Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Breaking the chain with individual gain? Investigating the moral intensity of COVID-19 digital contact tracing☆

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ABSTRACT

During the COVID-19 pandemic, contact tracing apps such as the German Corona-Warning-App (CWA) were introduced to facilitate contact tracing of infected individuals with the aim of breaking chains of infection. Therefore, using a contact tracing app is beneficial to society as a whole. Even though this is a good cause, the rather reluctant use of the CWA in the beginning indicated that the pains (e.g., privacy concerns) obviously outweighed the gains (helping others) at the level of the individual user. Thus, in order to identify what lies behind the gain of this app and how it can be promoted, we were interested in the individual's moral perspective (helping others) on the app. We expected a positive relation between CWA download and moral intensity derived from (i) the magnitude or seriousness of consequences, (ii) social norms about app use, (iii) the individual proximity to COVID-19 cases, and (iv) the probability of the app's positive effect. Using a heterogeneous German sample of $N = 1{,}454$, we found a strong influence of moral intensity on app download. Furthermore, a manipulation of moral intensity among non-users led to a higher number of downloads in a follow-up study ($N = 662$) as compared to the population. Our results show possibilities to enhance the adoption of contact tracing apps and potentially other apps for the common good in the population.

1. Introduction

In 2019, an infectious disease that would later spread to most countries in the world was discovered in the city of Wuhan, China. As of October 11, 2022, more than 621 million people have been diagnosed with Coronavirus Disease 2019 (COVID-19) and more than 6 million people died after an infection (Johns Hopkins University, 2022). To control the spread of the virus, it is of fundamental importance to quickly detect and isolate potentially infectious individuals. Therefore, health authorities strongly rely on contact tracing, that is, the notification and quarantine of relevant contact persons of individuals diagnosed with infectious diseases such as severe acute respiratory syndrome (SARS)—including the recent coronavirus strain SARS-CoV-2—to break transmission chains (Eames & Keeling, 2003; Klinkenberg, Fraser, & Heesterbeek, 2006). However, manual contact tracing is not only threatened by potentially inaccurate recall (Bengio et al., 2020). With a large degree of asymptomatic infections and transmissions prior to the individual being symptomatic, it is a race against time (Ferretti et al., 2020). As a result, many countries have introduced digital systems that allow for more efficient contact tracing (e.g., Kahn, 2020; Sharma et al., 2020). In Germany, the Robert Koch Institute (RKI), which is responsible for disease control and prevention, introduced the Corona-Warning-App (CWA). This app works by generating random codes and exchanging them via Bluetooth with other smartphones at close distances. These codes are then stored on the smartphone for up to 14 days after the encounter. If one person is diagnosed with COVID-19, they can share their test result in the app and their contacts will be informed anonymously. Because in the beginning, there was no obligation to install the app and only minimal personal benefit for doing so, the success of this app heavily depended on individuals' moral decision to help others by

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installing the app (Williams, Armitage, Tampe, & Dienes, 2021). In turn, such a moral decision is driven by moral cues that indicate the moral quality such as in social norms (e.g., Allidina & Cunningham, 2018; Leavitt, Zhu, & Aquino, 2016; Reynolds, Leavitt, & DeCelles, 2010a, 2010b), and the perceived intensity of the moral issue at hand (e.g., the seriousness of consequences and, in our case, also the individual proximity to people infected with COVID-19).

According to modeling studies, a download by 56–95% of the population is necessary to stop the spread of the pandemic through a contact tracing app (Braithwaite, Callender, Bullock, & Aldridge, 2020). Prior to the launch of the CWA, studies predicted acceptance of contact tracing apps by approximately 75% of the population (Milsom et al., 2021). By the end of January 2021 (the time of this study and seven months after its launch), the app had been downloaded by 25.2 million German citizens, or roughly 35% of the population over the age of 16 (Statistisches Bundesamt, 2022). To effectively break the chains of infection and control the transmission of the virus, it would be beneficial if a greater proportion of the population used the app. It is therefore necessary to better understand the gain and pain factors that influence CWA adoption and to discover how they can be addressed, for example through policy or targeted campaigns. Notably, while the use of the CWA is generally considered to be beneficial to society, at the time we conducted this study the individual gains of using the app were limited.[1] Although the launch of the CWA was accompanied by intensive advertising and information campaigns (Die Bundesregierung, 2020b), the relatively low level of adoption indicates that for a majority of Germans, the pain factors seem to have prevailed so far.

Despite the high societal relevance of this topic, however, current research on contact tracing app usage has focused on classical design aspects of technology acceptance (e.g., Chopdar, 2022; Farrell, Pammer, & Drebert, 2021), or on privacy concerns (Walrave, Waeterloos, & Ponnet, 2020), but not on prosocial or moral aspects that might explain app adoption. At the same time, and unrelated, studies abound that explicitly investigate moral issues in the context of COVID-19 contact tracing apps, ranging from inquiries into the formation of normative positions or public attitudes toward the apps (e.g., Lucivero et al., 2022; Williams et al., 2021) to debates about privacy concerns or the (responsible) design of such apps (e.g., Parker, Fraser, Abeler-Dörner, & Bonsall, 2020; Ranisch et al., 2021; Rowe, 2020). Moreover, Kokkoris and Kamleitner (2020) found that prosociality is related to contact tracing app adoption, implying that more prosocial individuals experience a higher gain from being able to help other people through app use. In contrast, individual disadvantages (i.e., pain), such as the disclosure of personal data, may reduce the willingness to download the app especially if privacy concerns are high (Chan & Saqib, 2021; Pape, Harborth, & Kröger, 2021). The decision to download the CWA can thus be regarded as an indicator that the gains eventually outweigh the pains. However, to date, none of these studies has investigated whether or how the perceived moral imperative with respect to COVID-19 contact tracing apps can be regarded as an additional gain factor that influences an individual's intention to download or use them. With this article, we aim to fill this research gap and contribute to a better understanding of the moral issues related to app use for the common good. In this context, we agree with Lucivero et al. (2022) that research needs to look beyond the apparent dichotomy between privacy concerns and public health to obtain a clearer and more nuanced picture of the factors that either hinder or facilitate the uptake and use of contact tracing apps at a more general level that connects to constructs from relevant disciplines such as psychology or consumer ethics.

