

The Digital Architecture of Time Management

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Abstract

This article explores how the shift from print to electronic calendars materializes and exacerbates a distinctively quantitative, “spreadsheet” orientation to time. Drawing on interviews with engineers, I argue that calendaring systems are emblematic of a larger design rationale in Silicon Valley to mechanize human thought and action in order to make them more efficient and reliable. The belief that technology can be profitably employed to control and manage time has a long history and continues to animate contemporary sociotechnical imaginaries of what automation will deliver. In the current moment we live in the age of the algorithm and machine learning, so it is no wonder, then, that the contemporary design of digital calendars is driven by a vision of intelligent time management. As I go on to show in the second part of the article, this vision is increasingly realized in the form of intelligent digital assistants whose tracking capacities and behavioral algorithms aim to solve life’s existential problem—how best to organize the time of our lives. This article contributes to STS scholarship on the role of technological artifacts in generating new temporalities that shape

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people's perception of time, how they act in the world, and how they understand themselves.

Keywords

calendars, time management, artificial intelligence, acceleration, algorithms

Introduction

Waste of time is thus the first and in principle the deadliest of sins.

Weber (1930, 158)

Americans report “wasting my time” as a major cause and reason for anger.

Cherry and Flanagan (2018, xiv)

In conversation with a couple of high-tech guys at Stanford University's Museum of Art on a sunny afternoon, I was told about a growing trend in Silicon Valley. “There's quite a culture here of speed watching and speed listening (to audio books and podcasts). It was a hacker thing, but YouTube recently added a feature to watch at $2\times$ (double) speed . . . Lots of people will not go to the real time event because they have conditioned themselves such that it feels slow.” The aim is simple: “So you can consume more content, get more done faster, to save time, fit more in, or to avoid wasting time in particular. People get very sensitive about wasting their time.”

The Protestant work ethic is alive and well and nowhere more evident than in Silicon Valley. Here, the quest of optimizing time has become an overriding principle, with Moore's law of acceleration seemingly elevated to an ideal to be applied to every aspect of life. Reading, listening, eating, dating, and—as ever—working: there is apparently no activity that cannot be made better by being made faster. A new movement has emerged called “*Getting Things Done*” (or GTD to those in the know), centered on a time management system that promises to unlock your full potential and master the “art of stress-free productivity” (Allen 2001). Yet this is just one manifestation of what is a wider cultural phenomenon that is, fittingly, always seeking to improve itself.

Reflected in popular commentary, much social and cultural theory portrays the increased digitalization of our lives as spawning and propelling a new, accelerated temporality.¹ Concepts such as *timeless* time (Castells 2010), *instantaneous* time (Urry 2000), *network* time (Hassan 2009), and *chronoscopic* time (Virilio 1986) abound to describe the pace of high-speed society in which we are all constantly pressed for time. However, despite acknowledging that modern time consciousness is the result of a long historical process, this literature tends toward technological determinism, imbuing digital technologies with an inherent logic of acceleration. As I have argued elsewhere (Wajcman 2015), such theories are too preoccupied with large-scale epochal change to capture the highly differentiated, multiple, and often conflicting regimes of lived time we inhabit (see also Sharma 2014; Wajcman and Dodd 2017). Ironically, while seeing technology as the driving force, these theories also suffer from a lack of interest in technology—what it is really made up of, what it consists of, and so on.

To be sure, some recent research into social media platforms, such as Twitter, Facebook, and Snapchat, does link these new forms of communication to new temporalities. Similarly, studies of the vast array of self-tracking and time management apps suggest that more and more people adopt them to cope with our hyperconnected fast-paced lifestyle (Neff and Nafus 2016; Lupton 2016). Such tools promote self-knowledge by quantifying and visualizing our activities, which ends up having performative effects that encourage a corrective orientation to the future that is anchored in self-discipline. We are all constantly expected to work on our relationship to time, especially with the aid of technology.

Within this optimization framework, however, new technologies are imbued with more importance than long-standing technologies. There is no denying the infatuation with the “new,” particularly in Silicon Valley. Research, unfortunately, appears to mirror this bias somewhat. The “mediatization” of time—how “logistical media,” such as clocks, calendars, and, most recently, the digitalization and datafication of communication, shape temporalities—is only beginning to attract attention among scholars of media (Couldry and Hepp 2017; Fornas 2016; Pentzold 2018; Peters 2016). There is a growing awareness that previous scholarship has mostly ignored the ways in which mediating instruments, devices, and textual representations actually operate and how their affordances may be restructuring our sense of time. This gap is especially remarkable as the tasks of microcoordination and synchronization become ever more complex. The multiplicity of intertwining chains of social interdependence requires fine-tuned and precise planning, regulation, and ordering of schedules.

My study set out to investigate how digital calendars and their close progeny may be mutually shaping the sociomaterial practices through which we experience and strategize about time. The role of calendars in the temporal organization of social life has been neglected compared to, say, the mechanical clock (Galison 2003). Yet, shareable electronic calendars have become the standard office tool for coordinating and synchronizing work activities. They are ubiquitous among professionals and managers as the human personal assistant becomes the exclusive prerogative, and status signifier, of only the most senior executives. Rather than being mundane productivity tools, however, they are becoming platforms for the calibration and valuation of time. Calendaring apps increasingly utilize automated algorithmic scheduling to assist us in navigating the complex terrain of everyday choice making about the allocation of time. In this sense, the digital calendar can be understood as a new time technology that (rather like the clock) materializes a moral enterprise of time optimization.

