Shelter-in-place orders, loneliness, and collaborative behavior

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ARTICLE INFO

ABSTRACT

The outbreak of COVID-19 resulted in numerous jurisdictions instituting "shelter-in-place'' orders (SPOs). While designed to restrict or impede normal levels of social proximity, SPOs altered the way or degree to which workers interact with each other and have likely imposed a toll on employee well-being. The authors exploit the temporal and geographic variation in U.S. SPOs to investigate their effect on loneliness among online workers. Variation in loneliness is then linked to worker behavior in a simple two-person, collaborative task (a framed stag hunt). The analysis reveals a strong positive relationship between SPOs and loneliness on average, peaking during the wave associated with the most prolonged duration of isolation. SPOs disproportionately impacted workers in occupations not substantially involving teamwork or collaboration. As reported loneliness increases, the probability of an individual collaborating in a simple interactive workplace scenario decreases significantly. In the final survey wave, SPOs are scarcer, loneliness subsides, and cooperative behavior increases dramatically.

1. Introduction

Amid the outbreak of COVID-19, numerous states and municipalities adopted various *shelter-in-place orders* (hereafter SPOs, also known as *stay-at-home orders*), forged as mitigation strategies meant to reduce the spread of the disease. These orders typically restricted nonessential travel, commercial or employment activity and required individuals to remain isolated in their residences. By April 2020, most U.S. states (42) had issued some version of SPOs mandating the closure of schools and nonessential businesses (D. Lee, 2020; A. Lee, 2020). In this paper, we ask whether being under a shelter-in-place order impacts a person's feelings of loneliness and, subsequently, whether loneliness in the pandemic environment relates to a worker's willingness to collaborate toward an efficient or mutually productive outcome.

Some unfortunate byproducts of SPOs are that they affect normal social interaction levels, employment, and consumption (Nelson et al., 2020), leading to adverse effects on crime rates health. Suspected drug overdoses nationally jumped 18% in March 2020, 29% that April, and 42% that May (Wan and Long, 2020). Bullinger et al. (2020) observed an increase in domestic violence-related calls for police services, estimating that nearly 1000 cases of domestic violence crimes went under-reported between March and April 2020. Fenoll and Grossbard (2020) identify higher COVID mortality rates in areas where young adults cohabitate

with their parents, an effect complicated by SPOs keeping younger and older people in close contact. Other researchers note that increased symptoms of depression, loneliness, and anger can result during times of quarantine (Killgore et al., 2020; Wanberg et al., 2020).

While Cacioppo and Patrick (2008) estimate 1 in 5 adults is lonely in times of relative normalcy, researchers have expressed concern that curtailing social contact and normal activities may intensify feelings of loneliness, particularly among vulnerable groups in the U.S. (e.g., Miller, 2020) and in the U.K. (Banerjee and Rai, 2020; Sanders, 2020). One key study, Luchetti et al. (2020), explores loneliness during the initial outbreak of the coronavirus in the U.S., finding an initial increase in loneliness only among older individuals and loneliness tending to level off by the end of April 2020. Their analysis does not differentiate by the presence of an SPO within a locality. Their results also contrast with those in Killgore et al. (2020), who find a steady increase in loneliness between April, May, and June 2020.

In addition to curtailing social activities, the pandemic has profoundly affected the work environment for many individuals. The percentage of part-time or full-time workers reporting "always" working from home peaked at 51% in April 2020, with less than a third of workers reporting "never" working remotely (Brenan, 2020). Prior research suggests that these alternative work arrangements lead to fewer opportunities for social interactions (Ten Brummelhuis et al., 2010;

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Vega and Brennan, 2000). A change to remote work is shown to have ramifications on individuals' overall mental health even before COVID-19 (Mann and Holdsworth, 2003). Indeed, even prior to the COVID-19 pandemic, a survey of remote workers found that 21% of respondents identified loneliness as the biggest struggle with working remotely (Hickman, 2019). Loneliness may also impact worker behavior and performance. Negative well-being indicators like loneliness have been shown to be negatively related to performance (Miner and Glomb, 2010; Ozcelik and Barsade, 2011), decision-making accuracy (Isen and Means, 1983), and organizational citizenship behavior (Lam and Lau, 2012), and loneliness is considered a driver of worker burnout (Seppala and King, 2017).

Loneliness may also affect relational performance or worker productivity in team environments. Collaboration is critical to organizational success and an increasing component of workers' day-to-day activities, with collaborative activities comprising as much as 80% of workers' time within some companies (Cross et al., 2016). While loneliness leads to diminished team performance and commitment (Barsade and Gibson, 2007; Ozcelik and Barsade, 2011), what remains less known is how a worker's feelings of loneliness or social isolation relate specifically to collaborative behavior in a team setting. Further, Barsade and Gibson (2007) indicate a need for further research into how employee affect can impact organizations in non-face-to-face interactions, a line of inquiry that is still significantly under-studied given that remote work has become increasingly common.

To address our research questions, we exploit the sequential adoption and expiration of COVID-19 related SPOs, collecting four cross-sectional waves of personal, household, and employment-related data from adult workers on Amazon's MTurk throughout the U.S. The first wave covers a time with an increasing number of SPOs nationally, while the final wave of data was collected when almost all SPOs had expired, while those still under SPOs had been for a long duration. To measure collaborative behavior in workers, we randomly and anonymously paired individuals in a hypothetical workplace task – a simple game-theoretic interaction, *stag hunt* – in which coordination depends on both an individual's action and the action of their counterpart.

An advantage of our research design is that we track personal characteristics and psychometrics for workers who are either under SPOs or free from such policies. Our online data collection procedure allows for observations from a wide variety of workers in the U.S. and enables us to gauge worker behavior in collaborative scenarios where actual interaction would be precluded during the COVID-19 pandemic. The setting also aligns with the remote work environment of many individuals' primary jobs during the pandemic. We collect data across multiple waves to incorporate variation in the duration of SPOs and the pandemic environment's overall effects. Finally, while many studies use MTurk workers as a convenience sample, we consider these online workers to be important research subjects in their own right. While remote work in online, crowd-sourced environments was commonplace and growing pre-COVID-19 (Abrams, 2019), such markets offer a new opportunity for many to opt into the labor force or augment their labor supply (Hooton, 2017), and the COVID-19 pandemic has only increased its popularity. Arechar and Rand (2020) document an influx of new participants that are more diverse and nationally representative than the prior worker pool.

This paper provides several important contributions to the literature. To our knowledge, this is the first study to explore loneliness and cooperative behavior using a game-theoretical framework directly. Additionally, we collect data during the 2020 COVID-19 crisis, a unique period when SPO policies directly impacted human interaction and overall economic activity. We demonstrate a strong positive relationship between SPOs and loneliness on average, peaking during the wave associated with the most prolonged duration of isolation. SPOs disproportionately impacted workers in occupations not substantially involving teamwork or collaboration. While Luchetti et al. (2020) explored loneliness during times of COVID-19, their data end in late

April 2020; we capture a period from April to July 2020 – demonstrating the impact of reopening and the lag in loneliness associated with SPOs. Beyond measuring the longer-term implications of the pandemic and associated policies on loneliness, we exploit the rather unprecedented, acute changes in loneliness to consider its role in cooperative behavior in simple, team-based tasks. We frame these strategic interactions in terms of the mutual and individual effort that directly affect worker earnings, suggesting that the implications from our results are particularly relevant to the labor market. As reported loneliness increases, the probability of an individual collaborating in a simple interactive workplace scenario decreases significantly. This research enriches understanding of how workers are affected by feelings of isolation or displacement and identifies one channel through which loneliness can impact their decision-making. The results may direct policy at various government and industry levels, both during the current crisis and throughout the long process of normalization, particularly if online or remote work continues to be the norm after the COVID-19 crisis.

