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"Don't Hold Back": Swearing Improves Strength Through State Disinhibition

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Swearing, often dismissed as socially inappropriate, has been linked to increased physical performance. However, the underlying mechanism remains unclear. One proposed explanation is state disinhibition, a psychological state in which individuals are less likely to restrain their behavior. This study tested whether swearing enhances physical performance and whether that effect was mediated by psychological variables linked to state disinhibition. Two preregistered, repeated measures experiments (N = 88; N = 94) and an aggregated analysis including a prior preregistered study (total N = 300) examined the impact of repeating a self-selected swear word versus a neutral word on a chair push-up task. Experiments assessed potential mediators related to state disinhibition, including psychological flow, distraction, humor, and self-confidence. Both experiments replicated the swearing advantage, showing significant performance improvements in the swearing condition. Although mediation analyses varied across individual experiments, the aggregated analysis demonstrated that psychological flow, distraction, and self-confidence significantly mediated the swearing effect. These findings suggest that swearing promotes psychological states conducive to maximizing effort and overcoming internal constraints. These effects have potential implications for athletic performance, rehabilitation, and contexts requiring courage or assertiveness. As such, swearing may represent a low-cost, widely accessible psychological intervention to help individuals "not hold back" when peak performance is needed.

Public Significance Statement

In many situations we hold ourselves back and, in doing so, limit our opportunities for success. Here we propose swearing as a cheap, readily available intervention that appears to encourage us to "not hold back" and instead to "go for it" a little more, with positive benefits on physical performance. This study shows that swearing can improve physical performance, and it works by helping people feel focused, confident, and less distracted.

Keywords: swearing, state disinhibition, physical performance, flow, self-confidence

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The preregistrations, study materials, data sets, and analysis code are permanently available on the Open Science Framework at https://osf.io/qyv3b/ (Stephens et al., 2025). The authors thank Chris Stiff for suggesting bystander apathy as a potential variable for assessing state disinhibition.

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Richard Stephens played a lead role in conceptualization, data curation, formal analysis, and supervision, a supporting role in project administration and writing–original draft, and an equal role in investigation, methodology, and writing–review and editing. Harry Dowber played a supporting role in conceptualization, data curation, formal analysis, investigation, methodology, project administration, and writing–review and editing. Christopher Richardson played a supporting role in conceptualization, data curation,

continued



Richard Stephens

In many situations, people hold themselves back, consciously or unconsciously, limiting their opportunities for success. For example, fear of public speaking can prevent individuals from expressing ideas or seizing personal and professional opportunities (Bodie, 2010). Job applicants may hesitate when negotiating salaries, diminishing long-term earnings (Marks & Harold, 2011). In childbirth, women sometimes refrain from pushing fully or vocalizing discomfort due to fear of judgment (Danford et al., 2023; McKay & Barrows, 1991). Socially, a person may feel too shy to approach a person they are attracted to, missing out on meaningful connections (Erwin, 2007).

This tendency to hold back can also be observed in sport and rehabilitation contexts. In gyms, women sometimes limit effort to avoid appearing unfeminine (Dworkin, 2001). Athletes returning from injury frequently demonstrate hesitation and reduced self-confidence, which can interfere with full performance (Burland et al., 2018). Even elite athletes are not immune: In 2021, the footballer Mark Noble missed a high-pressure penalty kick after being subbed in moments before, leading commentators to suggest he lacked the psychological readiness required for optimal performance (Wilkinson, 2021).

In each of these examples, individuals appear to be psychologically restrained from using their full capability. A timely psychological boost, particularly one that facilitates a more disinhibited state, might have produced more favorable outcomes. Empirical support for this idea is growing. For example, grunting has been found to enhance tennis players' racquet power by 19%–26% (O'Connell et al., 2014), and shouting increases grip strength by 7% (Welch & Tschampl, 2012), suggesting vocal expressions can enhance exertion.

This article proposes that swearing, a simple and universally accessible linguistic tool, can function as an effective intervention to counteract tendencies to hold back and enhance performance. Swearing, defined as the use of taboo or potentially offensive language (Beers Fägersten, 2012), is a near-universal aspect of language with significant roles in human communication and emotional regulation (Van Lancker & Cummings, 1999). Although social norms often discourage swearing, research shows it may produce beneficial physiological, psychological, and social effects (Stapleton et al., 2022). In particular, swearing has been shown to enhance physical performance in tasks requiring maximal effort. Stephens et al. (2018) reported that repeating a swear word increased grip strength by 8% and power output during cycling by 4.5% compared with repeating a neutral word. Follow-up work has replicated and expanded these findings, showing that swearing improves chair push-up task duration by 10% (Stephens et al., 2022), which is a body weight exercise requiring participants to raise their bodies and support their body weight on their hands and arms against the chair seat for as long as possible. Similar benefits were found for push-ups, wall sit hold times, and plank hold times (Jiannine & Antonio, 2023).

While these effects of swearing appear to be reliable, the underlying mechanism is less clear. The original theory that motivated research assessing effects of swearing on physical performance assumed a psychophysiological mechanism linked to autonomic arousal (Stephens et al., 2018), supported by elevated heart rate during swearing (Stephens et al., 2009; Stephens & Umland, 2011). However, Stephens et al. (2018) showed that swearing benefitted physical performance in the absence of psychophysiological markers of autonomic arousal, prompting a shift toward a psychological explanation: state disinhibition, characterized by reduced restraint.

State disinhibition can be defined as "temporarily tending towards behaviours that are under-controlled rather than over-controlled" (Stephens et al., 2022, p. 306). The state disinhibition theory posits that, in disrupting social norms and diminishing internal psychological barriers, swearing pushes individuals to not hold back and thereby fully take

formal analysis, methodology, project administration, writing–original draft, and writing–review and editing. Nicholas B. Washmuth played a lead role in writing–original draft, a supporting role in methodology and project administration, and an equal role in writing–review and editing.

