Heart rate change and attitudes to global warming: A conceptual replication of the visceral fit mechanism

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ABSTRACT

Visceral fit effects occur when a physical state (e.g., warmth) increases the plausibility of future related states (e.g., global warming). We attempted to conceptually replicate such effects by investigating whether belief in global warming is influenced by a change in heart rate, which is linked to body warmth. In four studies, participants’ heart rates were varied via mental manipulation or physical exercise. In three of the studies, increased heart rate was associated with greater self-reported belief that global warming was occurring. Across all studies, the association between heart rate and self-reported belief in global warming was small in statistical effect size and very small in absolute terms. We suggest that the effects of incidental cues are interesting because such factors should not influence global warming beliefs at all, but the small absolute size of the effects means that situational cues are unlikely to alter a person’s stance on climate change.

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1. Introduction

Although there is widespread consensus among scientists that climate change is occurring (Doran & Zimmerman, 2009), in countries such as the U.S., belief in climate change is far less prevalent among the general public (Leiserowitz, Maibach, Roser-Renouf, Feinberg, & Howe, 2012; Weber & Stern, 2011). Given that many policies to mitigate climate change rely on public support and engagement in order to succeed (e.g., UKREC, 2009), it is important to understand factors that shape beliefs about climate change among the general population.

Considering the potential consequences of climate change, it might be hoped that members of the public would base their attitudes to climate change on information that directly relates to the issue, such as relevant scientific evidence. However, this is not always the case, and there is growing evidence that beliefs about climate change are influenced by transient, situational cues that do not actually reflect climate change, such as current local weather conditions (Joireman, Truelove, & Duell, 2010). Recently, Guéguen (2012) showed that the condition of indoor plants can affect beliefs about climate change. In two experiments, participants were placed in a room that contained an indoor plant that was either dead-looking or healthy. Participants who reported that the plants looked healthy were more likely to believe that climate change was occurring.

There is also growing evidence that beliefs about global warming can be influenced by transient, situational cues that do not actually reflect global warming, such as current local weather conditions (Joireman, Truelove, & Duell, 2010). Recently, Guéguen (2012) showed that the condition of indoor plants can affect beliefs about climate change. In two experiments, participants were placed in a room that contained an indoor plant that was either dead-looking or healthy. Participants who reported that the plants looked healthy were more likely to believe that climate change was occurring.

1.1. The effects of situational cues on climate change beliefs

Of the various transient cues shown to affect climate change beliefs, perhaps the most intuitive is the current local weather. In one study conducted at various times of the year and, hence, in a wide range of outdoor temperatures (Joireman, Truelove, & Duell, 2010), participants who reported that the weather was warmer tended to report greater belief that global warming was occurring. Similar results have also been reported by other researchers (e.g., Guéguen, 2012). Recently, Guéguen (2012) extended this line of research to show that beliefs about global warming can be affected not only by actual current weather, but also by perceptions of whether the current day is warmer (or cooler) than usual for the time of year. Participants who reported that they thought the current day was warmer than usual for the time of year also tended to report greater belief that global warming was occurring.

Other research has demonstrated less intuitive effects of situational cues on climate change beliefs. For example, Guéguen (2012) showed that the condition of indoor plants can affect beliefs about climate change. In two experiments, participants were placed in a room that contained an indoor plant that was either dead-looking or healthy. Participants who reported that the plants looked healthy were more likely to believe that climate change was occurring.
(no foliage) or healthy-looking (with foliage). Participants reported greater belief in global warming when in the presence of a dead-looking plant rather than a healthy-looking plant. This difference became even larger when the number of dead-looking plants in the room was increased to three.

In another line of research examining the effects of transient cues on climate change beliefs, Risen and Critcher (2011) found that room temperature affected climate change beliefs. Specifically, participants who were placed in a warmed room reported greater belief in global warming than those placed in an un-warmed room. Importantly, these effects could not be attributed to the influence of room temperature on perceptions of outdoor temperature, which were unrelated to global warming beliefs (Study 3). Risen and Critcher explained their findings in terms of a novel visceral fit mechanism, whereby experiencing a physical state (e.g., warmth) facilitates the mental simulation of related states, making future occurrences of such states seem more plausible. Thus, experiencing physical warmth makes future global warming seem more plausible.