2. Theoretical background and hypotheses

2.1. Loneliness and SPOs

While Weiss (1973) described loneliness as a chronic condition, a form of depression, with no redeeming features, evidence from both the social psychology and neuropsychology fields demonstrates that loneliness may be transient and impacted by one's situation and environment (Cacioppo and Patrick, 2008). Further, evolutionary psychology emphasizes the importance of the aversive nature of loneliness. According to Cacioppo et al., (2014, p. 3), "The pain of loneliness served to prompt us to renew the connections we needed to insure [sic] survival and to promote social trust, cohesiveness, and collective action." According to cognitive discrepancy theory, Archibald et al. (1995), the feeling of loneliness results from a mismatch between one's actual and desired quality or quantity of social contact or relationships. Each of these views of loneliness suggests that SPOs, and potentially other aspects of the pandemic environment, are likely to affect loneliness. SPOs, by their very nature, were designed to limit certain types of social interactions and reduce face-to-face workplace interactions by often mandating that companies allow work to be performed remotely when possible. Other contributing factors to reducing the quantity or quality of social interactions are face masks, physical distancing guidelines, and quarantine measures.

As loneliness is a relational phenomenon, it is clear that loneliness may be impacted by changes in the nature and setting of employment. Several adverse outcomes, including worker withdrawal, have been linked to a lack of desired social connections in the workplace (Chiaburu and Harrison, 2008). Reduced hours, furloughs, or layoffs directly and negatively impact the quantity of workplace interaction. The dramatic shift to remote work within organizations, even with rapidly developing technological advancements, may fall short in providing interactions of sufficient quality – particularly, informal social interactions – which research suggests represent important, affective events (Winslow et al., 2019). The impact on loneliness may be particularly severe for those workers whose tasks are mostly independent of their coworkers, as physical proximity is an important facilitator for social engagement. On the contrary, workers who typically work in team environments are more likely to continue collaborative work and communication remotely – albeit using media/technology. These considerations lead us to the following hypotheses:

H1. There is a positive relationship between workers that report being under an SPO and their loneliness score.

H2. The impact of SPOs on loneliness is smaller for those who typically work in a team environment compared to those who do not.

2.2. The loneliness-collaboration relationship

Online workgroups and other team settings involving collaboration often resemble the classic coordination problem. Thus, it is reasonable to believe that loneliness could impact outcomes in this setting. Under the social exchange model (Blau, 1964; Coyle-Shapiro and Shore, 2007), a norm of reciprocity (Gouldner, 1960) allows for trusting and productive relationships between organizations and employees. In exchange for providing resources, training, and growth opportunities, employees help their employers by providing effort, commitment, and organizational citizenship behavior (OCB, Bateman and Organ, 1983). A component of OCB is interpersonal citizenship behavior (ICB) (Settoon and Mossholder, 2002), which describes helping or altruistic behaviors among coworkers. Compared to OCB more generally, ICB tends to be oriented toward specific tasks and recipients (Bowler and Brass, 2006).

Loneliness may affect ICB and, by extension, cooperative behavior through various channels. First, loneliness causes disengagement and lower affiliation with work and one's coworkers, including lessened feelings of obligation towards employers and coworkers. Given prior research, this, in turn, affects various worker outcomes, including performance (Ozcelik and Barsade, 2011, 2018) and OCB (Lam and Lau, 2012). Second, despite exhibiting limited social connectedness, lonely individuals tend not to lose social awareness (Gardner et al., 2005) but instead tend to focus more on negative rather than positive social cues (Cacioppo and Hawkley, 2009). Thus, they are less willing to take social risks and avoid social exchange relationships out of fear that their effort will not be reciprocated. This finding also suggests that loneliness may lead to reduced trust of others. Rotenberg (1994) found that loneliness reduced individuals' willingness to trust in strategic environments, resulting in a lower likelihood of efficient outcomes being reached. Ernst and Cacioppo (1999) suggest that chronically lonely individuals lack trust in themselves and others. Given that explicit or implicit incentive structures within most organizations include aspects of both cooperation and competition (Milkman et al., 2014), regular interaction and interpersonal trust may be critical to efficiency (from an organizational perspective) or collectively beneficial outcomes (from the standpoint of employees).

While these theoretical considerations and related empirical research motivate our novel investigation into the link between loneliness and cooperative behavior, particularities of the COVID-19 environment also suggest a possible exacerbation of this potential relationship. Fear of communicability, competition over resources, and increased political division may have led to lower trust and the inclination towards cooperation. A survey carried out near the beginning of the outbreak in the U.S. found that a majority (57%) of adults have low trust in others' altruism (Rainie and Perrin, 2020). Trust is shown to be correlated with mental health: those with low trust were more than twice as likely as those with high trust to have experienced depression or loneliness. This discussion drives our final hypothesis:

H3. Workers reporting higher levels of loneliness are less likely to achieve the collaborative outcomes (efficient equilibrium) in interactive tasks than those with lower loneliness scores.

3. Materials and methods

We collected worker data in four waves between April 28 and July 1, 2020 (detailed in Fig. 1). The study design involved two phases: a Reporting phase and an Interaction phase, each delivered the instrument via Qualtrics, including Captcha and 'bot' screening methods for data quality control.

In the Reporting phase, workers filled out an electronic questionnaire, collecting demographics, employment information, risk preferences, attitudes toward cooperative behavior, loneliness, and competency checks. To assess a worker's loneliness (the first critical outcome variable), we administered the UCLA Loneliness Scale (V3,

Russell, 1996), a well-vetted, 20 question assessment that provides a loneliness score for each respondent. Workers answered questions such as "How much of the time do you feel isolated from others?" and "How much of the time do you feel that there are people you can talk to?" on a 4-point scale (with some items reverse scored). In addition to its common usage, this scale's advantages are that it captures loneliness across multiple dimensions, retains a high alpha throughout ($0.89 > \alpha > 0.94$), and that individual questions do not allow for a neutral option.

To broadly assess local COVID-19 policy responses, we asked workers, "Are you currently under a "Shelter in Place order" in response to the COVID-19 virus?" Workers gave a binary response, defining the *SPO* variable in our analyses. To account for heterogeneous social interactions (in either the presence or absence of an SPO), we measured workers' non-domestic social interactions by having them report, "During this past week, approximately how many times have you been away from your home and around other people outside your household?" We also asked workers if they personally knew someone directly afflicted with the COVID-19 virus to capture "proximity" to the pandemic. This measure, used as a control variable, may be correlated with SPO status and may also directly impact one's loneliness. Workers also provided binary responses to a teamwork-based question: "Do you consistently work in teams or in a group setting in your primary occupation (other than on MTurk)?" This variable allows us to test whether the impact of SPOs on loneliness differs by one's typical work environment.