The data are available at https://osf.io/qyv3b/

The experimental materials are available at https://osf.io/qyv3b/

The preregistered design is available at https://osf.io/qyv3b/

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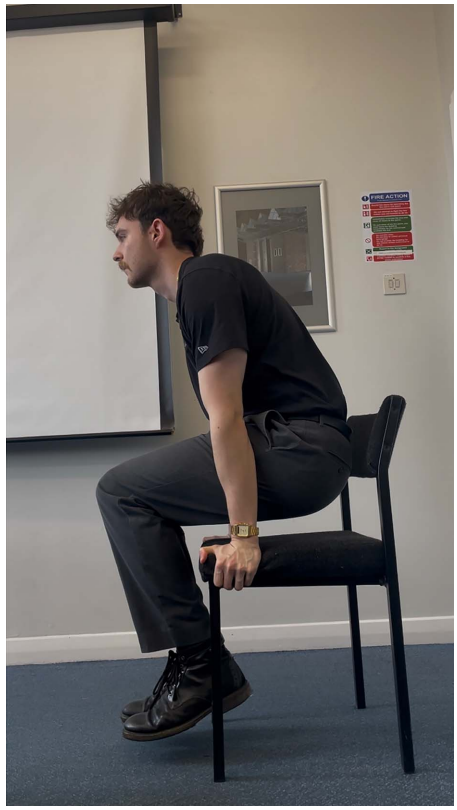
Harry Dowber

advantage of resources such as physical strength, attentional focus, and determination. According to Hirsh et al. (2011), the concept of state disinhibition can be understood through Gray's (1982) behavioral inhibition system (BIS). The BIS typically functions to lessen impulsive actions and prioritize socially appropriate behavior; however, when the BIS is subdued, the behavioral activation system (BAS) takes precedence. The BAS narrows the focus toward immediate goals and inhibits conflicting social concerns, driving action-oriented behavior. Swearing leverages these systems in multiple ways, such as reducing attention to irrelevant distractions and amplifying goal-directed efforts and increasing self-confidence (Stephens et al., 2022). This release from inhibition enables individuals to push beyond personally or socially imposed limits and thereby access their full potential more effectively.

The theory that swearing promotes physical strength via a psychological mechanism of increased state disinhibition is testable using mediation analysis within an experimental paradigm. However, this approach has produced equivocal results to date. Experiment 2 of Stephens et al.'s (2022) study, which was preregistered and included a sample of 118 adults, examined the impact of swearing on a chair push-up task (see Figure 1) while assessing mediating effects of several psychological variables linked to state disinhibition (hereafter referred to as Stephens et al., 2022). Repeating a swear word increased chair push-up hold time relative to a neutral word and increased scores on the following variables linked to state disinhibition: positive emotion, humor, distraction, self-confidence, and psychological flow. Flow is a pleasant psychological state occurring when a person becomes immersed in performing an activity to the exclusion of unrelated cognitions (Csikszentmihalyi, 1990). Stephens et al. hypothesized that flow is related to state disinhibition via increased BAS activation. Flow has also been linked to reduced activation of the salience network, which may map onto increased state disinhibition via reduced BIS activity (van der Linden et al., 2021). However, mediation analyses carried out by Stephens et al. found that only one of the variables linked to state disinhibition mediated the effect of swearing on physical performance: humor. Humor is linked with state disinhibition via activation of the BAS (Stephens et al., 2022). Nevertheless, as this analysis was not preregistered, this was an exploratory finding requiring verification in a further study.

This article builds upon this work by testing the disinhibition hypothesis more rigorously. We conducted two preregistered experiments, similar in design to those of Stephens et al. (2022). Experiment 1 aimed to replicate the beneficial effect of swearing on the chair push-up task and to confirm humor as a mediator of this effect, as found in exploratory analyses by Stephens et al. In addition to humor, Experiment 1 also assessed other variables linked to state disinhibition and assessed the individual difference variable, neuroticism, as likely to moderate the effects of swearing. This predicted effect was based on the theory that trait neuroticism is correlated with trait BIS activation (Hirsh et al., 2011).

Figure 1
Chair Push-Up Task



Note. The task required participants to raise and then support their body weight on their hands against the chair seat for as long as possible. See the online article for the color version of this figure.

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Christopher Richardson

Experiment 1 tested the preregistered hypotheses (aspredicted.org No. 83682) that repeating a swear word, compared with a neutral word, would (a) increase chair push-up hold time, (b) increase psychological flow, (c) increase self-confidence, (d) increase distraction, (e) increase humor, and (f) increase perceived freedom from constraints. Experiment 1 further tested the preregistered hypothesis that the predicted beneficial effects of swearing on chair push-up task performance would be mediated by Smith et al.'s (2020) humor scale and the humor VAS (g, h) and perceived freedom from constraints (i). A final preregistered hypothesis was that the predicted beneficial effect of swearing on physical task performance would be moderated by neuroticism (j).

Experiment 1

Method

Participants

Eighty-eight participants were recruited primarily from the campus community via convenience sampling (Table 1). Inclusion criteria were ages 18–65 years and absence of any health condition, injury, or pain that would impair their ability to exert full physical effort. Informed consent was obtained prior to data collection, and this study gained a favorable opinion from Keele University Psychology Faculty Research Ethics Committee.

Design

A repeated measures design compared performance and psychological responses across two conditions: repeating a self-selected swear word versus a neutral word. The order of conditions was randomized. Dependent variables included chair push-up hold times, and the psychological measures linked to state disinhibition: humor, psychological flow, self-confidence, social desirability, and distraction.

Materials

Vocalizations. Participants selected a swear word they might use after bumping their head and a neutral word they might use to describe a table. At designated times during the procedure, participants repeated their chosen word every 2 s at normal speech volume.

Chair Push-Up Task. As a physical challenge, participants sat on a sturdy chair and placed their hands under their thighs at a 45° angle, with their fingers pointing inward. They were then asked to lift their feet while straightening their arms to support their body weight on their hands for as long as possible (see Figure 1). For safety, participants were asked to stop if they reached 60 s.

Humor. Four measures assessed state humor in response to the vocalizations:

1. A three-item version of Smith et al.'s (2020) scale, adapted to the context of Experiment 1. Responses were recorded using a 7-point Likert scale, with 1 representing *strongly disagree* and 7 representing *strongly agree*. This scale has been shown to be a reliable measure, with Cronbach's α above .90 (Smith et al., 2020).