1.2. Overview of studies

The present research represents a conceptual replication and extension of Risen and Critcher’s (2011) finding that the physical experience of warmth increases belief in global warming. For the purposes of this research, it is important to note that according to Risen and Critcher’s account, this visceral fit effect should be triggered not only by warmth emanating from one’s immediate physical surroundings—as in Risen and Critcher’s manipulation of room temperature—but also by warmth resulting from other factors. We tested this prediction by manipulating warmth via a different mechanism: heart rate.

The scientific literature has long recognized a link between heart rate and warmth, such that increased heart rate is associated with higher body temperature (e.g., Harris & Benedict, 1918; Kleinman & Ransaroor, 1948). This covariation occurs, for example, because an increase in heart rate can redistribute blood to peripheral areas (e.g., hands and feet) to regulate body temperature (Charkoudian, 2003). Using differences in heart rate to manipulate warmth allowed us to not only conceptually replicate the basic effects found by Risen and Critcher, but also to test whether these effects would be produced by warmth resulting from an internal bodily state, rather than the external environment.

We tested whether differences in heart rate affect global warming belief in a series of laboratory experiments and field studies. In Study 1, participants mentally manipulated their heart rate and—in an ostensibly unrelated task—reported the extent to which they believed global warming was occurring. In Study 2, we examined whether global warming beliefs vary with physical exercise, an everyday experience that influences heart rate. In Studies 3 and 4, we tested whether the effects of heart rate change extend to two indirect, ecologically-valid measures of global warming belief: donations to an environmental charity, and support for actual economic policy designed to mitigate climate change. In line with contemporary approaches to data analysis, we not only examined the effects of heart rate on global warming beliefs in each individual study, but also examined the average size of the effect across the series of studies (e.g., Cumming, 2008; Psychonomic Society, 2012).

2. Study 1a

Study 1a was designed to test the basic premise that experimentally-induced differences in heart rate would affect self-reported belief that global warming was happening. We chose a manipulation of heart rate previously used in psychophysiology research, which involves simply asking participants to attempt to raise or lower their heart rate while monitoring it via visual feedback (Blanchard, Young, & McLeod, 1972; McFarland, 1975). This manipulation was chosen because it provides a simple, non-invasive method of selectively manipulating heart rate.

2.1. Method

2.1.1. Participants

Participants were 177 undergraduate students who participated for payment. Participants were randomly assigned to the increase heart rate (n = 88) or decrease heart rate (n = 89) conditions.

2.1.2. Procedure

Study 1a was conducted by a research assistant blind to the purpose and hypothesis of the study, and to the condition each participant experienced. Participants completed Study 1 alone in individual cubicles and followed written experimental instructions. Thus, the experimenter had no contact with participants during the manipulation or measures.

Participants were recruited on the pretext that they were participating in two unrelated studies. The first was described as a pilot test to see whether people could voluntarily adjust their heart rate. Participants were provided with finger-mounted infrared sensors that show current heart rate via digital display. Pilot testing showed that measures from these monitors corresponded very well with those from Polar® brand, chest-strap, heart rate monitors (r = 0.95, p < .01). Participants were instructed to sit still for two minutes and then record their baseline heart rate. Participants were then asked to attempt to increase or decrease their heart rate for one minute (timed via a computer-displayed countdown), while breathing regularly and avoiding excessive movement (McFarland, 1975). Participants then recorded their heart rate again.

Participants then completed the second study, an ostensibly unrelated questionnaire about social issues (i.e., climate change, education, and politics). This questionnaire contained the following item previously used by Li et al. (2011) to assess global warming beliefs: “How convinced are you that global warming is happening?” with responses made on a 7-point Likert-type scale (from 1 — not at all convinced to 7 — completely convinced). To test whether any effects of the manipulation were specific to beliefs about global warming, participants were also asked similar questions about two other potentially problematic social issues: “How convinced are you that high school education standards are falling?” and “How convinced are you that prison overcrowding is occurring?” During debriefing, no participants expressed suspicion that the two studies were related (This was also the case for Studies 1b, 3 and 4. In fact, based on feedback from the research assistant, most participants were primarily interested in learning more about the heart-rate manipulation task.)