In assessing the impact of loneliness on cooperative behavior, we control for a worker's overall propensity toward cooperative and competitive behavior in one specification (thus, accounting for an individual worker's likelihood of selecting the cooperative action distinctly from the impact of loneliness or SPOs). We adopted a version of the Tang (1999) CCSS assessment, an externally validated scale that provides two scores: a *cooperation score* and a *competitiveness score*, each ranging from 7 (high) to 1 (low). Archer and Webb (2006) first used the scale in a comparison with related variables, including the score on the Buss-Perry aggressiveness scale. These two measures are not mutually exclusive: one can both be cooperative and competitive. A person's attitude toward risk is often observed to affect choices in simple economic games (e.g., Glöckner and Hilbig, 2012). Considering the relationship between risk preferences and strategic choice documented in Büyükboyacı (2014). To control for this factor, we asked a commonly used risk preference question from the German SOEP survey: "Generally speaking, are you a person who is always ready to take risks or are you trying to avoid risks?" This question, validated in Dohmen et al. (2011), is useful because it is not domain-specific and easy to understand compared to other risk preference elicitation methods.

In the Interaction phase, workers participated in a strategic interaction to provide the basis for our other primary outcome variable. The interaction, framed as a hypothetical workplace collaborative project, takes the form of a one-shot *stag hunt* game. Numerous researchers have used stag hunt to describe the potential conflict between personal benefit and social cooperation (e.g., Myerson, 2009; Schelling, 1960; Skyrms, 2001) and to model markets or the provision of public goods (Binmore et al., 1994; Cooper, 1999; McAdams, 2008).[2] Following Schelling (1960), stag hunt involves a *coordination problem*, the focal solution to which is typically realized through a norms-based mechanism that Gintis (2010) calls *social choreography*. Empirically, people regularly coordinate on the mutually beneficial equilibrium, yet gravitation to this outcome is shown to be sensitive to interventions such as hunger or communication, as well as emotional or psychological state (e.g., Chen et al., 2019; Kagel and Roth, 2016; Luhan et al., 2017).

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[2] The stag hunt is used by Rousseau as a parable to describe social contracts. It takes its name from Rousseau, who describes how a collective hunt for a deer may be derailed by individuals opting for the easier pursuit of a rabbit that is adequate for their own needs.
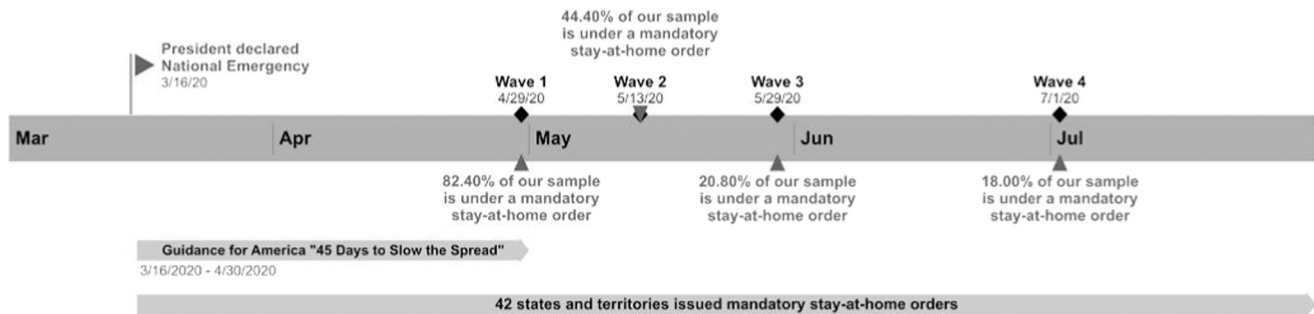
Fig. 1. Study timeline.

This part of the study focuses on a worker's gravitation to one of the two Nash equilibria in pure strategies for how players behave. One involves each player choosing to work together, coordinating on a mutually (or socially) beneficial outcome, and one predicts each player chooses to work alone for a diminished – but guaranteed – payoff. This coordination is sub-optimal yet relatively safer for each player [3] Fig. 2 provides the simple matrix form for the framed stag hunt.[4] All participants played this game after completing comprehension checks. Workers were reminded that there would be hundreds of participants and that everyone would receive the same information. Game instructions framed the game as a workplace-oriented decision, and their choices of strategies were to "cooperate" or "work alone" on a collaborative project. Workers were randomly matched with other workers in

Fig. 2. Stag Hunt Variant. Notes: team-based work resembles the classic coordination problem. We adapt and frame this classic game as a "team task." The model describes the trade-off between mutual gain and safe, personal benefit, while empirical results from such games, in general, are important to determining under what circumstances socially desirable behaviors, like collaboration, can exist. The theoretical predictions (pure strategy Nash equilibria) of the model are coordination on the strategy profiles (Coop, Coop) and (Alone, Alone).

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[3] For simplicity, we exclude the complexities of analyzing the mixed strategy Nash equilibrium (MSNE). However, in an MSNE, increased cooperation among both players still leads to increased gains.

[4] We opted against showing workers matrices for the game, fearing that workers with experience in similar studies, such as those involving prisoner's dilemmas, would lead to individuals ignoring the instructions.

the study after submitting responses. This interactive scenario allows us to approximate the type of collaborative situation that may commonly be found in the workplace in an easy way for respondents to understand. Perhaps most importantly, there are real consequences to workers' chosen actions. This exercise's monetary bonus gave workers the potential to dramatically increase their remuneration above the base pay for a survey response. We consider *collaboration* and *cooperation* as semantically the same in this manuscript (as leading coordination on the Pareto efficient outcome), despite nuanced differences in classification in non-cooperative game theory. The worker's action provides our second dependent variable, a binary variable indicating whether the worker selected the collaborative "cooperate" strategy.

3.1. Participants

Ad hoc power tests ($\delta > 0.5$, power = 0.85, $\alpha = 0.05$) indicated a target sample of 240–320 subjects per wave. Our Qualtrics instrument was listed as a human intelligence task (HIT) on the Amazon Mechanical Turk jobs board. Our MTurk sample choice was driven by the need to collect a large, diverse national sample and the desire to observe collaboration (SPOs making other methods relatively infeasible). We were mindful of the need to review and clean the data to ensure the internal validity of the responses while targeting a balanced sample by wave and keeping the sample large enough for ample statistical power. The instrument included a number of attention and competency checks to ensure workers understood the interaction; to filter potential "bots," we employed a Captcha mechanism and included short answer text questions that allowed us to remove observations with numerous nonsensical or questionable responses. We also added a qualification to ensure that previous participants could not re-enter the study. After cleaning the data, 1000 worker observations remained, 250 per wave. We focus on a particular subset of the overall U.S. labor force – those with internet connections and working in virtual labor markets at the time of the pandemic. Most MTurk workers are employed outside of the platform (Difallah et al., 2018), although it is likely COVID-19 forced many to work in crowdsourced labor markets as the economy reeled. While this sample is not wholly representative of the entire U.S. labor force, it does capture a broad demographic with varying occupations and levels of (non-MTurk) labor force participation.

Table 1 provides a detailed summary of our sample and the variables in our analysis and F statistics comparing means across the four waves of data collection. The sample is reasonably gender-balanced (48.6% female). Sixty-eight percent report being of Caucasian descent, 9.3% African, 9.5% Asian, and 7.6% Hispanic, proportions that are generally representative of the US. The average worker was 36.39 years old (*s.d.* 12.51) with a little less than a bachelor's degree education, generally indifferent to risk, and rated their overall satisfaction with their life at 6.40 out of 10 (2.12). These characteristics are within the range of those detailed in Difallah et al. (2018) as the typical profile for MTurk workers and closely reflect the demographic composition observed by Arechar and Rand (2020) during the time of COVID-19. Nearly 19.8% percent of

Table 1

Summary Statistics.

