


Personality Psychology

# Three Pillars of Physical Distancing: Anxiety, Prosociality, and Rule Compliance During the COVID-19 Pandemic

Mathias Twardawski<sup>1</sup> <sup>a</sup>, Lena Steindorf<sup>2</sup>, Isabel Thielmann<sup>3</sup>

<sup>1</sup> Department of Psychology, Ludwig-Maximilians-Universität München, Munich, Germany, <sup>2</sup> Department of Psychology, Heidelberg University, Heidelberg, Germany, <sup>3</sup> Department of Psychology, University of Koblenz-Landau, Landau, Germany

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The outbreak of a global pandemic such as COVID-19 poses a challenge for societies across the world. Lacking both vaccination and medical treatment, the only way to combat the spread of a virus in its early stages are behavioral measures, particularly physical distancing behavior. The present work proposes three pillars of individuals' engagement in physical distancing: anxiety, prosociality, and rule compliance. In a large ( $N = 1,504$ ), pre-registered study among German adults, we studied both situation-specific tendencies and stable personality traits that are theoretically associated with these pillars in relation to self-reported physical distancing behavior and underlying motives. Results supported the importance of each of the proposed pillars for physical distancing behavior. That is, for each pillar, we found (some) relations of the corresponding tendencies and personality traits with physical distancing (motives) as expected. Overall, the project provides a comprehensive picture of physical distancing behavior during the COVID-19 pandemic.

In the beginning of 2020, the world faced a crisis of hardly conceivable dimension. A new coronavirus (SARS-CoV-2) spread across our globalized world, leading to more than 2,500,000 cases of the corresponding disease (COVID-19) and 175,000 deaths by the middle of April 2020 (<https://coronavirus.jhu.edu/map.html>). Lacking both medical treatment of and vaccine against the virus, scientists and governments tried to slow down new infections to reduce the impact on healthcare systems while developing (medical) protection. To dispense the number of newly infected individuals over time, people were urged to avoid physical contact (i.e., engage in physical distancing behavior<sup>1</sup>) as much as possible, as these measures have been found to significantly decrease the spread of the coronavirus (Thu et al., 2020). Whereas some countries' governments imposed extensive curfews (e.g., in Spain), other countries counted on their citizens' (social) responsibility to reduce physical interactions, encouraged by repeated calls by governments and through other channels such as social media (e.g., #flattenthecurve; <https://www.flattenthecurve.com>). These calls, however, were only partly successful. For example, although Europe was announced the epicenter of the corona pandemic on Friday, March 15th,

people (in Germany) were still meeting in public parks the subsequent weekend (Leber, 2020).

Reducing one's physical contacts was fundamental in effectively managing the pandemic, in particular as long as vaccines were missing (Prem et al., 2020). Corresponding to this significance, recent studies already investigated physical distancing in the COVID-19 pandemic, providing data on stable individual differences in corresponding behaviors (Pfattheicher et al., 2020; Zettler et al., 2021), the effectiveness of moral messages on behavioral intentions (Everett et al., 2020), and other psychological and sociodemographic correlates (Brouard et al., 2020). The present research complements and extends this evidence by simultaneously considering various situation-specific and personality determinants of physical distancing behavior during the COVID-19 crisis.

To this end, we draw on existing, yet limited evidence from research in the social and behavioral sciences on protective behaviors during past pandemics (Bish & Michie, 2010) and on research investigating structurally comparable public-health measures, in particular vaccination (Böhm et al., 2016). We further rely on evidence on another major challenge humanity is facing bearing some resem-

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a m.twardawski@lmu.de

1 Although frequently used in both media and science, researchers (Aminnejad & Alikhani, 2020; Saltzman et al., 2020) as well as the World Health Organization (WHO; Kaur, 2020) have criticized the use of the term "social distancing", given the serious negative effects of social isolation. In fact, the WHO encourages continued social interactions (e.g., via telecommunication) during isolation-periods, while promoting to *physically* distance from others. In line with the WHO's suggestion, we use the term "physical distancing" in this article.

blance with the COVID-19 pandemic, namely fighting against global warming (Chen, 2015; Fritsche et al., 2018; Hilbig et al., 2013). Notably, there are crucial differences between the climate crisis and the COVID-19 pandemic. For example, while the climate crisis has developed over centuries, the COVID-19 pandemic hit the world within weeks. Furthermore, physical distancing behavior entails very direct personal benefits (i.e., self-protection), which pro-environmental behavior arguably does not. Still, various structural aspects of the two crises resemble each other (see also Schmidt, 2021, for an in-depth discussion): both crises affect humanity as a whole (although to varying degrees), both involve uncertainty that may elicit anxiety, their development is dependent on individuals' behavior, and fighting against the crises requires accepting personal restrictions. Thus, there are clear similarities in the foundations of individuals' behavior in fighting both the climate crisis (i.e., pro-environmental behavior) and the spread of the coronavirus (i.e., physical distancing behavior). Our theoretical reasoning was therefore partly inspired by findings from environmental psychology and the associations revealed between personality traits, situation-specific tendencies, and pro-environmental behavior.

In the present research, we propose and illuminate three classes of factors – or *pillars* – that are arguably crucial for individuals' engagement in physical distancing behavior: (a) *anxiety* resulting from the inherently uncertain situation, (b) *prosociality* in terms of accepting personal sacrifices for the sake of others' wellbeing, and (c) *rule compliance* as governments strongly urged their citizens to engage in physical distancing. Within these classes, we aim to integrate situation-specific tendencies (e.g., beliefs and appraisals) as well as personality traits (e.g., dimensions from the HEXACO model) to provide a more holistic picture of the processes at play.

### Three Pillars of Physical Distancing

#### Anxiety: Physical distancing as a coping strategy

In the beginning of the COVID-19 pandemic, numbers of infections were increasing rapidly across the world. At the same time, experts' evaluation of the situation and their accompanying recommendations were inconsistent and vague, leading to high levels of uncertainty among people and corresponding anxiety and stress (e.g., Rajkumar, 2020; Volk et al., 2021). One effective strategy to reduce stress associated with the fear of being infected is physical distancing. Indeed, evidence from the global H1N1 flu pandemic in 2009 showed that state anxiety (i.e., perceived susceptibility to becoming infected) predicts protective behaviors such as avoiding public places (Bish & Michie, 2010).

