Climate scientists' wide prediction intervals may be more likely but are perceived to be less certain

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Experiment 1

Procedure

The study was part of a study taking place over 15 days, with the participants responding to different questionnaires on each of the consecutive days of the study. Ninety-one participants took part in the initial study when they completed a series of individual differences measures, among these measures was a test of cognitive reflection (i.e., the ability to override an intuitive response; Frederick, 2005). Eighty-one of these participants completed a daily survey for 14 days. As explained in the main manuscript, the participants answered questions about which of a narrow and a wide interval "is most likely to be correct" and "conveys most uncertainty" on days 3 and 6, with the same questions repeated on day 9 and 11, but here, including an explanation for the variability in the expert forecasts. On day 14 the participants' belief in climate change was measured using four questions taken from Heath and Gifford (2006).

Analysis

We conducted a generalized estimating equation (GEE) for multinomial dependent variables (Hardin & Hilbe, 2002), with the question ("conveys most uncertainty" vs. "most likely to be correct"), the scenario, the presence of an explanation for variability, and their two-level interactions as independent variables, and interval choice (narrow, wide, equal) as the dependent variable. Type of question affected participants' choice: narrow intervals were chosen more often as the prediction that was "most likely to be correct" than as the prediction that "conveys most uncertainty" (tests of Model Effects), Wald χ^2 (1) = 6.96, p = .008. Scenario did not have an effect on interval choice, nor did it interact with the question, Wald χ^2 (1) < 0.01, p = .971 and Wald χ^2 (1) = 0.29, p = .588, respectively. The presence of an explanation for variability did not affect interval selection, nor did it interact with the question type, Wald χ^2 (1) = 2.08, p = .150 and Wald χ^2 (1) = 0.20, p = .654.

We conducted the same GEE with climate change and cognitive reflection as covariates along with their interaction with the question manipulation (likely vs. uncertain) because we hypothesized participants with higher cognitive reflection would endorse more frequently the view that wide intervals are more likely to be correct than narrow intervals, and to find narrow intervals as conveying more uncertainty than wide ones. Similarly, we expected climate change belief to determine range selected: the wide range, which featured more extreme climate change values was expected to be more often selected as likely but less often as uncertain for those scoring higher on this variable. The introduction of the covariates reduced the effect of the question manipulation which was no longer statistically significant, Wald χ^2 (1) = 1.87, p = .171. Cognitive reflection predicted the interval selection but did not interact with the condition, Wald χ^2 (1) = 4.11, p = .043 and Wald χ^2 (1) = 0.82, p = .367. Specifically, participants with higher scores on the CRT less often chose the "equal" option, and instead preferred any of the other two options as being "more likely to be correct", and more often chose the wide interval as conveying uncertainty. Further, climate change belief did not have a main effect nor interacted with the question to determine interval selection, although the interaction was close to statistical significance, Wald χ^2 (1) = 0.11, p = .741 and Wald χ^2 (1) = 3.43, p = .064.

Experiment 2

Procedure

The materials were the same as in Experiment 1, but with question type and reason for variability varied between subjects in a 2 x 2 design.

Analysis

We conducted a GEE for multinomial dependent variable with question ("conveys most uncertainty" vs. "most likely to be correct"), scenario, explanation for variability

(present vs. absent) and their interactions as independent variables, and interval choice (narrow, wide, equal) as the dependent variable. The GEE showed that only the question type had an effect on the interval selection, Wald χ^2 (1) = 24.13, $p < .001$. The scenario (sea level vs. temperature) and the presence of a reason did not have a main effect on the interval selected, Wald χ^2 (1) = 0.24, $p = .627$ and Wald χ^2 (1) = 1.06, $p = .303$, nor were any of the interaction terms statistically significant, Wald χs^2 (1) < 1.02, p's > .05.

Experiment 3

Procedure

Participants in Experiment 3 were again given wide and narrow interval predictions about sea level and temperature rise, but in this case, were given either a question about which prediction "conveys more [un]certainty" or which prediction is "more [un]certain to be correct". In other words, question type (conveys vs. to be correct) and directionality (uncertain vs. certain) was varied between subjects in a 2 x 2 design.

As a secondary hypothesis, Experiment 3 also investigated whether perceptions of the forecaster may be influenced by the question types, which would evoke either the informativeness or the accuracy mindset. Hence, after selecting which interval conveys more (un)certainty or is more (un)certain to be correct, participants rated which team seemed more trustworthy, seemed to have most knowledge (about temperature rise or sea level rise), seemed to have the best models (for predicting temperature rise or sea level rise), and which team seemed to be most competent, on scales from 1 (definitely the team with the wide interval) to 5 (definitely the team with the narrow interval). Note that this hypothesis as well as the results and analysis, is described in full in the main manuscript.

