

# Loneliness and social monitoring: A conceptual replication of Knowles et al.

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## Abstract

Contrary to the claim that loneliness routinely impairs the decoding of social cues such as emotion displays, Knowles, Lucas, Baumeister, and Gardner (2015) proposed that lonely adults “choke under pressure,” experiencing impairments only when social monitoring is framed as diagnostic of general social skill. In four experiments, Knowles et al. showed that lonely individuals performed worse than nonlonely individuals at decoding social cues when the decoding task was framed as a test of social aptitude, but not when it was framed as a test of academic aptitude. The studies were small ( $N$ 's ranging from 78 to 203), and all employed a convenience sample of mostly female undergraduate students, impairing both statistical power and external validity. In addition, the lack of a true control group precluded the studies from establishing whether loneliness inhibits social monitoring ability if no frame is offered. This study conceptually replicates the central hypothesis of Knowles et al. using a sample of adults that is substantially larger and more diverse demographically and geographically, and using a true control group in addition to the comparison group. Results revealed a significant main effect of loneliness on social

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monitoring ability but did not replicate the choking under pressure phenomenon.

#### KEYWORDS

emotion, framing, loneliness, social monitoring

## 1 | INTRODUCTION

For a highly social species such as humans, the ability to form and maintain meaningful relationships is paramount to both physical and mental well-being (Baumeister & Leary, 1995). It is therefore unsurprising that loneliness—a condition characterized by a perceived deficit in desired social connection—is associated with multiple physical and mental impairments (Cacioppo & Patrick, 2008). Although it may seem logical that loneliness would motivate approach behaviors aimed at increasing social connection, it appears instead to be more strongly associated with avoidance behavior (see, e.g., Gable, 2006). Some research suggests that lonely individuals struggle to achieve greater social connectedness because they are deficient in social skills that are instrumental to the formation and maintenance of meaningful relational bonds (Jones, Hobbs, & Hockenbury, 1982). A series of studies by Knowles, Lucas, Baumeister, and Gardner (2015), however, demonstrated that loneliness impairs social skill only when the skill is framed as a test of social ability, and not when it is framed as a test of academic aptitude. These results raise the possibility that loneliness does not inhibit social skill in general, but that lonely individuals “choke under pressure” when they believe their abilities reflect their overall social aptitude.

The Knowles et al. (2015) studies shed light on the question of how loneliness is maintained, and if it is true that lonely adults experience social skills impairments only under particular conditions, this information could have important implications for intervention. The contributions of the Knowles et al. investigations are tempered by some significant methodological limitations, however, making it worthwhile to replicate their hypothesis under methodologically improved conditions. We begin by reviewing research on the maintenance of loneliness and the concept of choking under pressure. Next, we describe the Knowles et al. studies, identifying both their contributions and their limitations, and then report the methods and results of a conceptual replication to test their central prediction.

### 1.1 | The maintenance of loneliness

Multiple studies have suggested that deficiencies in social skill contribute to the maintenance of loneliness. Compared to their nonlonely counterparts, lonely adults are less emotionally intelligent (Qualter, Quinton, Wagner, & Brown, 2009; Zysberg, 2012), less expressive (Gerson & Perlman, 1979) and self-disclosive (Jones, Carpenter, & Quintana, 1985; Wei, Russell, & Zakalik, 2005), less emotionally supportive of others (Buhrmester, Furman, Wittenberg, & Reis, 1988), less attentive to conversational partners (Jones et al., 1982), and less sociable overall (Horowitz & de Sales French, 1979). Consequently, lonely people are often perceived more negatively than less lonely people (Tsai & Reis, 2009).

These deficits notwithstanding, however, lonely individuals engage in more social monitoring than nonlonely people, perhaps as a way to surveil their environments (see Cacioppo & Patrick, 2008). For example, Gardner, Pickett, Jefferis, and Knowles (2005) demonstrated that loneliness predicted incidental social memory, and a lack of friends predicted higher accuracy at decoding facial expressions. The same is true for those with high motivations to belong. For instance, Gardner, Pickett, and Brewer (2000) reported that people attended more to social information after being socially excluded. Similarly, Pickett, Gardner, and Knowles (2004) found that both acute rejection and chronically heightened inclusion needs predicted higher accuracy in decoding facial expressions and vocal tones. In the laboratory environment, at least, loneliness does not appear to impair social monitoring abilities; in fact, it may advantage lonely individuals over their nonlonely counterparts.

