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Short communication

Evidence for the effectiveness of holistic process goals for learning and performance under pressure

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ABSTRACT

Objectives: Research has suggested that holistic process goals might help avoid the effects associated with conscious processing of task relevant information by skilled but anxious athletes. This experiment compared the efficacy of holistic and part process goal strategies for novices using a learning paradigm.
Design: Laboratory-based experimental design incorporating practice, retention and transfer phases.
Method: Twenty-four males were randomly assigned to a part process goal, holistic process goal or control condition and performed a simulated race-driving task in practice, retention and transfer tests.
Results: Analyses of variance revealed that performance during practice was similar in all conditions but that the holistic process goal group outperformed the part process goal group at both retention and transfer.
Conclusions: Compared to part process goals, holistic process goals result in more effective motor learning and performance that appears to be more robust under pressure.

Introduction

Process goals specify the behaviors, skills and strategies that are essential for effective task execution. According to Kingston and Hardy (1997), process goals can help performers deal with high anxiety by providing them with a means of focusing their attention on important aspects of performance, such as technique, movement form, self-regulation or strategy. When focused upon technique or movement form, process goals encourage performers to focus on specific aspects of a task using explicit knowledge about the task. This represents something of a paradox in the context of Masters' (1992) conscious processing hypothesis (CPH), which predicts that a focus on *part* of a movement underpinned by explicit knowledge (i.e., a process goal) might disrupt the normal automatic task processing of skilled performers (Mullen & Hardy, 2010). Such conscious control of movements is normally associated with the early stages of learning. Kingston and Hardy (1997) suggested that one way of dealing with this apparent paradox is to tailor process goals according to the skill level of the performer. Less able performers might use part process goals that focus on key elements of performance; for example, a novice golfer might focus on a firm but relaxed grip of the club when putting. In contrast, more skilled individuals might use more global, holistically focused cues to conceptualize the whole of a movement, thus avoiding conscious processing effects. An example of a holistic process goal might be a golfer using "Smooth" to conceptualize the feeling of the whole movement while putting. Critically, holistic process goals also differ from an external focus of attention (Wulf, 2007), as a holistic focus involves concentrating on the feeling of the movement itself, in effect an internal focus, while an external focus involves a focus on the environmental effect produced by a movement. An additional advantage of using part and holistic goals to examine the CPH is that their use controls for attentional explanations of anxiety effects. Both types of goal can be thought of as using equivalent amounts of attentional space, even though the sub-actions they control differ in magnitude.

Although researchers have started to examine the utility of process goals (e.g., Gucciardi & Dimmock, 2008; Jackson, Ashford, & Norsworthy, 2006), the findings from these studies are

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inconsistent. Mullen and Hardy (2010) claimed that these mixed results do little to clarify the part process goal paradox. Consequently, in three experiments they compared the effectiveness of part and holistically focused process goals, predicting that skilled but anxious performers who used a holistic process goal would outperform those who used part process goals, and also that part process goals would lead to performance impairment. The results were consistent across all three experiments; a single holistic process goal helped maintain or improve performance in the high anxiety conditions. The prediction that part process goals would disrupt task execution under pressure was less clear as, in all three experiments, performance did not significantly deteriorate from baseline (low anxiety) levels, but performance was significantly impaired relative to participants who used a holistic process goal. Mullen and Hardy argued that as participants who used a part process goal did not experience the same performance benefits as those using a holistic process goal, this relative impairment was evidence that conscious processing was activated. A more critical interpretation would be that a single part process goal does not activate conscious processing but instead helps maintain performance in stressful situations (cf. Jackson & Willson, 1999). It might also be possible that the type of process goal adopted in stressful situations interacts with other moderating variables, such as perceived control or self-confidence, to impact positively on performance, although this suggestion remains unexplored.

