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Additive benefits of autonomy support and enhanced expectancies for motor learning

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ABSTRACT

Two factors that have been shown to facilitate motor learning are autonomy support (AS) and enhanced expectancies (EE) for performance. We examined the individual and combined influences of these factors. In a 2 × 2 design, participants learning a novel motor skill (throwing with the non-dominant arm) were or were not provided a choice (AS) about the ball color on each of 6 10-trial blocks during practice, and were or were not given bogus positive social-comparative feedback (EE). This resulted in four groups: AS/EE, AS, EE, and C (control). One day after the practice phase, participants completed 10 retention and 10 transfer trials. The distance to the target – a bull's eye with a 1 m radius and 10 concentric circles – was 7.5 m during practice and retention, and 8.5 m during transfer. Autonomy support and enhanced expectancies had additive advantages for learning, with both main effects being significant for retention and transfer. On both tests, the AS/EE group showed the greatest throwing accuracy. Also, the accuracy scores of the AS and EE groups were higher than those of the C group. Furthermore, self-efficacy measured after practice and before retention and transfer was increased by both AS and EE. Thus, supporting learners' need for autonomy by given them a small choice – even though it was not directly related to task performance – and enhancing their performance expectancies appeared to independently influence learning.

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1. Introduction

Two factors that have consistently been shown to benefit learning are autonomy support – in the motor learning domain typically operationalized by giving participants self-control over certain aspects of practice (for reviews, see Sanli, Patterson, Bray, & Lee, 2013; Wulf, 2007) – and enhanced expectancies for performance (e.g., Wulf, Chiviacowsky, & Lewthwaite, 2012). The present study addressed the question whether combining both factors would yield additive benefits. Thus, we hoped to gain a better understanding of the relative contributions of these influential variables as well as a potentially mediating variable (i.e., self-efficacy).

Autonomy, or having choices and being able to make one's own decisions, has been identified as a fundamental psychological need (Deci & Ryan, 2000, 2008). Autonomy-supportive environments, in which individuals are given choices – including apparently inconsequential ones (e.g., Tafarodi, Milne, & Smith, 1999; Wulf, Freitas, & Tandy, 2014), or instructions that provide the learner with a sense of choice (Hooyman, Wulf, & Lewthwaite, 2014; Reeve & Tseng, 2011) – have been shown to increase individuals' motivation and performance or learning in a variety of situations. The learning of motor skills has been found to be enhanced by giving learners the opportunity to make decisions about the delivery of feedback, the frequency of skill demonstrations, the use of assistive devices, practice schedules, or other practice variables. For example, more effective learning with self-controlled feedback, relative to externally controlled feedback (yoked control conditions), has been demonstrated for different movement tasks, including throwing (e.g., Chiviacowsky, Wulf, Medeiros, Kaefer, & Tani, 2008; Janelle, Barba, Frehlich, Tennant, & Cauraugh, 1997) and sequential timing (Chen, Hendrick, & Lidor, 2002; Chiviacowsky & Wulf, 2002; Patterson & Carter, 2010). Furthermore, allowing learners to decide when and how often to observe a demonstration of the skill (e.g., basketball jump shot; Wulf, Raupach, & Pfeiffer, 2005) or how many practice trials to perform (basketball set shot; Post, Fairbrother, Barros, & Kulpa, 2014) has been shown to lead to superior learning relative to yoked control conditions. The learning of balance tasks has been found to benefit from giving learners control over the use of assistive devices, such as balance poles (Chiviacowsky, Wulf, Lewthwaite, & Campos, 2012; Hartman, 2007; Wulf, Clauss, Shea, & Whitacre, 2001; Wulf & Toole, 1999). Interestingly, even giving individuals choices that are incidental to the motor task can have a positive effect on the learning of that task. In one experiment (Lewthwaite, Chiviacowsky, & Wulf, 2014, Experiment 1), allowing participants to choose the color of golf balls they were putting led to more effective task learning than not having a choice.

A potential mediator of learning under autonomy-supportive conditions is self-efficacy. Self-efficacy reflects a person's confidence in their ability to perform a certain task successfully in the future (Bandura, 1977, 1997). In a few studies, self-efficacy has been found to be correlated with perceptions of autonomy. Autonomy-supportive task instructions, which implied that participants had some freedom in how they performed or practiced a given task, resulted in higher self-efficacy (Hooyman et al., 2014) or perceived competence (Reeve & Tseng, 2011) than did controlling-language instructions that left participants with no choices. Granting learners the opportunity to make their own decisions may convey a sense of trust in their capability that increases their own confidence in being able to do well on a given task. Even providing participants incidental choices (i.e., choosing names of characters in a story) has been shown to increase their task-related confidence (reading comprehension) (Tafarodi et al., 1999). Thus, there is reason to believe that supporting learners' need for autonomy, by giving them relatively insignificant choices, might enhance their self-efficacy and in turn learning.

Learners' expectancies have been enhanced through various manipulations. For instance, by providing feedback after relatively successful trials, as opposed to less successful ones, learning is facilitated (Badami, VaezMousavi, Wulf, & Namazizadeh, 2011, 2012; Chiviacowsky & Wulf, 2007; Chiviacowsky, Wulf, Wally, & Borges, 2009; Saemi, Porter, Ghotbi-Varzaneh, Zarghami, & Maleki, 2012; Saemi, Wulf, Varzaneh, & Zarghami, 2011). Furthermore, edited video feedback showing only good performance (so-called self-modeling) rather than actual (i.e., good and poor) performance (so-called self-observation) has been found to result in more effective learning (e.g., Clark & Ste-Marie, 2007). Hypnosis also seems to have the capacity to increase performance outcome