Considered together, these studies suggest that loneliness fails to impair individuals (and may even advantage them) at social monitoring tasks in controlled laboratory experiments, but that the reverse is true in nonlaboratory, real-world settings. As the laboratory studies demonstrate, lonely individuals have the skills to succeed in social situations (see Vitkus & Horowitz, 1987), but in actual social environments, these skills appear not to translate to social success, contributing instead to the maintenance of loneliness over time. One explanation for why people with sufficient skill may nonetheless fail to achieve their goals is suggested by Baumeister's (1984) concept of *choking under pressure*, explicated next.

## 1.2 | Choking under pressure

“Choking under pressure” references the tendency to perform poorly at a task despite having both the ability and the motivation to perform successfully. Baumeister (1984) proposed that choking under pressure occurs when a focus on success increases conscious attention to the performer's process of performance, disrupting the automatic or highly practiced nature of his or her execution. Paradoxically, being both able and highly motivated to succeed can actually reduce an individual's likelihood of success, whether in an athletic competition, an artistic performance, an academic task, or some other context. In six experiments, Baumeister documented that increasing attention to the performance process and/or the stakes for success impaired participants' abilities to succeed in a dexterity activity requiring motor and visual-motor coordination.

Some research has documented the choking under pressure phenomenon among experts in a given task, such as expert golfers in a putting task (Beilock & Carr, 2001) and expert baseball players in a batting task (Gray, 2004). Research suggests that nonexperts can choke under pressure, too. Bertrams, Englert, Dickhauser, and Baumeister (2013) found that college students who had test anxiety performed worse on cognitive tests because their anxiety and worry deprived them of the cognitive resources necessary to perform. Cheryan and Bodenhausen (2000) made salient their participants' racial stereotypes (i.e., Asians are superior at mathematics compared to other races), and such a distraction inhibited the Asian women participants' ability to concentrate. Ultimately, this resulted in poorer test performance despite the fact that the stereotype highlighted a seemingly positive trait. It is clear that monitoring one's abilities also appears to contribute to the choking effect.

Given that lonely individuals engage in more social monitoring than their nonlonely counterparts, their inability to connect with others may not be attributable to a lack of skill. Perhaps,

then, lonely people have the necessary social skills and information, but are simply choking under pressure, a possibility addressed by Knowles et al. (2015).

### 1.3 | The Knowles et al. studies

To investigate how lonely individuals performed on social monitoring tasks under different forms of duress, Knowles et al. (2015) conducted four studies that varied by the type of social monitoring task and how the tasks themselves were framed. The purpose of Study 1 was to establish whether or not the choking under pressure phenomenon exists. The researchers pre-tested 80 undergraduate students for loneliness before asking the participants to complete the Diagnostic Analysis of Nonverbal Accuracy (DANVA; Nowicki & Duke, 1994) under one of two conditions. The nonsocially framed condition stressed how participants' problem-solving ability was related to their academic and career success, whereas the socially framed condition stressed how their problem-solving ability was related to performing in social interactions and relational maintenance. The researchers had predicted that lonely participants would perform worse on the DANVA than nonlonely participants in the socially framed condition but not in the nonsocially framed condition, and this was the observed result.

The first study used two different versions of the loneliness pretest measure. To remedy that limitation, all participants in Study 2 took the same pretest measure of loneliness. Instead of a facial recognition task (DANVA), 78 undergraduate participants in Study 2 completed a vocal tone recognition assessment after being assigned to either a socially or nonsocially framed condition. The vocal recognition test involved "listening to 32 words, half of which were spoken in a positive tone of voice whereas the other half had a negative tone," and participants were instructed to categorize each word accurately, paying attention to tone rather than content (Knowles et al., 2015, p. 809). Half of the words were positive in nature, and the remaining half were negative, and the valence of their content was crossed with the valence of vocal tone. As in Study 1, loneliness reduced accuracy under the social frame, although it increased accuracy under the nonsocial frame. In addition, loneliness predicted higher accuracy in the nonsocially framed incongruent trials (wherein the valence of a word's content and tone differed) but not in the socially framed incongruent trials.

Using 84 undergraduates, the authors conducted a third study that assessed the potential role of social exclusion-related anxiety. In this study, social frame (social vs. nonsocial) was crossed with an anxiety induction that involved asking participants to relive an experience of intense social rejection (rejection group) or to recall their trip to campus and class that morning (neutral group). Participants then completed an anagram task (in which they were required to unscramble as many anagrams as possible) and then the Reading the Mind in the Eyes (RME) test (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), which required them to identify which emotional state was conveyed through photographs of various pairs of eyes.