Likewise, research from environmental psychology proposes a similar account of individuals' responses to the emerging climate crisis (Chen, 2015). It has been suggested that people's appraisal of the situation plays a crucial role for their decision to act pro-environmentally (Homburg & Stolberg, 2006). Specifically, people are assumed to monitor their environment regarding potential demands and the resources they have to manage these demands. If they perceive an event as threatening, they engage in environmentally-friendly behavior to cope with the situation. Following

this reasoning, anxiety emerging during the corona pandemic should be an important pillar of protective physical distancing behavior. Correspondingly, initial evidence showed positive associations between anxiety and compliance with public health instructions (Abdelrahman, 2020; Blagov, 2020; Brouard et al., 2020; Harper et al., 2020), but also with stockpiling during the COVID-19 pandemic (Garbe et al., 2020).

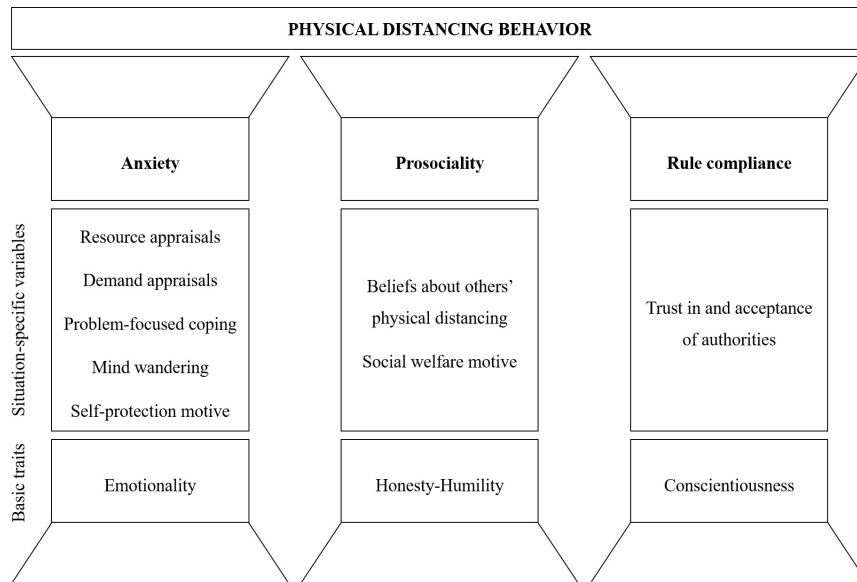
#### Prosociality: Physical distancing as an act of social welfare maximization

Physical distancing represents a way to express solidarity with and to protect others. Specifically, physical distancing comes at considerable personal costs (e.g., restricting one's social life) and entails the loss of freedom and autonomy (i.e., the freedom to meet as many people at any time) which also leads to corresponding negative consequences, such as the experience of reactance (Díaz & Cova, 2021). In fact, there is cumulating evidence showing that distancing measures lead to detrimental psychological outcomes such as higher levels of loneliness (Heidinger & Richter, 2020; Krendl & Perry, 2021; Lee et al., 2020; Stolz et al., 2021; van Tilburg et al., 2020) and an increase in even more serious mental health problems (e.g., Brooks et al., 2020; Gruber et al., 2020; Marroquín et al., 2020). In contrast, physical distancing behavior only entails weak personal benefits (in terms of direct self-protection), especially for those with small risks of experiencing a serious course of the disease if infected (Jin et al., 2021). As such, physical distancing during the COVID-19 pandemic has been proposed to reflect a real-life social dilemma, representing a conflict between individual and collective interests (Fischer et al., 2021; Johnson et al., 2020; Ling & Ho, 2020). Thus, physical distancing can be considered a prosocial act if aimed at protecting others (Blagov, 2020; Heffner et al., 2021; Jordan et al., 2020; Pfattheicher et al., 2020; Zettler et al., 2021), comparable to other health-related behaviors, such as the decision to vaccinate facilitating herd immunity (Böhm et al., 2016).

Likewise, prosociality has been proposed to account for pro-environmental behavior (Hilbig et al., 2013). Specifically, fighting the climate crisis, each individual "faces private costs to reduce greenhouse gas emissions, while the benefits of such efforts are shared by all regardless of their own contributions" (Hasson et al., 2010, p. 331). Thus, the climate crisis represents another prime example for a social dilemma: Like physical distancing, engaging in pro-environmental behavior is individually costly, but mutual cooperation increases social welfare.

#### Rule compliance: Physical distancing as a duty

Lastly, the overarching nature of the virus spread bears responsibilities for authorities, most prominently governments. Most governments across the globe strongly urged their citizens to decrease or completely avoid physical contacts. Importantly, there is substantive evidence that individuals' trust in political institutions fosters law compliance within a society (Marien & Hooghe, 2011). Moreover, trust in the government has been proven to be an important determinant of citizens' compliance with public health poli-



**Figure 1.** Situation-specific variables and basic traits that are theoretically associated with the three pillars of physical distancing behavior.

cies, especially in times of crisis (Blair et al., 2017). Data from the 2014-2015 Ebola-virus disease epidemic in Liberia revealed a positive correlation between individuals' trust in the government and their likelihood to comply with policies designed to contain the spread of the virus, such as physical distancing. Correspondingly, physical distancing during the COVID-19 pandemic may also be subject to people's trust in authorities and their general willingness to obey governmental rules. Interestingly, recent evidence for the association of institutional trust with rule compliance and physical distancing during the COVID-19 pandemic revealed a rather mixed picture. Some studies found corresponding results (Han et al., 2020), while others found no (Brouard et al., 2020) or only weak associations (Raude et al., 2020; van Rooij et al., 2020).

### The Present Research

To provide a comprehensive picture of physical distancing behavior during the COVID-19 pandemic, we study both situation-specific tendencies and stable personality traits associated with each of the proposed pillars (see Figure 1). In this regard, we also consider – in an exploratory fashion – the possibility that situation-specific tendencies might mediate the influence of personality, following the idea that state-like tendencies are manifestations of traits (Fleeson, 2001).