Variable	Full Sample		Under SPO		No SPO		
	Mean	s.d.	Mean	s.d.	Mean	s.d.	p-value (difference:SPO v. not)
Primary Measures							
Worker under SPO (binary)	0.516[a]	0.500					
Worker loneliness score (UCLA V3, 20–80)	41.54[a]	12.44	43.19	0.542	39.79	0.561	0.000
Worker chose "cooperate" in Stag Hunt (binary)	0.771	0.420	0.740	0.019	0.804	0.018	0.017
Demographics and Household Variables							
Worker unemployed (outside MTurk, binary)	0.198[a]	0.399	0.196	0.017	0.200	0.018	0.853
Unemployment due to COVID19 (binary)	0.597	0.492	0.650	0.048	0.541	0.051	0.123
Worker is retired (binary)	0.028	0.165	0.025	0.007	0.031	0.008	0.579
Occupation regularly involves teamwork (binary)	0.675	0.469	0.698	0.020	0.651	0.022	0.114
Times out past week around people	4.663[a]	4.353	4.153[a]	0.188	5.207	0.199	0.000
Worker knows someone with COVID-19 (binary)	0.337[a]	0.473	0.343	0.021	0.331	0.021	0.678
Number of people in household	2.860[a]	1.771	2.814	0.080	2.909	0.077	0.396
School-aged children in household (binary)	0.444	0.497	0.414	0.022	0.475	0.023	0.055
Worker Age	36.34	12.51	36.44	0.555	36.23	0.565	0.787
Worker education (yrs. beyond grade school)	9.153	3.430	9.372	3.465	8.919	3.379	0.217
Female worker (binary)	0.486[a]	0.500	0.500	0.022	0.471	0.023	0.361
African descent (binary)	0.093[a]	0.291	0.081	0.012	0.105	0.014	0.192
Asian descent (binary)	0.095	0.213	0.124	0.015	0.064	0.011	0.001
Caucasian descent (binary)	0.687[a]	0.464	0.672	0.021	0.702	0.021	0.307
Hispanic descent (binary)	0.076[a]	0.265	0.070	0.011	0.083	0.013	0.443
Additional Controls							
Risk tolerance (German SOEP, 1–100)	51.06[a]	26.22	51.30	1.134	50.80	1.215	0.763
Worker's overall life satisfaction (SOEP scale, 1–10)	6.397	2.123	6.297	0.092	6.504	0.098	0.122
Worker cooperation score (Tang, 1999 scale 1–7)	4.677[a]	0.912	4.700	0.039	4.652	0.042	0.400
Worker competition score (Tang, 1999 scale 1–7)	4.569[a]	0.932	4.586	0.041	4.552	0.042	0.563

Notes: Full sample, N = 100, 516 under SPO, 486 not under SPO. Those unemployed due to COVID: N = 196, 110 under SPO, 96 not. Final column reports p-values from two-sided *t*-tests of difference in means across SPO and non-SPO samples. Wave dummies include 250 observations per wave.

[a] Indicates difference in means across sample waves is significant at the 95% level.

our sample reported being unemployed at the time of the study, while 60% of those workers said COVID-19 was the primary reason for their unemployment. However, several of our observed demographic characteristics, most notably race and gender, are not found to be constant over time. While this confirms the relatively high varying composition of MTurk workers observed by Arechar and Rand (2020) in the months following the COVID-19 outbreak, it also motivates the inclusion of these variables as controls in our analysis.

Of particular interest for our analysis is whether or not the composition of our sample differs by SPO status, as SPO enactment and duration may be related to characteristics of the local population (Brzezinski et al., 2020), which might be correlated underlying differences in loneliness prevalence or tendency toward cooperative behavior. To investigate this possibility, in Table 1, we report sample means by SPO status, as well as results from *t*-tests for differences in these subsamples' means. Except for our outcome variables and a variable clearly correlated with SPOs (number of times out of the house and around people), only one variable (being of Asian descent) was found to statistically differ by SPO status.[5]

The mean time commitment for our survey was 10 min. Workers earned a US $0.25 participation fee and subsequently a bonus of up to US $0.75 depending on joint action in the game. The stakes were consistent with similar studies (e.g., Büyükboyacı, 2014; Capraro et al., 2020; Jacquemet et al., 2021; Guarin and Babin, 2021). Given the numerous studies establishing a negligible stake size effect (e.g., Camerer, 2003; Levitt and List, 2007), we believe the interaction was properly induced. As economists, we took concerns for equitable compensation seriously and considered this factor in the design, mindful of the tradeoff between the perception of "fair" wages and sample size.

We calculated the expected value of any compensation at just under US $5/h (below the US minimum wage of $7.25/h, but well above the vast majority of studies at the time on MTurk based on our own perusal and observations from Arechar and Rand, 2020). The mean amount paid as a bonus for the game was $0.53 per subject, for mean total compensation of $0.78.

Fig. 3 details the distribution of worker loneliness scores by wave. Mean loneliness increases steadily between waves 1 and 3 and then drops at wave 4 (but does not return to the baseline level of wave 1).

4. Results

4.1. Loneliness and shelter-in-place orders

Given the aforementioned studies, it is useful to consider a change in loneliness as a sort of productivity shock. We begin by comparing mean loneliness scores across the SPO indicator using the UCLA Scale V3. For the full sample, the mean loneliness score for workers is 41.544 (*s.d.* 12.442, $n = 1000$). The mean for those under SPOs is 43.194 (*s.d.* 12.314, $n = 516$) compared to 39.785 for those not under SPOs (*s.d.* 12.350, n = 484). The difference between these means, 3.409 (s.d. 0.704), is highly statistically significant (p < 0.01). This result is our first indicator that the stay-at-home policies impact feelings of loneliness in workers and supports hypothesis H1.

Because time under SPOs may matter, we compare loneliness scores between isolated and non-isolated workers by wave to capture duration effects. Fig. 4 illustrates the means in worker loneliness scores, separated by their SPO status and listed by wave. The mean scores during wave 1 are not statistically different between those workers not under SPOs and those that are (37.674 and 38.379, respectively). In wave 2, more workers report being under SPOs and many have been isolated longer than reported in wave 1. We observe a significant difference in means between the SPO groups, where loneliness is 3.346 higher in those under SPOs ($t = 2.084$). Similarly, in wave three at the longest average duration of SPOs in our study, the mean loneliness score for those under SPOs is 45.914 (*s.d.* 0.881, $n = 187$) compared to 41.016 (*s.d.* 1.205, $n = 63$),

