[Bostrom, A., Böhm, G., O'Connor, R., Hanss, D., Bodi-Fernandez, O. & Halder, P. (2020) Comparative risk science for the coronavirus pandemic. *Journal of Risk Research, 23*(7-8), 902-911.]

[DOI: https://doi.org/10.1080/13669877.2020.1756384]

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Journal:	*Journal of Risk Research*
Manuscript ID	Draft
Manuscript Type:	Perspective
Keywords:	coronavirus, pandemic, climate change, risk comparisons, risk communication

This is an Accepted Manuscript of an article published by Routledge in the journal Journal of Risk Research issue 23(7-8), 2020, pp. 902-911; published online 12 May 2020. Authors: Bostrom, A., Böhm, G., O'Connor, R., Hanss, D., Bodi-Fernandez, O., & Halder, P. Available online: https://doi.org/10.1080/13669877.2020.1756384

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Abstract

Judgment, decision making, and risk researchers have learned a great deal over the years about how people prepare for and react to global risks. In recent years, risk scholars have increasingly focused their energies on climate change, and as pandemic coronavirus has swept the globe many of these scholars are comparing the coronavirus pandemic with climate change to inform risk management. Risk communication research and the best practices developed from it are predicated on findings from the 1970's to the present showing that there are structural similarities in how people think about widely divergent risks. Consequently, these lessons from risk communication of climate change (and from the canon of best practices) apply to the coronavirus pandemic. In the empirical comparison of student perceptions reported here, we replicate these structural similarity findings, but also find that moral concerns in particular deserve attention as a potentially distinct dimension of risk perception, on which different risks may also differ, as pandemic risks appear to evoke less moral concern than climate change. The need for communications to be timely, honest, credible, empathetic, and informative of useful individual actions is fundamental and essential for communicating effectively about the coronavirus epidemic. Some countries have heeded risk sciences, and are coping more successfully with pandemic coronavirus. Others have failed to implement these old lessons, which our data suggest still apply. While these failures may reinforce cynicism about political and public enthusiasm for accepting science, comparisons between the coronavirus pandemic and climate change may also foster greater aspirations for collective action.

Keywords: coronavirus, climate change, risk comparisons, risk communication

Risk researchers are no strangers to pandemic disease and the climate crisis, which have been topics of research and comparison for many decades (e.g., Fischhoff & Furby 1983, Fischhoff et al 1982, Kates & Kasperson 1983, Slovic et al 1984). These early efforts were exceptionally fruitful. Together with advances in understanding judgment and decision making, these have led to risk management insights and approaches, which governments have begun—if in a limited way—to assess and adopt (e.g., Fischhoff et al., 2011; Samson, 2019; WHO, 2017). Judgment, decision making, and risk researchers have long called for these lessons to be applied broadly, and mere weeks into the pandemic are pointing with new urgency to how comparisons between pandemic coronavirus and climate change can inform risk management (e.g., Gilad, 2020; Kunreuther & Slovic, 2020; van Bavel et al 2020; Zarnett, 2020). As evident from this burst of recent pandemic coronavirus--climate change comparisons, comparing these two global risks to inform risk management is irresistible. Far be it from us to resist this temptation. To the small numbers of these recent comparisons that highlight public perceptions (e.g., Kunreuther & Slovic, 2020), we add our perspective based on empirical comparison.

Comparisons and analogies are to learning as information is to democracy; essential, wildly influential, and potentially hugely misleading. It is in this spirit that we anchor our perspectives on coronavirus in a previously unpublished comparison of the psychometrics of pandemics and climate change. Our purpose is to explore whether people are using the same constructs to make sense of climate change and pandemic risks and suggest that, if they are thinking about these two seemingly quite different phenomena in the same way, then lessons from risk communication of climate change apply to the coronavirus pandemic. After briefly reporting our findings we discuss lessons for—and from—the coronavirus pandemic.

METHODS and MATERIALS

Participants

During the 2009-2010 academic year, 664 undergraduate students from six countries, majoring in either economics or business administration participated in a survey. The survey was conducted at universities in six countries: Austria, Bangladesh, Finland, Germany, Norway, and the USA. A detailed account of the recruitment and data collection is given in <*omitted for review*>.