2.2. Results

2.2.1. Manipulation check

The heart rate manipulation was successful. Post-manipulation heart rates were, on average, higher in the increase (M = 88 bpm, SD = 18 bpm) than the decrease condition (M = 81 bpm, SD = 12 bpm), t(175) = 2.80, p < .01, Cohen’s d = 0.46. Baseline heart rate did not differ significantly between the conditions, t < 1.

2.2.2. Global warming beliefs

The results were consistent with our hypothesis. Participants who were asked to increase their heart rate (M = 5.78, SD = 1.26) reported higher global warming beliefs than those asked to
decrease their heart rate \((M = 5.36, SD = 1.54)\), \(t(175) = 2.00, p < .05, d = 0.30\) (see Fig. 1). The effects of the manipulation were specific to global warming beliefs. Increased heart rate was not associated with increased belief in prison overcrowding \((t < 1)\) or falling education standards, which showed a non-significant trend in the opposite direction \(i.e.,\) toward increased heart rate being associated with lower reported belief, \(t(175) = 1.76, p = .08\). Thus, the effect of heart rate change did not generalize to other potentially problematic societal issues.

We conducted an additional analysis to test whether the effects of the heart rate manipulation on global warming beliefs were mediated by the change in heart rate from pre- to post-manipulation \(\text{calculated as post-manipulation heart rate minus pre-manipulation heart rate}\). If this was the case, it would imply that the size of the effect on global warming beliefs depends on the amount of heart rate change produced by the manipulation. To test this mediation hypothesis, we used the INDIRECT model \(\text{Preacher \\& Hayes, 2008}\) with bootstrap confidence intervals based on 5000 samples. This analysis yielded a non-significant indirect effect, \(ab = 0.08, 95\% \text{CI}\left[{-0.02, 0.19}\right], SE = 0.05, z = 1.22, p = .22\). Thus, the effect of the manipulation on reported global warming beliefs was not mediated by the magnitude of heart rate change.

2.3. Discussion

The results of Study 1a provide evidence that change in heart rate can affect self-reported beliefs about global warming. This suggests that beliefs about global warming can be influenced not only by incidental cues that are intuitively linked to climate change \(e.g.,\) local weather conditions, but also by incidental cues that bear no intuitive relationship whatsoever to climate change.

In addition, mediation analysis indicated that the effect of the manipulation on reported global warming beliefs was not mediated by the magnitude of heart rate change. This indicates that the amount of heart rate change experienced as a result of the manipulation did not determine the size of the resulting effect on global warming beliefs.

3. Study 1b

To further explore the specificity of the effects found in Study 1a, we conducted a follow up experiment to test an alternative explanation for the results. It could be argued that global warming represented a non-immediate, personal threat to participants in Study 1a, whereas prison overcrowding and falling high-school education standards did not. Thus, based on the results of Study 1a, we cannot rule out the possibility that differences in heart rate affect beliefs about any societal issue that represents a potential personal threat. To test this possibility, we repeated Study 1a, but this time asked participants about two non-immediate threats more likely to be perceived as having personal consequences: local crime rates and national economic decline. Participants in Study 1b were not asked the other questions about global warming, education, and prison overcrowding used in Study 1a.

3.1. Method

3.1.1. Participants

Participants in Study 1b were 100 paid undergraduate students who were randomly assigned to the increase \((n = 50)\) or decrease \((n = 50)\) conditions.

3.1.2. Procedure

The procedure was the same as for Study 1a, except that the critical item assessing global warming beliefs was replaced by two items that asked participants to report the extent to which they were convinced that local crime-rates were rising, and that the national \(\text{Australian}\) economy was in decline \(\text{on the same 7-point scale used in Study 1a}\).

