



# Testing a new indirect measure of general self-worth: The Self-esteem Questionnaire-based Implicit Association Test

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The self-esteem Questionnaire-based Implicit Association Test (SE-qlAT) provides an indirect assessment of general self-worth that is based on the items of the well-validated Rosenberg Self-Esteem Scale (RSES), and the structure of this variant of the IAT enables a clearer interpretation, compared with the conventional self-esteem IAT. Study 1 ( $N = 224$ ) provided support for the internal consistency, test–retest reliability, and implicit–explicit convergent validity of the SE-qlAT. In Study 2 ( $N = 305$ ), the correlation of the SE-qlAT with the explicit RSES was replicated, and it was larger than the correlations of the SE-qlAT with other self-reports. As to criterion validity, the SE-qlAT moderated the effect of a mild social threat (being excluded in the Cyberball game) on participants' performance in a subsequent anagram task, and this effect was incremental to the explicit self-esteem assessment. In Study 3 ( $N = 334$ ), the SE-qlAT correlated positively with the self-esteem IAT and negatively with a measure of depression. The two implicit tasks correlated uniquely with each other, above and beyond the variance they each shared with the explicit RSES. Taken together, these findings provide initial support for the reliability and validity of the SE-qlAT.

Implicit–explicit relationships of attitudes about the self tend to be weaker compared with other types of attitudes (e.g., political, racial; De Cuyper et al., 2017; Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005), especially when assessing general self-esteem. A great deal of research suggests that the convergent validity of implicit self-esteem with parallel explicit measures and the criterion validity of this construct are exceptionally low (Bar-Anan & Nosek, 2014; for reviews see Buhrmester, Blanton, & Swann, 2011; Falk & Heine, 2015; Hofmann, Gawronski, et al., 2005; Schimmack, 2021). In this paper, we present a new indirect measure of general self-esteem, which was designed reflect closely the characterizations of this construct (e.g., Baumeister, Campbell, Krueger, & Vohs, 2003).

Compared with some other aspects of the self that have been assessed indirectly (e.g., Big Five traits; Back, Schmukle, & Egloff, 2009), the conceptualizations – and consequently the operationalizations – of explicit and implicit self-esteem diverge in more fundamental ways. For example, the stimuli that are commonly used in self-IATs that measure extraversion (e.g., *sociable*, *reserved*) are single words rather than propositions, but their content is fairly similar to the items of parallel explicit instruments (e.g., 'I start conversations', 'I keep in the background'; Goldberg et al., 2006). This is not the case with

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self-esteem. Explicit self-esteem commonly refers to favourable versus unfavourable overall evaluation of the self (Baumeister et al., 2003). Accordingly, the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), which is the most frequently used self-report measure of this construct (Baumeister et al., 2003; Sowislo & Orth, 2013), includes items such as ‘I am able to do things as well as most other people’ and ‘All in all, I am inclined to think that I am a failure’ (reverse-scored). Implicit self-esteem, on the other hand, has been conceptualized differently. Greenwald et al. (2002), for example, defined it as ‘...the association of the concept of self with a valence attribute’ (p. 5). The IAT, which is the most reliable (e.g., Krause, Back, Egloff, & Schmukle, 2011) and most frequently used measure of implicit self-esteem (Buhrmester et al., 2011), follows this definition directly. The self-esteem measurement of the IAT is typically based on the association between stimuli related to the self (vs. other people) and positive (e.g., *paradise, pleasure*) versus negative words (e.g., *poison, grief*; Greenwald & Farnham, 2000). Thus, the content that is routinely used for the indirect measurement of self-esteem (e.g., ‘paradise’ vs. ‘poison’) diverges more substantially from the content of common parallel self-report instruments, compared with other aspects of the self (e.g., ‘sociable’ vs. ‘reserved’ for extraversion). As Gawronski (2019) recently suggested, to better understand the nature of implicit compared with explicit assessment, it is crucial to employ measures that resemble each other in terms of the assessed content.

The Questionnaire-Based Implicit Association Test (qIAT; Friedman, Katz, Cohen, & Yovel, 2021; Yovel & Friedman, 2013), which follows earlier variants of the IAT (Greenwald, McGhee, & Schwartz, 1998; Sartori, Agosta, Zogmaister, Ferrara, & Castiello, 2008), provides an indirect assessment that is based on the items of common self-report scales. The score of this task is based on the speed of classification of such items (e.g., ‘I talk a lot to different people at parties’, ‘I am quiet around strangers’) to relevant target categories (e.g., extravert vs. introvert, respectively), when they need to be classified interchangeably with logical true (e.g., ‘I am in front of the computer’) versus false (e.g., ‘I am climbing a steep mountain’) self-related statements (cf. Sartori et al., 2008). As in other versions of the IAT, the outcome of the qIAT is based on facilitation and inhibition processes that result from the different pairings of categories in the different parts of this task. Specifically, the qIAT includes two types of double classification blocks. In each, a different pair of categories is combined (i.e., ‘extravert’ with ‘true’ and ‘introvert’ with ‘false’, vs. ‘introvert’ with ‘true’ and ‘extravert’ with ‘false’). The outcome is based on the standardized difference in response times between these two parts of the task (Greenwald, Nosek, & Banaji, 2003). Notwithstanding existing controversies regarding the definition of implicit assessment (e.g., de Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009; Perugini, Hagemeyer, Wrzus, & Back, 2021), which are beyond the scope of the present paper, this assessment procedure is considered indirect because it does not require any awareness of the connections between the response and what is being measured (Greenwald & Lai, 2020; Nosek, Hawkins, & Frazier, 2011).

