

Harmony and Aversion in the Face of a Pandemic¹

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Abstract: While the survival function of culture against infectious disease has been investigated, little is known about its psychological processes under the real-world threat of infection. Here, we compare the subjective COVID-19-related symptoms of Japanese and French adults during the spring of 2021. We tested two regression models describing the downregulation of symptoms by germ aversion, and by interdependent happiness, together with relational mobility and demographics. We regard germ aversion as an individualized fending-off process marked by discomfort with the general other in the face of possible infection. We regard interdependent happiness as a relational safeguarding process against possible infection. Results suggest that the effect of germ aversion differed across nations, negatively explaining symptoms in Japan but not in France, and that the effect of interdependent happiness was shared. A possible psychological mechanism whereby collectivist culture suppresses infection in the face of the pandemic is discussed.

Key words: COVID-19, interdependent happiness, germ aversion.

The current global impact of the novel coronavirus, commonly known as COVID-19 or SARS-COV-2, has been a catastrophic pandemic since early 2020. Because of the worldwide damage it has caused, individual as well as societal differences in its effects have been investigated across multiple sectors of society and fields of research (Van Bavel et al., 2020). The current cross-cultural study tries to ascertain the psychological mechanisms of how collectivist cultures might suppress self-reported infection-related symptoms. The study is therefore applied research on culture and collective-level dynamics of interpersonal relationships in the time of the pandemic (Kitayama, 2020).

Culture and Its Adaptive Function

The emerging understanding of culture in psychology is that culture or culturally patterned behavior could be a vestige of the social strategy for adapting to the demands of a group living environment. This social evolutionary notion is predicated on the view that group living is likely to have caused several adaptive problems in any society (Richerson & Boyd, 2005; Takemura & Sato, 2012). Specifically, the historical ways in which a population coped with universal needs, such as food provision (Uskul et al., 2008; Van de Vliert et al., 2018) or safety (Gelfand et al., 2006) during the evolutionary past, created patterns in the group's behavior that contributed to the survival or well-being of its

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members. Those behaviors and pivotal meanings around them have been propagated across the group's members and down its generations as norms or shared values (Nisbett & Cohen, 1996), resulting in collective-behavior patterns we see today.

Fending off disease was undoubtedly one such universal need with which every society had to cope, from the evolutionary past to the present. Fincher et al. (2008) showed that national orientations to individualism–collectivism (hereafter, IC) matched the historical pathogen prevalence of various nations, indicating that present-day IC behavior patterns; namely, stark in-group and out-group distinctions, might be a vestige of immunity-related behavior: distancing from strangers or out-groups who might not share the same set of immunities and who might therefore potentiate infectious danger (Diamond, 1999).

However, culture may not only be a mere vestige of past solutions but can also be a legacy: behavior patterns that provide coping tactics when certain occasions arise. Hamamura and Park (2010) showed that after the outbreak of swine flu during 2009, in collectivist corners of the world, namely Asian countries, airline companies responded defensively (i.e., decreased traffic) compared to their Western counterparts, out of fear of foreigners. These societal patterns of behavior indicate that culture, even in its present-day versions, retains a function when the occasion, or an adaptive problem, should arise.

Function of Culture in the Face of an Adaptive Problem

Culturally shared patterns of behavior that we repeatedly engage in can shape the cognitive, emotional, and motivational agents, or selves, that we utilize to smoothly engage in our daily life activities (Kitayama & Park, 2010). Engaging in a collectivistic behavior pattern of living may enable us to be attentive to, and adapt to, in-group demands and norms. Given that these modes of self are sustained by culture, and assuming that culture is a legacy to cope with ecological requirements, it stands to reason that our self-related psychological mechanisms

should have a function in dealing with adaptive problems. In this study, we call this adaptive unfolding of such individually internalized values and their derived psycho-behavioral patterns, leading to increased efficiency in thriving, a *functional contingency* (Hamamura & Park, 2010).

By taking this view, we can see self-related psychological mechanisms not as endorsed individual traits, but as acquired tendencies that derive healthy results when they align with those that are mandated or sanctioned (Kitayama et al., 2010). Leung and Cohen (2011) similarly argued that a value is not simply rhetoric but triggers pro-social behavior when situated in culturally meaningful situations. For example, they showed that American students of southern origin who endorsed honor-related violence (Nisbett & Cohen, 1996) tended to repay their benefactors when indebted; it is a meaningful situation in honor culture to feel obligated to repay others. Provided that their prosocial behavior acts as a glue for group living, this model can be seen as showing how the honor-related affective system triggered in the individual (i.e., an agent who endorses a value) acts adaptively when it aligns with cultural mandates and the individual is called upon to use it.

A similar focus on functional contingency was also provided by Norasakkunkit and Uchida (2011). They showed that a higher risk of social withdrawal accompanied lower levels of traditional motivational patterns among Japanese students when facing a feedback task, in turn indicating that those endorsing the Japanese motivation to improve were the individuals best suited to participate in the mainstream work environment. These studies collectively point to how self-related psychological mechanisms could lead to individual thriving via interacting with the nation under specific circumstances that require individuals to act upon their respective mandates.

However, whether such psychological mechanisms could also demonstrate a functional contingency in the face of the real-world threat of an adaptive task (i.e., infection) is unknown. In this study, we extend this view in light of the recent pandemic as an overarching situation

that challenges the functional contingency of two broad concepts that involve either affective behavior regulation or general evaluation of one's interdependent relationships. They are theoretically related to the cultural self and are considered functional to solve the adaptive task of defense against infection.

Aversion. First is the avoidance of others, in general, via implicating them as a threat. After all, the core task of infection prevention should be to distance the self from potentially infected others (Fincher et al., 2008; Rozin & Fallon, 1987). Hitokoto et al. (2016) applied a gambling paradigm to induce feedback-related brain potentials (such as feedback-related negativity and positivity) in participants, measured from the dorsolateral prefrontal area of the brain. Since these potentials reflect a neural process of behavior monitoring and adjustment, they hypothesized and observed that among Asian Americans, as compared to European Americans, brief exposure to a face could temporarily enhance the monitoring of their committed actions. This was interpreted as reflecting greater habitual engagement among Asian Americans than among European Americans in perceiving others as threats to which the self must adjust (also see Park and Kitayama, 2012). Interestingly, the face stimuli were simply schematic, line-drawn faces, indicating that the effect was a response to others that were merely generalized. The faces had positive and negative emotional variants, but the effect was no different across these expressions. If the perceived threat is social rejection, the effect should be unique to a negative face posed by in-group others, but this was not the case. The results indicated that, for Asian Americans, merely hinting at a general other was enough to alarm them such that they automatically monitored their behavior.

This deeply ingrained alarm induced by general others may retain an adaptive function in a certain ecological context. That is, split-second automatic monitoring and adjustment of one's behavior can be required when anyone can infect the self. In a pandemic situation, for example, one must almost always be reminded to maintain awareness that someone, a general

other, might have touched the elevator button that one is just about to reach, or has regrettably already touched. Taking the general other as a threat, coupled with split-second adjustment of, or reflection on, one's own actions, can be an efficient mode of processing to protect the self from potential infection. Then, in this pandemic, this type of aversive response that leads the self to retreat from general others may be functional, especially among members of interdependent cultures. Germ aversion is a concept defined as an aversive affective response to situations that connote a relatively high likelihood of pathogen transmission (Duncan et al., 2009). An aversive reaction to general others in the high-stakes situation of the pandemic may call on the function of this pathogen avoidance (Rozin & Fallon, 1987) to defend the self.