Regarding the anxiety pillar, we draw on research on global warming and examine situation-specific tendencies that have been found to be crucial for individuals' pro-environmental behavior. Specifically, this research proposed a positive relation of individuals' *personal demand appraisal* (i.e., monitoring of events that may potentially affect one's wellbeing) and their *personal resource appraisal* (i.e., beliefs in own capabilities to adapt to the given situational demands) with pro-environmental behaviors (Homburg & Stolberg, 2006). Additionally, people's *problem-focused cop-*

*ing* with uncertainty should foster corresponding behavior. Recently, this rather individualistic perspective has been extended by a more collective approach, given that global crises can only be solved by collective efforts (Chen, 2015; Fritsche et al., 2018). It is thus vital to further consider individuals' *collective demand appraisal* (i.e., monitoring of events with regard to the group's wellbeing) and their *collective resource appraisal* (i.e., beliefs in the group's capabilities to adapt to the given situational demands) in predicting individuals' protective behavior. Finally, individuals' thoughts may be involuntarily occupied by the virus and corresponding threat. Such mental occupation has been referred to as *mind wandering* (Smallwood & Schooler, 2006). Crucially, people's tendency to engage in unintentional mind wandering may be a function of their anxiety caused by uncertainty (Seli et al., 2019), eventually increasing physical distancing.

Considering basic personality traits, anxiety should be particularly high for individuals high in *Emotionality* as conceptualized in the HEXACO model (Ashton & Lee, 2007). Emotionality captures individual differences in experiencing fear of physical dangers (for themselves and close others) and anxiety in response to life stressors (Ashton & Lee, 2007) and has, correspondingly, been strongly associated with diverse outcomes related to state and trait anxiety (Zettler et al., 2020). As such, people high in Emotionality should show physical distancing particularly to protect themselves and close others (i.e., *self-protection motive*), even though recent studies surprisingly failed to find robust evidence for this hypothesis (Zettler et al., 2021).

Concerning the prosociality pillar, we draw on research on human cooperation which showed that cooperation in social dilemmas is higher when actors believe others to cooperate as well (Balliet & Van Lange, 2013). People's physical distancing behavior may therefore be strongly associated with positive *beliefs about others' engagement in physical distancing*, which we considered a situation-specific

tendency related to the prosociality pillar.

Regarding basic personality traits, prosocial behavior has most consistently been linked to *Honesty-Humility* from the HEXACO model (Thielmann et al., 2020). Honesty-Humility characterizes a lack of greed and exploitative tendencies (Ashton & Lee, 2007). Recent research provided initial evidence for an association of Honesty-Humility with physical distancing behavior during the corona pandemic (Lazarević et al., 2021; Zettler et al., 2021), and this relationship was particularly pronounced for physical distancing aimed at *protecting others* (i.e., social welfare motive). Similar findings have been provided for stockpiling behavior (Columbus, 2021; Fischer et al., 2021). We therefore expected a positive link between Honesty-Humility and a social welfare motive for physical distancing.

Finally, regarding the rule-compliance pillar, we considered individuals' *trust in and acceptance of authorities* in the context of the corona situation as a situation-specific tendency underlying physical distancing behavior. Correspondingly, considering the trait side, we proposed a positive relation of physical distancing to *Conscientiousness*. High levels in Conscientiousness are, by definition, related to being disciplined and dutiful (Ashton & Lee, 2007) and have been shown to be positively related to various outcomes in the realm of duty (Zettler et al., 2020). This prediction is also in line with recent research providing first evidence for the positive associations of Conscientiousness with taking more precautions against the coronavirus, such as hand hygiene or physical distancing behavior (Abdelrahman, 2020; Aschwanden et al., 2020; Blagov, 2020; Brouard et al., 2020; Carvalho et al., 2020; Zettler et al., 2021).

Besides the theoretical basis outlined above, it is conceivable that individuals' *knowledge* about the virus affects physical distancing behavior, with more knowledge potentially leading to more distancing. Given that knowledge requires understanding of rather complex topics such as exponential growth, individuals' tendency to engage in and enjoy activities requiring thinking – also referred to as *need for cognition* (Cacioppo & Petty, 1982) – may also be positively associated with physical distancing. We therefore considered both variables as additional (potential) predictors of physical distancing. In line with this reasoning, recent research has shown that both knowledge about exponential growth (Lammers et al., 2020) and need for cognition (Xu & Cheng, 2021) are related to physical distancing. Finally, people may only accept personal restraints if they believe that they themselves and the society as a whole can make a difference in reducing the number of infections (Bandura, 2000). As such, people's *personal efficacy beliefs* and *collective efficacy beliefs* may be another determinant of physical distancing behavior worth considering, as has also been suggested as an important factor for people's behavior in face of the corona crisis (Habersaat et al., 2020; van Bavel et al., 2020).

In sum, the present study considers situation-specific

tendencies and stable personality traits associated with the three proposed pillars of physical distancing, as well as knowledge, need for cognition, and personal and collective efficacy beliefs as predictors of physical distancing behavior during early stages of the COVID-19 pandemic.

## Methods

We preregistered the study including all hypotheses outlined above (<https://aspredicted.org/5rr2b.pdf>).<sup>2</sup> Study materials, data, analyses scripts, and supplementary analyses are available on the Open Science Framework (<https://osf.io/nxzv4>). We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures. All data treatment and analyses were conducted in R (Version 4.0.3) using the following packages: tidyverse (Wickham et al., 2019), psych (Revelle, 2019), lavaan (Rosseel, 2012), and apaTables (Stanley, 2018).

## Context

Data collection started on March 19th, 2020 and ended in the morning of March 23rd.<sup>3</sup> Therefore, the context of data collection was as follows: On Thursday, 12th of March, it was announced that schools and kindergartens in some German states will be closed the following week, with all other parts of Germany following this announcement until Saturday 14th. These measures emphasized the importance of physical distancing in the government's strategy against the spread of the virus, making citizens aware that physical contact is a major threat contributing to the pandemic. In our study, we asked participants to refer to their behavior related to the corona situation within the last seven days. Thus, we particularly investigated people's behavior following the aforementioned announcements. At the same time, there were no strict regulations regarding physical contact in Germany by the time of data collection. These only started in some regions of Germany on March 21st and were announced throughout Germany on the evening of March 22nd.