The qIAT and the parallel self-report scale typically use the exact same set of target items. Therefore, implicit–explicit dissociations between these modes of assessment need to be attributed to other factors (Gawronski, 2019; Nosek et al., 2011; Perugini et al., 2021; Schnabel & Asendorpf, 2010). Also, the qIAT measures the extent to which people associate the target construct with self-related truth. It thus resembles the assessment method of most self-report questionnaires, in which people are usually asked to rate the degree to which each item is true about themselves (e.g., using a Likert scale). More importantly, this procedure addresses some of the limitations associated with the commonly used self-concept IAT (see De Cuyper et al., 2017), which measures the

association between the self (vs. others) and the target construct. The nature of these ‘others’ in the IAT may not be clear, and moreover, the obtained score confounds self-positive with others negative associations (Karpinski & Steinman, 2006). Critically, the association measured by the IAT is broad and ambiguous, and it may actually reflect several different relationships between the self and the measure construct (e.g., ‘I am an extravert person’, ‘I wish I were an extravert person’; de Houwer, 2014). To illustrate, depression is expected to be associated with low self-esteem (e.g., Haaga, Dyck, & Ernst, 1991). However, such effects have been consistently observed when self-esteem was measured directly (Sowislo & Orth, 2013) but not indirectly (Franck, De Raedt, & De Houwer, 2008). Remue and colleagues (Remue, Hughes, De Houwer, & De Raedt, 2014) suggested that the mere association between concepts (i.e., the self and self-esteem) assessed by the self-concept IAT may actually reflect different propositional relationships for different people (e.g., ‘I am good’ vs. ‘I want to be good’).

In the qIAT, the self is *not* the target. Instead, the target is the measured trait (e.g., general self-esteem), the attribute represents self-related truth, and the task’s score is expected to reflect the association between these concepts. Thus, the outcome of the qIAT is designed to reflect unambiguously the extent to which individuals associate high versus low levels of the measured construct with truth about themselves.

The qIAT may help bridge the conceptual and operational gap that currently exists between implicit and explicit self-esteem. As opposed to the conventional self-esteem IAT (SE-IAT), the self-esteem qIAT (SE-qIAT) uses the original items of the well-validated RSES. Thus, its target stimuli better represent the measured construct (i.e., general self-esteem) and minimize extraneous influences on implicit–explicit relationships (e.g., Gawronski, 2019). Also, paralleling the explicit scale, the SE-qIAT score unambiguously reflects the extent to which people associate favourable versus unfavourable global self-evaluation (i.e., the construct measured by the RSES items) with truth about the self.

The qIAT has been previously used for the assessment of several self-related constructs, including extraversion (Yovel & Friedman, 2013), shame aversion (Currie, Katz, & Yovel, 2017), and conscientiousness (Friedman et al., 2021). Taken together, findings supported the reliability and validity of this indirect assessment procedure. Here, for the first time, we tested the utility of the qIAT in the implicit assessment of general self-esteem. In Study 1, we examined the reliability and the implicit–explicit convergent validity of the SE-qIAT. In Study 2, we focussed on additional aspects of the validity of this task and tested whether it moderated the effect of a mild social threat on performance. In Study 3, we further examined the validity of the SE-qIAT and compared it with the conventional SE-IAT.<sup>1</sup>

## STUDY 1

In this study, we tested the reliability of the qIAT that used the items of the RSES (i.e., the SE-qIAT). Participants completed this task along with the standard self-report RSES twice, in two separate sessions administered two weeks apart. We examined the internal consistency of the SE-qIAT in each session and expected that the two implicit scores would correlate with each other, thus supporting the task’s test–retest reliability. In addition, we expected that in each session the explicit and implicit RSES scores would

<sup>1</sup> Materials, raw and processed data and syntax for analysis for all studies can be found at [https://osf.io/gr5zd/?view\\_only=89d9cb3123da483ba48267628aeb144](https://osf.io/gr5zd/?view_only=89d9cb3123da483ba48267628aeb144)

correlate with each other, thus providing initial support for the convergent validity of the SE-qIAT assessment of general self-esteem.

## Method

### Participants

In previous investigations, correlations between the implicit qIAT score and the parallel self-report explicit questionnaire (measuring constructs other than self-esteem) were  $r = .28$  or greater (Currie et al., 2017; Yovel & Friedman, 2013). Based on an *a priori* power analysis, we needed a sample of  $N = 124$  to detect a correlation of  $r = .25$  between the explicit and implicit measures of self-esteem with alpha levels set at .05 and a power of .80. We recruited 235 native English speakers via Prolific Academic platform, who had completed at least 50 previous submissions with an approval rate of at least 95%. Eleven participants were excluded based on their performance in the SE-qIAT (see below). Specifically, they were excluded due to high error rate (20% or above) in the critical blocks of the task, high rate of extremely fast responses (at least 10% with  $RT < 300$  ms), or taking a break while completing the task (based on  $RT > 30$  s in any trial). Analyses were based on the remaining 224 participants (143 females; mean age = 37.02,  $SD = 13.01$ ). Of these, 169 participants (70%) returned to participate in the second session of the study, and five were excluded based on their performance in the second qIAT. Analyses in the second session were based on the remaining 164 participants (106 females; mean age = 38.43,  $SD = 12.67$ ).

### Materials

#### **Explicit measure: Rosenberg Self-Esteem scale (RSES; Rosenberg, 1965)**

This questionnaire is composed of 10 items (five reversed) designed to measure self-esteem. A higher score indicates higher self-esteem. Internal consistencies for the scale in the current study were alpha = .92 in the first session and alpha = .94 in the second session.

#### *Implicit measure: The self-esteem qIAT (SE-qIAT)*

The SE-qIAT (Yovel & Friedman, 2013) was presented by a Flash program (Macromedia Flash 10.0 Professional, 2005) for measurement of reaction times (Reimers & Stewart, 2007). On each trial of the task, a stimulus sentence was presented, and participants were required to classify it using two designated response keys to one of two categories presented at the top of the screen. The task included seven blocks. The first two blocks were practice blocks. In Block 1, which included 40 trials, participants learned the classification of the items of the RSES (e.g., ‘On the whole, I am satisfied with myself’; ‘At times, I think I am no good at all’) into the target categories (‘High self-esteem’ vs. ‘Low self-esteem’, respectively; see Table 1). In Block 2 (20 trials), participants learned to classify the self-related logical stimuli (e.g., ‘I am in front of the computer’; ‘I am sunbathing at the beach’) into the logical categories *True* versus *False*, respectively. Blocks 3 (20 trials) and 4 (40 trials) were double-categorization blocks, in which these two tasks appeared interchangeably. In these critical blocks, the two category types shared response keys (e.g., *High self-esteem* and *True* versus *Low self-esteem* and *False*). In Block 5, the target categories switched sides, and participants practiced this reversed

**Table 1.** Categories and stimuli used in the SE-qIAT

High self-esteem	Low self-esteem
On the whole, I am satisfied with myself	At times I think I am no good at all
I feel that I have a number of good qualities	I feel I do not have much to be proud of
I am able to do things as well as most other people	I certainly feel useless at times
I feel that I am a person of worth, at least on an equal plane with others	All in all, I am inclined to feel that I am a failure
I take a positive attitude toward myself	I wish I could have more respect for myself
True	False
I am doing a psychology experiment	I am playing football on the grass
I am in front of the computer	I am sunbathing at the beach
I am participating in an experiment on the internet	I am currently playing an electric guitar
I am looking at a computer screen	I am climbing a steep mountain
I am putting my fingers on the keyboard	I am buying groceries in the local grocery store

SE-qIAT = Self-esteem Questionnaire-based Implicit Association Test.

classification (40 trials). The critical Blocks 6 and 7 included the second double-categorization task, with the reversed target classification (e.g., *Low self-esteem* and *True* versus *High self-esteem* and *False*). The order of the critical double-categorization tasks was counterbalanced across participants. In all trials, a red 'X' appeared following erroneous classifications, until the correct key was pressed.