Analysis

We conducted a GEE for multinomial dependent variable with the question (to be correct vs. convey), the directionality of the term (uncertain vs. certain) and the scenario (sea level vs. temperature), and all possible interactions between them, as independent variables, while interval choice (narrow, wide, equal) was the dependent variable. The analysis found that interval choice was not significantly affected by the question, Wald χ^2 (1) = 1.20, p = .274, but there was an effect of directionality, Wald χ^2 (1) = 13.60, $p < .001$, and, more importantly, an interaction between the two main factors, Wald χ^2 (1) = 25.50, $p < .001$. The scenario did not have an effect on the interval choice, nor did it interact with the question, directionality, or both of them, Wald χ^2's (1) < 0.41, p's > .52.

For the analysis and results of the secondary hypothesis, see the main manuscript.

Experiment 4

Procedure

Participants were given the same scenarios as in previous experiments, and told to choose which of a wide and a narrow interval conveyed more (un)certainty or was more certain to be correct, in three between-subjects conditions. In this experiments, there was no "equal" option, so participants chose between the wide and the narrow interval in each condition. After selecting which interval conveys more (un)certainty or which interval is more certain to be correct, participants rated the fluency of the predictions of sea level and temperature rise featuring a narrow and a wide interval. The forecasts focused on either a wide or a narrow interval and featured either the quantifier certain or uncertain. Participants assessed the fluency of the resulting four forecasts in the sea rise context and in the temperature rise context. The fluency of each forecast was measured through four questions: the extent to which it was easy to understand, how intuitively and quickly it could be understood and whether it was hard to process (reverse coded). In addition, four items

measured the perceived expertise of the team making the prediction in terms of how much it knew, whether the team had knowledge, experience and expertise (the full questionnaire for Experiment 4, including the questions for fluency and expertise are provided on pages 17-22 in the Supplementary materials). The reliability of the fluency scale was good for certainty and uncertainty and for the two interval widths (Cronbach's $\alpha > .80$). The reliability of the expertise was also good for the two interval widths (Cronbach's $\alpha > .80$). We computed difference scores for fluency and expertise by subtracting the average score of the narrow interval by the score of the wide interval. Greater scores of fluency and expertise indicate that participants judged the narrow interval more fluent and inferred that their forecasters had a greater expertise compared to wider intervals.

Analysis

Participants believed that the wide interval both conveyed more uncertainty and was more certain to be correct, while the narrow interval was seen as conveying more certainty. Thus, removing the incorrect option of "the intervals are equal" led to a majority choosing the accuracy mindset when the question is focused on accuracy. The focus of the question had an effect on the interval chosen in both the temperature and the sea rise contexts, $\chi^2(2, N = 302) = 75.8$, $p < .001$, $\varphi = .50$ and $\chi^2(2, N = 302) = 77.14$, $p < .001$, $\varphi = .51$.

Table S2. Mean ratings (SD) in Experiment 4.

	Temperature intervals		Sea rise intervals	
	Narrow	Wide	Narrow	Wide
Expertise	3.79 (0.84)	2.82 (0.90)	3.70 (0.83)	2.80 (0.83)
Fluency certain	3.89 (0.89)	3.63 (1.01)	3.85 (0.90)	3.58 (1.04)
Fluency uncertain	3.34 (0.82)	3.14 (0.86)	3.38 (0.80)	3.18 (0.86)
Fluency total	3.71 (0.91)	3.47 (0.99)	3.69 (0.89)	3.45 (1.00)

Effect of interval width on fluency and perceived expertise.

As shown in Table S2, participants judged the narrow interval as reflecting more expertise and to be easier to process (i.e., more fluent) than the wide interval. Further, the prediction was judged harder to process if it was about uncertainty than if it was about certainty. A mixed design ANOVA with interval width and scenarios as within-subject independent variables and certainty word (certain vs. uncertain) as between-subjects independent variable confirmed this impression, showing a main effect of the interval width and certainty word on fluency, $F(1, 300) = 27.10$, $p < .001$, $\eta^2_p = .08$ and $F(1, 300) = 21.97$, $p < .001$, $\eta^2_p = .07$. There was no interaction effect between the width of the interval and the certainty word, $F(1, 300) < 1$, $\eta^2_p < .01$.