Drawing on interviews conducted among engineers, I explore how the design and use of digital calendars promotes and materializes a distinctively quantitative, “spreadsheet” orientation to time. As these designs become more integrated with AI, they also begin to embody and reflect a cultural aspiration to mechanize human thought and action in order to make them more efficient and reliable. The belief that technology can be profitably employed to control and manage time has a long history and continues to animate contemporary sociotechnical imaginaries of what automation will deliver. In the current moment, it is artificial intelligence, machine learning, and data analytics that are emblematic—we live in the age of the algorithm (Beer 2017; Ziewitz 2016).

No wonder, then, that a vision of “intelligent” time management drives the current iteration of digital calendars. As I go on to show in the second part of this article, calendars are increasingly conceived as digital assistants whose tracking capacities and behavioral algorithms can solve life’s existential problem—in the words of one designer: how to “use our time wisely.” The study contributes to the rich STS scholarship on the role of artifacts in generating new temporalities that irrevocably shape people’s perception of time, how they act in the world, and how they understand themselves.

Calendars and Schedules in Social Life

But first, what sort of artifact is a calendar? According to Peters (2016; see also Richards 1999), calendars are the most basic of all human sensemaking devices. They are primarily responsible for creating the regular temporal

patterns through which nearly all societies, social institutions, and social groups introduce and manage orderliness. Indeed, the first item printed by Gutenberg was a calendar—an almanac: a program of future events or a record of past events, each assigned to a day or year. Calendars are at once “modes of representation and instruments of intervention: they constitute time in describing it” (Peters 2016, 177).

However, while the calendar established a system of temporal regularity, it was the invention of the schedule that made orderliness possible at the microscopic level of the hour. Schedules, which are uniquely characteristic of modern life, presuppose a particular view of temporality. They reflect and promote a *quantitative* or economic-utilitarian philosophy of time: “time as an entity which is segmentable into various quantities of duration and, therefore, is countable and measurable” (Zerubavel 1985, 59). Crucially, scheduling is key to the modern art of time management. It fosters the need to minimize our indulgence in “time-wasting” activities. As Zerubavel suggests, calendars as schedules fundamentally underscore the highly rationalized temporal order in which time is viewed as a scarce resource that must be optimally utilized. Calendars therefore materialize a historically and culturally distinctive way of measuring and sequencing time. Their basic fixed form remained unchanged until the mid-1980s, when various electronic products were developed to augment print.

In the digital realm, online diary planners, or personal organizers, were the first scheduling tools developed to serve individual users. They were generally accessed via handheld pocket computers, such as the Palm or Psion. The first major advance over paper calendars was the introduction of groupware calendar systems that stored information on the Internet, enabling people to communicate and work together in collaborative environments.² Microsoft Outlook (formerly Hotmail) became the dominant application during the first decade of the twenty-first century, and eventually this tool came to support social awareness or translucency, enabling users to see what other users were doing, import events into their own diary, and invite others to events in the calendar.

Today, mobile, ubiquitous, 24/7 calendar access is taken for granted. Indeed, the year in which this research began coincided with the tenth anniversary of the invention of the iPhone. As Fornas (2016, 5225) observes, digital mediatization has transformed calendars: “from the fixed material form of print media into more fluid Internet logs and time lines. They have been automatized, compressed, precise, integrated, globalized, and abstracted.” Despite still being called calendars, they have arguably become a new platform (Gillespie 2010; Plantin et al. 2018) for

time-making and timekeeping. In this sense, calendars can be viewed as evolving sociotechnical systems that carefully orchestrate all kinds of human and nonhuman actors (such as rooms) through their distinct technical affordances and constraints. Moreover, in tracking and recording users' behavior, they are increasingly integral to what Fourcade and Healy (2017) theorize as a new economy of moral judgment whereby the infrastructure of big data collection provides new strategies of profit-making.

Digital calendars, then, are designed to serve particular clients, purposes, and markets, and, as we shall see, the political choices baked into these platforms reveal fundamental tensions between organizational effectiveness and the aims of the single, individual user.

Research Approach

The empirical research for this study was conducted during the academic year (2017-2018)—a year I spent at Stanford University in the heart of California's Silicon Valley. My aim was to probe into the digital architecture of calendars and the affordances they provide for managing temporal relations by speaking to different engineers working on related software applications in various companies all around me. My initial interest in the topic was piqued by meeting the lead developer of the *Timeful* app, which aimed to improve time management by transforming the calendar from a passive repository of events into an “active, intelligent scheduling assistant” (see Bank et al. 2012; Etherington 2015). As he explained, “There's no question that we're going to get much more algorithmic advice in areas of our life. Time is one of those frontiers.” When Google acquired *Timeful* in 2015, Google's Alex Gawley blogged:

The Timeful team has built an impressive system that helps you organize your life by understanding your schedule, habits and needs. You can tell Timeful you want to exercise three times a week . . . and their system will make sure you get it done We're excited about all the ways Timeful's technology can be applied across products like Inbox, Calendar and beyond, so we can do more of the work for you and let you focus on being creative, having fun and spending time with the people you care about.

I began my data collection by interviewing the team involved in the *Timeful* app and moved on to interview designers, software engineers, and product managers working on several other calendar products. In all, I interviewed twenty people (eighteen men and two women) directly involved in calendar

design by way of snowball sampling. The interviewees all live and work in Silicon Valley (apart from two who work in European branches) and, apart from one older manager, they were all aged between twenty-five and forty.

