Acta Psychologica 186 (2018) 39–46

Contents lists available at ScienceDirect

Acta Psychologica

journal homepage: www.elsevier.com/locate/actpsy

Expert monitoring and verbal feedback as sources of performance pressure

John J. Buchanan[a,*], Inchon Park[a], Jing Chen[a], Ranjana K. Mehta[b], Austin McCulloch[a], Joohyun Rhee[b], David L. Wright[a]

[a] Texas A&M University, Department of Health and Kinesiology, Perception-Action Dynamics Lab, 4243 TAMU, College Station, TX 78423, USA
[b] Texas A&M Health Science Center, Department of Environmental and Occupational Health, NeuroErgonomics Lab, 1266 TAMU, College Station, TX 77843, USA

ARTICLE INFO

Keywords:
Explicit monitoring
Attention
Stress
Coordination dynamics
Relative phase
Stability

ABSTRACT

The influence of monitoring-pressure and verbal feedback on the performance of the intrinsically stable bimanual coordination patterns of in-phase and anti-phase was examined. The two bimanual patterns were produced under three conditions: 1) no-monitoring, 2) monitoring-pressure (viewed by experts), and 3) monitoring-pressure (viewed by experts) combined with verbal feedback emphasizing poor performance. The bimanual patterns were produced at self-paced movement frequencies. Anti-phase coordination was always less stable than in-phase coordination across all three conditions. When performed under conditions 2 and 3, both bimanual patterns were performed with less variability in relative phase across a wide range of self-paced movement frequencies compared to the no-monitoring condition. Thus, monitoring-pressure resulted in performance stabilization rather than degradation and the presence of verbal feedback had no impact on the influence of monitoring pressure. The current findings are inconsistent with the predictions of explicit monitoring theory; however, the findings are consistent with studies that have revealed increased stability for the system's intrinsic dynamics as a result of attentional focus and intentional control. The results are discussed within the contexts of the dynamic pattern theory of coordination, explicit monitoring theory, and action-focused theories as explanations for choking under pressure.

1. Introduction

In many situations, performing under pressure is required and often even those that are highly prepared/trained to perform in pressure situations (athletes, musicians, etc.) fail. When an individual, professional or not, finds themselves in a situation where performance can lead to a high return, this need to perform may lead to performance pressure (Baumeister, 1984). What underlies failure when the pressure is on – loss of attentional focus, inappropriate use of conscious control, emotional/motivational factors? The study of failure under pressure within the area of motor skills, which most often is associated with athletes, has primarily focused on how the pressure context influences attentional processing (Carson & Collins, 2016; Gray, 2011; Gropel, 2016; Hanin & Hanina, 2009; Kinrade, Jackson, & Ashford, 2010; Toner & Moran, 2011). Theoretically, several positions have been offered to address the notion of "choking" under pressure, 1) distraction theory, 2) explicit monitoring theory, and 3) action-focused or motoric-focused theories. Within distraction theory and explicit monitoring theory it is the coopting and redirecting of attentional resources that underlies failure or performance breakdown. This being said, it needs to be noted that in many instances performance failure does not emerge in pressure filled contexts, thus failure does not always occur. Action-focused and motor-focused theories emphasize that self-focus on the movements of the limbs and body need not always be associated with detrimental effects in high pressure contexts (Carson & Collins, 2016; Hanin & Hanina, 2009). The current experiment was designed to see if performance failure, specifically coordination failure in a bimanual task, would emerge under the influence of monitoring-pressure.

