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In COVID-19 Health Messaging, Loss Framing Increases Anxiety with Little-to-No Concomitant Benefits: Experimental Evidence from 84 Countries

Charles A. Dorison · Jennifer S. Lerner · Blake H. Heller · Alexander J. Rothman · Ichiro I. Kawachi · Ke Wang, et al. [full author details at the end of the article]

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Abstract

The COVID-19 pandemic (and its aftermath) highlights a critical need to communicate health information effectively to the global public. Given that subtle differences in information framing can have meaningful effects on behavior, behavioral science research highlights a pressing question: Is it more effective to frame COVID-19 health messages in terms of potential losses (e.g., “If you do not practice these steps, you can endanger yourself and others”) or potential gains (e.g., “If you practice these steps, you can protect yourself and others”)? Collecting data in 48 languages from 15,929 participants in 84 countries, we experimentally tested the effects of message framing on COVID-19-related judgments, intentions, and feelings. Loss- (vs. gain-) framed messages increased self-reported anxiety among participants cross-nationally with little-to-no impact on policy attitudes, behavioral intentions, or information seeking relevant to pandemic risks. These results were consistent across 84 countries, three variations of the message framing wording, and 560 data processing and analytic choices. Thus, results provide an empirical answer to a global communication question and highlight the emotional toll of loss-framed messages. Critically, this work demonstrates the importance of considering unintended affective consequences when evaluating nudge-style interventions.

Keywords Message framing · Anxiety · Nudges · COVID-19

Managing the COVID-19 pandemic (and its aftermath) hinges in part on effectively communicating health messages to the global public. One critical question is how to frame such messages, given widespread evidence from psychology and related fields that the way in which information is framed can have meaningful effects on behavior, even when the core information is essentially the same across distinct frames (for reviews, see Gallagher & Updegraff, 2012; Rothman et al., 2020). Indeed, in their widely cited review recommending social and behavioral science applications for reducing the spread of COVID-19, Van Bavel et al. (2020) highlighted this very question: “Research is needed to determine whether a more positive [vs. negative] frame could educate the public and relieve negative emotions while increasing public health behaviors” (p. 462). More generally, Sunstein and Thaler (2003, p. 1182) have long argued that “In order to be

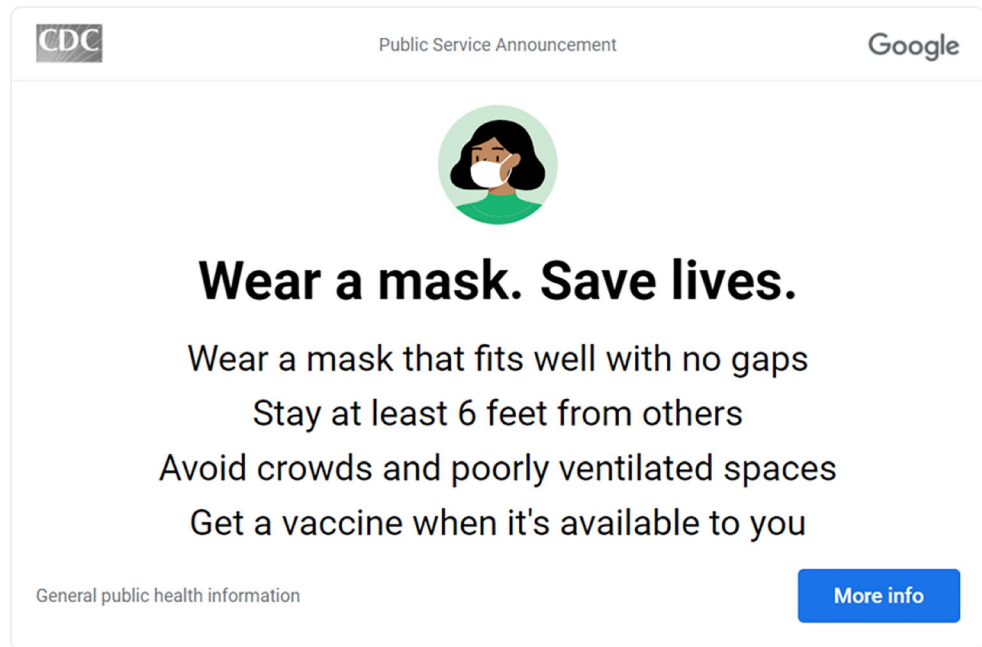
effective, any effort to inform people must be rooted in an understanding of how people actually think. Presentation makes a great deal of difference: The behavioral consequences of otherwise identical pieces of information depend on how they are framed.” In their view, framing constitutes a potentially powerful nudge—i.e., a way of altering people’s behavior in a predictable way without changing the underlying incentives (Thaler & Sunstein, 2009; see also de Bruin & Bostrom, 2013; Downs, 2014).

In the case of COVID-19 health messaging, communicators could emphasize either (a) the benefits of compliance (i.e., *gain framing*) or (b) the costs of non-compliance (i.e., *loss framing*) with recommended actions. For example, as depicted in Fig. 1, the United States Centers for Disease Control and Prevention (CDC) website (perhaps unintentionally) framed messages in terms of gains, asking the public to: “Wear a mask. Save lives” (CDC, 2021). However, an alternative loss framing might have said: “If you do not wear a mask, lives may be lost.”

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Erin M. Buchanan and Nicholas A. Coles contributed equally to this work.

Fig. 1 An example of a public service announcement from the CDC. This public service announcement used gain-framed messages to encourage mask-wearing (image from May, 2021)



Given the ability of news media, national and international health organizations, and political leaders to reach wide audiences, message framing effects could save a substantial number of lives with limited implementation costs. With this possibility in mind, we conducted an experiment to test the effect of loss- versus gain-framing of COVID-19-related public health messages on behavioral intentions, policy attitudes, and information seeking among participants in 84 countries during the pandemic. Moreover, we sought to assess the potential benefit of changes on those outcomes against the potential emotional costs that loss (vs. gain) framing might elicit.¹ Prior studies suggest that loss frames (versus gain frames) are associated with relatively more global negative than positive affect (Nabi et al., 2020; Gosling et al., 2020). Here, we chose to examine whether loss (versus gain) framing would increase participants' anxiety, in particular, given that framing effects on anxiety have received little to no empirical attention and that anxiety has the potential to trigger significant health burdens.

Anxiety, “an emotion characterized by feelings of tension, worried thoughts, and physical changes like increased blood pressure” (American Psychological Association, 2021), may take the form of a temporary state, a chronic trait-like tendency, or a clinical disorder.² Anxiety has been linked with leading causes of human morbidity and mortality. For example, heightened anxiety

is linked to increased risk of cardiovascular disease mortality and morbidity (e.g., heart disease, stroke, and heart failure; Levine et al., 2021). It has also been linked to increased reactivity to losses (Hartley & Phelps, 2012; Xu et al., 2013) and increased stress hormone secretion (i.e., cortisol), which, when chronic, diminishes immune function and complicates individuals' ability to cope with stress (for review, Taylor, 2021). Moreover, the effect of anxiety on stress hormone secretion may worsen with age (Ó Hartaigh et al., 2012; Otte et al., 2005), potentially putting elderly individuals who already face heightened risks from COVID-19 in an even more vulnerable position. While the anxiety triggered by exposure to public health messages is likely mild compared to the levels associated with a clinical disorder, any potential behavioral benefit from message framing must still be weighed against a potential emotional cost (intended or otherwise).

Given the global nature of the pandemic, it is critical to assess the generalizability of message framing effects on a global scale. Traditionally, psychological research on human behavior includes sample populations in western, educated, industrialized, rich, and democratic societies (i.e., WEIRD societies; Henrich et al., 2010a, 2010b). However, extrapolating from studies conducted in only a single location may miss meaningful cross-regional variation in effects. Consequently, this can lead to incomplete—and even potentially detrimental—policy recommendations. Thus, rather than

¹ Although behavioral decision researchers studying loss vs. gain framing have traditionally examined emotional states to understand their influence on behaviors and attitudes (for reviews, Dorison, Klusowski et al., 2020; Lerner et al., 2015), they have tended to omit emotion as an outcome in nudge-style interventions (i.e., interventions that encourage desirable behavior without restricting choice or introducing economic incentives; Thaler & Sunstein, 2009). For counter-examples, see Allcott & Kessler, 2019; Loewenstein & O'Donoghue, 2006; Zlatev & Rogers, 2020.

² Anxiety disorders are ranked as the sixth largest contributor to non-fatal health loss globally and appear in the top 10 causes of years of healthy life lost in all WHO Regions (World Health Organization, 2021). We chose anxiety not only because it was a focal emotional state heightened by the pandemic (Aknin et al., 2021), but also because of its association with negative downstream consequences for coping and for overall health.

assume generalization from a single population, research that aims to inform global policy recommendations during COVID-19 should incorporate a global sample (c.f., Bauer, 2019).

Method

We launched a global participant recruitment effort between April and September 2020, collecting data in 48 languages from 15,929 participants in 84 countries.³ Participants were recruited by (1) research groups affiliated with the Psychological Science Accelerator (PSA; Moshontz et al., 2018) and (2) semi-representative research panels. The present experiment was bundled with another experiment—also conducted in collaboration with the PSA, but led by an independent research group—that assessed the relative effects of autonomy-supportive messages vs. controlling messages on motivation and behavioral intentions relevant to COVID-19. Participants completed both experiments in a randomized order after completing a pre-study survey that included demographic questions (for full wording of all questions from the pre-study survey and relevant descriptive statistics, see Table 1). The order of the study (first vs. second) did not have a main effect on any of the dependent variables, although there was one higher-order interaction with self-reported anxiety (described below). A third experiment investigated the effect of cognitive reappraisal, an emotion regulation strategy, and was conducted concurrently by the PSA with a different sample of participants (Wang et al., 2021).

In the present experiment, participants were randomly assigned to read COVID-19 health recommendations adapted from World Health Organization (WHO) advisories (e.g., social distancing, mask wearing) that were framed in terms of losses (e.g., “if you do not practice these four steps, you can endanger yourself and others”) or gains (e.g., “if you practice these four steps, you can protect yourself and others”). To ensure that any observed effects arose from meaningful conceptual differences (as opposed to particular wording; see Wells & Windschitl, 1999), we also examined three variations of the framed messages (described below). These variations of the framed messages were designed to assess generalizability of loss vs. gain framing across different wordings. As such, the differences in wording are relatively minor compared to the more central manipulation of loss vs. gain framing. Thus, participants were randomly assigned to one of six between-subjects experimental conditions that varied both the

framing and wording/version of the COVID-19 health recommendation.

Following the message framing manipulation, we measured four outcome variables: (1) behavioral intentions to follow guidelines to prevent COVID-19 transmission, (2) attitudes toward COVID-19 prevention policies, (3) whether participants chose to seek more information about COVID-19, and (4) self-reported anxiety. Seeking to create conditions under which one might detect any systematic effect of framing, we selected scale responses concerning behavioral intentions and information seeking as outcome variables. We selected attitudes toward COVID-19 prevention policies because garnering citizen support for public policies is a critical ingredient in successfully combating the COVID-19 pandemic. Finally, we measured self-reported anxiety to assess the extent to which message framing may trigger unintended affective consequences, beyond traditional behavioral or policy outcomes.

Psychological Science Accelerator (PSA) COVID-19 Rapid Project

We conducted the present experiment as part of a larger PSA COVID-19 Rapid Project, which involved one pre-study general survey and three experiments related to COVID-19 (Forscher et al., 2020). The study and the experiments were presented online through the *formR* survey platform (Arslan et al., 2020). The present experiment was bundled with another experiment, both of which participants completed in random order after completing the pre-study general survey that included questions about beliefs and behaviors related to COVID-19.

Participants

Sample size was primarily determined by the availability of resources among members of the PSA. Nevertheless, results from an a-priori power simulation estimating power as a function of number of countries, number of participants per country, intraclass correlations, effect sizes, and between-country variability in effect sizes can be found at <https://osf.io/m6q8f/>. After excluding data from participants who (a) had corrupted data due to technical difficulties, (b) did not provide responses to our outcomes of interest, or (c) did not indicate their country of origin, we were left with data from 15,929 participants (62% female, 37% male, 1% other or non-response, < 1% other; $M_{\text{age}} = 33.70$, $SD_{\text{age}} = 14.45$), who lived in 84 different countries and completed the survey in a total of 48 languages. Participants were recruited either through semi-representative research panels ($n = 5,555$) or by PSA research groups ($n = 10,374$; see Forscher et al., 2020, for more details on sampling and translations). The survey was conducted during the Spring and Summer of 2020.

³ For country classification, we relied on standards promoted by the International Organization for Standardization. Nevertheless, we acknowledge the presence of ongoing territory disputes that are not reflected in these standards.

Table 1 Questions, response format, and relevant descriptive statistics of measures in the pre-study survey

Question text	Response format	Relevant descriptives
In the past seven days, how many times did you go out of your home or residence?	Open numeric	$M = 7.42, SD = 7.1$
In the past seven days, what were your reasons for going out of your home or residence? Please check all that apply.	Multiple choice	Work: 41%; Health visits: 16%; Groceries: 70% Non-essential goods: 21%; Visiting family and friends: 34%; Outdoor physical activity: 32%; Animal care: 12%; Other: 15
Of the places that you visited in the past seven days, how many would you characterize as being crowded? Crowded here means that you could not maintain a 6-foot/2-meter distance between you and other people.	Numeric (1 = None of them; 6 = All of them)	$M = 3.32, SD = 1.26$
When you have gone out in the past seven days, how often have you worn a mask for your face?	Numeric (1 = Never; 6 = All the time)	$M = 4.44, SD = 1.64$
If you wore a mask when going outside your home, what type did you most frequently wear?	Forced choice	Cloth mask: 39%; Surgical mask: 33%; N95/FFP1/P100/other respirator: 6%; Homemade/makeshift mask: 4%; Unsure: 2%; None: 13%; Not applicable: 4%
In the past seven days, where have you most frequently directed your coughs and sneezes?	Forced choice	Air: 4%; Palms: 8%; Tissue/handkerchief: 10%; Elbow: 42%; Mask: 9%; Not applicable: 28%
Different cities and regions around the world are placing different levels of restrictions on their residents to slow the spread of COVID-19. Which of these options best describes the restrictions that are currently in place in your area?	Forced choice	Total lockdown: 12%; Partial lockdown: 60%; No lockdown: 28%
How difficult do you find the level of restrictions in your area to manage?	Numeric (1 = Not at all difficult, 5 = Extremely difficult)	$M = 2.24, SD = 1.12$
I live in a country where the central government provides honest and helpful guidance about issues related to public health.	Numeric (1 = Strongly disagree, 7 = Strongly agree)	$M = 4.67, SD = 1.91$
I live in a city or region where the local government provides honest and helpful guidance about issues related to public health.	Numeric (1 = Strongly disagree, 7 = Strongly agree)	$M = 4.74, SD = 1.78$
To what degree are you satisfied or dissatisfied with the current policies of your national government to slow the spread of COVID-19?	Numeric (1 = Extremely dissatisfied, 7 = Extremely satisfied)	$M = 4.24, SD = 1.72$
Have you ever been tested for COVID-19?	Forced choice	Yes, tested positive: 1%; Yes, tested negative, but diagnosed positive: 1%; Yes, tested negative, not diagnosed positive: 7%; No, diagnosed positive: 3%; No: 88%
Are you currently self-isolating due to flu-like or cold-like symptoms?	Forced choice	Yes: 5%; No: 95%
To the best of your knowledge, have you been exposed to anyone known or suspected of having COVID-19 within the past two weeks?	Forced choice	Yes: 7%; No: 93%
How confident are you about your understanding of how COVID-19 spreads?	Numeric (1 = Not at all confident, 5 = Extremely confident)	$M = 3.6, SD = 1$
Based on your current daily routine, how confident are you that you can prevent yourself from catching or spreading COVID-19?	Numeric (1 = Not at all confident, 5 = Extremely confident)	$M = 3.32, SD = 1.05$
How worried are you that your physical well-being will get worse over the next two weeks?	Numeric (1 = Not at all worried, 5 = Extremely worried)	$M = 1.99, SD = 1.08$
How worried are you that your emotional well-being will get worse over the next two weeks?	Numeric (1 = Not at all worried, 5 = Extremely worried)	$M = 2.23, SD = 1.24$
How did you receive this survey?	Forced choice	Research agency: 20%; University pool: 29%; Friends or family: 17%; Social media: 27%; Other: 7%
How would you describe your current employment?	Forced choice	Employed with current income: 46%; Employed without current income: 6%; Not employed with current income: 15%; Not employed without current income: 32%