The semistructured interviews each lasted approximately an hour and were recorded and transcribed. They were mostly conducted face-to-face; however, four were conducted via Skype. Meeting venues varied, some held at their workplace, others in my office, and a couple at cafes in Palo Alto. The research was further informed by many other conversations with a wide range of people working in the tech industry. Topics discussed include working practices, time management, reasons for developing the software, attraction to and experience of particular platforms, the development process, and scheduling algorithms.

Throughout this year in Silicon Valley, I immersed myself as much as possible in the local culture. As a “scavenging ethnographer” (Seaver 2017), I treated the calendar as an entry point to begin ascertaining how algorithms and AI are or are becoming deeply embedded in scheduling software. I sought to capture insights regarding how a wide range of people and processes so involved were producing the sociomaterial tangles we call “algorithms.” Many actors shape the sociotechnical systems that companies build and I have tried to locate my study of “intelligent” scheduling in the broad ecology and cultural life in which these platforms are being inculcated. The fact that the people I interviewed are, at once, designers, producers, and consumers of digital apps meant that I was able to study the dynamic interrelated processes of innovation and usage. The interviews conducted for the study were all scheduled via calendar apps, many features of which were designed by these same engineers. Tellingly, however, senior executives had a human assistant do the booking on the app.

Enacting the User

I began by inquiring about the intended user of a calendar. In this regard, there is nothing surprising to uncover. The inscribed user that animated the design process for all of my participants is explicitly someone like himself (rarely herself). The distinctive finding here is that these imagined users, like the developers themselves, saw time management as a major problem. Interviewees, especially managers, spoke of regularly having back-to-back meetings and dealing with hundreds of e-mails daily. They repeatedly complained about the laborious process of scheduling and how much time would be saved if this process could be fully automated. One manager (mid-thirties, married, no children) described his typical work pattern:

I get into the office by about six, having driven from San Francisco for about forty-five minutes. I stay till usually about 6 or 6:30. Then I'll typically exercise from 6 to 7:30, down here in Palo Alto, sometimes at Stanford. Then I'll drive home from about eight to nine and I'll go immediately to sleep. That's Monday through Thursday. From 8 a.m. to 6 p.m. every single half-hour slot in my calendar is filled with a different meeting.

Several interviewees spoke about their love of order; that they were deliberate about their own time management, planning, and logistics; and had developed various scheduling systems for themselves. Consistent with this perspective, they imagine themselves as rational actors who live in an orderly world in which they can exert control over time. It is the engineering model of a human being as a well-functioning machine that requires various inputs, such as sleep, to perform efficiently: a subjectivity that Gregg (2017, 113) encapsulates as “an ‘aesthetics of existence’ . . . the end result of a series of technical innovations that allowed individuals to view themselves differently, namely, from the point of view of efficiency.”

In this sense, scheduling apps are being designed by and for knowledge workers who inhabit a work culture in Silicon Valley that is hyper-driven. While these values are not unique to Silicon Valley, recent ethnographies of the tech giants echo my interviewees' proclaimed self-identities and “intangible emotional tool kit.” English-Lueck (2017, 76), for example, depicts a distinctive lifestyle in which the omnipresence of work and the driving passion for technology infiltrates into every pore of people's lives: “in a community of technological producers, the very process of designing, crafting, manufacturing, and maintaining technology acts as a template and makes technology itself the lens through which the world is seen and defined.” It is not surprising, then, that making the most of time is diagnosed as an urgent “social engineering problem” to be solved.

That this mental model assumes a user who is young, male, and unencumbered hardly needs stating (Chang 2018). It is a model that Lynch (2010) has memorably described as the “care-less” subject: an unfettered, autonomous subject, one that implicitly refuses to recognize the responsibilities of care. As the manager quoted above went on to say:

I work very long hours but I enjoy it. Not to say that I don't think the concept of work life balance exists for others, but it's never been a dichotomy that made sense to me.

Indeed, the very concept of work–life balance comes to seem antiquated as private time in Silicon Valley is, by default, defined as a “residual category” (Zerubavel 1985, 150). Moreover, the human foundation that services workers’ extreme work lifestyle, be it the cooks and cleaners of the office or the home delivery drivers of pizza vans, is also rendered invisible. In addressing the problem of time, time is reified again and again as an individual resource to be husbanded, rather than as a relational, collective accomplishment.

In the remainder of this article, I explore how this contrivance of productivity is encoded and reinforced in the machinations of scheduling software. If engineers are doing ethics by other means—materializing morality (Verbeek 2006)—how might calendar design materialize a particular orientation to time?

The Matrix

As noted above, calendars express modern temporality as composed of abstract entities of mixed duration that are measured and standardized by clock time. Their matrix or grid architecture institutionalizes a particular form of chronological order, allowing us to fix dates and deadlines and to synchronize schedules. It is a particular way of representing the sociotemporal order, permitting extraordinary precision for measuring, recording, and monitoring time. In this sense, the calendar is emblematic of linear, clock time perfected by the scientific management system of the twentieth-century industrial workplace.

So it is intriguing that, in the twenty-first-century knowledge economy, digital calendars adopt the linear representation of time as a conventional grid. If we are supposedly living in postmodern “timeless time,” characterized by instantaneity and simultaneity, why does this trope still predominate? Is it simply a case of path dependency or might it be indicative of how time is framed in contemporary organizations? Indeed, how might the fact that the standard grid interface is sliced into thirty-minute slots, in even chunks, affect how time is perceived?