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[5] Especially given the rise of anti-Asian sentiment and hate crimes beginning during our sample period, to ensure that this difference was not driving our results presented below, we reran all of our analyses excluding the Asian subsample (9.5% of our overall sample). The results were substantively very similar to those presented in Tables 2 and 3.
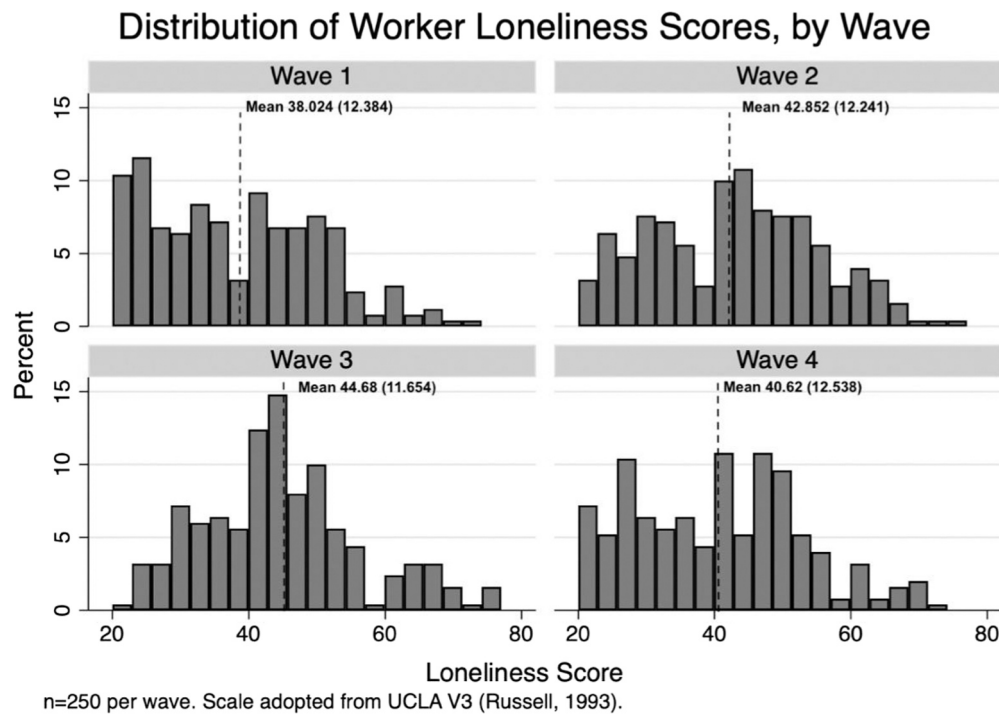
Fig. 3. Distribution of Worker Loneliness Scores, by Wave. Notes: Loneliness derived from UCLA Loneliness Scale V3. Means and right-tail kurtosis increase across Wave 1–3, then recess in Wave 4.
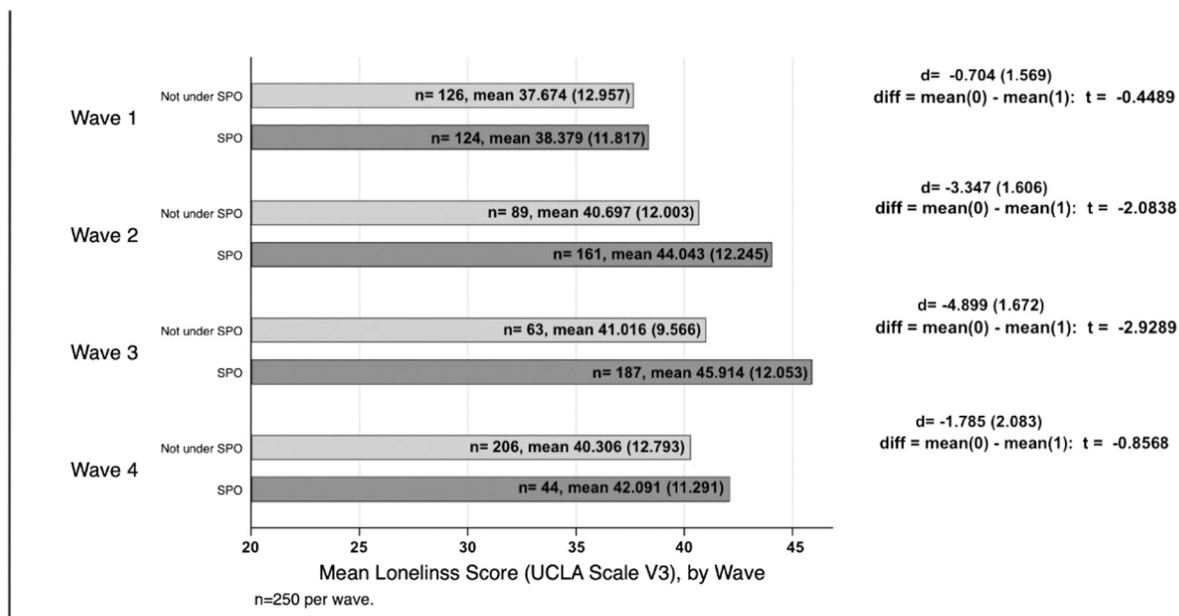

Fig. 4. Mean Loneliness Scores, by Wave and Shelter-in-Place Status.

a highly significant difference of 4.898 points ($t = 2.939$). Finally, in wave 4, when most SPOs had expired and replaced other mitigation policies, mean loneliness decreased from wave 3 (though not to wave 1 levels).[6] The difference in means across groups also became insignificant (42.091 for those still under SPOs, versus 40.306 for those not under SPOs; $t = 0.857$).

The difference in means results suggest that as an outcome, loneliness is significantly affected by SPOs and depends on the wave (capturing the length of time SPOs have been in effect as well as the general duration of the pandemic). However, given that other factors may impact workers' reported loneliness, including those that may correlate with SPOs, we proceed to use multivariate regression to isolate the impact of SPOs and identify other potential determinants of loneliness. Table 2 provides estimates of several variables' marginal impacts on a worker's loneliness score. Panel A details estimates for the full sample, with and without controls (Models 1 and 2). We focus on Model

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[6] Putting these means into perspective, Morahan-Martin and Schumacher (2003) consider loneliness scores greater than or equal to 47 (out of 80) as representing abnormally high levels of loneliness. 35% of our sample surpassed this cutoff, peaking in wave 3 among those under SPOs (42%).

Table 2
Determinants of Worker Loneliness Score.

Variable	Panel A		Panel B	
	Model 1	Model 2	Model 3	Model 4
	Full Sample		Teamwork	Non-teamwork
	(s.e.)	(s.e.)	(s.e.)	(s.e.)
Worker under SPO	2.615***	1.597***	0.856	2.785***
	(0.821)	(0.724)	(0.879)	(1.270)
Times out past week around people		−0.406***	−0.239***	−1.016***
		(0.080)	(0.093)	(0.156)
Knows someone with COVID-19		2.687***	2.778***	3.282***
		(0.750)	(0.878)	(1.391)
Overall satisfaction with life		−2.451***	−2.194***	−2.682***
		(0.181)	(0.239)	(0.281)
Worker unemployed		−1.141	−2.045	−1.066
		(0.900)	(1.379)	(1.271)
Number of people in household		0.572***	0.404	0.609
		(0.236)	(0.283)	(0.447)
School-aged children in household		0.037	0.836	−2.029
		(0.814)	(0.971)	(1.498)
Worker Age		−0.091***	−0.091***	−0.095***
		(0.026)	(0.034)	(0.042)
Education		0.135	0.210*	−0.121
		(0.098)	(0.114)	(0.195)
Female worker		−0.948	−0.682	−1.349
		(0.686)	(0.819)	(1.249)
African descent		−0.992	−0.527	−0.784
		(1.754)	(2.095)	(2.849)
Asian descent		−3.466***	−2.215	−4.316*
		(1.527)	(1.946)	(2.519)
Caucasian descent		−2.560***	−2.067	−3.414
		(1.306)	(1.630)	(2.124)
Hispanic descent		−0.881	−0.052	−2.035
		(1.771)	(2.194)	(2.656)
Wave 2	4.441***	4.076***	5.943***	−0.103
	(1.100)	(0.940)	(1.121)	(1.634)
Wave 3	5.997***	6.125***	7.254***	4.743***
	(1.071)	(0.952)	(1.146)	(1.613)
Wave 4	3.433***	2.872***	4.659***	−0.478
	(1.149)	(1.049)	(1.293)	(1.771)
Constant	36.727***	57.560***	52.786***	66.358***
	(0.904)	(2.300)	(2.851)	(4.235)
N	1000	1000	675	325
R^2	0.049	0.277	0.242	0.423

Notes: Estimates from OLS model with robust standard errors. Dependent variable is Loneliness score on UCLA Scale V3. Panel A: unrestricted model with full controls; Panel B: sample split by whether worker's normal occupation regularly involves teamwork. Wave dummies capture which collection period the worker was sampled in; Wave 1 is omitted category. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

2, which includes numerous demographic and household controls plausibly related to loneliness.