Measures and Methods

The questionnaire focused on climate change and comprised measures of perceived risk, causal beliefs, and policy support with respect to climate change. The climate change related results are published in <*omitted for review*>. In addition, the questionnaire contained an as-yet unpublished measure of perceived risk concerning pandemic influenza as a comparison case for climate change. This measure consisted of the 12 psychometric scales listed in Table 1. We conducted a series of factor analytic procedures. All are based on exploratory principal component analysis (PCA) with varimax rotation. Following common psychometric analysis procedures (e.g., Fischhoff et al., 1978), we report methods of dimension reduction followed by mean profiles of climate change and pandemics across the psychometric scales.

RESULTS

Risk dimensions

From analysis of pandemic influenzas and climate change conducted on the combined data set we extract four factors, shown in Table 1[1]. The loading pattern suggests the following interpretations of these factors: Threat / Dread, Moral responsibility, Known risk, and Benefits.

--TABLE 1 HERE--

The Threat / Dread dimension shows high loadings for perceived threat for the three targets: humankind, personal threat, and threat to plants and animals. Feelings of dread also load highly on this factor. Moral concern shows a cross-loading on this factor, indicating that judgments of threat and morality are not entirely independent.

Variables with high loadings on the Moral Responsibility factor are moral concern, personal contribution to mitigation, and equitable distribution of risks and benefits.

The Known Risk factor very clearly comprises judgments of how well the risk issue is understood by science and how well informed the respondent feels about the risk issue.

The Benefits factor shows high loadings for human benefits, delay of consequences, and the extent to which consequences are uncontrollable (negative loading of controllability of consequences).

This factor structure is clear, with only a few aspects deserving extra comments. One is the cross-loading of moral concern on the Threat / Dread factor. Previous research has found that threat and moral judgments are related (Bassarak, Pfister, & Böhm, 2017). However, this research also showed that these two kinds of judgment are far from being redundant; they contribute independently to explaining, for example, overall perceived risk. Our interpretation is that threat and moral judgments are based on different features of a risk issue but that a certain

amount of risk is necessary to elicit moral concerns (Böhm & Pfister, 2017). Another aspect is that personal contribution to mitigation might be expected to be related to perceived controllability. The fact that personal contribution to mitigation loads on Moral Responsibility suggests that the implications of personal contribution for the assignment of responsibility and blame are particularly salient in the context of these two risk issues, more so than the causal implications of personal contributions. A somewhat puzzling finding is that perceived human benefits go together with the perception that consequences are delayed and uncontrollable . This might reflect a cognitive appeasement strategy in the sense that risks are downplayed as being delayed and anyway uncontrollable if high benefits are involved; the affect heuristic (Finucane et al, 2000) explains this mechanism by postulating that perceived benefits and perceived risks shape each other via the affect that they arouse, resulting in a negative correlation between the two.

Figure 1 shows the means of pandemic influenza and climate change on the four factors (factore scores, aggregated across respondents for the two risk domains). As can be seen, climate change is perceived as more threatening, raising more moral responsibility concerns, and bringing more benefits for humans than pandemics; the two risk issues do not differ with respect to how much they appear as known. We will consider in the discussion section to what extent differences can be expected compared to the current Corona crisis.

--FIGURE 1 HERE---

In the psychometrics of risk literature, two factors are commonly extracted: Dread and Unknown / Known Risk (Slovic, 1987). To facilitate comparisons with this approach, we also conducted separate analyses for pandemics and climate change, extracting two factors in each of these analyses. The results are included in Table 2. The two factors are reproduced for both risk

domains, in that the core variables load on the respective factors (the threat and dread variables on the Dread factor and known to science and well informed on the Known Risk factor). It is also apparent, though, that several variables are not as well represented in the two-factor solutions. These are delay of consequences, human benefits, and perhaps equitable distribution of risks and benefits in the solution for pandemics, and controllability, and perhaps human benefits, in the solution for climate change.