However, in contrast to nearly all existing apps—which have some substantial gain (or pain) for the individual—we are dealing with a very specific application that we suspect has an uncommon gain-factor in the form of *moral intensity* depending on an individual's prosociality. Moral intensity has been defined as "a construct that captures the extent of issue-related moral imperative in a situation" (Jones, 1991, p. 372). An individual's perceived moral intensity has been argued to affect their recognition of issues as moral dilemmas, consequently affecting ethical judgments and behavioral intentions toward those issues (Barnett, 2001). Thus, we will show that technology acceptance models, which mostly capture the immediate benefits of app use for the individual (e.g., Davis, 1989), should also focus, at least in the case of contact tracing apps, on societal circumstances related to individuals' prosociality (Trang, Trenz, Weiger, Tarafdar, & Cheung, 2020)—in our case expressed by moral intensity. Therefore, in this study, we draw inspiration from an adjacent strand of literature that deals with related moral dilemmas of individual vs. collective interests, that is, the consumer social responsibility debates (e.g., Otto, Hildebrandt, Will, Henn, & Beer, 2021; Schlaile, Klein, & Böck, 2018; Vitell, 2015). More precisely, to better understand the multidimensionality of the moral-issue-contingent gain factors that influence the decision to "consume",[2] that is, to obtain and use a contact tracing smartphone application for the common good, we adopt the concept of *moral intensity*. To the best of our knowledge, ours is the first study to apply the moral intensity construct both in the general context of COVID-19-related moral or ethical decisions and in the specific context of digital contact tracing.

An additional, more practice-oriented aim of this study is to show that individual download decisions can be influenced by highlighting facets of the moral intensity of CWA download. In this regard, our study contributes to policy-relevant research and opens possibilities to influence contact tracing app acceptance beyond technological design aspects. Using a repeated-measures quasi-experimental design, we manipulate the seriousness of consequences of CWA download for non-users and measure their download rates approximately two weeks later.

1.1. Theoretical background

While the concept of a self-interested and rationally optimizing *homo economicus* still seems to dominate standard economics textbooks and curricula (e.g., Bäuerle, 2021; Bäuerle, Pühringer, & Ötsch, 2020; Graupe, 2012, 2020), most other social sciences dealing with human behavior have long recognized that humans are not only egoistic and competitive but also altruistic, prosocial, and highly cooperative beings (e.g., Atkins, Wilson, & Hayes, 2019; Batson & Powell, 2003; Bregman, 2020; Hare & Woods, 2020; Schlaile, Klein, & Böck, 2018; Schlaile, Mueller, Schramm, & Pyka, 2018). Yet, this fact alone is obviously not enough to explain why some people have been more prone than others to engage in behaviors that can help to keep COVID-19 at bay. As mentioned above, previous studies on the factors that influence the decision to consume (i.e., especially to obtain and use) the service of a contact-tracing smartphone application have provided important insights into the role of individual traits or design aspects, but have so far neglected potentially relevant knowledge and approaches from the adjacent field of consumer social responsibility. (e.g., Caruana & Chatzidakis, 2014; Hentschke, Kibbe, & Otto, 2017; Schlaile, Klein, & Böck, 2018; D. Shaw et al., 2016; Wilke et al., 2021). More generally, there have been long-standing debates in moral theory between adherents of an individualist view, focusing on a person's stage of moral development or personality traits, and proponents of more context-dependent and situational views on morality (see, e.g., Hodgson, 2014; Kelley & Elm, 2003; Trevino, 1986, 1992). In this study, we take an intermediate

[1] The only objective individual gain was the right to get a free polymerase chain reaction (PCR) test after the app detected a relevant contact with an infected person. Such a test would otherwise cost at least 60.- € but was not needed by many.

[2] Note that consumer social responsibility particularly concerns moral principles and standards guiding individuals' behaviors as they "*obtain, use,* and *dispose* of goods and services" (Vitell, 2015, p. 768, with reference to Muncy and Vitell, 1992).

perspective on the moral dimension of consumers' decision making that focuses on the characteristics of the *moral issue* itself. According to Jones (1991), "a moral issue is present where a person's actions, when freely performed, may harm or benefit others" (Jones, 1991, p. 367, with reference to Velasquez & Rostankowski, 1985). Downloading contact tracing apps can thus be regarded as a moral issue, as the decision relates to breaking chains of infection and controlling the transmission of COVID-19, which can potentially save lives.

1.2. Moral intensity

The extent to which people react to a moral issue has been argued to depend on its moral intensity, among other things (Barnett, 2001; Jones, 1991; Morris & McDonald, 1995; Schlaile, Klein, & Böck, 2018). Moral intensity is a multidimensional issue-related construct (Jones, 1991) frequently taken up in the literature on ethical decision making (e.g., Husser, Andre, & Lespinet-Najib, 2019; Marshall & Dewe, 1997; Moores, Smith, & Limayem, 2018; Paolillo & Vitell, 2002; Schlaile, Klein, & Böck, 2018; T. R. Shaw, 2003). The theory of moral intensity is based in part on arguments from moral philosophy, yet Jones (1991) introduces concepts that are non-existent in prior approaches. While some earlier theories suggest that characteristics of the moral issue affect moral judgment, the focus of these models is more on the deciders. Therefore, Jones (1991) argues that his theory, which emphasizes the importance of situational factors, is intended to complement, rather than replace, existing models of ethical decision making. According to Jones (1991), moral intensity comprises the following six "dimensions" or facets (those in bold are relevant to this study): **(i) *magnitude or seriousness of consequences*, (ii) *social consensus*, (iii) *proximity*, (iv) *probability of effect*,** (v) *temporal immediacy*, and (vi) *concentration of effect*. Hence, the more people perceive an issue to be relevant (i.e., of serious consequences, etc.) and their decision to be both effective and important (i.e., their own behavior can lead to benefits for others), the more likely they are to engage in the moral behavior in question—in our case, the decision to use the contact tracing app. The facets of the moral intensity construct relate to the download and use of the German contact tracing app CWA in the following ways.