## Sample

Participants were recruited through mailing lists, social media, and the panel PsyWeb (<https://psyweb.uni-muenster.de>). As incentive for participation, we raffled four 25€ gift vouchers. Overall, 1,870 participants started the study lasting approximately 15 minutes, of which 1,733 (93%) completed it. As preregistered, we excluded participants indicating ( $n = 9$ ) or implying non-serious participation (i.e., failing an instructed attention check;  $n = 220$ ). The final sample ( $N = 1,504$ ) was approximately representative (see supplementary materials on the OSF for details) of the German population with regard to age (range = 18–84 years,  $M = 44.4$ ,  $SD = 15.5$ ). Around two thirds of participants were

<sup>2</sup> We also predicted relations between variables across pillars. However, since these are beyond our scope, they will not be discussed here.

<sup>3</sup> We preregistered that data collection will end in the evening of March 22nd. Excluding those participants who completed the study afterwards ( $n = 59$ ) led to the same results.

female ( $n = 1,003$ ; 67%).

We used zero-order correlations to test our hypotheses. A sensitivity power analysis using G\*Power (Faul et al., 2009) suggested that we had high power ( $1 - \beta = .90$ ) to detect even (very) small correlations of  $\rho = |0.08|$  ( $\alpha = .05$ , two-tailed).

## Measures

Unless stated otherwise, all items were answered on 6-point Likert scales ranging from 1 = “completely disagree” to 6 = “completely agree”.

### *Physical distancing behavior*

We asked participants to indicate their engagement in physical distancing during the last seven days. Participants were provided with concrete behaviors that were recommended by the Robert-Koch Institute (i.e., the German federal government agency and research institute responsible for disease control and prevention) to decrease the virus spread and asked to indicate the degree to which they complied with these recommendations. Responses were collected on a 6-point Likert scale ranging from 1 = “does not apply at all” to 6 = “applies completely”. The scale showed good reliability,  $\Omega_t = .86$  (see Forbes et al., 2021).

### *Motives for physical distancing behavior*

To measure motives for physical distancing, participants were asked to indicate for all physical distancing behaviors they reported having engaged in (i.e., all behaviors for which participants indicated a score greater than 2) the degree to which they showed this behavior (i) to protect themselves and close others (self-protection motive) and (ii) to protect the general public (social welfare motive). Both scales showed very good reliabilities, both  $\Omega_t$ 's = .96.

### *Trust in and acceptance of authorities*

We developed four items to measure the extent to which participants trusted their government's actions in response to the spread of the coronavirus. An example item is “I think the Federal Government is doing a good job in fighting the spread of the coronavirus.” The scale showed sufficient reliability,  $\Omega_t = .76$ .

### *Personal and collective resource appraisal*

The personal and collective resource appraisal scales were adopted from Chen (2015) and assessed participants' beliefs in their personal and in society's abilities to deal with the threat and difficulties related to the spread of the coronavirus, respectively. Both scales comprised five items each and showed good reliabilities (i.e.,  $\Omega_t = .82$  and  $\Omega_t = .81$ , respectively).

### *Personal and collective demand appraisal*

The personal and collective demand appraisal scales were also adapted from Chen (2015) and assessed participants' beliefs about the demand and threat the spread of

the coronavirus represents for their personal life and for people's lives in their social environment, respectively. Both scales showed nearly sufficient internal consistencies ( $\Omega_t = .74$  and  $\Omega_t = .71$ , respectively).

### *Problem-focused coping*

Items measuring problem-focused coping were again informed by Chen (2015), assessing participants' intentional search for information about the spread of the coronavirus using eight items. The scale showed good reliability,  $\Omega_t = .87$ .

### *Mind wandering*

We adapted four items from Carriere et al. (2013) to measure participants' unintentional mind wandering about the spread of the coronavirus. Items were answered on a 6-point Likert scale ranging from 1 = “rarely” to 6 = “very often”. The scale showed good reliability,  $\Omega_t = .89$ .

### *Beliefs about others' physical distancing behaviors*

We presented participants with the same list of behaviors that was used to measure their own engagement in physical distancing and asked them to indicate the extent to which they believed that others showed these behaviors within the last seven days. Answers were provided on a 6-point Likert scale ranging from 1 = “does not apply at all” to 6 = “applies completely”. The scale showed good reliability,  $\Omega_t = .86$ .

### *Knowledge about the virus*

Based on information provided by the Robert-Koch Institute, we developed ten items testing participants' factual knowledge about the coronavirus. Participants were urged to refrain from searching the Internet while indicating whether the information provided is correct.

### *Personal and collective efficacy beliefs*

Participants' personal and collective efficacy beliefs were assessed with three items each. These scales assessed participants' beliefs about whether they themselves (personal efficacy) or society (collective efficacy) had an impact on the spread of the virus. Both scales showed nearly sufficient reliabilities ( $\Omega_t = .73$  and  $\Omega_t = .71$ , respectively).

### *HEXACO personality traits*

Basic personality traits were assessed using a German translation of the 24-item Brief HEXACO Inventory (BHI; De Vries, 2013). Each of the six HEXACO dimensions was assessed using four items<sup>4</sup> on a 5-point Likert scale ranging from 1 = “strongly disagree” to 5 = “strongly agree”. Scales showed relatively poor internal consistencies:  $\Omega_t = .57$  (Emotionality),  $\Omega_t = .45$  (Honesty-Humility), and  $\Omega_t = .54$  (Conscientiousness).

### *Need for cognition*

Participants' need for cognition was assessed using a German short-scale (Beißert et al., 2014) of the Need for

Cognition Scale (Cacioppo & Petty, 1982). The scale comprises four items that are answered on a 6-point Likert scale ranging from 1 = “does not apply at all” to 6 = “applies completely”. The scale showed weak internal consistency,  $\Omega_t = .61$ .

## Procedure

Data were collected online through SoSci Survey (Leiner, 2019). Participants were first asked to provide informed consent and demographic information as well as information related to their personal contact with COVID-19 (e.g., whether they themselves or someone they know were infected with the virus). Next, they completed the BHI and the need for cognition scale. Subsequently, participants answered questions on their beliefs and appraisals related to the corona situation. These questions were presented in (block-wise) random order. Afterwards, participants indicated their physical distancing behavior (including motives) and their trust in and acceptance of authorities, before they completed the corona-knowledge quiz. Finally, participants indicated whether they participated attentively.

