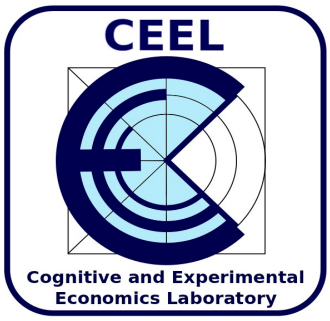

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The Tragedy of the Masks: curbing stockpiling behavior through a "victim"

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ABSTRACT

The phenomenon of household products disappearing from supermarket shelves after the COVID-19 outbreak has received strong attention in the media. After a negative shock, household products can be viewed as a common-pool resource subject to a rule of capture by the first appropriator. Using a sample of US participants, we show that when the participants are informed that a fixed supply of facial masks exists, they often coordinate on an egalitarian allocation of masks. In another study in which it is brought to the participants' attention that COVID-19 disproportionately affects the elderly population, participants 24 or younger spontaneously demand fewer masks than 65 or older participants. A group of incentivized external observers identifies a prudentially-low demand for masks as appropriate in this environment.

Keywords: COVID-19, common-pool resource, stockpiling, identified victim.

JEL codes: I12; C92; H41; Q20.

1. Introduction

The empty shelves in the household-product aisles of supermarkets are among the most striking images of the recent COVID-19 pandemic.[2] In pre-pandemic times, few would have found it desirable to hoard items such as toilet paper, hand sanitizer, or facial masks. The recent pandemic is not the first time people initiate "shopping frenzies" after a negative shock. Countries as diverse as the UK and Argentina have experienced "bank runs" (cf. Arifovic et al. 2013; Schotter & Yorulmazer, 2009; Kiss et al., 2018), i.e., bank customers forming long lines in front of ATMs to withdraw cash. Stockpiling behavior was also reported after the outbreak of the Spanish Influenza (cf. Lal, 2020). We ask in this paper how we can persuade consumers not to stockpile a resource that is subject to potential raids.

We document through a survey that the reason many shoppers stockpiled products in the recent pandemic was that they were persuaded availability was bound to vanish. This is the same reasoning underlying the overexploitation of "common-pool resources," i.e., resources that can be appropriated according to a "rule of capture," i.e., "first in time, first in right" (Ostrom, 1990; Lueck, 1995). An example of such a resource is a groundwater basin, where appropriators keep pumping water in the fear that if they do not, others will (cf., e.g., Holt et al., 2012). Similarly, shoppers seem to believe that the "flows" of household products that they do not appropriate will be appropriated by someone else and not replenished in the immediate. A "tragedy of toilet

[2] Media reports of such shortages, from all the world, are abundant. Cf. e.g. https://www.nytimes.com/2020/02/29/business/coronavirus-hand-sanitizer.html and https://www.businessinsider.com/three-women-brawl-panic-buying-toilet-paper-australia-woolworths-coronavirus-2020-3 (reporting shortages of household products in the US and Australia at the beginning of the pandemic, February and March 2020); also: https://apnews.com/article/toilet-paper-limits-virus-surge-3e22bd5b4d448c3906c1dabd81f19abeand (reports of shortages in the US in November 2020). Links last accessed in June, 2021.

paper" ensues whereby the product's stock is depleted (the "tragedy of the commons," Hardin, 1968).

The perception of a looming state of dearth of certain resources results in shopping behavior that would have seemed highly unusual before the pandemic.[3] The shoppers appeared to suddenly become numb to the implications of their shopping decisions on others. Quarantelli (1975) argues that choices made under the influence of panic often have nonsocial features. In the face of a potentially life-threatening negative shock, the "flight, fight or freeze" brain rarely favors a pondered and pro-social response.[4] Garbe et al. (2020) find that people who felt more threatened by the coronavirus and people higher on the emotionality scale stockpiled more toilet paper. Micalizzi et al. (2021) find a significant positive relation between "COVID-19 worry" and the number of items respondents reported stockpiling. O'Connell et al. (2021) find that antisocial behavior during the COVID-19 period increased the risk of transmission since many were left without personal protective equipment (PPE). In the United States, public health organizations began advocating against mask use by the general public in March and April of 2020 because of a shortage of these materials for healthcare workers (*id.*). Individual stockpiling decisions likely contributed to the shortage of PPE for those most in need.[5]

[3] The thesis is defended in *Coronavirus is spreading panic. Here's the science behind why* by Amy McKeever (*National Geographic*, published March 17, 2020, available at: https://www.nationalgeographic.com/history/article/why-we-evolved-to-feel-panic-anxiety, last retrieved January, 2022).
[4] Cf. *Coronavirus is spreading* panic, cited above.
[5] On the hazards posed by the lack of PPE for health care workers worldwide, cf. https://www.who.int/news/item/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide (last accessed January, 2022).

The analogy between household products after a negative shock and natural resource depletion deserves some justification. The supply of household products is not directly subject to Nature's exogenously-given laws, unlike resources such as groundwater basins or pastures. We also do not suppose, under physiological circumstances of the economy, that shoppers impose non-pecuniary negative externalities on other shoppers by the mere activity of appropriating goods or services. On the contrary, the fisherperson who does not respect a quota imposes a nonpecuniary externality on other fisherpersons who might not reach their quota. Also, the suppliers of household products possess intentionality, unlike Nature, and might adjust supply following a shock. If the suppliers opt to restrict production amid a crisis, any effort to abate demand by the appropriators would be of scarce use. However, such "gouging" behavior seems likely to expose suppliers to legal scrutiny and public scorn, even though in the case of a global pandemic, price gouging might be justified on the ground that it incentivizes finding ways to boost production of suddenly-scarce goods (Finestone & Kingston, 2021).[6] Alternatively, suppliers might boost production, quickly regenerating supply. This scenario might be unlikely because, following a negative shock, the possibility of increasing the production rate of suddenly-scarce goods is limited. The textbook (Marshallian) theory of the supply curve defines the short-run as the length of time in which one of the factors of production is in rigid supply (cf., e.g., Kaldor, 1934). The recent pandemic has complicated the supply chain considerably, limiting the producers' choice set in the short run.[7] Labor markets were also likely disrupted by the disease and stimulus and unemployment payments (cf., e.g., Coibion et al., 2020). Therefore, the supply of household

[6] Cf., among the many reports of alleged price gouging during the initial stages of the pandemic, https://www.nytimes.com/2020/03/27/us/coronavirus-price-gouging-hand-sanitizer-masks-wipes.html. Last retrieved in May, 2021.