For participants in the neutral group (who recalled how they arrived on campus), loneliness led to worse performance on the RME test under the social frame, but not under the nonsocial frame, thus reflecting the principle of choking under pressure. These results were absent for participants who relived a rejection experience, however. Loneliness did not interact with framing condition to influence results on the anagram task.

The final study tested the role of anxiety more directly by providing lonely participants an opportunity to misattribute their anxiety to an external source (a caffeinated drink). The hypothesis was that lonely individuals who attributed their anxiety to an external source would

perform as well as nonlonely individuals, irrespective of how the task was framed. The authors enrolled 203 students from either the top or bottom third of the distribution of loneliness scores and assigned them either to a misattribution condition or a no-misattribution control condition. Participants in both conditions consumed a sugar- and caffeine-free beverage intended to mimic an energy drink. Those in the misattribution condition were told the drink could cause them to experience feelings of anxiety and other physiological effects that are associated with the consumption of caffeine, whereas those in the control condition were told simply that it was a new type of sugar-free drink. The remainder of the study followed the same procedures as Study 1. As predicted, the worst performance was exhibited by lonely participants in the no-misattribution condition under the social frame.

Knowles et al. also conducted a meta-analysis of their findings across their four studies to examine the effects of loneliness and the various measures of social performance under the two framing conditions (social vs. nonsocial). The meta-analysis confirmed that lonely individuals performed significantly worse when the tasks were framed in a social way. This effect was significant even with the addition of participant data that was previously removed for quality-control reasons (e.g., failed manipulations checks).

#### 1.4 | Limitations of Knowles et al. studies

The Knowles et al. experiments are compelling in their demonstration of the choking under pressure phenomenon, and to the extent that this phenomenon impedes the ability of lonely individuals to interpret social cues accurately, it may account for some of the significant social detriments that accompany loneliness (see, for example, Cacioppo & Patrick, 2008). It is therefore worth replicating the findings of Knowles et al. to provide further, independent verification of the choking under pressure phenomenon.

This study offers a conceptual replication aimed at addressing three limitations of the Knowles et al. experiments. First, the sample sizes in the individual studies were small. Knowles et al. used a total of 445 participants across four studies, but the first three studies all had valid *N*'s (i.e., after excluding participants from data analysis for quality-control reasons) of 80, 78, and 84, respectively. No power analyses attesting to the adequacy of these small samples were reported, so the small sample sizes may impair both statistical power and external validity.

Second, all four samples were composed exclusively of undergraduate students, which likely severely limited their demographic diversity. The authors reported no demographic information about their samples other than their gender distribution (61% female, on average), but it is reasonable to infer that, like most undergraduate samples who complete a study in exchange for extra course credit, the participants were young adults with highly similar levels of education. Although the authors of the Knowles et al. article represent four different educational institutions, it is unclear which institution(s) the student participants attended, raising the possibility that the sample also had highly restricted geographic diversity. In addition to the small sample sizes, these attributes also limit the external validity of the findings.

Finally, although the authors demonstrated that lonely individuals choked under pressure when the social monitoring task was framed as a test of social aptitude, the comparison in all four studies was to a task framed as a test of academic aptitude. None of the experiments included a true control group, in which participants would complete the social monitoring task in the absence of a specific frame. As an analogy, multiple studies have documented a placebo

effect for medication (e.g., Kirsch & Sapirstein, 1999), wherein patients receiving a biologically inert placebo instead of an actual medication nonetheless show improvement in their condition, but some research has indicated that the placebo effect becomes clinically nonsignificant when compared with no-treatment control groups (e.g., Hróbjartsson & Gøtzsche, 2001). To increase confidence in the robustness of the choking under pressure phenomenon, this study tests its effects in comparison to a no-frame control condition as well as the academic-ability comparison group.

## 1.5 | The present study

To remedy the limitations identified above, this study conceptually replicates the procedure employed by Knowles et al. by using a sample that is substantially larger and more demographically and geographically diverse and by employing a true control group in addition to a comparison group. Specifically, participants recruited online completed the RME test (likely the most commonly used of the emotion decoding tasks employed by Knowles et al.) and then reported on their loneliness. These data are used to test the principal prediction of Knowles et al.:

H1: Framing condition interacts with loneliness to affect emotion decoding accuracy, such that loneliness is negatively related to accuracy in the social frame condition but unrelated to accuracy in the comparison and control conditions.