2. A visual analogue scale (VAS; Hayes & Patterson, 1921) rated funniness from 0 to 100, with 0 representing *strongly disagree* and 100 representing

Table 1
Demographic Data by Experiment

Demographic characteristic	Experiment 1, $N = 88$	Experiment 2, $N = 94$	Stephens et al. (2022), $N = 118$
Females	54	37	53
Males	32	55	63
Nonbinary	1	0	1
Prefer not to disclose	1	2	1
Mean age	26.4	22.4	25.8
SD age	10.5	5.8	10.0

Note. Total $N = 300$.

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Nicholas B. Washmuth

strongly agree, in responses to the single question "Repeating the word was funny or humorous." This VAS is a reliable and valid measure (De Boer et al., 2004).

3. A four-face scale ranging from *not funny* to *very funny* (Purser et al., 2021). Participants selected the face that best reflected their response to vocalizing the words during the exercise task.

4. The two-item 3-Witz Dimensionen scale (Ruch, 1992), measuring both the funniness and aversiveness of a 7-point Likert scale. Numerous studies have demonstrated the 3-Witz Dimensionen scale's reliability, with Cronbach's α value above .80 (Ruch, 1992).

Psychological Flow. Flow during the chair push-up task was measured using a three-item flow index on a 7-point Likert scale, assessing enjoyment, task engagement, and skill-challenge balance (Ulrich et al., 2014). This psychological flow index has demonstrated acceptable reliability, with a Cronbach's α of .80 (Ulrich et al., 2014).

Self-Confidence. The five-item self-confidence subscale from the Revised Competitive State Anxiety Inventory–2 scale was used to assess participants' self-confidence during the chair push-up task (Cox et al., 2003). This subscale has demonstrated strong reliability, with a Cronbach's α above .80 (Cox et al., 2003).

Social Desirability. A two-item measure was used to measure social desirability (Steidle & Werth, 2014). Participants responded on a 5-point Likert scale, with each end of the scale anchored by bipolar adjectives. The first pair of adjectives was *externally controlled* versus *self-determined*, and the second pair was *inhibited* versus *self-assured*. This scale has demonstrated reliability (Jacobs & Scholl, 2005; Ryan & Deci, 2000).

Distraction. A VAS measured distraction ("Repeating the word distracted me from thinking about other things") on a scale of 0 (*not at all*) to 100 (*a lot*).

Procedure

In line with Stephens et al.'s (2022) study, all data collection was conducted via a Microsoft Teams video meeting using a standardized script. After obtaining informed consent and collecting demographic information, participants completed the chair push-up task, holding as long as possible. During the chair push-up task, participants were required to repeat their self-select word—either the swear word or neutral word, depending on randomization. To minimize online disinhibition, participants were instructed to maintain eye contact with the experimenter by looking at the experimenter's eyes on their screen (Lapidot-Lefler & Barak, 2012). The researcher avoided providing direct feedback on performance to avoid influencing subsequent trials. After each trial, participants completed the psychological measures in random order. The procedure was then repeated with the other word condition.

Statistics

Outliers, defined at the upper end as scores more than three times the interquartile range above the 75th percentile value and at the lower end as scores more than three times the interquartile range below the 25th percentile value, were winsorized (Field, 2017). Hypotheses a–f were tested using one-way repeated measures analysis of variance. Hypotheses g–i were tested using repeated measures mediation analysis developed by Montoya and Hayes (2017).

Results

Descriptive data are reported in Table 2. Chair push-up hold times were longer in the swear word condition, $F(1, 87) = 8.432$, $p = .005$, $\eta_p^2 = .088$. Relative to a neutral word, the swear word condition also showed increases in psychological flow, $F(1, 87) = 25.975$, $p < .001$, $\eta_p^2 = .230$; distraction, $F(1, 87) = 23.166$, $p < .001$, $\eta_p^2 = .210$; humor VAS, $F(1, 87) = 36.761$, $p < .001$, $\eta_p^2 = .297$; Ruch's 3-Witz Dimensionen humor scale, $F(1, 87) = 6.869$, $p = .010$, $\eta_p^2 = .073$; the Purser humor scale, $F(1, 87) = 40.682$, $p < .001$, $\eta_p^2 = .319$; and perceived freedom from constraints, $F(1, 87) = 11.728$, $p < .001$, $\eta_p^2 = .119$. However, there were no significant differences between the swear word and neutral word conditions for Smith et al.'s (2020) humor scale, $F(1, 87) < 1.0$, $\eta_p^2 = .009$, or self-confidence, $F(1, 87) = 3.726$, $p = .057$, $\eta_p^2 = .041$.

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Table 2
Descriptive Data: Experiment 1

Dependent variable	*M*	*SD*	Winsorization percentile
Chair push-up score (s)			
Neutral	24.19	18.13	
Swear	26.92	11.36	
Flow scale			
Neutral	10.72	3.81	93rd
Swear	12.46	4.36	
Self-confidence scale			
Neutral	24.02	7.89	
Swear	25.50	7.33	
Distraction VAS			
Neutral	60.56	22.62	
Swear	70.35	18.80	97th
Humor VAS			
Neutral	56.90	27.48	
Swear	75.05	21.63	94th
Smith, Hoogland and Brown humor scale			
Neutral	13.59	4.40	99th
Swear	17.03	3.48	95th
Ruch's 3-Witz Dimensionen humor scale			
Neutral	0.98	2.12	98th
Swear	1.71	2.54	
Purser humor scale			
Neutral	2.43	0.80	
Swear	1.82	0.72	
Freedom from constraints			
Neutral	6.84	1.89	
Swear	7.51	1.76	

Note. VAS = visual analogue scale.

In the mediation analyses, neither Smith et al.'s (2020) humor scale (coefficient = 1.19, $p > .05$) nor the humor VAS (coefficient = −0.10, $p > .05$) was found to mediate the effect of swearing on chair push-up time. However, perceived freedom from constraints was found to mediate the beneficial effects of swearing on physical performance (coefficient = 0.76, $p < .05$; see Figure 2a). Exploratory analyses indicated that flow significantly mediated the effect (coefficient = 1.31, $p < .05$; see Figure 2b); however, distraction (coefficient = 0.38, $p > .05$) and self-confidence (coefficient = 0.75, $p > .05$) showed no mediation effects.

