competition corresponds. In the intermediate cases the significance of a moderate elasticity

[1] The elasticity of demand for the products of a monopolist cannot, of course, be less than unity in respect to prices immediately above the equilibrium price—that is, in respect to that part of the demand curve which alone counts in regard to the determination of the power of a monopolist in his own market; a question which is quite distinct from that of the magnitude of the gains obtainable by the monopoly, as the latter is dependent, not so much on the ratio of change, as on the absolute measure of the demand and the demand price.

in the demand is that, although the monopolist has a certain freedom in fixing his prices, whenever he increases them he is forsaken by a portion of his purchasers, who prefer to spend their money in some other manner. It matters little to the monopolist if they spend it in purchasing goods very different from his own, or goods identical with them, but supplied by other producers who have not increased their price; in either case he must undergo —if only in a slight degree—actual competition from such goods, since it is precisely the possibility of buying them that leads the purchasers gradually to give up using his product as he increases the price. The direct effects are thus equal whether the sums set free as the result of an increase in price by an undertaking are expended on a large number of different commodities, or whether they are employed preponderatingly in the purchase of one or a few rival commodities which are more or less available for buyers, as occurs in the case of an undertaking which, while controlling only a small part of the total production of a commodity, has the advantage of possessing a particular market of its own. But the indirect effects in the two cases are substantially different.

The method indicated by Marshall in regard to manufactures designed for particular tastes is applicable for the study of this latter case. "When we are considering an individual producer," he writes, "we must couple his supply curve, not with the general demand curve for his commodity in a wide market, but with the particular demand curve of his own special market" (*Principles*, V. xii. 2). If we extend this method to those industries in which each firm has more or less a particular market, we must not restrict its employment to the occasions when we are considering the individual producer, but we must adhere to it also when we examine the manner in which equilibrium is attained in the trade as a whole; for it is clear that such particular curves can by no means be compounded so as to form a single pair of collective demand and supply curves. The method mentioned above is the very same as that followed in cases of ordinary monopoly, and in both cases, in fact, the individual producer determines his selling price by the well-known method which makes his monopoly revenue or his profits the maximum obtainable.

The peculiarity of the case of the firm which does not possess an actual monopoly but has merely a particular market is that, in the demand schedule for the goods produced by it, the possible buyers are entered in descending order according to the price which each of them is prepared to pay, not rather than go entirely without, but rather than not buy it from that particular producer

instead of elsewhere. That is to say, that two elements enter into the composition of such demand prices—the price at which the goods can be purchased from those other producers who, in the order of a purchaser's preference, immediately follow the producer under consideration, and the monetary measure of the value (a quantity which may be positive or negative) which the purchaser puts on his preference for the products of the firm in question.

For convenience in discussion it may be assumed that initially, in an industry in which like conditions prevail, each producer sells at a price which barely covers his costs. The individual interest of each producer will urge him to increase his price quickly so as to obtain the maximum profit. But in proportion as this practice spreads throughout the trade the various demand schedules will be modified as a result; for, as each buyer finds that the prices of the substitutes upon which he was able to reckon are increased, he will be inclined to pay a higher price for the products of the firm whose customer he is. So that, even before the first increase in price has been completely carried into effect, the conditions will be created which may permit every one of the concerns to make a further increase—and so on in succession. Naturally this process speedily reaches its limit. The customers lost by a firm whenever it raises its prices have recourse in part to other suppliers, and these will return to it when the others also have raised their prices; but in part they entirely give up buying the goods and definitely drop out of the market. Thus, every business has two classes of marginal customers—those who are at the margin only from its own individual standpoint and fix a limit for the excess of its prices over the prices generally ruling, and those who are at the margin from the standpoint of the general market and fix a limit for the general increase in price of the product.

It is, of course, possible that a general rise in the prices of a product may affect the conditions of demand and supply of certain firms in such a way as to make it advantageous for them to lower their prices rather than conform with the rise. But in an industry which has attained a certain degree of stability in its general structure, in regard of its methods of production, the number of undertakings composing it, and its commercial customs —in respect to which, therefore, statical assumptions are more nearly justified—this alternative is much less likely to be adopted than its opposite. In the first place, it involves great elasticity in the demand for the products of an individual business and rapidly diminishing costs for it—that is to say, a state of things the almost inevitable and speedy result of which is complete

monopolisation, and which, therefore, is not likely to be found in a trade operated normally by a number of independent firms. In the second place, the forces which impel producers to raise prices are much more effective than those which impel them to reduce them; and this not merely owing to the fear which every seller has of spoiling his market, but mainly because an increase of profit secured by means of a cut in price is obtained *at the cost* of the competing firms, and consequently it impels them to take such defensive action as may jeopardise the greater profits secured; whereas an increase of profit obtained by means of a rise in prices not only does not injure competitors but brings them a positive *gain*, and it may therefore be regarded as having been more durably acquired. An undertaking, therefore, when confronted with the dual possibility of increasing its profits by raising its selling prices, or by reducing them, will generally adopt the first alternative unless the additional profits expected from the second are considerably greater.

These same reasons may serve to dispel the doubt, which might at first sight arise, whether in the case considered above the equilibrium may be indeterminate, as it is generally considered to be in the analogous case of multiple monopoly. In the first place, even in this case, as Edgeworth has noticed, "the extent of indeterminateness diminishes with the diminution of the degree of correlation between the articles" produced by the different monopolists [1]; that is to say, in our case, with the diminution of the elasticity of demand for the products of the individual firm—a limitation, it may be added, the effectiveness of which is the greater in proportion as the rapidity of decrease in the individual cost with the increase in the quantity produced becomes less. Both these conditions, as has been said above, are generally present to a large extent in the case we are considering. Moreover, the indeterminateness of the equilibrium in the case of multiple monopoly is necessarily dependent upon the assumption that at any moment each of the monopolists is *equally* inclined either to raise or to reduce his price, according as one or the other may suit him best from the point of view of immediate gain—a supposition which, at least in our case, is not, as we have said, justified.[2]

[1] *The Pure Theory of Monopoly*, in Papers Relating to P. E., Vol. I. p. 121.

[2] The determinateness of the equilibrium would be more evident if, instead of regarding the various units of the same goods produced by different undertakings as rival commodities, we had regarded each unit as being composed of two commodities having, within each particular market, a joint demand, one of which (the commodity itself) is sold under competitive conditions, and the other

The conclusion that the equilibrium is in general determinate does not mean that generalising statements can be made regarding the price corresponding to that equilibrium; it may be different in the case of each undertaking, and is dependent to a great extent upon the special conditions affecting it.

The only case in which it would be possible to speak of a general price would be that of a trade in which the productive organisation of the different undertakings was uniform, and in which their particular markets were alike as regards the nature and attachment of the customers. In that case, as may readily be seen, the general price of the product, through the independent action of a number of firms, each of which is prompted only by its individual interests, would tend to reach the same level as that which would be fixed by a single monopolistic association in accordance with the ordinary principles of monopoly. This result, far from being conditioned by the existence of an almost complete isolation of the individual markets, requires only a very slight degree of preference for a particular firm in each of the groups of customers. In itself, this case is of no importance, because it is extremely unlikely that such uniformity would actually be found; but it is representative of a tendency, which prevails even in actual cases where the conditions of the various undertakings differ among each other, whereby the cumulative action of slight obstacles to competition produces on prices effects which approximate to those of monopoly.

It should be noted that in the foregoing the disturbing influence exercised by the competition of new firms attracted to an industry the conditions of which permit of high monopolist profits has been neglected. This appeared justified, in the first place because the entrance of new-comers is frequently hindered by the heavy expenses necessary for setting up a connection in a trade in which the existing firms have an established goodwill—expenses which may often exceed the capital value of the profits obtainable; in the second place, this element can acquire importance only when the monopoly profits in a trade are considerably above the normal level of profits in the trade in general, which, however, does not prevent the prices from being determined up to that point in the manner which has been indicated.