## Results

Descriptive statistics of all variables as well as correlations with physical distancing and corresponding motives are provided in [Table 1](#) (see supplementary materials on the OSF for a full correlation matrix). Given the large sample size and resulting (high) statistical power to detect even very small correlations, we focused on effect sizes rather than on statistical significance in our interpretation of results. Following Cohen (1988), we considered effects of  $r \geq .10$  as relevant and any smaller effects as negligible.<sup>5</sup>

As summarized in [Table 1](#), physical distancing behavior was strongly correlated with both a self-protection ( $r = .48$ ) and a social welfare motive ( $r = .40$ ), supporting both motives' relevance for behavior. In turn, as hypothesized, physical distancing was positively related to several variables theoretically associated with the anxiety pillar. Among the situation-specific tendencies, physical distancing yielded a medium-sized correlation with problem-focused coping ( $r = .33$ ) and small to medium-sized correlations with personal demand appraisal ( $r = .17$ ), collective demand appraisal ( $r = .16$ ), and mind wandering ( $r = .12$ ). Of note, most of these correlations were descriptively stronger when focusing on physical distancing as particularly motivated by self-protection. No meaningful links were apparent for personal and collective resource appraisal ( $r = .09$  and  $r = .04$ , respectively). Among basic traits, results also failed to reveal a meaningful correlation of Emotionality with physical distancing behavior ( $r = .07$ ), even when fo-

cusing on the hypothesized link with a self-protection motive ( $r = .08$ ). Overall, these results show that individuals who were more concerned about the coronavirus were indeed more willing to engage in physical distancing behavior. However, this was only evident for (some) situation-specific tendencies, not for the corresponding basic trait (Emotionality).

With regard to the prosociality pillar, data generally supported our hypotheses. Specifically, beliefs about others' distancing behavior yielded a strong association with physical distancing ( $r = .52$ ). Moreover, results supported the hypothesized positive relation between Honesty-Humility and a social welfare motive underlying physical distancing ( $r = .18$ ). Correspondingly, Honesty-Humility was also positively related to physical distancing behavior in general, albeit showing a small effect only ( $r = .13$ ).

Results also supported our hypotheses for the rule compliance pillar. That is, trust in and acceptance of authorities yielded a medium-sized positive correlation ( $r = .34$ ) with physical distancing behavior. Additionally, there was a small positive correlation with the respective basic trait, Conscientiousness ( $r = .12$ ).

Finally, regarding the additional variables considered, we found strong positive correlations of individuals' personal self-efficacy beliefs ( $r = .46$ ) and their collective efficacy beliefs ( $r = .35$ ) with physical distancing. By contrast, no meaningful correlations occurred for need for cognition ( $r = .05$ ) and factual knowledge ( $r = .06$ ).

## Exploratory mediation analyses

We further tested (bootstrapped) mediation models for each pillar, using the *lavaan* package. We focused on those models that can be theoretically derived from our hypotheses and the idea that the situation-specific (state-like) tendencies are manifestations of traits and may therefore mediate the relations of the corresponding basic traits (HEXACO dimensions) on behavior. We tested these mediations regardless of whether the corresponding direct effect of a trait on physical distancing was meaningful (Hayes, 2009).

For the anxiety pillar, we tested the indirect effect of Emotionality on physical distancing through personal demand appraisal, personal resource appraisal, problem-focused coping, mind wandering, and a self-protection motive. As such, we only included those (anxiety-related) situation-specific tendencies in the mediation model that we expected to correlate with Emotionality (i.e., focusing on variables associated with personal appraisals and behaviors). As shown in [Figure 2](#), all indirect effects except for mind wandering were significant, while the direct effect be-

4 One item of the subscale measuring Extraversion was negatively correlated with the total scale. Revisiting the German translation, this item indeed turned out to be problematic and was thus removed from all analyses.

5 Notably, there has been some discussion about effect sizes' relevance thresholds in psychology. However, we considered the  $r \geq .10$ -threshold appropriate, as even small effects can have large practical relevance (Funder & Ozer, 2019; Gignac & Szodorai, 2016). In light of the influential role of the “super spreader phenomenon” in the current pandemic (i.e., a single person contaminating a host of people in one event; Ebrahim & Memish, 2020), already small differences in physical distancing behavior may fundamentally impact the spread of the coronavirus.

**Table 1. Means and standard deviations of all variables as well as correlations with physical distancing and the motives underlying it (i.e., self-protection motive and social welfare motive).**

| Variable                                   | M    | SD   | 1                   | 2                      | 3                   |
|--|------|------|---------------------|------------------------|---------------------|
| 1. Physical distancing behavior            | 5.54 | 0.69 |                     |                        |                     |
| 2. Self-protection motive                  | 5.51 | 0.92 | .48**<br>[.44, .51] |                        |                     |
| 3. Social welfare motive                   | 5.53 | 0.84 | .40**<br>[.36, .45] | .34**<br>[.30, .39]    |                     |
| <b>Anxiety and stress</b>                  |      |      |                     |                        |                     |
| 4. Personal resource appraisal             | 4.94 | 0.78 | .09**<br>[.04, .14] | .04<br>[-.01, .09]     | .10**<br>[.05, .15] |
| 5. Collective resource appraisal           | 3.86 | 0.95 | .04<br>[-.01, .09]  | -.00<br>[-.06, .05]    | .09**<br>[.04, .14] |
| 6. Personal demand appraisal               | 3.41 | 0.96 | .17**<br>[.12, .22] | .20**<br>[.15, .25]    | .10**<br>[.05, .15] |
| 7. Collective demand appraisal             | 3.63 | 0.91 | .16**<br>[.11, .21] | .20**<br>[.15, .25]    | .11**<br>[.06, .16] |
| 8. Problem-focused coping                  | 4.77 | 0.89 | .33**<br>[.28, .37] | .28**<br>[.23, .32]    | .29**<br>[.24, .33] |
| 9. Mind wandering                          | 2.71 | 1.38 | .12**<br>[.07, .17] | .15**<br>[.10, .19]    | .07**<br>[.02, .12] |
| 10. Emotionality                           | 3.06 | 0.69 | .07**<br>[.02, .12] | .08**<br>[.03, .13]    | .07**<br>[.02, .12] |
| <b>Prosociality</b>                        |      |      |                     |                        |                     |
| 11. Beliefs about others' behavior         | 5.14 | 0.83 | .52**<br>[.49, .56] | .26**<br>[.22, .31]    | .27**<br>[.22, .32] |
| 12. Honesty-Humility                       | 3.89 | 0.59 | .13**<br>[.08, .18] | .08**<br>[.03, .13]    | .17**<br>[.12, .22] |
| <b>Rule compliance</b>                     |      |      |                     |                        |                     |
| 13. Trust in and acceptance of authorities | 4.75 | 0.95 | .34**<br>[.30, .38] | .27**<br>[.22, .31]    | .34**<br>[.29, .38] |
| 14. Conscientiousness                      | 3.55 | 0.57 | .12**<br>[.07, .17] | .10**<br>[.05, .15]    | .11**<br>[.06, .16] |
| <b>Other variables</b>                     |      |      |                     |                        |                     |
| 15. Personal efficacy beliefs              | 5.50 | 0.81 | .46**<br>[.42, .50] | .35**<br>[.30, .39]    | .42**<br>[.38, .46] |
| 16. Collective efficacy beliefs            | 5.62 | 0.72 | .35**<br>[.31, .40] | .25**<br>[.20, .29]    | .38**<br>[.33, .42] |
| 17. Need for cognition                     | 4.19 | 0.84 | .05<br>[-.00, .10]  | -.05*<br>[-.10, -.00]  | .07**<br>[.02, .12] |
| 18. Factual knowledge                      | 8.65 | 1.26 | .06*<br>[.01, .11]  | -.04<br>[-.09, .01]    | .02<br>[-.03, .07]  |
| 19. Extraversion                           | 3.79 | 0.72 | .09**<br>[.04, .14] | .07**<br>[.02, .12]    | .15**<br>[.10, .20] |
| 20. Agreeableness                          | 3.01 | 0.56 | -.00<br>[-.05, .05] | -.07**<br>[-.12, -.02] | .10**<br>[.05, .15] |
| 21. Openness to Experience                 | 3.87 | 0.54 | .03<br>[-.03, .08]  | .03<br>[-.02, .08]     | .08**<br>[.03, .13] |