A general linear model assessing the interaction of vocalization (swear vs. neutral word) and neuroticism ($M = 26.66$, $SD = 3.95$, winsorized at 99th percentile) on chair push-up time found no significant effect, $F(1, 86) < 1.0$, $\eta_p^2 < .001$.

Discussion

In supporting the preregistered hypothesis that swearing would benefit chair push-up time, Experiment 1 provided a replication of this effect. The results also supported the preregistered hypotheses that swearing would increase psychological flow, distraction, social desirability, and humor, consistent with the theory that swearing benefits physical performance via state disinhibition. However, the mediation analyses provided mixed support for the state disinhibition theory. The absence of the hypothesized mediating effect of humor detracts from the state disinhibition theory, but the mediation effect for perceived freedom from constraints supports the state disinhibition theory. The exploratory mediation analysis showing that flow was a significant mediator also supports the state disinhibition theory, although flow was not a significant mediator in Stephens et al.'s (2022) study, indicating an inconsistent effect. The absence of a moderating effect of neuroticism suggests either that BIS activity is unrelated to the effect of swearing on physical performance, which would undermine the state disinhibition theory, or that baseline BIS is not important when considering the effects of reduced BIS activity.

Introduction: Experiment 2

A second preregistered experiment (https://aspredicted.org No. 123103) was conducted to further evaluate the effects of swearing on chair push-up performance and to test the state disinhibition theory. Experiment 2 employed a novel means of assessing state disinhibition in the context of swearing, bystander apathy, a variable that has been linked with state disinhibition via BIS activity (van den Bos et al., 2009). Experiment 2 also assessed the following variables linked to state disinhibition: flow, self-confidence, somatic and cognitive anxiety, positive and negative emotion, humor, distraction, novelty, state BIS, and state BAS.

For Experiment 2, it was hypothesized that repeating a swear word, compared with a neutral word, would (a) increase chair push-up hold time; (b) increase psychological flow, self-confidence, somatic anxiety, positive emotion, humor, distraction, novelty, and state BAS; and (c) decrease bystander apathy, state BIS, cognitive anxiety, and negative emotion. Additionally, we hypothesized that the impact of swearing on the chair push-up task would be mediated by (d) bystander apathy, (e) state BAS, (f) state BIS, and (g) flow.

Method

Participants

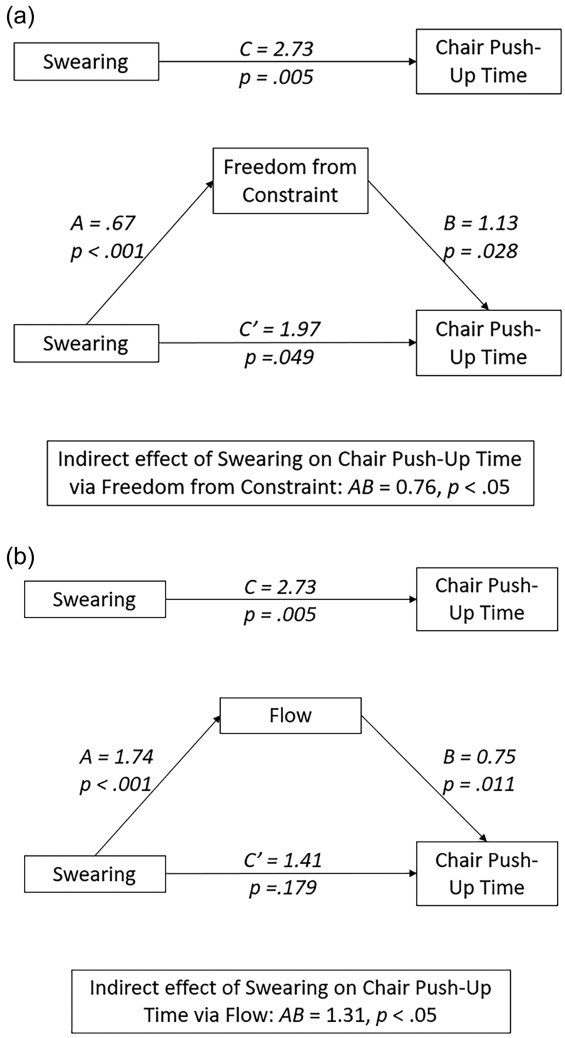
Ninety-four participants were recruited using procedures consistent with Experiment 1. Demographic characteristics are reported in Table 1. All participants provided informed consent. The study was approved by Keele University Psychology Faculty Research Ethics Committee.

Design

A repeated measures experimental design was used, comparing performance and psychological outcomes between swearing and neutral word conditions. In addition to variables from Experiment 1, Experiment 2 included assessments of bystander apathy, somatic and cognitive

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Figure 2
Mediation Effects of Perceived Freedom From Constraints (a) and Flow (b) on the Effect of Swearing on Chair Push-Up Time



anxiety, VASs for novelty, positive and negative emotion, and state BIS/BAS.

Materials

Vocalizations, Chair Push-Up Task, Psychological Flow, Self-Confidence, Distraction, and Humor. These measures were administered as in Experiment 1.

State BIS/BAS. The 20-item scale (van den Bos et al., 2009) was used to measure state disinhibition across four subscales: state BIS (e.g., "At this moment, I worry about making mistakes"; Cronbach's $\alpha = .72$), BAS reward responsiveness (e.g., "At this moment, it would excite me to win a contest"; Cronbach's $\alpha = .73$); BAS drive (e.g., "At this moment, I would go out of my way to get things I want"; Cronbach's $\alpha = .76$), and BAS fun seeking (e.g., "At this moment I would be willing to try something new if I think it will be fun"; Cronbach's $\alpha = .66$). Items were rated on a 7-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).

VASs. Participants rated both the swear and neutral world vocalizations on VASs for novelty ("Repeating the word felt like a new or different experience"), positive emotion ("Repeating the word made me feel a positive emotion along the lines of excitement or happiness"), and negative emotion ("Repeating the word made me feel a negative emotion along the lines of anger or sadness"). Responses ranged from 0 (*not at all*) to 100 (*a lot*) and were validated by Stephens and Robertson (2020) and Stephens et al. (2022).