--TABLE 2 HERE--

There are strong commonalities in the factor structures emerging from the two-factor analyses of pandemics and climate change, reminiscent of the large body of work revealing Dread and Known/Unknown as important in people's thinking about risks. Differences in the two-factor solutions—regarding individual control, equitable distribution of risk, and moral responsibility, on the one hand, and immediacy, controllability, and benefits on the other—come into focus in the four-factor solution for the combined data. The four-factor solution explains almost twice as much variance, by accounting separately for moral responsibility, and benefits (uncontrollability). In sum, the four factors compared to the two factors add a substantial increase in explained variance and provide a clearer and more nuanced description of the dimensions underlying perceived risks of pandemics and climate change.

Risk profiles

Overall, the picture that emerged from the dimensional analyses is one of similarity between perceived risks of pandemic disease and global climate change. In order to take a more detailed look at the differences between the two risk issues, we now consider the profiles of mean evaluations across the individual psychometric scales, which are depicted in Figure 2.

--FIGURE 2 HERE---

Figure 2 lists the psychometric scales in the order of the four factors (Table 1). The two risk domains show profiles that are largely similar, with some noteworthy exceptions. It is particularly the Threat / Dread and Moral Responsibility scales on which the two profiles differ. Pandemics score lower on all threat and dread scales than climate change. Both pandemics and climate change are perceived as posing a greater threat to humankind than personally; this difference between human and personal threat is smaller for pandemics than for climate change. The largest difference between the two risk issues exists concerning perceived threat to plants and animals, which is much lower for pandemic influenzas than for climate change, but still in the moderate range. Pandemic influenza scores also lower on the Moral Responsibility scales than climate change, especially with regard to the level of moral concerns that it raises. The two risk issues are similar on Known Risk. Interestingly, the controllability of consequences is judged to be higher for pandemic influenzas than for climate change.

DISCUSSION/CONCLUSION

In the community of experts on cataclysmic risks, pandemic disease and climate change have great similarities. Both threaten public health and socio-economic stability in massive ways with great uncertainties. Although the epidemiological community has long viewed the threat from a deadly pandemic as a question of "when," not "whether," lay publics have given little attention to the threat from pandemics. Although climate scientists have warned us of the threat from climate change for decades, with increasing urgency, lay publics still often see the risk as distant in both time (a problem perhaps for future generations) and space (a problem for people

somewhere else). When queried about important issues governments need to address, preparing for pandemics has been even less popular than climate change.

These similarities are mirrored in our data, which reveal similar perceptions of climate change and pandemic influenzas in our student sample. Both risks were considered as rather well known, controllable, and moderately threatening - with the exception of climate change being perceived as more threatening to the natural environment. Study participants also seemed to feel only moderately efficacious with regard to mitigating these risks.

However, when it comes to the current coronavirus pandemic, we see great differences in these phenomena. The coronavirus pandemic has exploded in a small number of months from a medical problem in Hubei province to an international phenomenon that has likely already killed hundreds of thousands and forced well over a billion people to sequester themselves in their homes (including the authors of this piece). In contrast, climate change for many is still lurking as a likely threat for future generations and for distant peoples. The existing problems from climate change are more indirect (e.g., storms of unusual intensity) and contested by some political leaders with large followings.

No doubt, the failures of governments around the world—including Germany and the United States—to employ the risk research-informed pandemic strategies and plans they had on their books increased this sense of urgency. Germany had a corona scenario on the books, but ignored it. [5] The U.S. too had developed a pandemic influenza strategy in 2005 (HSC, 2005), and later updates (Holloway et al., 2014), but seemed to ignore this planning in the critical early days and weeks of the coronavirus pandemic. Nevertheless, striking differences have emerged between countries—and even between states and localities within countries—due in part to variations in the quality of public health care in each place, but also to the level of attention

leadership has paid to risk sciences – including risk communication research (CDC, 2018; WHO, 2017). Case-fatality ratios remain low in Germany. Surveys show that Germans support current lock-down measures and have trust in the competence of both science and politics.[2] The Norwegian Citizen Panel Survey shows similar results for Norway.[3] In contrast, surveys in the U.S. show increasing distrust in the president (ABC News/Ipsos, 2020)[4], as concerns grow about the crisis.