The *D* score of the SE-qIAT was computed based on Greenwald and colleagues' improved scoring algorithm (Greenwald et al., 2003). Specifically, we used the  $D_2$  variant, which involves the deletion of latencies above 10,000 ms or below 400 ms. Paralleling the total scores of the self-report RSES, larger positive *D* scores reflected a stronger association between the *High self-esteem* the self-related *True* categories (i.e., higher levels of self-esteem).

### Procedure

In each of the two sessions of the study, participants first completed the standard, self-report RSES, which was followed by the SE-qIAT. Research suggests that in general the IAT is robust against order effects of the explicit and implicit assessments (Hofmann, Gschwendner, Nosek, & Schmitt, 2005). In this this case, however, the target construct was assessed explicitly and implicitly using the exact same set of statements (i.e., the items of the RSES). Therefore, to prevent a likely carry-over effect from the implicit task (in which each item was presented many times) to the self-report assessment (in which the items were presented only once), the explicit questionnaire was administered first (see Yovel & Friedman, 2013). Participants were informed that the study would include a second session that would be administered two weeks later, for which they received a reminding email. They received GBP 1.25 for the first session and GBP 1.90 for completing the second session.

### Results and discussion

Descriptive statistics of the explicit and implicit self-esteem measures in all studies are presented in Table 2. The split-half reliabilities of the self-esteem qIAT tasks, based on the

**Table 2.** Descriptive statistics of the scores of the explicit and implicit measures of self-esteem in all studies

Variable	Implicit self-esteem				Explicit self-esteem (RSES)		
	N	M (SD)	Skewness	Range	M (SD)	Skewness	Range
Study 1							
First SE-qlAT	224	0.84 (0.50)	-0.06	-0.99 to 2.34	27.57 (5.83)	-0.10	10.00–40.00
Second SE-qlAT	170	0.74 (0.44)	0.05	-0.48 to 1.83	28.15 (6.28)	-0.002	12.00–40.00
Study 2							
SE-qlAT	305	0.80 (0.52)	0.29	-0.71 to 2.52	23.34 (5.65)	-1.33	6.00–31.00
Study 3							
SE-qlAT	334	0.85 (0.52)	-0.17	-1.14 to 2.96	28.31 (6.01)	-0.21	12.00–40.00
SE-IAT	334	0.71 (0.54)	0.04	-1.38 to 2.52			

RSES = Rosenberg Self-Esteem Scale; SE-qlAT = Self-esteem Questionnaire-based Implicit Association Test; SE-IAT = Self-esteem Implicit Association Test.

correlations between  $D$  scores that were calculated separately for odd and even trials in each task (Spearman–Brown corrected), were  $r_{tt} = .82$  in the first session and  $r_{tt} = .75$  in the second session. As to test–retest reliability, the correlation between the SE-qlAT tasks completed two weeks apart was  $r_{tt} = .47$ . The test–retest reliability of the self-report RSES was  $r_{tt} = .92$ . Supporting the convergent validity of the SE-qlAT, the correlation between this implicit score and the parallel self-report RSES was  $r = .31$ ,  $p < .001$ , 95% CI [0.19, 0.42] in the first session and  $r = .34$ ,  $p < .001$ , 95% CI [0.20, 0.47] in the second session.

The reliability coefficients observed here are similar to previous findings obtained for the self-concept IAT. For example, Krause et al. (2011) examined several implicit measures of self-esteem and found that the highest internal consistency and test–retest reliability were found for the IAT. However, as was the case here for the SE-qlAT, they also found that the stability of the self-esteem IAT was lower than split-half reliability of this implicit measure and that it was also lower than the stability of the explicit RSES. The relationships between the SE-qlAT and the self-report RSES in both sessions appear to be stronger than the implicit–explicit correlations typically obtained for the conventional self-esteem IAT (e.g., Bar-Anan & Nosek, 2014; for reviews see Buhrmester et al., 2011; Falk & Heine, 2015). In Study 2, we attempted to replicate this finding and to examine additional aspects of the validity of the self-esteem qlAT.

## STUDY 2

The findings of Study 1 provided initial support for the reliability and convergent validity of the self-esteem qlAT. In the present study, we focussed on the validity of this indirect measure of general self-esteem. We tested the convergent and discriminant validity of the SE-qlAT by examining its relationships with the explicit RSES and with the Big Five personality traits. To test its criterion validity, we examined whether it moderated participants' reactions to a mild social threat (for a review see Buhrmester et al., 2011). We employed the Cyberball paradigm, a virtual ball-tossing game that has been used in numerous studies to manipulate feelings of social exclusion or ostracism (Hartgerink, van

Beest, Wicherts, & Williams, 2015; Williams, Cheung, & Choi, 2000), and examined whether the SE-qIAT moderated the effects of this task on performance in a subsequent tedious anagram task (DeWall, Baumeister, & Vohs, 2008; Sommer & Baumeister, 2002). We based this expectation of previous research that has shown that social threat affects self-regulation (Baumeister, DeWall, Ciarocco, & Twenge, 2005; Stillman & Baumeister, 2013) and that self-esteem moderates such effects (e.g., Sommer & Baumeister, 2002; for a review see vanDellen, Campbell, Hoyle, & Bradfield, 2011). Typically, it has been found that relatively mild social threats (e.g., recalling an instance of social rejection; vanDellen et al., 2012) have little impact on people with average or high levels of trait self-esteem, but such threats negatively affect individuals with low self-esteem.

