

Incorporating Principles of Mindfulness in the Design of Technology

Authors

Cami Goray, University of Michigan at Ann Arbor

Mohammad Hossein Jarrahi, University of North Carolina at Chapel Hill

Abstract

The ability to focus is a key skill for today's knowledge workers. While the COVID-19 pandemic may have presented a host of other types of responsibilities that could impact work focus, such as economic distress or work-life balance, this short paper is specifically focused on digital distraction. As a result of the COVID-19 pandemic upending traditional work routines, the seismic shift to virtual work in the home ignites even more urgency to the conversation about how digital technology can distract or support workers in allocating their attention wisely. This paper contributes to current research in digital distraction (and, more broadly, human-computer interaction) by introducing how the principles of mindfulness can be incorporated in the design of technology, with a focus on intelligent assistants.

Keywords

Knowledge work, digital distraction, mindfulness, mindful work, mindful design, interaction design, productivity, wellbeing, intelligent assistant

Introduction

The ability to focus is a key skill for today's knowledge workers. While the COVID-19 pandemic may have presented a host of other types of responsibilities that could impact work focus, such as economic distress or work-life balance, this short paper is specifically focused on digital distraction. As a result of the COVID-19 pandemic upending traditional work routines, the seismic shift to virtual work in the home ignites even more urgency to the conversation about how digital technology can distract or support workers in allocating their attention wisely. This paper contributes to current research in digital distraction (and, more broadly, human-computer interaction) by introducing how the principles of mindfulness can be incorporated in the design of technology, with a focus on intelligent assistants.

Stress and Digital Distraction in the Workplace

The U.S. Center for Disease Control and Prevention reported in 2016 that stress was the leading workplace health problem, ahead of physical inactivity and obesity (Pfeffer 2019; “Workplace Health Promotion | CDC” 2019). Research presents disruption as one major source of stress (Mark, Gudith, and Klocke 2008). Processing multiple streams of information may impair cognitive control, impacting the quality of work and stress on the work (Ophir, Nass, and Wagner 2009).

People’s access to an expanding universe of information enables new work activities deemed impossible in the past (e.g., synchronous collaboration on a google document). Yet more information scattered across more apps means that the worker has more to choose from—it is the classic choice paradox where more options does not always equal better, combined with the fear of missing out (FOMO) (Przybylski et al. 2013). This creates a multi-contextual, digital environment that is highly magnetic and potentially highly disorienting (Berthon and Pitt 2019). Common interfaces are magnetic because the primitive part of our brains crave the information rewards provided by the stimulating content in games and social feeds—that is the unspoken motivation to be interrupted (Cash et al. 2012).

To further complicate the role of communications platforms on work behavior, the traditional social networking “culprits” of distraction, for example Facebook, Twitter or LinkedIn, are becoming a growing part of knowledge workers’ work routines (Jarrahi, 2017). Thanks to network effects, the social media sites have morphed into a digital “Third Space” that allow workers to communicate with people they otherwise would not have access to. Social networks have been sites of study for social boundary crossing (Skeels and Grudin 2009), but they are also interesting sites of what we call attention boundary crossing—where the mindful transforms into the mindless.

Mark, Czerwinski, and Iqbal (2018) note that in the HCI research community, distractions have been studied from the perspective of interruptions and task-switching. Studying interruptions and task-switching is important as they are a pervasive part of work, but they are mostly studies that revolve around the activity or task. The impact of digital distraction can also be seen at the reflective level of emotional design (Norman 2004), beyond the visceral or behavioral level. Whereas interruptions and task-switching relate to people’s behavior, the reflective level is where the interaction affects the person’s self-image, pride, and meaning-making. But supporting behavior change requires one to reflect on their self-management strategies and how they perceive their behaviors.

Prior Research

We argue that principles of mindfulness can be used as a solution to digital distraction. Further, by drawing on these principles, we can consider and develop technology designs that are more mindful, and could help workers address the issues of digital distraction.

Benefits of Mindfulness

Mindfulness is defined as “paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally” (Zinn 1994, p.4). Bishop et al. (2004) describes mindfulness as composed of two-stages, the first stage involving the self-regulation of attention and the second as adopting a particular orientation to experience.