Our results throw light on the question of whether people think of different potentially catastrophic risks in the same way or instead formulate their thinking in different ways tied to the specific dangers associated with the risk. The answer matters to risk communicators who want to know if risk communication research results generalize, and are germane to the coronavirus situation, or if different practices are in order. Our findings reaffirm that the best practices of risk communications apply to the coronavirus crisis. As Lunn et al (2020, p) put it, "Effective crisis communication involves speed, honesty, credibility, empathy, and promoting useful individual actions." This aligns with the WHO (2017) Guideline for communicating risk in health emergences, which summarizes a suite of systematic reviews. Ignoring this science is costly.

Among the young, climate change appears to evoke more dread than pandemics. As we are beginning to collect and analyze new data, some from students similar to those represented in the U.S. sample included above, this difference—that climate change is the more dreaded—persists, despite the exponentially increasing coronavirus cases and deaths in parts of the United States. How well known these risks are, however, shows evidence of change. In the data presented here both risks are perceived as similarly known—respondents feel moderately well informed about them, and report that science understands both of them somewhat more. Our

analysis in progress of coronavirus perceptions suggest that climate change may be perceived as better known than pandemic coronavirus. Anecdotally, doctors protest that "we know nothing" about coronavirus. In contrast, after decades of research, IPCC reports, and risk communication efforts, the balance finally appears to be shifting on climate change (Leiserowitz et al., 2019). In light of this, it is perhaps not surprising that the lessons our students draw from coronavirus-climate change comparisons include that governments can act, and that collective action can work, and so it must be possible to flatten the curve on climate change.

Our findings also show that pandemic influenzas raise less moral concern than climate change does. A prerequisite of moral concern is perceived human causation (Böhm & Pfister, 2017). The difference that we find between the two risk issues may thus suggest that pandemic influenzas are seen as a more "natural" risk than is climate change. One might speculate whether this is different now for the current pandemic; although analyses in progress with new data suggest that it is not. The 2009-10 survey took place in the aftermath of the swine flu, which remained, at least for Europe and North America, a much more remote problem than COVID-19 is now. People's conception of a pandemic may then have focused on the biological mechanism of a virus. The current pandemic, in contrast, is hugely affecting people's everyday life, with the "Stay Home—Stay Safe" measures taken by most governments drawing attention to the social behaviors that contribute to causing the problem. Disaster researchers have long highlighted that disasters are "by design" (Mileti, 1999), and pandemics are no exception. The roots of disasters lie in the societal choices we make (Oliver-Smith et al., 2017; Tierney, 2014, 2019), the inequitable risk protections afforded to vulnerable populations (Howell & Elliott 2018), and the risk management strategies we fail to assess or adopt (Kunreuther 2016).

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Endnote

[1] When analyzing climate change and pandemics separately, the solutions for the two risk domains are sufficiently similar to justify pooling. When extracting four factors, their interpretation is the same for both risk domains as for the mutual analysis. Factor congruency of the corresponding factors in the two domains is .94, .63, .60, and .46 for Threat / Dread, Moral responsibility, Known risk, and Benefits, respectively.

[2] Survey Germany (Support for measures, trust in health system): https://www.tagesschau.de/inland/deutschlandtrend-extra-blitzumfrage-103.html

[3] Survey Citizen Panel (Support for measures, trust in health system and government): https://www.uib.no/aktuelt/134902/hva-mener-folk-under-koronakrisen

[4] ABC News/Ipsos (Coronavirus Outbreak Triggering Significant Changes to American Society) poll conducted April 1-2, 2020, reported April 3, 2020. Accessed April 7 2020 at : https://www.ipsos.com/en-us/news-polls/abc-news-coronavirus-poll

[5] https://www.rbb24.de/politik/thema/2020/coronavirus/beitraege/risikoanalyse-robert-koch-institut-rki-bundestag-schutz-szenario.html

Table 1

Principal Component Analysis of Psychometric Scales, Mutual Analysis of Pandemic Influenzas and Climate Change

