國立體育大學 102 學年度研究所博士班入學考試試題

系所:體育研究所　　組別:運動心理組

科目:運動心理學專業學科文獻評論（本試題共 6 頁）

※注意：1 答案一律寫在答案卷上，否則不予計分
2 請核對試卷、准考證號碼與座位號碼三者是否相符。
3 試卷『彌封處』不得污損、破壞。
4 行動電話或呼叫器等通訊器材不得隨身攜帶，並且關機。
5 請以中文作答。請橫書。

本卷共 **100** 分

請根據所附的研究論文作答。

Chalabaev, A., Brisswalter, J., Radel, R., Coombes, S.A., Easthope, C., & Clément-Guillotin, C. (2013). Can stereotype threat affect motor performance in the absence of explicit monitoring processes?: Evidence using a strength task. J*ournal of Sport & Exercise Psychology*, *35*(2), 211-215.

一、緒論部份（30％）

1. 本研究的主要研究問題（或目的）是什麼？
2. 本研究的研究問題（或目的）的學理基礎是什麼？論文中是否有明確陳述？
3. 本研究的研究假設是什麼？研究假設形成的邏輯推演過程是什麼？論文中是否有明確陳述？

二、方法部份（20％）

1. 本研究的主要研究設計是什麼？
2. 主要的變項及測量工具是什麼？論文中是否提供了充分而必要的訊息？

三、結果部份（20％）

1. 論文中是否明確陳述使用哪些資料分析方法來回答研究問題？若是，是哪些分析方法？
2. 本研究是否使用了適當的資料分析方法來回答研究問題？請說明理由。是否有缺失或對統計結果做了不當的分析？請說明。

四、討論部份（30％）

1. 本研究的主要研究發現是什麼？是否支持假設？
2. 本研究的發現有何學理上的意義？論文中是否有明確陳述？
3. 本研究的發現有何應用上的意義？論文中是否有明確陳述？

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RESEARCH NOTE

Can Stereotype Threat Affect Motor Performance in the Absence of Explicit Monitoring Processes?: Evidence Using a Strength Task

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Previous evidence shows that stereotype threat impairs complex motor skills through increased conscious monitoring of task performance. Given that one-step motor skills may not be susceptible to these processes, we examined whether performance on a simple strength task may be reduced under stereotype threat. Forty females and males performed maximum voluntary contractions under stereotypical or nullified-stereotype conditions. Results showed that the velocity of force production within the first milliseconds of the contraction decreased in females when the negative stereotype was induced, whereas maximal force did not change. In males, the stereotype induction only increased maximal force. These findings suggest that stereotype threat may impair motor skills in the absence of explicit monitoring processes, by influencing the planning stage of force production.

Keywords: stereotype threat, stereotype lift, rate of force development, maximal voluntary contraction, avoidance processes

An emerging body of research indicates that stereotypes may be an important factor in athletic performance. Based on stereotype threat theory (Steele, 1997), these studies provided evidence that activating negative stereotypes may disrupt stereotyped individuals' performance on complex sensorimotor tasks, such as a golf-putting task (Beilock, Jellison, Rydell, McConnell, & Carr, 2006; Beilock & McConnell, 2004; Stone, Lynch, Sjomeling, & Darley, 1999; Stone & McWhinnie, 2008), a soccer-dribbling task (Chalabaev, Sarrazin, Stone, & Cury, 2008), and a free-throw basketball task (Krendl, Gainsburg, & Ambady, 2012).

Specifically, stereotype threat induces a motivation to avoid failure (e.g., Chalabaev, Sarrazin, et al., 2008). This motivation is associated with a careful processing style (Seibt & Förster, 2004), which results in an increased conscious monitoring of task execution, impairing in turn motor performance (e.g., Beilock et al., 2006; Schmader, Johns, & Forbes, 2008). Indeed, expertise in complex sensorimotor tasks (e.g., golf putting) relies on proceduralized skills, represented as integrated procedures that run relatively automatically with minimal intervention from the working memory system. Pressure-induced conscious control of such skills leads the individual to isolate and focus on specific components of task execution. This results in a breakdown of the integrated control structure into a sequence of smaller independent units. Once broken down, each unit must be activated and run separately. This creates opportunities for error that were not present in the integrated control structure, resulting in a decrease of performance.

