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Appendix

Satisfaction: *Overall I'm satisfied with working on MTurk.*

Turnover intention: *I plan to continue working on MTurk regularly.*

Worker seriousness: *I consider myself a serious Turker (for example, I rely on the site for critical income, work regular hours, multiple days a week).*

Data quality: *Last question (answer won't affect payment). Were you serious and honest about your responses?* (Response options: *Yes – my data is good!* or *Nope*)

The Need for Conceptual Models of Technology in Training and Development: How Immersive Does Training Need to Be?

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Morelli, Potosky, Arthur, and Tippins (2017) articulate a strong need for industrial and organizational (I-O) psychologists to develop a more theory-based understanding of the role of technology in employee selection and assessment. We agree with their concerns but argue that this issue should include examination of how technology impacts training also. Researchers have noted that training is increasingly important for firms, and technology-

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enhanced training can improve learning and transfer (Ford & Meyer, 2013). However, the arguments that the authors make about the need for a theory-driven approach for examining the impact of technology on selection applies to training outcomes as well. Although considerable evidence exists that workplace training is effective and that technology can impact the success of training, there has been less theory-driven research exploring how technology can enhance or detract from training success. Researchers have already identified several variables related to technology that promote learning, but one variable that remains consistently unexplored in the organizational literature is immersion. This research is particularly important given how increasingly accessible immersive technology, such as virtual reality (VR), is becoming. Thus, we argue that as virtual training environments become more widely available, the variable of "immersion" in training environments is a particularly important one that warrants additional research.

Organizational researchers have explored many situational and individual variables related to technology that predict success in training environments. Technology, for example, provides trainees with considerable control over their learning experience (e.g., the sequence, availability, and speed of the material), which promotes learning, particularly for some populations such as older adults (Wolfson, Cavanagh, & Kraiger, 2014). Further, Bell and Koslowski (2002) have demonstrated that trainees sometimes make ineffective choices in training, and they demonstrated that adaptive guidance (also delivered electronically) can promote better learning choices among trainees. Other researchers have noted that the opportunities for active learning that technology provides also appears to promote learning compared to other methods of training (Sitzmann & Ely, 2011). Organizational researchers have also demonstrated that self-efficacy for technology is an important predictor of success in training involving technology (e.g., Gist, Schwoerer, & Rosen, 1989; Sitzmann & Ely, 2011; see also Colquitt, Lepine, & Noe, 2000).

One variable related to technological advancement that has remained somewhat unexplored in workplace training literature is immersion. Immersion, in reference to technology, refers to the extent to which one feels fully surrounded and focused on the virtual environment. Immersion can be experienced in many ways: narrative immersion refers to feeling connected with a story provided within the training, ludic immersion refers to feeling focused on the difficulty of the training, and perceptual immersion refers to the feeling of being connected to the virtual world being provided (McMahan, 2003; Nilsson, Serafin, & Nordahl, 2016). Further, there is some evidence that immersion predicts success in training environments. DiBello and Missildine (2011) for example, recently reported success in developing a 16-week training program for project management using Second Life.

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The authors argued that the program was successful, in part, due to how immersive the virtual world was. Dzeng, Lin, and Wang (2014) designed a web-based game for training construction managers' negotiation skills. They compared the web-based game to a paper-and-pencil version of the same game. They found that although the web-based game was rated more positively by the students, both versions of the game were equally effective in promoting student performance compared to a control group.

Immersion as a technology-related variable that promotes learning may become more important as virtual environments generally and VR specifically become more cheaply available. As many authors have noted, virtual reality technology "has generated much excitement but little formal proof that it is useful" (Vora et al., 2002, p. 559). That said, there is some research indicating that VR can promote learning. Research by Matthew Smith and colleagues has found that found that VR environments were successful in providing job interview training to adults with autism spectrum disorder (Smith et al., 2015a) and veterans with posttraumatic stress disorder (Smith et al., 2015b). Similarly, Vora et al. (2002) found that utilizing virtual reality training improved performance for aircraft inspectors. Noting that most training for inspectors had been provided on the job, the researchers found that providing VR training significantly improved inspection performance compared to on-the-job training.