[7] Cf., e.g., https://www.whitehouse.gov/cea/written-materials/2021/06/17/why-the-pandemic-has-disrupted-supply-chains/. Last retrieved in Januay, 2022.

products appears relatively fixed in the short term after a negative shock, at a level that does not allow everyone to purchase the commodity if, all of a sudden, demand peaks.

Bentkowska (2021) claims that successful formal restrictions to limit the effects of the pandemic require strong supporting informal institutions. The well-known design principles of Ostrom (1990) might be a source of guidance into which rules might help alleviate stockpiling behavior. The drafting of clearly defined membership rules, and collective decision mechanisms to revise those rules, require a stable community of appropriators. The shoppers of a supermarket do not typically form such a stable community. Also, rules to limit the amount one can purchase[8] can be easily circumvented by shopping at different stores. Clearly defined boundaries are difficult to draw, even though shops occasionally "fence" valuable merchandise. Monitoring against over-appropriation is perhaps the most appealing of the principles. Shoppers are likely to encounter disapproving attendants or fellow shoppers if they fill their cart with, e.g., toilet paper during their store visits. Shoppers might, however, turn to e-commerce or a shopping assistant as a way to avoid monitoring and sanctioning. The store attendants might also be subject to hostility by the shoppers, rendering such a solution impractical.[9] In summary, it is unlikely that the shoppers in the recent pandemic have had the time to develop informal rules to prevent stockpiling.

[8] Cf. https://www.cnn.com/2020/03/06/business/coronavirus-global-panic-buying-toilet-paper/index.html. Last retrieved in May, 2021.

[9] For reports of hostility against store attendants, cf., e.g., https://www.nytimes.com/2020/05/15/us/coronavirus-masks-violence.html, and https://www.chicagotribune.com/coronavirus/sns-nyt-coronavirus-grocery-store-employees-20200321-d2kf3347uzgutgdr3uyhotuej4-story.html. Last retrieved in May, 2021.

Given the limited usefulness of Ostrom's principles of resilient institutional design in our case,[10] we ask whether alerting the appropriators of the vulnerability of certain subgroups to the disease might limit stockpiling. In a control study, groups of five participants were asked how many (virtual) facial masks they wished to appropriate. The participants knew of a fixed supply of 15 masks available for appropriation. If the sum of individual demands exceeded the supply, all group members forfeited their payoff. This is a five-player version of the classic bargaining game Schelling (1957) first described. As already noticed by Schelling, splitting the prize equally is a focal point in these games, leading to the emergence of an egalitarian norm (Xiao & Bicchieri, 2010). Appropriators in our experiment believe others in their group demand three masks because it is common knowledge that this number is focal in this context (descriptive expectations). Appropriators also believe that asking for three masks is the appropriate choice in this experiment because of the homogeneity among the players (normative expectations). The resulting allocation (3 masks each) is equitable and efficient, as no masks are left unallocated.

We then devised a treatment study where the participants were informed that each group of five was composed of one participant aged 65 or older (65>) and four aged 24 or younger (24<). We also informed the players that COVID-19 disproportionately affects the 65> population. The egalitarian norm is still efficient in this new environment, but not equitable, given that equity implies, in the conventional definition (cf., e.g., Westen, 1982), treating like cases alike (as in the control study above with homogeneity), but different cases in different manners (this study). On top of these normative reasons, the 24< players are likely to expect the 65> player to demand

[10] Paniagua & Rayamajhee (2021) discuss the usefulness of Ostrom's polycentric approach to deal with the externalities created by the pandemic. In this paper, we deal with a specific phenomenon, the disappearance of certain utilitarian items, but refrain from commenting on the nestedness of this phenomenon in other challenges COVID-19 has created for labor markets, supply chains, etc.

more than three masks, inducing the 24< players to revise their demands downwards to avoid miscoordination.

The extensive literature on "victims" shows that reducing the distance between victims and the potential benefactors increases help towards the victim (Loewenstein & Small 2007; Kogut & Ritov 2005a; Small et al., 2007). Furthermore, studies have shown that an identified single victim elicits more help than a non-identified single victim (Kogut & Ritov 2005b; Yam & Reynolds, 2016). In our study, the victim is "statistic" (Jenni & Loewenstein, 1997) in the sense that we alert participants that COVID mortality in the 65> group is much higher than in the 24< group. The victim is also "part of the group," at least in a virtual sense.

Our studies with and without a victim differ in terms of the amount of information given to the participants. The study with no health-risk information submits to the participants' attention an "impoverished" (Shafir et al., 1993) narrative compared to the "enriched" (*id.*) narrative of the study with a victim. We hypothesize that the impoverished narrative triggers the egalitarian norm: there are no "reasons" (*id.*) for any player to get a number of masks different from three. The presence of a victim in the group weakens the reasons for the egalitarian norm and provides new reasons to leave more masks available for the victim. We summarize our hypothesis regarding the effect of our victim manipulation in Figure 1.