Psychometric Scale	PCA Factor Loading			
	Threat/ Dread	Moral respon-sibility	Known risk	Benefits
How serious a threat <are pandemic influenzas / is climate change> to humankind? *(1: No threat, 7: Very serious threat)*	**.88**	.14	.01	.02
How serious a threat <are pandemic influenzas / is climate change> to you personally? *(1: No threat, 7: Very serious threat)*	**.83**	-.08	.03	-.12
How serious a threat <are pandemic influenzas / is climate change> to plants and animals? *(1: No threat, 7: Very serious threat)*	**.74**	.19	-.01	.30
How much does the idea of <pandemic influenzas / climate change> fill you with dread? *(1: Not at all dreadful, 7: Very dreadful)*	**.73**	.20	-.04	-.21
To what extent do you have moral concerns about <pandemic influenzas / climate change>? *(1: No moral concern, 7: Very strong moral concern)*	**.58**	**.51**	.10	.09
How much can you personally contribute to mitigating (reducing or stopping) <pandemic influenzas / climate change>? *(1: Can do nothing personally, 7: Can do a great deal personally)*	.20	**.73**	.08	-.05
Are the risks and benefits of <pandemic influenzas / climate change> equitably distributed among humans *(1: Very equitably distributed, 7: Very inequitably distributed)*	.05	**.66**	-.01	-.03
How well <are pandemic influenzas / is climate change> understood by science? *(1: Not at all understood, 7: Very well understood)*	.13	-.16	**.84**	-.09
How well informed do you feel about <pandemic influenzas / climate change>? *(1: Not informed at all, 7: Very well informed)*	-.09	.33	**.74**	.04
How much do humans benefit from <pandemic influenzas / climate change>? *(1: Not at all, 7: A great deal)*	-.04	.12	.08	**.70**
How soon will the consequences of <pandemic influenzas / climate change> be experienced? *(1: Immediate, 7: Far in the future)*	-.17	-.24	.00	**.57**
To what extent are the consequences of <pandemic influenzas / climate change> controllable? *(1: Not at all controllable, 7: Completely controllable)*	-.20	.02	.24	**-.48**
% of variance explained (after rotation; 59% of the total variance is explained by these four factors):	25%	13%	11%	10%

Note. N = 644. These were the first questions in the questionnaire. Wording: "Please circle the number that corresponds to your best judgment for each of the following. Questions about climate change are followed by questions about pandemic influenzas." The response scale ranged from 1 to 7 with endpoints labeled as indicated for each item. The analysis was conducted across both risk domains (climate change and pandemic influenzas) and all countries, with equal weighting for each country. Factor loadings are derived from principal components factor analysis, with varimax rotation. Factor loadings with absolute values above .40 are in bold.

Table 2

Principal Component Analyses of Psychometric Scales, Separate for Pandemic Influenzas and Climate Change

Psychometric Scale	PCA Factor Loading			
	Pandemic Influenzas		Climate Change	
	Threat/ Dread	Known risk	Threat/ Dread	Known risk
Threat to humankind	**.85**	-.05	**.88**	.02
Personal threat	**.80**	-.12	**.72**	.01
Dread	**.77**	.01	**.76**	.11
Threat to plants and animals	**.66**	-.29	**.76**	.07
Moral concerns	**.59**	.32	**.63**	.33
Delay of consequences	-.08	-.02	**-.55**	-.26
Well informed	-.18	**.67**	-.10	**.86**
Understood by science	-.05	**.63**	.13	**.50**
Controllability of consequences	.00	**.53**	.00	.14
Personal contribution	.25	**.47**	**.43**	.37
Inequitable distribution of risks and benefits	.12	.39	.20	**.43**
Human benefits	-.02	.10	-.29	-.01
% of variance explained (after rotation; 38% of the total variance is explained by the two factors for pandemic influenzas, 42% for climate change):	24%	14%	29%	13%

Note. N = 632 for pandemic influenzas, N = 656 for climate change. These were the first questions in the questionnaire. Wording: "Please circle the number that corresponds to your best judgment for each of the following. Questions about climate change are followed by questions about pandemic influenzas." See Table 1 for complete item wordings. The response scale ranged from 1 to 7 with endpoints labeled as indicated for each item. Separate analyses were conducted for the two risk domains (pandemic influenzas and climate change). Both analyses are across all countries and are based on equal weighting for each country. Factor loadings are derived from principal components factor analysis, with varimax rotation. PCA factors with eigenvalues greater than 1 were extracted. Factor loadings with absolute values above .40 are in bold.

