Industrial and Organizational Psychology (2022), **15**, 487–490
doi:10.1017/iop.2022.43

CAMBRIDGE UNIVERSITY PRESS

COMMENTARY

Catching up in two races: Applying technology design approaches to design technology research

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I appreciate White et al.'s (2022) recommendation for industrial-organizational (I-O) psychologists to approach technology research in a more active ("action, exploration, creation") and collective ("collaborate, disseminate") way. However, I doubt whether White et al.'s (and many I-O psychologists') idea to conceptualize technology as a boundary condition for psychological theories and human action is an appropriate basis for timely theorizing, examining, and supporting technology application at work. If I-O psychologists examine how a specific (fixed type of) technology affects work experience, they lag behind in two races. First, their deductive research will not keep pace with technology design advancements, which proceed rapidly and in unpredictable ways. Second, they lose time, as those who apply technologies at work are themselves designers who use and redevelop technology in a way that furthers their goals and satisfies their needs (Orlikowski & Scott, 2008; Rindova & Martins, 2021). Moreover, these goals and needs also change as new technologies become available.

My commentary draws on the idea that we should treat technology as a genuine part of the organized human approach to purposefully changing the world (what many call work; Cascio & Montealegre, 2016). This will lead to timelier technology research because it will help I-O psychologists to catch up in two important races: technology design and technology-influenced work design. I start with contrasting the "technology-as-context" approach with the "technology-as-designed" approach (Landers & Marin, 2021). Then I use a current project on digitalization in health care to illustrate how design science may help to create timelier technology research.

"Technology as context," "technology as design," and running in two races

White et al. (2022) suggest conceptualizing technology "as a boundary condition" (p. X) and argue (at times) in a deterministic tradition. Landers and Marin (2021) labeled this approach "technology-as-context" approach because it implies that technologies emerge outside of the organization (e.g., technological innovations), are selected by stakeholders to realize pregiven purposes (e.g., increase efficacy), and influence their users through their effects on work design features (e.g., increase autonomy or reduce privacy; see Model 1 in Figure 1). Reviewing technology research in the organizational behavior and psychology literature, Landers and Marin (2021) argue in favor of a "technology-as-designed" approach. This approach (see also Orlikowski & Scott, 2008) suggests that it is more appropriate to view technology implementation in terms of technologies' affordances (i.e., specific design characteristics that gain value by providing what a specific user needs to fulfil a purpose; Greeno, 1994); users' and intended users' skills, motives, and preferences; and how technology and users might change over time (see Model 2 in Figure 1).

White et al. (2022) describe the need to catch up with technological innovations to produce timelier technology research. I think this is just one race I-O psychologists are in. By referring

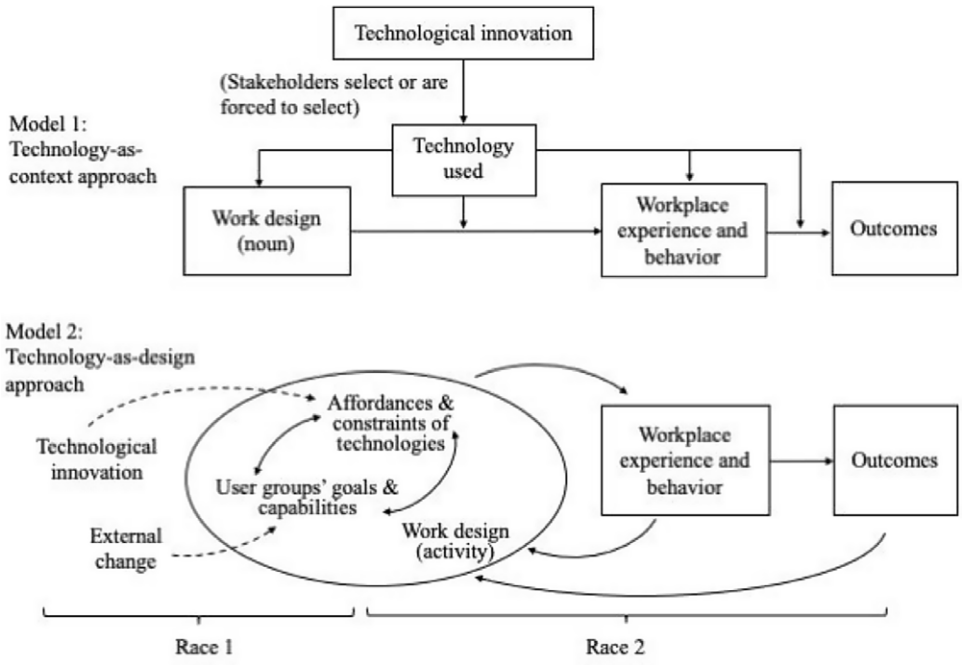

Figure 1. Approaches to understanding technology use and its effects.