1.3. Magnitude of consequences

Jones (1991) defines the magnitude or seriousness of consequences as "the sum of harms (or benefits) done to victims (or beneficiaries) of the moral act in question" (p. 374). That is, the severity of consequences for others determines whether a moral behavior is exercised. With regards to the CWA, the decision whether or not to use the app depends on how many people one perceives to be helped by using the app and how much they benefit from the individual's use of the app. One of the goals of this study is to show that the perceived magnitude or seriousness of consequences can be influenced by providing information on the consequences of using the app. We therefore expect:

Non-users are more likely to download the CWA if they receive an explanation on how the app helps break chains of infection and how many lives could be saved by using the app (high magnitude of consequences).

1.4. Social consensus

The second component reflects the social agreement about the valence of the proposed act (Jones, 1991). It is related to the psychological concept of social norms, which refers to what is approved of or what is done by relevant others (Cialdini, Kallgren, & Reno, 1991), and will therefore be referred to as social norms in this article. Norms can guide behavior, for instance by providing information about effective behaviors, thereby facilitating decision making (Cialdini et al., 1991). An influence of social norms on consumer behavior has been found in various contexts, for example, in terms of pro-environmental behavior (e.g., Goldstein, Cialdini, & Griskevicius, 2008). Because norms are shaped by particular social groups, they operate at different levels depending on which groups are considered. On a macro level, social norms reflect what "most people" in a society approve of or do. In terms of the CWA, the German government has called on society to use the app to combat the COVID-19 pandemic (e.g., Die Bundesregierung, 2020a), thereby signaling desirable behavior that is approved by the authorities. Moreover, the RKI presents current numbers of app downloads on their website.

Additionally, at the micro level, norms in small social groups can influence the behavior of their in-group members (Vesely & Klöckner, 2018; Wuketits, 1993). That is, CWA use and acceptance in one's social microenvironment (i.e., among family and friends) are also likely to affect individual CWA use (Zabel, Kuhle, Kärner, Karsten, & Otto, 2022). In contrast, cautionary voices from critics in one's social group who fear digital surveillance may impede CWA downloads. Because social norms operate at both the micro and the macro level and are sometimes in conflict, it is necessary to capture them separately. We therefore hypothesize:

Social norms influence CWA use at a macro and a micro level.

1.5. Proximity

Jones (1991) defines proximity as a "feeling of nearness (social, cultural, psychological, or physical) that the moral agent has for victims (beneficiaries) of the evil (beneficial) act in question" (p. 376). Because the characteristics of the CWA determine the beneficiaries of app use (people in close physical proximity), we focus on the psychological and physical proximity of the victims of the disease. Feeling close to others suffering from COVID-19 is likely to increase the perceived urgency of taking moral action, that is, downloading the CWA; hence: *Perceived (physical and psychological) proximity influence individuals' decision to use the app.*

1.6. Probability of effect

The probability of effect refers to "the probability that the act in question will actually take place and the act in question will actually cause the harm (benefit) predicted." (Jones, 1991, p. 375). That is, using the CWA must therefore be perceived as an effective way to pursue the objective of reducing infections. It is therefore expected: *Perceived probability of effect influences the individual's decision to use the app.*

Together, probability of effect and magnitude of consequences constitute the expected consequences of a moral act (Jones, 1991). Consequently, the higher the perceived efficacy of CWA use in terms of controlling the spread of the virus and the greater the consequences for other people, the more likely the app will be used.

Jones (1991) identified two more components of moral intensity. Temporal immediacy and concentration of effect. The first refers to people valuating events with a greater temporal proximity more than distant events. In terms of the CWA, during the COVID-19 pandemic, the temporal distance to the effect is unknown (i.e., users do not know if and when they will receive a message urging them to self-quarantine). The second depends on the number of beneficiaries (or victims) of an act. This component is mostly determined by the functionality of the app and the number of app users in one's environment. Therefore, temporal immediacy and concentration of effect were excluded from this study.

So far, moral intensity has mostly been studied in the context of organizational behavior, whereas its influence on consumption decisions has been underrepresented in empirical research. Two exceptions can be found in the environmental domain: Mäkiniemi and Vainio (2013) examined whether the perceived moral intensity of climate change is related to the choice of climate-friendly food alternatives. In their study, the seriousness of consequences and the perceived proximity predicted consumption intentions. Social consensus was not associated with climate-friendly food choices, which the authors explained by the

absence of a clear social consensus on climate change. Hong and Kang (2019) examined the connection between moral intensity and the purchase of sustainable clothing. All five dimensions of moral intensity were related to sustainable textile purchasing behavior. The partial discrepancy between these two studies in terms of the influence of moral intensity on behavior could also be related to the fact that situational influence within the same subdomain (e.g., the purchase of sustainable clothing) has a more direct effect than the moral intensity of the overarching context (i.e., climate change). The latter could have an impact in a variety of contexts, depending on individual characteristics of the actor, and would not necessarily be acted out in one particular domain. Therefore, the current study addresses the specific context of contact tracing app use when measuring moral intensity and extends previous studies in the consumer context to the area of social responsibility. This specific context allows us to examine a real decision, thus extending knowledge from previous studies which mostly involved hypothetical decision scenarios (e.g., Barnett, 2001; de Graaff, Giebels, Meijer, & Verweij, 2019).