## 2 | METHOD

### 2.1 | Participants

Participants ( $N = 1,118$ ) were adults 18 years of age or older. Of these, 549 identified as male, 520 as female, two as transgender, and two as another gender, whereas three preferred not to report a gender identity and 42 did not respond to the question about gender. Ages ranged from 18 to 74 years, with a mean of 39.41 years ( $SD = 11.78$ ). Most (75.2%) identified as White/Caucasian, whereas 11.4% were Black/African American, 6.7% were Asian/Pacific Islander, 4.3% were Hispanic, 1.5% were Native American or Aleut, 1.1% were Latino/a, 0.5% were Arab, and 1.3% identified with a different racial or ethnic group (these percentages sum to >100 because participants could report more than one racial or ethnic identity). At the time of the study, 46.0% of participants were single and never married, 43.5% were married, 9.3% were divorced, and 1.3% were widowed. Participants represented 49 of 50 U.S. states plus the District of Columbia and Guam, as well as 22 foreign countries.

The target sample size was 350 participants per condition ( $N = 1,050$ ), and an a priori power analysis (G\*Power 4; Faul, Erdfelder, Buchner, & Lang, 2009) indicated that such a sample would provide in excess of 95% power to identify an effect size of  $r = |.21|$ , the average effect of loneliness under the social frame condition as identified in Knowles et al.'s meta-analysis, using a multiple regression analysis and assuming a .05 probability level.

### 2.2 | Procedure

Participants were recruited via the Amazon.com crowdsourcing marketplace Mechanical Turk (MTurk). To be eligible for the study, participants had to be at least 18 years old; be able to read

and write English; have achieved “master worker” status (a designation indicating consistently high quality in submitted work); and have an average approval rate equaling or exceeding 90%. Eligible participants completed and submitted an online questionnaire in exchange for US \$2.50. Research has found that although samples recruited on MTurk for academic research are not truly representative of the U.S. adult population, they are typically *more* representative than are in-person convenience samples, such as those recruited by Knowles et al. (see, e.g., Paolacci, Chandler, & Ipeirotis, 2010).

Participants were randomly assigned either to the social frame condition, the academic frame comparison condition, or a no-frame control condition. Prior to completing the social monitoring task, participants in the social frame condition read the following description, from Knowles et al. (2015):

You should know that people who do well on this task tend to perform well in social situations every day, and tend to form strong, long-lasting relationships with other people throughout life. Unfortunately, people who do poorly on this task tend to perform quite badly in social interactions and have difficulty forming and maintaining meaningful relationships as they get older. (p. 807)

Participants in the academic frame condition read the following description, from Knowles et al. (2015):

You should know that people who do well on this task tend to perform well in problem-solving situations every day, and tend to excel in school and attain good jobs after graduation. Unfortunately, people who do poorly on this task tend to perform quite badly in daily problem-solving situations and have difficulty getting ahead in school and in their careers. (p. 807)

Participants in the control group were presented with no frame. After reading the social frame, academic frame, or no frame, participants completed the 36-item social monitoring task (RME test) employed by Knowles et al. (Study 3). Once the task was finished, participants completed a measure of their loneliness. The study's hypothesis and analytical strategy were preregistered with Open Science Framework on June 7, 2018, and the study was approved by the university's institutional review board.

## 2.3 | Measures

Measures of both social monitoring ability and loneliness replicate those used by Knowles et al.

### 2.3.1 | Social monitoring ability

Social monitoring ability was measured using the RME test, revised version (Baron-Cohen et al., 2001). This test presents participants with 36 images of facial expressions in which only the eyes, lower part of the forehead, and upper bridge of the nose are visible. For each image, participants are asked to select from four emotional states to describe what the person is feeling. In the current study, participants responded to one practice image before responding to the

36 test images, which were presented to each participant in random order. Each of the four response options for each image was accompanied by its official definition from the RME test manual. Although Knowles et al. used other decoding tasks in addition to the RME test, we chose the RME test for the replication because it is likely the most widely used of all the social monitoring tasks employed in their studies.<sup>1</sup>

### 2.3.2 | Loneliness

Loneliness was assessed using the 20-item Revised UCLA Loneliness Scale (Russell, 1996), which includes 11 negatively worded items (e.g., “No one really knows me well”) and nine positively worded (reverse-scored) items (e.g., “There are people I feel close to”). Participants responded to the items using a 9-point scale, with higher scores indicating greater levels of loneliness ( $\alpha = .97$ ). Participants received and responded to the items in an individually randomized order.

