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Digital Emotion Regulation

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Abstract

People routinely regulate their emotions in order to function more effectively at work, to behave more appropriately in social situations, or simply to feel better. Recently, researchers have begun to examine how people shape their affective states using digital technologies, such as smartphones. In this article, we discuss the emergence of *digital emotion regulation*, both as a widespread behavioral phenomenon and a new cross-disciplinary field of research. This field bridges two largely distinct areas of enquiry: (a) psychological research into how and why people regulate their emotions, which has yet to systematically explore the role of digital technology, and (b) computing research into how digital technologies impact users' emotions, which has yet to integrate psychological theories of emotion regulation. We argue that bringing these two areas into better contact will benefit both and will facilitate a deeper understanding of the nature and significance of digital emotion regulation.

Keywords

emotion, affect, emotion regulation, digital technology

> If you ride a subway in the morning there are people sitting there zoning out on these little devices. . . . They're helping people to modulate and manage their moods.
>
> —Natasha Dow Schüll (Ethnography Matters, 2015, para. 7)

Digital technology is now pervasive, creating myriad possibilities for understanding and manipulating the world around us. One less-well-recognized but growing use of digital technology is as a tool for strategically influencing our affective states (including emotions, moods, and stress levels), a phenomenon we refer to as *digital emotion regulation* (ER). Our aim in this article is to introduce digital ER as an emerging field of study at the intersection of two established areas of enquiry: psychological research into how and why people regulate their emotions and computing research that examines the design, adoption, and impact of digital technologies. The importance of digital ER lies in the scale and novelty of the activities it encompasses, as well as its potential to inform discourse on effective and ethical technology design and use.

Psychological Research Into ER

Over the past few decades, an expanding body of work in psychology and related disciplines has examined how, why, and with what consequences people regulate their emotions (Davidson, 1998; Grandey, 2000; Gross, 2015; Webb, Miles, & Sheeran, 2012). Emotions and other affective states can be understood as evolutionary adaptations that guide how we respond to environmental challenges and opportunities (Nesse & Ellsworth, 2009). However, in particular situations, people may evaluate their current emotion as undesirable or counterproductive and thus may seek to modify their affective states (Gross, 1998).

To understand how people regulate emotions, Gross's (1998, 2015) process model distinguishes between emotion *generation* and emotion *regulation*. Emotion generation is a first-order process in which people encounter, perceive, evaluate, and respond to situations. ER is a

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second-order process in which people evaluate their emotions in relation to their current goals and decide whether to modify them and, if so, select which regulation strategy to use, implement a situation-specific tactic, and monitor its success (Gross, 2015).

The process model addresses how people regulate their emotions by classifying ER strategies into five families according to when they intervene in the emotion-generation sequence. The earliest intervention is *situation selection*, which involves approaching situations that may evoke desired emotions and avoiding situations that may evoke unwanted emotions. Once a situation is encountered, but before an emotional response has fully developed, it is possible to regulate emotions by directly changing selected aspects of that situation (*situation modification*); by directing one's attention toward or away from emotion-relevant features (*attentional deployment*); or by reappraising a situation to alter its emotional impact (*cognitive change*). Finally, even after an emotional response has arisen, an individual can use *response modulation* to alter its physiological, behavioral, or experiential components, for example, by inhibiting or amplifying facial expressions (Gross, 1998).

To understand why people regulate their emotions, Tamir (2016) proposed a taxonomy of ER motives. When regulating for hedonic motives, people are motivated to experience (or avoid) certain feelings for their own sake, usually enhancing pleasant emotions (or diminishing painful ones). However, ER can also be driven by instrumental motives when people believe that particular affective states will help them achieve performance goals or exhibit socially acceptable expressions and behaviors. For example, people may up-regulate positive emotions to boost creativity, down-regulate positive emotions to facilitate analytic thinking, increase anger or anxiety to help them win in competitive settings, and try to shape their emotions to fit work, family, and cultural norms.

The examples discussed so far concern intrinsic regulation, in which people attempt to influence their own emotional states. However, also important is extrinsic regulation (Gross, 2015), in which people purposefully influence the emotions of others, for example, teachers attempting to deal with the anger or sadness of children in their care. As we discuss later, extrinsic regulation may be especially relevant to digital ER and technology design. Another important distinction is between explicit (effortful, consciously intended) and implicit (automatic, without conscious insight or awareness) regulation (Braunstein, Gross, & Ochsner, 2017; Gyurak, Gross, & Etkin, 2011). Finally, a key finding from studies of ER is that different forms of ER can have very different consequences for well-being (Gross, 2015; Webb et al., 2012).