Somatic Anxiety and Cognitive Anxiety. The 17-item Revised Competitive State Anxiety Inventory–2 scale (Cox et al., 2003) measured cognitive anxiety (five items, e.g., "I am concerned about losing"; Cronbach's $\alpha = .81$) and somatic anxiety (seven items, e.g., "My body feels tense"; Cronbach's $\alpha = .81$). Score ranged from 10 to 40, with higher scores indicating higher levels of each construct.

Bystander Apathy. Adapted from van den Bos et al. (2009), participants read vignettes describing scenarios in which someone needed help (e.g., a lost person) and rated their likelihood, speed, and extent of helping. Each response was on a 0–100 scale, with scores averaged into a single index.

Procedure

Procedures mirrored Experiment 1, except that participants repeated their assigned word for 20 s prior to and during the chair push-up task, following the protocol used in Stephens et al. (2022).

Statistics

Outliers were defined and winsorized using the same criteria as in Experiment 1. Hypotheses a–c were tested using one-way repeated measures analysis of variance. Hypotheses d–g (mediation effects) were tested using Montoya and Hayes's (2017) repeated-measures mediation framework with 5,000 bootstrapped samples and 95% confidence intervals.

Results

Descriptive data are reported in Table 3. Chair push-up performance improved in the swearing condition compared with the neutral condition, $F(1, 93) = 9.654$, $p = .003$, $\eta_p^2 = .094$. The swear word condition also resulted in greater positive emotion, $F(1, 93) = 23.550$, $p < .001$, $\eta_p^2 = .202$; humor $F(1, 93) = 13.181$, $p < .001$, $\eta_p^2 = .124$; distraction, $F(1, 93) = 10.847$, $p < .001$, $\eta_p^2 = .104$; novelty $F(1, 93) =$

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Table 3
Descriptive Data: Experiment 2

Dependent variable	*M*	*SD*	Winsorization percentile
Chair push-up score (s)			
Neutral	24.55	17.47	
Swear	26.97	17.51	
Flow scale			
Neutral	11.50	4.74	
Swear	12.07	4.65	
Self-confidence scale			
Neutral	24.38	7.94	
Swear	25.34	7.30	
Distraction VAS			
Neutral	51.27	33.05	
Swear	62.77	29.13	
Humor VAS			
Neutral	52.16	32.60	
Swear	62.96	32.14	
Somatic anxiety scale			
Neutral	20.43	5.90	98th
Swear	20.99	6.10	
Cognitive anxiety scale			
Neutral	18.72	7.15	97th
Swear	20.11	8.44	
Positive emotion VAS			
Neutral	26.10	23.76	
Swear	39.73	26.79	97th
Negative emotion VAS			
Neutral	12.23	16.28	
Swear	21.64	22.66	87th
Novelty VAS			
Neutral	50.12	32.41	
Swear	41.45	31.56	
BIS rating			
Neutral	23.02	7.44	
Swear	23.81	7.04	
BAS reward rating			
Neutral	22.62	4.91	98th
Swear	22.90	4.67	98th
BAS drive rating			
Neutral	14.72	4.77	
Swear	15.46	4.68	97th
BAS fun rating			
Neutral	16.20	4.46	
Swear	16.77	4.07	96th
Bystander apathy			
Neutral	45.45	18.84	97th
Swear	43.78	14.65	

Note. VAS = visual analogue scale; BIS = behavioral inhibition system; BAS = behavioral activation system.

7.576, $p = .007$, $\eta_p^2 = .075$; and negative emotion, $F(1, 93) = 19.297$, $p < .001$, $\eta_p^2 = .172$. Counter to our hypothesis, the swear word condition resulted in significantly higher, instead of lower, levels of cognitive anxiety, $F(1, 93) = 4.543$, $p = .036$, $\eta_p^2 = .047$. There was no significant difference between the swear word and neutral word conditions for psychological flow, $F(1, 93) = 3.328$, $p = .071$, $\eta_p^2 = .035$; self-confidence, $F(1, 93) = 2.439$, $p = .122$, $\eta_p^2 = .026$; somatic anxiety levels $F(1, 93) = 1.716$, $p = .193$, $\eta_p^2 = .018$; state BIS, $F(1, 93) = 2.306$, $p = .132$, $\eta_p^2 = .024$; for the three state BAS scores, namely, reward $F(1, 93) = 0.452$, $p = .503$, $\eta_p^2 = .005$; drive $F(1, 93) = 3.854$, $p = .053$, $\eta_p^2 = .040$; and fun $F(1, 93) = 3.522$, $p = .064$, $\eta_p^2 = .036$; and for bystander apathy, $F(1, 93) = 3.522$, $p = .064$, $\eta_p^2 = .036$.

Separate mediation analyses showed no mediating effect for bystander apathy (coefficient = 0.02, $p > .05$), state BAS (coefficient = 0.42, $p > .05$), state BIS (coefficient = 0.08, $p > .05$), or flow (coefficient = 0.33, $p > .05$). Exploratory mediation analyses showed a significant mediation effect of distraction (coefficient = 0.51, $p < .05$; see Figure 3), but no mediation effect for humor (coefficient = 0.10, $p > .05$) or self-confidence (coefficient = 0.37, $p > .05$).