We expected that the self-esteem qIAT would correlate with the parallel explicit RSES, replicating the results in Study 1, and that this correlation would be larger than the correlations between the qIAT and the other self-report scales that measure different constructs (i.e., the Big Five subscales). Based on earlier research (see VanDellen et al., 2011), we expected that implicit self-esteem would moderate the effect of the Cyberball task. Specifically, we predicted only for participants with low self-esteem that being 'ostracized' in the Cyberball task would negatively affect performance in the subsequent anagram task. Because self-reported self-esteem may be contaminated by impression-management efforts (Baumeister & Vohs, 2018), we expected that this moderation effect of the self-esteem qIAT would be incremental to the effect of the explicit RSES.

## Method

### Participants

The results of Study 1 suggest that the implicit–explicit correlations between the self-esteem qIAT with the parallel self-report can be expected to be moderate. A sample of  $N = 85$  would be required to detect such correlations ( $r = .30$ ) with alpha levels set at 0.05 and a power of 0.80. However, we also performed more complex analyses that did not have prior effect sizes available. Therefore, we employed a considerably larger sample to ensure detection of potentially smaller effects. Of the 375 English speakers who completed the study via Amazon's Mechanical Turk platform, 42 were excluded from the analysis due to their performance in the SE-qIAT task, based on the criteria detailed above (Study 1: Participants). Twenty-eight additional participants were excluded because the following indications suggested that they were not fully engaged in other parts of this relatively complex Internet-based study: participants who spent an extremely long time ( $z > 3$ ) on the Cyberball task (actual range for the 13 excluded participants: 321.49–859.66 s. vs. mean for the remaining sample = 169.24 s,  $SD = 40.92$ ) or on the questionnaires that followed it (actual range for the 12 excluded participants: 224.26–1,256.39 s. vs. mean for the remaining sample = 98.66 s,  $SD = 33.37$ ), and additional three participants who did not solve any anagram during 6 min (see below; mean number of solved anagrams for the remaining sample = 19.11,  $SD = 10.27$ ).<sup>2</sup> Analyses were based on the remaining 305 participants (186 females; mean age = 37.03,  $SD = 11.64$ ).

<sup>2</sup> These exclusions did not affect the general statistical significance of any of the primary analyses (e.g., implicit–explicit correlation, mediational analyses).

## **Materials**

### *Explicit measures*

In addition to the RSES, participants completed the following self-reports:

#### *Big Five measure*

The 50-item IPIP (Goldberg et al., 2006) representation of the Goldberg markers (Goldberg, 1992) for the Big Five factor model of personality. Internal consistencies (Cronbach's alphas) in the current study ranged between .86 for Conscientiousness and .94 for Extraversion and Emotional Stability.

#### *Ostracism Impact Assessment (Zadro, Williams, & Richardson, 2004).*

This self-report measure includes several subscales, and it is commonly used in studies that employ the Cyberball game as a manipulation of ostracism (see below). Participants use a 5-point Likert scale to report their mood (eight items; alpha in the current study = .95), as well as four different types of needs they felt while performing the Cyberball game (Belonging, Self-Esteem, Meaningful Existence, and Control, five items each; alphas ranged between .90 and .96). This measure also includes three inclusion–exclusion manipulation-check items (e.g., 'I was ignored').

#### *Implicit measure*

The self-esteem qIAT (see Study 1).

## **Procedure**

Participants first completed the explicit RSES and the IPIP questionnaires, followed by the SE-qIAT. Then, they were randomly assigned to one of the two conditions (Inclusion or Ostracism) of the Cyberball task (Williams & Jarvis, 2006; Williams, Yeager, Cheung, & Choi, 2012). In this Internet-based task, which was presented as a mental visualization task, participants played a virtual ball-tossing game, ostensibly with two additional players. It has been shown (Summerville & Chartier, 2013) that Internet-based platforms are well suited for pseudo-dyadic research, in which participants ostensibly interact with another individual, as is the case in the Cyberball task.

In this game, three icons representing players are depicted on the screen, with the instructions that they will play a virtual game of catch. When a participant receives the ball, they then choose which other player will receive the ball next by 'throwing' it to them. The game consisted of 30 throws altogether. The participant was the only real player and depending upon the condition to which they were assigned, the other two 'players' would either include them in their game or ostracize them. In the Inclusion condition, participants received the ball for about one-third of the total throws; in the Ostracism condition, they received the ball twice at the beginning but not at all afterwards, and the two other 'players' kept throwing the ball only to each other until the game ended.

Next, all participants completed the Ostracism Impact Assessment Scales. Then, in order to assess levels of self-regulation and persistence, they completed an anagram task (cf. DeWall et al., 2008) that included a list of 40 solvable five-letter anagrams, taken from a

larger list used by Gilhooly and Hay (1977). Each anagram had a single solution (all non-plural nouns); and based on the English Lexicon Project (Balota et al., 2007), the log-transformed hyperspace analogue to language frequency of these words ranged from 5.5 to 10.48 (see Lee & McDaniel, 2013). Participants were given exactly 6 min to solve as many anagrams as possible, and the number of anagrams they solved served as the main dependent measure.

## Results and discussion

The split-half reliability of the qIAT, based on the correlation between the *D* scores computed separately for the odd and even trials (Spearman–Brown corrected) was  $r_{tt} = .81$ . The correlation between the self-report RSES and the SE-qIAT that used the same items was  $r = .37, p < .001, 95\% \text{ CI } [0.27, 0.46]$ , replicating the convergent implicit–explicit relationships observed in Study 1. This correlation was significantly larger than the correlations of the qIAT score with all Big Five IPIP scales (all Fisher’s *Z*s  $> 2.13$ , all  $p$ s  $< .034$ ), supporting the discriminant validity of the self-esteem qIAT. As Table 3 shows, the patterns of the relationships of the RSES and the qIAT with the explicit Big Five subscales (i.e., order of magnitudes of the correlations) were similar. Interestingly, however, after controlling for the explicit RSES, the partial correlations between the SE-qIAT and the Big-5 scales were all approaching zero (ranging between  $r = -.07$  for Agreeableness, and  $r = .06$  for Emotional Stability), and none was significant (all  $p$ s  $> 0.342$ ). These results indicate that the zero-order correlations between the implicit SE-qIAT score and the self-report Big-5 scales were mainly due to shared variance with the RSES.