Consistent with the main result reported above, we observe that the loneliness score of workers who reported being under SPOs increases by 1.55 points on average (*s.e.* 0.725) relative to those not under such orders, holding everything else constant. Because we control for survey waves, this observed effect is not due to a general psychological impact of the pandemic duration or national trends in COVID-19 cases. Overall, *loneliness score* is increasing in waves for the full sample, capturing both the duration of the SPOs and the overall effects of the pandemic. The loneliness score of workers who know someone with COVID-19 increases by 2.79 points (0.748) relative to those that do not, suggesting that the proximity of COVID-19 to one's personal network matters. Controlling for SPOs, workers who more frequently leave their homes (a likely avenue for increased social connections), and those with higher

life satisfaction, have lower average loneliness scores. We observe a strong inverse relationship between age and loneliness score in each model, suggesting heterogeneous age effects in the sample.

Panel B considers possible heterogeneity in the relationship between SPO and loneliness score by whether the respondent reports that their work "consistently involves a team setting." Model 3 (column 3) reports estimates for the sample working in a team environment, whereas Model 4 (column 4) restricts the sample to those workers who typically work alone. The results indicate that workers' loneliness score who work alone increases by 2.86 points on average if they are under SPOs, a highly statistically significant result ($p < 0.001$). However, though the point estimate is also positive, SPOs do not significantly impact the loneliness of workers who work as part of a team, a result that supports Hypothesis H2.

4.2. The loneliness-cooperation relationship

Turning to our results from the interactive game, we begin by noting levels of collaboration and moves toward coordination over time. Given the PSNE predictions and beliefs that players may demonstrate preferences for efficiency (see Capraro et al., 2020; Guarin and Babin, 2021), we expected and found very high levels of collaboration (that is, coordination on the efficient equilibrium). Fig. 5 illustrates the percentage of workers choosing the "cooperate" strategy in the game by wave. As we move from wave 1 to wave 3, we observe that collaboration in the game decreases but increases again in wave 4. Notably, this pattern of behavior mimics (inversely) the increasing and then decreasing trend observed over time for loneliness, especially among those under SPOs (as in Fig. 4).

To narrow in on the relationship between collaborative decisions and loneliness or SPOs and allow for possible confounding factors, we carry out logit regressions estimating the probability of a player choosing the strategy "cooperate" in the interaction. The estimates are presented in Table 3. Column (1) presents estimates from a model with no control variables present (other than survey wave indicators), while Column (2) includes household and demographic controls. Column (3) includes our full set of controls, including the Tang (1999) CCSS cooperation and
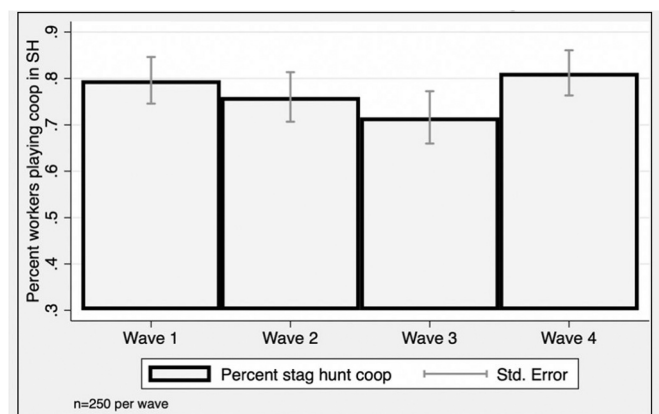
Fig. 5. Percentage of Workers Choosing the "Cooperate" Strategy in Framed Stag Hunt Game, By Wave. Notes: The wave measures capture both duration under shelter-in-place orders and the overall dynamic effects of the COVID-19 pandemic. Instances of playing "cooperate" indicate gravitation to efficient theoretical coordination.

Table 3
Estimates of Playing "Cooperate" Strategy in Collaborative Game.

Variable	Model 1 No Controls (s.e.)	Model 2 Controls (s.e.)	Model 3 Full Controls (s.e.)
Loneliness score (UCLA V3)	−0.048***	−0.049***	−0.043***
	(0.007)	(0.008)	(0.008)
Worker under SPO		−0.182	−0.200
		(0.177)	(−0.183)
Out of house around people/week		−0.047**	−0.031
		(0.019)	(0.020)
Knows someone with COVID-19		0.082	0.070
		(0.177)	(0.178)
Overall satisfaction with life		0.031	−0.037
		(0.042)	(0.043)
Unemployed		−0.107	−0.125
		(0.211)	(0.217)
Number living in household		−0.020	0.010
		(0.054)	(0.055)
Children in household		−0.128	−0.154
		(0.189)	(0.194)
Education		−0.002	0.006
		(0.024)	(0.025)
Age		−0.003	−0.003
		(0.006)	(0.007)
Female		0.152	0.077
		(0.161)	(0.169)
African descent		0.151	0.218
		(0.359)	(0.367)
Asian descent		0.235	0.135
		(0.360)	(0.365)
Caucasian descent		0.167	0.102
		(0.272)	(0.273)
Hispanic descent		0.233	0.250
		(0.364)	(0.367)
Cooperation score (Tang, 1999)			0.582***
			(0.103)
Competition score (Tang, 1999)			−0.234**
			(0.097)
Risk tolerance			−0.001
			(0.004)
Constant	3.297***	3.440***	1.451**
	(0.319)	(0.695)	(0.941)
N	1000	1000	1000
LR Chi^2	65.86	66.36	83.77
Pseudo R^2	0.061	0.072	0.104

Notes: Estimates from logit model with robust standard errors. Dependent variable is binary, indicating whether the work played "cooperate" in the framed stag hunt game. Wave dummies included (none statistically significant in any model). Loneliness score follows the UCLA Scale V3. Cooperation and Competition scores follow the Tang (1999) scales. Risk tolerance and Life Satisfaction follow the German SOEP 1–100 scale, with 1 indicating extreme risk aversion and 100 indicating extreme risk-loving preference. * p < 0.10, ** p < 0.05, *** p < 0.01.

competition scores and a risk tolerance measure.[7] In all cases, the loneliness score coefficient is negative and highly significant (p < 0.01), suggesting that as a worker's loneliness score increases, they become less likely to collaborate on average, drifting from the efficient equilibrium outcome. The coefficient of −0.048 (Column 1) results in a calculated marginal effect (at sample means) of −0.008. To put this magnitude in perspective, increasing loneliness score by one standard deviation results in an expected decrease in the likelihood of

collaborating by 10%. This estimated relationship strongly supports Hypothesis 3.[8] It is also notable that the inclusion of controls makes little difference in the results. The SPO indicator is not statistically significant in any of the three models, suggesting the policies themselves do not appear to directly impact collaboration beyond their already noted effect on loneliness.[9]

5. Discussion and conclusion

This study's message revolves around the notion that working together can lead to higher mutual gains yet is sometimes tenuous. Feelings of isolation, loneliness, restricted interaction, or abridged routine can impact a worker's willingness to collaborate and, by extension, the productivity of workers and organizations. We provide evidence that shelter-in-place orders can exacerbate loneliness in workers. Some suggestive evidence across survey waves also indicates that the duration of shelter-in-place orders may exacerbate feelings of loneliness. We further find that feelings of loneliness are associated with behavior. We observe that collaboration in a simple game reflecting a hypothetical workplace task is significantly less common when one or more workers exhibit higher loneliness scores.