Harmony. The quarantine life of 2020 and onwards forced everyone to stick to those to whom they were close. To "stay home, stay safe" became a standard behavioral way of coping against the spread of the infection. A behavioral approach to immunity under the spread of a virus is to restrict one's daily life to close others whose probability of being infected is expected to be low, as evidenced by one's daily life with someone with a similar immune system composition, rather than a stranger (Diamond, 1999).

Successfully maintaining life in quarantine with close others should involve maintaining harmony with them. If one's social circle harbours a conflict, disagreement, or disharmony, the ability to preserve quarantine as a behavioral approach to immunity will be significantly hindered. This might be evident in how preempting disharmony is quintessential to their well-being for members of interdependent cultures (Kitayama et al., 2010). Interdependent happiness, or achievement of harmony, quiescence, and ordinariness via actualization of interdependence (Hitokoto & Uchida, 2015) could, in turn, explain a successful staying-close approach to preventing infection.

Here, an important distinction should be made between being interdependent and achieving harmony. Having an interdependent self, or being interdependent, may be a

prerequisite for achieving in-group harmony. At the core of being interdependent is the concern about others' evaluations (Hashimoto & Yamagishi, 2013; Takata, 1999), and a critical task of interdependence involves prevention of exclusion. In such a task, the interdependent self per se may not guarantee the achievement of harmony and the existence of a stable social resource for the individual. Considering quarantine success as discussed above, an individual may keep the self safe by virtue of stable social resources built as a result of achieving this task. Also, the longer the pandemic continues, the more stable and lasting social resources may be challenged, for the longer duration may make it more difficult to maintain harmony, and pandemic life requires continuing mutual support and communication with already-related others. This implies that the impact of interdependent happiness will be different from that of the interdependent self in guarding against infection.

Recent advancement of the concept of interdependent happiness raises an interesting contribution to the concept regarding health in general. Kitazawa et al. (2019) surveyed 1,000 Japanese students and found that interdependent happiness was positively correlated with quality of sleep, healthy information-technology use, such as less internet addiction, and maintaining regular habits, as represented by attendance in class. These can be considered to represent a student version of a healthy lifestyle, especially in the context of youth social withdrawal that reduces real-world friendships and involves excessive internet use (Zielenziger, 2006). Although the above study was conducted before the pandemic, healthy social participants within the context of the pandemic may be those who can maintain connections to close others and healthy adherence to the normative demands of protecting others, such as staying at home.

Hitokoto and Takahashi (2020) recently tested the measurement reliability and comparability of the interdependent happiness scale across Costa Rica, Japan, and the Netherlands, three countries that greatly diverge on the IC. Interestingly, among the collectivist

countries of Costa Rica and Japan, interdependent happiness was not only endorsed more than in the individualistic Netherlands, but was greater among the elders than their younger counterparts. Despite the obvious vulnerability caused by aging, life in a collectivist culture may allow individuals to accumulate social resources via respect (Karasawa et al., 2011). Then, the health impact of interdependent happiness is expected to be independent of the vulnerability caused by aging, and the impact could be larger in collectivist cultures. Above all, whether the two impacts of interdependent happiness and age can be generalized to infectious symptoms has yet to be discovered.

Infection-Related Symptoms as a Dependent Variable

Past studies on culture and infectious disease focused on societal outcomes of infection as dependent variables, such as the rate at which a disease spread (Fincher et al., 2008; Salvador et al., 2020), or corporal actions (Hamamura & Park, 2010). It is reasonable to focus on these, given that people's reaction to a pandemic manifests society-wide. However, as we see in the current pandemic, the practicalities of infection prevention are grounded at the individual level, whether in handwashing or not meeting up with others. Moreover, the original theory on IC and infection (Fincher et al., 2008) refers to the actions of individuals (i.e., staying away from strangers), aggregated to the level of society (i.e., normatively maintaining distance from strangers), indicating the existence of individual actions before the emergence of a societal pattern (Hamamura & Park, 2010). Following the current framework, individual self-related psychological mechanisms and culture should interact to explain health or, specifically, fewer infectious symptoms.

Beginning in the first half of 2020, the Centers for Disease Control and Prevention (2019) recommended symptom-based screening as a criterion for SARS-CoV-2 testing. The first symptom reports were highly concordant with PCR test results (Afshar et al., 2021), with symptoms resolving approximately one month

after they were first noticed by patients whose PCR tests were positive. Thus, despite being self-reported, these symptoms and their aggregate should provide a useful approximation of the state of infection.²

Research Design

Given the above analyses, the current cross-national survey study compared Japanese and French adults facing the threat of infection during their third national lockdown or state-of-emergency period. The significance of comparing these two IC-diverse nations (Hofstede, 2001; Yama et al., 2010) lies in how the timing of their respective states-of-emergency protocols coincided, both effective from 2020 to 2021. During the spring of 2020, the Japanese government announced its first state of emergency from April to May. The French government announced its first national lockdown from March to May. The second emergency protocol took place in fall to winter, and the emergency in Japan was announced in January, after a steady increase started in October, while the second lockdown in France was from October to December. Paralleled by some locally restricted emergencies, both nations again ended up announcing their third region-wide emergency in April to May 2021, in response to the increased threat of new variants, such as N501Y in March. Although the Japanese emergency differed from the French lockdown in its weaker degree of legal enforcement, they were among the most stringent options in the respective countries to which the residents were normatively expected to conform. Unlike the U.S. or U.K., whose vaccinated population rates reached 40–50% by April 2021, that of France was less than 20%. Japanese vaccinations were also proceeding slowly, with only the most vulnerable 2% vaccinated by April of 2021.

²Still, because bio-measures such as the PCR test are the ultimate standard of COVID-19 infection, current findings based on self-reported data should be used with caution, and understood as equal to screening, at best.

With these commonalities in the national situations, however, the number of those infected up until May 2021 (since January 2020) in Japan was approximately 4,738 per million residents, while that of France was 84,416, and the death toll was 81 in Japan while it was 1,552 in France, leaving some mysteries regarding other societal differences. Treating these naturally occurring similarities as a control, and treating the nearly synchronized pandemic situations as an adaptive problem of infection threat, we tested whether emotions of aversion and harmony, operationalized here as germ aversion and interdependent happiness, would explain the two countries' prevalence of COVID-19-related symptoms. Based on the above analyses, hypotheses were generated, as follows.

Hypotheses

Based on extant individual difference studies on self and mobility (Oyserman et al., 2002; Thomson et al., 2018; see the next section, "Control Variables," for more information on relational mobility), we hypothesize that independence of the self is more highly endorsed in France than in Japan, that interdependence of the self is more highly endorsed in Japan than in France, and that relational mobility is more highly endorsed in France than in Japan (Validity check 1).

We then test if germ aversion and interdependent happiness can be explained by the interdependence of the self after controlling for independence (Hitokoto & Uchida, 2015, study 1; Validity check 2). As for germ aversion, since the interdependent self was positively correlated with the behavior-monitoring effect across cultural groups in the study conducted by Hitokoto et al. (2016), the main effect of the interdependent self is likely to be attained. Also, for interdependent happiness, the main effect of the interdependent self is likely to be attained (Hitokoto & Uchida, 2015). If interactions with the nation should be found, they may indicate functional contingency of the self (Leung & Cohen, 2011), as far as the interaction is indicative of a stronger effect in culturally mandated selves.