## 3 | RESULTS

### 3.1 | Preliminary and descriptive analyses

Prior to testing the hypothesis, the integrity of the data was carefully examined. Every MTurk worker has a unique respondent ID number, so to ensure that no individual worker performs the hit more than once, the frequencies for respondent ID number were examined to establish that no numbers were duplicated and that each respondent was unique. Time to completion was also examined, and no questionnaire's time to completion was more than two standard deviations below the mean. In addition, the questionnaire contained an attention check, and the records of 83 participants who failed the attention check were eliminated from the sample. This left 355 participants in the treatment condition, 348 in the comparison condition, and 332 in the control condition, for an effective  $N$  of 1,035, just shy of the target  $N$  of 1,050.

Loneliness scores ranged from 1.00 to 8.90, with an average of 3.81 ( $SD = 1.89$ ). Loneliness did not vary significantly as a function of gender,  $F(4, 1,027) = 1.53, p = .19$ , but was inversely associated with age,  $r(1033) = -.11, p$  (two-tailed) = .001. Hispanic participants reported significantly higher loneliness ( $M = 4.44, SD = 1.97$ ) than did non-Hispanic participants ( $M = 3.78, SD = 1.89$ ),  $t(1033) = -2.36, p$  (two-tailed) = .02, Cohen's  $d = .34$ ; similarly, participants identifying as Latino/a reported higher loneliness ( $M = 5.00, SD = 2.07$ ) than did non-Latino/a participants ( $M = 3.78, SD = 1.89$ ),  $t(1033) = -2.01, p$  (two-tailed) = .045, Cohen's  $d = .61$ . Loneliness did not vary significantly as a function of any of the other racial/ethnic categories.

Performance on the emotion decoding task had a theoretic range of 0–36 correct responses. Actual performance scores ranged from 4 to 36 correct responses, with an average of 26.50 ( $SD = 6.12$ ). Performance did not vary as a function of gender,  $F(4, 1,027) = 0.91, p = .46$ , and was not significantly correlated with age,  $r(1033) = -.01, p$  (two-tailed) = .67. Participants who identified as Black/African American had lower average accuracy scores ( $M = 23.40, SD = 7.26$ ) than did those who did not identify as Black/African American ( $M = 26.92, SD = 5.83$ ),  $t(1033) = 6.10, p$  (two-tailed) < .001, Cohen's  $d = .53$ ; moreover, White/Caucasian participants had higher average accuracy scores ( $M = 27.18, SD = 5.66$ ) than did non-White/Caucasian participants ( $M = 24.08, SD = 7.04$ ),  $t(1033) = -6.89, p$  (two-tailed) < .001, Cohen's  $d = .49$ .

Hispanic participants reported lower average accuracy scores ( $M = 24.77$ ,  $SD = 6.94$ ) than did non-Hispanic participants ( $M = 26.59$ ,  $SD = 6.07$ ),  $t(1033) = 2.01$ ,  $p$  (two-tailed) = .045, Cohen's  $d = .28$ ; and participants who identified as Native American or Aleut reported lower accuracy scores ( $M = 20.31$ ,  $SD = 5.79$ ) than those who did not ( $M = 26.60$ ,  $SD = 6.08$ ),  $t(1033) = 4.11$ ,  $p$  (two-tailed) < .001, Cohen's  $d = 1.06$ . No other racial/ethnic comparisons were significant.

### 3.2 | Hypothesis test

The hypothesis predicted that the framing condition interacts with loneliness to affect social monitoring accuracy, such that loneliness is negatively related to accuracy in the social frame condition but unrelated to accuracy in the comparison and control conditions. The hypothesis was tested in a hierarchical multiple regression in which control variables of Hispanic race, and Black/African American, White/Caucasian, and Native American/Aleut ethnicity were entered in the first step, loneliness and framing condition were entered in the second step, and the loneliness-by-condition interaction was entered in the third step. Each racial/ethnicity variable was coded as "1" if a participant claimed that racial/ethnic category and as "0" if not. Two dummy codes were created to represent framing condition (with the treatment condition as the reference), and both dummy codes were used to create interaction terms with loneliness to test the prediction. Loneliness was grand-mean centered (Aiken & West, 1996).