It might seem, moreover, that the importance of the marketing difficulties as a limit to the development of the productive

(the special services, or the distinguishing features added to it by each producer) is sold under monopolistic conditions. This point of view, however, is more artificial and less in conformity with the customary method of regarding the matter.

unit has been over-estimated as compared with the effect in the same direction exercised by the more than proportionate increase in the expenditure which a firm must sometimes incur in order to furnish itself with the additional means of production which it requires; but it will generally be found that such increases in costs are an effect, and not a determining cause, of the market conditions which render it necessary or desirable for a firm to restrict its production. Thus, the limited credit of many firms, which does not permit any one of them to obtain more than a limited amount of capital at the current rate of interest, is often a direct consequence of its being known that a given firm is unable to increase its sales outside its own particular market without incurring heavy marketing expenses. If it were known that a firm which is in a position to produce an increased quantity of goods at a lower cost is also in a position to sell them without difficulty at a constant price, such a firm could encounter no obstacle in a free capital market. On the other hand, if a banker, or the owner of land on which a firm proposes to extend its own plant, or any other supplier of the firm's means of production, stands in a privileged position in respect to it, he can certainly exact from it a price higher than the current price for his supplies, but this possibility will still be a direct consequence of the fact that such a firm, being in its turn in a privileged position in regard to its particular market, also sells its products at prices above cost. What happens in such cases is that a portion of its monopoly profits are taken away from the firm, not that its cost of production is increased.

But these are mainly aspects of the process of diffusion of profits throughout the various stages of production and of the process of forming a normal level of profits throughout all the industries of a country. Their influence on the formation of the prices of single commodities is relatively unimportant, and their consideration is therefore beyond the scope of this article.

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Allyn Abbott Young (1876–1929)

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INCREASING RETURNS AND ECONOMIC PROGRESS [1]

My subject may appear alarmingly formidable, but I did not intend it to be so. The words economic progress, taken by themselves, would suggest the pursuit of some philosophy of history, of some way of appraising the results of past and possible future changes in forms of economic organisation and modes of economic activities. But as I have used them, joined to the other half of my title, they are meant merely to dispel apprehensions, by suggesting that I do not propose to discuss any of those alluring but highly technical questions relating to the precise way in which some sort of equilibrium of supply and demand is achieved in the market for the products of industries which can increase their output without increasing their costs proportionately, or to the possible advantages of fostering the development of such industries while putting a handicap upon industries whose output can be increased only at the expense of a more than proportionate increase of costs. I suspect, indeed, that the apparatus which economists have built up for dealing effectively with the range of questions to which I have just referred may stand in the way of a clear view of the more general or elementary aspects of the phenomena of increasing returns, such as I wish to comment upon in this paper.

Consider, for example, Alfred Marshall's fruitful distinction between the internal productive economies which a particular firm is able to secure as the growth of the market permits it to enlarge the scale of its operations and the economies external to the individual firm which show themselves only in changes of the organisation of the industry as a whole. This distinction has been useful in at least two different ways. In the first place it is, or ought to be, a safeguard against the common error of assuming that wherever increasing returns operate there is necessarily an effective tendency towards monopoly. In the second

[1] Presidential Address before Section F (Economic Science and Statistics) of the British Association for the Advancement of Science, Glasgow, September 10, 1928.

place it simplifies the analysis of the manner in which the prices of commodities produced under conditions of increasing returns are determined. A representative firm within the industry, maintaining its own identity and devoting itself to a given range of activities, is made to be the vehicle or medium through which the economies achieved by the industry as a whole are transmitted to the market and have their effect upon the price of the product.

The view of the nature of the processes of industrial progress which is implied in the distinction between internal and external economies is necessarily a partial view. Certain aspects of those processes are illuminated, while, for that very reason, certain other aspects, important in relation to other problems, are obscured. This will be clear, I think, if we observe that, although the internal economies of some firms producing, let us say, materials or appliances may figure as the external economies of other firms, not all of the economies which are properly to be called external can be accounted for by adding up the internal economies of all the separate firms. When we look at the internal economies of a particular firm we envisage a condition of comparative stability. Year after year the firm, like its competitors, is manufacturing a particular product or group of products, or is confining itself to certain definite stages in the work of forwarding the products towards their final form. Its operations change in the sense that they are progressively adapted to an increasing output, but they are kept within definitely circumscribed bounds. Out beyond, in that obscurer field from which it derives its external economies, changes of another order are occurring. New products are appearing, firms are assuming new tasks, and new industries are coming into being. In short, change in this external field is qualitative as well as quantitative. No analysis of the forces making for economic equilibrium, forces which we might say are tangential at any moment of time, will serve to illumine this field, for movements away from equilibrium, departures from previous trends, are characteristic of it. Not much is to be gained by probing into it to see how increasing returns show themselves in the costs of individual firms and in the prices at which they offer their products.

Instead, we have to go back to a simpler and more inclusive view, such as some of the older economists took when they contrasted the increasing returns which they thought were characteristic of manufacturing industry taken as a whole with the diminishing returns which they thought were dominant in agriculture because of an increasingly unfavourable proportioning

of labour and land. Most of them were disappointingly vague with respect to the origins and the precise nature of the " improvements " which they counted upon to retard somewhat the operation of the tendency towards diminishing returns in agriculture and to secure a progressively more effective use of labour in manufactures. Their opinions appear to have rested partly upon an empirical generalisation. Improvements had been made, they were still being made, and it might be assumed that they would continue to be made. If they had looked back they would have seen that there were centuries during which there were few significant changes in either agricultural or industrial methods. But they were living in an age when men had turned their faces in a new direction and when economic progress was not only consciously sought but seemed in some way to grow out of the nature of things. Improvements, then, were not something to be explained. They were natural phenomena, like the precession of the equinoxes.

There were certain important exceptions, however, to this incurious attitude towards what might seem to be one of the most important of all economic problems. Senior's positive doctrine is well known, and there were others who made note of the circumstance that with the growth of population and of markets new opportunities for the division of labour appear and new advantages attach to it. In this way, and in this way only, were the generally commonplace things which they said about " improvements " related to anything which could properly be called a doctrine of increasing returns. They added nothing to Adam Smith's famous theorem that the division of labour depends upon the extent of the market. That theorem, I have always thought, is one of the most illuminating and fruitful generalisations which can be found anywhere in the whole literature of economics. In fact, as I am bound to confess, I am taking it as the text of this paper, in much the way that some minor composer borrows a theme from one of the masters and adds certain developments or variations of his own. To-day, of course, we mean by the division of labour something much broader in scope than that splitting up of occupations and development of specialised crafts which Adam Smith mostly had in mind. No one, so far as I know, has tried to enumerate all of the different aspects of the division of labour, and I do not propose to undertake that task. I shall deal with two related aspects only : the growth of indirect or roundabout methods of production and the division of labour among industries.

It is generally agreed that Adam Smith, when he suggested that the division of labour leads to inventions because workmen engaged in specialised routine operations come to see better ways of accomplishing the same results, missed the main point. The important thing, of course, is that with the division of labour a group of complex processes is transformed into a succession of simpler processes, some of which, at least, lend themselves to the use of machinery. In the use of machinery and the adoption of indirect processes there is a further division of labour, the economies of which are again limited by the extent of the market. It would be wasteful to make a hammer to drive a single nail; it would be better to use whatever awkward implement lies conveniently at hand. It would be wasteful to furnish a factory with an elaborate equipment of specially constructed jigs, gauges, lathes, drills, presses and conveyors to build a hundred automobiles; it would be better to rely mostly upon tools and machines of standard types, so as to make a relatively larger use of directly-applied and a relatively smaller use of indirectly-applied labour. Mr. Ford's methods would be absurdly uneconomical if his output were very small, and would be unprofitable even if his output were what many other manufacturers of automobiles would call large.