As for the main analysis, germ aversion is hypothesized to show a higher score among the Japanese than the French (Hypothesis 1). This is to indicate how this negative emotion towards others in the context of a pandemic is possibly positively sanctioned among the Japanese as compared to the French. Second, interdependent happiness may be endorsed more among the Japanese than the French (Hypothesis 2).

Third, germ aversion is expected to explain the lower level of symptoms (Hypothesis 3). This analysis (hereafter, *Aversion model*) is conducted by controlling for beliefs about immunological functioning and personal susceptibility to infectious diseases, or a general anxiety that one's immune system is vulnerable to disease. This is known to correlate with a general illness attitude (Duncan et al., 2009), and it explains prevention of infection (Smith et al., 2020). This is measured by the perceived infectability scale, a coupled sub-scale of germ aversion under the rubric of perceived vulnerability to disease (Duncan et al., 2009).

Fourth, interdependent happiness is expected to explain the lower level of symptoms (Hypothesis 4). This analysis (hereafter, *Harmony model*) is conducted by controlling for the interdependent self. This is to incorporate the idea that rather than the interdependent self per se, actualization of harmony with close others is functional in dealing with infection.

Hypotheses 3 and 4 also entail possible interactions with the nation: the effect of germ aversion and/or interdependent happiness may be enhanced among the Japanese as compared to the French, due to functional contingency (Hypothesis 5).

Control Variables

Because these hypotheses hinge on the psychological mechanism of self, we also test if the model stands after controlling for relational mobility, one's perception that relationships are open to change in one's social environment (Thomson et al., 2018). Relational mobility is reported to be linked with early COVID-19 spread within a nation, presumably because when societal members are open to new relationships, the potential to meet strangers is high,

exacerbating the speed of spread onset in a given population (Salvador et al., 2020). While this explanation seems to cover the functional contingency account, the current model is more attuned to *within*-individual internal psychological processes. In contrast, relational mobility is a perceived environmental property that essentially exists *outside* of the individual (Oishi & Graham, 2010). To make this point clear, we control for relational mobility in the main analysis, to see if the hypothesized effects hold after its control.

Last but not least, we control for the impacts of demographics that might affect the symptoms. Specifically, we use gender and age (Hitokoto & Takahashi, 2020; Hitokoto & Uchida, 2015), which should alter the symptoms' exacerbation. We also control for educational attainment, which may alter compliance with preventive knowledge (Bavel et al., 2020). We control for individuals' marital status, especially whether they were currently with a partner or not, to account for the support and connection partnerships can secure (Diener et al., 2000). As the COVID-19 symptoms are widely known to be exacerbated by existing chronic disease, we control for the impacts of having representative chronic conditions. At the time of the survey, as both countries had started to carry out their very first vaccinations of a small portion of the population, we also control for whether participants were vaccinated at the time of the survey.

Method

Participants

The participants were 353 Japanese people (female 178, mean age 47.25) and 305 French people (female 122, mean age 28.37).³ We

³The sample size was targeted to be comparable to those of the existing cross-cultural samples of the IHS, or at least 300 (Hitokoto & Takahashi, 2020; Hitokoto & Uchida, 2015). Because of some imbalance observed in gender and age between cultures, hypotheses regarding average difference of culture were tested using regression analysis controlling for these two variables. Also, ethnicity was not asked out of consideration for the local sensitivities regarding this demographic, especially in France.

recruited Japanese (consented to Neo Marketing) and French (to Prolific Academic) participants online using the Qualtrics survey platform during late April of 2021. Each survey was open to native-born adults of both genders from ages 18 through 69⁴ and was closed after one week of data collection. This was to ensure consistency in the quickly changing situation of the pandemic, and to conduct the survey during the state of emergency and lockdown against the third wave of the pandemic, so that the real-world threat was considered present in both nations. Of the 418 Japanese and 342 French participants who completed the survey, we removed 65 (16%) Japanese and 37 French (11%) who met any of the following criteria: (a) original country was either foreign or unanswered (total $n = 30$); (b) participant did not pass IMC (i.e., “please check ‘do not agree’ for this item (this is an attention check)”) ($n = 53$); (c) participant took more than an hour when it was stated that the survey would take 20 minutes to complete, using the built-in measure of response time in Qualtrics ($n = 23$). The number of participants in the analysis reported may further vary, depending on the missing values. Each participant who completed the survey was compensated with standard reward points in Japan and a monetary reward (£2.50) in France, defined by each platform, given the length of the survey. The survey also included scales that are not reported in this article. Respondents were allowed to participate only from their desktop PC.⁵ The survey was anonymous, and participants

gave consent before taking part. The study was approved by a university ethics review board.⁶

Measures

Self-reported infection-related symptoms (hereafter “symptoms”), or the dependent variable of the model, were measured by straightforwardly presenting the representative symptoms of COVID-19 defined by the World Health Organization that have been used as a clinical representation (<https://www.who.int/emergencies/diseases/novel-coronavirus-2019>, retrieved March, World Health Organization, 2021; see Table 2 for item information). These were so-called “milder” symptoms (Afshar et al., 2021; Verma et al., 2021) of COVID-19 infection, and did not include severe symptoms, such as shortness of breath or pressure in the chest (Menni et al., 2020), so as to attain reasonable variance among general participants. However, strong caution must be made regarding the lack of objective measures or diagnoses (i.e., body temperature or PCR test); therefore, the report will contain errors due to the use of general infection-related reports (Smith et al., 2020). Still, the internal consistency of these items was fair across nations ($\alpha_{\text{France}} = .85$ and $\alpha_{\text{Japan}} = .84$). For the skew of the symptoms, log-transformation was used for this dependent variable.⁷

Germ aversion was measured by an 8-item germ-aversion scale of the perceived vulnerability-to-disease scale (Duncan et al., 2009, Fukukawa et al., 2014; see Table 1 for scale information). Internal consistencies of these items were comparable to, or better than, those of past reports ($\alpha_{\text{France}} = .72$ and $\alpha_{\text{Japan}} = .78$). Also, perceived infectability was measured using the same scale, and the internal consistencies of the items were comparable to those of past studies ($\alpha_{\text{France}} = .84$ and $\alpha_{\text{Japan}} = .84$). Interdependent happiness was measured by the 9-item interdependent-happiness scale by Hitokoto and Uchida, 2015; Table 1).

⁴Age was restricted to this upper range concerning the representativeness of Japanese elders (age > 70 years) who register themselves as survey monitors and are therefore considered a special sub-sample within that of non-internet-penetrated Japanese elders.

⁵This was to present the survey’s appearance as clearly as possible on the participants’ side and was ensured by not allowing alternative presentations, such as using a phone, by both the survey system as well as the instructions on the consent form. Still, whether or not participants actually adhered is unchecked.

⁶Kwansei Gakuin University, ethics review number 2020–55.

⁷Results reported were no different, even when the non-transformed version was used.