Mindfulness interventions have been linked to numerous health benefits, such as reduced risk for anxiety and depression (Hofmann et al. 2010). With extensive practice, people may actually be able to rewire their brains to handle stress and pain in a more controlled way. In addition, mindfulness has been linked with prosocial behaviors (Hafenbrack et al. 2019). In particular, the present-centered attention of mindfulness and increased awareness may help workers become more attuned to the feelings and needs of colleagues (Hafenbrack et al. 2019). As a result, mindfulness can also help cultivate a healthier, more meaningful relationship with work (Malinowski and Lim 2015).

How does this all apply to the way people interact with technology? Media multitasking is associated with limitations in self-monitoring, emotional control and planning (Magen 2017). People have limited working memory; they can only hold three to five meaningful items at once, which impacts their ability to resume tasks in the ‘chain of distraction’ (Iqbal and Horvitz 2007). Moreover, emotional state plays a role in whether someone will become distracted. For example, when people are stressed and tired, their quality of attention suffers (Lyngs et al., 2019).

Mindfulness has a strong presence in psychology literature and some business management journals (Dane 2010). Recently, the topic has gained momentum in human-computer interaction research (Terzimehić et al., 2019). Several studies have documented the health and productivity benefits of a mindfulness intervention. For example, (Liu et al. 2019) studied the effects of mindfulness meditation on stress, affect, and performance in an information multitasking environment. Biometric data, including participants’ heart rate variability and EEG signals, served as proxies for stress. The results showed that a single mindfulness session can increase arousal and decrease stress. Our proposed solution implements a mindfulness intervention that would engage with the user over an extended period of time. Mindfulness is an exercise in attention, and like exercise, it is a mindset that can be trained.

Importance of Mindfulness During COVID-19

Our circadian rhythms depend not only on light but on social cues, which has the potential to impact our productivity and happiness in the workplace. The morning stand-up meeting, eating lunch with colleagues, passing a colleague by in the hallway for a brief water-cooler chat--workers may experience countless routine and spontaneous interactions with colleagues throughout the day. Those interactions stimulate creativity and provide a respite from solitude. Simply put, the lack of face-to-face interaction can be extremely stressful. This makes workers' ability to self-monitor their emotions even more critical.

A primary reason why mindfulness can serve as a relevant solution is because it embraces accepting and enjoying the moment. A mindful design embraces attention not only in relation to task focus (i.e., the ability to remain focused on the task at hand), but also in relation to self-awareness and self-observation. Self-awareness is the ability to observe one's feelings, the relationship between mind and body, and repeating patterns of helpful and unhelpful behaviors (Levy 2016).

In the following table, we introduce the Mindful Design framework, which is grounded in five tenets of mindfulness. Many of the design manifestations can be materialized through an intelligent cognitive assistant (ICA). The technology could ask questions that support mindful behavior, including those related to directing attention (What are you doing? Why are you doing it?), those related towards fostering a constructive and introspective attitude (How do you feel about it? What can I do to support myself?), and those contributing towards more self-aware actions (How do my actions relate to/trigger previous habits?) The table below outlines the relationship between each design manifestation.

Table 2: Mindful Design Framework

Mindfulness Attribute	Present-centered awareness	Deliberate and intentional	Non-judgmental	Attitudes of openness and acceptance	Reflective instead of reflexive reaction
	Attention		Attitude		Action
Design Manifestation	Asks “ <i>What are you doing?</i> ” E.g., Technology design helps	Asks “ <i>Why are you doing it?</i> ” E.g., Technology learns from	Asks “ <i>How do you feel about it?</i> ” E.g., Technology design helps people flesh	Asks “ <i>What can I do to support myself?</i> ” E.g., Technology	“ <i>How does my action relate to/trigger previous habits?</i> ”