As in earlier studies that employed the online Cyberball paradigm (see Hartgerink et al., 2015), we cannot assume that participants believed that they were actually playing with real live players. However, the differences between the Inclusion and the Ostracism conditions of the Cyberball task on the Ostracism Impact Assessment Scales and manipulation-check items were in the expected direction, and they were all substantial (*d*s ranged between 1.58 and 3.46; see Table 4). The overall difference between these two groups on the primary dependent measure, the number of anagrams solved, was small and not significant,  $M = 19.55$  ( $SD = 10.30$ ) vs.  $M = 18.64$  ( $SD = 10.25$ ), respectively,  $t(303) = .78, p = .439, d = .09, 95\% \text{ CI } [-1.40, 3.23]$ .

We next tested our main hypothesis and examined whether explicit and implicit measures of self-esteem moderated the effect of the Cyberball task on the performance in

**Table 3.** Bivariate correlations between the big five scales and the implicit and explicit self-esteem measures in Study 2

Big Five Scale	SE-qIAT	RSES
Emotional Stability	.26***	.59***
Extraversion	.19***	.41***
Conscientiousness	.14*	.38***
Intellect/Imagination	.02	.14*
Agreeableness	.01	.20**

RSES = Rosenberg Self-Esteem Scale; SE-qIAT = Self-esteem Questionnaire-based Implicit Association Test.

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ .

**Table 4.** Differences between the Cyberball conditions on the Ostracism Impact Assessment scales and manipulation-check items in Study 2

Variable	Inclusion		Ostracism		<i>t</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Perceived received passes (%)	31.37	10.83	6.26	5.08	25.67***	2.95
Felt being ignored	1.53	0.94	4.47	0.76	30.08***	3.46
Felt being excluded	1.53	1.00	4.49	0.77	28.99***	3.31
Belonging needs	4.13	0.94	1.79	0.77	23.75***	2.73
Self-esteem needs	3.90	0.87	2.48	0.94	13.72***	1.58
Meaningful existence needs	4.11	0.86	2.08	0.97	19.39***	2.23
Control needs	3.27	0.90	1.50	0.58	20.31***	2.33
Positive emotion	4.19	0.72	2.67	0.95	15.83***	1.82

\*\*\* $p < .001$ .

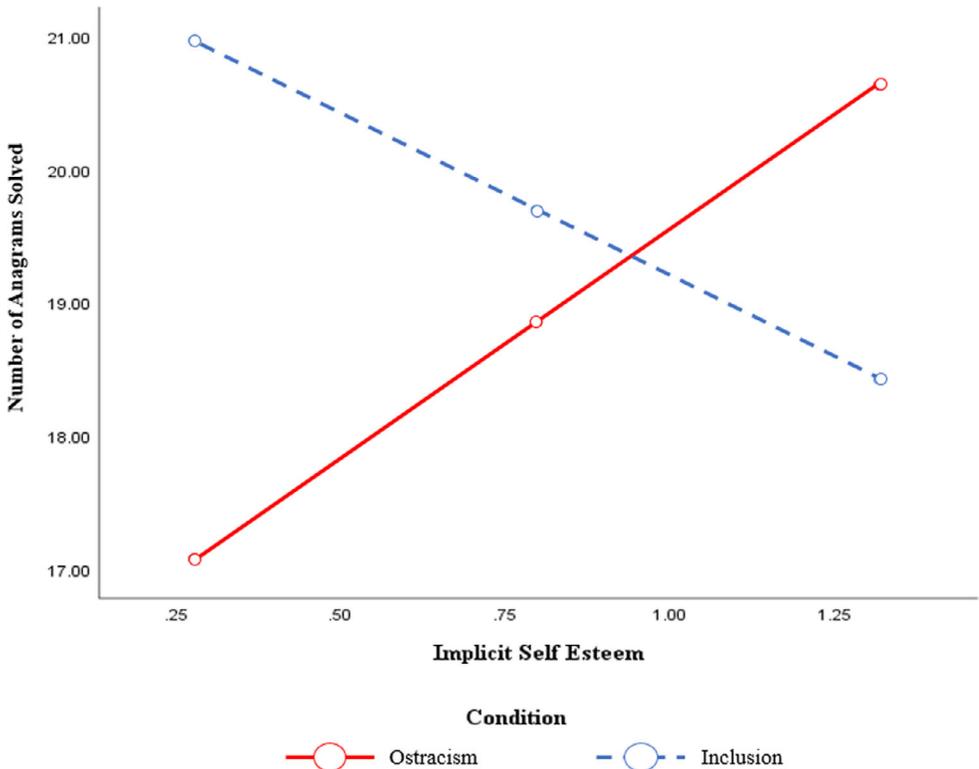
the subsequent anagram task. To do that, we conducted two separate multiple regression analyses predicting the number of anagrams solved; each included the main effects of Condition (contrast coded as  $-1$  for Inclusion and  $+1$  for Ostracism) and Self-Esteem (centred on its mean), and the interaction between these two variables. In the first model, explicit self-esteem (i.e., the self-reported RSES) was examined as the potential moderator variable, and in the second model, it was implicit self-esteem (i.e., the qIAT score; see Models 1 and 2 in Table 5). In the first model, the main effects and the interaction were all not significant,  $ps > .235$ . The second model, however, yielded the predicted two-way interaction between the Cyberball task condition and the qIAT self-esteem score,  $b = 2.94$ ,  $t(301) = 2.59$ ,  $p = .010$ ,  $d = .30$ , 95% CI [0.71, 5.17]. No other effects in this model were significant,  $ps > .474$ . Thus, as predicted, the implicit qIAT self-esteem score moderated the effect of the Cyberball task on performance in the anagram task. We then examined this interaction using simple slope analyses, following the procedures described by Aiken and West (1991). As predicted, these analyses showed that the effect of the Cyberball task on the number of anagrams solved (see Figure 1) was significant only

**Table 5.** Least square regression results for mediated moderation with the number of solved anagrams as the dependent variable in Study 2

Predictor	Model 1 Moderator: RSES		Model 2 Moderator: SE- qIAT		Model 3 Moderator: SE- qIAT Covariate: RSES	
	$\beta$	<i>t</i>	$\beta$	<i>t</i>	$\beta$	<i>t</i>
CB task condition	-0.48	-0.81	-0.42	-0.71	-0.40	-0.69
RSES	-0.12	-1.19			-0.17	-1.56
SE-qIAT			0.40	.35	1.09	0.90
CB task condition $\times$ RSES	-0.08	-0.81				
CB task condition $\times$ SE-qIAT			2.94	2.59**	2.96	2.62**

CB = Cyberball; RSES = Rosenberg Self-Esteem Scale; SE-qIAT = Self-esteem Questionnaire-based Implicit Association Test.