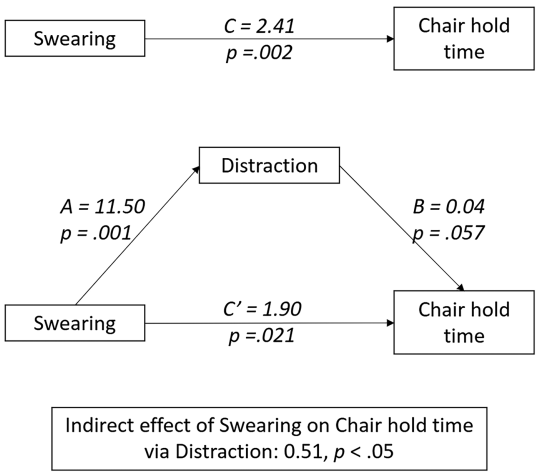
Discussion

Experiment 2 further replicated, via a preregistered hypothesis test, a beneficial effect of swearing on chair push-up time, offering further support for the beneficial effect of repeating a swear on physical task performance. Several psychological variables linked to state disinhibition, including positive emotion, humor, distraction, and novelty, also increased in the swearing condition, aligning with the theory that swearing facilitates a shift toward a more action-oriented psychological state. However, mediation analyses offered limited support for the state disinhibition hypothesis. None of the preregistered mediators (bystander apathy, state BIS/BAS, or flow) significantly explained the swearing effect. These null results may reflect measurement limitations, insufficient sensitivity to capture subtle psychological changes, or a true absence of mediation by these variables. Exploratory analysis identified distraction as a significant mediator. This finding supports the idea that swearing may disrupt irrelevant thoughts, thereby enhancing task focus, a mechanism consistent with disinhibition models (Hirsh et al., 2011). However, other hypothesized mediators, including humor and self-confidence, did not show significant results.

Taken together, the evidence across Experiments 1 and 2 presented here, and the previous experiment carried out in our lab (Stephens et al., 2022), offers partial support for the state disinhibition theory. Although swearing reliably improved performance and influenced several disinhibition-related constructs, the inconsistency of mediation findings limits strong conclusions. These results highlight the need for larger sample sizes and stronger statistical power to detect mediation effects (Pan et al., 2018). The three experiments, that of Stephens et al. (2022), Experiment 1, and Experiment 2, comprised a common design of a repeated measures test of the effect of repeating a swear versus neutral word on chair push-up time. Each measured a core set of variables linked to state disinhibition: flow, humor, distraction, and self-confidence. To address the limitations in statistical power, data from Stephens et al.'s; ($N = 118$) study, Experiment 1 ($N = 88$), and Experiment 2 ($N = 94$) were aggregated, resulting in a combined sample size of $N = 300$. We analyzed the aggregated data to test the hypotheses that repeating a swear word,

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Figure 3
Mediation Effect of Distraction on the Effects of Swearing on Chair Push-Up Time



compared with a neutral word, would (a) increase chair push-up hold time and (b) increase psychological flow, humor, distraction, and self-confidence and that (c) flow, humor, distraction, and self-confidence would mediate the effect of swearing on chair push-up task performance.

Aggregated Data Analysis

Descriptive data are presented in Tables 1 and 4. Across the three experiments, chair push-up time was significantly longer for the swearing condition, $F(1, 297) = 28.766, p < .001, \eta_p^2 = .088$. Adding data set as a second factor (Experiment 1 versus Experiment 2 versus that of Stephens et al., 2022) showed no main effect of data set, $F(2, 297) < 1.0$, and no interaction effect, $F(2, 297) < 1.0$. Swearing also showed significantly increased flow, $F(1, 299) = 24.535$, $p < .001$, $\eta_p^2 = .076$; humor, $F(1, 299) = 84.347$, $p < .001$, $\eta_p^2 = .221$; distraction, $F(1, 299) = 43.657$, $p < .001$, $\eta_p^2 = .128$; and self-confidence, $F(1, 299) = 12.472$, $p < .001$, $\eta_p^2 = .040$.

Table 4
Descriptive Data: Aggregated Data File

Dependent variable	*M*	*SD*
Chair push-up score (s)		
Neutral	25.36	17.39
Swear	27.97	17.11
Flow scale		
Neutral	11.87	4.51
Swear	12.79	4.48
Self-confidence scale		
Neutral	24.06	7.68
Swear	25.38	7.51
Distraction VAS		
Neutral	55.91	28.33
Swear	66.41	25.32
Humor VAS		
Neutral	54.67	30.66
Swear	70.63	27.76

Note. $N = 300$. VAS = visual analogue scale.

Separate mediation models for the effect of swearing on chair push-up time showed that flow (coefficient = 0.60, $p < .05$), distraction (coefficient = 0.56, $p < .05$), and self-confidence (coefficient = 0.54, $p < .05$) were significant mediators, although humor was not a significant mediator (coefficient = 0.41, $p > .05$). These mediation effects are shown in Figure 4. A mediation model looking at the combined mediation effects of flow, distraction, and self-confidence showed that all three remained significant mediators when included simultaneously in the mediation model (see Figure 5). Moreover, the residual effect of swearing on chair push-up time was reduced when all three mediators were included ($C' = 1.42$, $p < .005$) compared when each mediator was analyzed separately ($C' = 2.01$–2.06, $p < .001$), showing that, combined, these three mediators explained more of the variance.

Transparency and Openness

Preregistration, materials, data, and analysis code are publicly available on the Open Science Framework at https://osf.io/qyv3b/.