Table 1 Scales, example items, and their properties

Scale	Example items	N of item	Likert rating	Internal consistency (α)	
				France	Japan
Relational Mobility Scale	“They (the people around you) have many chances to get to know other people.” “If they did not like their current groups, they could leave for better ones.”	12	1: <i>Strongly disagree</i> to 6: <i>Strongly agree</i>	0.85	0.73
Perceived Vulnerability to Disease Scale					
– Perceived infectability	“If an illness is ‘going around’, I will get it.” “I have a history of susceptibility to infectious disease.”	8	1: <i>Strongly disagree</i> to 7: <i>Strongly agree</i>	0.84	0.84
– Germ aversion	“I prefer to wash my hands pretty soon after shaking someone’s hand.” “I am comfortable sharing a water bottle with a friend.” (reverse-scored)	8	1: <i>Strongly disagree</i> to 7: <i>Strongly agree</i>	0.72	0.78
Cultural Self-Construal Scale					
– Interdependent self	“I am concerned about what people think of me.” “When my opinion is in conflict with that of another person’s, I often accept the other opinion.”	10	1: <i>Strongly disagree</i> to 7: <i>Strongly agree</i>	0.66	0.80
– Independent self	“I always try to have my own opinions.” “I am not concerned if my ideas or behavior are different from those of other people.”	10	1: <i>Strongly disagree</i> to 7: <i>Strongly agree</i>	0.77	0.86
Interdependent Happiness Scale	“I believe that I and those around me are happy.” “I can do what I want without causing problems for other people.”	9	1: <i>Strongly disagree</i> to 5: <i>Strongly agree</i>	0.81	0.93

Internal consistencies of these items were good ($\alpha_{\text{France}} = .81$ and $\alpha_{\text{Japan}} = .93$). The translations and descriptive statistics⁸ for both interdependent

factor scores reflecting the invariant models were practically identical to the item average score (germ aversion; $r_{\text{France}} = .974$ and $r_{\text{Japan}} = .972$, interdependent happiness; $r_{\text{France}} = .991$ and $r_{\text{Japan}} = .997$), and independent studies on the IHS showed construct validity across 30 nations, including France and Japan (Gardiner et al., 2020) and more representative samples (Hitokoto & Takahashi, 2020). We used respective average scores in the main analysis. Because of this correlational level of invariance, however, average score comparisons on the two scales may contain level differences that cannot be attributed to the concepts they were intended to measure (Milfont & Fischer, 2010), such as response set or differential item functioning. Future studies on this point are warranted.

⁸For these two, key, translated explanatory variables, we ran invariance tests using multi-group confirmatory factor analysis (Milfont & Fischer, 2010). As for the germ aversion, we achieved measurement unit invariance ($\chi^2(45) = 138.78$, $p < .001$, $CFI = .91$, $RMSEA = .06$) after allowing for a between-error covariate on items 2 and 3. As for interdependent happiness, we achieved partial measurement unit invariance ($\chi^2(52) = 152.77$, $p < .001$, $CFI = .97$, $RMSEA = .05$) by setting factor loadings for items 2, 3, 4, 6, and 9 as non-equivalent. However, these

happiness and germ aversion are presented in Appendix A.

We used the relational mobility scale (Thomson et al., 2018; Table 1). Participants responded across 12 items ($\alpha_{\text{France}} = .85$ and $\alpha_{\text{Japan}} = .73$). Cultural self-construal was measured by a 20-item cultural self-construal scale (Park & Kitayama, 2012; Table 1). This scale was an amalgam of cross-culturally validated self-construal scales created by Takata (1999) and Singelis (1994), and was the model used in the study conducted by Hitokoto et al. (2016) that showed a unique correlation with the size of the brain potential of behavior monitoring. Internal consistencies of these items were either better than those reported by Hitokoto et al. (2016) or comparable to those by Singelis (1994) and Takata (1999) (for independence: $\alpha_{\text{France}} = .77$ and $\alpha_{\text{Japan}} = .86$, for interdependence: $\alpha_{\text{France}} = .66$ and $\alpha_{\text{Japan}} = .80$).

As for the demographics, gender (0: male, 1: female) and age (direct numeric response) were used (Appendix B). Educational attainment was measured by asking the highest level of schooling participants had completed (see Table 2 for item information). Participants who gave responses other than 9 were dummy coded as lower (0) or higher (1) than 5 to reflect educational status (Stephens et al., 2012). Marital status was measured (Table 2), and participants were dummy coded as lower or higher than 3 to reflect the existence (1) or non-existence (0) of a significant partner. Chronic disease was measured (Table 2), and participants were dummy coded as having 1 through 7 or not (i.e., 8) to reflect the existence (1) or non-existence (0) of these chronic vulnerabilities to COVID-19. Vaccination was measured by asking whether participants had received at least one dose of the COVID-19 vaccine at the time of participation (Table 2), and participants were dummy coded as having taken (1) or not taken (0) the vaccine.

All survey items and scales, except the symptoms and relational mobility scales that had existing French versions, were back-translated from the original English versions by the first author and two French-English bilinguals. During the rounds of translation, the first author

Table 2 Items used and their response options

Items	Categorical options										
Symptoms	(1) Fever	(2) Dry cough	(3) Fatigue	(4) Sore throat	(5) Diarrhea	(6) Headache	(7) Loss of taste	(8) Skin rash	(9) Nasal congestion		
Educational attainment	(10) Conjunctivitis (or "red eyes") (1) Less than high school degree	(11) Muscle or joint pain (2) High school graduate (high school diploma or equivalent)	(12) Nausea or vomiting (3) Some college but no degree	(13) Chills or dizziness (4) Associate degree in college (2-year)	(5) Bachelor's degree in college (4-year)	(6) Master's degree	(7) Doctoral degree	(8) Professional degree (JD)	(9) Prefer not to answer		
Marital status	(1) Married	(2) Cohabited (including the civil solidarity pact)	(3) Divorced	(4) Separated	(5) Single						
Chronic disease	(1) Diabetes	(2) Respiratory diseases (e.g. BPCO, COPD)	(3) Hypertension or high blood pressure	(4) Chronic kidney disease	(5) Cardiovascular disease	(6) Obesity	(7) Smoking problems	(8) None of above			
Vaccination	(1) Yes	(2) No									

thoroughly checked the match between the original items and the translated versions, further resolving the minor differences that existed between these bilingual collaborators. As for the Japanese translations, scales that had existing Japanese versions were used, and items that did not were back-translated by two Japanese-English bilinguals using the same process.

Results

Analyses, reported below, were conducted using the statistics software HAD (Shimizu, 2016). Each scale was averaged across items to form scale scores, which, in turn, were used for the following analyses. The distributions of the demographics are presented in Appendix B.

Validity Check 1

Cultural selves and relational mobility were each regressed on gender, age, and nation to test the effect of the nation (0 = France, 1 = Japan). Results showed that the French were more independent than the Japanese ($M_{France} = 4.99, SD_{France} = 0.82$ vs. $M_{Japan} = 4.50, SD_{Japan} = 0.92$, the main effect of nation: $\beta = -.35, p = .00, 95\% CI [-0.44, -0.25]$), but the Japanese happened to be less interdependent than the French ($M_{France} = 4.74, SD_{France} = 0.73$ vs. $M_{Japan} = 4.40, SD_{Japan} = 0.78, \beta = -.14, p = .01, 95\% CI [-0.24, -0.04]$). The French were more relationally mobile than the Japanese ($M_{France} = 4.14, SD_{France} = 0.69$ vs. $M_{Japan} = 3.65, SD_{Japan} = 0.52, \beta = -.39, p = .00, 95\% CI [-0.48, -0.30]$).