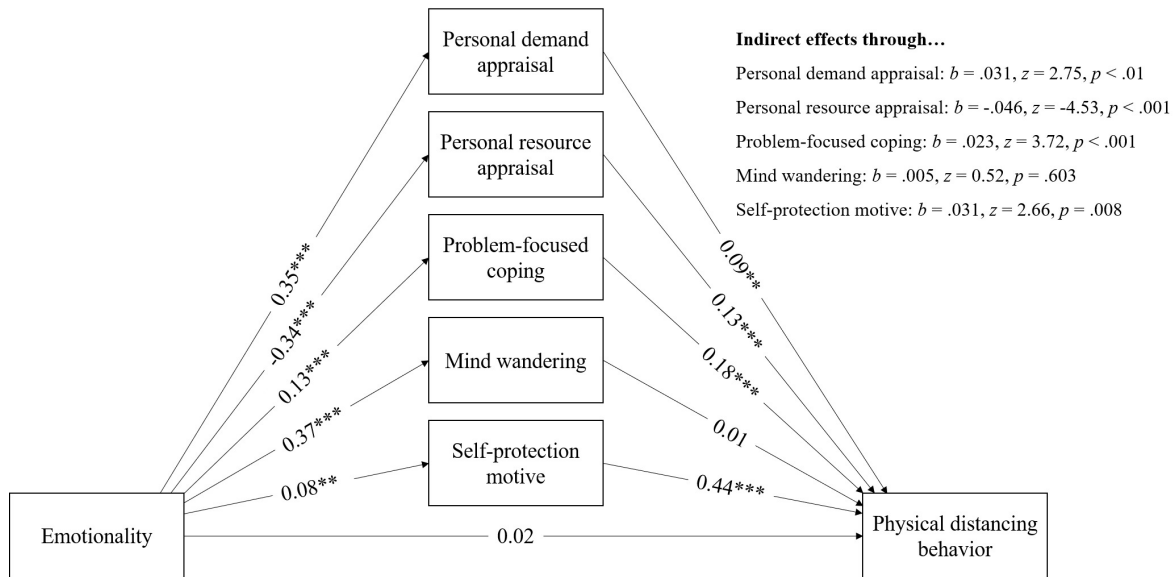
Note. Correlations are Pearson correlations. Values in square brackets indicate the 95% confidence interval for each correlation. \* indicates  $p < .05$ . \*\* indicates  $p < .01$ .

came statistically non-significant,  $b[\text{direct}] = .023$ ,  $z = 0.90$ ,  $p = .366$ .

For the prosociality pillar, we tested whether the effect of Honesty-Humility on physical distancing was mediated by beliefs about others' distancing behaviors and a social welfare motive (Figure 3). Indeed, both indirect effects were

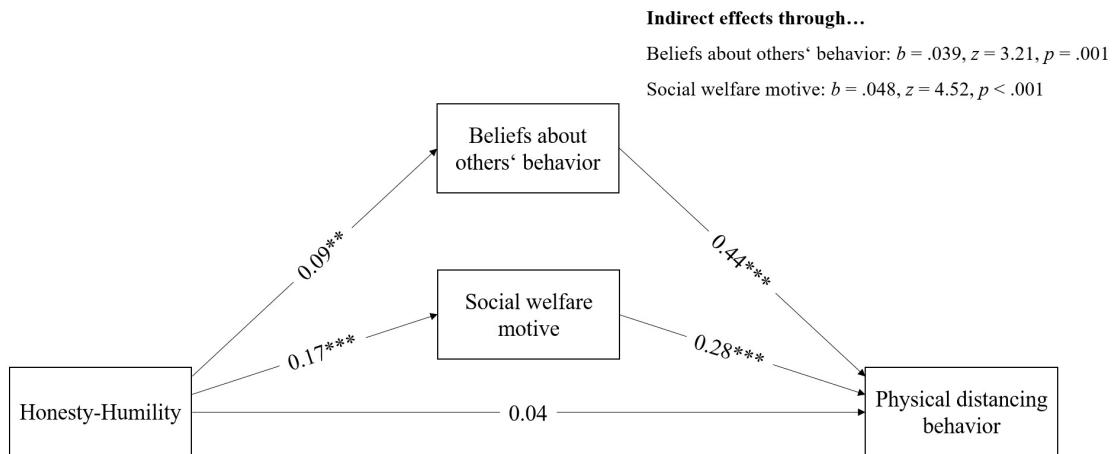
significant and they also fully accounted for the overall impact of Honesty-Humility on physical distancing, with the direct effect becoming non-significant,  $b[\text{direct}] = .046$ ,  $z = 1.78$ ,  $p = .075$ .