Then, of course, there are economies of what might be called a secondary order. How far it pays to go in equipping factories with special appliances for making hammers or for constructing specialised machinery for use in making different parts of automobiles depends again upon how many nails are to be driven and how many automobiles can be sold. In some instances, I suppose, these secondary economies, though real, have only a secondary importance. The derived demands for many types of specialised production appliances are inelastic over a fairly large range. If the benefits and the costs of using such appliances are spread over a relatively large volume of final products, their technical effectiveness is a larger factor in determining whether it is profitable to use them than any difference which producing them on a large or a small scale would commonly make in their costs. In other instances the demand for productive appliances is more elastic, and beyond a certain level of costs demand may fail completely. In such circumstances secondary economies may become highly important.

Doubtless, much of what I have said has been familiar and even elementary. I shall venture, nevertheless, to put further stress upon two points, which may be among those which have

a familiar ring, but which appear sometimes to be in danger of being forgotten. (Otherwise, economists of standing could not have suggested that increasing returns may be altogether illusory, or have maintained that where they are present they must lead to monopoly.) The first point is that the principal economies which manifest themselves in increasing returns are the economies of capitalistic or roundabout methods of production. These economies, again, are largely identical with the economies of the division of labour in its most important modern forms. In fact, these economies lie under our eyes, but we may miss them if we try to make of *large-scale* production (in the sense of production by large firms or large industries), as contrasted with *large* production, any more than an incident in the general process by which increasing returns are secured and if accordingly we look too much at the individual firm or even, as I shall suggest presently, at the individual industry.

The second point is that the economies of roundabout methods, even more than the economies of other forms of the division of labour, depend upon the extent of the market—and that, of course, is why we discuss them under the head of increasing returns. It would hardly be necessary to stress this point, if it were not that the economies of large-scale operations and of "mass-production" are often referred to as though they could be had for the taking, by means of a "rational" reorganisation of industry. Now I grant that at any given time routine and inertia play a very large part in the organisation and conduct of industrial operations. Real leadership is no more common in industrial than in other pursuits. New catch-words or slogans like mass-production and rationalisation may operate as stimuli; they may rouse men from routine and lead them to scrutinise again the organisation and processes of industry and to try to discover particular ways in which they can be bettered. For example, no one can doubt that there are genuine economies to be achieved in the way of "simplification and standardisation," or that the securing of these economies requires that certain deeply rooted competitive wastes be extirpated. This last requires a definite concerted effort—precisely the kind of thing which ordinary competitive motives are often powerless to effect, but which might come more easily as the response to the dissemination of a new idea.

There is a danger, however, that we shall expect too much from these "rational" industrial reforms. Pressed beyond a certain point they become the reverse of rational. I have

naturally been interested in British opinions respecting the reasons for the relatively high productivity (per labourer or per hour of labour) of representative American industries. The error of those who suggest that the explanation is to be found in the relatively high wages which prevail in America is not that they confuse cause and effect, but that they hold that what are really only two aspects of a single situation are, the one cause, and the other effect. Those who hold that American industry is managed better, that its leaders study its problems more intelligently and plan more courageously and more wisely can cite no facts in support of their opinion save the differences in the results achieved. Allowing for the circumstance that British industry, as a whole, has proved to be rather badly adjusted to the new post-war economic situation, I know of no facts which prove or even indicate that British industry, seen against the background of its own problems and its own possibilities, is less efficiently organised or less ably directed than American industry or the industry of any other country.

Sometimes the fact that the average American labourer works with the help of a larger supply of power-driven labour-saving machinery than the labourer of other countries is cited as evidence of the superior intelligence of the average American employer. But this will not do, for, as every economist knows, the greater the degree in which labour is productive or scarce—the words have the same meaning—the greater is the relative economy of using it in such indirect or roundabout ways as are technically advantageous, even though such procedure calls for larger advances of capital than simpler methods do.

It is encouraging to find that a fairly large number of commentators upon the volume of the American industrial product and the scale of American industrial organisation have come to surmise that the extent of the American domestic market, unimpeded by tariff barriers, may have something to do with the matter. This opinion seems even to be forced upon thoughtful observers by the general character of the facts, whether or no the observers think in terms of the economists' conception of increasing returns. In certain industries, although by no means in all, productive methods are economical and profitable in America which would not be profitable elsewhere. The importance of coal and iron and other natural resources needs no comment. Taking a country's economic endowment as given, however, the most important single factor in determining the effectiveness of its industry appears to be the size of the market. But

just what constitutes a large market? Not area or population alone, but buying power, the capacity to absorb a large annual output of goods. This trite observation, however, at once suggests another equally trite, namely, that capacity to buy depends upon capacity to produce. In an inclusive view, considering the market not as an outlet for the products of a particular industry, and therefore external to that industry, but as the outlet for goods in general, the size of the market is determined and defined by the volume of production. If this statement needs any qualification, it is that the conception of a market in this inclusive sense—an aggregate of productive activities, tied together by trade—carries with it the notion that there must be some sort of balance, that different productive activities must be proportioned one to another.

Modified, then, in the light of this broader conception of the market, Adam Smith's dictum amounts to the theorem that the division of labour depends in large part upon the division of labour. This is more than mere tautology. It means, if I read its significance rightly, that the counter forces which are continually defeating the forces which make for economic equilibrium are more pervasive and more deeply rooted in the constitution of the modern economic system than we commonly realise. Not only new or adventitious elements, coming in from the outside, but elements which are permanent characteristics of the ways in which goods are produced make continuously for change. Every important advance in the organisation of production, regardless of whether it is based upon anything which, in a narrow or technical sense, would be called a new "invention," or involves a fresh application of the fruits of scientific progress to industry, alters the conditions of industrial activity and initiates responses elsewhere in the industrial structure which in turn have a further unsettling effect. Thus change becomes progressive and propagates itself in a cumulative way.

The apparatus which economists have built up for the analysis of supply and demand in their relations to prices does not seem to be particularly helpful for the purposes of an inquiry into these broader aspects of increasing returns. In fact, as I have already suggested, reliance upon it may divert attention to incidental or partial aspects of a process which ought to be seen as a whole. If, nevertheless, one insists upon seeing just how far one can get into the problem by using the formulas of supply and demand, the simplest way, I suppose, is to begin by inquiring into the operations of reciprocal demand when the commodities exchanged

are produced competitively under conditions of increasing returns and when the demand for each commodity is elastic, in the special sense that a small increase in its supply will be attended by an increase in the amounts of other commodities which can be had in exchange for it.[1] Under such conditions an increase in the supply of one commodity *is* an increase in the demand for other commodities, and it must be supposed that every increase in demand will evoke an increase in supply. The rate at which any one industry grows is conditioned by the rate at which other industries grow, but since the elasticities of demand and of supply will differ for different products, some industries will grow faster than others. Even with a stationary population and in the absence of new discoveries [2] in pure or applied science there are no limits to the process of expansion except the limits beyond which demand is not elastic and returns do not increase.