Distraction theory argues that high pressure contexts, such as test taking, oral presentations, skilled performance in the presence of a large audience, etc. can result in a redirection of attention to distracting stimuli. This redirection of attention reduces the amount of cognitive resources available for skill execution and failure occurs (Beilock & Carr, 2001; Beilock & DeCaro, 2007; Wine, 1971). Working memory processes are actively involved in processing and maintaining specific amounts of task relevant information and studies have shown that high pressure contexts can lead to failure in cognitive tasks that require a high demand on the attentional resources associated with working memory (Beilock & DeCaro, 2007; Markman, Maddox, & Worthy, 2006). Explicit monitoring theory proposes that failure under pressure emerges when performers try to exert conscious control over processes that require minimal attentional resources, such as implicit motor skills

* Corresponding author at: Texas A&M University, Department of Health and Kinesiology, College Station, TX 78423, USA.
E-mail address: jjbuchanan@tamu.edu (J.J. Buchanan).

https://doi.org/10.1016/j.actpsy.2018.04.009
Received 18 December 2017; Received in revised form 13 April 2018; Accepted 17 April 2018
0001-6918/

(Baumeister, 1984; DeCaro, Thomas, Albert, & Beilock, 2011). Studies examining golf putting (Beilock & Carr, 2001; Lewis & Linder, 1997; Masters, 1992), baseball batting (Gray, 2004b), and serial reaction time tasks (SRTT) (DeCaro et al., 2011, experiment 4) have garnered support for explicit monitoring theory. Pressure within a motor skill context is thought to shift attentional resources to the evaluation of how the limbs/joints are used to accomplish a goal movement and thereby disrupt the otherwise automatic control that is thought to run outside of conscious awareness (Gray, 2011; McNevin, Shea, & Wulf, 2003; Wulf & Prinz, 2001). Action and motoric-focused theories propose that attentional focus on action execution is not always detrimental; instead, they propose that focusing attention on skill features that can be consciously controlled or monitored can result in the emergence of performance benefits (Carson & Collins, 2016; Hanin & Hanina, 2009). A recent study found evidence that focusing on an internal component of a task, preferred peddling rate in a cycling task, was as beneficial to enhancing performance as was the adoption of an external focus on a metronome to help control peddling rate (Bertollo et al., 2015).

Contextual factors that can influence the pressure to perform may be classified into two main categories, outcome-pressure and monitoring-pressure (DeCaro et al., 2011). Outcome pressure is associated with offering an incentive to perform at a certain level (typically very high) in order to receive an award (DeCaro et al., 2011; Gray, 2004a; Lawrence, Gottwald, Khan, & Kramer, 2012). The pressure placed on achieving high outcomes may shift the performer's attention to the negative consequences of failure (lack of award) and thereby lead to a performance breakdown. Monitoring-pressure is associated with being watched by an audience which may increase a performer's self-awareness and thereby shift attentional resources to the step-by-step control of the motion of the limbs resulting in performance degradation (Gray, 2004b, 2011). Monitoring pressure has been shown to disrupt performance in an SRTT (DeCaro et al., 2011, experiment 4). These results are in line with the general assumption of explicit monitoring theory that implicit motor tasks that rely on procedural processes suffer if attentional resources are shifted to monitoring skill execution. Within the framework of action/motoric-focused approaches to the pressure-performance relationship, it is emphasized that skill sets consist of different components, such as initial conditions, core features, effort, etc., and that monitoring of different components may lead to different outcomes (good or bad) across different athletes (Hanin & Hanina, 2009; Hanin, Hanina, Sasek, & Kobilsek, 2016). Thus, explicit-monitoring theory and action/motoric-focused theories provide distinct interpretations regarding how pressure can shift attention to so-called automatic skill processes.