\* $p < .05$ , \*\* $p < .01$ .



**Figure 1.** Depicting the simple slope analysis of the moderating effect of the qIAT implicit self-esteem score on the relation between the grouping variable in the Cyberball task and the number of anagrams solved in Study 2.

when levels of implicit self-esteem were low ( $-1$   $SD$ ),  $b = -1.95$ ,  $t(301) = -2.34$ ,  $p = .020$ ,  $d = .27$ , 95% CI  $[-3.59, -0.31]$ , but not when they were average,  $b = -.42$ ,  $t(301) = -.72$ ,  $p = .475$ ,  $d = .08$ , 95% CI  $[-1.58, 0.74]$  or high ( $+1$   $SD$ ),  $b = 1.11$ ,  $t(301) = 1.33$ ,  $p = .185$ ,  $d = .15$ , 95% CI  $[-.53, 2.74]$ . A follow-up Johnson–Neyman analysis of regions of significance showed that the effect of the Cyberball task on performance in the anagram task was significant for qIAT scores of 0.48 ( $SD = 0.62$  below the mean) or less (27.54% of the sample). Taken together, these results show that behaviour on the anagram task was only sensitive to ostracism among participants whose implicit self-esteem qIAT scores were low, while the explicit RSES did not show a similar moderation effect. Thus, in contrast to earlier laboratory-based studies (e.g., vanDellen et al., 2012), in the present context of a mild online manipulation (i.e., being ‘excluded’ in the Cyberball game) explicit self-esteem was not a significant moderator. Indeed, some studies (e.g., Weisbuch, Sinclair, Skorinko, & Eccleston, 2009) showed that implicit measures, which measure behavioural response, may be more sensitive to situation-specific contextual cues compared with explicit measures, which tap relatively stable narratives that people have about themselves (see Mitchell, Nosek, & Banaji, 2003).

We next tested the moderation effect of the implicit measure, controlling for the effect of the RSES. To do that, we repeated the second multiple regression analysis described above, in which the implicit SE-qIAT score was the moderator variable. To control for

explicit self-esteem, this time the model also included the explicit RSES as a covariate. As Model 3 in Table 5 shows, here again the interaction of Condition  $\times$  Implicit Self-Esteem was significant,  $b = 2.96$ ,  $t(300) = 2.62$ ,  $p = .009$ ,  $d = .30$ , 95% CI [0.74, 5.19], showing that even after controlling for self-reported self-esteem, implicit self-esteem moderated performance in the anagram task. Thus, the predicted moderating effect of the SE-qIAT was incremental to the self-reported RSES, despite the basic relationship between these two self-esteem measures.

## STUDY 3

The present study further tested the validity of the SE-qIAT by directly examining its relationship with the widely used self-esteem IAT (Greenwald & Farnham, 2000). Additionally, we tested the relationships of both these indirect measures of self-esteem with self-report measures of self-esteem (i.e., RSES) and depression. We expected the two tasks to positively correlate with each other and with explicit self-esteem, and negatively with depression.

## Method

### Participants

A sample of  $N = 194$  would be required to detect small correlations ( $r = .20$ ; e.g., between the two implicit tasks) with alpha levels set at 0.05 and a power of 0.80. Of the 350 English speakers recruited for the study via Prolific Academic platform, 16 were excluded from the analysis due to their performance in the implicit tasks, based on the criteria detailed above (Study 1: Participants). Analyses were based on the remaining 334 participants (207 females; Mean age = 37.32,  $SD = 12.82$ ).

### Materials

#### Explicit measures

In addition to the RSES, participants completed the *Depression Anxiety Stress Scale – 21* (DASS-21; Lovibond & Lovibond, 1995), Depression subscale. This subscale includes seven items that assess emotional distress associated with depression (e.g., ‘I felt that life was meaningless’). Participants rated the extent to which each statement applied to them in the previous week on a Likert scale of 0 (= ‘Did not apply to me at all’) to 3 (= ‘Applied to me very much, or most of the time’). Alpha in the current study = .93.

#### Implicit measures

In addition to the self-esteem qIAT (see Study 1), participants completed the *Self-Esteem Implicit Association Test* (SE-IAT; Greenwald & Farnham, 2000). The standard, 7-block SE-IAT (e.g., Bar-Anan & Nosek, 2014) included the following categories and stimuli: *Good Words* (i.e., *Paradise, Cheer, Pleasure, Splendid, Wonderful*) versus *Bad Words* (i.e., *Abuse, Bomb, Grief, Pain, Poison*), and *Self* (i.e., *I, Me, Mine, Self, Myself*) versus *Others* (i.e., *Others, They, Them, Their, Theirs*).

### Procedure

Following informed consent, participants completed a brief demographic survey, the explicit RSES, and the DASS Depression subscale. Next, they completed the two implicit tasks (i.e., the SE-qIAT or the SE-IAT), which were presented in a random order. Thus, the explicit RSES was never immediately followed by either task.

### Results and discussion

As expected, response latencies to the propositional stimuli in the SE-qIAT ( $M = 1,460.51$ ,  $SD = 302.54$ ) were substantially larger than the response latencies to the single-word stimuli in the SE-IAT ( $M = 988.09$ ,  $SD = 170.61$ ),  $t(333) = 41.34$ ,  $p < .001$ ,  $d = 2.26$ , 95% CI [449.93, 494.89]. The split-half reliabilities of the two implicit tasks, based on the correlations between  $D$  scores that were calculated separately for odd and even trials (Spearman-Brown corrected) in each task, were  $r_{tt} = .77$  for the SE-qIAT, and  $r_{tt} = .83$  for the SE-IAT. As expected, the two implicit self-esteem scores correlated significantly with each other,  $r = .23$ ,  $p < .001$ , 95% CI [0.13, 0.33].