The overall regression model was significant,  $F(9, 1,025) = 9.54$ ,  $p < .001$ . Interaction terms between loneliness and the two dummy codes were used to test the hypothesis, and as Table 1 reports, neither interaction term was significant ( $\beta_1 = .02$ ,  $p = .81$ ;  $\beta_2 = .11$ ,  $p = .17$ ). The hypothesis is not confirmed.

The regression produced a significant main effect of loneliness,  $\beta = -.10$ ,  $p = .001$ , indicating that loneliness was inversely related to social monitoring accuracy.

## 4 | DISCUSSION

This study offered a conceptual replication of Knowles et al.'s experiment to test the central claim that framing condition interacts with loneliness to affect emotion decoding accuracy. Contrary to the prediction, loneliness did not interact with framing condition to affect performance on the social monitoring task. Instead, loneliness exerted a main effect on social monitoring ability. In this discussion, we revisit our results, offer implications, and identify strengths and limitations of our replication before concluding with a direction for future research.

### 4.1 | A failure to replicate the choking under pressure effect

Knowles et al. identified a moderately robust choking under pressure effect in their studies, so we were surprised to find that the effect failed to replicate. Because this study represented a conceptual—rather than true—replication, methodological differences might have accounted for this outcome. As described, we used a sample of MTurk workers rather than a sample of undergraduate students. Online samples are frequently critiqued, especially for their representativeness (e.g., Crump, McDonnell, & Gureckis, 2013; Paolacci & Chandler, 2014), and it is certainly the case that an MTurk sample is not a truly representative sample of U.S. adults. In

**TABLE 1** Multiple regression predicting social monitoring accuracy ( $N = 1,033$ )

Step	Variable	Zero-order $r$	$B$	$SE B$	$\beta$	$\Delta R^2$
1	Black/African American	-.19	-1.95	.74	-.10*	.060**
	White/Caucasian	.21	1.85	.60	.13*	
	Hispanic	-.06	-.72	.92	-.03	
	Native American/Aleut	-.13	-5.09	1.52	-.10*	
2	Black/African American	-.19	-2.04	.74	-.11*	.015*
	White/Caucasian	.21	1.75	.60	.12*	
	Hispanic	-.06	-.52	.92	-.02	
	Native American/Aleut	-.13	-4.92	1.51	-.10*	
	Loneliness	-.10	-.32	.10	-.10*	
	Treatment to comparison (C1)	-.07	-.55	.45	-.04	
	Treatment to control (C2)	.07	.68	.45	.05	
3	Black/African American	-.19	-2.07	.74	-.11*	.002
	White/Caucasian	.21	1.75	.60	.12*	
	Hispanic	-.06	-.56	.92	-.02	
	Native American/Aleut	-.13	-4.86	1.51	-.10*	
	Loneliness	-.10	-.44	.16	-.14*	
	Treatment to comparison (C1)	-.07	-.76	1.0	-.06	
	Treatment to control (C2)	.07	-.58	1.0	-.04	
	C1-by-loneliness	-.10	.06	.24	.02	
	C2-by-loneliness	.05	.33	.24	.12	

Notes:  $R^2 = .08$ ; adjusted  $R^2 = .07$ ;  $F(9, 1,025) = 9.54$ ,  $p < .001$ .

\* $p < .01$ .; \*\* $p < .001$ .

particular, MTurk workers are, on average, younger, underemployed, overeducated, more liberal, and less religious than the general population (Berinsky, Huber, & Lenz, 2012; Paolacci et al., 2010; Shapiro, Chandler, & Mueller, 2013), and MTurk samples tend to overrepresent Asians and underrepresent Hispanics and African Americans, relative to the U.S. adult population (Berinsky et al., 2012). These caveats aside, however, we submit that the present sample was likely more diverse in terms of age, socioeconomic status, education, ethnicity, and geography than the samples recruited by Knowles et al. In a comparison of samples recruited from MTurk, from various social media platforms (Twitter, Facebook, Reddit), and from among undergraduate students, Casler, Bickel, and Hackett (2013) found that the MTurk sample was significantly more diverse ethnically and socioeconomically than the other two samples, bolstering our assertion. Importantly, however, Casler et al. found that the three samples were virtually indistinguishable in their performance on a behavioral task, making it unlikely that our failure to replicate the Knowles et al. effect is attributable to differences in our sampling techniques.

