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Is ego depletion associated with increased distractibility? Results from a basketball free throw task

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ABSTRACT

Objectives: It has been repeatedly demonstrated that athletes in a state of ego depletion do not perform up to their capabilities in high pressure situations. We assume that momentarily available self-control strength determines whether individuals in high pressure situations can resist distracting stimuli.
Design/method: In the present study, we applied a between-subjects design, as 31 experienced basketball players were randomly assigned to a depletion group or a non-depletion group. Participants performed 30 free throws while listening to statements representing worrisome thoughts (as frequently experienced in high pressure situations) over stereo headphones. Participants were instructed to block out these distracting audio messages and focus on the free throws. We postulated that depleted participants would be more likely to be distracted. They were also assumed to perform worse in the free throw task.
Results: The results supported our assumption as depleted participants paid more attention to the distracting stimuli. In addition, they displayed worse performance in the free throw task.
Conclusions: These results indicate that sufficient levels of self-control strength can serve as a buffer against distracting stimuli under pressure.

In perceptual-motor tasks it can be essential to ignore irrelevant, potentially distracting stimuli, for instance task-irrelevant thoughts or the audience in the stands, in order to focus attention on the relevant stimuli (e.g., the rim of the basket; Abernethy, Maxwell, Masters, Van der Kamp, & Jackson, 2007). In high pressure situations individuals often have difficulties regulating their attention which can negatively affect their perceptual-motor performance (e.g., Baumeister, 1984). An often used indicator for perceived pressure in a given situation is the level of state anxiety (e.g., Gucciardi, Longbottom, Jackson, & Dimmock, 2010). Several studies have demonstrated that higher levels of anxiety are associated with impaired performance in different perceptual-motor tasks, for instance in basketball free throws (Wilson, Vine, & Wood, 2009), dart throwing (e.g., Nibbeling, Oudejans, & Daanen, 2012) or golf putting (Gucciardi et al., 2010).

According to Attentional Control Theory (ACT; Eysenck, Derakshan, Santos, & Calvo, 2007) higher levels of state anxiety make individuals prone to be distracted by irrelevant stimuli (e.g., worrisome thoughts). This increased distractibility is assumed to be caused by a dominance of the bottom-up stimulus-driven attentional system over the top-down goal-oriented attentional system in a state of anxiety (Corbetta & Shulman, 2002). Several studies have delivered empirical support for this assumption of ACT (e.g., Wilson et al., 2009).

Of particular importance to the present study, Eysenck and colleagues argued that individuals are generally able to counteract the negative effects of anxiety on attention. This argument is tentatively supported by studies in which anxiety was not negatively related to perceptual-motor performance (e.g., Woodman & Hardy, 2003). However, thus far it has not been sufficiently investigated which processes determine whether anxious individuals can (or cannot) counteract the negative effects of anxiety on attention. In this respect, we argue that an individual's ability to exert self-control might be an important variable that needs to be taken into account when investigating the relationship between anxiety, attention, and skilled performance in perceptual-motor tasks.

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Speaking in terms of the strength model of self-control, volitionally regulating one's attention is a self-control act that is dependent on momentarily available self-control strength (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998). According to Baumeister and colleagues, all acts of self-control, meaning the process of volitionally controlling and overriding predominant response tendencies, are energized by the same metaphorical resource or strength of which the capacity is limited (e.g., Baumeister et al., 1998). After a primary self-control act, this resource can temporarily be depleted (a state termed *ego depletion*). As the resource is not immediately replenished, during this time subsequent self-control tasks are typically not executed sufficiently. It is important to note that the effects of ego depletion are not domain-specific, meaning that exerting self-control in one domain (e.g., impulse regulation) can have an effect on self-control from seemingly unrelated domains (e.g., emotion regulation; Baumeister et al., 1998). In general, one's self-control strength can be vital for tasks requiring emotion regulation (e.g., Bertrams, Englert, Dickhäuser, & Baumeister, 2013), persistence (e.g., Baumeister et al., 1998), decision making (e.g., Furley, Bertrams, Englert, & Delphia, 2013), and of particular importance for the current study attention regulation (Schmeichel & Baumeister, 2010). Findings from the field of sport psychology also support the assumptions of the strength model of self-control: In a state of ego depletion individuals are less persistent in physical endurance tasks (e.g., Bray, Martin Ginis, Hicks, & Woodgate, 2008), invest less effort in physical exercises (Dorris, Power, & Kenefick, 2012), display impaired performance in skilled perceptual-motor tasks (McEwan, Martin Ginis, & Bray, 2013), and are more likely to underperform in stressful situations (Englert & Bertrams, 2012). A recent meta-analysis revealed a reliable effect of ego depletion on subsequent self-control across 83 studies (Hagger, Wood, Stiff, & Chatzisarantis, 2010).