To summarize, in this study, we thus focus on empirically investigating three facets of the concept of moral intensity—(ii) social norms, (iii) proximity of COVID-19 cases, and (iv) probability of effect—to measure their influence on CWA use. Moreover, our practice-oriented aim is to show that (i) the seriousness of consequences can be manipulated to influence the perceived gain and thus CWA download.

With a focus on the practical applicability of our findings to real-world problems, our study is guided by a pragmatist research philosophy (cf. Žukauskas, Andriukaitien, & Vveinhardt, 2018). Pragmatism emphasizes the role of context as well as individual and cultural perspectives for understanding and knowledge generation. Moral intensity varies in different contexts and its judgment is shaped by the subjective perception of the individual and their potential biases (Jones, 1991; Tversky & Kahneman, 1974). This makes pragmatism especially well-suited for a study on the influence of situational characteristics on ethical decision making.

2. Method

We outline our sampling plan, as well as data exclusions, manipulations, and measures in this study. The study design, our hypotheses and analyses were preregistered; see https://osf.io/48mrq/?view_only=896bfabd772b48fdb9935e4b5aed090c. The preregistration also contains another study that was presented at a conference. Data and analysis code are made available at https://osf.io/jmu9e/?view_only=e3782b9e8c8345e9b5cc5a25c45484cf. This study was part of a larger project; therefore, the repository contains data that are not analyzed in this study. Following a pragmatist research philosophy, design and statistical analyses were selected to best meet our research goals (cf. Žukauskas et al., 2018).

2.1. Design and procedure

We used a cross-sectional design to examine the influence of social norms, probability of effect, and proximity on CWA use. To test the effect of the magnitude of consequences manipulation, we used a repeated measures design with two measures. During the first measurement, participants were not informed that there would be a follow-up survey.

An a priori power analysis was computed to determine the required sample size. A small effect was expected for the manipulation, that is, the influence of highlighting the magnitude of consequences on subsequent app download. A two-tailed alpha error of .05, a statistical power of .80 and an effect of $\Phi = 0.2$ were assumed, which resulted in $N = 197$ observations necessary to identify a small to medium effect.

An online questionnaire was distributed by Gapfish, an online access panel from Germany. Data for the first survey was collected between 18 January and 3 February 2021. All 745 participants who indicated not having downloaded CWA in the first survey (t1) were then invited to participate in a follow-up survey (t2) between 3 February and 15 February. Of these, 88.86% completed the follow-up questionnaire. The average time interval between t1 and t2 was 13.66 days ($SD = 1.73$).

2.2. Sample

Of the initial 1,711 participants who completed the survey, we excluded 257 due to completion speeds of less than 300 s or incorrect answers to the attention check. The answers of $N = 1,454$ participants were included in the analyses. We restricted our sample to smartphone users from Germany between the ages of 16 and 80. The sample is representative of the internet population in terms of gender, age, and education. The mean age of the sample is 45.21 years ($SD = 16.76$), 50.34% are female, 0.14% are inter/diverse. Of all participants, 53.30% live in a medium to large city, whereas the rest reported living in a small city or rural area.

2.3. Measures

The dependent variable CWA use was assessed with a dichotomous item (*I have installed the Corona-Warning-App)*. This item was also included in the follow-up study.

2.4. Moral intensity

Perceived social norms were assessed at the macro level with one item (*The use of the Corona-Warning-App is socially desirable*). To measure social norms at the micro level, six additional items were utilized to measure norms among an individual's in-group, that is, friends and family (e.g., *My family expects me to use the Corona-Warning-App*). Cronbach's Alpha for social norms in an individual's in-group is .86.

To measure proximity, participants indicated whether there are or have been cases of COVID-19 in their social environment (among friends or family) or in their spatial environment (0 – no; 1 – yes).

One item was created to measure probability of effect (*I believe that the Corona-Warning-App is helpful to combat the COVID-19 pandemic*).

Except for Proximity and CWA download, all items were assessed using 5-point Likert scales (1 – do not agree at all; 5 – fully agree).

2.5. Perception of privacy policy

In line with previous studies that found a negative influence of privacy concern on contact-tracing app uptake (e.g., Altmann et al., 2020; Chan & Saqib, 2021), we assessed the perception of privacy policy to account for a potential pain factor. It was assessed with one item *(I am convinced that my right to the protection of my personal data will be preserved when I use the Corona-Warning-App)*. This item was reversed for the analysis in order to indicate the perception that personal data are not protected.

2.6. Control variables

We further controlled for perceived vulnerability to COVID-19. Similar to Kokkoris and Kamleitner (2020), we assessed self-risk and close other-risk of a severe course of an infection with COVID-19, with one item each. There were no correlations between vulnerability and app download in t1 and t2, therefore, it was not included in the analyses. One possible reason is that individuals may underestimate the benefits of their own app use for their peers. In fact, people can inform their immediate environment about their infection themselves. The indirect protective effect (i.e., that a person receives information about a contact with an infected person and then protects their own environment by self-quarantining) may be less salient. The lack of correlation between self-risk and app use may be related to the functioning of the CWA. Its use does not protect an individual from infection, instead it informs them of a potential infection so that the individual can in turn protect

others.