As it turns out, all the designers I interviewed think about this a great deal. They typically said that they have tried to get away from the grid layout, but that they always come back to it because: “it best stabilizes the imaginary of the week.” However, several also remarked that a grid fragments time and makes it hard to represent longer-term thinking:

I'm too polluted in my mind by the calendaring system, so its hard for me to imagine a different unit of measurement that is not half hour or fifteen minutes . . . we definitely think in terms of the tools we use.

The half-hour slots mirror what has become the standard default length of meetings at several high-tech companies: "you can hear everyone's phones ping with a notification at twenty minutes past the hour and ten minutes to the hour." In Silicon Valley, it would appear that hundreds of thousands of people move every thirty minutes during the work day. This systematic regimentation of human bodies moving in space to an *x*-axis measured in time paradoxically conjures up classic Taylorism.

In a calendar, time has only the dimension of duration, it is purely quantitative—as if every time slot is of the same quality. This is precisely what makes for scheduling flexibility, but at the cost of flattening time: it cannot capture our lived experience of time as modulated, differentiated, and qualitative in character. As one software developer remarked:

the grid compared to, say, a month view . . . pushes people to think about time in exact segments. If we were to have a conversation about meeting for breakfast or meeting in the afternoon, we can deal with that concept and know what it is. But it's incredibly hard to show that on a grid, because how do you show that on a grid, this afternoon? Well, if I show it as 1:00 until 5:00 then I've blocked out everything else. And so one of the things that we are not able to do effectively with a grid is show people these approximate rough times.

Indeed, several interviewees remarked that the traditional wall calendar, still widely used by families, has superior qualities in that it is better able to represent multilayered activities:

If you look at what people do with the month wall calendar, they write in the boxes, and then they write around the boxes, and then they draw a heart or put a star or put a sticker. They break out of the grid, and that works incredibly well with pen and paper and incredibly badly with an app . . . Whether it's a Samsung fridge or a mirror with a calendar for the family, it doesn't work because you can't see what you need to see and you can't record what you need to record.

Some parallels can be drawn here to the logic and design of electronic spreadsheets, which developed on the same time as digital calendars. Like calendaring software, Lotus spreadsheets took their inspiration from earlier

paper-based versions, adopting the grid layout of a printed ledger sheet as the metaphor for the computer program. Both calendars and spreadsheets sprang from a particular way of looking at the world of information in a virtual universe. As Mitch Kapor, the developer of Lotus, expressed it:

The spreadsheet is a grid of cells organized into rows and columns. That seems the most fundamental structure. And each one has something in it. So it's a universe of discrete items with connections between them... Now calendars are another kind of productivity tool that were developed for personal computers around the same time and similarly view the universe of information as a collection of items in which the unit is an appointment. It exists in a pseudo-temporal space because the unique ID of each item has to do with its date and time.³

Without stretching the analogy too far, it may be that the rigid materiality of a grid structure rendered into digital calendar interfaces enhances and serves to intensify a quantitative, fungible view of time. Levy (2014, 18; see also Dourish 2017) argues that the Lotus spreadsheet evolved from a time saving tool to fundamentally changing the way American businesses operated by representing the world of work in rows and columns. It allowed businesses to keep track of things that were previously unquantified, encouraging executives to make daily (rather than quarterly) inventory checks that, in turn, increased the demand for quantitative rather than qualitative justification for decisions. The “spreadsheet way of knowledge” as a result has become a powerful professional worldview. The problem, Levy concludes, occurs when this powerful *imaginary* spreadsheet is taken too much to heart. It is only a metaphor. “Fortunately, few would argue that all relations between people can be quantified and manipulated by formulas.” Perhaps this cautionary note should be kept in mind when reading what follows.

The Organizational Gaze

Many of the people I interviewed keep separate work and private calendars, even though the standard weekly interface of most scheduling software is meant to occlude such distinctions. It is here that the contradictory character of automated scheduling emerges in the larger discussion of the digitization of time. Whereas the traditional paper diary was and is a personal, private record of events and plans, the key feature of the electronic calendar has come to be transparency. It is designed to be easily shared and to facilitate the

booking of appointments, meetings, and rooms with minimum effort. Indeed, today's calendars rely on an employee's daily activities being accessible, so that others can book and fill open time with optimal efficacy. For employers, the rationale for full visibility is to enable efficient orchestration of time, while the individual user wants to fulfill his or her own goals.

These differing aspirations may well be in conflict. The normalization of translucency, in which one's personhood is socially expected to bear all for the good of the enterprise, chimes with the corporate culture of today's high-tech firms that laud their radical openness and autonomy over work hours, while retaining hierarchical structures of authority. This is true even in the "conversational firm," as Turco (2016, 57) observes: "what is open and visible is open and visible for surveillance." The logic of openness to facilitate widely shared information within the organization also enables employers to readily monitor all employee activities.

Although calendars are marketed as individual time management tools, their primary function is organizational. This merger of the private diary and the public calendar has made the platform a boundary object, a core apparatus in the ongoing power dynamics over who controls whose time. Software such as Google Calendar or Microsoft Outlook is not intelligent enough yet to recognize the supervisor-subordinate distinction, but it is critical to the workplace. While not formalized, in practice, meetings are arranged on the most senior person's schedule. Although the user may feel like the master when they are inputting events into the calendar, they are simultaneously subject to others making temporal claims on their calendar. This ongoing trade-off between making users feel in control of their time (maintaining privacy) and increasing algorithmic scheduling is a theme to which I will return.