to videoconferencing as a technology that I-O psychologists examined very early (and earlier than its widespread use in organizations that we observe today), White et al. already hint at a second race: understanding why and how technologies are applied at work. Since the pandemic, the application of videoconferencing technology has accelerated, resulting in dramatic changes in the ways in which many employees and organizations work. This increased use cannot be explained by features of the technology as its essential features were available for some years. What has changed are the technology's affordances (Greeno, 1994). The affordance concept describes the extent to which features of objects and arrangements in the environment meet users' or potential users' abilities and needs, thus potentially supporting goal-directed activity. Videoconferencing did not gain affordance status for many until there was a need to redesign work in a way that enabled many distributed workers to interact and until many workers developed the skills needed to use it (either through interest or necessity).

To produce timely and useful technology research, as illustrated in Figure 1, I-O psychologists thus need to apply research strategies and tools that enable them to understand (a) when technology gains affordance status (i.e., Race 1) *and* (b) how users and potential users may redesign their work in a way that technological affordances can increase need satisfaction and goal achievement (i.e., Race 2). In the following, I use a current project on digitalization in health care settings to illustrate how design science strategies and tools may help I-O psychologists to catch up in both races.

Applying the technology-as-design approach to examine digitalization in care

When we started to examine the potential of digital technologies to improve working conditions and quality of care in health care settings using a technology-as-designed approach, we accepted three *preconditions* (Ferraro et al., 2015): First, care is a *complex* system comprising intermingled and evolving social and technological/material elements. Care givers and patients for whom

https://doi.org/10.1017/iop.2022.43 Published online by Cambridge University Press

technologies are designed are not passive recipients but are themselves designers who use technology to further their own goals. Second, it is *uncertain* which problems and opportunities technology use will bring and how these evolve. Third, there are multiple criteria of worth (e.g., productivity, health, sustainability, ethical concerns) relating to problems in care and multiple potential solutions provided by technology and different stakeholders value these criteria differently (i.e., *evaluative ambiguity*). For example, technologies that reduce interaction time with patients may be desirable for stakeholders interested in cost efficacy but threaten the professional identity of care givers and may limit what is most important for patients' estimation of quality of care.

Considering these preconditions, we acknowledged that we would need to find ways to proceed without knowing in advance how to best proceed and that we required the input and validation of heterogeneous actors including the research team, care professionals and their managers, patients and their relatives, technology developers, and other stakeholders involved in care (e.g., insurance companies, government; Ferraro et al., 2015). Participatory design science (Bjögvinsson et al., 2012; Rindova & Martins, 2021) provides principles and tools that helped us to create a research infrastructure that is robust enough to meet both criteria. Specifically, we established a participatory architecture (Ferraro et al., 2015) that enables *sustained and inclusive stakeholder dialogue*. The participatory architecture includes a series of temporally and spatially interconnected events and a (web-based) platform that enable diverse stakeholders on a permanent or punctual basis to contribute their ideas and concerns, cocreate and validate problem definitions and provisional solutions, secure ongoing learning and influx of ideas, and plan potential collaborative acts (e.g., studies). Aided by this architecture, we installed a *discovery-oriented*, *iterative process* that generates creative variation (to deal with the uncertainty and ambiguity regarding possible solutions; Rindova & Martins, 2021). Iterative proceeding also enables selection among potential solutions based on the affordance character that features of a technological solution have for stakeholders (Landers & Marin, 2021).

This process started with an *empathize* and a define stage in which we became familiar with the care setting and used input from stakeholders involved in this setting to *define* problems (mainly job demands such as tight schedules, physically demanding tasks, high responsibility, violence in care) that should be addressed and resources that should be built (Demerouti, 2020). Following Simon's (1996) logic of design, we were "concerned with how things ought to be" and not merely trying to understand "how things are" (p. 114). Therefore, our research team not only strives to repair technology's effects but also functions as a cocreator of a (hitherto hypothetical) future that includes technology as design. In an *ideation* stage, with technology developers, we discuss which features of technologies could reduce demands and built resources. Thus, we develop ideas in which technological features may have affordance for people involved in care work. In the following stage, we concretize the abstract ideas regarding problem definitions and potential solutions in the form of prototypes.