Validity Check 2

Germ aversion was regressed on gender, age, nation, independent and interdependent selves, as well as interactions between the selves and nation. Results of this multiple-regression analysis suggested, as hypothesized, the main effect of interdependent self ($\beta = .11, p = .01, 95\% CI [0.03, 0.19]$). Also, gender ($\beta = .17, p = .00, 95\% CI [0.10, 0.25]$) and nation ($\beta = .22, p = .00, 95\% CI [0.12, 0.32]$) showed main effects, which indicates that, additionally,

Table 3 Descriptive statistics of the scales for the main analyses

Scales	France			Japan			t	p	Symptoms	Relational mobility	Perceived Infect-ability	Germ aversion	Interdependent Self	Interdependent happiness
	M	SD	Min Max	M	SD	Min Max								
Symptoms	0.47	0.28	0.00 1.24	0.24	0.24	0.00 1.07	10.63	***		-.05	.17 **	-.06	-.05	-.26 **
Relational mobility	4.14	0.69	1.75 5.92	3.65	0.52	2.25 5.42	10.04	***	-.01 a)		.01	.08	.13 *	.26 **
Perceived infectability	3.33	1.07	1.00 7.00	3.80	1.04	1.00 7.00	5.64	***	.28 **	-.11 +		.28 **	.07	-.20 **
Germ aversion	4.06	1.06	1.00 7.00	4.53	1.01	1.50 7.00	5.94	***	.11 +	-.05	.23 **		.13 *	-.06
Interdependent self	4.74	0.73	2.90 6.60	4.40	0.78	1.60 7.00	5.84	***	.15 **	.03	.00	.08		.22 **
Interdependent happiness	3.33	0.63	1.56 5.00	3.12	0.86	1.00 5.00	3.66	***	-.25 **	.13 *	-.17 **	-.13 *	-.05	

Note. a) For the correlation matrix, the French results are below the diagonal and the Japanese results are above the diagonal.

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$.

females were more germ-avoiding than males, and the Japanese were more germ-avoiding than the French. There were no interactions between the selves and nation. The results indicate that germ aversion can be positively explained by the interdependence of the self.

Interdependent happiness was regressed on gender, age, nation, independent and interdependent selves, as well as interactions between the selves and nation. Results of this multiple regression analysis suggested, as hypothesized, the main effect of interdependent self ($\beta = .18, p = .00, 95\% \text{ CI } [0.10, 0.25]$) separately from that of independent self ($\beta = .35, p = .00, 95\% \text{ CI } [0.27, 0.43]$).⁹ The effect size of the interdependent self was comparable to that in Hitokoto and Uchida (2015). Also, age ($\beta = .12, p = .01, 95\% \text{ CI } [0.03, 0.21]$) showed a main effect. An interaction between nation and interdependent self was found ($\beta = .08, p = .03, 95\% \text{ CI } [0.01, 0.16]$), and a simple slope analysis further suggested a significant positive effect of interdependent self in Japan ($\beta = .26, p = .00, 95\% \text{ CI } [0.16, 0.36]$), but not in France ($\beta = .09, p = .13, 95\% \text{ CI } [-0.09, 0.18]$). These indicate impacts of both selves on interdependent happiness, as well as a functional contingency of interdependent self on interdependent happiness.

Main Analyses

Germ aversion and interdependent happiness were each regressed on gender, age, and nation to test the effect of the nation. Results showed

⁹The unique effect from independent self on interdependent happiness may sound counter-intuitive; however, this replicates a past finding (Hitokoto & Uchida, 2015), and the authors have separately found this to be due to the general association of independence with hedonic elements in happiness measures, which the IHS inevitably shares (Hitokoto et al., 2019). Although, this may seem to be a shortcoming of the IHS, the problem is a broad one when using self-report with questions framing positive acknowledgments about the self as a measure of well-being. Also, the effect of the IHS on the symptoms can be observed after additionally controlling for independence ($\beta = -.08, p = .08, 95\% \text{ CI } [-0.16, 0.01]$) and its interaction with culture ($\beta = .06, p = .12, 95\% \text{ CI } [-0.02, 0.14]$).

that germ aversion was more highly endorsed among the Japanese as compared to the French ($M_{France} = 4.06, SD_{France} = 1.06$ vs. $M_{Japan} = 4.53, SD_{Japan} = 1.01, \beta = .20, p = .00, 95\% \text{ CI } [0.11, 0.30]$), supporting hypothesis 1 (Table 3). The level of interdependent happiness was higher among the French than the Japanese, which did not support hypothesis 2 ($M_{France} = 3.33, SD_{France} = 0.63$ vs. $M_{Japan} = 3.12, SD_{Japan} = 0.86, \beta = -.24, p = .00, 95\% \text{ CI } [-0.33, -0.14]$).

As for the *Aversion model*, the symptoms were hierarchically regressed on demographics (i.e., gender, age, educational attainment, marital status, chronic disease, and vaccination), relational mobility, and nation as a first step. The main effects of germ aversion and perceived infectability were added as a second step, and the interactions between nation and these two explanatory variables were added as a third. Results are summarized in Table 4. Examination of the models indicated that the model in step 3 was sufficient in terms of both increment (a.k.a., ΔF) and relative fit (AIC). Therefore, we selected step 3 as our final model. The variance explained, using the final model, was $R^2 = .23$ ($Adj R^2 = .21$).

Effects for each explanatory variable are also summarized in Table 4. Regarding the final model, main effects of gender ($\beta = .08, p = .03, 95\% \text{ CI } [0.01, 0.16]$), age ($\beta = -.12, p = .02, 95\% \text{ CI } [-0.22, -0.02]$); chronic disease ($\beta = .10, p = .01, 95\% \text{ CI } [0.02, 0.18]$); nation ($\beta = -.38, p = .00, 95\% \text{ CI } [-0.48, -0.28]$);¹⁰ and perceived infectability ($\beta = .20, p = .00, 95\% \text{ CI } [0.13, 0.28]$) were found. Germ aversion did not show a main effect ($\beta = -.05, p = .17, 95\% \text{ CI } [-0.13, 0.02]$); thus, hypothesis 3 was not supported. However, it showed a significant interaction with nation ($\beta = -.08, p = .04, 95\%$

¹⁰Because we collected data from various regions within each culture, we additionally examined the intra-class correlations (*ICC*) of the respective administrative regions (in France, 16 out of 18 were collected, with mean group size $n = 26$) and prefectures (in Japan, 44 were collected out of 47, with mean group size $n = 10$) for the main measures in Table 3). As a result, most of them showed very small ICCs ($-.03 < ICC_{France} < -.00, -.02 < ICC_{Japan} < .06$), suggesting small regional variation as compared to the large individual difference.