The matrix that calendar apps set up, then, is not only a scheduling apparatus but a new form of knowledge about organizational practices. Its function is to ensure the efficient use of time, and it serves both as a powerful metaphor for visualizing temporality and a tool for enacting it. At least in this sense, the digital calendar echoes the traditional role that clocks and schedules played in promoting and internalizing time discipline as a moral standard in industrial society (Synder 2016, 40).

Then as now, however, a technology's impact depends not only on the design script but also on its appropriation by users and its context of use. While today's standard open calendar policy, in which anyone can insert a meeting in a free time slot, seems optimal at first sight, a common complaint among interviewees was that, with everyone able to scheduling meetings, the meeting rounds were endless, keeping bodies constantly in motion.

The provision of plentiful food on these company campuses fuels this movement, with the effect that even the traditional lunch hour as a break from work becomes hard to schedule.

An unintended consequence of open calendaring was that the software systems themselves were being subverted, with users seeking to claim back control. Several people mentioned elaborate forms of gaming or “scheduling defensively” (Palen 1999):

people put in fake meetings in order to make time for themselves. It’s like calendar bingo. If you put in a recurring meeting everyday at the same time, it looks fake, so you have to learn how to make it look realistic! So this game is taking up so much of my time—telling people I am available, I’m not available. This used to be secretarial work to manage calendars—now this support has gone so we are losing so much time and productivity doing this etiquette dance around availability—it’s all individualized, so there is no way to discuss it.

However, one informant went on to say that some women do discuss it:

because they are covering when they want to pick up the kids, when they want time with kids in the morning, saying they can’t do a meeting at 7 a.m. or 8 a.m., which is the competitive bullshit people do in corporate life—the earlier the meeting the more committed you are—showing you are not wasting time with your family in the morning.

These actions are necessary because standardized schedules assume uniformity, constancy, and predictability regarding the quotidian rhythms and patterns of life—rhythms and patterns that are unmarked by divisions of gender, class, generation, or ethnicity. Standardized schedules ignore the complex ways in which people engage in contested and uncertain practices of time coordination in specific workplaces and domestic settings. The time-consuming and often “invisible work” of affective labor and housework, for instance, is not chronicled. By treating time as quantitative, functional and fungible, the calendar thus instantiates the distinct time regime of calculative professional work: an economic-utilitarian philosophy of time (see Mazmanian and Erickson 2014).

Intelligent Time Management

For the remainder of this article, I excavate the idea that time can be managed “intelligently.” In other words, that the problem of time, its

apparent deficit in all facets of life, will be solved by the application of machine learning algorithms in the form of intelligent scheduling assistants. More abstractly, I am interested in the desire for a personal assistant to whom we can delegate labor, especially as this will increasingly be performed via voice commands. This is the predominant vision of the calendar ten years hence according to my interviewees.

The designers and software engineers whom I interviewed all share the aspiration of automating time management. For instance, Microsoft is building a virtual personal assistant to handle the conversational back-and-forth required for scheduling meetings, much the same way that executive administrators schedule meetings for CEOs. As one of the product developers remarked:

we began to think of calendar not as a tool but as a service, to do things for you . . . rather like the voice assistant Cortana . . . but we always struggled with this as in some ways having an assistant in some form is about also relinquishing power to this external entity.

The key question for them is: how much agency does the personal assistant have to act on your behalf? In other words, “how much control you want to give to the machines?” Kapor again:

Calendars . . . are sort of low agency assistants that give you the information you need when you want it without you having to think about too much, or just present it to you and organize it but doesn’t do things on your behalf without your asking for it. What people really want is the magical genie that makes your arrangements for you. That’s hard. (see Note 3)

Different views were expressed by interviewees as to the technical feasibility of this vision because intelligent time management requires collecting vast amounts of personal data.⁴ This requirement raises the issue of social acceptability; I was often told stories about users being “freaked” by the machines knowing so much about their habits. Nevertheless, there was a common belief that people would be prepared to trade privacy and control in exchange for efficient assisted time management.

There are several initiatives under way in pursuit of this objective. Timeful, which integrates behavioral economics with optimization algorithms for scheduling, serves as an illustrative case. Dan Ariely, its cofounder, is renowned for his experimental research measuring the inefficiency of how people allocate their time (see, e.g., Ariely and Wertenbroch 2002). For the

Timeful project, he joined forces with computer scientists to create an app that explores how machine learning can help “nudge” people to make better decisions. Behavioral science underpins this approach to time management and is increasingly incorporated into other calendaring apps.

Although the integration of computational and psychological sciences is as old as modern computing, Stark (2018) convincingly argues that the growing influence of the psychological sciences on digital platforms requires more attention from STS scholars. Grounded in big data sets and algorithmic psychometrics, this new behavioralism (whose hegemonic sway was all too clear in Silicon Valley) gives rise to what he terms the “scalable subject.” This entity is shaped and made legible through these computational processes that are then returned back to the human person as a model to which they should conform. What lies behind the massive collection of individual behavioral data in tools like Timeful is a powerful cultural abstraction: an efficient, purposive, and knowledgeable actor whose behavior “can be steered and nudged in ways both personally gratifying and economically profitable” (Fourcade and Healy 2017, 20; Thaler and Sunstein 2008). This is an interesting evolution of the imagined user who faced the problem of time at the beginning of this essay.

Importantly, Stark (2018, 220) views the influence of the psychological sciences on digital platforms as doubly occluded: “hidden from users by their baseline incorporation into the technical affordances of platforms, but also often veiled from the designers of those systems themselves.” My interviewees differed in this respect, as they were intentionally incorporating such methods into their software systems. So, it is worth examining some features of calendars as indicative of broad developments in this space.