Finally, for rule compliance, we tested whether the effect of Conscientiousness on physical distancing was mediated



**Figure 2. Mediation model for the anxiety pillar.**

Note. Numbers represent standardized regression coefficients. \* indicates  $p < .05$ . \*\* indicates  $p < .01$ . \*\*\* indicates  $p < .001$ .



**Figure 3. Mediation model for the prosociality pillar.**

Note. Numbers represent standardized regression coefficients. \* indicates  $p < .05$ . \*\* indicates  $p < .01$ . \*\*\* indicates  $p < .001$ .

by people's trust in and acceptance of authorities (Figure 4). Supporting this pathway, the indirect effect was significant. However, the direct effect of Conscientiousness remained significant,  $b[\text{direct}] = .105, z = 3.65, p < .001$ , suggesting a partial mediation.

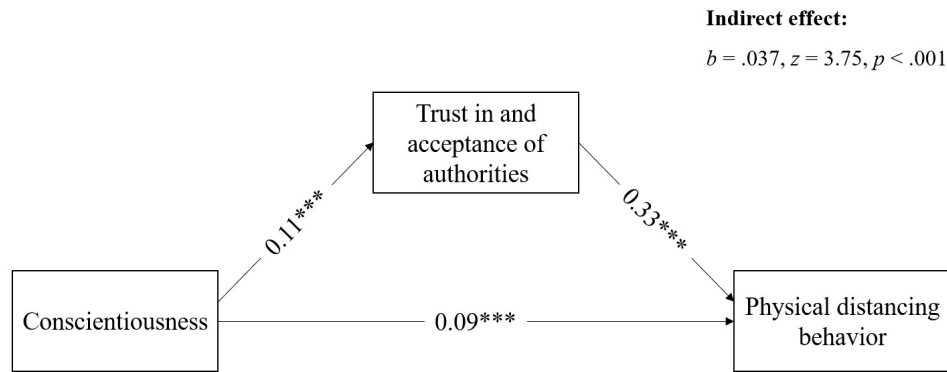
### Discussion

Physical distancing is crucial in fighting a pandemic such as the spread of SARS-CoV-2. Here, we proposed three pillars of individuals' engagement in physical distancing: *anxiety*, *prosociality*, and *rule compliance*. In a large, heterogeneous sample of German adults, we tested this framework by studying both situation-specific tendencies and stable personality traits theoretically associated with each of these pillars in relation to physical distancing behavior.

Overall, results supported the relevance of all three pil-

lars. That is, physical distancing was positively correlated with several anxiety-related variables indicative of concerns about and (un)intentional attention to developments surrounding the spread of the virus. As such, our findings showed some similarity with recent evidence on individuals' reactions to the emerging pandemic (e.g., Abdelrahman, 2020; Blagov, 2020; Brouard et al., 2020; Harper et al., 2020). However, we found no meaningful support for the expected relation of *trait anxiety* (as captured by HEXACO Emotionality) with physical distancing, adding to the mixed picture of recently published articles. Specifically, some studies found a positive correlation of trait anxiety with precautionary behaviors such as physical distancing (e.g., Abdelrahman, 2020; Blagov, 2020), whereas others did not observe such a relation (e.g., Lazarević et al., 2021; Zajenkowski et al., 2020), or reported mixed evidence (Zettler et al., 2021). Consequently, future research is needed to





**Figure 4. Mediation model for the rule compliance pillar.**

Note. Numbers represent standardized regression coefficients. \* indicates  $p < .05$ . \*\* indicates  $p < .01$ . \*\*\* indicates  $p < .001$ .

further investigate the underlying (moderating) effects of the heterogeneity of this relation. One promising approach could be to explore situation-specific tendencies that manifest in specific situations. That is, notwithstanding the absence of a main effect of Emotionality on physical distancing in the present research, mediation analyses showed indirect effects through personal demand and resource appraisals, problem-focused coping as well as a self-protection motive.

Besides anxiety, results supported the importance of prosociality for physical distancing. Specifically, much like cooperation in other social dilemmas, physical distancing was positively linked to (positive) beliefs about others' distancing behavior and trait Honesty-Humility. In turn, those high in Honesty-Humility tended to engage in physical distancing particularly to increase social welfare. Mediation analyses further showed that the positive effect of Honesty-Humility on physical distancing was mediated by beliefs about others' distancing and a social welfare motive. Overall, findings replicated evidence on stockpiling and self-restricting behavior during the COVID-19 pandemic (Columbus, 2021; Fischer et al., 2021; Lazarević et al., 2021; Zettler et al., 2021), although effect sizes were somewhat smaller.

Finally, results suggested rule compliance as a determinant of physical distancing. That is, trust in and acceptance of authorities during the COVID-19 crisis as well as trait Conscientiousness were positively related to physical distancing. Indeed, the link of Conscientiousness to physical distancing was (partially) mediated by trust in and acceptance of authorities. As such, our results support rule compliance as a basis of physical distancing, replicating findings on physical distancing behavior during the Ebola-virus epidemic in 2014-2015 (Blair et al., 2017). Importantly, this adds to a complex picture of recent evidence for this association during the COVID-19 pandemic, with some studies supporting the relation between rule compliance and physical distancing (Han et al., 2020), while others found no (Brouard et al., 2020) or only weak associations (Raude et al., 2020; van Rooij et al., 2020). Importantly, the correlation of institutional trust and physical distancing is not only interesting from a theoretical but also from a practical perspective, as it links citizens' behavior directly to the authorities' treatment of the pandemic. Consequently, this rela-

tion could have both negative and positive consequences, especially in times of high uncertainty. For example, while most leaders around the globe urged their citizens to reduce physical contacts to decrease the risk of infections, former US President Trump's suggestion that the use of malaria drugs or household disinfectants (Rogers et al., 2020) may help fighting COVID-19 led to fatal consequences for some of those who followed his advice (Waldrop, 2020). In any case, our results suggest rule compliance as an important third pillar influencing people's reactions to a pandemic.

In addition to the variables related to the three pillars, there were also meaningful positive links of people's personal and collective efficacy beliefs with physical distancing. That is, the more people believed that they themselves (or society as a whole) can make a difference in fighting the spread of the coronavirus, the more likely they were to engage in physical distancing. This corroborates both theoretical reasoning (Habersaat et al., 2020; van Bavel et al., 2020) and recent empirical evidence (Lin et al., 2020) for the association of efficacy beliefs and people's contribution in fighting a pandemic.