3.2. Results and discussion

3.2.1. Manipulation check

The manipulation was successful in altering heart rate; on average, post-manipulation heart rate was higher for the increase \((M = 91 \text{ bpm}, SD = 14 \text{ bpm})\) than the decrease condition \((M = 80 \text{ bpm}, SD = 12 \text{ bpm})\), \(t(98) = 4.24, p < .01, d = 0.85\). The difference in baseline heart rate approached significance, but it is important to note that this trend was in the opposite direction of the predicted effect of the manipulation, with baseline heart rate slightly higher in the decrease condition \((M = 86 \text{ bpm}, SD = 11 \text{ bpm})\) than the increase condition \((M = 83 \text{ bpm}, SD = 11 \text{ bpm})\), \(t(98) = 1.66, p = .10, d = 0.33\). Thus, although the two experimental groups differed somewhat in baseline heart rate, this difference cannot explain the difference in post-manipulation heart rate.

3.2.2. Beliefs about crime rates and the economy

The results provided further evidence that the effects of heart rate were specific to warmth-related judgments. The manipulation had no significant effect on self-reported belief in national economic decline \(\text{increase}: M = 4.00, SD = 1.25; \text{decrease}: M = 3.96, SD = 1.41\) or rising crime rates \(\text{increase}: M = 3.68, SD = 1.53; \text{decrease}: M = 3.94, SD = 1.78\), \(t_s < 1\).

4. Study 2

The results of Study 1a suggest that belief in global warming might be affected by everyday experiences that affect heart rate. We conducted a field study to investigate whether engaging in more vigorous physical exercise is associated with greater belief in global warming.

4.1. Method

4.1.1. Participants

Participants were 147 volunteers. Demographic information was not collected.
4.1.2. Procedure

Study 2 was conducted halfway up a steep hill (253 m long with slope of approximately 8°) on a university campus. A research assistant, who was blind to the purpose and hypothesis, approached passers-by who were either ascending or descending the hill. Those who consented to participate were asked to rate how convinced they were that global warming was occurring (on the same 7-point scale used in Study 1a). Data were collected during a 2 h period in the middle of a single day, to minimize any variation in weather conditions. Roughly equal numbers of participants were ascending (n = 68) and descending the hill (n = 79). The facilities positioned uphill and downhill from the location of data collection were similar (i.e., there were classrooms and car parks in both directions).

4.2. Results and discussion

As hypothesized, participants ascending the hill (M = 5.91, SD = 1.03) reported higher global warming belief than those descending (M = 5.44, SD = 1.57), t(136.22) = 2.17, p < .05, d = 0.35 (see Fig. 1). Because Study 2 used a quasi-experimental design, we cannot draw causal conclusions from the data. However, these results are consistent with the idea that belief in global warming can be influenced by everyday activities—such as physical exercise—that affect heart rate.

5. Study 3

Study 3 served three purposes. First, it provided a test of our hypothesis using a less explicit measure of belief in global warming to complement the explicit measures used in Studies 1a and 2 (which showed that differences in heart rate can affect reported belief that global warming is occurring). Second, it provided a test of whether the effects found with undergraduate student samples in Studies 1a and 2 could be replicated in a community sample. Third, it provided an indication of whether the effects of heart rate on reported belief in global warming might translate to effects on a measure that has actual economic and environmental consequences. Beliefs about global warming do not necessarily go hand-in-hand with perceptions of the necessity for action to counteract it (Weber, 2006, 2011). However, there is evidence that some cues, such as current weather conditions, affect not only belief in global warming but also willingness to take action to counteract climate change (e.g., by donating money to a global warming charity; Li et al., 2011). Drawing on such findings, we hypothesized that increased (vs. decreased) heart rate would be associated with greater support for economic policy designed to mitigate climate change. The policy in question was a national carbon tax that was being legislated in Australia at the time of data collection for Study 3 (Clean Energy Act, 2011).

5.1. Method

5.1.1. Participants

Participants were 272 passers-by in a metropolitan area in Australia who volunteered their time. Participants were randomly assigned to the increase (n = 136) or decrease (n = 136) conditions. We excluded an additional seven participants who sought advice from companions when rating their support for the carbon tax, and eight who did not comprehend the experimental instructions due to language difficulties.