Table 1 (continued)

Question text	Response format	Relevant descriptives
If you are employed, would you describe your current employment as providing an essential service during the pandemic? Essential services include roles for which interruptions would pose a danger to community health and safety.	Forced choice	Yes: 21%; No: 36%; Not employed: 43%
How old are you, in years?	Open numeric	$M = 33.59, SD = 14.51$
What is your gender?	Forced choice	Female: 62%; Male: 37%; Other: 0%; Decline: 0%
What is the highest degree or level of school you have completed? If currently enrolled, please indicate highest level received.	Forced choice	Less than high school: 2%; High school: 27%; Some college: 14%; Two year degree: 16%; Four year degree: 27%; Professional degree: 12%; Doctorate: 2%; Unknown: 0%
How would you describe the community where you're staying?	Forced choice	Urban: 56%; Suburban: 28%; Rural: 16%
Including you, how many members are there in your residence or household?	Open numeric	$M = 3.68, SD = 2.45$
Of all the members, including you, how many have existing health conditions, such as heart or lung disease, diabetes, or a chronic illness?	Open numeric	$M = 1.63, SD = 1.52$
On which rung would you place yourself on this [socioeconomic status] ladder?	Numeric (1 = lowest, 10 = highest)	$M = 5.76, SD = 1.8$

Procedure

Independent Variables

Participants were randomly assigned to view loss- or gain-framed versions of four recommendations related to COVID-19 adapted from the WHO in Spring 2020. These recommendations related to (1) staying home (unless absolutely necessary), (2) avoiding all shops other than necessary ones (such as for food), (3) wearing a mouth and nose covering in public at all times, and (4) completely isolating if exposed to COVID-19. All participants viewed four similarly worded recommendations—but were randomly assigned to view either a loss- or gain-framed message. To examine whether our conclusions generalize across multiple variants of framed messages, we created three different versions of each frame (see Wells & Windschitl, 1999, for more information on the importance of this stimulus sampling approach). Thus, the experiment took the form of a 2 (Framing: gain, loss) \times 3 (Version: Version 1, Version 2, Version 3) between-subjects factorial design, featuring the following messages:

- *Gain/Version 1*: “There is so much to gain. If you practice these four steps, you can protect yourself and others.”
- *Gain/Version 2*: “You have so much to gain. You can protect yourself and others if you practice these four steps.”

- *Gain/Version 3*: “There is so much to gain. Practicing these four steps can help you stay healthy and protect the health of others.”
- *Loss/Version 1*: “There is so much to lose. If you do not practice these four steps, you can endanger yourself and others.”
- *Loss/Version 2*: “You have so much to lose. You can endanger yourself and others if you do not practice these four steps.”
- *Loss/Version 3*: “There is so much to lose. You can get sick and endanger the health of others if you do not practice these four steps.”

The four recommendations and dependent variables were displayed for all participants, with the message frame and version type varied by condition. The manipulated message appeared at the top of the pages displaying each recommendation and instructions when completing the outcome variables.

Manipulation Check

At the end of the survey, participants completed a manipulation check. We asked participants which of the following phrases, if any, they recalled reading during the survey: (a) There is so much to gain. You can stay healthy and protect others by...; (b) There is so much to lose. You can avoid losing your health and avoid endangering others by...; or (c) neither.

Exact wording varied to match the precise wording across the six conditions.

Dependent Variables

After reading the four recommendations (with message framing varied by condition), participants completed three self-report questionnaires: behavioral intentions to follow guidelines to prevent COVID-19 transmission, attitudes toward COVID-19 prevention policies, and self-reported anxiety (described below). Afterwards, participants completed a behavioral measure, wherein they indicated whether they would be interested in learning more information about safe practices regarding COVID-19 (and were thus directed to the WHO website). Full wording of

all items are presented in Table 2. While the questions themselves were identical across conditions, participants received different instructions depending on their randomly-assigned condition. For example, for the behavioral intention questionnaire, participants in the gain/version 1 condition saw: “Stay healthy and protect others. There is so much to gain. We are interested in how you yourself will respond in the coming week in order to stay healthy and protect others.” Participants in the loss/version 1 condition saw: “Avoid losing your health and avoid endangering others. We are interested in how you yourself will respond in the coming week in order to avoid losing your health and avoid endangering others.” The presentation order of the dependent variables was held constant for all participants.

Table 2 Outcome variables, question text, and response format for the main survey

Outcome variable	Item	Response format
Behavioral Intentions	In the coming two weeks, if there is an order to stay at home at all times except times deemed essential, how likely are you to follow that order?	7-point scale with the following points: Extremely unlikely, moderately unlikely, slightly unlikely, neither likely nor unlikely, slightly likely, moderately likely, extremely likely
Behavioral Intentions	In the coming two weeks, if you are taking care of someone who is sick with COVID-19, how likely are you to wear a mouth and nose covering (such as a mask) in public at all times?	7-point scale with the following points: Extremely unlikely, moderately unlikely, slightly unlikely, neither likely nor unlikely, slightly likely, moderately likely, extremely likely
Behavioral Intentions	In the coming two weeks, if you notice yourself coughing and sneezing, how likely are you to wear a mouth and nose covering (such as a mask) in public at all times?	7-point scale with the following points: Extremely unlikely, moderately unlikely, slightly unlikely, neither likely nor unlikely, slightly likely, moderately likely, extremely likely
Behavioral Intentions	In the coming two weeks, if you think you may have been exposed to COVID-19, how likely are you to completely isolate yourself?	7-point scale with the following points: Extremely unlikely, moderately unlikely, slightly unlikely, neither likely nor unlikely, slightly likely, moderately likely, extremely likely
Policy support (individual autonomy)	Government health officials should allow individuals to determine how best to deal with the present COVID-19 pandemic	7-point scale with the following points: Strongly disagree, moderately disagree, slightly disagree, neither agree nor disagree, slightly agree, moderately agree, strongly agree
Policy support (individual autonomy)	Individuals, not governments, should decide how best to act during the COVID-19 pandemic	7-point scale with the following points: Strongly disagree, moderately disagree, slightly disagree, neither agree nor disagree, slightly agree, moderately agree, strongly agree
Policy support (government power)	Government health officials should authorize law enforcement to fine anyone who violates restrictions to slow the spread of COVID-19	7-point scale with the following points: Strongly disagree, moderately disagree, slightly disagree, neither agree nor disagree, slightly agree, moderately agree, strongly agree
Policy support (government power)	Government health officials should do everything in their power to address the spread of COVID-19, even if it severely limits daily activities for citizens	7-point scale with the following points: Strongly disagree, moderately disagree, slightly disagree, neither agree nor disagree, slightly agree, moderately agree, strongly agree
Policy support (government power)	Government health officials should decide how long social distancing practices stay in place	7-point scale with the following points: Strongly disagree, moderately disagree, slightly disagree, neither agree nor disagree, slightly agree, moderately agree, strongly agree
Anxiety	To what extent do you feel anxious when considering these recommendations?	5-point scale with the following points: not at all, slightly, moderately, very much, extremely
Anxiety	To what extent do you feel afraid when considering these recommendations?	5-point scale with the following points: not at all, slightly, moderately, very much, extremely
Anxiety	To what extent do you feel fearful when considering these recommendations?	5-point scale with the following points: not at all, slightly, moderately, very much, extremely
Information seeking	At the end of the study today, would you like to learn the latest reliable information about COVID-19?	binary response: yes, no

For the outcome variables, we created ad-hoc face-valid measures and relied on exploratory analyses to assess internal consistency and convergent validity (see “Results” section).⁴ Participants first indicated their intentions to engage in a variety of COVID-19 preventative behaviors (adapted from WHO recommendations at the time of survey launch in Spring 2020). Specifically, participants indicated how likely they were to (1) stay at home at all times unless absolutely necessary, (2) avoid all shops other than necessary ones (such as for food), (3) wear a mouth and nose covering (such as a mask) in public at all times, and (4) completely isolate themselves if they think they have been exposed to COVID-19. The four questions were presented in a randomized order and all responses were on a 7-point scale (1 = Extremely unlikely to 7 = Extremely likely).

Of note, we observed an unexpected J-shaped distribution in behavioral intentions—wherein a large majority of participants indicated very strong intentions to engage in protective behaviors ($M = 6.47$, $SD = 0.91$ on a 7-point scale). In the *SI*, we discuss potential explanations for, and additional analyses regarding, the restriction of range. Despite the restriction of range (and thus smaller-than-expected variation in the measure), behavioral intentions were still correlated with other variables in the convergent validity analyses (r s from .04 to .35; described in “Results” section below). Furthermore, we did not observe a restriction of range in the other continuous outcomes: attitudes about policies that empower individuals ($M = 3.46$, $SD = 1.93$ on a 7-point scale), attitudes about policies that extend government power ($M = 5.67$, $SD = 1.31$ on a 7-point scale), and anxiety ($M = 2.44$, $SD = 1.17$ on a 5-point scale). Concerns about restrictions of range also were not applicable to the measure of information seeking (25% no, 75% yes).

After responding to the behavioral intention items, participants reported their attitudes toward five statements regarding COVID-19 prevention policies. The policy attitude items focused on trade-offs between individual rights and collective security. Two statements emphasized individual rights and autonomy (e.g., “Individuals, not governments, should decide how best to act during the COVID-19 pandemic”), whereas the other three statements emphasized collective security (e.g., “Government health officials should do everything in their power to address the spread of COVID-19, even if it severely limits daily activities for citizens”). The five questions were presented in a randomized order and all responses were on a 7-point scale (1 = Strongly disagree to 7 = Strongly agree).

Next, the survey asked participants to indicate the extent to which they felt anxious, afraid, and fearful when considering the COVID-19 health recommendations. The three questions were presented in a randomized order and all responses were on 5-point scales (1 = Not at all to 5 = Extremely).

⁴ Unfortunately, due to the time pressure to launch this international data collection effort at the onset of the global pandemic, we did not have time to pretest the stimuli for the study.

Last, participants were asked if they would like to learn more information about COVID-19. (All participants, regardless of stated preference, received additional information about COVID-19 at the end of the study.) A one-item question asked participants: “At the end of the study today, would you like to learn the latest reliable information about COVID-19?” The dependent variable was assessed as a binary variable (Yes, No).

Ethics

All participating research groups either obtained approval from their host institution’s ethics committee, indicated that their institution did not require approval to conduct this type of experiment, or indicated that the experiment was covered by a preexisting ethics approval. All participants provided informed consent.

Results

First, we report a set of preliminary analyses concerning the manipulation check, internal consistency of scales, and convergent validity among variables. Next, we report the results of our inferential analyses. Finally, we report additional exploratory analyses regarding anxiety. Data, code, materials, power simulation details, and the pre-registered analysis plan for this experiment are available at <https://osf.io/m6q8f/>.

Preliminary Analyses

Manipulation Check

Results revealed that 73% of participants correctly identified their condition from among three different response options (gain message, loss message, or neither). In order to be conservative, and to keep with our pre-registration plan, we reported results with the full (Intent to Treat) sample even though 27% of participants did not correctly identify which treatment they received. Importantly, however, the pattern of results was similar when we restricted the sample to just the portion of the sample that passed the manipulation check (see *SI* for more information).

Internal Consistency of Outcome Measures

Internal consistency for both the four-item behavioral intention and three-item self-reported anxiety measures was appropriate ($\alpha > .78$, average inter-item $r > .47$). The internal consistency of the five-item policy support measure, however, was lower than expected ($\alpha = .67$; average inter-item $r = .29$). Thus, per our pre-registration plan, we performed an exploratory factor analysis. This exploratory factor analysis used varimax rotation and a minimal residual factoring

method to identify two distinct subgroups of items: support for (1) policies that empower individuals to make decisions about COVID-19 (two items; $\alpha = .74$; average inter-item $r = .59$), and (2) policies that extend governments' ability to stop the spread of COVID-19 (three items; $\alpha = .77$; average inter-item $r = .53$). These two scales were weakly and negatively correlated ($r = -.15, p < .001$), and we analyzed the two subscales separately. Our behavioral measure of information-seeking was a single item and thus internal consistency analyses are not applicable.

Convergent Validity of Outcome Variables

We examined the extent to which our outcome measures were associated with conceptually-related variables. To do so, we (a) post-hoc identified conceptually-related variables from the pre-study general survey, and (b) examined the extent to which they were associated with the outcome variables. Notably, these general survey items were administered before the present study (and thus were not affected by participants' experience in the study). In all cases, we observed associations in the anticipated direction ($ps < .001$) that ranged from very small ($|r| = .04$) to medium ($|r| = .35$) in size. For example, behavioral intentions were positively associated with the self-reported number of times that participants had recently worn a mask ($r = .28, p < .001$; see *SI* for more detail).

Inferential Analyses

We first modeled each outcome variable using linear (for continuous variables) or logistic (for dichotomized variables) mixed-effects regression with message framing entered as an effect-coded factor, country-level random intercepts, and country-level random slopes. For all outcomes besides behavioral intentions, country-level random slopes led to singular fits and were subsequently removed. These convergence issues provided preliminary evidence that the estimated effects of message framing on our outcomes of interest were consistent across countries. To facilitate comparisons across outcomes, we also estimated the overall message framing effects using random-effects meta-analysis. For the meta-analysis, we used Cohen's d as the effect size index, wherein positive values indicated higher levels of the outcome variables in the loss- (vs. gain-) framed conditions.⁵

⁵ For dichotomous outcomes (i.e., information seeking), we converted log odds ratios to Cohen's d s (Borenstein et al., 2009). Countries without at least one observation in each of the conditions were excluded from the meta-analysis.

Effects on Behavioral Intentions, Policy Support, and Information Seeking

Our first set of analyses tested the effect of message framing on behavioral intentions, attitudes toward two types of policies, and information seeking. Results indicated that framing messages in terms of losses vs. gains had extremely small, non-significant effects on (1) intentions to engage in protective behavior a 0.03 increase on a 7-point scale; $F(1, 35.17) = 2.70, p = .110, d = 0.03, 95\% \text{ CI} [-0.01, 0.07], \tau^2 = 0.005$; (2) support for policies that empower individuals to make decisions about COVID-19 a 0.01 increase on a 7-point scale; $F(1, 15871) = 0.05, p = .826, d = 0.004, 95\% \text{ CI} [-0.03, 0.04], \tau^2 \approx 0$; (3) support for policies that extend governments' ability to stop the spread of COVID-19 a 0.04 increase on a 7-point scale; $F(1, 15877) = 3.46, p = .063, d = 0.03, 95\% \text{ CI} [0.002, 0.06], \tau^2 \approx 0$; and (4) the probability that participants sought additional information about COVID-19 (a 1.2% point decrease; $z = -1.80, p = .071, d = -0.008, 95\% \text{ CI} [-0.02, 0.004], \tau^2 \approx 0$). Notably, the low τ^2 values suggest that the estimated effects of message framing on our outcomes of interest were consistent across countries (see Fig. 2).

While we found little evidence of between-country heterogeneity in the effects of message framing on behavioral intentions, attitudes, and information seeking, we next examined whether these estimated effects were moderated by methodological features of the study, such as (a) the version of the framed message (versions 1–3), (b) the sampling pool (panel, non-panel), and (c) the order in which participants completed the two bundled studies (present experiment first, present experiment second). To do so, we separately added each moderator-of-interest and its higher-order interaction with message framing as effect-coded factors in the mixed-effects models described above. Results did not indicate that the message framing effects interacted with any of the moderators of interest ($ps > .138$).

To probe the robustness of the estimated effects of message framing on behavioral intentions, attitudes, and information seeking, we performed exploratory *multiverse analyses* (also sometimes described as a specification-curve analysis; Simonsohn et al., 2020; Steegen et al., 2016).⁶ The present multiverse analyses examined how 398 justifiable approaches to data processing and modeling affected our conclusions.