While the influence of stereotypes on complex motor skills is well established, little is known about their effects on simple skills that do not require complex coordinations (e.g., performing an isometric muscle contraction task). According to Beilock and Carr (2001), one-step skills may be unaffected by conscious monitoring of task execution because they do not involve the integration and sequencing of multiple steps or parts. This suggests that stereotype threat does not detract performance on such tasks. This assumption is supported by results showing that the maximum force exerted by older individuals on a handgrip task was unaffected by the stereotype threat manipulation (Horton, Baker, Pearce, & Deakin, 2010).

However, there is evidence that certain aspects of simple skills may be influenced by threatening cues (Payen et al., 2011). In their study, Payen et al. induced threat by making participants perceive the color red

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before performing a maximal isometric contraction. As in Horton et al.'s (2010) study, the threat induction did not impact the maximal voluntary contraction (MVC) produced by participants. However, inducing threat inhibited the rate of force development (RFD), in other words, the velocity with which the force was produced. Interestingly, the early phase of RFD (<100 ms) takes place before attentional control is possible. If similar results were to be observed when negative stereotypes are induced, this would suggest that stereotype threat effects on motor tasks may occur in the absence of explicit monitoring processes. The present study investigated this question.

As in Payen et al.'s (2011) study, we used an isometric contraction of the quadriceps as a measuring task. We predicted that activating the negative stereotype about females' strength would decrease females' RFD, which corresponds to the rate of change of force production (i.e., the first derivative of force, in newton meters per second) during the initial phase of contraction and assesses explosive muscle strength. The first 100 ms of RFD were examined because this initial phase may not be consciously controlled (e.g., Andersen & Aagaard, 2006). We also examined the effects of stereotypes on the maximal voluntary contraction (MVC) force, which is the peak of force reached after more than 250 ms and may therefore be controlled (e.g., Andersen & Aagaard, 2006; Payen et al., 2011). We expected that this controlled aspect of the contraction would not be affected by the stereotype induction, as a one-step skill should not be susceptible to the reinvestment of controlled processing induced by stereotype threat (e.g., Beilock & Carr, 2001; Beilock et al., 2006).

A related goal was to examine how males' performance was affected by stereotypes. Past research indicates that negative stereotypes may boost performance of outgroup members (stereotype lift, Walton & Cohen, 2003) through increased effort (e.g., Chalabaev, Stone, Sarrazin, & Croizet, 2008). This increased energy mobilization could help males to better meet the demands of the task, enhancing both peak RFD and MVC.

Method

Participants

Forty kinesiology students (20 females and 20 males; $M_{age} = 21.07$, $SD_{age} = 3.01$) were randomly assigned to a stereotypical or a nullified-stereotype condition. To ensure that participants considered athletic ability important, they completed a 7-point item assessing its importance before the experiment, a mean score of 4 or higher being required for participation. Informed consent was obtained along with institutional approval of the protocol.

Procedure

Participants were run individually by a female or male experimenter (the sex of the experimenter was counterbalanced across conditions and revealed no significant effects). Upon arriving at the laboratory, they signed an informed consent form and completed five 7-point items assessing physical self-worth, which were taken from the French version (Ninot, Delignières, & Fortes, 2000) of the Physical Self-Perception Profile (Fox & Corbin, 1989). They were then asked to perform three 5-s isometric maximal voluntary contractions of the quadriceps as fast and as forcefully as possible (T1 measure). Next, participants were instructed that the study assessed gender differences on the strength test. They were told that females had been shown to underperform on the test relative to males in the stereotypical condition, or that the test had not been shown to produce gender differences in the nullified-stereotype condition. Following the stereotype manipulation, participants performed three maximal isometric contractions (T2 measure). Next, as a check on the stereotype manipulation, they rated on a 7-point Likert scale whether there were gender differences on the test or not. All participants correctly understood the instructions. Finally, they were thanked, fully debriefed, and checked for suspicion.

Apparatus and Measures

An isokinetic dynamometer (Biodex, Biodex Medical Systems, Inc., Shirley, NY, USA) with a 110° hip angle and a 60° knee angle (with 0° corresponding to the full extension of the knee) measured the maximal voluntary isometric torque of the knee extensor muscles, the axis of the dynamometer being aligned with the anatomical knee flexion-extension axis. Straps placed around the waist and two crossover shoulder harnesses limited hip motion during the contractions. Participants were required to keep their arms crossed on their chest during the testing procedure to avoid any pulling from the armrests of the chair.

