Chapter 3
Investigating Mindsets and Motivation through Eye Tracking and Other Physiological Measures

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ABSTRACT

Although the influence of mindsets on motivation has been investigated using behavioral measures or verbal responses (e.g., Cimpian et al., 2007), only a handful of studies have used physiological measures, such as eye-tracking, to understand this process beyond explicit responses. Physiological measures are needed to understand thoughts and feelings that children are unable or unwilling to express verbally (e.g., Nisbett & Wilson, 1977). Physiological measures provide the opportunity to identify and quantify possible contributing causes to motivational mindsets (e.g., level of stress or anxiety) that can be compared across settings. Understanding the implicit thoughts and emotions that underlie observable behaviors (e.g., persistence) allow us to better understand mechanism.

INTRODUCTION

A major question in education is why some children are motivated to persist after failure while others give up. One contributing factor is the child's belief about what caused that failure (e.g., mindsets; Dweck, 2006). If the child believes that intelligence is malleable and that effort determines success and failure, she is more likely to persist—believing that more effort will lead to success. If, on the other hand, a child believes that intelligence is fixed and that stable traits determine success and failure, she may be less likely to persist after failure, because failure suggests that she lacks the ability to perform or improve (Haimovitz, Wormington, & Corpus, 2011). What is less understood is the process through

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which mindsets change our behavior. Although there is an abundance of support for the influence of mindsets on motivation using explicit behavioral measures or verbal responses (e.g., Cimpian, Arce, Markman, & Dweck, 2007), only a handful of studies have used physiological measures, such as eye tracking, to measure the implicit, underlying processes in children. Physiological measures provide data that help researchers better understand thoughts and feelings that children are unable (or unwilling) to express verbally (e.g., Nisbett & Wilson, 1977). Physiological measures also provide the opportunity to identify and quantify effects of motivational mindsets (e.g., level of stress or anxiety) continuously across a task rather than at one time point, which helps explain how mindsets influence motivation behavior.

WHY ARE PHYSIOLOGICAL MEASURES IMPORTANT FOR STUDYING MOTIVATION?

To understand the importance of using physiological measures, we first need to disentangle the construct of motivation. Motivation includes a complex set of processes that produce a drive, as well as the regulation and control of that drive (Bahlmann, Aarts, & D'Espisito, 2015; Holroyd & Yeung, 2012). The basic drive (i.e., arousal) propels an organism toward a goal state. The presence of this arousal is a necessary condition for action. An extreme version of this is illustrated by people with a condition known as akinetic mutism who show little voluntary speech and motor action because of a substantial reduction in the drive to speak and act (Holroyd & Yeung, 2012). Conversely, too much arousal with insufficient regulation (e.g., test anxiety) often leads to poor performance (e.g., Elliot and McGregor, 1999). Thus, arousal provides the drive for goals but also must be appropriately controlled to achieve goals. This helps to explain two seemingly incommensurate results from the literature: anxiety appears to improve performance under some conditions, while decreasing performance in others (see Spielberger, 2013 for a review). One potential explanation for these differential effects is that there may an "optimal" level of arousal and that too much or too little arousal will negatively impact performance. The Yerkes-Dodson Law (1908) and Easterbrook's findings of Cue-Utilization Theory (1959) explain that there is an optimal level of arousal to promote optimal performance. These models predict that arousal levels that are too low or too high will result in poor performance (See Figure 1). For example, a child who is too bored to stay attentive will not perform well because of insufficient arousal while a child experiencing high levels of anxiety will not perform well because of excessive arousal. These examples suggest that there is an optimal threshold of arousal at which performance is optimal and, after reaching peak arousal, a point at which performance will start to decline with higher arousal states. Current research often frames performance as the output of motivation without distinguishing arousal from regulation. Physiological measures have the potential to allow us to investigate the interaction between arousal and regulation in real time to understand in more depth their relation to motivation behavior.

One of the goals of research incorporating physiological measures is to identify the patterns of behaviors and physiological responses associated with drive and control of the drive. The following sections provide emerging evidence for the arousal and control processes underlying motivation. We begin with a brief review of the behavioral evidence associated with motivational mindsets and incorporate the physiological evidence in the subsequent sections.