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Self-control and frequency of model presentation: Effects on learning a ballet passé relevé

Julie Fagundes [a], David D. Chen [b,*], Patricia Laguna [b]

[a] Irvine Valley College, United States
[b] California State University Fullerton, United States

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ABSTRACT

The purpose of this experiment was to examine the combined effects of self-control and frequency of model presentation on learning a complex motor skill, i.e., ballet passé relevé. Before practice started self-control participants were asked to choose two viewings or six viewings (before practice and then every five trials) and the externally controlled groups were yoked to their self-control counterparts. All participants completed 15 acquisition trials followed by 5 trials for the immediate and 5 trials for the delayed retention tests 48 hours later. Dependent variables included cognitive representation scores, physical reproduction rankings, and balance time. Statistical analyses indicated that under limited physical practice conditions self-control and higher frequency of model presentation facilitated the development of cognitive representation and did not produce further benefits in movement reproductions and balance time. The results were discussed with respect to the social cognitive theory.

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1. Introduction

It is common knowledge that individuals learn motor skills by repeatedly observing a skill demonstrated by others followed by attempting to imitate the observed skills themselves. This process is known by many names such as observational learning, modeling, imitation, etc. Even though

* Corresponding author. Address: California State University Fullerton, Department of Kinesiology, 800 N. State College Blvd, Fullerton, CA 92831, United States. Tel.: +1 (657)278 2514.

E-mail address: dapchen@fullerton.edu (D.D. Chen).

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researchers have learned a lot about the factors that determine the effectiveness of observational learning, much still remains unknown (see Ste-Marie et al., 2012 for a review).

Among theories that aim at explaining how learners benefit from observational learning and what is picked up during the observational learning, the social cognitive theory by Bandura (1971, 1986) and the direct perception theory based on Gibson's work (Gibson, 1950, 1979; Scully & Newell, 1985) are believed to be most prominent (Rose & Christina, 2006). According to the social cognitive theory (Bandura, 1971, 1986), behavior is stored in representational form, which then mediates an action response. Learners, when observing a model (e.g., live or video-taped), are in the process of updating the cognitive representation of the skill. To develop a good cognitive representation requires attention and retention processes and that the model's demonstration be accurate and effective. Translating this cognitive representation into physical action entails using an imaginal coding which will serve as a blueprint for the reproduction of the learned skill.

A second approach is the direct perception perspective originated with Gibson, who postulated that there is a direct translation of visual information into action units (1950, 1979). In other words, Gibson believed that what an individual perceives already contains motor elements. The proposal of the "early mediation" hypothesis (Vogt, 2002; Vogt & Thomaschke, 2007) agrees with the major tenet of the direct perception theory. The early mediation hypothesis claims that that perception-action mediation takes place directly during action observation without the need for physical practice. In other words, the learner's motor system can be covertly activated when observing an action.

The discovery of mirror neurons has initiated extensive research to find the common code as suggested by Prinz (1997) so that the two different theories about observational learning may be reconciled. Mirror neurons were discovered accidentally by Italian scientists when they were examining the ventral premotor cortex of the macaque monkey with single neuron recording (e.g., Di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996). The firings of visuomotor neurons were recorded while the monkey executed a goal-directed hand movement (Rizzolatti et al., 1996) as well as when it observed the same action executed by another monkey or by a human. The existence of similar mirror neurons in humans has been confirmed by studies using EEGs (e.g., Calmels et al., 2006; Cochin, Bathelemy, Roux, & Martineau, 1999) and fMRI (e.g., Buccino et al., 2001; Grèzes, Armony, Rowe, & Passingham, 2003). The accumulated evidence already supports the notion that mirror neurons form the human mirror system responsible for converting what one observes into what one does. When an individual observes a familiar motor action, his/her mirror system can easily code the perceptual and motor sides of the action (Rizzolatti & Craighero, 2004). When a novel action is presented, the mirror system is not sufficient and prefrontal brain areas are required (Buccino, Binkofski, & Riggio, 2004) probably because learning a new movement skill by observing requires the brain to break down the new skill into recognizable components that can be recombined in a novel manner (Byrne & Russon, 1998). In a nutshell, the mirror neuron system seems to plays an important role in mediating observational learning by organizing a "cognitive representation" using words of Bandura (1986) for executing the same action observed (Buccino et al., 2004; Craighero, Bello, Fadiga, & Rizzolatti, 2002; Vogt, Taylor, & Hopkins, 2003).

In a typical observational learning study, learners are provided with a model presentation by the experimenter. Recently the factor of self-regulation has been introduced to investigate if learners will benefit from observations of model presentations when given control over certain aspects of the learning environment such as the frequency of feedback (e.g., Wrisberg & Pein). Self-regulation learning is a way of maximizing learning effects by allowing the learner to control one or more aspects of the practice environment (e.g., Wulf & Toole, 1999; Zimmerman & Kitsantas, 1997). Enhancing the self-regulatory processes of the learner should enhance the learner's performance. This is thought to be the case because allowing the learner to control their learning environment increases the learner's interest, motivation, and thus their ultimate performance outcome (Bandura, 1977). Two important studies have supported the notion of added benefit from self-regulated learning.

Wrisberg and Pein (2002) allowed one of their three learner groups to decide how often they would view a correct model during the acquisition phase for the long serve in badminton. During three days of practice, one group viewed correct model video performance before each physical practice trial, a second group was only shown correct model video performance when they explicitly asked to view it (self-control group), and a third group served as a no-model control group (only physical practice).