If, under these hypothetical conditions, progress were unimpeded and frictionless, if it were not dependent in part upon a process of trial and error, if the organisation of industry were always such as, in relation to the immediate situation, is most economical, the realising of increasing returns might be progressive and continuous, although, for technical reasons, it could not always proceed at an even rate. But it would remain a process requiring time. An industrial dictator, with foresight and knowledge, could hasten the pace somewhat, but he could not achieve an Aladdin-like transformation of a country's industry, so as to reap the fruits of a half-century's ordinary progress in a few years. The obstacles are of two sorts. First, the human material which has to be used is resistant to change. New trades have to be learnt and new habits have to be acquired. There has to be a new geographical distribution of the population and established communal groups have to be broken up. Second, the accumulation of the necessary capital takes time, even though the process of accumulation is largely one of turning part of an increasing product into forms which will serve in securing a further increase of product. An acceleration of the rate of accumulation encounters increasing costs, into which both technical and psychological elements enter. One who likes

[1] If the circumstance that commodity a is produced under conditions of increasing returns is taken into account as a factor in the elasticity of demand for b in terms of a, elasticity of demand and elasticity of supply may be looked upon as different ways of expressing a single functional relation.

[2] As contrasted with such new ways of organising production and such new "inventions" as are merely adaptations of known ways of doing things, made practicable and economical by an enlarged scale of production.

to conceive of all economic processes in terms of tendencies towards an equilibrium might even maintain that increasing returns, so far as they depend upon the economies of indirect methods of production and the size of the market, are offset and negated by their costs, and that under such simplified conditions as I have dealt with the realising of increasing returns would be spread through time in such a way as to secure an equilibrium of costs and advantages. This would amount to saying that no real economic progress could come through the operation of forces engendered *within* the economic system—a conclusion repugnant to common sense. To deal with this point thoroughly would take us too far afield. I shall merely observe, first, that the appropriate conception is that of a *moving* equilibrium, and second, that the costs which (under increasing returns) grow less rapidly than the product are not the "costs" which figure in an "equilibrium of costs and advantages."

Moving away from these abstract considerations, so as to get closer to the complications of the real situation, account has to be taken, first, of various kinds of obstacles. The demand for some products is inelastic, or, with an increasing supply, soon becomes so. The producers of such commodities, however, often share in the advantages of the increase of the general scale of production in related industries, and so far as they do productive resources are released for other uses. Then there are natural scarcities, limitations or inelasticities of supply, such as effectively block the way to the securing of any important economies in the production of some commodities and which impair the effectiveness of the economies secured in the production of other commodities. In most fields, moreover, progress is not and cannot be continuous. The next important step forward is often initially costly, and cannot be taken until a certain quantum of prospective advantages has accumulated.

On the other side of the account are various factors which reinforce the influences which make for increasing returns. The discovery of new natural resources and of new uses for them and the growth of scientific knowledge are probably the most potent of such factors. The causal connections between the growth of industry and the progress of science run in both directions, but on which side the preponderant influence lies no one can say. At any rate, out of better knowledge of the materials and forces upon which men can lay their hands there come both new ways of producing familiar commodities and new products, and these last have a presumptive claim to be regarded as em-

bodying more economical uses of productive resources than the uses which they displace. Some weight has to be given also to the way in which, with the advance of the scientific spirit, a new kind of interest—which might be described as a scientific interest conditioned by an economic interest—is beginning to infiltrate into industry. It is a point of controversy, but I venture to maintain that under most circumstances, though not in all, the growth of population still has to be counted a factor making for a larger *per capita* product—although even that cautious statement needs to be interpreted and qualified. But just as there may be population growth with no increase of the average *per capita* product, so also, as I have tried to suggest, markets may grow and increasing returns may be secured while the population remains stationary.

It is dangerous to assign to any single factor the leading rôle in that continuing economic revolution which has taken the modern world so far away from the world of a few hundred years ago. But is there any other factor which has a better claim to that rôle than the persisting search for markets? No other hypothesis so well unites economic history and economic theory. The Industrial Revolution of the eighteenth century has come to be generally regarded, not as a cataclysm brought about by certain inspired improvements in industrial technique, but as a series of changes related in an orderly way to prior changes in industrial organisation and to the enlargement of markets. It is sometimes said, however, that while in the Middle Ages and in the early modern period industry was the servant of commerce, since the rise of "industrial capitalism" the relation has been reversed, commerce being now merely an agent of industry. If this means that the finding of markets is one of the tasks of modern industry it is true. If it means that industry imposes its will upon the market, that whereas formerly the things which were produced were the things which could be sold, now the things which have to be sold are the things that are produced, it is not true.

The great change, I imagine, is in the new importance which the *potential market* has in the planning and management of large industries. The difference between the cost per unit of output in an industry or in an individual plant properly adapted to a given volume of output and in an industry or plant equally well adapted to an output five times as large is often much greater than one would infer from looking merely at the economies which may accrue as an existing establishment gradually extends the

scale of its operations. Potential demand, then, in the planning of industrial undertakings, has to be balanced against potential economies, elasticity of demand against decreasing costs. The search for markets is not a matter of disposing of a "surplus product," in the Marxian sense, but of finding an outlet for a potential product. Nor is it wholly a matter of multiplying profits by multiplying sales; it is partly a matter of augmenting profits by reducing costs.

Although the initial displacement may be considerable and the repercussions upon particular industries unfavourable, the enlarging of the market for any one commodity, produced under conditions of increasing returns, generally has the net effect, as I have tried to show, of enlarging the market for other commodities. The business man's mercantilistic emphasis upon markets may have a sounder basis than the economist who thinks mostly in terms of economic statics is prone to admit. How far "selling expenses," for example, are to be counted sheer economic waste depends upon their effects upon the aggregate product of industry, as distinguished from their effects upon the fortunes of particular undertakings.

Increasing returns are often spoken of as though they were attached always to the growth of "industries," and I have not tried to avoid that way of speaking of them, although I think that it may be a misleading way. The point which I have in mind is something more than a quibble about the proper definition of an industry, for it involves a particular thesis with respect to the way in which increasing returns are reflected in changes in the organisation of industrial activities. Much has been said about industrial integration as a concomitant or a natural result of an increasing industrial output. It obviously is, under particular conditions, though I know of no satisfactory statement of just what those particular conditions are. But the opposed process, industrial differentiation, has been and remains the type of change characteristically associated with the growth of production. Notable as has been the increase in the complexity of the apparatus of living, as shown by the increase in the variety of goods offered in consumers' markets, the increase in the diversification of intermediate products and of industries manufacturing special products or groups of products has gone even further.

The successors of the early printers, it has often been observed, are not only the printers of to-day, with their own specialised establishments, but also the producers of wood pulp, of various

kinds of paper, of inks and their different ingredients, of type-metal and of type, the group of industries concerned with the technical parts of the producing of illustrations, and the manufacturers of specialised tools and machines for use in printing and in these various auxiliary industries. The list could be extended, both by enumerating other industries which are directly ancillary to the present printing trades and by going back to industries which, while supplying the industries which supply the printing trades, also supply other industries, concerned with preliminary stages in the making of final products other than printed books and newspapers. I do not think that the printing trades are an exceptional instance, but I shall not give other examples, for I do not want this paper to be too much like a primer of descriptive economics or an index to the reports of a census of production. It is sufficiently obvious, anyhow, that over a large part of the field of industry an increasingly intricate nexus of specialised undertakings has inserted itself between the producer of raw materials and the consumer of the final product.