Computing Research Into Digital ER

An interest in digital ER has recently begun to emerge across several disciplines concerned with the design and use of digital technology, including, among others, human–computer interaction, communication studies, game studies, cyberpsychology, and anthropology. For brevity, we refer to these disciplines collectively as *computing research*.

Some studies report people appropriating digital technologies as tools for ER. For example, a study by Myrick (2015) identified ER as a motive for watching online videos. Similarly, the use of digital music platforms has been studied as a means of coping with stressful situations, of distracting from problems, of evoking desired emotions, or of increasing arousal (Randall & Rickard, 2017; Wadley, Krause, Liang, Wang, & Leong, 2019). Digitally mediated nature soundscapes can serve emotion-regulatory functions without disrupting cognitive performance, pointing to ways in which the choice of digital tool may reflect situational constraints (Newbold, Luton, Cox, & Gould, 2017). Multiple studies have found that people use video games for relaxing, coping with stress, and managing or escaping (i.e., distracting from) negative feelings (Villani et al., 2018). Instant-messaging tools and social-networking sites have been shown to provide opportunities for ER, such as self-reflection and social sharing through message writing (Blumberg, Rice, & Dickmeis, 2016). Even the apparently instrumental activity of online shopping has been shown, in some situations, to be motivated by the desire to shape one's mood (Bui & Kemp, 2013).

A notable feature of digital ER is the way that contemporary smartphones bring these different tools—audio, video, games, social connection, e-commerce—together in a single personal, portable platform, making a highly tailorable array of tools for ER available at essentially all times and places. Indeed, emerging research suggests that, for some individuals in particular, emotions can drive phone use (Sarsenbayeva et al., 2020).

Beyond observing the appropriation of technologies for ER, attention has also been given to the design of tools specifically for ER. Eriksson and Johansson (2017) examined the use of emotionally labeled music playlists for shaping affect to boost productivity. Schüll (2014) proposed that addicted machine gamblers use gambling to alleviate stress and unpleasant emotions and that casinos and manufacturers explicitly design machines to fulfill this function. Paredes et al. (2018) designed relaxation exercises for car drivers using automated haptic seats and voice guidance to boost driving performance. Ashoori, Bellamy, and Weisz (2015) manipulated lighting, music, and images in work environments to improve employee mood and thereby enhance decision-making.

Table 1. Examples of Digital Emotion Regulation (ER), Organized Using the Process Model of ER

ER stage and family	Example
Identification stage	Using a phone-based app to help identify one's emotional state and guide the decision about whether to regulate
Selection stage	Reviewing online resources that suggest and elaborate strategies such as distraction or cognitive change
Implementation stage	
Situation selection	Choosing to watch online videos rather than performing a work task or attending a social gathering
Situation modification	Using digital communications to intervene in work or family situations; using ambient mood-music playlists in workplaces and stores
Attentional deployment	Browsing images on a smartphone during a stressful work meeting; providing a game on a tablet to comfort an upset child; ruminating on Facebook posts or events
Cognitive change	Searching online for alternative information or perspectives about a situation
Response modulation	Expressing a constructed, but desired, emotional state through posts on social media
Monitoring stage	Using a digital watch to monitor one's physiological responses to assess whether one's efforts at digital ER are successful

Phone apps for mood tracking (Bakker & Rickard, 2018) and mindfulness training (Flett, Hayne, Riordan, Thompson, & Conner, 2019) are designed to improve people's ER skills. Miri and colleagues (2020) developed a haptic device to facilitate deep breathing during stressful situations. Castillo, Castro-González, Alonso-Martin, Fernández-Caballero, and S´alichs (2018) proposed personal-assistant robots that regulate their owners' emotional states, and Amores and Maes (2017) explored interfaces that release scent to influence mood and improve task performance.

Integrating Digital-ER Research in Psychology and Computing

The research described in the prior sections demonstrates a growing interest in digital ER among psychologists and computing researchers. However, computing research is often disconnected from psychological theories of ER, and a coherent conceptual framework for studying digital ER is lacking. In this section, we consider how these disciplines might benefit from each other's concepts, methods, and insights.