Table 4 Results of the hierarchical multiple regression analysis for germ aversion as a main explanatory variable (Aversion model)

Explanatory variables	Step1		Step2		Step3		Final model				
	<i>B</i>		<i>B</i>		<i>B</i>		β	lower 95CI	Upper 95CI	<i>p</i>	VIF
Gender (0 = Male, 1 = Female)	0.05	*	0.05	*	0.05	*	.08	0.01	0.16	.03	1.10
Age	0.00	*	0.00	*	0.00	*	-.12	-0.22	-0.02	.02	1.97
Educational attainment (0 = Lower, 1 = Higher)	0.01		0.00		0.00		.01	-0.06	0.08	.84	1.02
Marital status (0 = No partner, 1 = With partner)	-0.02		-0.02		-0.02		-.03	-0.11	0.04	.39	1.22
Chronic disease (0 = Not have, 1 = Have)	0.08	**	0.07	**	0.06	*	.10	0.02	0.18	.01	1.17
Vaccination (0 = Not taken, 1 = Taken)	-0.02		-0.02		-0.03		-.02	-0.09	0.05	.55	1.02
Relational mobility	-0.02		-0.01		-0.01		-.02	-0.10	0.06	.58	1.20
Nation (0 = France, 1 = Japan)	-0.20	**	-0.22	**	-0.21	**	-.38	-0.48	-0.28	.00	1.92
Perceived infectability			0.05	**	0.05	**	.20	0.13	0.28	.00	1.15
Germ aversion			-0.01		-0.01		-.05	-0.13	0.02	.17	1.18
Perceived infectability X Nation					-0.02		-.05	-0.12	0.03	.23	1.10
Germ aversion X Nation					-0.04	*	-.08	-0.15	0.00	.04	1.10
<i>R</i> ²	.18		.22		.23						
ΔF	16.66	***	13.89	***	3.83	*					
AIC	73.22		49.56		45.79						

*** $p < .001$ ** $p < .01$, * $p < .05$.

CI [-0.15, -0.01]), supporting hypothesis 5. A simple slope-analysis further revealed this to be an interaction in which the effect of germ aversion was significantly negative for the Japanese ($\beta = -.13$, $p = .02$, 95% CI [-0.07, -0.01]) but not for the French ($\beta = .03$, $p = .60$, 95% CI [-0.02, 0.03]) (Figure 1).¹¹

¹¹Additional follow-up analyses were conducted to examine if there are correlations between germ-aversion-symptoms correlations and risks of community spread in both nations. The first risk indicator was population density. We used available regional data from both countries (Eurostat, 2021; Ministry of International Affairs and Communications, 2020) and calculated the slopes predicting symptoms from germ aversion separately for those participants in different provinces/prefectures. The results showed that population density did not correlate with the slopes in France ($r = -.01$, $p = \text{n.s.}$), and the same was true in Japan ($r = -.01$, $p = \text{n.s.}$). The second risk indicator was the incidence rate per population. Regional data were collected (Santé publique France, 2021; Idogawa, Tange, Nakase, & Tokino, 2020) at the time of the survey (i.e., late April 2021). Again,

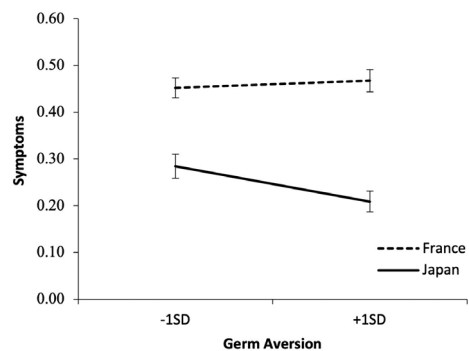


Figure 1 Interaction between germ aversion and nation in explaining the prevalence of COVID-19 symptoms. Error bars indicate standard errors.

incidence rates did not correlate with the slopes in France ($r = .01$, $p = \text{n.s.}$), and the same was true in Japan ($r = .05$, $p = \text{n.s.}$). This was also the case after removing the capital regions (i.e., Ile-de-France and Tokyo) when calculating the correlations.

Table 5 Results of the hierarchical multiple regression analysis for interdependent happiness as a main explanatory variable (Harmony model)

Explanatory variables	Step1	Step2	Step3	Final model				
	<i>B</i>	<i>B</i>	<i>B</i>	β	lower 95CI	Upper 95CI	<i>p</i>	VIF
Gender (0 = Male, 1 = Female)	0.06 **	0.05 *	0.05 *	.09	0.02	0.16	.01	1.06
Age	0.00 *	0.00 *	0.00 +	-.10	-0.20	0.00	.04	2.00
Educational attainment (0 = Lower, 1 = Higher)	0.00	0.01	0.01	.01	-0.06	0.08	.71	1.02
Marital status (0 = No partner, 1 = With partner)	-0.02	0.00	0.00	-.01	-0.09	0.07	.88	1.27
Chronic disease (0 = Not have, 1 = Have)	0.09 **	0.08 **	0.08 **	.13	0.06	0.21	.00	1.15
Vaccination (0 = Not taken, 1 = Taken)	-0.01	0.01	0.01	.01	-0.07	0.08	.87	1.03
Relational mobility	-0.02	0.00	0.00	-.01	-0.09	0.07	.85	1.23
Nation (0 = France, 1 = Japan)	-0.20 **	-0.22 **	-0.22 **	-.39	-0.48	-0.29	.00	1.87
Interdependent self		0.02 +	0.02 +	.06	-0.01	0.14	.09	1.10
Interdependent happiness		-0.08 **	-0.08 **	-.21	-0.28	-0.13	.00	1.15
Interdependent self × Nation			-0.06 *					
Interdependent happiness × Nation			0.02					
<i>R</i> ²	.19	.23	.24					
ΔF	17.64 ***	15.10 ***	2.33 +					
<i>AIC</i>	66.53	40.53	39.78					

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$.

Regarding the *Harmony model*, the symptoms were hierarchically regressed on demographics, relational mobility, and nation as a first step; interdependent self and interdependent happiness as a second; and the interactions between nation and these two explanatory variables as a third step. Results are summarized in Table 5. Examination of the models indicated that the model in step 2 was sufficient. Therefore, we selected step 2 as our final model. The variance explained using the final model was $R^2 = .23$ ($Adj R^2 = .22$).

Effects for each explanatory variable are also summarized in Table 5. Regarding the final model, main effects of gender ($\beta = .09$, $p = .01$, 95% CI [0.02, 0.16]), age ($\beta = -.10$, $p = .04$, 95% CI [-0.20, 0.00]); chronic disease ($\beta = .13$, $p = .00$, 95% CI [0.06, 0.21]), nation ($\beta = -.39$, $p = .00$, 95% CI [-0.48, -0.29]); and interdependent happiness ($\beta = -.21$, $p = .00$, 95% CI [-0.28, -0.13]) were found; therefore, hypothesis 4 was supported.

However, because step 3 was only marginally significant ($\Delta F = 2.34$, $p = .10$), hypothesis 5 was not supported.¹²

Discussion

The current cross-cultural survey study compared the impacts of germ aversion and interdependent happiness to subjective reports of infection-related symptoms across Japan

¹²For the step 3 model, one interaction term of interdependent self × culture was significant ($\beta = -.08$, $p = .04$, 95% CI [-0.15, -0.00]), although the overall step 3 model did not reach a significant increment. The nature of this interaction was that among the French, those with higher degrees of interdependent self showed *higher* levels of symptoms ($\beta = .14$, $p = .01$, 95% CI [0.01, 0.09]), while this was not observed among the Japanese ($\beta = -.01$, $p = .80$, 95% CI [-0.04, 0.03]). Also, adding perceived infectability to the explanatory variables, as we did in the *Aversion model*, did not change the effects reported for the *Harmony model*.

and France. Germ aversion showed a negative (i.e., suppressive) effect on the symptoms in Japan but not in France, and interdependent happiness showed a culturally common negative effect.