⁶ Such multiverse analyses acknowledge that (1) there are often many justifiable approaches to processing and modeling data, (2) justifiable differences in the processing and modeling of data can change the inferences one might draw from the data, (3) examining different data processing and modeling approaches helps probe the robustness of a set of results, and (4) reporting how different data processing and modeling approaches impact results can improve the transparency and credibility of research findings (Lebel et al., 2018). In the main text, we describe the results of multiverse analysis models that converged. Nevertheless, we describe the results of additional analytic approaches that yielded model convergence issues in the *SI*.

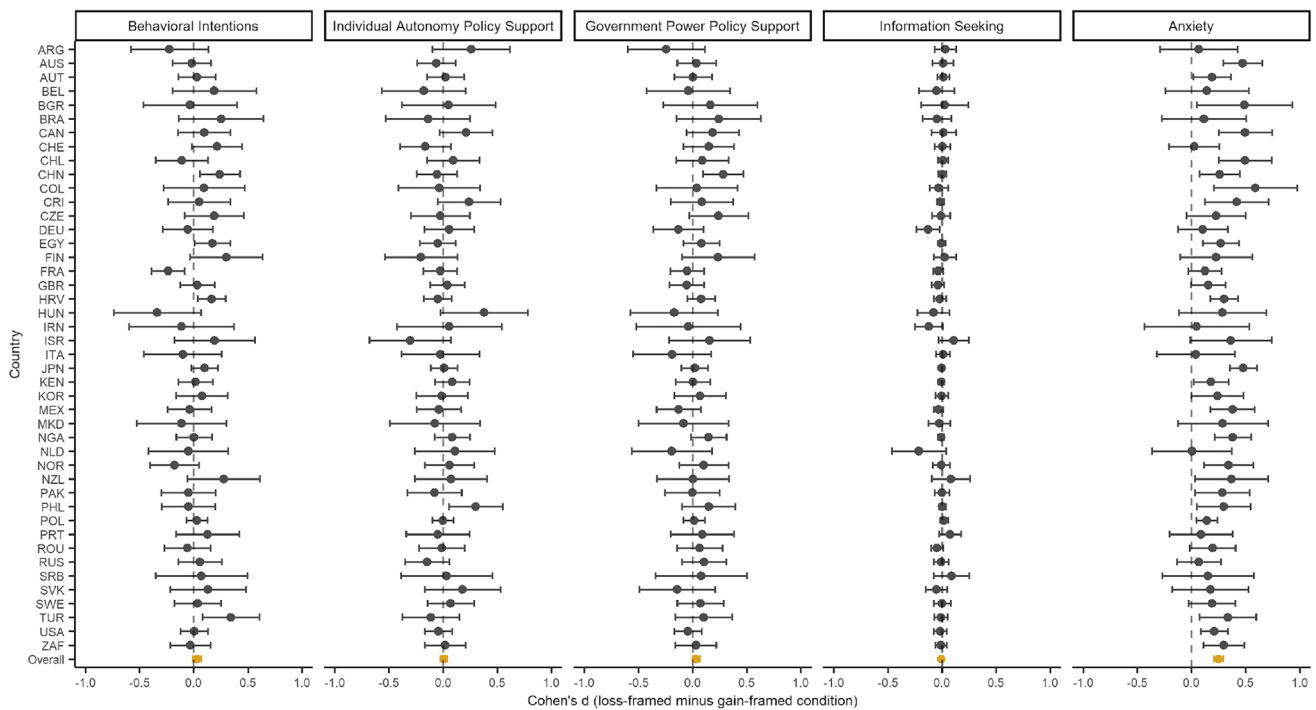


Fig. 2 Loss-framed vs. gain-framed messages regarding COVID-19 influenced anxiety but not behavioral intentions, policy support, or information seeking. Cohen's *d* was used as the effect size, with positive values indicating higher levels of the outcome variable in the loss-framed vs. gain-framed condition. Dots and bars represent the effect size estimates and 95% confidence intervals respectively. Country-level effect

size estimates are denoted in black and overall effect size estimates are denoted in yellow. Country names are denoted by their International Organization for Standardization codes. To improve the viewability of the x-axis, 40 countries with fewer than 30 participants per group (i.e., relatively wide error bars) are removed from the plot. Nevertheless, these countries are still included in the overall effect size estimates

Most approaches indicated that message framing did not impact intentions to engage in protective behavior (87% of models) or support for COVID-19-related policies (67% of models). In the scenarios where the estimated message framing effects were significant, the magnitudes were extremely small (i.e., less than a 0.06 change on a 7-point behavioral intentions measure; less than a 0.20 change in a 7-point policy support measure). Many justifiable data processing and analysis approaches did indicate that framing messages in terms of losses (vs. gains) decreased information seeking (80% of models). However, in these scenarios, the magnitude was small (i.e., less than a 4% point decrease in the probability of seeking information; see *SI* for more information).

Effects on Self-Reported Anxiety

The next set of analyses examined whether loss-framed vs. gain-framed messages had a differential impact on self-reported anxiety. Results indicated that participants reported higher levels of anxiety after being exposed to loss- ($M = 2.58, SD = 1.18$) vs. gain-framed ($M = 2.30, SD = 1.14$) messages, $F(1, 15881) = 253.67, p < .001, d = 0.25, 95\% CI [0.21, 0.29], \tau^2 = 0.007$. Once again, the low τ^2 value suggests that the estimated effect of message framing on anxiety was consistent across countries (see Fig. 2).

To assess these anxiety results in terms of practical perspective, we estimated the association between (a) self-reported personal exposure to COVID-19 (a presumably anxiety-producing event that was measured as a binary variable in the pre-study survey), and (b) experienced anxiety after the framing manipulation. The estimated effect of message framing on anxiety was nearly 1.5 times the size of the estimated association between actual exposure to COVID-19 and anxiety (which was associated with a 0.19 increase on the 5-point anxiety measure). Thus, in practical terms, the effect of message framing on anxiety appeared substantial. That being said, comparing the size of these relationships could be complicated by the fact that people who were exposed to COVID-19 and avoided negative outcomes could have decreased (rather than increased) anxiety.⁷ Future research is needed to further benchmark the relative size of loss- vs. gain-framing on self-reported anxiety.

Similar to the analyses of the other outcome variables, we next examined whether the estimated effect of framing on anxiety was moderated by methodological features of the study. Results did not indicate that the effect of message framing on anxiety was moderated by the version of the message ($p = .368$) or the sampling pool ($p = .799$). This implies that the

⁷ We thank the review team for this point.

underlying construct itself (loss vs. gain framing), rather than the particular wording associated with any instantiation of it, drives the effects. Inconsequentially, the message framing effect was moderated by the order in which participants completed the study, $F(1, 15880) = 4.35$, $p = .037$. Follow-up contrasts indicated that the effect of framing on anxiety was slightly larger when participants completed our study second (where message framing led to a 0.32 shift on the 5-point anxiety measure) vs. first (where message framing led to a 0.24 shift in the anxiety measure). It could be the case that completing the other study first (which also asked participants to read COVID-19 health messaging) heightened attention to COVID-19, and thus magnified the anxiety effects observed in the present data. Importantly, however, the observed effect of message framing on anxiety was significant regardless of the order of the studies (both $ps < .0001$) and the moderation by study order was relatively inconsequential in size compared to the overall effect of loss- vs. gain-framing.

Finally, we conducted a multiverse analysis to examine how 162 justifiable approaches to data processing and modeling affected our conclusions about anxiety. Strikingly, *all* 162 justifiable data processing and modeling approaches examined in the multiverse analysis indicated that framing messages in terms of losses (vs. gains) significantly increased anxiety (all $ps < .001$; all mean differences > 0.21). These results suggest that the inferences regarding the effects of message framing on anxiety are robust across a wide variety of justifiable analytic decisions.

Additional Analyses Regarding Pre-Study Worry

Our analyses to this point have examined anxiety in response to the framed messages. However, the pre-study survey also included two items assessing anxiety-relevant states: worry regarding one's physical and emotional health. Both items were moderately correlated ($r = .58$) and answered on 5-point scales (1 = Not at all worried, 5 = Extremely worried). For simplicity, we averaged the two items and refer to this combined index as pre-study worry. (Statistical significance of results remains unchanged when we analyze the two items separately.)

In order to be maximally comprehensive, we conducted a set of exploratory (post-hoc) analyses concerning whether loss (vs. gain) framing would exert differential effects on any of the four outcome variables for individuals higher (vs. lower) on pre-study worry. That is, we tested whether pre-study worry moderated any of the message framing effects documented above. To test this possibility, we modeled each outcome variable with (a) frame entered as an effect-coded factor, (b) pre-study worry entered mean-centered, (c) their higher-order interaction, and (d) random intercepts for country. For behavioral intentions, policy support, and post-study anxiety, we used linear mixed-effect models; for information seeking, we

used a logistic mixed-effect model. For all outcomes, there was not a significant interaction between message framing and pre-study worry ($p > .43$), suggesting that the effect of message framing did not depend on levels of pre-study worry.

Summary

While framing messages in terms of loss (versus gain) conferred little-to-no measured benefits, such loss framing exerted moderately sized and extremely consistent costs in terms of increased state anxiety (see Fig. 2). Moreover, the results for anxiety appeared consistent across countries, message wording, sampling pool, study order, and analytic choices—increasing confidence about generalizability.

Discussion

The COVID-19 pandemic (and its aftermath) highlights a critical need to effectively communicate health information to the global public. It also highlights the importance of rapidly testing psychological interventions on a global scale. We experimentally tested the differential effects of framing messages in terms of losses vs. gains on COVID-19-related behavioral intentions, policy attitudes, information seeking, and experienced anxiety.

Results indicated that message framing had little-to-no measurable benefit for behavioral intentions, policy attitudes, or information seeking, but did have a significant emotional cost in terms of increased anxiety. These results were consistent across 84 countries, three variations of the message framing wording, across semi-representative and non-representative samples, across survey order, and across 560 data processing and analytic choices. Taken together, these results imply that the conceptual difference between loss- and gain-framing accounts for its effect on anxiety (rather than any particular phrasing of stimuli, culturally specific connotation, methodological feature, or data analytic approach).

The effect of message framing on anxiety when reading loss- vs. gain-framed health recommendations was nearly 1.5 times the size of the association between self-reported personal exposure to COVID-19 and anxiety when reading the health messages, revealing the important practical impact of loss framing. Because heightened anxiety has been associated with major causes of morbidity and mortality, diminished coping abilities, and neuroendocrine dysregulation, the heightened levels of anxiety under loss-framed messages represent an important outcome. Of course, the anxiety triggered in our study was relatively mild compared to acute levels associated with clinically-diagnosable anxiety disorders. Indeed, the average post-treatment anxiety was quite low in both framing conditions (2.58/5 and 2.30/5 for the loss and gain conditions, respectively). Nevertheless, public health

communicators should benefit from learning that gain-framed messages COVID-19 messages are at least as effective as loss-framed messages in their impact on behavioral intentions, policy attitudes, and information seeking behavior—but induce significantly less anxiety at a population level.

While some commentators have urged organizations to “scare people” when communicating COVID-19 health information (e.g., in the *New York Times*; Rosenthal, 2020), the present results cast doubt on the wisdom of reminding people how much they stand to lose during the pandemic. Despite eliciting higher levels of anxiety, loss-framed (vs. gain-framed) messages did not meaningfully change behavioral intentions, information seeking behavior, or policy attitudes in the context of COVID-19. Admittedly, literature on fear appeals is nuanced (e.g., Kok et al., 2018; Peters et al., 2018). But because the present study is the largest and most globally representative study ever conducted on message framing and anxiety, there is compelling evidence that triggering anxiety through COVID-19 messaging does not improve behavioral intentions, attitudes, or actual behavior—at least in this context.

More generally, the present results contribute to a nascent literature broadening the scope of behavioral decision (nudge-style) interventions beyond strictly behavioral outcomes. Fields such as public health and health psychology have long considered affective states to be crucial outcome variables in and of themselves (e.g., Epel et al., 2018; Mikels et al., 2016; Taylor, 2021). The field of communication has also begun to consider affect as both an outcome itself and as a mediator of behavioral outcomes (Hameleers, 2021; Wong et al., 2013; Nabi et al., 2020). In the present work, we build both on these fields, and on emerging literature in behavioral decision research (Allcott & Kessler, 2019; Haushofer et al., 2021; Zlatev & Rogers, 2020), to propose that emotional consequences should be considered when evaluating the costs vs. benefits of nudge-style interventions (c.f., Glaeser, 2005).⁸ In the present case, under an expanded cost-benefit analysis that includes emotional consequences (c.f. Dukes et al., 2021), messages framed in terms of gains appear superior (for related discussion, see Loewenstein & O'Donoghue, 2006).

Limitations and Future Directions

Despite its global scope, the present experiment features some methodological limitations. First, it remains unknown whether sustained framing interventions (rather than single shot) could have stronger effects. Given that the measures rely on self-report and that the anxiety effects are measured immediately (rather than over time), it is unclear to what extent such effects

would persist outside of the specific experimental context. Second, the behavioral intentions variable exhibited restriction of range, which may have contributed to diminishing a message framing effect. However, behavioral intentions had sufficient variance to correlate with other expected predictors in the study (e.g., self-reported mask wearing), providing some evidence that the range was not sufficiently limited to preclude the detection of meaningful relationships. Moreover, we did not observe restrictions of range on policy attitudes and information seeking (variables that we similarly did not find affected by message framing).

A few future directions merit note. Most centrally, future research is needed to understand the lack of differential effects of loss vs. gain message framing on behavioral intentions, policy support, and information seeking. Perhaps the strongest explanation for why loss-gain framing shows substantial effects in other contexts—but not here—is because the present set-up differs substantially from classic loss-gain work on risk preferences. In canonical risk preference paradigms (e.g., Dorison & Heller, 2022; Kahneman & Tversky, 1979; Ruggieri et al., 2020; Tversky & Kahneman, 1991), participants are confronted with choices between a sure option and a risky gamble. Importantly, probabilities for each option are provided. Prior research identifies a robust effect that generalizes across contexts: people are typically risk-averse when the choice options are presented as losses but risk-seeking when choice options are presented as gains. Our paradigm intentionally deviated from this large body of research on loss-gain framing effects on risk preferences. In the present paradigm, probabilities were unknown and participants were not presented with a choice between a sure option and a risky gamble because it would have been unrealistic to provide known probabilities about the pandemic. Thus, the present paradigm follows more directly from research in the health psychology literature that compares health actions associated with gains (e.g., wearing sunscreen to clear skin) vs. inaction associated with losses (e.g., not wearing sunscreen to skin cancer). This literature has yielded mixed results (Rothman & Salovey, 1997; Rothman & Sheeran, 2021) for the effects of framing, suggesting that key moderators remain to be identified (for reviews, see Levin et al., 1998; van't Riet et al., 2016).

There is at least one study, however, that used a reasonably comparable paradigm but which found divergent results: Abhyankar et al. (2008) found a loss-frame advantage on intentions to obtain the MMR vaccine for one's child. It could be the case that the effects of loss- vs. gain-message framing differ when assessing health intentions for oneself vs. another person, especially when the other person is a child under one's care. Additional possibilities include that there may be something specific about an unfolding (and highly uncertain) pandemic that blunted such effects or that the gain/loss manipulations were weaker in the present study.

⁸ This idea is not new. Economist Jeremy Bentham's original (1879) conception of utility emphasized happiness as “the greatest good” (for discussion, see Lerner et al., 2022).

