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Focus of attention and automaticity in handwriting



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ABSTRACT

This study investigated the nature of automaticity in everyday tasks by testing handwriting performance under single and dual-task conditions. Item familiarity and hand dominance were also manipulated to understand both cognitive and motor components of the task. In line with previous literature, performance was superior in an extraneous focus of attention condition compared to two different skill focus conditions. This effect was found only when writing with the dominant hand. In addition, performance was superior for high familiarity compared to low familiarity items. These findings indicate that motor and cognitive familiarity are related to the degree of automaticity of motor skills and can be manipulated to produce different performance outcomes. The findings also imply that the progression of skill acquisition from novel to novice to expert levels can be traced using different dual-task conditions. The separation of motor and cognitive familiarity is a new approach in the handwriting domain, and provides insight into the nature of attentional demands during performance.

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1. Introduction

Previous research using the dual-task paradigm shows that the effects of different foci of attention on a primary task are moderated by the skill of the performer. In a study by [Beilock, Carr, MacMahon,](#)

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and Starkes (2002), for example, participants dribbled a soccer ball through a course as quickly as possible. Experienced soccer players performed this task better when also completing a word monitoring task (extraneous focus). Performance was worse when they simultaneously indicated which foot had last touched the ball in response to a tone (skill focus). The opposite pattern was found for novice soccer dribblers who performed better in the skill-focus than in the extraneous focus condition. In addition, although experienced soccer players performed better overall, their performance in the non-dominant foot was disrupted by the extraneous focus and facilitated by the skill focus; a pattern similar to that found in novices.

Ford, Hodges, and Williams (2005) further explored the relationship between focus of attention and performance by manipulating the relevance of the skill focus. Participants dribbled a soccer ball while paying attention to their foot (*relevant internal skill focus*), their arm (*irrelevant internal skill focus*) or to target words (*extraneous focus*). Experts were disrupted in both the relevant (foot) and irrelevant (arm) skill focus conditions, but not in the extraneous (word monitoring) condition. In comparison, novices were disrupted by the extraneous focus (word) and the irrelevant skill focus (arm) conditions, but not by the relevant skill focus condition. Experts were also tested on their non-dominant foot, which was not influenced by any of the different focus conditions. These results support Beilock and colleagues' position that unlearned skills benefit from attention, whereas automated skills are disrupted when monitored.

In the current study, we investigated the impact of different attentional focus conditions on the skill of handwriting, to address two gaps in the current literature. The first is that the focus of attention literature has emphasized investigations of learning over performance (Schorer, Jaitner, Wollny, Fath, & Baker, 2012). The second is an absence of testing for fine-motor tasks, which may require different attentional control.

Handwriting is a particularly interesting task because it is an everyday activity with which most people acquire a high level of skill. In addition, handwriting has both automated (motor) and controlled (output monitoring) processes (Tucha, Mecklinger, Walitza, & Lange, 2006). What is unclear is precisely what effect different skill- and extraneous-focused attentional manipulations have on this skill. Moreover, task manipulations can be used to explore the cognitive and motor aspects of handwriting within one individual by altering the familiarity of the text written and the hand that is used.

This study compared handwriting performance under an extraneous focus condition, an external skill focus condition, and an internal skill focus condition. We manipulated the motor aspect of hand dominance, assuming that people are experts at writing with their dominant hand (Tucha et al., 2006), and novices at writing with the non-dominant hand. We also manipulated the item being written, comparing a highly familiar item (first name) with low familiarity words.

We predicted superior performance in the dominant versus non-dominant hand, and in writing the first name versus low familiarity words. For the different attentional conditions, we expected that the skill-focus conditions (internal and external) would generally interfere with performance in the dominant hand and in writing names. We expected that the skill-focus conditions would improve performance for writing with the non-dominant hand and writing unfamiliar words. In addition, we expected greater non-dominant hand facilitation in the external skill-focus condition relative to the internal skill-focus condition.

2. Methods

2.1. Participants

Twenty right handed undergraduate students (17 female, 3 male) with an average age of 18.6 (SD = 1.7) years and with no arthritis or joint problems participated in this study.

2.2. Materials

Manual dexterity was tested using the Grooved Pegboard (Lafayette Instruments), and word comprehension was tested using the vocabulary subtest of the Shipley Institute of Living Scale. Lined

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