With the extension of the division of labour among industries the representative firm, like the industry of which it is a part, loses its identity. Its internal economies dissolve into the internal and external economies of the more highly specialised undertakings which are its successors, and are supplemented by new economies. In so far as it is an adjustment to a new situation created by the growth of the market for the final products of industry the division of labour among industries is a vehicle of increasing returns. It is more than a change of form incidental to the full securing of the advantages of capitalistic methods of production—although it is largely that—for it has some advantages of its own which are independent of changes in productive technique. For example, it permits of a higher degree of specialisation in management, and the advantages of such specialisation are doubtless often real, though they may easily be given too much weight. Again, it lends itself to a better geographical distribution of industrial operations, and this advantage is unquestionably both real and important. Nearness to the source of supply of a particular raw material or to cheap power counts for most in one part of a series of industrial processes, nearness to other industries or to cheap transport in another part, and nearness to a larger centre of population in yet another. A better *combination* of advantages of location, with a smaller element of compromise, can be had by the more

specialised industries. But the largest advantage secured by the division of labour among industries is the fuller realising of the economies of capitalistic or roundabout methods of production. This should be sufficiently obvious if we assume, as we must, that in most industries there are effective, though elastic, limits to the economical size of the individual firm. The output of the individual firm is generally a relatively small proportion of the aggregate output of an industry. The degree in which it can secure economies by making its own operations more roundabout is limited. But certain roundabout methods are fairly sure to become feasible and economical when their advantages can be spread over the output of the whole industry. These potential economies, then, are segregated and achieved by the operations of specialised undertakings which, taken together, constitute a new industry. It might conceivably be maintained that the *scale* upon which the firms in the new industry are able to operate is the secret of their ability to realise economies for industry as a whole, while presumably making profits for themselves. This is true in a way, but misleading. The scale of their operations (which is only incidentally or under special conditions a matter of the size of the individual firm) merely reflects the size of the market for the final products of the industry or industries to whose operations their own are ancillary. And the principal advantage of large-scale operation at this stage is that it again makes methods economical which would be uneconomical if their benefits could not be diffused over a large final product.

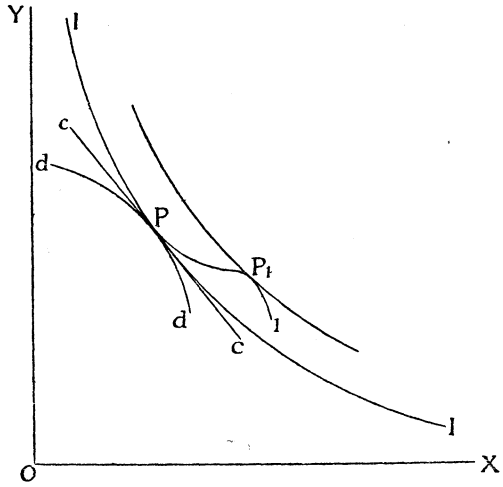
In recapitulation of these variations on a theme from Adam Smith there are three points to be stressed. First, the mechanism of increasing returns is not to be discerned adequately by observing the effects of variations in the size of an individual firm or of a particular industry, for the progressive division and specialisation of industries is an essential part of the process by which increasing returns are realised. What is required is that industrial operations be seen as an interrelated whole. Second, the securing of increasing returns depends upon the progressive division of labour, and the principal economies of the division of labour, in its modern forms, are the economies which are to be had by using labour in roundabout or indirect ways. Third, the division of labour depends upon the extent of the market, but the extent of the market also depends upon the division of labour. In this circumstance lies the possibility of economic progress, apart from the progress which comes as a result of the new knowledge

which men are able to gain, whether in the pursuit of their economic or of their non-economic interests.

ALLYN A. YOUNG

NOTE

IN the accompanying construction (which owes much to Pareto), a collective indifference curve, I, is defined by the condition that, at equal cost, there would be no sufficient inducement for the community to alter an annual production of x units of one commodity and y units of another in order to secure the alternative combination of the two commodities indicated by any other point on the curve.[1] Each commodity might be taken as representative of a special class of commodities,



produced under generally similar conditions. Or one commodity might be made to represent "other goods in general," the annual outlay of productive exertions being regarded as constant. Alternatively, one commodity might represent "leisure" (as a collective name for all non-productive uses of time). The other would then represent the aggregate economic product.

There will be equilibrium (subject to instability of a kind which will be described presently) at a point P, if at that point a curve of equal costs, such as d, is tangent to the indifference curve. The curve of equal costs defines the terms upon which the community can exchange one commodity for the other by merely producing less of the one and more of the other (abstraction being made of any incidental costs of

[1] The collective indifference is to be taken as an expository device, not as a rigorous conception. The relative weights to be assigned to the individual indifference curves of which it is compounded will depend upon how the aggregate product is distributed, and this will not be the same for all positions of P.

change). Negative curvature, as in *d*, reflects a condition of decreasing returns, in the sense that more of either commodity can be had only by sacrificing progressively larger amounts of the other. Although a sufficient condition, the presence of decreasing returns is not a necessary condition of equilibrium. There would be a loss in moving away from *P* if equal costs were defined by the straight line *c*, which represents constant returns. Increasing returns, even, are consistent with equilibrium, provided that the degree of curvature of their graph is less than that of the indifference curve. It might happen, of course, that returns would decrease in one direction and increase in the other. Curve *d*, for example, might have a point of inflexion at or near *P*.

Consider now the conditions of departure from equilibrium. The curve *i* is drawn so as to represent *potential* increasing returns between *P* and P_1, which lies on a preferred indifference curve. If these increasing returns were to be had merely for the taking, if *i* were, for example, merely a continuation of the upper segment of *d* or *c*, *P* would not be a point even of unstable equilibrium. The advance from *P* to P_1 would be made by merely altering the proportions of the two commodities produced annually. To isolate the *problem* of increasing returns it is necessary to assume that *P* is a true point of equilibrium in the sense that it is determined by a curve of equal costs, such as *d* or *c*. The problem, then, has to do with the way in which the lower segment of *d* or *c* can be transformed into or replaced by such a curve as *i*. This requires, of course, that *additional* costs be incurred, of a kind which have not yet been taken into account. To diminish the amount of the one commodity which must be sacrificed for a given increment of the other, some of the labour hitherto devoted to its production must be used indirectly, so that the increase of the annual output of the one lags behind the curtailing of the output of the other.

This new element of cost might be taken into account by utilising a third dimension, but it is simpler to regard it as operating upon Δx, the increment in x accompanying the movement from *P* to P_1, so as to move the indifference curve upon which P_1 lies towards the left. It would be an error, however, to think that the combinations of x with y and $x + (\Delta x)$ with $y - \Delta y$ (where (Δx) is the contracted form of Δx) are themselves indifferent, so that P_1 is, in effect, brought over on to the original indifference curve, *I*, and no advantage is reaped. The path from *P* to P_1 is a *preferred* route, not merely a segment of an indifference curve. The cost of moving along that route is a function of the *rate* (in time) of the movement. An equilibrium rate (which need not be constant), such as would keep the movement from *P* to P_1 continuous and undeviating, would be determined by the condition, not that (Δx) and $-\Delta y$ should negate one another, but that either an acceleration or a retarding of the rate would be costly or disadvantageous. Because a mountain climber adjusts his pace to his physical powers and to the conditions of the ascent, it does not follow that he might as well have stayed at the foot. Or, alternatively but not inconsistently,

the movement from P to P_1 may be conceived as made up of a series of small steps, each apparently yielding no more than a barely perceptible advantage, but only because the scale of reference for both costs and advantages depends at each step upon the position which has then been reached.

Several sets of circumstances will affect the amount and direction of the movement. (1) Even if i has no point of inflexion, such as has been indicated at P_1 (merely to simplify the first stages of this analysis), it will sooner or later (taking into account the " contraction " of Δx) become tangent to an indifference curve. In the absence of any other factor making for change, progress would then come to an end. (2) There may be another possible alternative path of increasing returns extending upwards from P and curving away from I. The most advantageous route will then be a compromise between (or a resultant of) the two limiting alternatives. In such circumstances the only effective limitation imposed upon the extent of the movement may come from the failure of elasticity of demand on one side or the other. (3) Successive indifference curves cannot be supposed to be symmetrical, in the sense that dy/dx remains the same function of y/x. If, for example, the slope of successive indifference curves at points corresponding to given values of y/x decreases (indicating that the demand for the commodity measured in units of y is relatively inelastic), freedom of movement in the direction of P_1 is reduced, while it becomes advantageous to move a little way in the opposite direction along even such a path as c or d. Under inverse conditions (with $-dy/dx$ increasing relatively to y/x for successive indifference curves) the extent of the possible movement in the direction of P_1 is increased. This conclusion amounts to no more than the obvious theorem that the degree in which the decreasing returns encountered in certain fields of economic activity operate as a drag upon the securing of increasing returns in other fields depends upon the relative elasticities of demand for the two types of products. But this consideration, like the others of which note has been made, serves to make clear the general nature of the reciprocal relation between increasing returns and the " extent of the market." (4) Discoveries of new supplies of natural resources or of *new* productive methods may have either or both of two kinds of effects. They may tilt the curves of equal cost and they may modify their curvature favourably. In either event a point such as P is moved to a higher indifference curve, and the paths along which further progress can be made are altered advantageously.