The highest peak torques reached after more than 250 ms in T1 and T2 were defined as MVC (newton meters) values. The RFD value (newton meters per second) was defined as the slope of the torque–time curve (i.e., Δtorque/Δtime) in 10 incrementing time periods of 0–10, 0–20, up to 0–100 ms from the onset of contraction. The RFD values reflected the peak slope during the first 100 ms of the contraction.

Results

Preliminary analyses examined potential group differences in T1 performance measures and physical self-worth. Two (gender) × 2 (stereotype) analyses of variance showed that neither the main effect of the stereotype manipulation nor the gender × stereotype interaction reached significance (Fs < 1.00). A significant main effect of gender emerged, with males producing higher maximal force levels at T1 ($M = 279.26$) than females ($M = 193.11$), $F(1,36) = 12.09$, $p < 001$, $\eta^2 = .25$, and showing a higher rate of force development ($M_{males} = 2525.06$; $M_{females} = 1346.11$), $F(1,36) = 6.54$, $p = .01$, $\eta^2 = .15$. Males also held significantly higher perceptions of

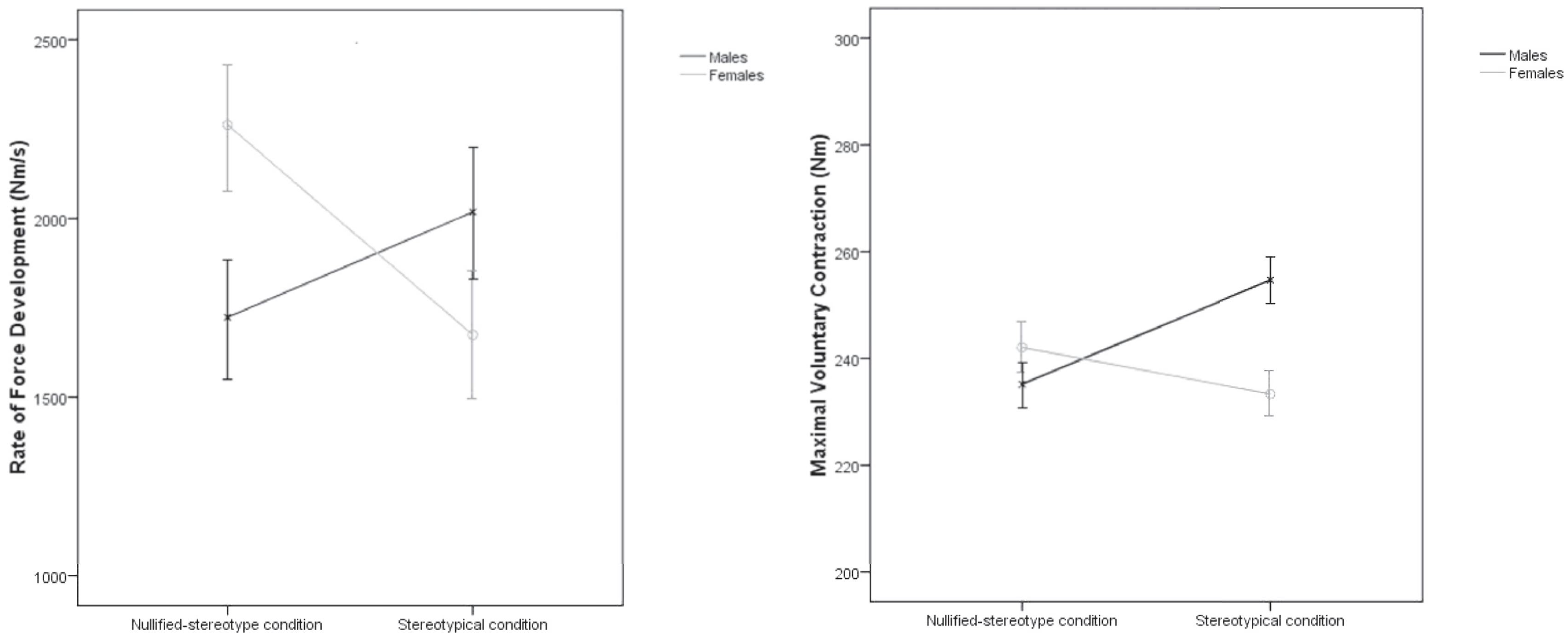

Figure 1 — Adjusted peak rate of force development and maximal voluntary contraction by gender and stereotype manipulation. *Note.* Rate of force development (in newton meters per second) and maximal voluntary contraction (in newton meters) represent peak values at T2 controlling for T1 values and physical self-worth. Error bars indicate standard errors.

physical self-worth ($M = 5.07$) than females ($M = 4.29$), $F(1,36) = 8.71$, $p = .005$, $\eta^2 = .19$.