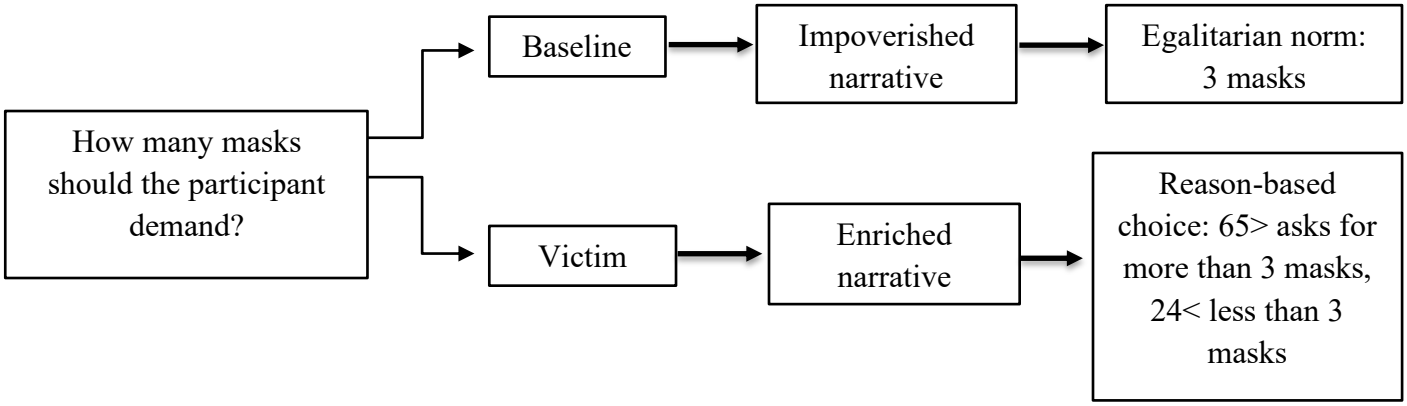

Figure 1. the decision framework for our studies, with and without a victim

Our framework does not exactly identify the number of masks the 24< and 65> participants demand in the study with a victim. The enriched narrative might lead the four 24< players to ask for two masks and leave seven available for the older participant. This outcome, however, creates a degree of inequality in the allocation of masks that might be hard to accept for some of the 24< players. The indeterminacy regarding exactly how many masks it is appropriate to ask in the study with a victim implies that greater equity might be achieved at the cost of more frequent miscoordination and inefficiency. Our paper shows that the victim manipulation resulted in the 24< group demanding significantly fewer masks than the 65< group. We do not find that this results in more instances of miscoordination.

The paper proceeds as follows. Section 2 presents our experimental design in detail and the results of preliminary surveys. Section 3 presents the results. Section 4 discusses our results and concludes.

2. Materials and Methods

2.1 Preliminary surveys

We conducted an initial survey in May 2020 using US residents (n=67) recruited on the platform Prolific[11] to choose which commodity was better suited to use in our experiments and the reasons behind the shopping frenzies in the recent pandemic. 67% of respondents answered that their workplace did not provide supplies such as hand sanitizer or masks, leading us to suppose that most of our respondents would have to purchase such goods. We asked participants whether they bought more, less, or about the same of 6 commodities: toilet paper, home cleaning products, sanitary gloves, hand sanitizer, meat products, facial masks. The most frequent response is "increased consumption" for hand sanitizers (49%) and facial masks (66%). Among those who reported increased consumption for both items, the most common explanation is that they expect the commodity to run out.[12] We then asked the same respondents to think about their friends and families' buying patterns since February 2020. Participants reported that acquaintances had bought more toilet paper (62%), home cleaning products (55%), sanitary gloves (52%), hand sanitizer (70%), and facial masks (72%). Among those who report an increase in demand among their acquaintances, the most common explanation is, once again, that acquaintances expect the good to run out. Finally, we asked participants if they believed that suppliers of the six commodities were taking advantage of the pandemic to increase prices. The most common answer was affirmative for all six goods; the highest consensus is facial masks (70%). Mask appropriators might be unable to determine if a low stock is attributable to fluctuations in supply, the behavior of other shoppers, or

[11] All our studies use this platform for participant recruiting purposes. Links to all our surveys can be found in Appendix.

[12] This answer was chosen from a menu of potential explanations, such as "I need more of this commodity now that I work from home," "I expect the price of the commodity to increase," "I enjoy having a stock at home of this commodity," "Because I have more free time than usual and I buy goods every day," "Because I shop for other people who cannot shop for themselves," plus a free-form answer.

both. We can address this concern in the experiment by specifying the number of masks available for appropriation.

We opted to use face masks in our experiment based on survey answers. Face masks are an instance of PPE, and they seem better suited to study victim effects than, e.g., cleaning products or food items. Furthermore, toilet paper, although the item seemingly most stockpiled at the beginning of the pandemic and the one that has received so far the most scholarly attention (e.g., Micalizzi et al., 2021; Garbe et al., 2020), raises concerns in terms of its connection to cleanliness and the association of toilet paper use with "civilized behavior"—a connection discussed by Stratton (2021) to explain toilet paper raids in Austalia. Masks lack these cultural confounds and seem better suited to our inquiry.

We ask if there is an unconditional preference of younger participants towards helping 65> participants or an unconditional preference of the 65> individuals to deny help to the younger participants. These behaviors might be justified based on norms of courtesy, such as holding the door open for an elderly shopper at the supermarket. We investigated this question through a series of dictator games. We studied a simple dictator game (n=51, recruited in the US) and four "enriched" dictator games in which the dictators (24< or 65>) are alerted of the recipient's age group (24< or 65>, n= 50 for each of the four studies, all participants recruited in the US). In the four studies with age information, all participants are told that "According to publicly-available data from the CDC (Centers for Disease Control and Prevention), of the 231,197 deaths involving COVID-19 registered in the United States as of November 23, 183,324 were Americans in the age group 65 or older (about 80%). In the age group 24 or younger, 501 deaths were attributed to COVID-19 (about 0.2%). The CDC data can be found at this website:

https://www.cdc.gov/nchs/nvss/vsrr/covid_weekly/index.htm." In the rest of this paper, we refer to this statement as the "COVID-risk message."

2.2 The baseline study

We studied a (one-shot) common-pool game using the strategy method, an incentive-compatible mechanism for choice elicitation (cf. Selten, 1967; Fischbacher et al., 2001). We randomly matched each participant to four other participants (n=143, all recruited in the US). We did not screen participants based on their age group. Each participant chose both an unconditional demand for face masks ("I wish to buy this number of masks: …") and a conditional demand, i.e., the number of masks demanded for each level of average demand by the other four players in th group ("Imagine the other participants wish to buy … [a number between 0 and 15] face mask(s), on average. You wish to buy this number of masks:…"). To calculate the payoffs, we used the unconditional demand for masks of four out of the five group members (and discarded the conditional demands of those four participants), and the conditional (on the other four players' unconditional) demand of one participant (and discarded this participant's unconditional demand). There were fifteen masks available in an online marketplace. If the sum of all players' demands in the group was equal or inferior to 15, each player received two dollars for each mask demanded. If the sum exceeded 15, the payoff was zero for all. Participants learned from the instructions that their conditional and unconditional choices were payoff-relevant. We proved the point through a guided example. Participants were then asked to answer three comprehension questions. Participants were rewarded with $.5 per correct answer in the comprehension test. After the comprehension test, we presented the correct answer for each question. We then elicited the unconditional choice, followed by the 16-step conditional choice (for all the other players' possible average demands, from 0 to 15).