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THE USE OF KNOWLEDGE IN SOCIETY

By F. A. HAYEK*

I

What is the problem we wish to solve when we try to construct a rational economic order?

On certain familiar assumptions the answer is simple enough. *If* we possess all the relevant information, *if* we can start out from a given system of preferences and *if* we command complete knowledge of available means, the problem which remains is purely one of logic. That is, the answer to the question of what is the best use of the available means is implicit in our assumptions. The conditions which the solution of this optimum problem must satisfy have been fully worked out and can be stated best in mathematical form: put at their briefest, they are that the marginal rates of substitution between any two commodities or factors must be the same in all their different uses.

This, however, is emphatically *not* the economic problem which society faces. And the economic calculus which we have developed to solve this logical problem, though an important step toward the solution of the economic problem of society, does not yet provide an answer to it. The reason for this is that the "data" from which the economic calculus starts are never for the whole society "given" to a single mind which could work out the implications, and can never be so given.

The peculiar character of the problem of a rational economic order is determined precisely by the fact that the knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess. The economic problem of society is thus not merely a problem

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of how to allocate "given" resources—if "given" is taken to mean given to a single mind which deliberately solves the problem set by these "data." It is rather a problem of how to secure the best use of resources known to any of the members of society, for ends whose relative importance only these individuals know. Or, to put it briefly, it is a problem of the utilization of knowledge not given to anyone in its totality.

This character of the fundamental problem has, I am afraid, been rather obscured than illuminated by many of the recent refinements of economic theory, particularly by many of the uses made of mathematics. Though the problem with which I want primarily to deal in this paper is the problem of a rational economic organization, I shall in its course be led again and again to point to its close connections with certain methodological questions. Many of the points I wish to make are indeed conclusions toward which diverse paths of reasoning have unexpectedly converged. But as I now see these problems, this is no accident. It seems to me that many of the current disputes with regard to both economic theory and economic policy have their common origin in a misconception about the nature of the economic problem of society. This misconception in turn is due to an erroneous transfer to social phenomena of the habits of thought we have developed in dealing with the phenomena of nature.

II

In ordinary language we describe by the word "planning" the complex of interrelated decisions about the allocation of our available resources. All economic activity is in this sense planning; and in any society in which many people collaborate, this planning, whoever does it, will in some measure have to be based on knowledge which, in the first instance, is not given to the planner but to somebody else, which somehow will have to be conveyed to the planner. The various ways in which the knowledge on which people base their plans is communicated to them is the crucial problem for any theory explaining the economic process. And the problem of what is the best way of utilizing knowledge initially dispersed among all the people is at least one of the main problems of economic policy—or of designing an efficient economic system.

The answer to this question is closely connected with that other question which arises here, that of *who* is to do the planning. It is about this question that all the dispute about "economic planning" centers. This is not a dispute about whether planning is to be done or not. It is a dispute as to whether planning is to be done centrally, by one authority for the whole economic system, or is to be divided

among many individuals. Planning in the specific sense in which the term is used in contemporary controversy necessarily means central planning—direction of the whole economic system according to one unified plan. Competition, on the other hand, means decentralized planning by many separate persons. The half-way house between the two, about which many people talk but which few like when they see it, is the delegation of planning to organized industries, or, in other words, monopoly.

Which of these systems is likely to be more efficient depends mainly on the question under which of them we can expect that fuller use will be made of the existing knowledge. And this, in turn, depends on whether we are more likely to succeed in putting at the disposal of a single central authority all the knowledge which ought to be used but which is initially dispersed among many different individuals, or in conveying to the individuals such additional knowledge as they need in order to enable them to fit their plans in with those of others.

III

It will at once be evident that on this point the position will be different with respect to different kinds of knowledge; and the answer to our question will therefore largely turn on the relative importance of the different kinds of knowledge; those more likely to be at the disposal of particular individuals and those which we should with greater confidence expect to find in the possession of an authority made up of suitably chosen experts. If it is today so widely assumed that the latter will be in a better position, this is because one kind of knowledge, namely, scientific knowledge, occupies now so prominent a place in public imagination that we tend to forget that it is not the only kind that is relevant. It may be admitted that, so far as scientific knowledge is concerned, a body of suitably chosen experts may be in the best position to command all the best knowledge available—though this is of course merely shifting the difficulty to the problem of selecting the experts. What I wish to point out is that, even assuming that this problem can be readily solved, it is only a small part of the wider problem.

Today it is almost heresy to suggest that scientific knowledge is not the sum of all knowledge. But a little reflection will show that there is beyond question a body of very important but unorganized knowledge which cannot possibly be called scientific in the sense of knowledge of general rules: the knowledge of the particular circumstances of time and place. It is with respect to this that practically every individual has some advantage over all others in that he possesses unique information of which beneficial use might be made, but of

which use can be made only if the decisions depending on it are left to him or are made with his active coöperation. We need to remember only how much we have to learn in any occupation after we have completed our theoretical training, how big a part of our working life we spend learning particular jobs, and how valuable an asset in all walks of life is knowledge of people, of local conditions, and special circumstances. To know of and put to use a machine not fully employed, or somebody's skill which could be better utilized, or to be aware of a surplus stock which can be drawn upon during an interruption of supplies, is socially quite as useful as the knowledge of better alternative techniques. And the shipper who earns his living from using otherwise empty or half-filled journeys of tramp-steamers, or the estate agent whose whole knowledge is almost exclusively one of temporary opportunities, or the *arbitrageur* who gains from local differences of commodity prices, are all performing eminently useful functions based on special knowledge of circumstances of the fleeting moment not known to others.

It is a curious fact that this sort of knowledge should today be generally regarded with a kind of contempt, and that anyone who by such knowledge gains an advantage over somebody better equipped with theoretical or technical knowledge is thought to have acted almost disreputably. To gain an advantage from better knowledge of facilities of communication or transport is sometimes regarded as almost dishonest, although it is quite as important that society make use of the best opportunities in this respect as in using the latest scientific discoveries. This prejudice has in a considerable measure affected the attitude toward commerce in general compared with that toward production. Even economists who regard themselves as definitely above the crude materialist fallacies of the past constantly commit the same mistake where activities directed toward the acquisition of such practical knowledge are concerned—apparently because in their scheme of things all such knowledge is supposed to be "given." The common idea now seems to be that all such knowledge should as a matter of course be readily at the command of everybody, and the reproach of irrationality leveled against the existing economic order is frequently based on the fact that it is not so available. This view disregards the fact that the method by which such knowledge can be made as widely available as possible is precisely the problem to which we have to find an answer.

IV

If it is fashionable today to minimize the importance of the knowledge of the particular circumstances of time and place, this is closely connected with the smaller importance which is now attached to change

as such. Indeed, there are few points on which the assumptions made (usually only implicitly) by the "planners" differ from those of their opponents as much as with regard to the significance and frequency of changes which will make substantial alterations of production plans necessary. Of course, if detailed economic plans could be laid down for fairly long periods in advance and then closely adhered to, so that no further economic decisions of importance would be required, the task of drawing up a comprehensive plan governing all economic activity would appear much less formidable.