Four additional future directions merit note. First, following from the point above, while we found limited heterogeneity by country, future research could explore heterogeneity in the effect of message framing across other dimensions (e.g., such as the tightness vs. looseness of the culture; Gelfand et al., 2021; Uskul et al., 2009). Indeed, it could be the case that our operationalization of country was limited by the manner in which we sampled participants. Second, while we also found limited heterogeneity in the effect of message framing across the different versions of loss and gain framing, future research could examine additional versions of these messages (e.g., self- vs. other-focused messages). Third, while we conducted an initial set of analyses with the pre-study survey (focused on pre-study worry), future research could test a more comprehensive set of hypotheses using these data. Finally, while the present work expanded the scope of nudge-style outcomes beyond behavior to include anxiety, future research is needed to further integrate emotional outcomes (both immediate and long-term) into cost-benefit calculations for implementing nudge-style interventions (e.g., framing). Not only does the subjective experience of emotion matter in and of itself (anxiety creates suffering) but also the myriad effects of emotion on health (e.g., Emdin et al., 2016; Kubzansky & Kawachi, 2020) and health behavior (e.g., Dorison, Wang et al., 2020; Dorison, Klusowski et al., 2020; Ferrer et al., 2020) matter as well.

Conclusion

In a global experiment spanning 84 countries and nearly 16,000 participants, loss vs. gain message framing had a widespread effect on self-reported anxiety while exerting no notable effects on cognitive and behavioral outcomes related to the COVID-19 pandemic. To the extent that policymakers and health organizations aim to minimize anxiety during a pandemic that has engendered high levels of stress and illness, our results provide evidence that gain framing may be superior to loss framing in communicating COVID-19 prevention messages. The results hold theoretical implications for multiple literatures, including research on health message framing, social influence, affective science, and public policy. More generally, the results underscore the lesson that, for policymakers and health organizations, large-scale collaborations can provide empirical answers to global questions (Coles et al., 2022; Forscher et al., *in press*), freeing communicators from having to rely on either intuition or speculation about applications of theory in particular contexts (c.f., Haushofer & Metcalfe, 2020).

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Data Availability Data and materials are available here: <https://osf.io/m6q8f/>.

Ethics Approval All participating research groups either obtained approval from their host institution's ethics committee, explicitly indicated that their institution did not require approval to conduct this type of experiment, or explicitly indicated that the experiment was covered by a preexisting ethics approval.

Conflict of Interest The authors declare no conflict of interest.

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Contribution Statement Conceptualization: C. A. Dorison, J. S. Lerner, B. H. Heller, A. J. Rothman, I. I. Kawachi, K. Wang, V. W. Rees, B. P. Gill, N. Gibbs, N. A. Coles

Data Curation: P.S. Forscher, E.M. Buchanan

Formal Analysis: N. A. Coles, C. A. Dorison

Funding Acquisition: P.S. Forscher, H. IJzerman, C. Chartier, E.M. Buchanan

Investigation: Z. Vally, Z. Tajchman, A.N. Zsido, Z. Chen, I. Ziano, C.D. Ceary, Y. Lin, Y. Kunisato, Q. Xiao, X. Jiang, E. Yao, J. Wilson, W. Jimenez-leal, W. Law, W. Collins, K.L. Richard, W. Vranka, V. Ankushev, V. Schei, U.S. Tran, S. Yeung, W. Hassan, T.J. Lima, T. Ostermann, T. Frizzo, T.E. Sverdrup, T. House, T. Gill, T. Jemsäther, Koptjevskaja-tamm, T.J. Hostler, T. Ishii, A. Studzinska, S.M. Janssen, S.E. Schulenberg, S. Tatachari, S. Azouaghe, P. Sorokowski, A. Sorokowska, X. Song, D. Grigoryev, S. Daches, S.N. Geniole, S. Vračar, S. Massoni, S. Zorjan, E. Sarioğuz, S.G. Alves, S. Pöntinen, S. Álvarez Solas, S. Ordoñez-Riño, S. Batić Očovaj, S. Onie, S. Lins, S. Çoksan, A. Sacakli, S. Ruiz-Fernández, S. Fatahmodares, R.B. Walczak, R. Vilar, R. Cárcamo, R.M. Ross, R. Mccarthy, T. Ballantyne, E.C. Westgate, R. Afhami, D. Ren, R.P. Monteiro, U.-D. Reips, N. Reggev, R.J. Calin-jageman, R. Oliveira, M. Nedelcheva-Datsova, R.-M. Rahal, T. Radtke, R. Searston, P. Zdybek, S. Chen, J.T. Perillo, P. Kačmár, P. Macapagal, P. Szwed, P. Hanel, P.A.G. Forbes, P. Arriaga, K.

Papachristopoulos, P.S. Correa, C. Ogbonnaya, O. Bialobrzeska, N. Kiselnikova, N. Simonovic, N. Nock, N. Albayrak-Aydemir, N. Say, N. Levy, N. Torunsky, N. Van Doren, N. Sunami, N.R. Rachev, N.M. Majeed, N.S. Corral-Frías, N. Ouherrou, M.Y. Lucas, M. Pantazi, M.R. Vasilev, M. Ortiz, M.M. Butt, R. Muda, M.M. Tejada Rivera, M. Sirota, M. Seehus, M. Parzuchowski, M. Toro, M. Hricova, M. Marszałek, M. Karekla, G. Mioni, M. Westerlund, M. Vdovic, M. Bialek, M. Anne, M. Misiak, M. Grinberg, M.F. Espinoza Barria, M.C. Mensink, M. Harutyunyan, M. Khosla, M. Adamkovič, M.F. Ribeiro, M. Terskova, M. Hruška, M. Martončík, M. Voracek, M. Frias-Armenta, M. Kowal, M. Roczniowska, M. Braun Kohlová, M. Paruzel-Czachura, M. Romanova, M. Papadatou-Pastou, M.V. Jones, M.S. Ortiz, M. Manavalan, M. Kossowska, M.A. Varella, M.F. Colloff, M. Bradford, L. Vaughn, L. Eudave, L. Vieira, L. Calderón Pérez, L.B. Lazarevic, L.M. Jaremka, E. Kushnir, G. Lins De Holanda Coelho, L. Ahlgren, L. Volz, L. Boucher, L. Javela Delgado, L. Beatrix, K. Yu, J. Wachowicz, K. Desai, K. Barzykowski, L. Kozma, K. Evans, M.A. Koehn, K. Wolfé, K. Klevjer, K. Vezirian, K. Damjanović, K. Schmidt, K. Moon, J. Kelińska, J.E. Cruz Vásquez, J. Vargas-nieto, J.T. Roxas, J. Taber, J. Urriago-Rayo, J.M. Pavlacić, J. Bavolar, J.A. Soto, J.K. Olofsson, J.K. Vilsmeier, J. Czamanski-cohen, J. Boudesseul, J. Kamburidis, J. Zickfeld, J.F. Miranda, E. Hristova, J. Milosevic Djordjevic, J.V. Valentova, J. Antfolk, J. Berkessel, J. Schrötter, J. Urban, J. Röer, J.O. Norton, J.R. Silva, J. Uttley, J.R. Kunst, I.L. Ndukaihe, A. Iyer, I. Vilares, A. Ivanov, I. Ropovik, I. Sarieva, I. Prusova, I. Pinto, I.A. Almeida, I. Dalgar, I. Zakharov, A.I. Arinze, K. Ihaya, I.D. Stephen, B. Gjoneska, H. Brohmer, H. Flowe, H. Godbersen, H. Kocalar, M.V. Hedgebeth, H. Manley, G. Kaminski, G. Nilsonne, G. Anjum, G.A. Travaglino, G. Feldman, G. Pfuhl, G.M. Marcu, G. Hofer, G. Banik, G. Bijlstra, F. Verbruggen, F.Y. Kung, F. Foroni, G. Singer, F. Mosannenzadeh, E. Marinova, E. Štrukelj, E. Baskin, E. Luis Garcia, E. Musser, E. Ahn, E. Pronizius, E.A. Jackson, E. Manunta, E. Agadullina, D. Šakan, O. Dujols, D. Dubrov, M. Willis, M. Tümer, I. Djamaï, D. Vega, H. Du, D. Mola, W.E. Davis, D. Holford, D. Lewis, D.C. Vaidis, D. Hausman Ozery, D. Zambrano Ricaurte, D. Storage, D. Sousa, D. Serrato Alvarez, A. Dalla Rosa, D. Marko, D. Moreau, C. Reeck, R.C. Correia, C.M. Whitt, C. Lamm, C. Singh Solorzano, C.C. von Bastian, C.A.M. Sutherland, C.L. Aberson, C. Karashiali, C. Noone, F. Chiu, C. Karaarslan, N. Cellini, C. Esteban-serna, C. Reyna, C. Batres, C. Grano, J. Carpentier, C.H. Fu, B. Jaeger, C. Bundt, T. Bulut Allred, A. Bokkour, N. Bogatyreva, W.J. Chopik, B. Antazo, B. Behzadnia, M. Becker, W. Chou, H. Bai, B. Balci, P. Babinčák, B.J.W. Dixon, A. Mokady, H.B. Kappes, M. Atari, J. Aruta, A. Domurat, N.C. Arinze, A. Vatakis, A. Adiguzel, K. Ait El Arabi, A.A. Özdoğru, A. Olaya Torres, A. Theodoropoulou, A.P. Kassianos, A. Findor, A. Hartanto, A. Thibault Landry, A. Ferreira, A.C. Santos, A. De La Rosa-Gomez, A. Gourdon-Kanhukamwe, A. Karababa, A. Janak, A. Bran, A.M. Tullett, A.O. Kuzminska, A.J. Krafnick, A. Urooj, A. Khaoudi, A. Ahmed, A. Groyecka-Bernard, A. Askelund, A. Adetula, A. Belaus, A.C. Charyate, A.L. Wischman, A. Stoyanova, A. Greenburgh, A. Thomas, A. Arvanitis, P.S. Forscher, J.K. Miller, H. Urry, H. IJzerman, E.M. Buchanan, M.A. Primbs

Methodology: C. A. Dorison, J. S. Lerner, B. H. Heller, A. J. Rothman, I. I. Kawachi, K. Wang, V. W. Rees, B. P. Gill, N. Gibbs, N. A. Coles

Project Administration: C.R. Ebersole, Y. Yamada, M. Vranka, V. Križanić, S.C. Lewis, S. Meir Drexler, S. Morales Izquierdo, N. Reggev, R. Habte, P. Hanel, P. Arriaga, B. Paris, M.R. Vasilev, M. Alarcón Maldonado, M.A. Silan, M. Martončík, M. Oosterlinck, C.A. Levitan, L. Volz, L. Kozma, K. Barzykowski, K. Kirgizova, K. Thommesen, J.W. Suchow, J.E. Beshears, J. Antfolk, I. Sula, I.L. Pit, I. Dalgar, B. Gjoneska, H. Chuan-Peng, M. Sharifian, H. Azab, G. Kaminski, G.M. Marcu, F. Azevedo, E. Štrukelj, E. Pronizius, J.L. Beaudry, D. Dunleavy, F. Chiu, N. Cellini, B. Ishkhanyan, L. Bylinina,

T. Bulut Allred, M. Becker, A. Szabelska, A.P. Kassianos, A. Gourdon-Kanhukamwe, A. Todsén, A. Urooj, A. Ahmed, A. Askelund, A. Adetula, P.S. Forscher, P.R. Mallik, N.A. Coles, J.K. Miller, H. Moshontz, H. Urry, H. Ilzerman, D.M. Basnight-brown, C. Chartier, E.M. Buchanan, M.A. Primbs.

Resources: A.N. Zsido, M. Zrimsek, Z. Chen, Z. Gialitaki, Y. Kunisato, Y. Yamada, X. Jiang, X. Du, E. Yao, W. Cyrus-lai, W. Law, M. Vranka, V. Schei, V. Križanić, V.H. Kadreva, V. Cubela Adoric, R. Houston, T.E. Sverdrup, M. Fedotov, T. Jernsäther, M. Koptjevskaja-Tamm, T. Ishii, B. Szasz, S. Adamus, L. Suter, S. Habib, A. Studzinska, D. Stojanovska, S. Stieger, S. Azouaghe, S.C. Lewis, S. Sinkolova, S. Meir Drexler, S. Massoni, E. Sarioğuz, S. Morales Izquierdo, S.G. Alves, S. Pöntinen, S. Çoksan, A. Sacakli, S. Ruiz-Fernández, S.J. Geiger, R. Bethlehem, R. Vilar, R.P. Monteiro, U.-D. Reips, N. Reggev, R. Pourafshari, R. Oliveira, M. Nedelcheva-datsova, R.R. Ribeiro, R. Habte, S. Chen, P.G. Maturan, P. Kačmár, P. Hanel, P. Arriaga, B. Paris, O. Kácha, M. Bernardo, O. Campos, O. Niño Bravo, O.J. Galindo-Caballero, O. Bialobrzeska, N. Cohen, N. Johannes, N. Say, N. Sunami, N.R. Rachev, N. Schmidt, K. Nadif, M. Pantazi, M.R. Vasilev, M. Kabir, M. Parzuchowski, M. Alarcón Maldonado, M. Marszałek, G. Mioni, M.J. Bosma, M. Westerlund, M. Vdovic, M. Bialek, M.A. Silan, M. Capizzi, M. A. Kurfali, M. Harutyunyan, M. Korbmacher, M. Adamkovič, M. Hruška, M. Čadek, M. Kowal, M. Topor, M. Roczniowska, M. Oosterlinck, M. Paruzel-Czachura, M. Lund, M. Antoniadi, A. Muminov, M. Kossowska, M. Friedemann, M. Wielgus, L. Vieira, L. Sanabria Pineda, E. Kushnir, L. Anton-boicuk, G. Lins De Holanda Coelho, L. Ahlgren, C.A. Levitan, L. Micheli, L. Volz, M. Stojanovska, L. Samojlenko, L. Kaliska, L. Beatrix, L. Warmelink, L. Rojas-Berscia, J. Wachowicz, K. Barzykowski, L. Kozma, K. Kirgizova, B.B. Agesin, T. Korobova, K. Klejver, K. Van Schie, K. Vezirian, K. Thommesen, K. Filip, K. Grzech, K. Hoyer, K. Rana, K. Janjić, J. Kiełńska, J. Beitner, J. Vargas-Nieto, J. Bavolar, J. Messerschmidt, J. Czamanski-cohen, J. Lee, J. Kamburidis, J. Zickfeld, J.P.H. Verharen, E. Hristova, J.E. Beshears, J. Milosevic Djordjevic, J. Bosch, J. Antfolk, J. Berkessel, J. Schrötter, J. Vint, J.R. Kunst, I. Ropovik, I. Sula, I. Metin-orta, A. Bozdoc, I.L. Pit, I. Dalgar, I. Zakharov, K. Ihaya, B. Gjoneska, H. Kocalar, H. Chuan-Peng, M. Sharifian, H. Akkas, H. Azab, G. Kaminski, G. Nilsson, G. Czarnek, G.M. Marcu, G. Banik, G.A. Adetula, F. Muchembled, F. Azevedo, F. Mosannenzadeh, E. Marinova, E. Štrukelj, Z. Etebari, I.M.M. van Steenkiste, E. Pronizius, E. Manunta, D. Šakan, P. Dursun, O. Dujols, D. Dubrov, M. Tümer, J.L. Beaudry, D. Popović, D. Dunleavy, I. Djama, D. Krupić, D. Vega, D. Zambrano Ricourte, D. Serrato Alvarez, A. Dalla Rosa, D. Krupić, D. Marko, R.C. Correia, C. Singh Solorzano, C.C. von Bastian, C. Overkott, C. Wang, F. Chiu, C. Picciochi, C. Karaarslan, N. Cellini, R. Li, C. Grano, C. Tamnes, B. Ishkhanian, T. Bulut Allred, A. Bokkour, N. Bogatyreva, B. Antazo, M. Becker, B. Cocco, B. Hubena, B. Ćuro, B. Aczel, E. Baklanova, A. Mokady, A. Szala, A. Szabelska, J. Aruta, A. Domurat, A. Modena, A. Adiguzel, A. Monajem, K. Ait El Arabi, A.A. Özdoğru, A. Penić Jurković, A.P. Kassianos, A. Findor, A. Thibault Landry, A.C. Santos, A. Gourdon-Kanhukamwe, A. Todsén, A. Karababa, A. Bran, A. Khaoudi, A. Ahmed, A. Groyecka-Bernard, A. Askelund, A. Adetula, A. Stoyanova, E.M. Buchanan

Supervision: C.R. Ebersole, K. Thommesen, J.W. Suchow, M. Sharifian, A. Todsén, P.S. Forscher, P.R. Mallik, N.A. Coles, J.K. Miller, H. Moshontz, H. Urry, H. Ilzerman, D.M. Basnight-brown, C. Chartier, E.M. Buchanan, M.A. Primbs

