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Self-controlled practice benefits motor learning in older adults

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ABSTRACT

Providing learners with the chance to choose over certain aspects of practice has been consistently shown to facilitate the acquisition of motor skills in several populations. However, studies investigating the effects of providing autonomy support during the learning process of older adults remain scarce. The objective of the present study was to investigate the effects of self-controlled amount of practice on the learning of a sequential motor task in older adults. Participants in the self-control group were able to choose when to stop practicing a speed cup stacking task, while the number of practice trials for a yoked group was pre-determined, mirroring the self-control group. The opportunity to choose when stop practicing facilitated motor performance and learning compared to the yoked condition. The findings suggest that letting older adult learners choose the amount of practice, supporting their autonomy needs, has a positive influence on motor learning.

1. Introduction

Autonomy is considered as a term referring to an individual's independence or freedom to determine one's own actions. According to the fundamental psychological needs framework of Deci and Ryan (2008), the satisfaction or support of autonomy, competence and social relatedness are key aspects for human psychological well-being, and for optimal functioning and learning. Indeed, the

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ability to exercise control over the environment has been considered as satisfying not only a basic psychological need (Deci & Ryan, 2000), but also a biological necessity (Leotti & Delgado, 2011; Leotti, Iyvengar, & Ochsner, 2010). Studies have demonstrating that humans (Tiger, Hanley, & Hernandez, 2006), as well as animals (Catania, 1975; Catania & Sagvolden, 1980; Voss & Homzie, 1970), prefer having the option to choose, even when having choices can result in greater work or effort, suggesting the existence of an inherent reward with the exercise of control (Leotti & Delgado, 2011). The benefits of autonomous regulation when compared to controlled regulation have been observed regarding affective experiences, persistence, quality of relationships, and general well-being, across a broad range of domains (Deci & Ryan, 2000, 2008). Individuals provided with autonomy have demonstrated superior performance and learning when compared with individuals not allowed to choose (Cordova & Lepper, 1996; Hackman & Oldham, 1976; Tafarodi, Milne, & Smith, 1999).

In the motor learning field, providing autonomy support has consistently shown to benefit young adults' learning, while controlling different kinds of variables during practice, as for example the amount of practice (Post, Fairbrother, & Barros, 2011; Post, Fairbrother, Barros, & Kulpa, 2014), the order of trials during multi-task practice (Wu & Magill, 2011), model observation (Wulf, Raupach, & Pfeiffer, 2005); task difficulty (Andrieux, Danna, & Thon, 2012), use of assistive devices (Hartman, 2007; Wulf, Clauss, Shea, & Whitacre, 2001; Wulf & Toole, 1999), and the provision of augmented feedback (Ali, Fawver, Kim, Fairbrother, & Janelle, 2012; Chiviacowsky, 2014; Chiviacowsky & Wulf, 2002; Huet, Camachon, Fernandez, Jacobs, & Montagne, 2009; Patterson & Carter, 2010). In addition, providing learners with the chance to choose over certain aspects of practice has been shown to facilitate the acquisition of motor skills in several populations, including children (Chiviacowsky, Wulf, Medeiros, Kaefer, & Tani, 2008; Ste-Marie, Vertes, Law, & Rymal, 2013), individuals presenting different levels of physical activity (Fairbrother, Laughlin, & Nguyen, 2012) or personality traits (Kaefer, Chiviacowsky, Meira, & Tani, 2014), as well as individuals with intellectual or motor disabilities (Chiviacowsky, Wulf, Lewthwaite, & Campos, 2012; Chiviacowsky, Wulf, Machado, & Rydberg, 2012).

Research investigating the effects of providing autonomy support during the learning process of older adults are, however, still scarce. In one study, the benefits of the self-controlled use of a physical assistance device while learning a balance task were found in older adults presenting Parkinson Disease (Chiviacowsky, Wulf, Lewthwaite, et al., 2012). Even so, results regarding another important variable, self-controlled feedback, were much less conclusive regarding the benefits of autonomy support for the older adult population. An experiment by Carter and Patterson (2012) suggested that the choices provided during self-controlled practice are not as beneficial for older adults as they are for younger individuals. In their experiment, while self-controlled young participants outperformed a yoked group in the learning of a discrete motor task, differences in older adults' learning were not found when comparing the same self and yoked feedback schedules conditions. In fact, age-related differences between young and older adults have been found both in terms of cognitive performance and the motor learning process. Cognitive aging has been associated with loss of memory, less control of memory retrieval processes, slower neural processing speed, and worse capacity to focus on relevant sources than younger adults (Gopie, Craik, & Hasher, 2011; Henninger, Madden, & Huettel, 2010; Ren, Wu, Chan, & Yan, 2013; Smyth & Shanks, 2011). Along the same lines, reduced motor learning rates were found with aging, in different practice contexts (Coats, Wilson, Snapp-Childs, Fath, & Bingham, 2014; Van Dijk & Hermens, 2006; Wishart, Lee, Cunningham, & Murdoch, 2002).

However, research has, as yet, failed to address the effects of providing autonomy support on the learning of older adults in other contexts of practice compared to the use of physical assistance devices or feedback schedules. Amount of practice has long been considered an important motor learning factor (Schmidt & Lee, 1988). Recently, it was demonstrated that allowing autonomy regarding amount of practice benefits young adults' learning (Post et al., 2011, 2014). In these two studies, participants who had the opportunity to control the number of trials during practice showed better performance in the learning tests than participants not allowed to choose when they would stop practice. These results indicate that identical amounts of practice may not always result in similar learning, with other factors, such as the provision of autonomy support for learners, playing important roles in the learning process. The objective of the present study was, therefore, to examine the effects of self-controlled amount of practice on the learning of a motor skill in older adults. Given the lack of studies investigating autonomy support over amount of practice in older adults, the cognitive and motor learning