Rather than having a sequential game in which the previous players' choice impacts the following players', as in Holt et al. (2012)'s "canal game" involving water appropriation, in our experiment, we elicit the players' choices simultaneously. Some of the conditional scenarios, e.g., when the others demand on average four masks or more, closely resemble the case of a downstream appropriator unable to appropriate any water because of overconsumption upstream. The conditional demands, in this case, would not have any impact. The conditional choices for averages of the other players between zero and three masks are helpful to examine the impact of empirical expectations about the other players on the demand for masks. The feature of our study that all players receive a payoff of zero when the sum of demands exceeds 15 masks can be interpreted as a costly conflict of appropriation. The game has an equilibrium in which each player demands three masks: this is the reasoning that we believe will prevail in this impoverished decision framework.

2.3 The treatment

In the treatment study, we used the COVID-risk message familiar from the dictator game presented above, alerting the participants that there were stark differences between the mortality rates in the 24< and the 65> subpopulations. We always used the most recent statistics available before each experiment, which did not affect the age groups' disparities in mortality rates.

We matched each participant to four more. Each group was composed of 4 participants 24< and one 65>. Participants were informed of this feature of the experiment and were asked to report their year of birth at the beginning of the experiment to identify their age group within the experiment. Participants played the same game as in the baseline study, three times in total. We

did not announce in rounds 1 or 2 that there would be further rounds, and we did not instruct participants that they would play with the same participants to whom they had been matched in earlier repetitions. In rounds two and three, we showed participants a histogram of the demands of the 24< and 65> participants in the previous round. The participants did not have to re-take the comprehension test in rounds 2 and 3 but were asked to complete two attention checks based on the histogram shown.

Given that the groups were reshuffled in every round and that repetitions were unannounced, we believe reputation concerns could not have played a role in our experiments. In the first round, the participants had not had the chance to observe their peers' demand behavior. In rounds 2 and 3, the participants could formulate their demands based on the distribution of demands in the previous round. Data collection for rounds 2 and 3 was carried out several days after the previous round, and enrollment in each round was left open for several days. After each round, subjects were paid their rewards (performance-based reward, flat fee, and comprehension-related reward), before recruitment started for the next round. The subject pool for rounds 2 and 3 were the participants who participated in round 1.

3. Results

All participants were informed that the study was about their consumption habits during the COVID-19 pandemic. They were informed that their participation was voluntary and revokable. Participants affirmed that they freely participated in the study and could provide legal consent in their country. Participants in the dictator game and the baseline study were excluded from the baseline and the treatment studies.

3.1 Dictator game

A Kruskal–Wallis equality-of-populations rank (nonparametric) test on the median amount sent in the five studies (4 with information on the age of the receiver, and one study without any age-related information) fails to find any significant differences. We regress the dictator's sent amount on gender and year of birth, whether the dictator donates to charities often or rarely/never (dummy-coded), and whether the receiver was young (dummy-coded, a feature of the experiment known to the dictator). We do not include in the regression whether the dictator is young or not, as the variable is collinear with the year of birth of the dictator. Dictators who report regularly donating to charities send more (coefficient estimate= .166, estimated robust standard error = .068; R-squared = 0.06). We find no evidence that the dictator's age, or the recipient's age dummy, affect the dictator's decision. Therefore, there seem to be no pre-existing norms related to the sender's or the recipient's age in this simple helping game. Hellmann et al. (2021) find, unlike us, significant differences in dictator giving to 7 different groups during the pandemic. The groups were constructed crossing sex and age (males 40<, females 40<, males 40-60, females 40-60, males 60>, females 60>, recipients suspected of being infected). The authors alerted participants that elderly and male participants were most likely to become infected. Hellmann et al. (2021) find a positive relation between dictator giving and self-reported responsibility (for the dictator) to help the recipient group and the perceived vulnerability of the recipient to infection. We did not measure in our dictator games responsibility to help and vulnerability. Therefore, we cannot determine whether the differences in results are due to sampling (Germany for Hellmann et al., 2021; the US in our study) or to differences in the degree of perceived responsibility and vulnerability in the two groups.

3.2 One-shot baseline

Participants were paid a $3 participation fee and won, on average, bonuses of about $1 from the comprehension test and $3 from the mask demand game. Participants took, on average, 17 minutes to complete the study. We dropped observations from those participants who did not answer two or more comprehension questions correctly (out of three, final *n*=114, original *n*=143). Table 1 shows the descriptive statistics. Only the contingent choices up to an average of 3 are shown.

Variable	Obs	Mean	Std. Dev.	Min	Max
male	113	0.504	0.502	0	1
year of birth	114	1984.035	14.578	1942	1997
simple choice	114	2.816	1.649	0	10
three masks	114	0.351	0.479	0	1
contingent (0)	114	6.009	5.541	0	15
compliant (0)	114	0.088	0.284	0	1
more than (0)	114	0.912	0.284	0	1
contingent (1)	114	5.123	4.287	0	14
compliant (1)	114	0.140	0.349	0	1
more than (1)	114	0.816	0.389	0	1
less than (1)	114	0.044	0.206	0	1
contingent (2)	114	4.123	3.213	0	13
compliant (2)	114	0.254	0.437	0	1
more than (2)	114	0.596	0.493	0	1
less than (2)	114	0.149	0.358	0	1
contingent (3)	114	3.175	2.940	0	15
compliant (3)	114	0.333	0.473	0	1
more than (3)	114	0.237	0.427	0	1
less than (3)	114	0.430	0.497	0	1
payoffzero	114	0.368	0.484	0	1