A reviewer of our replication proposal raised the possibility that participants in the control condition (who received no explicit frame for the social monitoring task) would nonetheless assume that the task was an assessment of social sensitivity or aptitude. If so, then lonely people

would be likely to choke in both the treatment and control conditions. We certainly acknowledge this possibility, but post hoc exploratory analyses do not support it. Loneliness and performance on the RME test were correlated with each other to highly similar degrees in the treatment condition ( $r = -.172$ ) and the comparison condition ( $r = -.152$ ), but only to a nonsignificant degree in the control condition ( $r = -.076$ ). Thus, loneliness impaired social monitoring ability similarly when the RME test was framed as a test of social ability or academic ability but did not impair social monitoring ability in the absence of an explicit frame.

Finally, Knowles et al. enforced a 2-min time limit for participants to complete as many RME test items as possible, whereas we did not enforce a time limit for completion. We acknowledge the possibility that the added pressure of the time limit may have contributed to the choking effect in the Knowles et al. studies and could possibly account for our failure to replicate that effect here. This speculation awaits empirical verification.

An implication of our result is that the choking effect of loneliness on social monitoring under conditions of social evaluation may not be as robust as initially suggested. Although Knowles et al. identified an average effect size of  $r = .21$  for loneliness under the social frame condition, it is possible that the effect is limited to the controlled laboratory environment and/or exaggerated by the demographic homogeneity of the Knowles et al. participants. It may also be the case that concerns about social skills and future relationship development are more salient for college-aged adults (such as the undergraduates whom Knowles et al. recruited) than for older adults. Recall that the social frame instructions pointed out that “Unfortunately, people who do poorly on this task tend to perform quite badly in social interactions and *have difficulty forming and maintaining meaningful relationships as they get older*” [emphasis added]. A concern about future relationship development might be especially salient to the Knowles et al. participants, who were likely in their early 20s or younger and probably mostly unmarried. In contrast, our participants were nearly 40 years of age, on average, and more than half had already been married at least once. This raises the possibility that the choking effect for loneliness may be more robust for younger (and less relationally experienced) adults than for others.

These are speculations, of course, and we acknowledge that future research is necessary before our failure to replicate can be understood in proper context. Nonetheless, it is notable that the choking effect failed to manifest in a sample that likely enhanced both statistical power and external validity relative to the Knowles et al. samples, which must cause us at least to question the true robustness of the effect.

## 4.2 | A main effect of loneliness

An unhypothesized finding was that, irrespective of framing condition, loneliness was negatively associated with performance on the RME test. As Lodder, Scholte, Goossens, Engels, and Verhagen (2016) pointed out, research on the association between loneliness and social monitoring has been consistent in its lack of consistency. Some findings have suggested a positive association. For instance, Gardner et al. (2005) demonstrated that loneliness was positively related to the ability to recall previously read descriptions of social incidents, and in a second study, the authors showed that the number of good friends participants reported having was negatively related to their performance on both a vocal emotional Stroop test and on DANVA. Similarly, Cacioppo, Norris, Decety, Monteleone, and Nusbaum (2009) reported that loneliness predicted stronger visual cortex activation when participants viewed images of negative social cues.

Other research has suggested—similar to this study—that loneliness impairs social monitoring ability. Kanai et al. (2012) observed that lonely people display smaller gray matter volume in the left posterior superior temporal sulcus, which may be indicative of a dampened ability to interpret social cues. Cacioppo et al. (2009) also reported that loneliness predicted weaker ventral striatal activation when participants viewed images depicting positive social cues, which suggests an impaired ability to attend to such cues.

Finally, some research—including the Knowles et al. investigations—has found no main effect of loneliness on social monitoring. In two studies, Lodder et al. (2016) tested the effect of loneliness on various emotion recognition tasks, including the RME test. In all cases, loneliness was unrelated to the interpretation of emotion signals. Similarly, Kanai et al. (2012) documented a nonsignificant effect of loneliness on the ability to differentiate between emotions.

These studies differ, sometimes substantially, in how they operationalize social monitoring ability. Nonetheless, juxtaposed against their diverse results, the present findings raise the question of how, exactly, loneliness affects social monitoring ability.