One designer reflected on the project of intelligent time management as follows:

I was interested in calendars because I was interested in behavior change . . . it ended up as a calendar—but the real mission of Timeful was to give people better ability to manage their time . . . the idea was that you enter into a dialogue with the calendar, because people don’t know themselves as well as they think they do. You kind of have to have an ongoing conversation over time, back and forth . . . It’s like, yeah, I’ll totally get his done by Thursday, but if you totally manage yourself you are going to procrastinate, and what was powerful is that the system accepts that, and it’s kind of engaging in a dialogue. Like, next Thursday all right, I will remind you on Wednesday.

With typical Silicon Valley optimism, the designers I spoke to saw inefficient time use, such as procrastinating or time wasting, as an engineering problem to be solved. They seemed unaware that procrastination might be open to other interpretations, such as being construed as an active form of psychological resistance to always having to be in control. Moreover, the ways in which notification systems can be experienced as moral injunctions to spend time “wisely,” with failure to comply in turn evoking frustration and guilt, was also not mentioned. After all, who would not want a personalized genie coach? His colleague added:

I worked a lot on the onboarding part of the app. We started to think about it as like meeting something. It wasn't personified, but it was still like, OK, you're starting this relationship with the application, and it is assistive in an intelligent way Like a coach, the system can nudge you in ways that you wouldn't have thought to do. Identifying the times of the week where you probably will be more likely to exercise and prompting you to do it at a good time.

Features of Google Calendar, such as “Goals,” also reflect this kind of thinking, encouraging people to enter into a conversation with the self via the calendar. This allows users to enter information on a specified personal goal “like Exercise or Friends & Family,” choose how much time you want to spend on it every week, and the app automatically schedules the optimal times to work on your goal. To quote the marketing material: “If you end up having a conflict at that time, the session is automatically rescheduled. Over time, scheduling gets better as Google Calendar learns your preferences.” In other words, the calendar will be able to program people's aspirations during “empty time” when they do not have work or meetings scheduled. Just as friends' encouragement helps people stay with a goal, so AI software will do the same thing.

In identifying our spare time and filling it up, albeit in accordance with our stated priorities, these apps are effectively making value judgments about our time use based on a specific conception of the self and the world. The messy business of everyday life is seen to be more than amenable to algorithmic improvement. A prescient line of Arendt's (1958) comes to mind. “The trouble with modern theories of behaviorism is not that they are wrong,” she wrote in *The Human Condition* (p. 322), “but that they could become true, that they actually are the best possible conceptualization of certain obvious trends in modern society.”

Digging deeper into how much time is actually saved by automated scheduling, it became clear over my year of data collection that at the

individual level, saving, say an hour a week, was not the right metric. At the heart of the issue is the appeal of delegating tasks or memory work; in other words, outsourcing the responsibility for remembering meetings and much more to a machine. Several spoke about the cognitive load of having “too many things on your plate” like unanswered e-mails and the annoyance of interruptions which do not in themselves take up much time but are cumulatively costly. The ideal scenario would be to delegate such tasks to a virtual assistant:

What if you could forward an e-mail that says, “Schedule an appointment with a doctor,” or something like my wife e-mails me, “Hey, what are we going to do when your parents come?” I don’t know. I need to figure out good restaurants to hang out with them or whatever. If I can simply say, “Figure out a thing for my parents. They like seafood or something.” And the assistant makes phone calls.

Another program manager remarked further that:

AI can learn your behaviors so you aren’t the one having to make the decisions and looking at your calendar constantly Now you know you won’t forget to buy a present for your kid’s birthday party . . . calendar is always there whispering in my ear what to do next.

The ultimate aim, I was told, is to make the calendar a reflection of what’s happening in your life, what you need to be doing every day, what’s most important to you, and help you navigate the complex temporal landscape of your day.

Interestingly, the highpoint of adulation at Google’s I/O 2018 developer conference was the demonstration of an automated appointment system making a phone call and talking to the person on the other end—scheduling a hair salon appointment and making a restaurant reservation. The program performed those tasks well enough that the person at the other end of the call did not suspect that she (*sic*) was talking to a computer. (In response to public outcry, a feature was quickly added to indicate that it was a machine and not a human making the call.) It appears that automated scheduling using natural language is the future direction of innovation. And the common theme across all these AI programs, Google’s chief executive Sundar Pichai concluded, is that “we are working hard to give users back time.”

Conclusion: Time “for what we will”

Digital calendars are increasingly marketed as personalized assistants whose tracking capacities and behavioral algorithms can help users align their daily rhythms with ideals about efficient time management. Individuals are nudged into making the right choices about the allocation of time, the implicit idea being that algorithms are objective and trustworthy systems. Indeed, because the intelligent software learns to know us better than we know ourselves, it is logical to cede control, as we would with a “coach”—a metaphor that was repeatedly drawn upon by those I studied.

An historical sensibility allows us to situate automated calendaring within the abiding human belief that mechanization will enable us to control and manage time efficiently. This is a familiar and yet disquieting narrative, constitutive of our modernity. Efficiency is after all one of the most powerful organizing ideologies of Western culture. Almost a century ago, Taylor (in)famously made use of stopwatches to break processes down into discrete microelements of duration in order to gain control over the time that lives “within” a work task. Clocks and schedules were key, not only as tools to coerce labor but also because of their role in developing and internalizing time discipline as a moral enterprise. The cult of productivity and our obsession with employing every minute wisely have become the great unquestioned virtues of our age. Time is finite, after all, so one better make the most of it. In their own way, almost all new technologies are deployed to this end: to save time, to spend it more effectively or more productively (which, in the common framing, all amount to the same thing).