The implicit–explicit correlation between the SE-qIAT and the self-report RSES was similar to those obtained in the previous two studies,  $r = .38$ ,  $p < .001$ , 95% CI [0.28, 0.47], indicating convergent validity. The SE-IAT also correlated significantly with the RSES,  $r = .21$ ,  $p < .001$ , 95% CI [0.11, 0.31], and this correlation was at least on par with those obtained in an earlier quantitative review ( $r = .13$ ; Buhrmester et al., 2011) and in a large-scale study ( $r = .17$ ; Bar-Anan & Nosek, 2014). The current correlation between the SE-qIAT and the RSES was larger than the parallel correlation of the SE-IAT and the RSES, Steiger's  $Z = 2.66$ ,  $p = .004$ , 95% CI [0.04, 0.30]. The two implicit tasks also correlated negatively and significantly with the DASS Depression,  $r = -.26$ ,  $p < .001$ , 95% CI [-0.16, -0.36] for the SE-qIAT and  $r = -.14$ ,  $p = .010$ , 95% CI [-0.03, -0.24] for the SE-IAT (all zero-order correlations are presented in Table 6).

Interestingly, partial correlational analyses showed that after controlling for the explicit RSES, the correlation between the two implicit tasks remained significant,  $r = .16$ ,  $p = .003$ , 95% CI [0.05, 0.26], as was the case for the correlation between the SE-qIAT and the RSES, controlling the SE-IAT,  $r = .35$ ,  $p < .001$ , 95% CI [0.25, 0.44]. These results indicate that the SE-qIAT shares unique variance with each of these commonly used implicit and explicit measures of self-esteem.

**Table 6.** Zero-order correlations between the implicit and explicit measures in Study 3

Variable	1	2	3	4
1. SE-qIAT	–			
2. SE-IAT	.23***	–		
3. RSES	.38***	.21***	–	
4. DASS-Dep	-.26***	-.14**	-.71***	–

DASS-Dep = Depression Anxiety Stress Scale-21 – Depression subscale; RSES = Rosenberg Self-Esteem Scale; SE-IAT = Self-esteem Implicit Association Test; SE-qIAT = Self-esteem Questionnaire-based Implicit Association Test.

\*\* $p = .01$ , \*\*\* $p < .001$ .

## GENERAL DISCUSSION

Despite being the most widely used indirect measure of self-esteem (Bar-Anan & Nosek, 2014), researchers have failed to find consistent support for the validity of the self-esteem IAT (Greenwald & Farnham, 2000), and the implicit–explicit relationships it typically showed have been particularly weak. It has therefore been concluded by some that the IAT is not a valid measure of self-esteem (for reviews, see Buhrmester et al., 2011; Falk & Heine, 2015). The qIAT (Yovel & Friedman, 2013) generally combines the simple and reliable assessment method of the IAT (e.g., Krause et al., 2011) with the established validity and propositional quality of the items of existing self-reports. The self-esteem qIAT assesses the extent to which people associate favourable versus unfavourable global evaluation – the construct measured by the items of the RSES – with truth about the themselves. The present findings provide initial support for the reliability and the validity of this implicit measure of global self-esteem.

The implicit–explicit correlations between the SE-qIAT and the RSES consistently observed all present studies suggest that this task is a valid measure of general self-esteem. In contrast, many studies reported observing no relationships between the SE-IAT and explicit measures of self-esteem (see Buhrmester et al., 2011). In Study 2, the correlation between the SE-qIAT and the RSES was also significantly larger than the correlations of the SE-qIAT with explicit measures of other constructs (e.g., the Big Five subscales), thus supporting the discriminant validity of this measure. Moreover, the patterns of the correlations of the two measures of self-esteem (i.e., the qIAT and the RSES) with the Big Five subscales resembled each other (see Table 3), and they were consistent with earlier findings on self-esteem (e.g., a relatively strong relationship with emotional stability; Judge et al., 2002). The present findings also provide initial support for the predictive validity of the SE-qIAT, which moderated in Study 2 the effect of a mild social threat (being excluded in the virtual Cyberball game; Williams & Jarvis, 2006) on subsequent performance in an anagram task. Those who were ‘ostracized’ in this game solved a smaller number of anagrams compared with the control group, but this effect was observed only for participants with low levels of implicit self-esteem. This moderation effect of the SE-qIAT was incremental to the self-reported RSES. Finally, the results observed in Study 3 provided further support for the convergent validity of the qIAT, which correlated with the SE-IAT, and negatively with a measure of depression.

### ***The qIAT versus the self-IAT***

The conventional SE-IAT measures the extent to which positive versus negative single-word stimuli are associated with the self (vs. other people). This task and the SE-qIAT are both variants of the same indirect assessment procedure, and indeed the results in Study 3 showed that they correlated with each other, above and beyond the variance each shared with the explicit RSES. However, these tasks differ from each other in two fundamental ways: the stimuli they use and the nature of the association they measure. As expected, the results of Study 3 also showed that response latencies in the SE-qIAT, which is based on longer and more complex propositional stimuli, are longer than in the SE-IAT. More importantly, the target stimuli in the SE-qIAT are the original items of the RSES. Indeed, the literature suggests that implicit–explicit correlations are stronger when both measures use the same set of stimuli (e.g., Hofmann, Gawronski, et al., 2005), as is the case for the SE-qIAT. Additionally, a notable general limitation of implicit assessment of the self has been the almost universal reliance on target stimuli with unknown psychometric properties

(De Cuyper et al., 2017). In contrast, the SE-qIAT indirect assessment of self-esteem is based on a well-validated measure of general self-esteem (i.e., the RSES) that has been used in numerous studies. Using the same set of stimuli for both the direct and indirect assessments also facilitates the ease of interpretation of the findings, because it minimizes the impact of extraneous measurement factors (see Nosek et al., 2011).

Also, in contrast to the self-concept IAT, the association measured by the qIAT unambiguously reflects the levels of target construct. As Remue et al. (2014) suggested, the broad association between the self and positive stimuli in the conventional self-esteem IAT may indeed signify the commonly assumed relationship (i.e., self-perceived high self-esteem), but it may also be the result of other, even conflicting relationships between these concepts (e.g., ‘I wish I had high self-esteem’). The indirect propositional assessment procedure of the qIAT, on the other hand, clearly differentiates between these possibilities. For example, the item ‘I wish I could have more respect for myself’, which reflects the latter type of relationship, is inversely scored in the RSES. It therefore needs to be classified to the category that reflects low self-esteem in the qIAT, along with other such items (e.g., ‘At times I think I am no good at all’).