5.1.2. Procedure

Study 3 was conducted by a research assistant blind to the purpose and hypothesis. Participants were asked to attempt to increase or decrease their heart-rate for 30 s via mental manipulation (as in Study 1a) and pre- and post-manipulation heart rate was recorded by the experimenter using finger-mounted infra-red sensors. In an ostensibly unrelated task, participants then rated their support for the Australian carbon tax (on a 7-point scale ranging from 1 — not at all to 7 — very much).

5.2. Results and discussion

5.2.1. Manipulation check

The heart rate manipulation was successful. On average, post-manipulation heart rate was higher for participants in the increase condition (M = 84 bpm, SD = 11 bpm) than the decrease condition (M = 75 bpm, SD = 12 bpm), t(270) = 5.73, p < .01, d = 0.69. As in Study 1a, there was a non-significant trend toward baseline heart rate being higher in the decrease condition (M = 80 bpm, SD = 9 bpm) then the increase condition (M = 79 bpm, SD = 7 bpm), t(270) = 1.49, p = .14, d = 0.12, which cannot account for the post-manipulation difference in heart rate.

5.2.2. Support for the carbon tax

As predicted, the manipulation affected support for the carbon tax. On average, participants who were asked to increase their heart rate (M = 3.96, SD = 2.06) reported greater support for the carbon tax than those asked to decrease their heart rate (M = 3.49, SD = 1.84), t(270) = 1.99, p < .05, d = 0.24 (see Fig. 1). These results provide converging evidence that the effect of heart rate extends to (a) a less explicit measure of belief in global warming, (b) a sample drawn from the wider community, and (c) an outcome with real economic and environmental consequences.

As in Study 1a, we conducted an additional analysis to test whether the effect of the manipulation on carbon tax support was mediated by the amount of change in heart rate from pre- to post-manipulation (calculated as post-manipulation heart rate minus pre-manipulation heart rate). This analysis yielded a nonsignificant indirect effect, ab = 0.16, 95% CI [−0.05, 0.39], SE = 0.12, z = 1.39, p = .17. Thus, the effect of the manipulation on reported carbon tax support was not mediated by the amount of heart rate change experienced.

6. Study 4

In Study 4, we tested whether differences in heart rate would affect another ecologically-valid measure of global warming beliefs: the allocation of financial donations to an environmental charity.

6.1. Method

6.1.1. Participants

Participants were 134 passers-by in a metropolitan area in Australia who volunteered their time. Participants were randomly assigned to the increase (n = 69) or decrease (n = 65) conditions.

6.1.2. Materials and procedure

Study 4 was conducted by a research assistant blind to the purpose and hypothesis. Participants were approached by the research assistant and invited to participate in a study investigating people’s ability to voluntarily control their heart rate. Participants who consented to participate completed the same heart rate manipulation as used in Study 3.

Following the heart rate manipulation, the experimenter informed participants that, as a token of appreciation for their time, the researchers would be making a small donation (AUD$1) to charity for each participant who completed the study. Participants
were informed that the money would be donated to two charities, one that aimed to reduce global warming and one that aimed to reduce the impact of diabetes. Participants were asked to indicate how they would like the donation to be divided between the two charities by placing a mark on a line, 100 mm long with end points labeled “100% to reducing global warming” and “100% to reducing the impact of diabetes”. The direction of the end points was counterbalanced so that each label appeared on the left-hand endpoint of the line for half of the participants.

Responses were scored by measuring the distance from the participant’s mark to the “reducing the impact of diabetes” endpoint of the scale. The greater this distance, the closer the participant’s mark was to the “reducing global warming” end of the scale and, hence, the greater the amount of money the participant was directing to the global warming charity. Because the response scale was 100 mm long, each mm represented AUD $0.01 of the total amount to be donated on behalf of that participant. Thus, a mark placed 10 mm from the “reducing the impact of diabetes” point equated to a donation of AUD $0.10 to reducing global warming and AUD $0.90 to reducing the impact of diabetes. At the completion of data collection, all donations were made to the relevant charities (Carbon Neutral and Diabetes Australia).