Algorithmic scheduling materializes this historically specific orientation to time management—one designed to valorize time optimization. In treating time as entirely calculative, fungible slots of duration, the calendar grid encodes a quantitative, utilitarian philosophy of time. When the calendar finally morphs into a fully fledged virtual personal assistant, we are told, we will finally be able to fulfill both the overwhelming demands of greedy corporations and meet our own individual goals. Insofar as having a personal secretary is a traditional marker of being a boss, we will all become our own bosses—we will all have someone else to book a restaurant for our pesky parents’ visit, buy presents for birthdays, and ensure that we stick to our gym regime. But, at the same time, we will also be surrendering autonomy as control over our private calendar is opened up to employers and colleagues. Given the difficulty of reconciling these conflicting aims, perhaps it is not so surprising that we look to machines to adjudicate.

However, the notion that digital assistants will become responsible for organizing the time of our lives conjures up (even for a skeptical Foucauldian) a vision of technologically assisted self-governance. Like Yeung (2017), I am uncomfortable ceding so much power to algorithmic decision-guidance techniques. Algorithmic nudges, she argues, are extremely potent “hypernudges,” due to their networked, continuously updated, dynamic, and pervasive nature. Her concern is that such techniques not only threaten privacy but more subtly shape individual behavior through their informational choice architecture. My focus here is how these technologies modulate and configure our consciousness of temporality. I am troubled by the temporal inscriptions of intelligent calendars that value overachievement as a good in and of itself and reflect a long-standing moral aversion to idleness.

I have always found Mark Zuckerberg’s promotional video for his “cutting-edge” AI system, Jarvis, very revealing (<https://www.youtube.com/watch?v=fS9lig222YY>). In this dream home, you wake up in your bed and Jarvis opens your curtains for you, informs you if your baby is awake, teaches them Chinese if they are, helps you get dressed, and makes you breakfast (it’s not clear how). Jarvis knows your calendar and will tell you what day it is—just in case you have forgotten in the frenzy of your life. “It’s Saturday, so you only have five meetings,” Jarvis tells Mr. Zuckerberg. You’ve got to feel for him. Even in this world where everything is done for him, Zuckerberg still can’t keep a free weekend. Is this really the best future we can offer ourselves?

Over the last decade or so, there has been increasing attention in political philosophy to the idea that the ability to choose how you allocate your time lies at the core of a positive notion of freedom. This discussion has recovered earlier ideas about temporal sovereignty, or control over one’s time, as a significant measure of life satisfaction and well-being. In *Free Time*, for example, Rose (2016, 27) argues that a just society must guarantee all citizens their fair share of free time. She pointedly distinguishes free time from spare time. Discretionary free time is a *resource*—an *all-purpose* means to pursue one’s conception of the good, *whatever it may be* (italics in the original).

Like me, Rose is fond of the nineteenth-century labor movement slogan: eight hours for work, eight hours for rest, and eight hours for what we will. While I demur, with Keynes, that an eight-hour workday is way too long, the core promise to increase free time rather than to optimize time is worth preserving. The question should not simply be how do we optimize the amount of time available to us, but rather, what do we want to save time for?

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Notes

1. Rosa (2013) has developed his thesis that social acceleration is the constitutive trait of postmodernity in a range of publications (see also Nowotny 2005; Adam 2004).
2. See the CSCW/HCI literature on the challenges of implementing groupware, for example, Grudin (1994), Orlikowski (1992), and Palen (1999).
3. Personal interview, Oakland, CA, December 4, 2017.
4. Ironically, the personified scheduling bot Cortana deals with meeting requests using a “Wizard of Oz” prototype, where users experience an interface that looks and feels real but behind the curtain is a human researcher pulling the strings and controlling the interface (see Monroy-Hernandez and Cranshaw 2017).

References

- Adam, B. 2004. *Time*. Cambridge, MA: Polity Press.
- Allen, D. 2001. *Getting Things Done*. New York: Penguin.
- Arendt, H. 1958. *The Human Condition*. Chicago, IL: Chicago University Press.
- Ariely, D., and K. Wertenbroch. 2002. “Procrastination, Deadlines, and Performance: Self-control by Precommitment.” *Psychological Science* 13 (3): 219-24.
- Bank, J., Z. Cain, Y. Shoham, C. Suen, and D. Ariely. 2012. “Turning Personal Calendars into Scheduling Assistants.” In *Annual Conference on Human Factors in Computing Systems*, pp.2667-72. ACM.
- Beer, D. 2017. “The Social Power of Algorithms.” *Information, Communication & Society* 20 (1): 1-13.
- Castells, M. 2010. *The Rise of the Network Society*, 2nd ed. Malden, MA: Blackwell.