Writing - Original Draft: C. A. Dorison, J. S. Lerner, B. H. Heller, A. J. Rothman, I. I. Kawachi, K. Wang, V. W. Rees, B. P. Gill, N. Gibbs, N. A. Coles

Writing - Review and Editing: C. A. Dorison, J. S. Lerner, B. H. Heller, A. J. Rothman, I. I. Kawachi, K. Wang, V. W. Rees, B. P. Gill, N. Gibbs, N. A. Coles, C.R. Ebersole, Z. Vally, Z. Tajchman, A.N. Zsido, M. Zrimsek, Z. Chen, I. Ziano, Z. Gialitaki, C.D. Ceary, Y. Jang, Y. Lin,

Y. Kunisato, Y. Yamada, Q. Xiao, X. Jiang, X. Du, E. Yao, J. Wilson, W. Cyrus-Lai, W. Jimenez-Leal, W. Law, W. Collins, K.L. Richard, M. Vranka, V. Ankushev, V. Schei, V. Križanić, V.H. Kadreva, V. Cubela Adoric, U.S. Tran, S. Yeung, W. Hassan, R. Houston, T.J. Lima, T. Ostermann, T. Frizzo, T.E. Sverdrup, T. House, T. Gill, M. Fedotov, T. Jernsäther, M. Koptjevskaja-Tamm, T.J. Hostler, T. Ishii, B. Szasz, S. Adamus, L. Suter, S. Habib, A. Studzinska, D. Stojanovska, S.M. Janssen, S. Stieger, S.E. Schulenberg, S. Tatchari, S. Azouaghe, P. Sorokowski, A. Sorokowska, X. Song, S.C. Lewis, S. Sinkolova, D. Grigoryev, S. Meir Drexler, S. Daches, S.N. Geniole, S. Vračar, S. Massoni, S. Zorjan, E. Sarioğuz, S. Morales Izquierdo, S.G. Alves, S. Pöntinen, S. Álvarez Solas, S. Ordoñez-Riaño, S. Batić Očovaj, S. Onie, S. Lins, S. Çoksan, A. Sacakli, S. Ruiz-Fernández, S.J. Geiger, R.M. Fatahmodares, R.B. Walczak, R. Bethlehem, R. Vilar, R. Cárcamo, R.M. Ross, R. Mccarthy, T. Ballantyne, E.C. Westgate, R. Afhami, D. Ren, R.P. Monteiro, U.-D. Reips, N. Reggev, R.J. Calin-jageman, R. Pourafshari, R. Oliveira, M. Nedelcheva-Datsova, R. Rahal, R.R. Ribeiro, T. Radtke, R. Searston, R. Habte, P. Zdybek, S. Chen, P.G. Maturan, J.T. Perillo, P.M. Isager, P. Kačmár, P. Macapagal, P. Szwed, P. Hanel, P.A.G. Forbes, B. Arriaga, B. Paris, K. Papachristopoulos, P.S. Correa, O. Kácha, M. Bernardo, O. Campos, O. Niño Bravo, O.J. Galindo-caballero, C. Ogbonnaya, O. Bialobrzeska, N. Kiselnikova, N. Simonovic, N. Cohen, N. Nock, N. Johannes, N. Albayrak-Aydemir, N. Say, N. Levy, N. Torunsky, N. Van Doren, N. Sunami, N.R. Rachev, N.M. Majeed, N. Schmidt, K. Nadif, N.S. Corral-Frías, N. Ouherrou, M. Pantazi, M.Y. Lucas, M.R. Vasilev, M. Ortiz, M.M. Butt, M. Kabir, R. Muda, M.M. Tejada Rivera, M. Sirota, M. Seehuus, M. Parzuchowski, M. Toro, M. Hricova, M. Alarcón Maldonado, M. Marszałek, M. Karekla, G. Mioni, M.J. Bosma, M. Westerlund, M. Vdovic, M. Bialek, M.A. Silan, M. Anne, M. Misiak, M. Grinberg, M. Capizzi, M.F. Espinoza Barria, M. A. Kurfali, M.C. Mensink, M. Harutyunyan, M. Khosla, M. Korbmacher, M. Adamkovič, M.F. Ribeiro, M. Terskova, M. Hruška, M. Martončík, M. Voracek, M. Čadek, M. Frias-Armenta, M. Kowal, M. Topor, M. Roczniowska, M. Oosterlinck, M. Braun Kohlová, M. Paruzel-Czachura, M. Romanova, M. Papadatou-Pastou, M. Lund, M. Antoniadi, M.V. Jones, M.S. Ortiz, M. Manavalan, A. Muminov, M. Kossowska, M. Friedemann, M. Wielgus, M.A. Varella, M.F. Colloff, M. Bradford, L. Vaughn, L. Eudave, L. Vieira, L. Sanabria Pineda, L. Calderón Pérez, L.B. Lazarevic, L.M. Jaremka, E. Kushnir, L. Anton-boicuk, G. Lins De Holanda Coelho, L. Ahlgren, C.A. Levitan, L. Micheli, L. Volz, M. Stojanovska, L. Boucher, L. Samojlenko, L. Javela Delgado, L. Kaliska, L. Beatrix, L. Warmelink, L. Rojas-Berscia, K. Yu, J. Wachowicz, K. Desai, K. Barzykowski, L. Kozma, K. Evans, K. Kirgizova, B.B. Agesin, M.A. Koehn, K. Wolfe, T. Korobova, K. Klejver, K. Van Schie, K. Vezirian, K. Damjanović, K. Thommesen, K. Schmidt, K. Filip, K. Grzech, K. Hoyer, K. Moon, K. Rana, K. Janjić, J.W. Suchow, J. Kiełńska, J.E. Cruz Vásquez, J. Beitner, J. Vargas-Nieto, J.T. Roxas, J. Taber, J. Urriago-Rayó, J.M. Pavlaci, J. Bavolar, J.A. Soto, J.K. Olofsson, J.K. Vilsmeier, J. Messerschmidt, J. Czamanski-cohen, J. Boudesseul, J. Lee, J. Kamburidis, J. Zickfeld, J.F. Miranda, J.P. Verharen, E. Hristova, J.E. Beshears, J. Milosevic Djordjevic, J. Bosch, J.V. Valentova, J. Antfolk, J. Berkessel, J. Schrötter, J. Urban, J. Röer, J.O. Norton, J.R. Silva, J.S. Pickering, J. Vint, J. Uttley, J.R. Kunst, I.L. Ndukaihe, A. Iyer, I. Vilares, A. Ivanov, I. Ropovik, I. Sula, I. Sarieva, I. Metin-orta, I. Prusova, I. Pinto, A. Bozdoc, I.A. Almeida, I.L. Pit, I. Dalgar, I. Zakharov, A.I. Arinze, K. Ihaya, I.D. Stephen, B. Gjoneska, H. Brohmer, H. Flowe, H. Godbersen, H. Kocalar, M.V. Hedgebeth, H. Chuan-Peng, M. Sharifian, H. Manley, H. Akkas, H. Azab, G. Kaminski, G. Nilsson, G. Anjum, G.A. Travaglino, G. Feldman, G. Pfuhl, G. Czarnek, G.M. Marcu, G. Hofer, G. Banik, G.A. Adetula, G. Bijlstra, F. Verbruggen, F.Y. Kung, F. Foroni, G. Singer, F. Muchembled, F. Azevedo, F. Mosannenzadeh, E. Marinova, E. Štrukelj, Z. Etebari, E. Baskin, E. Luis Garcia, E. Musser, I.M.M. van Steenkiste, E. Ahn, E. Pronizius, E.A. Jackson, E. Manunta, E. Agadullina, D. Šakan, P.

Dursun, O. Dujols, D. Dubrov, M. Willis, M. Tümer, J.L. Beaudry, D. Popović, D. Dunleavy, I. Djamai, D. Krupić, D. Vega, H. Du, D. Mola, W.E. Davis, D. Holford, D. Lewis, D.C. Vaidis, D. Hausman Ozery, D. Zambrano Ricaurte, D. Storage, D. Sousa, D. Serrato Alvarez, A. Dalla Rosa, D. Krupić, D. Marko, D. Moreau, C. Reeck, R.C. Correia, C.M. Whitt, C. Lamm, C. Singh Solorzano, C.C. von Bastian, C.A.M. Sutherland, C. Overkott, C.L. Aberson, C. Wang, C. Karashiali, C. Noone, F. Chiu, C. Picciocchi, C. Karaarslan, N. Cellini, C. Esteban-serna, C. Reyna, C. Batres, R. Li, C. Grano, J. Carpentier, C. Tamnes, C.H. Fu, B. Ishkhanyan, L. Bylinina, B. Jaeger, C. Bundt, T. Bulut Allred, A. Bokkour, N. Bogatyreva, W.J. Chopik, B. Antazo, B. Behzadnia, M. Becker, B. Cocco, W. Chou, B. Hubena, B. Turo, B. Aczel, E. Baklanova, H. Bai, B. Balci, P. Babinčák, B.J.W. Dixson, A. Mokady, H.B. Kappes, M. Atari, A. Szala, A. Szabelska, J. Aruta, A. Domurat, N.C. Arinze, A. Modena, A. Vatakis, A. Adiguzel, A. Monajem, K. Ait El Arabi, A.A. Özdoğan, A. Olaya Torres, A. Theodoropoulou, A. Penić Jurković, A.P. Kassianos, A. Findor, A. Hartanto, A. Thibault Landry, A. Ferreira, A.C. Santos, A. De La Rosagomez, A. Gourdon-Kanhukamwe, A. Todsén, A. Karababa, A. Janak, A. Bran, A.M. Tullett, A.O. Kuzminska, A.J. Krafnick, A. Urooj, A. Khaoudi, A. Ahmed, A. Groyecka-Bernard, A. Askelund, A. Adetula, A. Belaus, A.C. Charyate, A.L. Wichman, A. Stoyanova, A. Greenburgh, A. Thomas, A. Arvanitis, P.S. Forscher, P.R. Mallik, J. K. Miller, H. Moshontz, H. Urry, H. Iljerman, D.M. Basnight-brown, C. Chartier, E.M. Buchanan, M.A. Primbs.

Contributions listed here reflect reported contributions to the project. People who helped with translation are listed as Resources contributors; people who helped with data collection are listed as Investigation contributors.

The final list of authors is roughly organized in 3 tiers, with the first tier (Dorison to Gibbs) being the lead scientific team, the third tier (Forscher to Coles) being the lead administration team, and all else contributing primarily to data collection, translation, methodology, and administrative tasks. Within the first tier, authorship order corresponds to the amount of contribution. Within the second and third tiers, authorship order is largely arbitrary.

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Affiliations

Charles A. Dorison¹ · Jennifer S. Lerner^{2,3} · Blake H. Heller^{2,4} · Alexander J. Rothman⁵ · Ichiro I. Kawachi⁶ · Ke Wang² · Vaughan W. Rees⁶ · Brian P. Gill⁷ · Nancy Gibbs² · Charles R. Ebersole⁸ · Zahir Vally^{9,10} · Zuzanna Tajchman¹¹ · Andras N. Zsido¹² · Mija Zrimsek¹³ · Zhang Chen¹⁴ · Ignazio Ziano¹⁵ · Zoi Gialitaki¹⁶ · Chris D. Ceary¹⁷ · Yijun Lin¹⁸ · Yoshihiko Kunisato¹⁹ · Yuki Yamada²⁰ · Qinyu Xiao²¹ · Xiaoming Jiang²² · Xinkai Du²³ · Elvin Yao²⁴ · John Paul Wilson²⁵ · Wilson Cyrus-Lai²⁶ · William Jimenez-Leal²⁷ · Wilbert Law²⁸ · W. Matthew Collins²⁹ · Karley L. Richard¹⁷ · Marek Vranka³⁰ · Vladislav Ankushev³¹ · Vidar Schei³² · Valerija Križanić³³ · Veselina Hristova Kadreva³⁴ · Vera Cubela Adoric³⁵ · Ulrich S. Tran³⁶ · Siu Kit Yeung³⁷ · Widad Hassan³⁸ · Ralph Houston³⁹ · Tiago J. S. Lima⁴⁰ · Thomas Ostermann⁴¹ · Thomas Frizzo⁴² · Therese E. Sverdrup³² · Thea House^{43,44} · Tripat Gill⁴⁵ · Maksim Fedotov⁴⁶ · Tamar Paltrow⁴⁷ · Teodor Jernsäther⁴⁸ · Maria Koptjevskaja-Tamm⁴⁹ · Thomas J. Hostler⁵⁰ · Tatsunori Ishii⁵¹ · Barnabas Szaszi⁵² · Sylwia Adamus⁵³ · Lilian Suter⁵⁴ · Sumaiya Habib⁵⁵ · Anna Studzinska⁵⁶ · Dragana Stojanovska⁵⁷ · Steve M. J. Janssen⁵⁸ · Stefan Stieger⁵⁹ · Stefan E. Schulenberg⁶⁰ · Srinivasan Tatachari⁶¹ · Soufian Azouaghe^{62,63} · Piotr Sorokowski⁶⁴ · Agnieszka Sorokowska⁶⁴ · Xin Song¹¹ · Savannah C. Lewis⁶⁵ · Sladjana Sinkolova⁵⁷ · Dmitry Grigoryev⁶⁶ · Shira Meir Drexler⁶⁷ · Shimrit Daches⁶⁸ · Shawn N. Geniole⁶⁹ · Selena Vračar⁷⁰ · Sébastien Massoni⁴² · Saša Zorjan⁷¹ · Eylül Sarıoğuz⁷² · Sara Morales Izquierdo⁷³ · Sara G. Alves⁷⁴ · Sara Pöntinen⁷⁵ · Sara Álvarez Solas⁷⁶ · Santiago Ordoñez-Riaño⁷⁷ · Sanja Batić Očovaj⁷⁸ · Sandersan Onie^{79,80,81} · Samuel Lins⁷⁴ · Sami Çoksan⁸² · Asli Sacaklı⁸³ · Susana Ruiz-Fernández⁸⁴ · Sandra J. Geiger⁸⁵ · Saeideh FatahModares⁸⁶ · Radosław B. Walczak⁸⁷ · Ruben Betlehem³³ · Roosevelt Vilar⁸⁸ · Rodrigo Cárcamo⁸⁹ · Robert M. Ross⁹⁰ · Randy McCarthy⁹¹ · Tonia Ballantyne¹⁷ · Erin C. Westgate¹⁸ · Reza Afhami⁹² · Dongning Ren⁹³ · Renan P. Monteiro⁹⁴ · Ulf-Dietrich Reips⁹⁵ · Niv Reggev⁹⁶ · Robert J. Calin-Jageman⁹⁷ · Razieh Pourafshari⁹⁸ · Raquel Oliveira^{99,100} · Mina Nedelcheva-Datsova¹⁰¹ · Rima-Maria Rahal⁹³ · Rafael R. Ribeiro¹⁰² · Theda Radtke¹⁰³ · Rachel Searston¹⁰⁴ · Redeate Habte¹⁰⁵ · Przemysław Zdybek⁸⁷ · Sau-Chin Chen¹⁰⁶ · Princess Lovella G. Maturan¹⁰⁷ · Jennifer T. Perillo¹⁰⁸ · Peder Mortvedt Isager¹⁰⁹ · Pavol Kačmár¹¹⁰ · Paulo Manuel Macapagal^{111,112} · Paulina Szwed¹¹³ · Paul H. P. Hanel¹¹⁴ · Paul A. G. Forbes¹¹⁵ · Patricia Arriaga¹⁰² · Bastien Paris⁶³ · Konstantinos Papachristopoulos^{116,117} · Pablo Sebastián Correa¹¹⁸ · Ondřej Kácha¹¹⁹ · Márcia Bernardo¹²⁰ · Olatz Campos¹²¹ · Olalla Niño Bravo¹²² · Oscar J. Galindo-Caballero^{27,123} · Chisom Esther Ogbonnaya¹²⁴ · Olga Bialobrzeska¹²⁵ · Natalia Kiselnikova¹²⁶ · Nicolle Simonovic¹²⁷ · Noga Cohen¹²⁸ · Nora L. Nock¹²⁹ · Niklas Johannes¹³⁰ · Nihan Albayrak-Aydemir¹³¹ · Nicolas Say¹³² · Nathan Torunsky¹¹ · Natalia Van Doren¹³³ · Naoyuki Sunami¹³⁴ · Nikolay R. Rachev¹⁰¹ · Nadyanna M. Majeed¹³⁵ · Nadya-Daniela Schmidt¹³⁶ · Khaoula Nadif¹³⁷ · Nadia S. Corral-Frías¹³⁸ · Nihal Ouherrou¹³⁹ · Myrto Pantazi¹³⁰ · Marc Y. Lucas¹⁴⁰ · Martin R. Vasilev¹⁴¹ · María Victoria Ortiz^{142,143} · Muhammad Mussaffa Butt¹⁴⁴ · Muhib Kabir¹⁴⁵ · Rafał Muda¹⁴⁶ · Maria del Carmen MC Tejada Rivera¹⁴⁷ · Miroslav Sirota¹⁴⁸ · Martin Seehuus^{149,150} · Michal Parzuchowski¹⁵¹ · Mónica Toro¹⁵² · Monika Hricova¹¹⁰ · Mónica Alarcón Maldonado¹⁵³ · Magdalena Marszałek¹²⁵ · Maria Karekla¹⁵⁴ · Giovanna Mioni¹⁵⁵ · Minke Jasmijn Bosma¹⁵⁶ · Minja Westerlund⁷⁵ · Milica Vdovic¹⁵⁷ · Michal Bialek⁶⁴ · Miguel A. Silan¹⁵⁸ · Michele Anne⁵⁸ · Michal Misiak^{159,160} · Maurice Grinberg¹⁶¹ · Mariagrazia Capizzi¹⁶² · Mauricio F. Espinoza Barría¹⁶³ · Merve A. Kurfali¹⁶⁴ · Michael C. Mensink¹⁶⁵ · Mikayel Harutyunyan¹⁶⁶ · Meetu Khosla¹⁶⁷ · Max Korbmacher¹⁶⁸ · Matúš Adamkovič^{169,170} · Matheus Fernando Felix Ribeiro¹⁷¹ · Maria Terskova⁶⁶ · Matej Hruška¹⁷² · Marcel Martončík^{169,170} · Martin Voracek³⁶ · Martin Čadek¹⁷³ · Martha Frías-Armenta¹³⁸ · Marta Kowal⁶⁴ · Marta Topor¹⁷⁴ · Marta Roczniewska^{175,176} · Marlies Oosterlinck¹⁷⁷ · Markéta Braun Kohlová¹⁷⁸ · Mariola Paruzel-Czachura^{179,180} · Marina Romanova³¹ · Marietta Papadatou-Pastou¹⁸¹ · Maria Louise Lund¹⁸² · Maria Antoniadou¹⁵⁴ · Marc V. Jones⁵⁰ · Manuel S. Ortiz¹⁸³ · Mathi Manavalan¹¹ · Abdumalik Muminov¹⁸⁴ · Małgorzata Kossowska¹⁸⁵ · Maja Friedemann¹⁸⁶ · Magdalena Wielgus¹⁸⁷ · Marco A. C. Varella¹⁸⁸ · Melissa F. Colloff¹⁸⁹ · Maria Bradford²⁷ · Leigh Ann Vaughn¹⁹⁰ · Luis Eudave¹⁹¹ · Luc Vieira¹⁹² · Lina Maria Sanabria Pineda²⁷ · Laura Calderón Pérez²⁷ · Ljiljana B. Lazarević¹⁹³