This research complements and builds on recent studies documenting loneliness during the pandemic (particularly Killgore et al., 2020; Luchetti et al., 2020). While we observe remarkably similar overall levels of loneliness as Killgore et al. (2020), who also use an MTurk sample, our design reveals a significant decline in loneliness by July 2020. Compared to Luchetti et al. (2020), our results highlight the significant effect that policy can have on mental health. Between our first survey wave and wave 3, the peak of loneliness in our sample, loneliness increased among individuals under shelter-in-place orders by almost double the increase observed for those not under SPOs.

In one of the first studies of the impacts of worker loneliness in the workplace, Ozcelik and Barsade (2011) provide a narrative for loneliness as an *organizational problem* rather than a private emotion. The authors frame loneliness as a *social phenomenon* where lonely workers invest less in the organization because they find the team role less psychologically rewarding. Other workers observe worker behavior, causing a downward spiral in team effectiveness and significantly impacting productivity (in terms of both peer- and management-based evaluation). This scenario exists even in environments independent of social distress. A critical contribution of this paper is to demonstrate how SPOs might exacerbate this problem. Because loneliness is an unintended consequence of sheltering policies, our results highlight the trade-offs involved in pandemic mediation policies.

By focusing on a simple model in which collaboration is crucial to mutual benefit, we highlight the potential adverse effects of an employee's loneliness on 1) their own productivity, 2) productivity of co-workers and, 3) collective organizational outcomes. Jeffrey et al. (2017) estimate the annual cost of loneliness to employers in the U.K. at £2.5 billion, a result driven largely by health care costs, employee sick days,

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[7] In an alternative specification we considered the CCSS assessment cooperation score as an outcome variable. The results were similar to those reported here, with the relationship between loneliness and cooperation (attitudes) being negative and highly statistically significant. We prefer specifications using the cooperative action as an outcome variable, however. This variable results from an action in a specific, incentivized scenario, while cooperation score is more general and, given the similar construction to loneliness score, may be more susceptible to common method bias.

[8] Though not a formal hypothesis, we also investigated possible heterogeneity in the relationship between loneliness and cooperative behavior by whether or not the individual typically works in a team environment. No significant difference was found across the two groups.

[9] We also considered the possibility of using SPOs as an instrument for loneliness in estimating the relationship between loneliness and cooperative behavior. The lack of statistical significance of SPOs in Table 3 is promising in this regard, despite some evidence of the endogeneity of SPOs in the context of other behavior in the face of COVID-19 (Brzezinski et al., 2020). However, the first stage relationship was not strong enough to meet traditional criteria (eg., Staiger and Stock, 1997) or more recent suggestions (eg., A. Lee et al., 2020; D. Lee et al., 2020) for valid inference using instrumental variables. Our resulting estimates of the impact of loneliness on cooperative behavior were not statistically significant, though point estimates were negative and somewhat larger in magnitude than those presented in Table 3.

and turnover, as well as inferences about productivity based on job satisfaction measures. Since our measure of collaboration is not evaluative but based on actual worker decisions that directly impact their pay, we obtain demonstrable impacts of loneliness on worker outcomes and, by extension, organizational efficiency. Relative to the mean level of collaboration in our sample, a one standard deviation increase in the loneliness of one worker (in a pair) reduces the expected total payoff of the pair of workers by 9%. Increasing loneliness in both workers in the interaction decreases expected total payoffs by 16.5%. While these costs are, of course, reflective of our sample and the payoffs offered in our specific scenario, these results demonstrate how worker loneliness can have substantial efficiency costs in collaborative environments. Thus, organizations should not view loneliness as merely a health problem affecting individual employees but realize its potential effects on workplace interactions.

We also find evidence of heterogeneous impacts on workers, as those who do not typically work in a team setting appear to be more prone to loneliness from SPOs. While future research should investigate this relationship further, one explanation for the strong impact of SPOs on non-team-oriented workers involves their relative lack of social interaction on the job during these times. Social circles might persist with team-oriented workers during lockdowns (such as through Zoom meetings). In contrast, those workers who do not have on-the-job interaction typically find it in other venues that are cut off during SPOs (such as in bars and restaurants, sporting events, or spiritual gatherings). Further research should investigate other possible heterogeneous effects. While many negative effects of the pandemic, including loneliness, have been shown to impact some groups disproportionately (Jarvenpaa and Leidner, 1999; Luchetti et al., 2020), possible disparate impacts on employee productivity and cooperative behavior should be investigated. Organizations should also be aware that many employees impacted by SPOs and undesired remote work might not yet feel lonely due to possible lags in these effects (Hawkley and Cacioppo, 2010). Further research may investigate this possibility, including after the pandemic fully subsides. Relatedly, while our results suggest that the impacts of SPOs may be affected by SPO duration, further research should explore this conjecture.

We note some potential limitations of our study. First, worker loneliness likely varies day by day, given the availability of social contacts and interactions. Our repeated, cross-sectional design does not capture within-worker variation, results in samples that may differ in observable and unobservable ways over time, making our results potentially susceptible to common method bias. Potentially mitigating this last concern is that one of our primary variables of interest, SPO, is largely an objective measure. Also, an advantage of investigating cooperative behavior using a binary decision in a strategic scenario with additional pay on the line, rather than an attitudinal instrument within the survey, is that it is distinct from the approach and format of our elicitation of loneliness.

A second concern is the possibility of reverse causality, as some evidence suggests that workplace loneliness may result from a competitive and uncooperative organizational climate (Wright, 2005). While our study is uniquely carried out in a setting where loneliness has demonstrably increased, not due to organization-specific culture but due to government policy and a worldwide pandemic, this does not absolve us from endogeneity concerns, and our results should be viewed accordingly. One particular concern involves the potential for missing variables, which might affect our results or their interpretation. The time frame under study here was marked by significant events beyond those related to the pandemic. Instances of police violence sparked outrage and protests across the country, further leading to increased political divisiveness. This second "pandemic" may have influenced individuals' feelings of betrayal, trust, or social cohesiveness, which may have subsequently impacted cooperative tendencies. While this poses less of a problem for our analysis focusing on SPOs, we can not rule out the possibility that the link between loneliness and cooperative outcomes

are, at least in part, tied to other external events.

Finally, given that our online recruitment method was made necessary by the pandemic environment, we emphasize that the resulting sample is not fully representative of the U.S. labor force; it only includes workers with internet access and savvy to participate in online work on MTurk. Moody (2001, p. 393) points out that "Low levels of social and emotional loneliness. are associated with high degrees of face-to-face networks of friends, while high levels of Internet use are associated with low levels of social loneliness and high levels of emotional loneliness." That is, under certain circumstances, the Internet can decrease social well-being, even when used as a communication mode. However, our results suggest that meaningful differences in loneliness resulted among online workers due to SPOs. This increased variance in loneliness predicts online workers' behavior in collaborative environments. Our work, therefore, supports that of Jarvenpaa and Leidner (1999), who suggest virtual teams working on a common project, whose members "transcend time, space, and culture," may experience a form of trust that is very fragile and potentially fleeting. Future research should investigate outcomes in other collaborative settings, including face-to-face among actual work colleagues, as well as the effect of various methods of communication on cooperative behavior.