As previously mentioned, perceptual-motor tasks require selective attention so that irrelevant stimuli can be ignored (e.g., Wilson et al., 2009), meaning that the exertion of self-control may be necessary for efficient attention regulation during perceptual-motor tasks. In a series of studies, Englert and Bertrams (2012, 2013) demonstrated that the effects of pressure and related anxiety on performance in perceptual-motor tasks were moderated by momentarily available self-control strength. Anxiety only negatively affected performance if participants did not have sufficient self-control strength to counteract the debilitating effects of anxiety on attention regulation. When self-control strength was intact pressure and anxiety did not affect performance in any of the experiments. Moreover, self-control strength itself had no direct effect on performance but only in interaction with pressure and anxiety. In interpreting these results, the authors concluded that, in line with ACT (Eysenck et al., 2007), higher levels of anxiety were associated with increased distractibility (e.g., by worrisome ruminations). Furthermore, they argued that participants with high self-control strength were able to counteract the negative effects of anxiety on selective attention by volitionally regulating their attention.

The question arises, however, whether the anxious participants with depleted self-control strength in Englert and Bertrams's (2012, 2013) studies were actually distracted by task-irrelevant stimuli. As anxious depleted participants displayed worse performance than anxious participants with intact self-control strength, the authors proposed that increased distraction was responsible for these performance differences. They argued that the distraction may stem from worrisome thoughts that typically occur and may be one major source of distraction during high pressure situations (Oudejans, Kuijpers, Kooijman, & Bakker, 2011). However, the authors did not deliver evidence for the process of distraction itself. In the present paper we attempt to expand the findings of Englert and Bertrams by delivering first direct evidence for the assumed mechanism of increased distractibility under depleted self-control strength in high-pressure situations.

In the present study we experimentally manipulated momentarily available self-control strength in a between-subjects design. Participants then performed a series of basketball free throws under pressure, which can be considered a perceptual-motor task that requires attention regulation (e.g., Wilson et al., 2009). We did not manipulate pressure as an experimental factor as this was not the focus of the study, but built on previous self-control research consistently showing performance decrements only in high-pressure situations (e.g., Bertrams et al., 2013; Englert & Bertrams, 2012, 2013). While performing the free throws, the participants were listening to external auditory distraction presented via stereo headphones (for this procedure see also Furley et al., 2013). The audio stream contained typical worrisome thoughts athletes often experience in high pressure contexts (Oudejans et al., 2011). By these means we attempted to model what frequently may distract athletes' attention during such situations. Furthermore, the audio allowed us to measure distraction by irrelevant stimuli. Expanding previous findings we postulated that participants in the depletion group would be more distracted by the audio stream compared to the non-depletion group. Therefore, depleted participants should be more aware of changes in the audio stream than non-depleted participants while performing the basketball free throws under pressure. In replicating the results of Englert and Bertrams (2012, 2013), we also assumed that depleted compared to non-depleted participants would perform worse in the free throw task under pressure.

Method

Participants

The sample of the current study consisted of 31 experienced male basketball players ($M_{age} = 29.26$, $SD_{age} = 4.90$; 1 left-handed) from two clubs of the fourth highest German league (German Oberliga). Participants were randomly assigned to either the depletion group ($n = 16$) or the non-depletion group ($n = 15$). We obtained written informed consent from each participant before starting the experiment.

Materials and procedure

We conducted the study in a separate part of the gym of the respective basketball club. All questionnaires were administered as paper pencil versions, and we calculated overall scores by averaging each participant's value on the respective measure. As such, higher scores on our measures represent higher values of the respective variable. Participants first reported demographic information (age, experience, mother tongue, handedness, official free throw rate from current season).

To rule out differences in trait sport anxiety between our experimental groups, we assessed participants' dispositional sports anxiety by administering the German version of the Sport Anxiety Scale-2 (WAI-T; Brand, Ehrlenspiel, & Graf, 2009). Twelve items were answered on 4-point Likert-type scales (1 − *not at all* to 4 − *very much*) in regard to how participants generally feel before or during sports competitions. Four items each can be assigned to the subscales worry (e.g., "I worry that I will play badly"; $\alpha = .90$), somatic (e.g., "My stomach feels upset"; $\alpha = .81$), or concentration (e.g., "I lose focus on the game"; $\alpha = .85$).

In a next step, we experimentally manipulated momentarily available self-control strength with a transcription task that is a