Lisa M. Jaremka¹⁹⁴ · Elizaveta Kushnir¹⁹⁵ · Lisa Anton-Boicuk¹¹⁵ · Gabriel Lins de Holanda Coelho¹⁹⁶ · Lina Ahlgren¹⁹⁷ · Carmel A. Levitan¹⁹⁸ · Leticia Micheli¹⁹⁹ · Leonhard Volz²³ · Marija Stojanovska⁵⁸ · Leanne Boucher²⁹ · Lara Samojlenko²⁰⁰ · Lady Grey Javela Delgado²⁰¹ · Lada Kaliska²⁰² · Lara Warmelink²⁰³ · Luis Miguel Rojas-Berscia²⁰⁴ · Karen Yu²⁰⁵ · Jakub Wachowicz²⁰⁶ · Kermeka Desai¹⁷ · Krystian Barzykowski⁵⁴ · Luca Kozma¹² · Kortnee Evans²⁰⁷ · Komila Kirgizova²⁰⁸ · Bamikole Emmanuel Agesin²⁰⁹ · Monica A Koehn²¹⁰ · Kelly Wolfe²¹¹ · Tatiana Korobova²¹² · Kristoffer Klevjer²¹³ · Kevin van Schie^{214,215} · Kevin Vezirian⁶³ · Kaja Damjanovic²¹⁶ · Katrine Krabbe Thommesen²¹⁷ · Kathleen Schmidt²¹⁸ · Katarzyna Filip⁵⁴ · Karolina Grzech^{219,220} · Karlij Hoyer²²¹ · Karis Moon²²² · Kafeel Rana¹⁴⁴ · Kristina Janjić⁵⁷ · Jordan W. Suchow²²³ · Julita Kiełińska⁵⁴ · Julio E Cruz Vásquez²²⁴ · Julia Beitner²²⁵ · Juan Camilo Vargas-Nieto²⁷ · Jose Carlos T. Roxas^{107,226} · Jennifer Taber¹²⁷ · Joan Urriago-Rayo²²⁷ · Jeffrey M. Pavlacic⁶⁰ · Jozef Bavolar¹¹⁰ · José A. Soto¹³³ · Jonas K. Olofsson⁴⁸ · Johannes K. Vilsmeier²²⁸ · Johanna Messerschmidt²²⁹ · Johanna Czamanski-Cohen^{230,231} · Jordane Boudesseul²³² · Jeong Min Lee²³³ · Julia Kamburidis¹⁰¹ · Janis Zickfeld²³⁴ · Jacob F. Miranda²³⁵ · Jeroen P. H. Verharen²³⁶ · Evgeniya Hristova²³⁷ · Julie E. Beshears²³⁸ · Jasna Milošević Đorđević²³⁹ · Jasmijn Bosch²⁴⁰ · Jaroslava Varella Valentova¹⁸⁸ · Jan Antfolk¹⁹⁷ · Jana B. Berkessel²⁴¹ · Jana Schrötter²⁴² · Jan Urban¹⁷⁸ · Jan Philipp Röer²⁴³ · James O Norton²⁴⁴ · Jaime R. Silva^{245,246,247} · Jade S. Pickering²⁴⁸ · Jáchym Vintr²⁴⁹ · Jim Uttley²⁵⁰ · Jonas R. Kunst²⁵¹ · Izuchukwu L. G. Ndukaihe²⁵² · Aishwarya Iyer²⁵³ · Iris Vilarés¹¹ · Aleksandr Ivanov³¹ · Ivan Ropovik^{254,255} · Isabela Sula²⁵⁶ · Irena Sarijeva³¹ · Irem Metin-Orta²⁵⁷ · Irina Prusova⁶⁶ · Isabel Pinto⁷⁴ · Andreea Ioana Bozdoc²⁵⁸ · Inês A. T. Almeida²⁵⁹ · Ilse L. Pit^{260,261} · Ilker Dalgat²⁶² · Ilya Zakharov²⁶³ · Azuka Ikechukwu Arinze¹²⁴ · Keiko Ihaya²⁶⁴ · Ian D. Stephen⁹⁰ · Biljana Gjoneska²⁶⁵ · Hilmar Brohmer²⁶⁶ · Heather Flowe²⁶⁷ · Hendrik Godbersen⁸⁴ · Halil Emre Kocalar²⁶⁸ · Mattie V. Hedgebeth²⁶⁹ · Hu Chuan-Peng²⁷⁰ · MohammadHasan Sharifian²⁷¹ · Harry Manley²⁷² · Handan Akkas²⁷³ · Nandor Hajdu⁵² · Habiba Azab²⁷⁴ · Gwenael Kaminski²⁷⁵ · Gustav Nilsson^{48,276} · Gulnaz Anjum²⁵¹ · Giovanni A. Travaglino²⁷⁷ · Gilad Feldman²⁷⁸ · Gerit Pfuhl²⁷⁹ · Gabriela Czarnek⁵³ · Gabriela Mariana Marcu^{280,281} · Gabriela Hofer²⁶⁶ · Gabriel Banik²⁸² · Gabriel Agboola Adetula²⁸³ · Gijsbert Bijlstra²⁸⁴ · Frederick Verbruggen¹⁴ · Franki Y. H. Kung²⁸⁵ · Francesco Foroni²⁸⁶ · Gage Singer¹⁰⁸ · Fany Muchembled²⁸⁷ · Flavio Azevedo²⁸⁸ · Farnaz Mosannenzadeh²⁸⁹ · Evelina Marinov¹⁰¹ · Eva Štrukelj²⁹⁰ · Zahra Etebari²⁹¹ · Ernest Baskin²⁹² · Elkin Oswaldo Luis Garcia²⁹³ · Erica Musser²⁹⁴ · I.M.M. van Steenkiste²⁹⁵ · El Rim Ahn¹⁸ · Ekaterina Pronizius³⁶ · Emily A Jackson¹⁷ · Efsio Manunta²⁷⁴ · Elena Agadullina³¹ · Dušana Šakan⁷⁸ · Pinar Dursun²⁹⁶ · Olivier Dujols²⁹⁷ · Dmitrii Dubrov²⁹⁸ · Megan Willis²⁹⁹ · Murat Tümer³⁰⁰ · Jennifer L. Beaudry³⁰¹ · Dora Popović³⁰² · Daniel Dunleavy³⁰³ · Ikhlas Djamaï³⁰⁴ · Dino Krupić³⁰⁵ · Diego Vega³⁰⁶ · Hongfei Du³⁰⁷ · Débora Mola³⁰⁸ · William E. Davis³⁰⁹ · Dawn Liu Holford¹¹⁴ · David M. G. Lewis^{207,310} · David C. Vaidis¹⁹² · Daphna Hausman Ozery³¹¹ · Danilo Zambrano Ricaurte³¹² · Daniel Storage³¹³ · Daniela Sousa³¹⁴ · Daniela Serrato Alvarez³¹⁵ · Anna Dalla Rosa³¹⁶ · Dajana Krupić³¹⁷ · Dafne Marko³¹⁸ · David Moreau³¹⁹ · Crystal Reeck³²⁰ · Rita C. Correia⁷⁴ · Cassie M. Whitt³²¹ · Claus Lamm³⁶ · Claudio Singh Solorzano³²² · Claudia C. von Bastian³²³ · Clare AM Sutherland^{324,325} · Clara Overkott³²⁶ · Christopher L. Aberson³²⁷ · Chunhui Wang³²⁸ · Christiana Karashiali³²⁹ · Chris Noone³³⁰ · Faith Chiu³³¹ · Chiara Picciocchi³³² · Cemre Karaarslan⁷² · Nicola Cellini³³³ · Celia Esteban-Serna³³⁴ · Cecilia Reyna³³⁵ · Carlota Batres³³⁶ · Ranran Li³³⁷ · Caterina Grano³²² · Joelle Carpentier³³⁸ · Christian K. Tamnes²⁵¹ · Cynthia H.Y. Fu^{339,340} · Byurakn Ishkhanyan^{341,342} · Lisa Bylinina³⁴³ · Bastian Jaeger^{93,337} · Carsten Bundt²⁵¹ · Tara Bulut Allred³⁴⁴ · Ahmed Bokkour³⁰³ · Natalia Bogatyreva⁶⁶ · William J. Chopik³⁴⁵ · Benedict Antazo³⁴⁶ · Behzad Behzadnia³⁴⁷ · Maja Becker³⁴⁸ · Beatrice Cocco³⁴⁹ · Wei-Lun Chou³⁵⁰ · Barbora Hubena³⁵¹ · Barbara Žuro^{352,353} · Balazs Aczel⁵² · Ekaterina Baklanova³⁵⁴ · Hui Bai³⁵⁵ · Busra Bahar Balci^{356,357} · Peter Babinčák³⁵⁸ · Barnaby James Wyld Dixon³⁵⁹ · Aviv Mokady³⁶⁰ · Heather Barry Kappes³⁶¹ · Mohammad Atari³⁶² · Anna Szala³⁶³ · Anna Szabelska³⁶⁴ · John Jamir Benzon Aruta³⁶⁵ · Artur Domurat³⁶⁶ · Nwadiogo Chisom Arinze³⁶⁷ · Arianna Modena³⁶⁸ · Arca Adiguzel²⁶⁹ · Arash Monajem³⁶⁹ · Kanza AIT EL ARABI³⁷⁰ · Asil Ali Özdoğru³⁷¹ · Adriana Julieth Olaya Torres³⁷² · Andriana Theodoropoulou³⁷³ · Anita Penić Jurković³⁷⁴ · Angelos P. Kassianos^{375,376} · Andrej Findor³⁷⁷ · Andree Hartanto¹³⁵ · Anais Thibault Landry³⁷⁸ · Ana Ferreira²⁶⁰ · Anabela Caetano Santos^{278,379,380} · Anabel De la Rosa-Gomez³⁸¹ · Amélie Gourdon-Kanhukamwe^{382,383,384} · Anna Louise Todsén³⁸⁵ · Alper Karababa³⁸⁶ · Allison Janak³⁸⁷ · Alexandre Bran¹⁹² · Alexa M. Tullett³⁸⁸ · Anna O. Kuzminska³⁸⁹ · Anthony J Krafnick⁹⁷ · Anum Urooj²⁸⁶ · Ahmed Khaoudi³⁰⁴ · Afroja Ahmed³⁹⁰ · Agata Groyecka-Bernard⁶⁴ · Adrian Dahl Askelund³⁹¹ · Adeyemi Adetula^{63,252} · Anabel Belaus¹¹⁸ · Abdelilah Ca Charyate³⁹² · Aaron L. Wichman³⁹³ · Alina Stoyanova¹⁰¹ · Anna Greenburgh³⁹⁴ · Andrew G. Thomas³⁹⁵ · Alexios Arvanitis³⁹⁶ · Patrick S. Forscher^{63,397} · Peter R Mallik³⁹⁸

Maximilian A. Primbs²⁸⁴ · Jeremy K. Miller³⁹⁹ · Hannah Moshontz⁴⁰⁰ · Heather L. Urry⁴⁰¹ · Hans IJzerman^{63,402} · Dana M. Basnight-Brown⁴⁰³ · Christopher R. Chartier³⁹⁸ · Erin M. Buchanan⁴⁰⁴ · Nicholas A. Coles^{2,405}