Cacioppo's evolutionary theory of loneliness (Cacioppo & Cacioppo, 2018) postulates that loneliness motivates social vigilance, particularly to threats such as those that might be represented by negative emotion cues, in particular. This claim raised the possibility that although loneliness might impair the decoding of positive affect cues in the RME test, it might actually enhance the decoding of negative affect cues, a difference that would be obscured by examining only the total accuracy score on the RME test. Post hoc exploratory analyses did not support this possibility, however. When we computed average scores for the RME photos that explicitly depicted positive and negative affect separately, we found that loneliness had an equally inhibitory effect on both at the zero-order level ( $r$ 's =  $-.12$  and  $-.13$  for negative and positive affect, respectively). It may be the case that loneliness enhances *attention* to social cues—and particularly social threats—as Cacioppo's theory postulates, but does not enhance *accuracy* in decoding those cues.

As we intimated above, it is also possible that the enhancing effect of loneliness on social monitoring is a laboratory effect only, one that does not translate to success in noncontrolled, nonlaboratory contexts. Insofar as both of Gardner et al.'s (2005) studies were laboratory-based, this explanation may account for the discrepancy between their findings and ours, and at the very least, would warrant additional comparisons between laboratory and nonlaboratory contexts.

### 4.3 | Strengths, limitations, and conclusion

As detailed above, this conceptual replication offered three methodological strengths in particular that improved upon the original Knowles et al. investigations. First, our sample size in this study was more than twice the total combined sample size across Knowles et al.'s four studies, improving both statistical power and external validity. No power analyses attested to the adequacy of the samples in the Knowles et al. article, whereas the present sample was targeted to provide maximum power to detect the effect size identified by Knowles et al. Second, although Knowles et al. provided limited demographic information on their samples, it is wholly reasonable to infer that the present sample was substantially more diverse demographically and geographically, which also improves external validity. Finally, the inclusion of a true control group allowed the choking effect of a social frame to be tested not only relative to a nonsocial (academic) frame but also relative to the absence of a frame altogether.

As we acknowledged, some may consider our MTurk sample to be a limitation, despite evidence that MTurk samples are more representative of their populations than are convenience samples of undergraduate students. To enhance the integrity of our data, we employed several best practices for MTurk samples, including using only master workers, checking the uniqueness of worker identification numbers, discarding entries whose time to completion was fewer than two standard deviations below the mean time to completion, and discarding entries that failed attention checks. Although these efforts do not guarantee the highest quality data, they do help to weed out participants who did not take the study seriously.

A second limitation is that we replicated only one of the social monitoring tasks used by Knowles et al. Of the options, we chose the RME test deliberately, as it is likely the most commonly used task among those employed by Knowles et al. and it did demonstrate the choking effect in their investigation. Nonetheless, it would be worthwhile to follow up this conceptual replication with others employing the remaining social monitoring tasks; as it stands, we can conclude that the effect failed to replicate for the RME test only.

The principal conclusion of this study is that the choking under pressure effect of loneliness under a social framing condition did not replicate. Loneliness impaired the accuracy of decoding affect cues in the RME test overall, and to a nearly identical degree in the social frame and academic frame conditions. If anything, it appears that framing the RME test as indicative of *either* social or academic competence led to an impairment effect for loneliness, relative to offering no frame at all, as loneliness was nonsignificantly associated with decoding accuracy in the control condition. Although this was a conceptual rather than a true replication, we anticipated that the effect would be robust enough to manifest, especially given improvements to statistical power, and that was not the case. Future research may help illuminate the boundary conditions of the choking under pressure phenomenon and may aid our understanding of how loneliness—either on its own or in conjunction with social frames—influences social monitoring abilities.

## DATA AVAILABILITY STATEMENT

The data used in the research are available. The data can be obtained by emailing [koryfloyd@email.arizona.edu](mailto:koryfloyd@email.arizona.edu). The materials used in the research are available. The materials can be obtained by emailing [koryfloyd@email.arizona.edu](mailto:koryfloyd@email.arizona.edu).

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## ENDNOTE

<sup>1</sup> The other contender for a social monitoring task was DANVA. Although it is an inexact method of determining a given task's use in research, we searched the terms "Reading the Mind in the Eyes Test" and "Diagnostic Analysis of Nonverbal Accuracy Scale" on Google Scholar. Whereas DANVA returned approximately 66,900 results, the RME test returned approximately 966,000 results (thus, more than 14 times as many). Not all of the results represent empirical studies using one or the other tasks, of course, but we took this as compelling evidence of the relative popularity of the RME test (vs. DANVA). Thus, we chose the RME test for our conceptual replication.

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