This *prototyping stage* requires particular attention as it is central to design science and thinking. Instead of trying to develop one "perfect" solution, design thinking is about creating satisficing manifestations of ideas developed in the ideation stage. These prototypes enable focused discussions, reveal implicit theories and beliefs, and stabilize the process (Bjögvinsson et al., 2012). As we were not interested in designing a particular technology but how technology is applied in care, our prototypes were vignettes (Aguinis & Bradley, 2014). Vignettes are quick, inexpensive, and flexible prototypes (of technology implementations) that allow us to simulate technology application even if the technology has not yet been developed or is not available at the participating organizations. In addition, vignettes allow us to systematically vary features of the technologies, circumstances of its use, and characteristics of its applicants.

In the *test stage*, care professionals and other stakeholders rate the usefulness of the solutions that are represented in the vignettes and thus the affordance character of the technology features. Moreover, we also ask multiple potential users to explain how the respective implementations of

https://doi.org/10.1017/iop.2022.43 Published online by Cambridge University Press

the technology might change the care setting and how they might redesign the technology to reduce job demands and fulfil their needs. This gives us a head start in both races: We engage stakeholders not only as designers in the creation of technologies (i.e., "envision use before actual use"; Race 1) but also as designers of technology use after their implementation (i.e., "design after design"; Race 2; see Björgvinsson et al., 2012).

Note that vignettes allow us to implement and analyze a variety of alternative solutions with different partners in different sites simultaneously or consecutively. Drawing on abduction (Timmermans & Tavory, 2012), we formulate explanations and establish categories for organizing and explaining observations that are made in subsequent vignette experiments and, once technologies are available for use, in field studies. In a cascading process, critical circumstances, additional categories, and misguided preconceptions are identified and new (preliminary) theories of technology application are refined. By *cascading between the ideation, prototyping, and testing stage*, we learn from each successful and failed vignette study and its collaborative analysis and interpretation with diverse applicants and designers (i.e., evolutionary learning; Rindova & Martins, 2021). Frequently presenting and discussing findings not only disseminates new knowledge but also opens new spaces to liaise with new potential users, researchers, developers, and funders.

Acknowledgments. Michael Knoll's time working on this commentary was supported by the German Federal Ministry of Labour and Social Affairs, the European Social Fund, and the Federal State of Saxony within the project Zukunftszentren ("Transformation hubs").

References

Aguinis, H., & Bradley, K. J. (2014). Best practice recommendations for designing and implementing experimental vignette methodology studies. *Organizational Research Methods*, **17**(4), 351–371.

Björgvinsson, E., Ehn, P., & Hillgren, P. (2012). Design things and design thinking: Contemporary participatory design challenges. *Design Issues*, **28**(3), 101–116.

Cascio, W., & Montealegre, R. (2016). How technology is changing work and organizations. *Annual Review of Organizational Psychology and Organizational Behavior*, **3**, 349–375.

Demerouti, E. (2020). Turn digitalization and automation to a job resource. *Applied Psychology: An International Review*. Advance online publication. https://doi.org/10.1111/apps.12270

Ferraro, F., Etzion, D., & Gehman, J. (2015). Tackling grand challenges pragmatically: Robust action revisited. *Organization Studies*, **36**(3), 363–390.

Greeno, J. J. (1994). Gibson's affordances. *Psychological Review*, **101**(2), 336–342.

Landers, R. N., & Marin, S. (2021). Theory and technology in organizational psychology: A review of technology integration paradigms and their effects on the validity of theory. *Annual Review of Organizational Psychology and Organizational Behavior*, **8**, 235–258.

Orlikowski, W. J., & Scott, S. V. (2008). Sociomateriality: Challenging the separation of technology, work and organization. *Academy of Management Annals*, **2**, 433–474.

Rindova, V. P., & Martins, L. L. (2021). Shaping possibilities: A design science approach to developing novel strategies. *Academy of Management Review*, **46**(4), 800–822.

Simon, H. (1996). *The sciences of the artificial* (2nd ed.). MIT Press.

Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research: From grounded theory to abductive analysis. *Sociological Theory*, **30**(3), 167–186.

White J. C., Ravid D. M., Siderits I. O., & Behrend, T. S. (2022). An urgent call for I-O psychologists to produce timelier technology research. *Industrial and Organizational Psychology: Perspectives on Science and Practice*, **15**(3), 441–459.

Cite this article: Knoll, M. (2022). Catching up in two races: Applying technology design approaches to design technology research. *Industrial and Organizational Psychology* **15**, 487–490. https://doi.org/10.1017/iop.2022.43