	<p>the user prioritize tasks by asking the user about their goals for the day and what they are doing in the present moment.</p>	<p>past interactions with the user. The feedback loop helps the technology capture/predict the user's intent.</p> <p>The technology learns when to intervene to ask the user why they are doing an action.</p>	<p>out their feeling of the current task without a judgmental perspective.</p> <p>Throughout the day, technology chatbot asks the user about how they feel when they are working on a task. It does not apply moral judgements about how the user <i>should</i> be feeling.</p>	<p>design helps train the user to be more resilient and self-compassionate through reinforcing principles of a growth mindset.</p>	<p>E.g, Technology design helps support self-reflection and behavior change.</p> <p>Technology Helps the user identify triggers that spurred past habits so that when the user recognizes them, they take more thoughtful action.</p>
--	--	--	---	--	---

Current Implications

How the Intelligent Cognitive Assistant Can Support Mindfulness

We suggest a technical solution, human-technology symbiosis, as one example of a path towards more mindful work. In this scenario, the technology can be perceived as an intelligent cognitive assistant (ICA). ICAs can be one form of tracking people's attention and engagement (Williams et al. 2018). For example, the ICA can help the person identify content that triggers a certain pattern of behavior. The ICA's role is to act as an intervention by asking the person questions throughout their workday when certain patterns of behavior are triggered. The Mindful Design framework highlights five questions related to the user's attention, attitude and actions.

For example, to help the user reflect on their intention, the intelligent assistant may pose the question, “What are you currently working on?” to help the user stay focused on the present or “Why are you doing it?” to help the user reflect on their intention. The goal is to support the user in deciding how to spend their time.

Recent research has suggested that mindfulness training can be enhanced through a conversational chatbot. Williams et al. (2018) found that a conversational bot aided knowledge workers in detaching from and reattaching to work. The bot used a “pull,” rather than a “push” model of interaction; in the “pull” model, the users initiate the conversation with the bot, rather than the information being “pushed” to them. Our proposed ICA borrows from Williams et al.’s (2018) work by using emotion-centric dialogue that is personalized for the person, e.g., “How are you feeling about [the task?]”, “What can I do to support myself?”, a method that demonstrated improvements in sustained productivity.

The ICA of Mindful Design provides the resistance needed to convert the habit of performing a reflexive action into a reflective action by prompting a moment of contemplation. In this way, it helps the user perform the next action with intention. The ICA asks the person “Why are you doing [the task]?”. The intention is not to apply normative judgment of what is or is not distracting, but to aid user awareness of their behavior and to identify patterns of digital activity and their corresponding consequences of their mental state.

For this dynamic to work though, humans must trust a partnership with artificial intelligence manifested in the concept of ICA—trust the information that is given to it and received from as well as that it is working in the human’s best interest. Furthermore, concerns for privacy must also be addressed. Designers will need to figure out how access to the data will be safeguarded and for how long would the data be stored.

Conclusion

This paper can be interpreted as a call-to-action for integrating mindfulness into digital work practices. We need to interrogate what features of designs that exacerbate digital distraction, but at the same time we also need to imagine the work norms and best practices that can support more mindful usage of technology. The intelligent cognitive assistant designed to support mindful behavior described in this paper is a start in creating work environments that enhance people’s wellbeing.