Table 1: descriptive statistics, baseline study

Our sample size is gender-balanced, and it spans a wide range of birth years. The average (unconditional) number of masks demanded is slightly below the egalitarian choice of three, with participants demanding from 0 to 10 masks. About 35% of participants demand exactly three

masks, the modal choice, as shown in Figure 1. The contingent choices decrease with the increase in the number of masks demanded on average by the other participants. We interpret this finding as evidence that participants considered the others' averages when making their conditional choices. The contingent choice when the others demand, on average, three masks is slightly above three. We classify each contingent choice as compliant if, whenever the others' average is $\bar{x}_{-i}$, the participant chooses $x_i = \bar{x}_{-i}$. Alternatively, the participants might choose an $x_i > \bar{x}_{-i}$, the "more than choice," or $x_i < \bar{x}_{-i}$, the "less than choice." For an average of up to two masks, the participants typically demand more than the others. In this game, the preference to conform to the others' behavior is weakened by a preference for efficiency, i.e., not leaving masks unappropriated. The conditional demand on others demanding three masks is especially interesting, as the compliant choice with this descriptive expectation is also efficient (and an equilibrium). For an average demand of three masks, one-third of participants choose three masks, and 43% less than three. About 24% of the participants chose numbers exceeding three, which would have forfeited everyone's payoff. This counterintuitive choice might be explained as the result of the struggle of some of the players with the idea of contingent choice and the strategy method. The majority of participants, in this scenario, prefer to err on the side of caution, choosing two masks. Table 1 shows that coordination fails, i.e., participants earn zero, in about one-third of the cases.

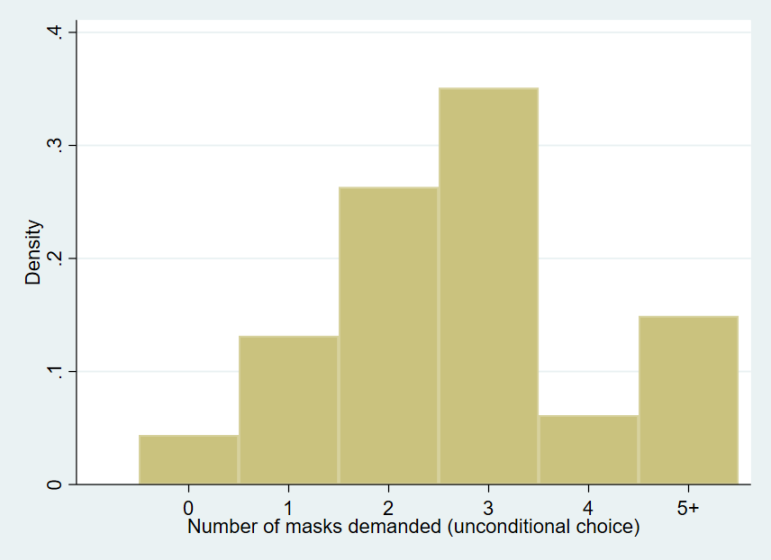

Figure 1: mask choice, baseline study

A regression of the simple choice on the year of birth of the participant and a gender dummy, with robust standard errors, does not uncover any significant relations. The same regression using the contingent choice on the others demanding on average three masks yields again no significant relations. Garbe et al. (2020) report that older participants tended to stockpile toilet paper more frequently, in a study in which the demand for toilet paper was self-reported rather than elicited in an incentive-compatible manner as in our study. Although we fail to find differences in behavior due to age in this study, the following section shows that differences in behavior due to age emerge once we include the COVID statement, i.e., when we enrich the decision framework and provide reasons for deviating from the egalitarian norm.

3.3 The victim study

The victim study includes the COVID-risk message. It has a panel structure with (up to) three observations for each participant. As in the baseline, inclusion criteria are answering two of the three comprehension questions correctly in round 1. Those who did not pass this test were not

invited to participate in rounds 2 and 3. We added two new inclusion criteria. The first is answering one of two comprehension questions correctly in round 2. Those who did not pass the round 2 test were dropped from round 2, but allowed to participate in round 3 (and their data retained for round 1). The second new inclusion criterion is answering one of two comprehension questions correctly in round 3. Therefore, our panel has gaps, i.e., not every participant was observed in all three periods.

Each group required 4 participants aged 24< and 1 participant 65> in this study. We would have thus necessitated a far greater number of younger participants than older. We recruited roughly the same number of participants from the two age groups because they did not interact in a physical lab, and we elicited choices via the strategy method.[13]

Table 2 shows the descriptive statistics for this study. We report statistics for the participant's (self-reported) opinion about the usefulness of masks (Likert scale; 1= I disagree entirely with the statement "masks protect myself/others", 10= I agree entirely with the statement); the participant's use of masks (Likert scale; 1=never wear one, 10=always wear one); the use of masks in the participant's community (Likert scale; 1=others never wear one, 10=others always wear one); the participant's supply of face masks; the price of a disposable surgical facial mask (a picture was provided, we capped this number at $14, setting to missing some observations that grossly exceeded this number). The rest of the regressors retain the same meaning as the one-shot baseline experiment. We asked participants in rounds 2 and 3 if they remembered their choice in

[13] This choice implies no deception. The younger participants were told they would be paired with three further 24< participants and one participant 65> to calculate their payoff—and we followed through on this commitment. The 65> participants were told they would be paired with four younger participants—and again, we followed through. The younger participants were paid only once, even though their choices were matched to several 65> participants to allow calculation of all the 65> participants' rewards.

the previous round, and only a minority reported remembering their choice, unsurprisingly, considering that Prolific subjects likely participate in several experiments per week. There seems to be a consensus about the usefulness of masks among participants, and participants report using a mask virtually always.[14] The average simple choice is below 3, and roughly a third of the participants demand three masks, as in the baseline study. 24< participants make on average lower simple demands than the 65>. The contingent choices decrease when the other players' average demands increase. Coordination fails in roughly one-third of the encounters.