✉ Charles A. Dorison
charles.dorison@kellogg.northwestern.edu

- 1 Kellogg School of Management, Northwestern University, Evanston, IL, USA
- 2 Harvard Kennedy School, Harvard University, Cambridge, MA, USA
- 3 Department of Psychology, Harvard University, Cambridge, MA, USA
- 4 Peabody College of Education and Human Development, Vanderbilt University, Nashville, USA
- 5 Department of Psychology, University of Minnesota, Minneapolis, USA
- 6 Harvard T.H. Chan School of Public Health, Harvard University, Boston, MA, USA
- 7 Mathematica, Cambridge, MA, USA
- 8 University of Virginia, Charlottesville, USA
- 9 United Arab Emirates University, Al Ain, United Arab Emirates
- 10 Wolfson College, University of Oxford, Oxford, UK
- 11 Twin Cities, Department of Psychology, University of Minnesota, Minneapolis, USA
- 12 Institute of Psychology, University of Pécs, Pécs, Hungary
- 13 Department of Translation Studies, Faculty of Arts, University of Ljubljana, Ljubljana, Slovenia
- 14 Department of Experimental Psychology, Ghent University, Ghent, Belgium
- 15 Grenoble Ecole de Management, Grenoble, France
- 16 Culemborg, Netherlands
- 17 Indiana University of Pennsylvania, Indiana, USA
- 18 Department of Psychology, University of Florida, Gainesville, USA
- 19 Department of Psychology, Senshu University, Kawasaki, Japan
- 20 Faculty of Arts and Science, Kyushu University, Fukuoka, Japan
- 21 Department of Psychology, University of Hong Kong, Hong Kong SAR, China
- 22 Institute of Linguistics, Shanghai International Studies University, Shanghai, China
- 23 University of Amsterdam, Amsterdam, Netherlands
- 24 Claremont Graduate University, Claremont, USA
- 25 Montclair State University, Montclair, USA
- 26 INSEAD, Singapore, Singapore
- 27 Department of Psychology, Universidad de los Andes, Bogotá, Colombia
- 28 Department of Psychology, The Education University of Hong Kong, Hong Kong, SAR, China
- 29 Department of Psychology and Neuroscience, Nova Southeastern University, Fort Lauderdale, USA
- 30 Charles University, Prague, Czechia
- 31 HSE University, Moscow, Russia
- 32 Department of Strategy and Management, NHH Norwegian School of Economics, Bergen, Norway
- 33 Department of Psychology, Faculty of Humanities and Social Sciences, Josip Juraj Strossmayer University of Osijek, Osijek, Croatia
- 34 Department of Cognitive Science and Psychology, New Bulgarian University, Sofia, Bulgaria
- 35 Department of Psychology, University of Zadar, Zadar, Croatia
- 36 Department of Cognition, Emotion, and Methods in Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria
- 37 University of Hong Kong, Hong Kong, SAR, China
- 38 Department of Psychology, University of East London, Dubai, United Arab Emirates
- 39 Dunoon, Scotland
- 40 Department of Social and Work Psychology, University of Brasília, Brasília, Brasília, Brazil
- 41 Department of Psychology and Psychotherapy, Witten/Herdecke University, Witten, Germany
- 42 Université de Lorraine, Université de Strasbourg, CNRS, BETA, Nancy, France
- 43 Macquarie University, Sydney, Australia
- 44 University of Bristol, Bristol, UK
- 45 Lazaridis School of Business and Economics, Wilfrid Laurier University, Waterloo, Canada
- 46 Institute for Linguistic Studies, Russian Academy of Sciences, Saint Petersburg, Russia
- 47 South Carolina, USA

- 48 Department of Psychology, Stockholm University, Stockholm, Sweden
- 49 Department of Linguistics, Stockholm University, Stockholm, Sweden
- 50 Department of Psychology, Manchester Metropolitan University, Manchester, UK
- 51 Faculty of Integrated Arts and Social Sciences, Japan Women's University, Tokyo, Japan
- 52 Institute of Psychology, ELTE Eötvös Loránd University, Budapest, Hungary
- 53 Institute of Psychology, Jagiellonian University, Krakow, Poland
- 54 School of Applied Psychology, ZHAW Zurich University of Applied Sciences, Winterthur, Switzerland
- 55 Department of Clinical Psychology, University of Dhaka, Dhaka, Bangladesh
- 56 Icam Toulouse, Department of Humanities, Toulouse, France
- 57 PSA Psihesko, Skopje, North Macedonia
- 58 School of Psychology, University of Nottingham Malaysia, Semenyih, Malaysia
- 59 Department of Psychology and Psychodynamics, Karl Landsteiner University of Health Sciences, Krems an der Donau, Austria
- 60 Department of Psychology, University of Mississippi, Oxford, MS, USA
- 61 T A Pai Management Institute, Manipal Academy of Higher Education, Manipal, India
- 62 Department of Psychology, Mohammed V University in Rabat, Rabat, Morocco
- 63 Université Grenoble Alpes, LIP/PC2S, Grenoble, France
- 64 Institute of Psychology, University of Wroclaw, Wroclaw, Poland
- 65 Ashland University, Ashland, USA
- 66 National Research University Higher School of Economics, Moscow, Russia
- 67 Department of Neurology, Mauritius Hospital Meerbusch, Meerbusch, Germany
- 68 Department of Psychology, Bar-Ilan University, Ramat Gan, Israel
- 69 Department of Psychology, University of the Fraser Valley, Abbotsford, Canada
- 70 Department of Psychology, University of Belgrade, Belgrade, Serbia
- 71 Department of Psychology, University of Maribor, Maribor, Slovenia
- 72 Department of Psychology, Institute of Social Sciences, University of Başkent, Ankara, Turkey
- 73 University of Warwick, Coventry, UK
- 74 Center for Psychology at University of Porto, University of Porto, Porto, Portugal
- 75 Faculty of Arts, Psychology, and Theology, Åbo Akademi University, Turku, Finland
- 76 Grupo de investigación en Biogeografía y Ecología Espacial (BioGeoE2), Universidad Regional Amazónica Ikiam, Tena, Ecuador
- 77 University of Guadalajara, Guadalajara, Colombia
- 78 Department of Psychology, Faculty of Legal and Business Studies Dr Lazar Vrkatic, Union University, Novi Sad, Serbia
- 79 Black Dog Institute, Sydney, Australia
- 80 School of Psychology, University of New South Wales, Sydney, Australia
- 81 Emotional Health For All Foundation, Jakarta, Indonesia
- 82 Department of Psychology, Erzurum Technical University, Erzurum, Turkey
- 83 Ankara, Turkey
- 84 FOM University of Applied Sciences, Essen, Germany
- 85 Department of Psychology, Faculty of Social and Behavioural Sciences, University of Amsterdam, Amsterdam, Netherlands
- 86 Department of Sport Management, Faculty of Physical Education and Sport Science, Urmia University, Urmia, Iran
- 87 Institute of Psychology, University of Opole, Opole, Poland
- 88 Universidade Cruzeiro do Sul, São Paulo, Brazil
- 89 Facultad de Psicología, Universidad San Sebastián, Valdivia, Chile
- 90 Department of Psychology, Macquarie University, Sydney, Australia
- 91 Department of Psychology, Northern Illinois University, DeKalb, USA
- 92 Department of Art Studies, Tarbiat Modares University, Tehran, Iran
- 93 Department of Social Psychology, Tilburg University, Tilburg, Netherlands
- 94 Department of Psychology, Federal University of Mato Grosso, Cuiabá, Brazil
- 95 Department of Psychology, University of Konstanz, Konstanz, Switzerland
- 96 Department of Psychology and Zlotowski Center for Neuroscience, Ben Gurion University, Beersheba, Israel
- 97 Department of Psychology, Dominican University, River Forest, USA

- ⁹⁸ Department of Psychology, Faculty of Psychology and Education, University of Tehran, Tehran, Iran
- ⁹⁹ Iscte-University Institute of Lisbon, CIS-IUL, Lisbon, Portugal
- ¹⁰⁰ Intelligent Agents and Synthetic Characters Group (GAIPS), INESC-ID, Lisbon, Portugal
- ¹⁰¹ Department of General, Experimental, Developmental, and Health Psychology, Sofia University St. Kliment Ohridski, Sofia, Bulgaria
- ¹⁰² ISCTE - Instituto Universitário de Lisboa, CIS-IUL, Lisbon, Portugal
- ¹⁰³ Department of Psychology, University of Wuppertal, Wuppertal, Germany
- ¹⁰⁴ The University of Adelaide, Adelaide, Australia
- ¹⁰⁵ Jacobs University Bremen, Bremen, Germany
- ¹⁰⁶ Department of Human Development and Psychology, Tzu-Chi University, Hualien, Taiwan
- ¹⁰⁷ Department of Psychology, University of the Philippines Diliman, Quezon City, Philippines
- ¹⁰⁸ Department of Psychology, Indiana University of Pennsylvania, Indiana, USA
- ¹⁰⁹ Department of Industrial Engineering and Innovation Sciences, Eindhoven University of Technology, Eindhoven, Netherlands
- ¹¹⁰ Department of Psychology, Faculty of Arts, Pavol Jozef Šafárik University in Košice, Košice, Slovakia
- ¹¹¹ School of Psychology, Arellano University, Manila, Philippines
- ¹¹² Social Science Department, College of Liberal Arts, Technological University of the Philippines, Manila, Philippines
- ¹¹³ Jagiellonian University, Krakow, Poland
- ¹¹⁴ University of Essex, Essex, UK
- ¹¹⁵ Social, Cognitive and Affective Neuroscience Unit, Department of Cognition, Emotion, and Methods in Psychology, Faculty of Psychology, University of Vienna, Vienna, Austria
- ¹¹⁶ Concordia University, Montreal, Canada
- ¹¹⁷ Athens University of Economics and Business, Athens, Greece
- ¹¹⁸ Instituto de Investigaciones Psicológicas (IIPsi), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Universidad Nacional de Córdoba (UNC), Córdoba, Argentina
- ¹¹⁹ Department of Psychology, University of Cambridge, Cambridge, UK
- ¹²⁰ Faculdade de Psicologia e Ciências da Educação, Universidade do Porto, Porto, Portugal
- ¹²¹ University of Deusto, Bilbao, Spain
- ¹²² Barakaldo, Spain
- ¹²³ Faculty of Education, Human and Social Sciences, Universidad Manuela Beltrán, Bogotá, Colombia
- ¹²⁴ Alex Ekwueme Federal University, Ndufu-Alike, Nigeria
- ¹²⁵ SWPS University of Social Sciences and Humanities, Warsaw, Poland
- ¹²⁶ Psychological Institute of Russian Academy of Education, Moscow, Russia
- ¹²⁷ Department of Psychological Sciences, Kent State University, Kent, USA
- ¹²⁸ Department of Special Education and The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, Haifa, Israel
- ¹²⁹ Department of Population and Quantitative Health Sciences, School of Medicine, Case Western Reserve University, Cleveland, USA
- ¹³⁰ Oxford Internet Institute, University of Oxford, Oxford, UK
- ¹³¹ Milton Keynes, United Kingdom & London School of Economics and Political Science, Open University, London, UK
- ¹³² Prague University of Economics and Business, Prague, Czechia
- ¹³³ Department of Psychology, State College, The Pennsylvania State University, Philadelphia, USA
- ¹³⁴ University of Delaware, Newark, USA
- ¹³⁵ School of Social Sciences, Singapore Management University, Singapore, Singapore
- ¹³⁶ Institute of Psychology, University of Hildesheim, Hildesheim, Germany
- ¹³⁷ Poggio Imperiale, Italy
- ¹³⁸ Universidad de Sonora, Sonora, México
- ¹³⁹ Lhumain Laboratory, Paul Valéry Montpellier 3 University, Montpellier, France
- ¹⁴⁰ Department of Psychology, Universidad de Sonora, Sonora, Mexico
- ¹⁴¹ Department of Psychology, Boumemouth University, Poole, UK
- ¹⁴² Instituto de Investigaciones Psicológicas (IIPsi), - CONICET – UNC, Cordoba, Argentina
- ¹⁴³ Facultad de Psicología, Universidad Nacional de Córdoba, Cordoba, Argentina
- ¹⁴⁴ Government College University, Lahore, Pakistan
- ¹⁴⁵ Bangladesh Clinical Psychology Society, Dhaka, Bangladesh
- ¹⁴⁶ Faculty of Economics, Maria Curie-Skłodowska University, Lublin, Poland
- ¹⁴⁷ University of Desarrollo, Concepción, Chile

- 148 Department of Psychology, University of Essex, Colchester, UK
- 149 Department of Psychology, Middlebury College, Middlebury, USA
- 150 Vermont Psychological Services, University of Vermont, Burlington, USA
- 151 Center for Research on Cognition and Behavior, SWPS University of Social Sciences and Humanities in Sopot, Sopot, Poland
- 152 Centro de Apego y Regulación Emocional, Facultad de Psicología, Universidad Del Desarrollo, Concepción, Chile
- 153 Puebla, Mexico
- 154 University of Cyprus, Nicosia, Cyprus
- 155 Department of General Psychology, University of Padova, Padua, Italy
- 156 Department of Psychology, University of Amsterdam, Amsterdam, Netherlands
- 157 Faculty of Media and Communications, Department of Psychology, Singidunum University, Belgrade, Serbia
- 158 University of the Philippines Diliman, Quezon City, Philippines
- 159 IDN Being Human Lab, University of Wroclaw, Wroclaw, Poland
- 160 School of Anthropology & Museum Ethnography, University of Oxford, Oxford, UK
- 161 Department of Cognitive Science and Psychology, Research Center for Cognitive Science, New Bulgarian University, Sofia, Bulgaria
- 162 Université Paul Valéry Montpellier 3, Montpellier, France
- 163 Centre of Attachment and Emotional Regulation, Faculty of Psychology, Universidad del Desarrollo, Santiago, Chile
- 164 Department of Political Science, Bilkent University, Ankara, Turkey
- 165 Department of Psychology, University of Wisconsin-Stout, Menomonie, USA
- 166 Institute of Economic Studies, Charles University, Prague, Czechia
- 167 Psychology Department, University of Delhi, DRC, Delhi, India
- 168 Western Norway University of Applied Sciences, Bergen, Norway
- 169 Institute of Psychology, Faculty of Arts, University of Presov, Presov, Slovakia
- 170 CSPS Slovak Academy of Sciences, Institute of Social Sciences, Košice, Slovakia
- 171 Institute of Psychology, University of Brasilia, Brasilia, Brazil
- 172 Institute of European Studies and International Relations, Faculty of Social and Economic Sciences, Comenius University in Bratislava, Bratislava, Slovakia
- 173 Carnegie School of Sport, Leeds Beckett University, Leeds, UK
- 174 School of Psychology, University of Surrey, Guildford, UK
- 175 Department of Psychology, SWPS University of Social Sciences and Humanities in Sopot, Sopot, Poland
- 176 Karolinska Institutet, Department of Learning, Informatics, Management, and Ethics, Stockholm, Sweden
- 177 Gent, Belgium
- 178 Charles University, Environment Centre, Prague, Czechia
- 179 Institute of Psychology, University of Silesia in Katowice, Katowice, Poland
- 180 Facultad de Psicología, Universidad Complutense Madrid, Madrid, Spain
- 181 National and Kapodistrian University of Athens, Athens, Greece
- 182 University of Oslo, Oslo, Norway
- 183 Departamento de Psicología. Laboratorio de Estrés y Salud, Universidad de La Frontera, Temuco, Chile
- 184 Samarkand, Uzbekistan
- 185 Department of Philosophy, Institute of Psychology, Jagiellonian University, Krakow, Poland
- 186 University of Oxford, Oxford, UK
- 187 Institute of Applied Psychology, Jagiellonian University, Krakow, Poland
- 188 Institute of Psychology, Department of Experimental Psychology, University of São Paulo, São Paulo, Brazil
- 189 University of Birmingham, Birmingham, UK
- 190 Ithaca College, Ithaca, USA
- 191 University of Navarra, Pamplona, Spain
- 192 Université de Paris, Paris, France
- 193 Faculty of Philosophy, University of Belgrade, Belgrade, Serbia
- 194 Department of Psychological and Brain Sciences, University of Delaware, Newark, USA
- 195 Stockholm, Sweden
- 196 University College Cork, Cork, Ireland
- 197 Faculty of Arts, Psychology and Theology, Åbo Akademi University, Turku, Finland
- 198 Department of Cognitive Science, Occidental College, Los Angeles, USA
- 199 Institute of Psychology, Leibniz University Hannover, Hanover, Germany
- 200 Department of Psychology, Faculty of Mathematics, Natural Sciences and Information Technologies, University of Primorska, Koper, Slovenia
- 201 Programa de Psicología, Universidad del Rosario, Bogotá, Colombia