2.7. Manipulation of the magnitude of consequences

At the end of the survey, all participants who had not yet downloaded the CWA received a short text explaining how the app helps to break chains of infection (by alerting contact persons of infected people so that they can self-isolate and prevent other people from being infected). Based on app statistics and pandemic parameters (the number of shared positive COVID-19 tests, mortality rate, and the number of contacts), participants are presented with the number of lives that could be saved by using the app. Appendix A displays the text that was shown to highlight the magnitude of consequences. To ensure that participants read the text, they could not proceed to the next questionnaire page for 17 s.

3. Results

Table 1 displays the means, standard deviations, and Pearson correlations of our dependent and independent variables. Except for proximity (family), all variables measuring moral intensity were significantly correlated to CWA use at t1. These effects were large for the probability of effect and both measures of social norms, which were also substantially correlated to each other. The correlation between the perception of privacy policy and app use at t1 was also large. App downloads two weeks after the magnitude of consequences intervention (t2) were sHignificantly correlated to social norms (in-group), $r = 0.11$ and perception of privacy policy ($r = 0.09$) and marginally correlated to social norms (general), $r = 0.07$. All other measures showed small or no intercorrelations.

Before analyzing the effect of perceived moral intensity on app use, we tested for multicollinearity of the predictors. The variance inflation factor for all coefficients was below 2, indicating that our variables were not affected by multicollinearity.

3.1. H1—Hierarchical regression of app use on the pain and gain factors

We conducted a hierarchical logistic regression analysis to examine the influence of moral intensity and the perception of the app's privacy policy on an individual's decision to use the CWA. Except for proximity (friends and family), all facets of moral intensity were included in the model. The perception of privacy policy demonstrated incremental validity and was also included in the model. Table 2 shows the results of the logistic regression analysis. Social norms at the micro level had the largest impact on CWA use, $B = 1.40$, SE(B) $= 0.11$, $p < .001$. If this predictor increases by 1, the odds ratio increases by 4.04, that is, app use gets four times more likely. Probability of effect, $B = 0.26$, SE(B) $= 0.08$, $p < .001$, social norms on a macro level, $B = 0.29$, SE(B) $= 0.11$, $p < .001$, and spatial proximity of COVID-19, $B = 0.64$, SE(B) $= 0.16$, $p < .001$, accounted for additional variance. Social proximity of COVID-19 (among friends and family) did not explain enough incremental variance to be included in the model. Regarding the pain of using the CWA, the perception that personal data are not sufficiently protected was related to CWA use, $B = -0.54$, SE(B) $= 0.07$, $p < .001$.

Table 2
Results of the hierarchical logistic regression analysis with CWA download as the criterion.

	B	SE (B)	e^B	95% CI for e^B	z	p
Constant	−4.53	0.48			−9.50	<.001
Social Consensus (macro)	0.29	0.08	1.34	[1.15; 1.56]	3.71	<.001
Social Consensus (micro)	1.40	0.11	4.04	[3.27; 5.04]	12.71	<.001
Proximity (Spatial)	0.64	0.16	1.89	[1.39; 2.58]	4.03	<.001
Probability of Effect	0.26	0.08	1.30	[1.11; 1.51]	3.35	<.001
Privacy Policy	- 0.54	0.07	0.58	[0.51; 0.67]	−7.75	<.001
AIC						1072.5

Note. Unstandardized regression coefficients.

The model correctly predicts app use vs. non-use for 85.08% of all participants. An ANOVA with the actual groups (CWA-users vs. non-users) as the independent variable and the groups predicted by the model as dependent variable was computed to estimate the explained variance in the logistic regression. The effect was large, $\eta^2 = 0.55$.

3.2. H2—Manipulation of the magnitude of consequences

To evaluate the success of our manipulation, we compared the number of downloads between t1 and t2 in Germany (RKI) and in our study. In Germany, 237,700 downloads were registered between t1 and t2 (Robert Koch-Institut, 2021), which corresponds to a growth rate of 0.94%. Meanwhile, in this study, 38 participants reported having downloaded the app between t1 and t2. Since only 88.86% of all non-users in t1 participated in our follow-up study, the resulting growth rate of 6.08% is a conservative estimate of the increase in app downloads in our study. To compute a Fisher's exact test (Fisher, 1992), we estimated the number of German smartphone users of 16 years and older who did not download the app. Based on the number of smartphone users in 2020 (Statista, 2021), we subtracted 14- and 15-year-old users because our sample was limited to individuals aged 16 and older (see Statistisches Bundesamt, 2022 for the number of 14- and 15-year-old individuals in Germany and Statista, 2022, for the share of smartphone users in this age group). We found a significant difference in CWA downloads between our sample and the RKI sample ($p < .001$, one-sided Fisher's exact test). In our sample, the actual frequency of app download was 7.6 times higher than the expected frequency.

Table 1
Descriptive Statistics and Correlations for the main variables.

	N	M	SD	1	2	3	4	5	6	7	8
1. Social Consensus (Macro)	1,454	3.55	1.28								
2. Social Consensus (Micro)	1,454	2.69	1.09	.54***							
3. Proximity (Family)	1,454	0.17	0.38	.04	.04						
4. Proximity (Friends)	1,454	0.36	0.48	.10***	.11***	.22***					
5. Proximity (Spatial)	1,454	0.40	0.49	.13***	.11***	.15***	.25***				
6. Probability of Effect	1,454	3.12	1.35	.57***	.62***	.07*	.11***	.14***			
7. Privacy Policy	1,454	2.70	1.46	−.56***	−.57***	−.03	−.10***	−.12***	−.62***		
8. App download (t1)	1,454	0.49	0.50	.51***	.65***	.03	.15***	.16***	.55***	−.57***	
9. App download after intervention (t2)	662	0.06	0.23	.07†	.11**	.00	.03	.03	.05	−.09*	–

Notes. App download after intervention (t2) includes only participants who had not downloaded CWA in the first study.
†$p < .10$. *$p < .05$. ***$p < .001$.