Variable	Obs	Mean	Std. Dev.	Min	Max
masks protect myself	204	7.902	2.628	1	10
masks protect others	204	9.294	1.737	2	10
I wear face masks	204	9.191	1.587	1	10
others wear face masks	204	7.382	1.682	2	10
my supply of face masks	204	26.206	52.101	1	300
price of a face mask	195	2.156	2.705	0.050	14
male	252	0.607	0.489	0	1
year of birth	256	1976.438	24.743	1942	2002
simple choice – all	256	2.770	1.932	0	15
simple choice – 24<	137	2.482	1.672	0	15
simple choice – 65>	119	3.101	2.153	1	15
three masks	256	0.332	0.472	0	1
contingent (0)	256	6.160	5.428	0	15
contingent (1)	256	5.227	4.139	0	15
contingent (2)	256	4.063	3.117	0	15
contingent (3)	256	2.910	2.668	0	15
remember round-1 choice	76	0.395	0.492	0	1
remember round-2 choice	65	0.462	0.502	0	1
payoffzero	256	0.390	0.489	0	1

Table 2: descriptive statistics, victim study

[14] McDonald's omega of internal consistency of the values reported by participants for 4 variables measured on a Likert scale from 1 to 10, "masks protect myself," "masks protect others," "I wear face masks," "others wear face masks," is 0.7, at the conventional threshold. The omega estimation relies on fewer assumptions than the more common Cronbach alpha (Dunn et al., 2014).

Figure 2 shows that the median choice is two masks in the younger population and three in the 65> population. Observations are pooled for this figure from all three rounds.

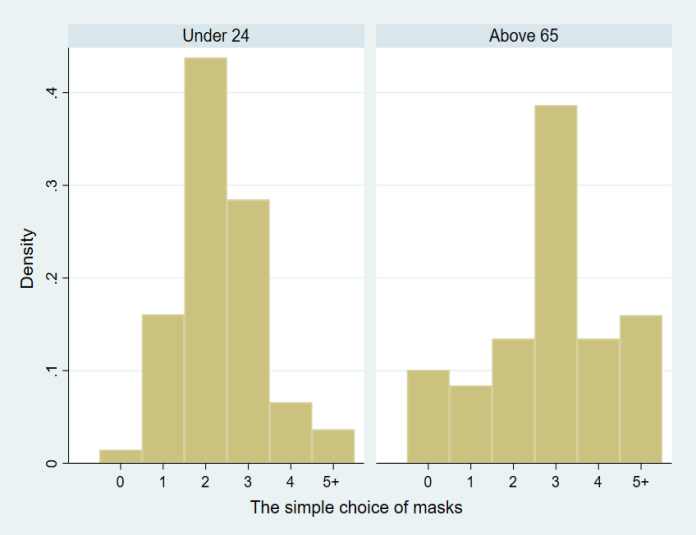

Figure 2: mask choice by age group, victim study

Figure 3 shows the evolution of mask demands by age group in the three rounds.

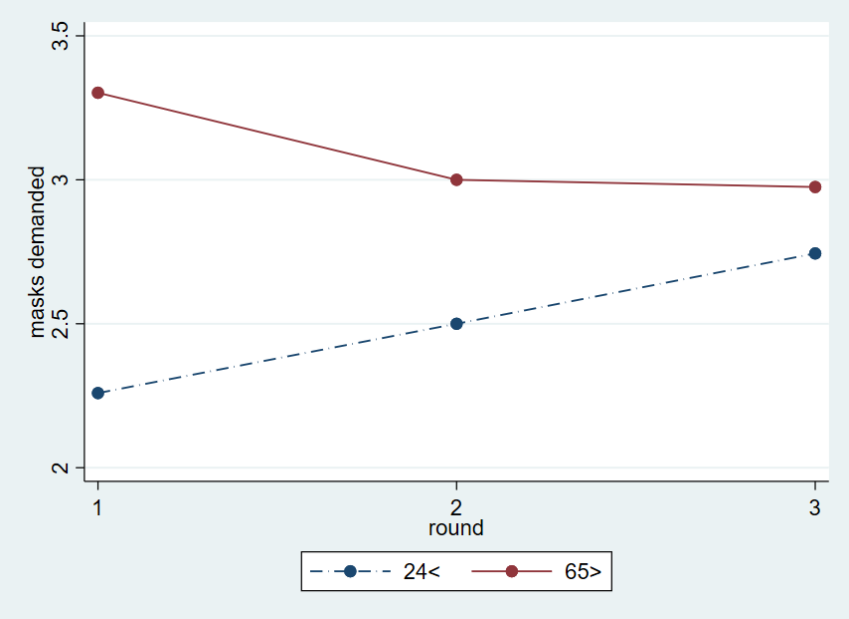

Figure 3: mask choice over time by age group, victim study

We find initial evidence in Figure 2 that the 65> participants demanded more masks than the 24< group. A two-sample Kolmogorov-Smirnov test for equality of distribution functions finds significant differences between the simple choices in the two age groups ($p<0.01$). The test is carried out considering, for each participant, the average number of masks demanded in the rounds in which the inclusion criteria were satisfied. Figure 3 shows that differences in mask demands are stark in round 1, but shrink over time as participants observe previous-period choices.

We turn now to panel regression. Table 3 shows the results of a (random-effects)[15] estimation of the simple choice of masks on survey answers, age, gender dummy, a time trend, and year of birth of the participant (R-squared=0.14).[16] The simulations performed through the STATA ® command *pc_simulate* (Burlig et al., 2020) yield a $\beta= 0.86$, above the conventional threshold.[17] As expected, younger participants demanded fewer masks.

[15] All of the covariates of interest in our regression model are time-invariant, making the random-effects model the only possibility in our case, excluding the so-called "population-averaged model" (Cameron & Trivedi, 2005, p. 720) that sets all the individual effects to their average level, which seems undesirable in our case given that the participants likely come from widely different backgrounds across the US.

[16] A regression model that includes only the round, the gender, and the year of birth, finds equivalent signs and p-values. We take this as evidence that there is no relation between demographic controls and the questionnaire answers.

[17] These are the parameter choices for the implementation of the command: $\alpha=0.05$, we use the actual number of observations in our sample, half of the subjects are assigned to treatment, the minimum detectable effect is 1 extra mask demanded, three rounds of play, and controlling for the same covariates as in the regression model (excluding age).