6.2. Results and discussion

6.2.1. Manipulation check

The heart rate manipulation was successful. On average, post-manipulation heart rate was higher for participants in the increase condition ($M = 81$ bpm, $SD = 8$ bpm) than the decrease condition ($M = 76$ bpm, $SD = 8$ bpm), $t(132) = 3.91, p < .01, d = 0.63$. Again, there was a non-significant trend toward baseline heart rate being higher in the decrease condition ($M = 79$ bpm, $SD = 6$ bpm) than the increase condition ($M = 77$ bpm, $SD = 7$ bpm), $t(132) = 1.81, p = .07, d = 0.31$.

6.2.2. Charity donations

Contrary to predictions, the heart rate manipulation had no significant effect on charity donations, $t(132) = 0.79, p = .44$, $d = 0.13$. In fact, as shown in Fig. 1, there was a slight trend toward larger donations to the global warming charity in the decrease condition ($M = AUD$ $0.40, SD = 0.33$) than the increase condition ($M = AUD$ $0.36, SD = 0.31$). Thus, the data for Study 4 offered no hint of replication of the effects found in Studies 1a, 2, and 3.

It would be premature to attempt a detailed interpretation of the difference in results between Study 4 and the other studies. The discrepant result may indicate that differences in heart rate do not affect behavioral measures related to global warming beliefs, or (more specifically) decisions about the distribution of money to climate change charities. However, the discrepancy may also have occurred by chance, or may indicate that the effects of heart rate on beliefs about global warming are not robust. Further research would be required to distinguish between such explanations; for the moment, we suggest that the results of Study 4 are best interpreted simply as a non-replication of the effect under investigation.

7. Estimating the effect size across all studies

Recent recommendations for data analysis emphasize the value of estimating the size of an effect across multiple studies, rather than assessing whether the effect is present or absent in individual studies (e.g., Cumming, 2008; Psychonomic Society, 2012). In line with these recommendations, we conducted a meta-analysis of the results of Studies 1a, 2, 3, and 4 in order to estimate the size of the effect of heart rate on global warming beliefs and calculate a confidence interval around that estimate. The meta-analysis used a random effects model computed using Exploratory Software for Confidence Intervals (ESCI; see Cumming, 2012).

The results of this analysis are shown in Fig. 2, which depicts an effect size (Cohen’s $d$) and accompanying 95% confidence intervals (CIs) for each of Studies 1a, 2, 3, and 4, along with the overall meta-analytic effect. Across the four studies, the meta-analytic effect of heart rate on global warming beliefs was small: weighted mean Cohen’s $d = 0.20, 95\%$ CI $[0.001, 0.397]$. Thus, the evidence suggests that, although increases in heart rate do increase belief in global warming, the effect is small and equivocal.1

8. General discussion

Overall, the results reported here suggest that increased heart rate is associated with increased self-reported belief in global warming. From a theoretical perspective, these studies advance understanding of the phenomenon of visceral fit in two ways. First, they provide a conceptual replication of Risen and Critcher’s (2011) finding that experiences of warmth increase the plausibility of future warm states. Risen and Critcher demonstrated this phenomenon using a manipulation of warmth via an exogenous factor (room temperature), but according to their proposed visceral fit mechanism, any factor that facilitates an experience of physical warmth should increase the plausibility of future warm states, such as global warming. Our results are consistent with this view. They also extend this line of research to show that such effects occur when warmth is manipulated via an endogenous factor (rather than the exogenous factor of room temperature), and when global warming beliefs are measured indirectly via reported support for actual economic policy to counteract climate change (rather than via an explicit self-report of belief).

Second, the results suggest that the effects of visceral experiences (e.g., physical warmth) on judgments may operate in an all-or-none manner, rather than a graded manner. The effects of the heart rate manipulation on reported global warming beliefs (Study

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1 Note that these results slightly overestimate the width of the confidence interval around the meta-analytic effect size. Because the ESCI software allows a maximum of 202 participants per study, we could only calculate a 95% CI for $d$ in Study 3 as though there were 101 participants in each condition, rather than the actual numbers of 136 per condition. Hence, the 95% CI for $d$ in Study 3, and for the overall effect, are slightly larger than their true values.
1a) and support for a carbon tax (Study 3) were not mediated by the amount of heart rate change experienced. This indicates that when the manipulation produced a large change in heart rate (and, presumably, a relatively large change in experienced warmth), this did not necessarily translate to a large difference in global warming beliefs or carbon tax support. In turn, these results suggest that when the experience of a visceral state increases the plausibility of related states, the magnitude of this effect does not depend on the intensity with which the state is experienced. The results of Study 2 cloud this interpretation somewhat; given that walking uphill and walking downhill would both be expected to increase heart rate relative to standing still, a strict all-or-none effect should have produced equivalent effects on global warming belief in the downhill and uphill conditions. However, the results of the mediation analyses in Studies 1a and 3 suggest that the possibility that visceral fit effects operate in an all-or-none fashion warrants further investigation.