We conducted 2 × 2 analyses of covariance (ANCOVA) on T2 peak RFD and MVC values, controlling for physical self-worth and T1 performance measures (see Figure 1). We first examined whether the homogeneity of regression assumption was satisfied, by checking that the covariates significantly correlated with T2 performance, and that they did not interact with gender to predict T2 performance. Each of these requirements was met. Results showed a significant gender × stereotype interaction on RFD, $F(2,34) = 6.51$, $p = .01$, $\eta^2 = .16$. Follow-up simple comparisons revealed that females' peak rate of force development was significantly lower when the negative stereotype was induced (Adj$M$ = 1674.81) than when this stereotype was nullified (Adj$M$ = 2262.28), $F(1,34) = 5.65$, $p = .02$, $\eta^2 = .14$. In contrast, the peak RFD of males did not differ in the stereotypical condition (Adj$M$ = 2018.28) or in the nullified-stereotype condition (Adj$M$ = 1723.79), $F(1,34) = 1.46$, $p = .24$. The main effects of gender and stereotype did not reach significance, Fs < 1.00.

Concerning MVC values, results yielded a significant gender × stereotype interaction, $F(2,34) = 9.78$, $p = .004$, $\eta^2 = .22$. Specifically, the peak MVC of females did not differ in the stereotypical condition (Adj$M$ = 233.32) and in the nullified-stereotype condition (Adj$M$ = 242.06), $F(1,34) = 1.79$, $p = .19$. In contrast, males developed a significantly higher maximal force level in the stereotypical condition (Adj$M$ = 254.67) than in the nullified-stereotype condition (Adj$M$ = 235.20), $F(1,34) = 9.63$, $p = .004$, $\eta^2 = .22$. Finally, the main effects of gender and stereotype were not significant, Fs < 1.00.

A separate 2 (gender) × 2 (condition) ANCOVA was conducted on T2 time (in seconds) from contraction onset until peak MVC was reached, controlling for physical self-worth and T1 time to peak MVC. The analysis did not yield any significant main or interactive effects, Fs < 1.00. More particularly, there was no difference in time to peak MVC in either gender between the stereotypical condition (AdjM_{female} = 2.65; AdjM_{male} = 2.61) and the nullified-stereotype condition (AdjM_{female} = 2.82; AdjM_{male} = 2.75).

Discussion

This study showed that inducing the stereotype that females have poor strength decreased females' velocity of force development on an isometric muscle contraction task. This finding provides evidence that stereotype threat may affect performance on simple motor tasks, and may do so by influencing the planning stage of force production. Indeed, given that RFD is more closely associated with the planning as compared with the execution and control stages of force production, our findings suggest that the influence of stereotype threat is not limited to motor tasks that involve explicit monitoring processes. Moreover, the stereotype induction did not impact females' maximal force, a controlled component of force production that may be consciously monitored. This finding is consistent with Beilock and Carr's (2001) argument that simple one-step skills are not impaired by the explicit monitoring of task execution because they do not involve the integration and sequencing of multiple steps.

If explicit monitoring processes are not responsible for the stereotype influence on RFD, what drove the effect? Rate of force development is modulated by anticipatory processes related to the upcoming motor task (Raghavan, Krakauer, & Gordon, 2006; Ray, Slobounov, Mordkoff, Johnston, & Simon, 2000). One possible explanation, therefore, is that stereotype threat inhibited RFD by influencing the preparatory processes that occurred before task execution. This assumption is based on evidence that stereotype threat triggers avoidance responses (e.g., motivation to avoid failure, self-handicapping strategies) before the performance task begins (e.g., Schmader et al., 2008; Stone, 2002). These avoidance-related processes may have interfered with the preparatory stages of our maximal voluntary contraction task.

Finally, as documented in past research (e.g., Walton & Cohen, 2003), the results showed a stereotype lift effect on males' maximal force. This performance boost may be due to an increased effort expenditure, which has been shown to occur when negative outgroup stereotypes are induced (e.g., Chalabaev, Stone, et al., 2008). Interestingly, stereotype lift increased maximal force but not the velocity of that force, suggesting that the extra effort expended under stereotype lift only affects aspects of performance that may be consciously controlled. This confirms that stereotype threat and lift affects performance through different processes.

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