	Coef.	**Robust Std. Err.**
round	0.074	0.168
masks protect myself	-.160	0.140
masks protect others	0.189	0.217
I wear face masks	0.191	0.166
others wear facemasks	0.085	0.104
supply of masks	0.001	0.002
price of a face mask	0.102	0.054
male	0.399	0.304
year of birth	-.015***	0.006
constant	28.087	11.353

Table 3: the regressand is the simple demand, victim study; *=1% significance**

A regression of the contingent choice on 3 masks demanded by the other players, using the same covariates as in Table 3, confirms that younger participants make smaller conditional demands, but the estimate is marginally insignificant. This regression also finds a significant positive relationship between the price of masks and the conditional demand. Given the variability in reported prices for masks (cf. Table 2) and the choice to cap the prices at an arbitrary level, we do not consider this result of interest.

We asked if the enriched narrative of the victim study might lead to more miscoordination. To shed light on this question, we compare the baseline and the first round of the victim study. In both samples, participants had no previous exposure to the other participants' decisions. The only differences are more 65> participants and the COVID-risk message in the victim study. A Kruskal–Wallis test on the unconditional demand does not find significant differences in the two studies. The presence of a victim has thus produced a redistribution of masks from the 24< to the 65>, without affecting the allocative efficiency levels of the baseline study without the victim

manipulation. If one adopts a Rawlsian social welfare function, this redistribution increases group welfare because it benefits the most vulnerable.

3.4 Social norms

In this study, the choices of the mask appropriators were reviewed and potentially punished by a group of external "referees."[18] We are interested in studying if the fear of a sanction can curb the demands for masks (cf., e.g., Tittle, 1977). We also aimed at gaining insights into the expectations of a group of external participants about appropriate behavior in this game. We introduced a series of design simplifications for this study because the referees had to familiarize themselves with the rules of the mask appropriation game to perform their role adequately. We did not use the strategy method, i.e., choices were elicited only through a direct response (the simple choice of earlier studies with the strategy method).[19] We also did not include any references to the victim. Finally, the game was played only once. Those who participated as mask appropriators were excluded when recruiting the referees. All participants were recruited in the US. Appropriators and referees had to correctly answer at least one of two comprehension questions to be included in the analysis. All features of the experiment were known to the appropriators and the referees. Descriptive statistics for the mask appropriators are shown in Table 4.

[18] This was the term used in the experiment—more neutral than "punishers."
[19] Brandts & Charness (2011) survey the evidence of differences in experimental results using the strategy method or the direct response method. A majority of the studies find no differences.

Variable	Obs	Mean	Std. dev.	Min	Max
masks protect myself	96	8.094	2.518	1	10
masks protect others	96	9.083	1.696	1	10
I wear face masks	96	8.750	1.692	3	10
others wear facemasks	96	6.031	2.217	2	10
supply of masks	96	8.313	2.773	1	10
price of a face mask	96	1.984	2.384	0.04	10
male	94	0.468	0.502	0	1
year of birth	96	1990.646	8.876	1963	2003
simple choice	96	3.010	1.815	0	10
three masks	96	0.375	0.487	0	1

Table 4: descriptive statistics for the appropriators, punishment study

The average number of masks is very close to 3. The sample is roughly gendered balanced and mainly composed of younger participants. We regress the masks demanded on questionnaire answers and demographics. Table 5 shows the results (R^2=0.2, the study is adequately powered with a minimum sample of 65 participants).

simple	Coef.	Robust Std. Err.
masks protect myself	0.105	0.066
masks protect others	0.027	0.122
I wear face masks	0.264**	0.106
others wear facemasks	-0.026	0.084
supply of masks	0.042	0.054
price of a face mask	0.203**	0.086
male	-0.046	0.343
year of birth	0.020	0.017
constant	-41.704	32.985

Table 5: the regressand is mask demand, punishment study; **=5% significance

We find a significant positive effect of the personal use of masks on the number of masks demanded. As in the baseline study, we do not find any age effect.

The referees were not shown the actual choices of the appropriators. Rather, referees were asked if they wished to apply a penalty of 0%, 50%, or 100% for respondent choices of 0, 1 2, 3, 4, 5, 6 (or more) masks. There was no cost for punishing, a feature known to both appropriators and referees. For mask demands of 2, 3, 4, and 5, referees were asked if each choice of the appropriators was socially very acceptable, socially quite acceptable, socially quite unacceptable, or socially very unacceptable. A bonus was awarded if a referee chose the most common answer (among the referees) to this question for each number of masks. This procedure is an adaptation of the procedure of Krupka and Weber (2013) to elicit normative beliefs in an incentive-compatible manner. Normative beliefs are beliefs in the community of referees about what constitutes appropriate behavior in the game of mask demands. We transform these normative beliefs into a dummy equal to 1 if the "socially very acceptable" or "socially quite acceptable" options are chosen, and zero otherwise. Finally, referees were asked to express their (descriptive) beliefs about the frequency of choices of 2, 3, and 4 masks. Subjects received a bonus if they approximated the true frequency within a ten percentage point interval. Descriptive statistics for the referees are shown in Table 6.

Variable	Obs	Mean	Std. dev.	Min	Max
masks protect myself	94	8.032	2.550	1	10
masks protect others	94	9.074	2.012	1	10
I wear face masks	94	8.394	2.001	1	10
others wear facemasks	94	6.723	1.942	1	10
supply of masks	94	7.745	3.048	1	10
price of a face mask	94	2.471	3.292	0.01	19
male	86	0.512	0.503	0	1
year of birth	94	1989.074	10.657	1952	2002
punishment (0)	94	0.261	0.393	0	1
punishment (1 mask)	94	0.117	0.225	0	1
punishment(2 masks)	94	0.096	0.198	0	0.5
punishment (3 masks)	94	0.117	0.237	0	1
punishment (4 masks)	94	0.303	0.304	0	1
punishment (5 masks)	94	0.410	0.336	0	1
punishment (6 masks)	94	0.590	0.381	0	1
acceptability (2 masks)	94	0.904	0.296	0	1
acceptability (3 masks)	94	0.840	0.368	0	1
acceptability (4 masks)	94	0.500	0.503	0	1
acceptability (5 masks)	94	0.309	0.464	0	1
correct guess (2 masks)	94	0.234	0.426	0	1
correct guess (3 masks)	94	0.213	0.411	0	1
correct guess (4 masks)	94	0.245	0.432	0	1