It is, perhaps, worth stressing that economic problems arise always and only in consequence of change. So long as things continue as before, or at least as they were expected to, there arise no new problems requiring a decision, no need to form a new plan. The belief that changes, or at least day-to-day adjustments, have become less important in modern times implies the contention that economic problems also have become less important. This belief in the decreasing importance of change is, for that reason, usually held by the same people who argue that the importance of economic considerations has been driven into the background by the growing importance of technological knowledge.

Is it true that, with the elaborate apparatus of modern production, economic decisions are required only at long intervals, as when a new factory is to be erected or a new process to be introduced? Is it true that, once a plant has been built, the rest is all more or less mechanical, determined by the character of the plant, and leaving little to be changed in adapting to the ever-changing circumstances of the moment?

The fairly widespread belief in the affirmative is not, so far as I can ascertain, borne out by the practical experience of the business man. In a competitive industry at any rate—and such an industry alone can serve as a test—the task of keeping cost from rising requires constant struggle, absorbing a great part of the energy of the manager. How easy it is for an inefficient manager to dissipate the differentials on which profitability rests, and that it is possible, with the same technical facilities, to produce with a great variety of costs, are among the commonplaces of business experience which do not seem to be equally familiar in the study of the economist. The very strength of the desire, constantly voiced by producers and engineers, to be able to proceed untrammeled by considerations of money costs, is eloquent testimony to the extent to which these factors enter into their daily work.

One reason why economists are increasingly apt to forget about the constant small changes which make up the whole economic picture is probably their growing preoccupation with statistical aggregates, which

show a very much greater stability than the movements of the detail. The comparative stability of the aggregates cannot, however, be accounted for—as the statisticians seem occasionally to be inclined to do—by the "law of large numbers" or the mutual compensation of random changes. The number of elements with which we have to deal is not large enough for such accidental forces to produce stability. The continuous flow of goods and services is maintained by constant deliberate adjustments, by new dispositions made every day in the light of circumstances not known the day before, by *B* stepping in at once when *A* fails to deliver. Even the large and highly mechanized plant keeps going largely because of an environment upon which it can draw for all sorts of unexpected needs; tiles for its roof, stationery for its forms, and all the thousand and one kinds of equipment in which it cannot be self-contained and which the plans for the operation of the plant require to be readily available in the market.

This is, perhaps, also the point where I should briefly mention the fact that the sort of knowledge with which I have been concerned is knowledge of the kind which by its nature cannot enter into statistics and therefore cannot be conveyed to any central authority in statistical form. The statistics which such a central authority would have to use would have to be arrived at precisely by abstracting from minor differences between the things, by lumping together, as resources of one kind, items which differ as regards location, quality, and other particulars, in a way which may be very significant for the specific decision. It follows from this that central planning based on statistical information by its nature cannot take direct account of these circumstances of time and place, and that the central planner will have to find some way or other in which the decisions depending on them can be left to the "man on the spot."

V

If we can agree that the economic problem of society is mainly one of rapid adaptation to changes in the particular circumstances of time and place, it would seem to follow that the ultimate decisions must be left to the people who are familiar with these circumstances, who know directly of the relevant changes and of the resources immediately available to meet them. We cannot expect that this problem will be solved by first communicating all this knowledge to a central board which, after integrating *all* knowledge, issues its orders. We must solve it by some form of decentralization. But this answers only part of our problem. We need decentralization because only thus can we ensure that the knowledge of the particular circumstances of time and place will be promptly used. But the "man on the spot" cannot decide

solely on the basis of his limited but intimate knowledge of the facts of his immediate surroundings. There still remains the problem of communicating to him such further information as he needs to fit his decisions into the whole pattern of changes of the larger economic system.

How much knowledge does he need to do so successfully? Which of the events which happen beyond the horizon of his immediate knowledge are of relevance to his immediate decision, and how much of them need he know?

There is hardly anything that happens anywhere in the world that *might* not have an effect on the decision he ought to make. But he need not know of these events as such, nor of *all* their effects. It does not matter for him *why* at the particular moment more screws of one size than of another are wanted, *why* paper bags are more readily available than canvas bags, or *why* skilled labor, or particular machine tools, have for the moment become more difficult to acquire. All that is significant for him is *how much more or less* difficult to procure they have become compared with other things with which he is also concerned, or how much more or less urgently wanted are the alternative things he produces or uses. It is always a question of the relative importance of the particular things with which he is concerned, and the causes which alter their relative importance are of no interest to him beyond the effect on those concrete things of his own environment.

It is in this connection that what I have called the economic calculus proper helps us, at least by analogy, to see how this problem can be solved, and in fact is being solved, by the price system. Even the single controlling mind, in possession of all the data for some small, self-contained economic system, would not—every time some small adjustment in the allocation of resources had to be made—go explicitly through all the relations between ends and means which might possibly be affected. It is indeed the great contribution of the pure logic of choice that it has demonstrated conclusively that even such a single mind could solve this kind of problem only by constructing and constantly using rates of equivalence (or "values," or "marginal rates of substitution"), *i.e.*, by attaching to each kind of scarce resource a numerical index which cannot be derived from any property possessed by that particular thing, but which reflects, or in which is condensed, its significance in view of the whole means-end structure. In any small change he will have to consider only these quantitative indices (or "values") in which all the relevant information is concentrated; and by adjusting the quantities one by one, he can appropriately rearrange his dispositions without having to solve the whole puzzle *ab initio*, or without needing at any stage to survey it at once in all its ramifications.

Fundamentally, in a system where the knowledge of the relevant facts is dispersed among many people, prices can act to coördinate the separate actions of different people in the same way as subjective values help the individual to coördinate the parts of his plan. It is worth contemplating for a moment a very simple and commonplace instance of the action of the price system to see what precisely it accomplishes. Assume that somewhere in the world a new opportunity for the use of some raw material, say tin, has arisen, or that one of the sources of supply of tin has been eliminated. It does not matter for our purpose—and it is very significant that it does not matter—which of these two causes has made tin more scarce. All that the users of tin need to know is that some of the tin they used to consume is now more profitably employed elsewhere, and that in consequence they must economize tin. There is no need for the great majority of them even to know where the more urgent need has arisen, or in favor of what other needs they ought to husband the supply. If only some of them know directly of the new demand, and switch resources over to it, and if the people who are aware of the new gap thus created in turn fill it from still other sources, the effect will rapidly spread throughout the whole economic system and influence not only all the uses of tin, but also those of its substitutes and the substitutes of these substitutes, the supply of all the things made of tin, and their substitutes, and so on; and all this without the great majority of those instrumental in bringing about these substitutions knowing anything at all about the original cause of these changes. The whole acts as one market, not because any of its members survey the whole field, but because their limited individual fields of vision sufficiently overlap so that through many intermediaries the relevant information is communicated to all. The mere fact that there is one price for any commodity—or rather that local prices are connected in a manner determined by the cost of transport, etc.—brings about the solution which (it is just conceptually possible) might have been arrived at by one single mind possessing all the information which is in fact dispersed among all the people involved in the process.

VI

We must look at the price system as such a mechanism for communicating information if we want to understand its real function—a function which, of course, it fulfills less perfectly as prices grow more rigid. (Even when quoted prices have become quite rigid, however, the forces which would operate through changes in price still operate to a considerable extent through changes in the other terms of the contract.) The most significant fact about this system is the economy of knowledge

with which it operates, or how little the individual participants need to know in order to be able to take the right action. In abbreviated form, by a kind of symbol, only the most essential information is passed on, and passed on only to those concerned. It is more than a metaphor to describe the price system as a kind of machinery for registering change, or a system of telecommunications which enables individual producers to watch merely the movement of a few pointers, as an engineer might watch the hands of a few dials, in order to adjust their activities to changes of which they may never know more than is reflected in the price movement.