Despite the evidence that using VR environments promotes learning in some populations, there is a conspicuous lack of research identifying the theoretical understanding of how exactly VR is effective (Fowler, 2015). Numerous mechanisms have been hypothesized as being the source of the success of VR training. Dalgarno and Lee (2010) noted that VR allows for greater learner control, which can promote successful training outcomes (see Wolfson et al., 2014). VR can also provide opportunities for more active learning, which may lead to greater learning (Sitzmann & Ely, 2011). However, one of the most frequently explored potential mechanisms to account for the success of VR is immersion (Nilsson et al., 2016), which is a variable that has not received much attention in the I-O psychology literature. For example, researchers have argued that perceptual immersion may be particularly important as VR environments can provide high fidelity (i.e., realistic depictions of the work environment), which can lead to greater engagement and greater mastery (Dalgarno & Lee, 2010).

In our own research, we have explored the ability for immersion to predict performance in a VR training module. Participants in our study played a game in which one teammate views an object in virtual reality while other teammates convey instructions on how to interact with the object. Success in the game requires efficient communication between the teammates who have access to the instructions and the teammate viewing the object. We found

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that self-reported immersion did not predict performance in the VR portion (i.e., when interacting with the object, $r = .02$, $p = .87$) but did predict performance when conveying instructions ($r = .26$, $p = .02$). This suggests that experiencing immersion in the VR portion (when interacting with the object) enabled participants to be better able to advise others in how best to interact with the object. Given that the goal of VR training is often to transfer to non-VR environments, our results suggest that immersion may be an important factor in predicting this transfer.

Although the concept of immersion seems to hold promise in exploring the utility of using VR in training, there remains considerable work to be done in defining and conceptualizing the construct. Nilsson et al. (2016) noted that the term immersion has been used so broadly as to encompass several components, including the extent to which the technology provides an immersive experience, the immersion an individual feels in the sensory aspects of the virtual environment, the extent to which one feels immersed in the narrative portions of a game, and the extent to which one feels immersed in the challenge of the game (see also McMahan, 2003). It may be that not all of these aspects of immersion are important for training performance, and research seems to support the idea that these various components of immersion may have different effects on the ability of learners to acquire the material. In a large meta-analysis, Gegenfurtner, Quesada-Pallares, and Knogler (2014) found that although computer simulations in training can lead to greater transfer and self-efficacy, social and narrative characteristics of the game did not impact the outcome variables significantly. However, three-dimensional environments did have stronger effects on training performance than two-dimensional environments. Further, allowing the users to make the simulation more difficult led to greater outcomes for participants than either maintaining the same level of difficulty or utilizing system-controlled difficulty increases. Likewise, Chao, Wu, Yau, Feng, and Tseng (2017) recently found support for their hypothesis that VR training provides appropriate level of mental workload for learning complex tasks. Thus, some aspects of immersion (e.g., difficulty, environmental richness) in virtual environments appear to be more related to learning outcomes than other aspects (e.g., game narrative).

Morelli et al.'s (2017) call for a more theoretical understanding of the impact of technology is well taken, particularly as the speed of technological advancement is increasing. We would further this call by expanding the focus beyond selection and assessment to include training and development as well. Industrial-organizational psychology has an opportunity to provide some important theoretical research and empirical data to identify the best practices for companies considering utilizing these technologies, particularly VR technology. The structural characteristics and information

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processing (SCIP) framework may be particularly useful in this endeavor (Arthur, Keiser, & Doverspike, 2017). There appears to be a wealth of empirical data being generated in other fields (e.g., education, instructional design) that could aid in development of additional theoretical models that could be applied to understanding the role of technology in developing effective training programs. I-O psychology should explore the research from these fields to develop theoretical models for understanding these new technologies. Further, we think the concept of immersion, specifically, deserves specific attention as virtual reality becomes more widely accessible. Additional research in this area could provide important, theory-based data for organizations to utilize when making decisions about utilizing the increasingly immersive technologies available for training their employees.

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