Interpretations and Implications

Germ aversion was more strongly endorsed among the Japanese than the French, as hypothesized, and it was also functional in negatively explaining the symptoms. This may indicate a psycho-social process of societal collectivism defending its members from infectious threat. That is, in an interdependent society, a gut feeling of disgust against germs directed towards general others retains a function, and a normative distancing of the self from strangers may maintain safety from infection. On the other hand, in an independent society, shared semantics of general others are more benign and thus tend to imply a “safety cue” (Hitokoto et al., 2016), thereby hindering its members from taking advantage of the function of this gut feeling to steer away from potential threats. In a regular situation, a benign notion of general others will facilitate openness to connections and relationships. However, in a pandemic, this meaning of others may lead to risk of infection.

The level of interdependent happiness was higher among the French than the Japanese, and negatively explained the symptoms, regardless of nation. The high score on the IHS in an independent society actually replicates a past Japanese-North American comparison (Hitokoto & Uchida, 2015), and this replicable finding may either represent response bias stemming from the scale’s lack of scalar invariance, or a scale confound with a positive relational orientation in an independent society (Hashimoto & Yamagishi, 2013).¹³

Hitokoto and Uchida (2015) observed differing impacts of the concept on overall well-being, which was a positive outcome. On the other

hand, the current dependent variable of symptoms was a negative physical condition. This difference in valence, or difference in the mental-physical distinction, may have overwritten the societally dependent impact of interdependent happiness in the current model. Still, the data also showed a societally dependent impact of germ aversion, which is mental, and happiness in general does predict physical health (Myers & Diener, 1995); therefore, the mental-physical distinction may be a less plausible guess. However, as valence is a major dimension of affective appraisal followed by arousal, and self-related appraisal seems to follow these more potent ones (Kitayama et al., 2000; Mauro et al., 1992), semantics tied to society may be better tapped by either controlling these appraisals or by using a method to circumvent conscious appraisals of these dimensions (Kitayama & Park, 2010).

Nevertheless, against the current pandemic, the function of interdependent happiness to regulate infection worked strongly in both nations. Given its common impact, one straightforward interpretation of the current finding regarding what affords interdependent happiness is the increased threat of infection at its ecological level, with which the members of the affected society must cope by using their established interdependent social resources to deal with infection. Then, our unique finding is that, in fact, it was not the interdependent *self*, but interdependent *happiness* that explained the presence of fewer symptoms. Although the collectivism of a nation and the interdependent self of an individual are not exactly the same (Na et al., 2010), the infectious safety account suggested by Fincher et al. (2008), focusing on only the in-group behavior pattern of a nation, may require further scrutiny regarding its process of fostering health. Rather than simply being interdependent and oriented towards one’s in-group, actualized harmony as a stable social resource could be used in decreasing infectious threat. This is plausible if the danger of infection is somehow mitigated by the use of stable social resources; i.e., social support of one’s family and friends (Hitokoto & Takahashi, 2021), and/or countered by a biological mechanism,

¹³Consulting findings on harmony-seeking in independence (Hashimoto & Yamagishi, 2013), the way the IHS is framed to ask about the possession of positive relationships may be affiliated with this particular side of independence (Hitokoto et al., 2019).

such as a buffering of loneliness, that facilitates immunological functioning, which requires meaningful social integration (Cole et al., 2015). Importantly here, interdependent happiness was functionally contingent with interdependent self only in Japan (Validity check 2). This may point to the fact that the stable social resource to deal with infection cross-societally is attained via concerns about others' evaluations more efficiently in an interdependent society, as compared to an independent society.

As the current work fell short of revealing the real-world ways or behaviors through which social resources allowed individuals to fend off disease, the next step would be to locate a more concrete behavioral process connected to how happiness negatively explained infection. Speculations can be made, such as that those with higher levels of interdependent happiness were able to stay at home longer, because they were simply happy being with family and friends, and thus might have co-created comfortable and rewarding stay-home measures and had little reason to go out seeking new opportunities. Included in these measures may be the efficient use of telecommunication to maintain close relationships (Hitokoto & Takahashi, 2021; Kitazawa et al., 2019). Also, considering the ordinariness included in the IHS, those with high levels of interdependent happiness may have experienced a smaller threat of personal choice in following the norms for taking preventive actions, such as wearing a face-covering while others did the same. Thus, when specifying a more concrete level of the process, behaviors regarding going out, the status of staying at home, methods of relating to close others, or adherence to preventive actions will provide valuable information.

However, these suggested processes remain a conundrum when it comes to within-group infection. If staying home is likely for those with high levels of interdependent happiness, once the pandemic becomes so widespread that it enters the home mediated by community-wide infection, then in-group harmony could breed infection due to the fact that in-group members are close. This may simply be an inherent weakness of behavior related to immunity, but it

poses questions as to whether interdependent happiness continues to provide solutions, even regarding an in-group threat. The current study finds no answer to this, but first, whether the behaviors of in-groups are the same across cultures during a pandemic warrants investigation. Hamamura and Park (2010) reported interesting estimates of Easterners and Westerners regarding who they thought might infect the self. Easterners nominated out-group members, while Westerners tended to nominate in-group members. If Easterners are generally avoiding others, then in such a context, in-group members are likely not to be infected. Conversely, for Westerners, who have less hesitation in meeting others, infection will more easily penetrate to someone in one's in-group circle. Then, the level of in-group threat and therefore the limit to in-group safety may not be the same across cultures in the long run, posing questions concerning whether interdependent happiness continues to be effective following a prolonged pandemic.

The two findings across germ aversion and interdependent happiness may be integrated to understand how cultural psychological mechanisms function through parallel routes to regulate an ecological threat. As far as infectious threat is concerned, its basic unit of threat will be at the individual level: infectious damage to an individual's physical health. To counter this threat, individuals must detect and cope well with an unobservable virus, against which laypeople can best defend themselves by mutually distancing the self from potentially infected others. Here, such an intuitive defense mechanism can be motivated by a gut feeling, sustained by a pre-reasoning affective process. When this threat perception of others is shared within a society and members mutually hesitate to get close, societal coping will be effectively achieved. This could be the reason behind why germ aversion showed a selective function in Japan.

The more people retreat from others to stay within their close relationships, the more crucial the quality of the stable resources one has accumulated in those relationships, so that one can continue to stay in and be supported by this stable resource that cannot be freely expanded. This impact of stable resources on safety from

infection could be a general one. Without these resources, the self, or someone in that relationship, may go out to seek a new relationship, undermining the whole scheme. At the same time, such stable social resources are more efficiently attained by having a relational self within a nation that encourages interdependence. These multiple processes, spanning from an individual affective, motivational process to possibly the interactional and group level, may work in tandem to sustain our health during a pandemic.

Limitations

Although the findings are promising, we would like to note several limitations of the current study. First, the observed effect size was small, at best. Given the applied orientation of this study, the remaining significant main effect of nation, and the individual difference we could not explain – given the model – must be explicated. Also, a more representative sample should be tested to make the findings generalizable. Relying only on online platforms that inevitably contain methodological limitations, such as inattentive responses – and the current data was no exception – should be considered an approach that is not perfect but is useful when dealing with short-lived phenomena in a timely manner.

As discussed, because we relied heavily on conceptual measures, people's exact behaviors during the pandemic were not discovered. For example, germ-avoiding individuals may have adhered to the rules of not going out so much, or may have significantly decreased their numbers of meetings with friends. Given the vast shift to online communication after 2020, these individuals may have increased their use of online communication tools more than ever before. These specific behaviors that further mediated these concepts may be culturally dependent, as well.