It is important to keep in mind two caveats when interpreting the results of this research. First, our central finding represents a small effect that occurred in only three of four studies, which suggests that the relationship between heart rate and belief in global warming is perhaps not a robust one. Second, although there is reason to expect that the divergence between heart rate between conditions in our studies were accompanied by differences in body temperature (e.g., Harris & Benedict, 1918; Kleitman & Rasmussen, 1948), we did not measure body temperature. Hence, we cannot say with certainty that the observed association between heart rate and belief in global warming was underpinned by a visceral fit mechanism; it may be that other mechanisms were at play. For example, the perception of an increased heart rate (created via false feedback) has been linked to increased propensity to engage in moral decision-making (Gu, Zhong, & Page-Gould, 2013). Because false heart rate feedback can produce this effect, it does not rely on physical warmth. Thus, it is possible that participants in our increased heart rate conditions reported greater belief in global warming because their higher heart rate prompted them to make more moral decisions, regardless of any change in experienced warmth. Although we cannot rule out this alternative account, the fact that heart rate did not affect reported beliefs about high school education standards or prison overcrowding (in Studies 1a and 1b) weighs against it.

The effects of heart rate and physical warmth on attitudes to global warming are interesting, in part, because they should not occur at all. Judgments about a long-term trend in global climate should in no way be affected by the warmth of a room or a subtle change in physiological state. Similarly, such judgments should not be swayed by other situational cues, such as current local weather conditions or the presence of dead indoor plants. The fact that they are bears testimony to the pervasive influence of heuristics and biases on judgments (e.g., Gigerenzer, Hoffrage, & Kleinbölting, 1991; Kahneman & Frederick, 2002; Tversky & Kahneman, 1973).

Although several studies have now documented effects of situational cues on beliefs about global warming, numerous questions about these effects remain unanswered. One concerns whether the effects of different cues interact with one another. For example, the effects of some cues (e.g., walking uphill) may vary depending on current local weather conditions. Another question concerns whether there is a limit on the amount by which global warming beliefs can be affected by situational cues. The fact that all studies to date have found small effects (in the context of the scales of measurement used to measure global warming beliefs) suggests that this might be the case. Future research may shed light on these issues.

From a practical perspective, it is worthwhile thinking about how the effects of incidental cues on beliefs about global warming might play out in everyday life. Does our stance on global warming really change every time we enter a warm room, walk up a flight of stairs, or go to the gym? Or every time we sit near a dead indoor plant? Can the result of an election be swayed by placing polling booths at the top (or bottom) of hills throughout the nation?

We suggest that such things are highly unlikely to occur, primarily because the effects of situational cues are very small in the context of the scales they are measured on. In our research, manipulations of heart rate produced differences in the order of a half-point on a 7-point scale. Joireman et al. (2010) found differences of a very similar magnitude, also on a 7-point scale. (That scale represented participants’ mean level of agreement with four statements about climate change, e.g., “I am quite sure global warming is occurring now. The scale end points were 1 — strongly disagree and 7 — strongly agree.”) Guéguen (2012) used the same scale as Joireman et al., and found differences of between a half-point and one point. Risen and Critcher (2011) reported differences of around one to two points on an 11-point scale (from 1 — Global warming is a proven fact to 7 — Global warming is a theory that has not yet been proven). Thus, although the effects of incidental cues on global warming beliefs may be statistically significant, the absolute magnitudes of such effects tend to be small. In turn, although it is interesting to study the effects of incidental cues, there is little evidence to suggest that such cues regularly convert climate change skeptics to believers, or believers to skeptics.

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References


Warranted