General Discussion

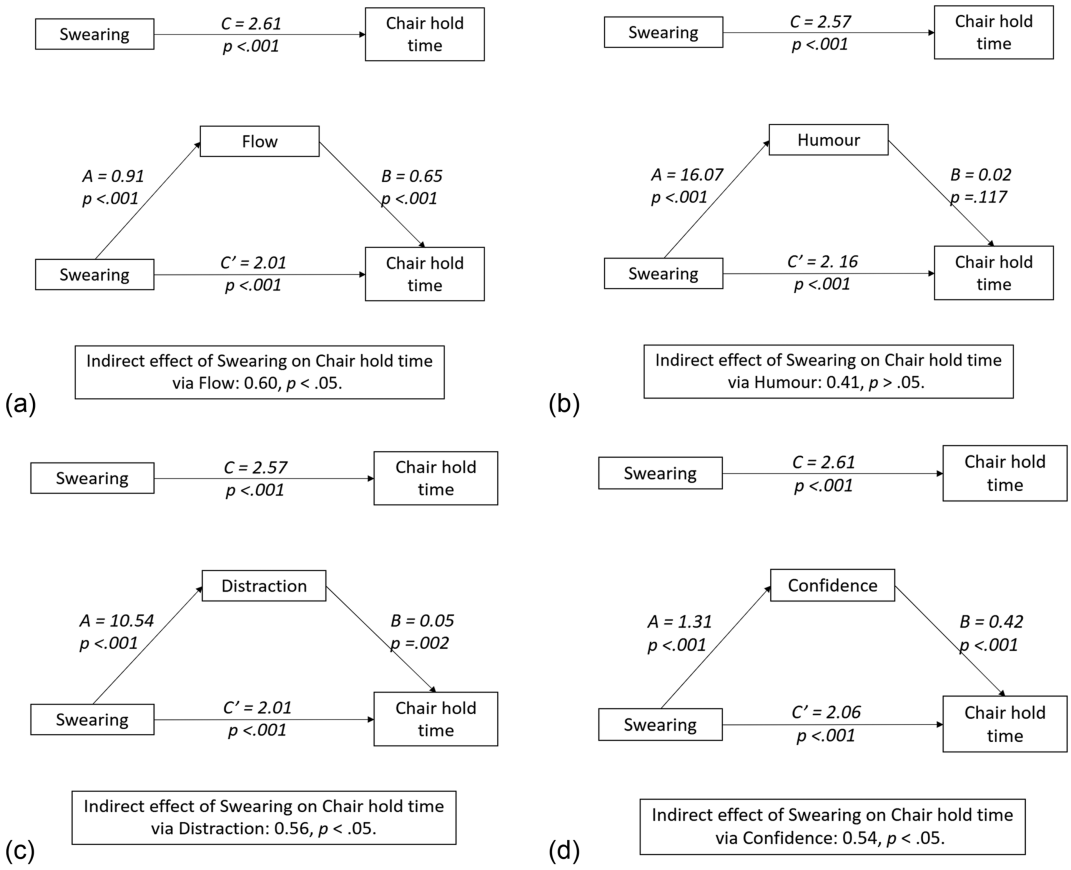
This study aimed to replicate prior findings that swearing improves physical performance and to investigate whether constructs related to state disinhibition could explain these effects. The results from the preregistered Experiments 1 and 2 presented here replicated the findings from the preregistered study of Stephens et al. (2022), confirming that swearing improves chair push-up task performance. Together with previous data (Jiannine & Antonio, 2023; Stephens et al., 2018, 2022; Washmuth et al., 2024), there is strong evidence that repeating a swear word enhances physical performance in short, intense tasks. While mediation analyses within the individual experiments yielded mixed results, when the data were aggregated across the two experiments presented here, and a comparable previous experiment carried out in our lab, we found that psychological flow, distraction, and self-confidence were significant mediators of the effect of swearing on physical performance, although, contrary to our hypothesis and the findings of Stephens et al., humor did not mediate this effect.

The analysis of the aggregated data set appeared to support the assumption that low statistical power contributed to the inconsistent mediation effects observed across the individual experiments. The increased statistical power obtained by pooling the data confirmed the hypothesized mediation effects by variables related to state disinhibition, namely, psychological flow, distraction, and self-confidence. These findings, therefore, support a role for state disinhibition

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Figure 4

Mediation Effects of Flow (a), Humor (b), Distraction (c), and Self-Confidence (d) in the Combined Data Set



Note. $N = 300$.

in explaining, psychologically, the mechanism by which swearing improves physical performance.

A key strength of the data and analyses presented here was that all three data sets originated from preregistered studies. Although mediator variables were not consistently specified across all preregistrations, psychological flow was specified in the preregistrations for Experiment 2 and for Stephens et al.'s (2022) study. This evidences that the researchers hypothesized a priori that flow would mediate the effect of swearing on physical task performance, supporting the interpretation of these mediation analyses as confirmatory. Furthermore, there was no evidence of carryover effects consistent with state disinhibition levels being raised for the neutral word condition wherein this condition was encountered second, after swearing, compared with the neutral condition encountered first (see Supplemental Material "Order Effects").

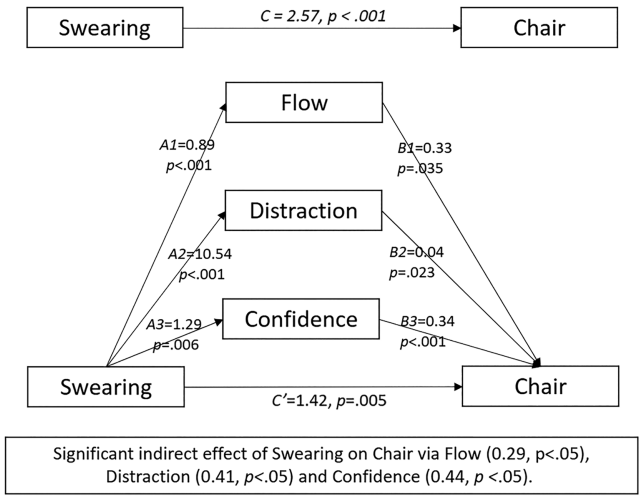
Several limitations should be noted in studies presented. First, the analysis of the aggregated data was not preregistered. However, the conception of combining the data occurred after all the data had been collected, and open science guidelines advise preregistering prior to data collection, which was not possible in this case. Because meta-analysis of mediation effects is not yet developed, particularly for repeated measures designs (Tudur Smith et al., 2016; Vo & Vansteelandt, 2022), direct aggregation is a reasonable and informative method.

Second, the variance explained in the combined analysis was relatively modest, at $R^2 = 0.14$, suggesting that the combined model illustrated in Figure 4 explains 14% of the variance in the effect of swearing on chair push-up time. While modest, this proportion is meaningful in the context of complex psychological and physiological interactions that govern physical output (Raz & Lahad, 2022). Strength is influenced by both neural and muscular factors (Akbar et al., 2022; French et al., 2007), and even small shifts in motivation, confidence, focus, and perception of effort can substantially impact exertion (Ballmann, 2021; Chua et al., 2021; Gould & Udry, 1994; Marcora et al., 2009; Van Cutsem et al., 2017). Nevertheless, there are likely other mechanisms through which swearing may influence physical task performance.

Expectancy (i.e., placebo) effects are likely given it is not possible to blind participants to the swearing manipulation.