In sum, the target stimuli of the SE-qIAT are the well-validated items of the RSES, and responses in both these measures (but not necessarily in the conventional self-esteem IAT) are expected to echo each other. It is likely that both these factors contributed to the robust implicit–explicit relationships between the qIAT and the RSES observed in all present studies.

### ***A propositional indirect measure of self-esteem***

It has been argued (e.g., Back et al., 2009; Schnabel & Asendorpf, 2010) that the explicit self-concept is propositional in nature, while the implicit self-concept is based on associations between the self and other concepts (such as self-esteem). To clarify this distinction, Schnabel and Asendorpf (2010) stated that ‘Differently from associations, propositions consist of concepts that are linked by a relation (e.g., ‘I am extraverted’ with ‘am’ representing the relation. . .) . . . [that] can be either accepted as true or rejected as false’ (p. 410). Interestingly, this depiction of the explicit (vs. the implicit) self-concept generally describes the measurement procedure of the qIAT, which is based on propositions and on logical true–false relations. However, as is the case with other variants of the IAT, the qIAT assessment reflects a comparison of behavioural performance between conditions in a within-subject experimental design (see Nosek et al., 2011). Moreover, consistent with previous findings in which the qIAT measured different self-related construct (e.g., conscientiousness; Friedman et al., 2021), in Study 2 the SE-qIAT accounted for a unique portion of the variance of the criterion variable, above and beyond explicit self-report assessment.

Thus, despite being based on propositions, the measurement procedure of the qIAT is clearly indirect, as it does not require any reflection or deliberate introspection of the connections between the assessed content and the self. The present findings are therefore in agreement with the suggestion (e.g., de Houwer, 2014) that implicit cognitions may result from propositions that can be activated automatically (see also Perugini et al., 2021). Moreover, the indirect assessment of the qIAT, which is based on the association between the measured construct (e.g., self-esteem) and self-related truth, reflects a validation process. Based on the perspective suggested by Shidlovski, Schul, and Mayo (2014), it may be argued that while the self-report questionnaire assesses the explicit truth

value of the RSES items via reflection and deliberation, this task assesses the implicit truth value of the same set of propositions.

### **Limitations and future directions**

As mentioned above, due to potential carry-over effects from the SE-qIAT (in which the RSES items are presented many times) to the explicit questionnaire, the self-report measure always needed to be administered before the parallel implicit task. This design demand may not be relevant when the two modes of assessment are based on different sets of stimuli. Also, the SE-qIAT showed good levels of internal consistency in all three studies, but the test–retest reliability of this task observed in Study 1 was much smaller. This temporal stability estimate (.47) was in the range of what have been found in previous studies for the SE-IAT (e.g., .26 in Bar-Anan & Nosek, 2014; .69 in Bosson, Swann, & Pennebaker, 2000), but it was substantially smaller compared with the parallel explicit RSES (.92). Taken together, the present results are similar to the general pattern observed in earlier studies for the conventional self-IAT: good internal consistency, but only moderate stability over time (Gawronski, 2019; Gawronski, Morrison, Phillips, & Galdi, 2017). Perhaps indirect tasks are less stable compared with self-reports because the assessment in such procedures reflects certain patterns of behaviour that may be situation-specific (e.g., Perugini et al., 2021), while explicit measurement is based on the narratives that people have about themselves. Indeed, Mischel (2004) argued that while the ways people perceive their own personalities are relatively stable, their actual behavioural patterns tend to be affected by contextual factors (see also Mitchell et al., 2003). Future research may further examine whether the qIAT shows inferior temporal stability because it captures specific situation–behaviour patterns, rather than people’s relatively stable constructions of their personalities and traits.

More work is needed to further establish the validity of the SE-qIAT. For example, it will be interesting to examine the convergent validity of this task with additional direct and indirect measures of self-esteem (cf. Bar-Anan & Vianello, 2018). Future research may also perform confirmatory factor analyses using *D* scores of sets of items of this task (e.g., odd vs even trials), to examine the extent to which it effectively measures the latent construct of interest. Using longitudinal models, future investigations may also examine whether the constructs measured by the SE-qIAT and the parallel RSES (which use the same set of items) are indeed different from each other (cf. Greenwald & Farnham, 2000). Such studies may shed light on the nature of the construct that is measured by the SE-qIAT, and they will hopefully lead to a better understanding of the construct validity of implicit self-esteem in general (see Schimmack, 2021).

In addition, the SE-qIAT will need to show a better criterion validity compared with earlier measures of implicit self-esteem and, for example, differentiate reliably between dysphoric and non-dysphoric populations (cf. Remue et al., 2014). Most importantly, in Study 2 the moderation effect of the SE-qIAT was incremental to the parallel RSES, but more research is needed to further establish the pragmatic utility of this task in providing information above and beyond the assessment of explicit self-reports. For example, in a recent online study, participants were paid in advance to complete a two-session study, and the qIAT that measured conscientiousness predicted incrementally above and beyond the parallel self-report scale who would return to complete the second session, across two independent samples (Friedman et al., 2021, Studies 2 and 3). As was the case here, in which the explicit RSES did not moderate the effect of the Cyberball task in Study 2, in Friedman et al. (2021) study the explicit self-report conscientiousness scale did not

predict significantly the criterion behaviour. Hopefully, future research will identify the conditions in which the qIAT may be useful in providing information that cannot be provided by conventional explicit measures.

### **Conclusion**

To conclude, we present a novel indirect measure of general self-worth, which was designed to address the primary limitations of the commonly used self-esteem IAT. The self-esteem qIAT combines the reliable assessment procedure of the IAT with the propositional stimuli of the most widely used self-report measure of general self-esteem, and the score it provides is based on a clear and easily interpretable association. More work is needed to further examine the validity of this proposition-based implicit assessment method of general self-esteem. The present findings, which provide initial support for the self-esteem qIAT, suggest that such efforts may shed light on a construct that has thus far remained elusive.

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### **Conflicts of interest**

All authors declare no conflict of interest.

### **Data availability statement**

Materials, raw and processed data, and syntax for analysis for all studies can be found at [https://osf.io/gr5zd/?view\\_only=89d9cb3123da483ba48267628aecb144](https://osf.io/gr5zd/?view_only=89d9cb3123da483ba48267628aecb144).

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