References

- Berthon, Pierre R., and Leyland F. Pitt. 2019. "Types of Mindfulness in an Age of Digital Distraction." *Business Horizons* 62 (2): 131–37.
- Bishop, Scott R., Mark Lau, Shauna Shapiro, Linda Carlson, Nicole D. Anderson, James Carmody, Zindel V. Segal, et al. 2004. "Mindfulness: A Proposed Operational Definition." *Clinical Psychology: Science and Practice* 11 (3): 230–41.
- Cash, Hilarie, Cosette D. Rae, Ann H. Steel, and Alexander Winkler. 2012. "Internet Addiction: A Brief Summary of Research and Practice." *Current Psychiatry Reviews* 8 (4): 292–98.
- Dane, Erik. 2010. "Reconsidering the Trade-off Between Expertise and Flexibility: A Cognitive Entrenchment Perspective." *AMRO* 35 (4): 579–603.
- Hafenbrack, Andrew C., Lindsey D. Cameron, Gretchen M. Spreitzer, Chen Zhang, Laura J. Noval, and Samah Shaffakat. 2019. "Helping People by Being in the Present: Mindfulness Increases Prosocial Behavior." *Organizational Behavior and Human Decision Processes*, September. <https://doi.org/10.1016/j.obhdp.2019.08.005>.
- Hofmann, Stefan G., Alice T. Sawyer, Ashley A. Witt, and Diana Oh. 2010. "The Effect of Mindfulness-Based Therapy on Anxiety and Depression: A Meta-Analytic Review." *Journal of Consulting and Clinical Psychology* 78 (2): 169–83.
- Iqbal, Shamsi T., and Eric Horvitz. 2007. "Disruption and Recovery of Computing Tasks: Field Study, Analysis, and Directions." In *CHI*, 7:677–86.
- Levy, David M. 2016. *Mindful Tech: How to Bring Balance to Our Digital Lives*. Yale University Press.
- Liu, Na, Yubo Zhang, Gloria Mark, Ziyang Li, and Pei-Luen Patrick Rau. 2019. "Mindfulness Meditation: Investigating Immediate Effects in an Information Multitasking Environment." In *Cross-Cultural Design. Methods, Tools and User Experience*, 531–42. Springer International Publishing.
- Magen, Hagit. 2017. "The Relations between Executive Functions, Media Multitasking and Polychronicity." *Computers in Human Behavior* 67 (February): 1–9.
- Malinowski, Peter, and Hui Jia Lim. 2015. "Mindfulness at Work: Positive Affect, Hope, and Optimism Mediate the Relationship between Dispositional Mindfulness, Work Engagement, and Well-Being." *Mindfulness* 6 (6): 1250–62.
- Mark, Gloria, Mary Czerwinski, and Shamsi T. Iqbal. 2018. "Effects of Individual Differences in Blocking Workplace Distractions." In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*, 92:1–92:12. CHI '18. New York, NY, USA: ACM.
- Mark, Gloria, Daniela Gudith, and Ulrich Klocke. 2008. "The Cost of Interrupted Work: More Speed and Stress." In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 107–10. CHI '08. New York, NY, USA: Association for Computing Machinery.
- Norman, Donald A. 2004. *Emotional Design: Why We Love (or Hate) Everyday Things*. Basic Books.
- Ophir, Eyal, Clifford Nass, and Anthony D. Wagner. 2009. "Cognitive Control in Media Multitaskers." *Proceedings of the National Academy of Sciences of the United States of America* 106 (37): 15583–87.
- Pfeffer, Jeffrey. 2019. "The Hidden Costs of Stressed-Out Workers." *WSJ Online*, February 28, 2019. <https://www.wsj.com/articles/the-hidden-costs-of-stressed-out-workers-11551367913>.

- Przybylski, Andrew K., Kou Murayama, Cody R. DeHaan, and Valerie Gladwell. 2013. "Motivational, Emotional, and Behavioral Correlates of Fear of Missing out." *Computers in Human Behavior* 29 (4): 1841–48.
- Skeels, Meredith M., and Jonathan Grudin. 2009. "When Social Networks Cross Boundaries: A Case Study of Workplace Use of Facebook and LinkedIn." In *Proceedings of the ACM 2009 International Conference on Supporting Group Work*, 95–104. GROUP '09. New York, NY, USA: ACM.
- Terzimehić, N., Häuslschmid, R., Hussmann, H., & Schraefel, M. C. (2019, May). A Review & Analysis of Mindfulness Research in HCI: Framing Current Lines of Research and Future Opportunities. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (pp. 1-13).
- Williams, A. C., H. Kaur, G. Mark, and A. L. Thompson. 2018. "Supporting Workplace Detachment and Reattachment with Conversational Intelligence." *Proceedings of the*. <https://dl.acm.org/citation.cfm?id=3173662>.
- "Workplace Health Promotion | CDC." 2019. February 12, 2019. https://www.cdc.gov/chronicdisease/resources/publications/aag/workplace-health.htm?mod=article_inline.
- Zinn, Jon Kabat. 1994. "Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life." *Hyperion*, 78–80.