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Figure 5
Mediation Effects of Flow, Distraction, and Self-Confidence in Parallel



Placebo effects are understood as psychologically activated processes with neurobiological underpinnings (Price et al., 2008). For swearing and strength, it is likely that similar or identical mechanisms are tapped by the intervention (swearing) and placebo (psychologically activated beliefs about the intervention) such that meaningfully disentangling these may not be possible. Swearing may also lead to heightened emotional arousal with potential to bring about psychological and psychobiological changes separate from disinhibition that might contribute to strength task performance. Numerous studies have shown psychophysiological responses following swearing (e.g., Bowers & Pleydell-Pearce, 2011) although we note here that it was research from our own lab showing strength effects of swearing in the absence of psychophysiological responses (Stephens et al., 2018) that lead to theorizing around the mechanism linked to state disinhibition. Future research should investigate other mechanisms by which swearing leads to strength performance benefits beyond state disinhibition.

Another possible limitation is a potentially flawed casual mediation analysis due to investigators not properly checking that the sequential ignorability assumption has been met (Wulff et al., 2023). The sequential ignorability assumption has two levels. First, that there is equipoise across experimental conditions, which can usually be met by randomly allocating participants to conditions (Imai et al., 2010). Second, that there is equipoise across the mediator variable(s), which is usually not met in experiments because mediator variables are usually measured rather than subject to random (Imai et al., 2010). Our mediation analysis relies on measured rather than experimentally manipulated mediators (e.g., flow), leaving open a reverse causal interpretation that perceived quality of performance of the chair push-up task might have influenced scores on mediator variables such as flow (Y → M) rather than the theorized X → M → Y causal pathway. Recently, the "manipulation-of-mediation-as-a-moderator (MMM) design" (Ge, 2023) has been proposed to avoid this interpretative problem. The design features a manipulation of the mediator, for example, in this case, having a low and high flow manipulation alongside the swearing versus neutral word condition. We recommend this approach in future research on this topic.

Theoretical Implications

Our theoretical position is that swearing brings about a state of disinhibition, temporarily tending toward behaviors that are undercontrolled rather than overcontrolled, as a consequence of reduced state BIS and increased state BAS activation. In turn, this state of disinhibition leads to increased performance of a physical strength task through release from holding back. We did not show a mediation effect for state BIS or state BAS, but this mediation analysis, applied only to the Experiment 2 data set, was underpowered. However, we did show that flow, distraction, and self-confidence mediated the effect of swearing on the chair push-up task. It is worth considering how each of these constructs is linked to state disinhibition.

We contend that flow is a disinhibited state given its characterization as effortless performance, which speaks to undercontrolled behavior, and given also that the absence of self-consciousness, consistent with the silenced BIS route to disinhibition (Hirsh et al., 2011), is one of the nine elements in the flow theory formulation (Csikszentmihalyi, 1990). To be in flow is to be disinhibited and vice versa. Increased distraction (by swearing) in the swearing condition also speaks to undercontrolled behavior consistent with state disinhibition because the cognitive distraction of the swear word reduces available cognitive bandwidth to ruminate about the strength task, leading to a more free, unconstrained attempt. In support, reduced cognitive bandwidth was discussed by Hirsh et al. (2011) as a pathway to state disinhibition. Finally, increased self-confidence is also consistent with swearing-induced state disinhibition, as self-confidence is consistent with both the BAS activation pathway to state disinhibition and fewer self-critical thoughts, consistent with the lowered BIS activity pathway to state disinhibition (Hirsh et al., 2011).

The mediation model in Figure 5 combined these three constructs linked to state disinhibition to explain the mechanism by which swearing benefits physical task performance. It would be useful to explore in further research which of these constructs are more central to the construct of state disinhibition and which may be better understood as correlates or downstream outcomes of a disinhibited state. We should add that we do not claim to have isolated an exhaustive list of state disinhibition elements relevant to this

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context and further research could expand these. However, in demonstrating mediation effects of these variables, which are theoretically linked to the state disinhibition construct, we have added further support to our thesis that state disinhibition explains, at least in part, how swearing may benefit physical performance.

In terms of the broader theoretical significance, several theories have been put forward to explain how expressive acts like shouting or grunting positively impact physical performance. At a psychophysiological level, noise generated by vocalizations may heighten arousal by activating the sympathetic nervous system, boosting adrenaline and readiness for action (Goyal et al., 2010). Shouting may also increase motor unit recruitment, leading to increased muscle contraction force (Takarada & Nozaki, 2021), and forceful air exhalation may increase muscle effort by stabilizing the body's core (Hackett & Chow, 2013). Vocalizing the expression "ow" has further been found to reduce pain perception, possibly allowing greater physical effort to be exerted before reaching a pain threshold (Swee & Schirmer, 2015). Fewer theories exist at a psychological level. One is that the loudness of a vocalization serves to display dominance, intimidating others (Anikin et al., 2024), although this is not applicable to the opponentless task deployed in the present study. The state disinhibition theory can be traced back to an article from the 1960s suggesting that shouting, loud noise, alcohol, and other interventions shown to boost physical strength did so by reducing inhibitions (Ikai & Steinhaus, 1961). However, these pioneering authors neither measured psychological disinhibition nor assessed whether it mediated the observed effects. Therefore, our article moves forward a literature assessing the effects of expressive acts, like shouting or grunting, on physical performance by evidencing a previously discussed psychological mechanism linked to state disinhibition.

Conclusions

The two experiments presented in this article have replicated the beneficial effect of swearing on physical task performance, confirming that this is a robust and reliable outcome. While the individual experiments showed mixed evidence regarding the role of state disinhibition as the underlying mechanism, the aggregation of data from these two and a previous preregistered experiment suggest that swearing improved performance by increasing psychological flow, enhancing self-confidence, and reducing distraction. These data support the contention that swearing functions as a simple, cheap, widely accessible technique for rapidly counteracting tendencies to hold back.

Although the effects demonstrated here are specific to swearing and physical strength, we propose that the underlying mechanism will generalize to other situations wherein success depends on overcoming hesitation. Repeating a swear word at key moments, particularly when individuals feel challenged or outside their comfort zone, may serve as a strategic tool. Our findings suggest that swearing, a simple and widely accessible form of language, can help counteract the tendency to hold back. In doing so, it empowers individuals to perform closer to their full potential and, ultimately, to achieve greater success.

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