In a previous study, we tested the predictions of explicit monitoring theory for a bimanual coordination task that required participants to produce in-phase and anti-phase patterns between the index fingers on the sagittal motion plane (flexion/extension motions) (Buchanan, Park, Chen, Wright, & Mehta, 2017). In-phase bimanual coordination is typically more stable than anti-phase over a range of movement frequencies and movement amplitudes (Buchanan, Kelso, deGuzman, & Ding, 1997; Buchanan & Ryu, 2005, 2006; Byblow, Carson, & Goodman, 1994; Kelso, Scholz, & Schoner, 1986). Theoretically, these patterns have been classified as representing the systems intrinsic dynamics (Kelso et al., 1986; Schöner & Kelso, 1988), in other words, patterns that adults can produce with no training or practice. This representation as the systems intrinsic dynamics was important for the previous study in that it implied that minimal cognitive resources were necessary to produce and maintain these patterns. Thus, it was predicted that the performance of these patterns in a monitoring-pressure context would destabilize them, wherein the destabilization would be viewed as performance failure. Moreover, since anti-phase is typically less stable than in-phase, it was also predicted that the destabilization of anti-phase would be larger than in-phase. Neither of the above predictions were supported. In fact, the monitoring-pressure condition resulted in an overall increase in the stability (decrease in variability) of both patterns (92% of participants) (Buchanan et al., 2017). Execution processes in terms of movement amplitude and movement frequency were altered under monitoring-pressure, but not in a specific direction across all participants. With regard to movement frequency, 67% of the participants reduced frequency, while 33% increased frequency. In terms of movement amplitude, 50% decreased finger amplitude and 50% increased finger amplitude. Thus, the results from Buchanan et al. (2017) were not consistent with explicit monitoring theory regarding performance outcome, even though execution processes were altered. The findings from our first study were more congruent with the predictions of action/motoric-focused theories.

A reasonable question to ask is whether or not the monitoring-pressure context lead to a shift in attention in the bimanual task. The increase in pattern stability in our first study aligns with dual task studies that shift attention onto the production of the intrinsic bimanual patterns by employing the optimize-maximum method. Several studies have shown that shifting attention onto the anti-phase pattern can stabilize it under a variety of experimental manipulations (Hiraga, Summers, & Temprado, 2004; Monno, Chardenon, Temprado, Zanone, & Laurent, 2000; Temprado, Zanone, Monno, & Laurent, 1999). Evidence of an increase in stability for in-phase coordination in such dual tasks has been less convincing (Monno et al., 2000; Temprado et al., 1999; Zanone, Monno, Temprado, & Laurent, 2001); however, a decrease in stability (decrement in performance) has not been observed even with the shift of attention to the pattern. Moreover, some studies manipulating attentional focus in bimanual tasks have shown modification in individual limb execution processes (Hiraga, Summers, & Temprado, 2005; Temprado et al., 1999). The results from Buchanan et al. (2017) are consistent with a shift in attention that influenced execution processes and pattern stability as found in the above dual task studies.

In our previous study, when one group of participants were 2/3 of the way into the experiment they were told that their performance was not satisfactory and that they would have to be monitored by a pair of experts. The experts sat within 3 ft of a participant and were visible to the participant, yet the experts never talked to the participant. At the end of each trial, one of the experts whispered to the experimenter, after which the experimenter instructed the participant that their performance needed to improve. Instruction on how to modify performance or to modify performance toward a given goal was not provided because we did not want to mix outcome-pressure (goal based) and monitoring-pressure conditions. The use of the experts and verbal feedback was designed to increase the monitoring-pressure experienced by the participants. Although not our intention, the verbal feedback received by the participant could be viewed as a form of negative feedback or even possibly outcome-pressure. In other words, negative feedback/outcome-pressure contributed to the effects observed and therefore monitoring-pressure was not the only or main source of the observed stabilization of the patterns.

The current study was designed to determine if verbal feedback increased pressure above that created by the presence of experts alone. If our previous findings were primarily the result of mixing negative feedback/outcome-pressure with monitoring-pressure, then participants viewed only by experts should show a smaller improvement in performance, whereas participants viewed by experts and receiving verbal feedback should show a larger improvement in performance to the results from our previous study (Buchanan et al., 2017). An early study demonstrated that performance varies as an inverted u-shaped function under the threat of electrical shock (Martens & Landers, 1970), with a medium threat level resulting in better performance compared to high and low threat levels. If negative feedback increases pressure associated with expert monitoring, then performance may deteriorate and possibly lead to a u-shaped function in our performance measures. Specifically, it was predicted that the stability of in-phase and anti-phase coordination would increase under monitoring-pressure alone, contrary to the predictions of the explicit monitoring theory. Moreover,