3.3. Explorative analyses

Because CWA download after the intervention was correlated to perceived social norms (micro level) at t1, we computed a repeated measures analysis of covariance for app download with time as a factor and social norms as a covariate. According to Lunney (1970), an analysis of variance is an appropriate method for dichotomous dependent variables under certain conditions, that is, in a large sample. In order to obtain conservative estimates, participants who indicated not having downloaded the CWA at t1 and did not answer the follow-up survey were treated as if they still had not downloaded the app. There were significant main effects for social norms, $F(1,1453) = 1183.03$, $p < .001$, $\eta p^2 = 0.45$ and time point, $F(1,1453) = 49.08$, $p < .001$, $\eta p^2 = 0.03$ on app use. Furthermore, the interaction effect of social norms and time on app use was significant, $F(1,1453) = 4.43$, $p = .035$, however, the effect size was negligible ($\eta p^2 < 0.01$).

4. Discussion

4.1. Theoretical contributions

With this study, we present the first empirical investigation of moral intensity in the context of COVID-19-related ethical decisions. Although our study focuses on the specific case of contact tracing apps, it also provides new insights for the operationalization of moral intensity as well as for the field of consumer social responsibility, as discussed below.

First, the moral intensity construct allows researchers interested in ethical decision making to take an intermediate perspective on morality that focuses on the perceptions of the moral issue itself rather than on individual personality traits, consequences of one's decisions, or structural aspects. Our study shows that this perspective is helpful for obtaining a more nuanced picture of consumers' decisions to download and use contact tracing apps, which can be expected to apply to other types of societally beneficial apps as well, and should thus be taken up in future research. Therefore, one of our study's theoretical contributions is a knowledge synthesis in terms of combining previously unconnected but closely related strands of research (in particular, research on contact tracing apps and research on consumer social responsibility). As also highlighted by de Graaff et al. (2019), theories that focus on individual moral development and personality traits as a basis for responding to a moral issue are insufficient for explaining or predicting ethical or moral decision making (see also Kelley & Elm, 2003; Trevino, 1986, 1992). Over the past three decades, empirical studies have examined the relationship between moral intensity and ethical or moral decision making, though mostly in a management or marketing setting (e.g., Barnett, 2001; de Graaff et al., 2019; Kelley & Elm, 2003; Marshall & Dewe, 1997; May & Pauli, 2002; McMahon & Harvey, 2007; Morris & McDonald, 1995; T. R. Shaw, 2003). Nonetheless, the concept has been starting to gain in relevance also outside its original domain, for example in the context of responses to climate change (e.g., Hong & Kang, 2019; Mäkiniemi & Vainio, 2013; Mazutis & Eckardt, 2017). While it is beyond the scope of our article to further develop moral theory, we would indeed argue that, by selecting and operationalizing the relevant constituents of moral intensity in the context of contact tracing apps, and by testing the impact of a moral intensity intervention on a real-world decision, we also show that moral intensity is an explanatory model of empirical relevance in ethical decision making beyond individual traits or moral development, and beyond the confines of the concept's original domain of management or business ethics and marketing research.

Second, we clearly demonstrated that the measured components of moral intensity are related to CWA use. Social norms at the micro level, that is, perceived norms concerning CWA use in the in-group (i.e., friends and family), showed the strongest relation to individual CWA use. While this finding is not surprising in itself, given previous empirical research on moral intensity and social norms, these findings support theoretical discussions in the field of consumer social responsibility, namely that notions of individual responsibility fall short of capturing the relational aspects of social actions, thus highlighting the need for extending responsibility towards those peers who have the largest influence on one's cultural evolution of morality (Schlaile, Klein, & Böck, 2018; Schlaile, Mueller, et al., 2018). The large effect of social norms in our study as compared to the other components of moral intensity is in line with Reynolds and Ceranic (2007), who argue that when the moral behavior is apparent due to social consensus, the need for individual moral judgment is reduced. Moreover, this influence of social norms on CWA use corroborates the findings of Zabel, Vinan Navas, & Otto, (2022) as well as Venkatesh, Morris, Davis, and Davis (2003), who included social influence as a predictor of technology acceptance in their model. However, our results on the influence of overall moral intensity further highlight the need for reconsidering predictors of technology use when it comes to technologies for the common good. While user experience certainly is a predictor of technology use (Zabel & Otto, 2021), focusing on the objectives of the particular technology, including moral issues, is at least as important.

Our study also contributes to the operationalization of moral intensity. The effects found in this study suggest that, similar to the studies in the environmental domain (Hong & Kang, 2019), the moral intensity of a particular behavior (rather than a broader domain) explains a large amount of variance in that behavior. Whereas prior studies in a work and marketing setting have mainly operationalized moral intensity via scenarios or questionnaires measuring hypothetical decisions, we showed that highlighting the moral intensity has an impact on real decisions. Thus, we open another perspective for operationalizing the moral intensity and for practical application.

Third, in terms of research on contact tracing apps, our study contributes to the literature by extending the findings of previous studies in several ways. Whereas Williams et al. (2021) argued on the basis of focus group interviews with 27 participants that the attitude towards contact tracing app use in the UK is influenced by moral reasoning, we showed for a large sample of German smartphone users that moral intensity as a situational driver substantially impacts CWA use. While Kokkoris and Kamleitner (2020) found an influence of personal prosocial motives on the willingness to sacrifice privacy during the COVID-19 pandemic, we have shed light on the relevance of moral characteristics of the situation and their interplay with privacy considerations. In contrast to prosociality as a trait, which can only *explain* the adoption of contact tracing apps, moral intensity opens possibilities to *influence* their acceptance beyond technological design aspects. Because moral intensity as a situational gain factor can be manipulated, our findings may help to promote the adoption of contact tracing apps by means of dedicated communication efforts.