Table 6: descriptive statistics for the referees, punishment study

Referees seem to share the same demographics and survey answers as the appropriators. Punishment is frequent—a robust finding in the literature (cf., e.g., Fehr & Gächter, 2002; Friesen, 2012).[20] Choosing zero is punished more harshly than choosing 1, 2, or 3 masks—a punishment of individuals who exceed in their zeal (cf., e.g., Rand et al., 2010). The choice of two masks is the one that attracts the least amount of punishment, and punishment rapidly increases for choices above three masks. The referees state almost unanimously that choosing two or three masks is appropriate in this game. Opinions are equally split regarding the acceptability of demanding four

[20] Brandts & Charness (2011) find that eliciting punishment through the strategy method, as in our case, might have biased punishments downwards.

masks, while above four masks, we quickly enter the territory of social unacceptability. Only a minority of referees predict the empirical distribution of the appropriators' choices correctly. The choice of two masks is believed to be popular (42%, the true figure is 22%). As we have seen, the choice of two masks is believed to be appropriate, and it rarely attracts punishment. The prediction for three masks (40%) is close to the actual average. Regarding four masks, the prediction is again on average off by a wide margin, 27%, versus a true percentage of 9%. The appropriateness of demanding two masks in the eyes of the referees might be interpreted in prudential terms: choosing two masks is a "conservative" choice that limits the chances of miscoordination if others are believed to demand more than three masks.

4 Discussion and Conclusion

In this paper, we claim that after a negative shock such as the COVID-19 outbreak, some goods can be studied as a common pool resource subject to a "Tragedy of the Commons." When participants are informed that a fixed supply of facial masks exists, the most common choice is the egalitarian norm. When it is brought to the players' attention that COVID-19 disproportionately affects the elderly, younger participants demand fewer masks than older participants. We did not find evidence that the victim narrative resulted in more frequent miscoordination. Loewenstein & Small (2007: 124) notice that "sympathy … provides the motive force for helping behavior," in this case, for the younger participants to help the elderly participant. However, they add, sympathy "is prone to direct the helping behavior it motivates in erratic, inefficient, and irrational directions" (*id*.). The simplicity of our choice might have avoided this potential shortcoming of helping behavior. In a study using simulations, Santos & Pacheco (2011) found that collective action problems admit an easier solution in situations with a high chance of collective failure.

At the beginning of the paper, we have offered reasons to be skeptical that institutions can help alleviate stockpiling after a shock, and we have offered victims as an alternative. A policy implication of our analysis is that information about vulnerabilities in the population of appropriators is crucial to curb stockpiling. We speculate that identifying a victim might be an effective intervention because both the enriched victim narrative and stockpiling behavior are the expression of impulsive (or System-1, Kahneman, 2011) neural circuitry, and this commonality makes them an effective pair.

We view our results concerning the help the 24< participants are willing to provide to the 65> participants as a lower bound on the true amount of helping behavior in a similar decision situation outside the lab. Increasing the social proximity between the "benefactors" and the victim would likely increase help. In studies such as Kogut & Ritov (2005a), the victims are identified by name, age, and photo. Small & Simonsohn (2008) show that one's acquaintance with a victim and his/her condition increases the likelihood of helping a victim in similar circumstances. Similarly, in the context of managing stakeholder relations in organizations, McVea & Freeman (2005) propose a "names and faces" approach. Even in our highly impersonal setting, the US participants in the low-risk age group were willing to forgo some masks, probably because of the vividness of the COVID-19 pandemic and the extensive media coverage of mortality in nursing homes (cf., e.g., Veronese et al., 2021). It is also likely that concentrated, versus distributed, helping might be easier to observe in the lab (cf. Sharps & Schroeder, 2019; Engelen et al., 2018).

Another possible explanation is that the 24< group might have demanded fewer masks out of a prudential motive, i.e., they might have thought that the 65> were likely to demand more than

three masks, and hence, the others in the group had to adjust their demands downwards. A future study might be designed to specifically disentangle helping motivations, prudential motivations (low demands for fear of miscoordination), and motivations based on descriptive (what others do) and normative expectations (what others expect me to do).

Our study focused on antisocial behaviors such as sudden stockpiling. Hellmann et al. (2021) find that research participants' *prosociality* increased after the pandemic. The different determinants of increases in anti-social behavior in certain domains and increases in prosociality in others during the pandemic deserve further study.

Another dimension that deserves further consideration when comparing the relative strength of different appropriation rules is how open they are to multiple interpretations. For instance, a norm that holds that shoppers should take only as much toilet paper as they presently need allows for more wiggle room than a norm that holds that shoppers should continue shopping as they always have. Players often possess a self-serving bias that predisposes them to adopt a norm that serves them (Bicchieri & Chavez, 2010).

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Appendix

Links to all surveys

The initial survey

https://forms.gle/qNdeQLsPPotzuyMi7

Simple dictator game

https://forms.gle/E2XZuuuvDjugFTiRA

Dictator game 24< to 65>

https://forms.gle/QiSnozTkmxS1VxdF9

Dictator game 24< to 24<

https://forms.gle/X8KECs11FrhaYMyA6

Dictator game 65> to 24<

https://forms.gle/mYKohFXjp4iC1uHk6

Dictator game 65> to 65>

https://forms.gle/jLFns2kLebvYdErA7

Baseline

https://forms.gle/cqysNgzyUUsgy6B58

Victim study, round 1, 24<

https://forms.gle/bRVegTjjqsVN99Xy8

Victim study, round 1, 65>

https://forms.gle/dTwrHC5c7YtW45qEA

Debriefing questionnaire for all participants in the victim study, performed at the end of round 1.

https://forms.gle/uRx750yHoha9Exug7

Study with punishment - appropriators

https://forms.gle/ptbYzsei7GnVXtkq9

Study with punishment – referees

https://forms.gle/bFgpBCqYGURE1ZbX6