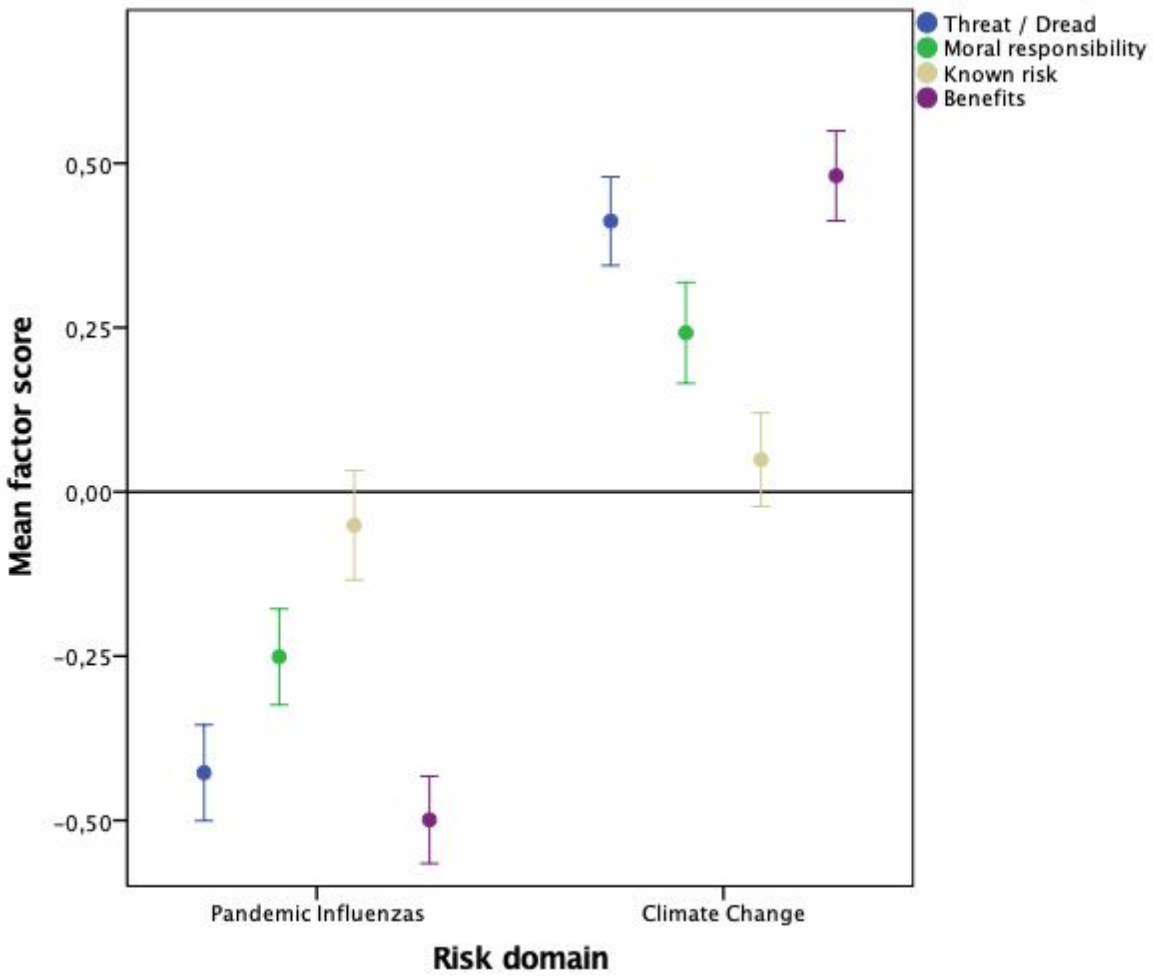

Figure 1. Plot of mean PCA factor scores by risk domain (pandemic influenzas vs climate change).