Ethics

The design and protocol were approved under "expedited" review by the Western Illinois University IRB #121-20. Authors obtained electronically signed informed consent forms. We collected no personally identifiable information and randomly assigned identifiers linking subject actions across the data. Workers were paid privately into their Amazon accounts. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

J. Jobu Babin: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Visualization, Writing – review & editing. **Marine Foray:** Data curation, Investigation, Visualization, Writing – original draft, Writing – review & editing. **Andrew Hussey:** Conceptualization, Formal analysis, Methodology, Writing – original draft, Writing – review & editing.

Acknowledgment

Appendices

A1 – Survey Instrument

For this HIT, you will have two phases: a Reporting Phase and a Bargaining Phase. In the Reporting Phase, you will fill out a short questionnaire. Your responses are completely anonymous. In the Bargaining Phase, you provide responses that indicate how you will play in a bargaining game in which you are randomly matched up with another MTurk worker.

Please pay attention – there are comprehension checks. Click to proceed to the Reporting Phase.

Welcome to the Reporting Phase: We would now like to ask you some questions about yourself. Please answer honestly, thoughtfully, and completely (Captcha box).

1. What best describes your gender?
2. Are you a full time student?
3. How old are you in years?
4. All things considered, how satisfied are you with your life as a whole these days? Put yourself on the scale below with the slider. (0-Completely dissatisfied, 10-Completely Satisfied)
5. What is your household's yearly income (estimated)?
6. How many people share the household in which you currently reside?
7. Do you have children under 18 currently in your household?
8. How would you describe your ethnicity (choose all that apply)?
9. How many years of education beyond grade school (8th grade) do you have?
10. What is your employment status? (Full time employed, part time employed, laid off or unemployed, retired)
11. Are you currently under a "Shelter in Place order" in response to the Covid-19 virus?
12. What is your household's geographic location (city and state in the U.S.)
13. During this past week, approximately how many times have you been away from your home and around other people outside your household?
14. Please indicate whether you personally know someone who has been infected with the COVID-19 virus.
15. (If unemployed) How many weeks has it been since your most recent full time employment ended?
16. (If unemployed) Was this underemployment a direct result of the COVID-19 outbreak or resulting Shelter in Place Orders?
17. Do you consistently work in teams or in a group setting in your primary occupation (other than on MTurk)?
18. Write your primary occupation and industry (outside of MTurk), as applicable (text entry).
19. How long have you been a worker on MTurk?
20. Have you ever suffered a <u>fatal</u> heart attack? (attention check)
21. Briefly describe your motivation to begin working on MTurk (text entry).
22. How many days out of an average month would you say you attend church or religious/spiritual gatherings?
23. In general terms, how would you describe your political orientation relative to others? 0–100 slider scale
24. Generally speaking, are you a person who is always ready to take risks or are you trying to avoid risks? (How often, as a percentage of the time, are you willing to TAKE risks? 0–100 slider scale

A2 – UCLA Loneliness Scale V3 Questions

Reference: Russell, D. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment*, 66, 20–40.

Description of Measure: A 20-item scale designed to measure one's subjective feelings of loneliness as well as feelings of social isolation. Participants rate each item on a scale from 1 (Never) to 4 (Often). This measure is a revised version of both the original and the Revised UCLA Loneliness Scale. Score scale: 20–80. Question reverse scored (indicated by *). The order is randomized to minimize bias.

Instructions: Indicate how *often* each of the statements below is descriptive of you.

Statement: Never = 1, Rarely = 2, Sometimes = 3, Often = 4.

1. How often do you feel that you are "in tune" with the people around you? *
2. How often do you feel that you lack companionship?
3. How often do you feel that there is no one you can turn to?
4. How often do you feel alone?
5. How often do you feel part of a group of friends? *
6. How often do you feel that you have a lot in common with the people around you? *
7. How often do you feel that you are no longer close to anyone?
8. How often do you feel that your interests and ideas are not shared by those around you?
9. How often do you feel outgoing and friendly? *
10. How often do you feel close to people? *
11. How often do you feel left out?
12. How often do you feel that your relationships with others are not meaningful?
13. How often do you feel that no one really knows you well?
14. How often do you feel isolated from others?
15. How often do you fee1 you can find companionship when you want it? *
16. How often do you feel that there are people who really understand you? *
17. How often do you feel shy?
18. How often do you feel that people are around you but not with you?
19. How often do you feel that there are people you can talk to? *
20. How often do you feel that there are people you can turn to? *

A3 – Tang (1999) Cooperation and Competition Scale Questions (CCSS)

People vary in the degree to which they view cooperation and competition as useful strategies to reach their goals. The CCSS was originally developed by Tang (1999) to compare American and Chinese college students and identifies interesting differences in individual items across the scale. Archer and Webb (2006) first used the scale in a comparison with related variables, including the score on the Buss-Perry aggressiveness scale. The CCSS assessment produces a score for both *cooperation* and *competition* (each the average response on a scale from 1 to 7). Questions 1–8 measure *cooperation* and 9–19 assess *competition*. The order is randomized to minimize bias. **Scoring:** The response *Always* is scored with a 7, Sometimes a 4, *Never* with a 1.

Instructions: Indicate for each statement how *often* it is true for you. The scale runs from **always** to **never**.

1. Individual success can be achieved while working with others
2. Joint effort is the best way to achieve success
3. To succeed, one must cooperate with others
4. Success is only achieved through individual effort
5. Success is best achieved through cooperation rather than through competition
6. In the end, cooperation with others is not compatible with success
7. Shared efforts can lead to both individual and group success
8. I enjoy working with others to achieve joint success
9. It is important to me to do better than others
10. Success is not very important to me
11. By achieving success, I also get other things that are important to me
12. To succeed, one must compete against others
13. People who succeed are more likely to have satisfying lives
14. Success is something I am willing to work hard for
15. I enjoy the challenge of competing against others to succeed
16. The rewards of success outweigh the costs
17. Success is my major goal in life
18. I am happier when I am not striving to succeed
19. I feel better about myself when I am working toward success

A4 – Collaborative Interaction (framed stag hunt) Instrument

Welcome to the Bargaining Phase.

• In this phase, you are going to tell us how you will play a simple bargaining game.

- There will be hundreds of participants in this HIT. You will be randomly matched with another worker.
- Every player in the game will get the same information.
- You will not know any information about your counterpart other than that they are another worker in the HIT.
- Your responses matched with theirs will determine your bonus.

The bargaining game involves the following scenario: Suppose you and your counterpart are asked to complete a potentially collaborative project. You each decide among one of two strategies: cooperate on the project or work alone. You will make this choice once and must choose without observing your counterpart's choice.

- In order for the project to be completed efficiently, you each must choose to "cooperate." In this case, each of you will receive a bonus payoff of $0.75.
- If either player chooses "cooperate" when the other chooses "work alone," that player's effort is wasted, and they receive no bonus payoff, $0.
- However, anytime either of you chooses to "work alone," that person is guaranteed a payoff of $0.25 regardless of what the other chooses.

Comprehension Checks:

- If my counterpart chooses "cooperate" and you choose "cooperate," what is your payoff?
- If my counterpart chooses "work alone" and you choose "cooperate," what is your payoff?

Critical response: What strategy will you choose? Your counterpart will answer the same question. (Cooperate, Work Alone).

You participated in a reporting task and a bargaining game. Describe what you think the HIT is about or your thought processes in the game (text entry check).

Please enter your Amazon worker ID into the box below. After you submit, you will receive a completion code. You must enter this code into the Amazon MTurk page to get credit for completing the HIT. Please click next to submit.

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