The focus of the research conducted so far has been exclusively on the use of process goals by skilled but anxious performers. To date, no research has examined the relative effectiveness of part and holistic process goals for the acquisition of motor skills by novices in unpressured practice situations and the subsequent transfer of those skills to competitive conditions where cognitive state anxiety is likely to be elevated. In terms of skill acquisition, there are at least two possibilities. Specifically, novices might benefit from using a part process goal that focuses attention on a key aspect of performance, for example, to focus on following through in the direction of the pass when kicking a soccer ball. During the early stages of learning more holistic representations of a skill might be redundant as the novice is still consciously controlling a skill. As expertise develops, however, holistic process goals might become more important as more skilled performers are able to use the global representation of the movement to avoid lapsing into conscious processing (Kingston & Wilson, 2009). Alternatively, a holistic process goal used early in learning might accelerate the acquisition of a skill by encouraging a more automatic type of functioning, similar to the effect of analogy learning on motor performance (Masters & Poolton, 2012). Analogies allow learners to label instructions and movement instructions symbolically, thus avoiding the accrual of explicit knowledge about how to perform a movement. However, holistic process goals are different to analogies as the latter are symbolically coded while the former are coded kinesthetically (Mullen & Hardy, 2010). In this study, we predicted that holistic process goals would accelerate the learning of novices. Further, and in line with the existing evidence, we also predicted that after a period of learning, driving performance would be more robust under competitive pressure in participants who had acquired the skill using holistic process goals relative to their counterparts who learned using part process goals. This study also set out to address one of the limitations evident in previous work by including a control condition to examine how effective part and holistic goals are relative to discovery learning, where participants are allowed to search the motor workspace naturally, without direction (Vereijken & Whiting, 1990). Previous work has also focused primarily on discrete motor skills such as golf putting or basketball free throwing. The present study extends this focus by using the continuous skill of simulated race car driving.

Method

Participants

Twenty-four male undergraduate students between 19 and 23 years of age ($M = 19.58$, $SD = 1.89$) were recruited from a university in the United Kingdom. Participants reported no experience of the driving game used in the study, had been in possession of a full UK driving license for at least one year ($M = 2.04$ years, SD = .70), and provided informed consent. Ethical clearance was obtained from the university ethics committee.

Apparatus and measures

Race simulator

Participants completed a driving simulation task using the Gran Turismo™ computer game (Sony; Foster City, CA) presented on an 81 cm screen. Participants used an analog force feedback steering wheel and pedals and drove around a track with 12 bends in a Mazda MX5 with automatic gear changes. Participants used the driver's perspective to perform the task and drove in time trial mode to avoid any confounding effects of other cars on track. Driving performance was assessed using lap times, recorded by the computer software, and the number of driving errors made. An error was made if two or more wheels left the track, if the car hit a wall or barrier, or if the car spun.

Cognitive state anxiety

State anxiety was measured using the cognitive anxiety subscale of the revised Competitive State Anxiety Inventory-2 (CSAI-2R; Cox, Martens, & Russell, 2003). The CSAI-2R is a sport-specific, self-report inventory that has been shown to be a valid and reliable measure of cognitive and somatic anxiety and self-confidence by Cox et al. Only the cognitive anxiety subscale was used in line with Eysenck, Derakshan, Santos and Calvo's (2007) assertion that the cognitive component of anxiety is primarily responsible for the effects of anxiety upon performance. Participants rated their cognitive anxiety on a Likert scale ranging from 1 (*not at all*) to 4 (*very much so*). Item responses were summed, divided by 5 and multiplied by 10, resulting in a score range of 10–40 (Cox et al., 2003). Modifications were made to the orienting instructions at the beginning of the CSAI-2R and some of the questions to reflect the fact that the baseline anxiety condition was a practice condition. The standard instructional set and questions were used for the competitive transfer condition. For the present study, Cronbach's alpha coefficients indicated adequate internal consistency for the CSAI-2R cognitive anxiety subscale (alpha = .76).

Manipulation check

Participants in the holistic and part process goal groups were asked whether they believed they had maintained their assigned focus, requiring a yes or no response. Participants who responded negatively were asked an open-ended question to determine what they perceived the issue to be.

Design

Participants were tested on three consecutive days. The first two days comprised the practice phase of the study, during which participants completed eight blocks of two trials (1 trial = 2 laps). Four blocks were completed on day one and four on day two. The third day consisted of two blocks completed in a retention condition, followed by a further two blocks in a competitive transfer condition designed to elevate cognitive state anxiety. In total, each participant completed eight blocks of two trials (32 laps) during the