Related to this is an alternative explanation by the tightness–looseness dimension of societal differences (Gelfand et al., 2006). Japan is relatively tighter than France, indicating that the Japanese may have adhered to the new norms, such as quarantine measures, online communication, or face-covering, more than the French, by virtue of the fact that violating them invites punishment, and thereby succeeded in fending off the

infection. This is conceivable, for collectivism and tightness are mildly positively correlated at the national level. Because of this partly conceptual overlap, teasing apart the difference between the two could be worth exploring, with comparisons of independent but tight or less independent but loose cultures, together with a measure of tightness and looseness at the individual level.

As the current comparison entailed only two nations, societal-level effects of individual-level psychological process were obscure, at best. As many nations are suffering the pandemic, multi-level analysis with control variables introduced at the national level (such as emergency protocol differences, new-variant entrance differences, or hospital capacity differences and so on) is an ideal design to examine which part of our infection defense is truly cultural, national, socio-political, or situational. In other words, the observed differences might be based simply on the country-specific infection situation, not cultural traits; therefore the current design cannot conclude that the effects are solely cultural. Also, since the current analysis used individual-level measures of cultural variables, it is also silent about whether the same concepts could show a unique contextual effect when aggregated at the societal level (Na et al., 2010). At the same time, such an analysis requires a number of nations and comparable measures of political strategies, together with cross-national survey responses, and for the pandemic, some temporal considerations to account for changes throughout the year, as well. By taking these steps, one may truly ascertain the impacts of culture on infection-related behavior.

Last but not least, the current design has no control condition where the threat did not exist. That is, the results we reported may not be unique to the pandemic situation, reducing our assertion about the effects to a cultural mandate that exists all of the time. We prefer to argue that the situation of the third national emergency plays an important situational role in the observed effects, though true knowledge of whether this was the case requires a comparison with a non-pandemic situation. The model needs to be tested in different situations before fully concluding that it demonstrates a response to a survival threat.

With these limitations in mind, our timely cross-cultural comparison suggests the effects of interdependent happiness on pandemic symptoms across Japan and France, and impacts of interdependent happiness and germ aversion. These may, together, point to some cultural psychological patterns in how people preserve their health in the face of a pandemic.

Conflict of Interest

The authors declare no conflicts of interest associated with this manuscript.

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Appendix A

Items and descriptive statistics for germ aversion and interdependent happiness

French items	Japanese items	France			Japan			<i>t</i>	<i>p</i>
		<i>M</i>	<i>SD</i>	PCA loading	<i>M</i>	<i>SD</i>	PCA loading		
1. Après avoir serré la main de quelqu'un, je préfère me laver les mains assez rapidement.	1. 誰かと握手したあとは、手を洗いたくなる	3.53	1.78	0.75	3.77	1.66	0.81	1.88	†
2. J'évite d'utiliser les téléphones publics pour ne pas prendre le risque d'attraper quelque chose qu'aurait le précédent utilisateur.	2. 前に使った人から何かうつりそうなので、公衆電話は使いたくない	3.64	1.75	0.69	3.74	1.56	0.74	0.67	
3. Je n'aime pas écrire avec un stylo qui a vraisemblablement été mordillé par quelqu'un.	3. 誰かの噛み跡がついた鉛筆では書きたくない	4.73	1.80	0.58	5.49	1.51	0.61	5.81	***
4. Je n'aime pas porter des vêtements d'occasion, car vous ne savez pas comment était la dernière personne à les avoir portés.	4. 最後に着た人がわからないので、古着は着たくない	3.05	2.02	0.51	4.21	1.90	0.55	7.51	***
5. Cela ne me dérange pas de partager une bouteille d'eau avec un ami. (Reversed)	5. 友人が口をつけたボトルから、平気で水が飲める(逆転済)	3.42	1.91	0.64	5.23	1.56	0.57	13.27	***
6. Cela me dérange vraiment lorsque les gens éternuent sans se couvrir la bouche.	6. 口に手をあてずにくしゃみをする人とは、一緒にいたくない	5.61	1.58	0.49	5.43	1.43	0.62	1.66	†
7. Cela ne me rend pas anxieux(cieuse) d'être à côté de personnes malades. (Reversed)	7. 病気が人がそばにいても、いやではない(逆転済)	4.26	1.68	0.45	4.33	1.48	0.58	0.50	
8. Mes mains ne me paraissent pas sales après avoir touché de l'argent. (Reversed)	8. お金に触ったあとでも、自分の手を汚なく感じたりはしない(逆転済)	4.27	1.94	0.54	4.12	1.67	0.58	1.04	

Appendix A Continued

French items	Japanese items	France			Japan			<i>t</i>	<i>p</i>
		<i>M</i>	<i>SD</i>	PCA loading	<i>M</i>	<i>SD</i>	PCA loading		
Interdependent happiness									
1. Je pense que moi, ainsi que les personnes qui m'entourent, sommes heureux.	1. 自分だけでなく、身近なまわりの人も楽しい気持ちでいると思う	3.26	0.93	0.78	3.09	0.90	0.74	2.24	*
2. Je me sens positivement évalué(e) par les personnes qui m'entourent.	2. 周りの人に認められていると感じる	3.56	0.93	0.65	2.94	1.01	0.82	8.09	***
3. Je rends heureux(euses) les personnes qui me sont proches.	3. 大切な人を幸せにしていると思う	3.65	0.77	0.57	3.10	1.11	0.77	7.22	***
4. Même si ma vie est. plutôt moyenne, je vis une vie stable.	4. 平凡だが安定した日々を過ごしている	3.80	0.91	0.42	3.56	1.02	0.73	3.24	**
5. Je n'ai aucuns problèmes majeurs ou d'anxiété majeure.	5. 大きな悩み事はない	3.02	1.28	0.64	2.79	1.21	0.73	2.46	*
6. Je peux faire ce que je veux sans que cela ne cause de problèmes à autrui.	6. 人に迷惑をかけずに自分のやりたいことができている	3.34	1.06	0.40	3.25	1.08	0.77	0.90	
7. Je pense que ma vie est. toute aussi heureuse que celle des personnes sont autour de moi.	7. まわりの人たちと同じくらい幸せだと思う	3.10	1.04	0.78	3.03	1.10	0.89	0.69	
8. Je pense avoir atteint le même niveau de vie que les personnes de mon entourage.	8. まわりの人並みの生活は手に入れている自信がある	2.84	1.10	0.71	3.15	1.12	0.84	3.73	***
9. En général, je pense que les choses se passent bien pour moi à leur propre manière et qu'il en va de même pour les gens de mon entourage.	9. まわりの人たちと同じくらい、それなりにうまくいっている	3.41	0.85	0.75	3.09	1.11	0.90	3.96	***

*** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$.

Appendix B

Distributions of the demographic variables in the main analysis

	Categories	France	(%)	Japan	(%)
Gender	Male	172	58.5	171	49.0
	Female	122	41.5	178	51.0
Educational attainment	Lower	112	37.1	158	45.0
	Higher	190	62.9	193	55.0
Marital status	No partner	190	62.3	147	41.9
	With partner	115	37.7	204	58.1
Chronic disease	Not have	256	83.9	233	66.4
	Have	49	16.1	118	33.6
Vaccination	Not taken	287	94.1	342	97.2
	Taken	18	5.9	10	2.8