Within computing research, the identification of digital ER is often imprecise, given the richness of real-world observations. It would be valuable for such studies to develop stronger operational criteria to distinguish examples of first-order emotion generation (e.g., getting angry when reading a Facebook post) from second-order ER (e.g., intentionally reading anger-inducing posts with the intention of becoming more angry in the service of a goal). Future studies would benefit from greater recognition that the motivations underlying digital ER are likely to be diverse and to include not only hedonic but also instrumental motives (Tamir, 2016). Computing research stands to benefit by differentiating the different ER strategies that people deploy (Gross, 2015) and by investigating how digital tools may be more or less effective in instantiating different strategies. Table 1 illustrates how the process model of ER can be used to categorize examples of digital ER according to stages of regulation and strategy families.

At the same time, psychological research might benefit from greater engagement with computing research. One area of opportunity is the use of digital technologies themselves, extended through hardware or software modifications, to collect data on emotion-related activities in the wild and at scale: One such research platform is described by Ferreira, Kostakos, and Dey (2015). Whereas psychologists' focus historically has been on observing explicit ER strategies under controlled laboratory conditions, the use by computing researchers of tools to collect context and activity data has facilitated the naturalistic investigation of diverse and often implicit ER tactics. Hence, computing researchers have pointed to how seemingly mundane, and sometimes fleeting, daily activities may be instances of ER.

Computing disciplines also draw attention to the important role of technology design and designers as enacting a kind of extrinsic ER through the features they create. Some branches of computing research have a tradition of critiquing the broader sociopolitical foundations of technology design (Dourish, Finlay, Sengers, & Wright, 2004), and these are relevant in that the tools appropriated for digital ER are the products of market forces and may be both beneficial and harmful to users.

An Interdisciplinary Research Agenda

Having identified the value of bringing psychological and computing research together to study digital ER, we now propose several areas of focus for an interdisciplinary research agenda for digital ER. As the field

develops, we anticipate that a refinement of existing theoretical concepts will permit more precise questions and issues to emerge.

Establishing methods for studying digital ER

Psychological research into nondigital ER has typically used lab experiments and global or retrospective self-report questionnaires. More recently, studies have examined ER in naturalistic settings using experience-sampling methods (e.g., Brans, Koval, Verduyn, Lim, & Kuppens, 2013), although the emphasis remains on detecting predefined forms of explicit ER rather than discovering the diverse ER tactics that people use in everyday life. Techniques from computing research offer ways to detect and study these everyday activities, such as measuring ER automatically using smartphones equipped with passive sensing apps (e.g., Sarsenbayeva et al., 2020). In principle, such smartphone-based tools are capable of recording multiple time series that represent a person's physical and social context, their technology use, and some of the changing physiological, behavioral, and experiential components of emotion (Harari et al., 2016). Exploring the relationships between these data streams promises to yield new insights into the antecedents and consequences of digital ER, corroborating and extending self-report.

Bringing these methods together may make it possible to address the perennial challenge of distinguishing between emotion generation and emotion regulation, which in practice can be intertwined and hard to distinguish (Gross, Sheppes, & Urry, 2011). As we have noted, the key to this distinction is whether a goal has been activated to influence an actual or possible affective state. Although such intentions may not always become directly accessible, they might be inferred using sophisticated modeling combined with fine-grained recordings of people's digital activities that chart their switching between apps, areas of content, and interactive activities such as creating and posting content. The emotion-generating effects of these activities may be established through concurrent physiological measures or by later self-report. The identification of recurring patterns and choices of activity, interpreted with respect to their emotional consequences, will likely inform new theories regarding intended and habitual forms of regulatory control and management of emotions.

Identifying common and unique characteristics of digital ER

A prominent question for this emerging field will be whether and in what ways digital ER differs from nondigital ER. We see points of both continuity and discontinuity.