Of course, these adjustments are probably never "perfect" in the sense in which the economist conceives of them in his equilibrium analysis. But I fear that our theoretical habits of approaching the problem with the assumption of more or less perfect knowledge on the part of almost everyone has made us somewhat blind to the true function of the price mechanism and led us to apply rather misleading standards in judging its efficiency. The marvel is that in a case like that of a scarcity of one raw material, without an order being issued, without more than perhaps a handful of people knowing the cause, tens of thousands of people whose identity could not be ascertained by months of investigation, are made to use the material or its products more sparingly; *i.e.*, they move in the right direction. This is enough of a marvel even if, in a constantly changing world, not all will hit it off so perfectly that their profit rates will always be maintained at the same constant or "normal" level.

I have deliberately used the word "marvel" to shock the reader out of the complacency with which we often take the working of this mechanism for granted. I am convinced that if it were the result of deliberate human design, and if the people guided by the price changes understood that their decisions have significance far beyond their immediate aim, this mechanism would have been acclaimed as one of the greatest triumphs of the human mind. Its misfortune is the double one that it is not the product of human design and that the people guided by it usually do not know why they are made to do what they do. But those who clamor for "conscious direction"—and who cannot believe that anything which has evolved without design (and even without our understanding it) should solve problems which we should not be able to solve consciously—should remember this: The problem is precisely how to extend the span of our utilization of resources beyond the span of the control of any one mind; and, therefore, how to dispense with the need of conscious control and how to provide inducements which will make the individuals do the desirable things without anyone having to tell them what to do.

The problem which we meet here is by no means peculiar to economics but arises in connection with nearly all truly social phenomena, with language and most of our cultural inheritance, and constitutes really the central theoretical problem of all social science. As Alfred Whitehead has said in another connection, "It is a profoundly erroneous truism, repeated by all copy-books and by eminent people when they are making speeches, that we should cultivate the habit of thinking what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them." This is of profound significance in the social field. We make constant use of formulas, symbols and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess. We have developed these practices and institutions by building upon habits and institutions which have proved successful in their own sphere and which have in turn become the foundation of the civilization we have built up.

The price system is just one of those formations which man has learned to use (though he is still very far from having learned to make the best use of it) after he had stumbled upon it without understanding it. Through it not only a division of labor but also a coördinated utilization of resources based on an equally divided knowledge has become possible. The people who like to deride any suggestion that this may be so usually distort the argument by insinuating that it asserts that by some miracle just that sort of system has spontaneously grown up which is best suited to modern civilization. It is the other way round: man has been able to develop that division of labor on which our civilization is based because he happened to stumble upon a method which made it possible. Had he not done so he might still have developed some other, altogether different, type of civilization, something like the "state" of the termite ants, or some other altogether unimaginable type. All that we can say is that nobody has yet succeeded in designing an alternative system in which certain features of the existing one can be preserved which are dear even to those who most violently assail it—such as particularly the extent to which the individual can choose his pursuits and consequently freely use his own knowledge and skill.

VII

It is in many ways fortunate that the dispute about the indispensability of the price system for any rational calculation in a complex society is now no longer conducted entirely between camps holding different political views. The thesis that without the price system we

could not preserve a society based on such extensive division of labor as ours was greeted with a howl of derision when it was first advanced by von Mises twenty-five years ago. Today the difficulties which some still find in accepting it are no longer mainly political, and this makes for an atmosphere much more conducive to reasonable discussion. When we find Leon Trotsky arguing that "economic accounting is unthinkable without market relations"; when Professor Oscar Lange promises Professor von Mises a statue in the marble halls of the future Central Planning Board; and when Professor Abba P. Lerner rediscovers Adam Smith and emphasizes that the essential utility of the price system consists in inducing the individual, while seeking his own interest, to do what is in the general interest, the differences can indeed no longer be ascribed to political prejudice. The remaining dissent seems clearly to be due to purely intellectual, and more particularly methodological, differences.

A recent statement by Professor Joseph Schumpeter in his *Capitalism, Socialism and Democracy* provides a clear illustration of one of the methodological differences which I have in mind. Its author is preeminent among those economists who approach economic phenomena in the light of a certain branch of positivism. To him these phenomena accordingly appear as objectively given quantities of commodities impinging directly upon each other, almost, it would seem, without any intervention of human minds. Only against this background can I account for the following (to me startling) pronouncement. Professor Schumpeter argues that the possibility of a rational calculation in the absence of markets for the factors of production follows for the theorist "from the elementary proposition that consumers in evaluating ('demanding') consumers' goods *ipso facto* also evaluate the means of production which enter into the production of these goods."[1]

Taken literally, this statement is simply untrue. The consumers do nothing of the kind. What Professor Schumpeter's *"ipso facto"* presumably means is that the valuation of the factors of production is

[1] J. Schumpeter, *Capitalism, Socialism, and Democracy* (New York, Harper, 1942), p. 175. Professor Schumpeter is, I believe, also the original author of the myth that Pareto and Barone have "solved" the problem of socialist calculation. What they, and many others, did was merely to state the conditions which a rational allocation of resources would have to satisfy, and to point out that these were essentially the same as the conditions of equilibrium of a competitive market. This is something altogether different from showing how the allocation of resources satisfying these conditions can be found in practice. Pareto himself (from whom Barone has taken practically everything he has to say), far from claiming to have solved the practical problem, in fact explicitly denies that it can be solved without the help of the market. See his *Manuel d'économie pure* (2nd ed., 1927), pp. 233-34. The relevant passage is quoted in an English translation at the beginning of my article → "Socialist Calculation: The Competitive 'Solution,'" in *Economica*, New Series, Vol. VIII, No. 26 (May, 1940), p. 125.

implied in, or follows necessarily from, the valuation of consumers' goods. But this, too, is not correct. Implication is a logical relationship which can be meaningfully asserted only of propositions simultaneously present to one and the same mind. It is evident, however, that the values of the factors of production do not depend solely on the valuation of the consumers' goods but also on the conditions of supply of the various factors of production. Only to a mind to which all these facts were simultaneously known would the answer necessarily follow from the facts given to it. The practical problem, however, arises precisely because these facts are never so given to a single mind, and because, in consequence, it is necessary that in the solution of the problem knowledge should be used that is dispersed among many people.

The problem is thus in no way solved if we can show that all the facts, *if* they were known to a single mind (as we hypothetically assume them to be given to the observing economist), would uniquely determine the solution; instead we must show how a solution is produced by the interactions of people each of whom possesses only partial knowledge. To assume all the knowledge to be given to a single mind in the same manner in which we assume it to be given to us as the explaining economists is to assume the problem away and to disregard everything that is important and significant in the real world.

That an economist of Professor Schumpeter's standing should thus have fallen into a trap which the ambiguity of the term "datum" sets to the unwary can hardly be explained as a simple error. It suggests rather than there is something fundamentally wrong with an approach which habitually disregards an essential part of the phenomena with which we have to deal: the unavoidable imperfection of man's knowledge and the consequent need for a process by which knowledge is constantly communicated and acquired. Any approach, such as that of much of mathematical economics with its simultaneous equations, which in effect starts from the assumption that people's *knowledge* corresponds with the objective *facts* of the situation, systematically leaves out what is our main task to explain. I am far from denying that in our system equilibrium analysis has a useful function to perform. But when it comes to the point where it misleads some of our leading thinkers into believing that the situation which it describes has direct relevance to the solution of practical problems, it is time that we remember that it does not deal with the social process at all and that it is no more than a useful preliminary to the study of the main problem.