Fourth, our results also support previous findings by Chan and Saqib (2021), who found a reduced willingness to download contact tracing apps related to privacy concerns, and Trang et al. (2020), who showed that design that ensures a high level of privacy had a positive influence on app acceptance. The correct prediction of app use for 85.08% of all participants by our model suggests that weighing the identified gain and pain factors influenced their download decision. For instance, a negative gain to pain ratio because in-group app use is low (social norms) and data protection is perceived as insufficient leads to non-download. Considering the low download rate of 35% at the time of this survey, this result suggests that the pain factors prevailed for a large proportion of Germans. This finding is particularly noteworthy due to the comparatively low level of private data shared by the German CWA, in contrast to most social media apps. One explanation could be that there are other pain factors that were not taken into account, such as the battery consumption of the app. However, it is more likely that the moral intensity—which has been shown to be a particularly strong predictor of CWA use—was not perceived as sufficiently high to outweigh the pain. With increasingly complex technologies serving a variety of purposes, such as protecting society from a disease, there is a

need to also consider gains in the form of social benefits that address the prosocial or environmental motivation of individuals. Consistent with other studies (e.g., Trang et al., 2020) we have shown that such social benefits can be a substantial gain that benefits app uptake. With this result, we argue for a broader consideration of technology use for the common good (i.e., social benefit) within technology acceptance models (e.g., Venkatesh et al., 2003).

Fifth, by adopting the concept of moral intensity, we present the first study on contact tracing apps that can establish a link to debates on consumer social responsibility (Schlaile, Klein, & Böck, 2018). More precisely, Schlaile, Klein, and Böck (2018) have argued that a low moral intensity can be considered an obstacle to socially responsible consumption and, vice versa, that increasing moral intensity positively influences the propensity to consume responsibly. Although downloading and using the CWA may not be a conventional "consumption" decision at a first glance, we still argue that our study has implications for studies of consumer social responsibility, as it empirically supports the claim that moral intensity is an important factor influencing ethical decisions. In this regard, downloading the CWA can indeed be viewed as a form of socially responsible consumption. As already mentioned above, the strong influence of social norms gives empirical support to theoretical discussions on shared responsibility.

4.2. Limitations

There are several limitations that should be considered when interpreting the results. With respect to the moral intensity manipulation, it is possible that answers in the follow-up study are biased in a socially desirable way. Apart from that, it is unlikely that participants' behavior between t1 and t2 was influenced by the fact that they were part of an ongoing study, as they were not informed that there would be a follow-up survey.

The comparability of RKI statistics and download rates in our study is limited in several ways: We kept the time interval between t1 and t2 (13.66 days) as similar as possible to the RKI's measurement (14 days), however, our t1 was between 18 January and 3 February, while the RKI released the download statistics we compared our numbers to on 22 January. This opens up the possibility that other events may have influenced app downloads at the time of our study, although, according to the RKI statistics, download rates were similar in the subsequent weeks. Moreover, the RKI statistics capture the number of app downloads, as compared to the number of individuals who downloaded the app. That is, due to individuals downloading the app on more than one smartphone (i.e., because they own a company smartphone or change phones), the actual growth of new users in the population might be overestimated compared to our study, which excluded CWA users from the follow-up study. Overall, our conservative estimate allows us to conclude that our magnitude of consequences manipulation successfully influenced participants' download decisions over the subsequent two weeks.

Another limitation relates to the measurement of moral intensity. A part of the moral intensity was assessed with single items, which results in a lower reliability (see also Neef, Zabel, Lauckner, & Otto, 2022), and some items are not limited to measuring moral reasons for CWA download. For instance, whether one's social environment uses the app is an expression of the descriptive norm (i.e., what is commonly done, see Cialdini et al., 1991), but it also improves the functionality of the app, which relies on other app users at close distances. However, only two of the six items of the scale measuring the social norm (micro level) are also related to the functionality of the app. Since the scale has good internal consistency, it is considered suitable for measuring social consensus in this form.

4.3. Implications for future research

Based on these results, further research is needed to clarify the influence of manipulations of the moral intensity on CWA download. Besides the magnitude of consequences, social norms could be experimentally manipulated, similar to studies in the context of pro-environmental behavior (Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). Crises have been argued to open windows of opportunity for new (pro-)social norms and practices to emerge and spread (e.g., Dahlke et al., 2021; Diekmann, 2020; Neville, Templeton, Smith, & Louis, 2021). The COVID-19 pandemic has demanded a rapid adaptation of behavior, and new socially accepted behaviors like "social"—or rather, physical—distancing, wearing masks, and getting vaccinated have gained currency. Future research should examine whether the results found in this study can be generalized to these contexts, that is, whether moral intensity plays a role in determining social/physical distancing behavior, mask wearing, or the decision to get a COVID-19 vaccination, especially in groups that are less vulnerable to severe courses of the disease. In the present study, we focused on the moral intensity of the situation. Our insights could be enhanced by further studies on the role of the moral identity regarding the perception of gain of using the CWA, for instance, by investigating the relationship between moral intensity and manifestations of the "helper's high" (Dossey, 2018). Reynolds et al. (2010a, 2010b) suggest that contextual cues, such as the moral intensity, interplay with a moral identity in shaping moral behaviors. In that respect, examining both factors together could provide insights into how these factors interact.

We conducted our study in the earlier days of the CWA, when its functions were mostly limited to contact tracing, that is, individual benefits subjective in nature (i.e., using the app could lead to subjective perceptions of control over one's infection status). After our study, the functionality was significantly enhanced by including a check-in function for events, the possibility to store a digital vaccination certificate, and other features with higher benefits for the users. It is unclear whether moral intensity is still an equally powerful motivator for CWA download now as it was then, or whether other gain factors dominate for those people who decided to download the app later. Examining these factors would provide a more nuanced picture of the gain to pain ratio of using the CWA. It is further possible that people who initially downloaded the app did not use it afterwards. It is, therefore, important to examine the conditions under which the app is used in the longer term and whether moral intensity is as important a determinant of CWA use as it is of CWA download.