In terms of continuity, it is likely that instances of digital ER can be categorized within existing psychological frameworks, such as Gross's (1998, 2015) process model (see Table 1). Digital technology appears particularly well suited to implementing attentional-deployment strategies, such as distraction (Atzori, Hoffman, Vagnoli, Messeri, & Grotto, 2019) and rumination (e.g., dwelling on an ex-partner's status updates or on an event that one did not attend; Fox & Moreland, 2015; Marshall, 2012). However, choosing digital media can also be understood as situation selection or modification (cf. Gross, 1998), and Internet resources can support cognitive-change strategies, such as crowdsourcing reappraisal (Morris, Schueller, & Picard, 2015), whereas social media provide virtually constant opportunities for response modulation (e.g., social sharing or expressive suppression; Bazarova, Choi, Sosik, Cosley, & Whitlock, 2015).

In terms of discontinuity, there are some possible areas of difference between digital and nondigital ER. The mobility, connectivity, and multifunctionality of digital technologies provide virtually ever-present access to a wider array of ER tactics than ever before, and sophisticated forms of interactivity provide ways of navigating among these tools, allowing people to fine-tune their own strategies for particular situations and to engage in more frequent ER switching (Gross, 2015). Further, digital ER does not just empower humans individually. It also does this collectively through sharing of resources and ubiquitous social interaction, which also create new demands for ER. Digital-ER research should continue to explore questions regarding the relationship between digital and nondigital ER. For example, are the effects of social sharing different in an online environment versus face to face (cf. Rimé, Bouchat, Paquot, & Giglio, 2020)? Do the role and nature of distraction change when people can call up their favorite resources at any time?

One potentially unique feature of digital ER is worthy of special emphasis. Our account has emphasized how research into digital ER is likely to follow nondigital ER in being primarily focused on intrinsic activities; that is, directed at oneself, with less emphasis on extrinsic regulation, such as handing over a device to calm an upset child and using music to influence customer or employee affect (DeNora, 2000). However, the act of designing features into a tool for ER can be considered a form of extrinsic ER, and with the rapid and fluid design evolution of digital applications, this kind of designed intervention is likely to increase in importance. Related to this, future research should focus on the ways users may appropriate technologies for ER purposes, often through habit rather than conscious intent, when the designers

did not explicitly intend this usage. For example, some people binge-watch streaming television services to relieve negative emotions in ways that service designers may not have originally anticipated (Flayelle, Maurage, Vögele, Karila, & Billieux, 2019).

Clarifying the benefits and harms of digital ER

Research into digital ER has begun at a moment when many commentators are concerned about the overuse of digital technology, including its potentially negative effects on mental well-being (Alter, 2017). An awareness of digital ER does not nullify such concerns, but a growing understanding of digital ER does suggest that at least some digital usage may be an element of more positive psychological strategies. Knowing more about digital ER can add nuance to discourse on overuse of digital tools, alerting us to the possibility that when people use technology for apparently unproductive purposes, such as distraction, their motive is not necessarily hedonic but may serve important instrumental functions, such as enhancing work performance or social harmony.

Research has shown that ER can be both harmful and beneficial, depending on multiple personal and contextual factors (e.g., Troy, Shallcross, & Mauss, 2013). Although many researchers propose that the ability to regulate emotion is a necessary part of healthy psychological functioning and that a deficiency creates vulnerability and risks of mental illness, other researchers suggest that some ER strategies can lead to poor outcomes, depending on how and when they are used (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Gross, 2015). Evidence from computing research suggests that this variation applies also to digital ER, with studies demonstrating both positive (Collins & Cox, 2014) and negative (Rozgonjuk & Elhai, 2019) outcomes. After all, some common regulatory behaviors may have short-term benefits (e.g., using a phone to cope with frustration) while cumulatively leading to long-term harm (e.g., failure to achieve work goals because of frequent distraction). Understanding the factors and contexts that influence whether particular instances of digital ER are productive or counterproductive is a further research challenge.

Conclusion

A recent wave of naturalistic studies by computing researchers is revealing how a wide range of commonplace digital technologies are being used by people to influence their emotions in everyday life. Concepts and theories drawn from psychological research into ER are needed to make greater sense of these observations. Equally, psychologists can benefit by addressing the findings of these naturalistic studies and by taking on board the tools and methods used in computing research for data collection in the wild. As technologies evolve with new capabilities to shape affective states, the significance of digital ER is likely to grow. Growing attention to digital ER promises to clarify how and why people engage in digital ER and provide a deeper understanding of digital ER strategies and their diverse impacts, as well as the practical and ethical implications for designing tools to enable digital ER.

Recommended Reading

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Transparency

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