- 202 Department of Psychology, Faculty of Education, Matej Bel University, Banska Bystrica, Slovakia
- 203 Pontifical Catholic University of Puerto Rico Pontificia Universidad Católica Puerto Rico, Ponce, Puerto Rico
- 204 School of Languages and Cultures, University of Queensland, Brisbane, Australia
- 205 Department of Psychology, Sewanee: The University of the South, Sewanee, USA
- 206 Lublin, Poland
- 207 College of Science, Health, Engineering and Education, Murdoch University, Perth, Australia
- 208 Florence, Italy
- 209 Adekunle Ajasin University, Akungba Akoko, Ondo State, Nigeria
- 210 Faculty of Health, Discipline of Psychology, University of Canberra, Canberra, Australia
- 211 Department of Psychology, University of Edinburgh, Edinburgh, UK
- 212 London Gates Education Group, Moscow, Russia
- 213 Department of Psychology, UiT The Arctic University of Norway, Tromsø, Norway
- 214 Department of Psychology, Education & Child Studies, Erasmus School of Social and Behavioural Sciences, Erasmus University Rotterdam, Rotterdam, Netherlands
- 215 MRC Cognition and Brain Sciences Unit, University of Cambridge, Cambridge, UK
- 216 Faculty of Philosophy, Department of Psychology, Institute of Philosophy, The University of Belgrade, Belgrade, Serbia
- 217 Faculty of Health and Medical Sciences, University of Copenhagen, Copenhagen, Denmark
- 218 School of Psychological and Behavioral Sciences, Southern Illinois University, Carbondale, USA
- 219 University of Valencia, Valencia, Spain
- 220 Stockholm University, Stockholm, Sweden
- 221 Tilburg University, Tilburg, Netherlands
- 222 Department of Management, Kingston University London, London, UK
- 223 Stevens Institute of Technology, School of Business, Hoboken, USA
- 224 Department of Psychology Bogotá, Universidad de los Andes, Bogotá, Colombia
- 225 Department of Psychology, Goethe University Frankfurt, Frankfurt am Main, Germany
- 226 Department of Psychology, De La Salle College of Saint Benilde, Antipolo, Philippines
- 227 Bogotá, Colombia
- 228 Department of Cognition, Emotion, and Methods in Psychology, University of Vienna, Vienna, Austria
- 229 Institute of Psychology, Leipzig University, Leipzig, Germany
- 230 School of Creative Arts Therapies, University of Haifa, Haifa, Israel
- 231 Emili Sagol Creative Arts Therapies Research Center, University of Haifa, Haifa, Israel
- 232 Facultad de Psicología, Instituto de Investigación Científica, Universidad de Lima, Lima, Peru
- 233 Department of Psychology, Georgia State University, Atlanta, USA
- 234 Department of Management, Aarhus University, Aarhus, Denmark
- 235 Department of Psychology, The University of Alabama, Tuscaloosa, USA
- 236 Department of Molecular and Cell Biology, University of California Berkeley, Berkeley, USA
- 237 Cognitive Science and Psychology Department, New Bulgarian University, Sofia, Bulgaria
- 238 Alliant International University, San Diego, USA
- 239 Faculty of Media and Communication, Singidunum University, Belgrade, Serbia
- 240 University of Milan-Bicocca, Milan, Italy
- 241 Mannheim Centre for European Social Research, University of Mannheim, Mannheim, Germany
- 242 1st Department of Psychiatry, Faculty of Medicine, Pavol Jozef Šafárik University in Košice, Košice, Slovakia
- 243 Department of Psychology, Witten/Herdecke University, Witten, Germany
- 244 College of Science, Health, Engineering & Education, Murdoch University, Perth, Australia
- 245 Facultad de Psicología, Universidad del Desarrollo, Santiago, Chile
- 246 Clínica Alemana de Santiago, Santiago, Chile
- 247 Sociedad Desarrollo Emocional, Santiago, Chile
- 248 School of Psychology, University of Southampton, Southampton, UK
- 249 Department of Psychology, Faculty of Arts, Charles University, Prague, Czechia
- 250 School of Architecture, University of Sheffield, Sheffield, UK
- 251 Department of Psychology, University of Oslo, Oslo, Norway
- 252 Department of Psychology, Alex Ekwueme Federal University, Ndufu-Alike, Nigeria
- 253 Sampurna Montfort College, Bangalore, India

- 254 Faculty of Education, Institute for Research and Development of Education, Charles University, Prague, Czechia
- 255 Faculty of Education, University of Presov, Presov, Slovakia
- 256 San Polo d'Enza, Italy
- 257 Department of Psychology, Atilim University, Ankara, Turkey
- 258 Department of Psychology, Lucian Blaga University of Sibiu, Sibiu, Romania
- 259 Faculty of Medicine FMUC, Institute of Nuclear Sciences Applied to Health ICNAS, Coimbra Institute for Biomedical Imaging and Translational Research CIBIT, University of Coimbra, Coimbra, Portugal
- 260 Institute of Human Sciences, University of Oxford, Oxford, UK
- 261 Calleva Research Centre for Evolution and Human Sciences, Magdalen College, Oxford, UK
- 262 Department of Psychology, Ankara Medipol University, Ankara, Turkey
- 263 Psychological Institute of the Russian Academy of Education, Developmental Behavioral Genetics Laboratory, Moscow, Russia
- 264 Fukuoka Institute of Technology, Center for Liberal Arts, Fukuoka, Japan
- 265 Macedonian Academy of Sciences and Arts, Skopje, North Macedonia
- 266 Institute of Psychology, University of Graz, Graz, Austria
- 267 School of Psychology, Birmingham, University of Birmingham, Birmingham, UK
- 268 Department of Psychological Counseling and Guidance, Muğla Sıtkı Koçman University, Muğla, Turkey
- 269 Virginia Commonwealth University, Richmond, USA
- 270 School of Psychology, Nanjing Normal University, Nanjing, China
- 271 Department of Psychology, University of Tehran, Tehran, Iran
- 272 Faculty of Psychology, Chulalongkorn University, Bangkok, Thailand
- 273 Business Administration Department, Ankara Science University, Ankara, Turkey
- 274 Department of Neurosurgery, Baylor College of Medicine, Houston, USA
- 275 Université de Toulouse, CLLE, CNRS, UT2J, Toulouse, France
- 276 Department of Clinical Neuroscience, Karolinska Institutet, Solna, Sweden
- 277 Department of Law and Criminology, Royal Holloway, University of London, London, UK
- 278 University of Hong Kong, Pok Fu Lam, Hong Kong SAR
- 279 UiT The Arctic University of Norway, Tromsø, Norway
- 280 Department of Psychology, Lucian Blaga University of Sibiu, Sibiu, Romania
- 281 Carol Davila University of Medicine and Pharmacy Bucharest, Bucharest, Romania
- 282 Institute of Psychology, University of Presov, Presov, Slovakia
- 283 Department of Pure and Applied Psychology, Faculty of Social and Management Sciences, Adekunle Ajasin University, Akungba Akoko, Nigeria
- 284 Behavioural Science Institute, Radboud University, Nijmegen, Netherlands
- 285 Purdue University, West Lafayette, USA
- 286 Australian Catholic University, Sydney, Australia
- 287 Instituto Tecnológico de Estudios Superiores de Monterrey, Monterrey, Mexico
- 288 University of Cambridge, Cambridge, United Kingdom
- 289 Faculty of Social Sciences, Behavioural Science Institute, Radboud University, Nijmegen, Netherlands
- 290 Dynamic and Clinical Psychology, Sapienza University of Rome, Rome, Italy
- 291 Ferdowsi University of Mashhad, Mashhad, Iran
- 292 Saint Joseph's University, Philadelphia, USA
- 293 Universidad de Navarra, Pamplona, Spain
- 294 Department of Psychology, Center for Children and Families, Florida International University, Miami, USA
- 295 Universiteit Leiden, Leiden, Netherlands
- 296 Department of Psychology, Afyon Kocatepe University, Afyonkarahisar, Turkey
- 297 University of Grenoble Alpes, Grenoble, France
- 298 HSE University, Moscow, Russia
- 299 School of Behavioural and Health Sciences, Australian Catholic University, Sydney, Australia
- 300 Department of Anesthesiology and Reanimation, Hacettepe University, Ankara, Turkey
- 301 Department of Psychological Sciences, Swinburne University of Technology, Melbourne, Australia
- 302 Institute of Social Sciences Ivo Pilar, Zagreb, Croatia
- 303 Center for Translational Behavioral Science, Florida State University, Tallahassee, USA
- 304 Mohammed V University in Rabat, Rabat, Morocco
- 305 Faculty of Humanities and Social Science, The University of Osijek, Osijek, Croatia
- 306 Universidad Latina de Costa Rica, San Pedro, Costa Rica

- 307 Institute of Advanced Studies in Humanities and Social Sciences, Beijing Normal University at Zhuhai, Zhuhai, China
- 308 Instituto de Investigaciones Psicológicas ([IIPsi]CONICET y UNC), Facultad de Psicología, Universidad Nacional de Córdoba, Córdoba, Argentina
- 309 Department of Psychology, Wittenberg University, Springfield, USA
- 310 Centre for Healthy Ageing, Health Futures Institute, Murdoch University, Perth, Australia
- 311 California State University, Northridge, USA
- 312 Faculty of Psychology, Fundación Universitaria Konrad Lorenz, Bogotá, Colombia
- 313 Department of Psychology, University of Denver, Denver, USA
- 314 Institute of Nuclear Sciences Applied to Health ICNAS, Coimbra Institute for Biomedical Imaging and Translational Research CIBIT, University of Coimbra, Coimbra, Portugal
- 315 Fundación Universitaria Konrad Lorenz, Bogotá, Colombia
- 316 Department of Philosophy, Sociology, Education and Applied Psychology, University of Padova, Padua, Italy
- 317 Norvel - Psychological Centre for Counselling and Research, Osijek, Croatia
- 318 Cognitive Science, Faculty of Education, University of Ljubljana, Ljubljana, Slovenia
- 319 School of Psychology and Centre for Brain Research, The University of Auckland, Auckland, New Zealand
- 320 Fox School of Business, Temple University, Philadelphia, USA
- 321 University of Alabama, Tuscaloosa, USA
- 322 Department of Psychology, Sapienza University, Rome, Italy
- 323 Department of Psychology, University of Sheffield, Sheffield, UK
- 324 School of Psychology, King's College, University of Aberdeen, Aberdeen, Scotland
- 325 School of Psychological Science, University of Western Australia, Perth, Australia
- 326 Department of Psychology, University of Zurich, Zurich, Switzerland
- 327 Cal Poly Humboldt, Arcata, USA
- 328 Chinese Center of Disease Prevention and Control, Beijing, China
- 329 Department of Psychology, University of Cyprus, Nicosia, Cyprus
- 330 School of Psychology, National University of Ireland, Galway, Ireland
- 331 Department of Language and Linguistics, University of Essex, Essex, UK
- 332 University of Naples L'Orientale, Naples, Italy
- 333 Department of General Psychology, Department of Biomedical Sciences, Padova Neuroscience Center, and Human Inspired Technology Center, University of Padua, Padua, Italy
- 334 Division of Psychology & Language Sciences, University College London, London, UK
- 335 Facultad de Psicología, Instituto de Investigaciones Psicológicas (IIPsi) - Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) – UNC, Universidad Nacional de Córdoba (UNC), Córdoba, Argentina
- 336 Department of Psychology, Franklin and Marshall College, Lancaster, USA
- 337 Department of Experimental and Applied Psychology, Vrije Universiteit Amsterdam, Amsterdam, Netherlands
- 338 School of Management, Department of Organization and Human Resources, Université du Québec à Montréal, Montreal, Canada
- 339 School of Psychology, University of East London, London, UK
- 340 Centre for Affective Disorders, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK
- 341 School of Communication and Culture, Aarhus University, Aarhus, Denmark
- 342 Department of Nordic Studies and Linguistics, University of Copenhagen, Copenhagen, Denmark
- 343 Leiden University, Leiden, Netherlands
- 344 Faculty of Philosophy, Laboratory for Research of Individual Differences, University of Belgrade, Belgrade, Serbia
- 345 Department of Psychology, Michigan State University, East Lansing, USA
- 346 Department of Psychology, Jose Rizal University, Mandaluyong, Philippines
- 347 Faculty of Physical Education and Sport Science, Department of Motor Behavior, University of Tabriz, Tabriz, Iran
- 348 Université de Toulouse, CLLE, CNRS, Toulouse, France
- 349 Rieti, Italy
- 350 Department of Psychology, Fo Guang University, Jiaoxi, Taiwan
- 351 Prague, Czech Republic
- 352 The Institute of Psychology, Dublin, Ireland
- 353 Faculty of Humanities and Social Sciences, University of Osijek, Osijek, Croatia
- 354 Institute of Asian and African Studies, Lomonosov Moscow State University, Moscow, Russia
- 355 University of Minnesota Twin Cities, Minneapolis, USA
- 356 Department of Psychology, Samsun University, Samsun, Turkey
- 357 Department of Psychology, Dokuz Eylül University, Izmir, Turkey

- 358 Faculty of Arts, Institute and Psychology, University of Presov, Presov, Slovakia
- 359 School of Health and Behavioural Sciences, University of the Sunshine Coast, Sippy Downs, Australia
- 360 Department of Psychology, Ben Gurion University, Beersheba, Israel
- 361 Department of Management, London School of Economics and Political Science, London, UK
- 362 Department of Psychology, University of Southern California, Los Angeles, USA
- 363 Centre of Language Evolution Studies, Nicolaus Copernicus University in Toruń, Toruń, Poland
- 364 Queen's University Belfast, Belfast, Ireland
- 365 Department of Psychology, School of Medical and Life Sciences, Sunway University, Kuala Lumpur, Malaysia
- 366 Institute of Psychology, University of Silesia in Katowice, Katowice, Poland
- 367 Alex Ekwueme Federal University Ndufu-Alike, Abakaliki, Nigeria
- 368 Dipartimento di Scienze Giuridiche, del Linguaggio, dell'Interpretazione e della Traduzione, Università degli Studi di Trieste, Trieste, Italy
- 369 University of Tehran, Tehran, Iran
- 370 Mohammed V University of Rabat, Rabat, Morocco
- 371 Department of Psychology, Üsküdar University, Istanbul, Turkey
- 372 Faculty of Psychology, Universidad del Desarrollo, Santiago, Chile
- 373 Department of Psychology, University of Essex, Essex, UK
- 374 Kindergarten Kustošija, Zagreb, Croatia
- 375 Department of Nursing, Cyprus University of Technology, Limassol, Cyprus
- 376 Department of Applied Health Research, University College London, London, UK
- 377 Faculty of Social and Economic Sciences, Comenius University in Bratislava, Bratislava, Slovakia
- 378 John Molson Business School, Concordia University, Montreal, Canada
- 379 Aventura Social and DESSH, Faculty of Human Kinetics, University of Lisbon, Lisbon, Portugal
- 380 Institute of Environmental Health, Medicine Faculty, University of Lisbon, Lisbon, Portugal
- 381 Faculty of Higher Studies Iztacala, National Autonomous University of Mexico, Mexico City, Mexico
- 382 Kingston University, London, UK
- 383 King's College London, London, UK
- 384 Institute for Globally Distributed Open Research and Education (IGDORE), London, UK
- 385 Department of Psychology and Neuroscience, University of St. Andrews, St. Andrews, UK
- 386 Department of Psychological Counselling and Guidance, Faculty of Education, Muğla Sıtkı Koçman University, Muğla, Turkey
- 387 Steinhardt, Department of Applied Psychology, New York University, New York, USA
- 388 Department of Psychology, University of Alabama, Tuscaloosa, USA
- 389 Faculty of Management, University of Warsaw, Warsaw, Poland
- 390 Global MINDS, Department of Psychology, University of Limerick, Limerick, Ireland
- 391 Nic Waals Institute, Lovisenberg Diaconal Hospital, Oslo, Norway
- 392 Higher College of Education & Training Kenitra, Ibn Tofail University, Kenitra, Morocco
- 393 Western Kentucky University, Bowling Green, USA
- 394 Department of Experimental Psychology, University College London, London, UK
- 395 Psychology Department, Swansea University, Swansea, UK
- 396 Department of Psychology, University of Crete, Rethymno, Greece
- 397 Busara Center for Behavioral Economics, Nairobi, Kenya
- 398 Department of Psychology, Ashland University, Ashland, USA
- 399 Department of Psychology, Willamette University, Salem, USA
- 400 Department of Psychology, University of Wisconsin-Madison, Madison, USA
- 401 Department of Psychology, Tufts University, Medford, USA
- 402 Institut Universitaire de France, Paris, France
- 403 United States International University – Africa, Nairobi, Kenya
- 404 Harrisburg University of Science and Technology, Harrisburg, USA
- 405 Center for the Study of Language and Information, Stanford University, Stanford, USA