Likewise, there were also relations between variables across (as well as beyond) the three pillars. For example, data revealed a small, yet positive correlation of trait Agreeableness with people's rule compliance, replicating recent publications (e.g., Zajenkowski et al., 2020; Zettler et al., 2021). However, other research failed to find such an association (e.g., Abdelrahman, 2020; Carvalho et al., 2020). Consequently, future studies may further discuss and elaborate on this specific and other relations that were unexpectedly found in our data (and the literature as a whole).

With regard to effect sizes, findings may be taken to imply that situation-specific variables related to the corona outbreak are more relevant for physical distancing than basic traits (for a corresponding argument in light of the COVID-19 pandemic, see Zajenkowski et al., 2020). However, this needs to be qualified by the (very) low reliabilities of the BHI scales used to operationalize the HEXACO dimensions, naturally limiting obtainable effect sizes.<sup>6</sup> Moreover, basic traits are, by definition, much broader than situation-specific tendencies – applying to general behavioral tendencies rather than corona-related attitudes and behaviors – so their influence cannot be expected to be large

in the first place. Crucially, exploratory mediation analyses nonetheless revealed that the state-like tendencies examined herein may be manifestations of basic traits (Fleeson, 2001), mediating the influence of the traits on physical distancing. As such, building on stable individual differences is a fruitful approach for both empirical work understanding human behavior during a pandemic and practical applications to fight the spread of a virus.

Although the study offers important insights into the determinants of physical distancing, some limitations ought to be acknowledged. First, we used a correlational design that prohibits strong causal claims. This particularly dictates caution concerning the interpretability of the exploratory mediation analyses, most prominently for the two motives for physical distancing (self-protection motive and social welfare motive) given the overlap in the items measuring these motives (as mediators) and physical distancing behavior (as dependent variable). Second, parts of our theoretical reasoning are based on the assumption that physical distancing behavior is (perceived as) personally costly. Although this argument has been discussed more extensively elsewhere (Johnson et al., 2020; Ling & Ho, 2020), some physical distancing behaviors as measured in the present study may actually be less burdensome for some people. For example, besides canceling otherwise joyful activities (e.g., attending private parties), physical distancing has also enabled people to increase their “personal space” in situations where it was previously lacking (e.g., crowded public transport, elevators, supermarkets). Third, the study may have particularly attracted people interested in the topic, limiting the generalizability of results.

Furthermore, we assessed retrospective self-reports of participants’ distancing behavior, which may be subject to socially desirable responding. Importantly, recent evidence suggests that the use of self-reports to investigate people’s physical distancing is a valid approach to measure actual behavior (Gollwitzer et al., 2021). Nevertheless, future research assessing actual behavior is desired to corroborate the current results. Relatedly, method-inherent demand effects of the self-report measures in our study may partly explain the skewedness of our dependent variable, with the vast majority of participants indicating that they engaged in most physical distancing measures.<sup>7</sup> However, these patterns also mirror research showing that most people in fact supported and engaged in physical distancing behavior, in particular during the early stages of the COVID-19 pandemic (Rosman et al., 2021). The low base rate of deviations from physical distancing behavior generally comes as good news to societies fighting the pandemic. At the same time, it limits the informative value of analyses including this central variable. However, one might argue that the low

base rate represents people who are fundamentally important for the course of the ongoing pandemic, since already small degrees of negligence in physical distancing may substantially influence the spread of the coronavirus (cf. the “super spreader phenomenon”).

Moreover, we do not claim that the pillars suggested herein constitute a comprehensive framework fully explaining physical distancing behavior during a pandemic. Instead, the present research represents a contribution to a growing body of research investigating individuals’ perceptions and behaviors during the COVID-19 pandemic, such as studies showing associations between people’s working memory capacity (Lammers et al., 2020) or perceived vulnerability (Coninck et al., 2020) and their attitudes regarding public health measures (e.g., physical distancing).

Lastly, data was collected in the early stages of the developing pandemic in Germany. Although this is a very interesting time period and deserves study in itself (Bish & Michie, 2010), developments in pandemics are typically rather dynamic and relations found at one point of a pandemic may not endure to other times. For example, the COVID-19 pandemic forced most governments to enact strict curfews and other measures curtailing citizen’s freedom, as many parts of the world have been inflicted with a second or even third wave of infections. Such decisions by officials may foster reactance and, eventually, non-compliance among people (e.g., Díaz & Cova, 2021; Welter et al., 2021). Therefore, the present findings may be interpreted in light of a very specific context (see above for more information on the context of the data collection) and future research is needed to investigate the boundary conditions of the associations revealed in the present work.

Nonetheless, the present findings offer vital implications for theory-based interventions to conquer global crises such as the corona pandemic. For example, our results suggest that individuals may be differently responsive to warnings against high risks of infections (i.e., building on anxiety), calls for people’s cooperation (i.e., building on prosociality), and politicians urging their citizens to largely avoid physical contacts (i.e., building on rule compliance). As such, the findings may offer information on dealing with potential future global crises that require collective action.

## Contributions

Contributed to conception and design: MT, LS, IT  
 Contributed to acquisition of data: MT  
 Contributed to analysis and interpretation of data: MT, LS, IT  
 Drafted and/or revised the article: MT, LS, IT

<sup>6</sup> Note, however, that prior research on the BHI has shown high test-retest stability, self-other agreement, and convergent correlations with the full-length scales from the HEXACO-Personality Inventory-Revised, suggesting satisfactory validity despite relatively low internal consistency (De Vries, 2013).

<sup>7</sup> Given the skewedness of our data, we replicated the correlation analyses using Spearman correlations (which are, as non-parametric estimators, arguably more robust when correlating highly skewed variables) and this resulted in highly similar results (see correlation table in the supplementary materials on the OSF).

Approved the submitted version for publication: MT, LS, IT

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### Competing interests

The authors disclose any actual or potential conflict of

interest including any financial, personal or other relationships with other people or organizations within three years of beginning the submitted work that could inappropriately influence, or be perceived to influence, their work.

### Data accessibility statement

Study materials, data, analyses scripts, and supplementary analyses are available on the Open Science Framework: <https://osf.io/nxzv4>.

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