- Chang, E. 2018. *Brotopia: Breaking Up the Boys' Club of Silicon Valley*. New York: Portfolio.
- Cherry, M., and O. Flanagan, eds. 2018. *The Moral Psychology of Anger*. London, UK: Rowan & Littlefield.
- Couldry, N., and A. Hepp. 2017. *The Mediated Construction of Reality*. Cambridge, MA: Polity Press.
- Dourish, P. 2017. *The Stuff of Bits: An Essay on the Materialities of Information*. Cambridge, MA: MIT Press.
- English-Lueck, J. A. 2017. *Cultures@SiliconValley*, 2nd ed. Stanford, CA: Stanford University Press.
- Etherington, D. 2015, May 4. "Google Acquires Timeful To Bring Smart Scheduling To Google Apps." *TechCrunch*. Accessed November 11, 2017. <http://social.techcrunch.com/2015/05/04/google-acquires-timeful-to-bring-smart-scheduling-to-google-apps/>.
- Fornas, J. 2016. "The Mediatization of Third-time Tools: Culturalizing and Historicizing Temporality." *International Journal of Communication* 10: 5213-32.
- Fourcade, M., and K. Healy. 2017. "Seeing Like a Market." *Socio-Economic Review* 15 (1): 9-29.
- Galison, P. 2003. *Einstein's Clock's, Poincaré's Maps*. New York: W. W. Norton.
- Gillespie, T. 2010. "The Politics of 'Platforms.'" *New Media & Society* 12 (3): 347-64.
- Gregg, M. 2017. "The Athleticism of Accomplishment: Speed in the Workplace." In *The Sociology of Speed: Digital, Organizational, and Social Temporalities*, edited by J. Wajcman and N. Dodd, 102-14. Oxford, UK: Oxford University Press.
- Grudin, J. 1994. "Groupware and Social Dynamics: Eight Challenges for Developers." *Communications of the ACM* 37 (1): 92-105.
- Hassan, R. 2009. *Empires of Speed: Time and the Acceleration of Politics and Society*. Leiden, the Netherlands: Brill.
- Levy, S. 2014. "A Spreadsheet Way of Knowledge." *Wired* 1-18.
- Lupton, D. 2016. *The Quantified Self*. Cambridge, MA: Polity Press.
- Lynch, K. 2010. "Carelessness: A Hidden Doxa of Higher Education." *Arts and Humanities in Higher Education* 9 (1): 54-67.
- Mazmanian, M., and I. Erickson. 2014. "The Product of Availability: Understanding the Economic Underpinnings of Constant Connectivity." In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pp. 763-72. ACM.
- Monroy-Hernandez, A., and J. Cranshaw. 2017. "How We Built a Virtual Scheduling Assistant at Microsoft." *Harvard Business Review*, July 28.
- Neff, G., and D. Nafus. 2016. *Self-tracking*. Cambridge, MA: MIT Press.

- Nowotny, H. 2005. *Time: The Modern and Postmodern Experience*. Cambridge, MA: Polity Press.
- Orlikowski, W. 1992. "Learning from Notes: Organizational Issues in Groupware Implementation." In *Proceedings of ACM Conference on CSCW*, pp. 362-69.
- Palen, L. 1999. "Social, Individual & Technological Issues for Groupware Calendar Systems." In *Proceedings of ACM CHI Conference*, pp. 17-24.
- Pentzold, C. 2018, January 23. "Between Moments and Millennia: Temporalising Mediatization." *Media, Culture and Society* 40 (6): 927-37.
- Peters, J. D. 2016. *The Marvelous Clouds: Toward a Philosophy of Elemental Media*. Chicago, IL: Chicago University Press.
- Plantin, J.-C., C. Lagoze, P. N. Edwards, and C. Sandvig. 2018. "Infrastructure Studies Meet Platform Studies in the Age of Google and Facebook." *New Media & Society* 20 (1): 293-310.
- Richards, E. G. 1999. *Mapping Time: The Calendar and its History*. Oxford, UK: Oxford University Press.
- Rosa, H. 2013. *Social Acceleration: A New Theory of Modernity*. New York: Columbia University Press.
- Rose, J. 2016 *Free Time*. Princeton, NJ: Princeton University Press.
- Seaver, N. 2017. "Algorithms as Culture: Some Tactics for the Ethnography of Algorithmic Systems." *Big Data & Society* 4 (2): 1-12.
- Sharma, S. 2014. *In the Meantime: Temporality and Cultural Politics*. Durham, NC: Duke University Press.
- Stark, L. 2018. "Algorithmic Psychometrics and the Scalable Subject." *Social Studies of Science* 48 (2): 204-31.
- Synder, B. 2016. *The Disrupted Workplace: Time and the Moral Order of Flexible Capitalism*. Oxford, UK: Oxford University Press.
- Thaler, R., and C. Sunstein. 2008. *Nudge*. New Haven, CT: Yale University Press.
- Turco, C. 2016. *The Conversational Firm: Rethinking Bureaucracy in the Age of Social Media*. New York: Columbia University Press.
- Urry, J. 2000. *Sociology beyond Societies: Mobilities for the Twenty-first Century*. London, UK: Routledge.
- Verbeek, P. 2006. "Materializing Morality: Design Ethics and Technological Mediation." *Science, Technology, & Human Values* 31 (3): 361-80.
- Virilio, P. 1986. *Speed and Politics*. New York: Semiotext(e).
- Wajcman, J. 2015. *Pressed for Time: The Acceleration of Life in Digital Capitalism*. Chicago, IL: University of Chicago Press.
- Wajcman, J., and D. Dodd, eds. 2017. *The Sociology of Speed: Digital, Organizational, and Social Temporalities*. Oxford, UK: Oxford University Press.
- Weber, M. 1930. *The Protestant Ethic and the Spirit of Capitalism*. London, UK: Unwin Hyman.

- Yeung, K. 2017. “‘Hypernudge’: Big Data as a Mode of Regulation by Design.” *Information, Communication & Society* 20 (1): 118-36.
- Zerubavel, E. 1985. *Hidden Rhythms: Schedules and Calendars in Social Life*. Berkeley: University of California Press.
- Ziewitz, M., ed. 2016. “Governing Algorithms.” *Science, Technology, & Human Values* 41(1).

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