Moreover, given the link we have established between research on contact tracing apps and consumer social responsibility, future research might add to the picture by controlling for the other variables—aside from moral intensity—that have been proposed by Schlaile, Klein, and Böck (2018) to be either impeding or, respectively, enabling socially responsible consumption: *informational complexity, perceived consumer effectiveness, moral stupefaction*, and *altruistic attitude*.

4.4. Practical implications

The results of our study suggest a particularly strong relationship between social norms and CWA use. These norms can be made salient, for instance, by including information about other people's CWA usage behavior in marketing campaigns. Such social norm nudges have already been shown to be effective in the context of prosocial behavior (Gråd, Erlandsson, & Tinghög, 2021) or pro-environmental behavior (e.g., Farrow, Grolleau, & Ibanez, 2017). Such similarities are not surprising, since pro-environmental and prosocial behaviors most likely stem from the same individual propensity (Otto, Pensini, et al., 2021). Policy makers and campaigns could also initiate a discourse about the app in one's social environment, thereby increasing the salience of the social norm at the micro level. Similar to our manipulation, the magnitude of consequences of CWA use could be highlighted by providing information to potential users. Besides that, providing easily accessible information about the app's functionality and privacy policy could reduce concerns about insufficient data protection (Pape et al.,

2021). By communicating the positive individual contribution of app use to others and addressing privacy concerns, the perceived moral intensity of the situation might outweigh hindrances for the individual, and thus may be a way to foster CWA adoption. The results of this study are especially important in the context of technologies for the social good, which require widespread acceptance in the population in order to make them work. Besides contact tracing technologies, these could be data donation apps (e.g., Robert Koch-Institut, 2021), for instance. In this case, individuals disclose information without gaining personal benefit from it. In the broader picture and in addition to existing research, we have shown that focusing on gains that contribute not only to the individual outcome, but also to the common good, might be worthy of further and more extensive investigation.

Authors statement

Sarah Zabel: Research design, Data collection Manuscript Revision, Data analysis, Manuscript drafting, Final approval, Manuscript Revision, **Michael P. Schlaile**: Data collection, Manuscript drafting, Final approval, Manuscript Revision, Funding acquisition, **Siegmar Otto**: Data collection, Manuscript drafting, Final approval, Manuscript Revision, Funding acquisition.

Data availability

Data will be made available on request.

Appendix A

Table A1
Overview of the Measures used in this Study

Variable	Item
CWA download	- I have installed the Corona-Warning-App.
Moral Intensity	
Social Norms, macro level	- The use of the Corona-Warning-App is socially desirable.
Social Norms, micro level	- My family expects me to use the Corona-Warning-App.
	- My friends expects me to use the Corona-Warning-App.
	- My family thinks the Corona-warning-App is useless. (reversed)
	- My friends think the Corona-warning-App is useless. (reversed)
	- My family has installed the Corona-Warning-App.
	- My friends have installed the Corona-Warning-App.
Probability of Effect	- I believe that the Corona-Warning-App is helpful to combat the COVID-19 pandemic.
Proximity (Family)	- There have already been COVID-19 cases in my family.
Proximity (Friends)	- There have already been COVID-19 cases in my circle of friends.
Proximity (spatial environment)	- There have already been COVID-19 cases in my spatial environment.
Perception of Privacy Policy	- I am convinced that my right to the protection of my personal data will be preserved when I use the Corona-Warning-App. (reversed)
Vulnerability: close other-risk (Control Variable)	- I am in regular contact with one or more persons from a risk group (previous illness, age, etc.).
Vulnerability: self-risk (Control Variable)	- I belong to the risk group myself (previous illness, age, etc.).

Note. Except for CWA download and proximity (0 – no, 1 – yes), all variables were assessed on a 5-point scale from 1 – do not agree at all to 5 – fully agree.

Appendix B

Moral Intensity Manipulation (Original):
„Wir befinden uns momentan in einer Situation, in der für einen groβen Teil der COVID-19 Fälle das Infektionsumfeld nicht mehr ermittelt werden kann (RKI, 6.12.2020). Pro Woche werden ca. **15.000 positive Testergebnisse** über die App geteilt (RKI, 6.12.2020). Falls dadurch jeweils nur eine infizierte Kontaktperson frühzeitig vor einer Ansteckung gewarnt wird und sich isoliert, können die Infektionsketten an dieser Stelle gebrochen werden. Dadurch kann die infizierte Person insgesamt bis zu **75.000 Kontaktpersonen** vor einer Ansteckung bewahren. Dies hilft nicht nur dabei, das Gesundheitssystem vor dem Kollaps zu bewahren, sondern rettet bei einer Sterblichkeit von 1,59% (Statista, 7.12.2020) auch bis zu **1.193 Personen** das Leben."

Moral Intensity Manipulation (translated to English):
"We are currently in a situation where for a large proportion of COVID-19 cases, it is no longer possible to determine the infection setting (RKI, Dec 6, 2020). Approximately **15,000 positive test results** are shared via the app each week (RKI, Dec 6, 2020). If this means that only one infected contact person at a time is warned of infection at an early stage and isolates themselves, the chain of infection can be broken at this point. As a result, the infected person can prevent a total of up to **75,000 contact persons** from becoming infected. Not only does this help keep the healthcare system from collapsing, but with a mortality rate of 1.59% (Statista, 7 Dec 2020), it also saves the lives of up to **1193 people**."

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