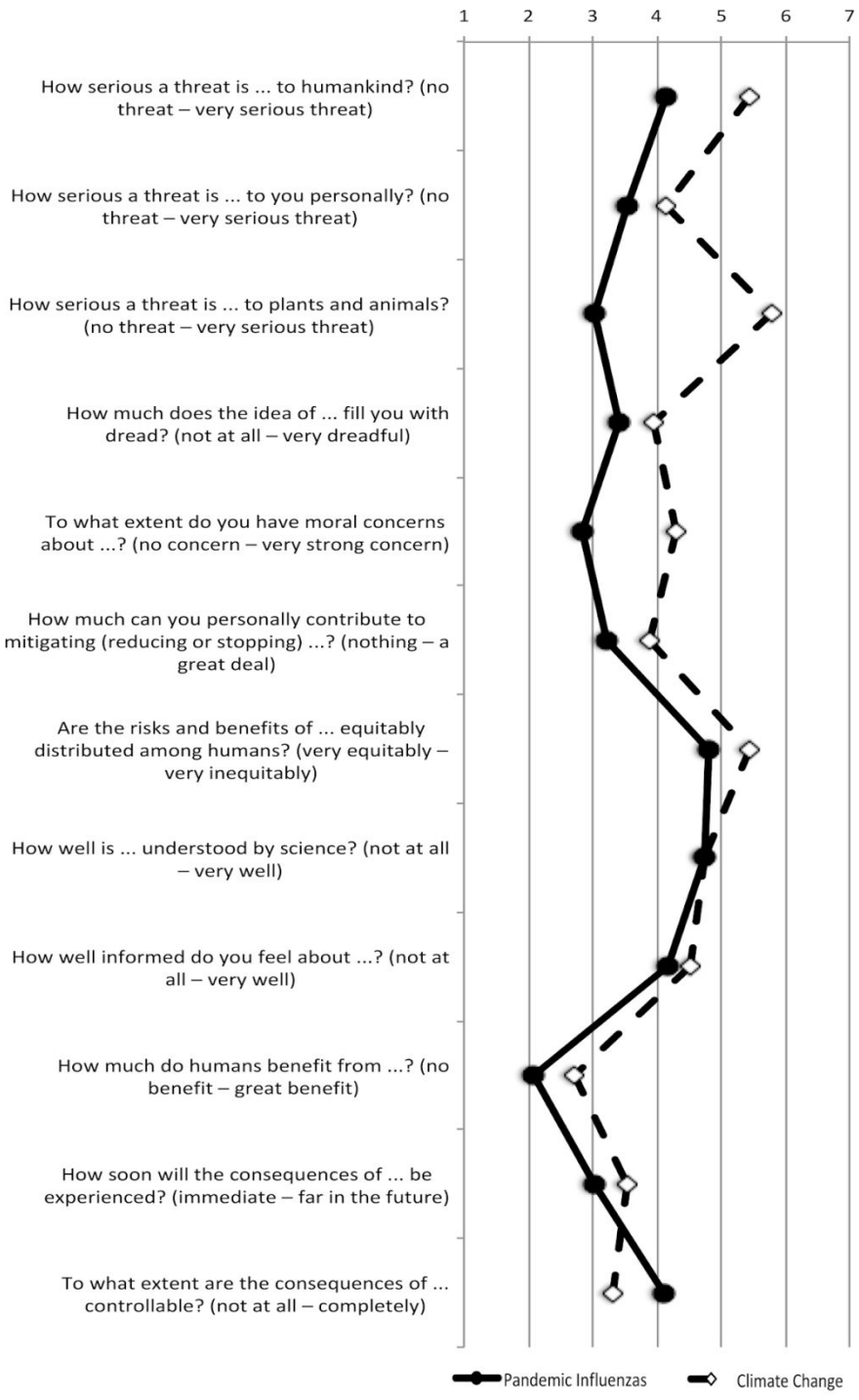

Figure 2. Profiles of mean ratings on psychometric scales for climate change and pandemic influenzas. Means are aggregated across countries, with equal weighting for each country.