Experiment 5

Procedure

In Experiment 5, participants were given the same scenarios as in previous experiments, but in this case, a third interval was included. This means that participants were asked to select which of a (very) narrow, a "medium", and a wide interval conveyed more (un)certainty or is more certain to be correct, in three between-subjects conditions.

Experiment 5 also included three measures of individual differences that might be related to the belief that wide intervals are more uncertain and narrow intervals are more certain or convey more certainty, namely a climate change belief scale (Heath & Gifford, 2006), a numeracy scale (Lipkus, Samsa, & Rimer, 2001), and a disjunction task (Costello, 2009). The climate change and disjunction scales had satisfactory reliability, Cronbach's α = .83 and Cronbach's α = .98, while the numeracy scale had a reliability that was lower than expected, Cronbach's α = .54. The individual difference measures were presented as one block of questions (in randomized order), and the order of the individual differences block and the interval selection block was randomized.

Analysis

Interval selection. Participants believed that the wide interval conveyed more uncertainty and was more certain to be correct, while the narrow interval was thought to convey more certainty. The focus of the question had an effect of the interval chosen in both the temperature and the sea rise contexts, $\chi^2(4, N = 101) = 28.56$, $p < .001$, $\varphi = .53$ and $\chi^2(4, N = 302) = 28.85$, $p < .001$, $\varphi = .49$.

Individual differences. There were no clear correlation patterns between interval choice and the individual difference measures across groups. And since there were only 31-35 participants in each condition in this experiment, we did not have enough power to detect effects within each condition. Thus, we do not further describe these results.

Experiment 6

Procedure

See main text.

Analysis

Individual differences.

Three participants did not respond to either the CRT or the numeracy test, and one additional participant did not respond to the CRT (and only partially to the numeracy test). To be as conservative as possible, these four participants were included in the analyses of the ratings of the two mindsets as described in the main text, but were necessarily excluded in the analyses of individual differences. Participants on average had 1.54 correct answers on the CRT ($SD = 1.17$), with 23.8% getting a score of zero, and 29.5% getting all answers correct. The CRT score did not differ between conditions, $F(1,99) = 1.369$, $p = .245$, $\eta^2_p = .014$. Sixteen participants reported seeing the CRT-questions earlier, and scored higher ($M = 2.13$, $SD = .96$) than those who had not seen the questions before ($M = 1.44$, $SD = 1.18$), $F(1,99) = 4.854$, $p = .030$, $\eta^2_p = .047$. On the numeracy test, there were also no difference in scores between conditions, $F < 1$. The mean score across participants was 3.67 ($SD = 1.36$).

Neither CRT (r = .005, p = .958) nor numeracy (r = .093, p = .355) correlated significantly with the average difference score. However, we did find positive correlations between CRT and the average separate ratings of the informativeness and the accuracy mindsets, r = .204, p = .040, and r = .208, p = .037, respectively. Similarly, numeracy correlates positively with the informativeness mindset, r = .243, p = .014, and the accuracy mindset, r = .141, p = .161.

References

Costello, F. J. (2009). Fallacies in probability judgments for conjunctions and disjunctions of everyday events. *Journal of Behavioral Decision Making, 22*(3), 235-251. doi:10.1002/bdm.623

Hardin, J. W., & Hilbe, J. M. (2002). *Generalized estimating equations*: Chapman and Hall/CRC.

Heath, Y., & Gifford, R. (2006). Free-market ideology and environmental degradation - The case of belief in global climate change. *Environment and Behavior, 38*(1), 48-71. doi:10.1177/0013916505277998

Lipkus, I. M., Samsa, G., & Rimer, B. K. (2001). General performance on a numeracy scale among highly educated samples. *Medical Decision Making, 21*(1), 37-44. doi:10.1177/0272989x0102100105

Questionnaire Experiments 1 and 2

Informativness-focused question

Without reason for variability

Projections of future changes in temperature

Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that conveys the greatest level of uncertainty.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)
- The two predictions convey the same level of uncertainty. (3)

Projections of future changes in sea level

Two teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that conveys the greatest level of uncertainty.

- Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
- Team Y: The sea level will rise between 23 centimeters and 51 centimeters. (2)
- The two predictions convey the same level of uncertainty. (3)

With reason for variability

Projections of future changes in temperature

Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that conveys the greatest level of uncertainty.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius in different countries. (1)
- Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius in different countries. (2)
- The two predictions convey the same level of uncertainty. (3)

Projections of future changes in sea level

Two teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that conveys the greatest level of uncertainty.

- Team X: The sea level will rise between 18 centimeters and 59 centimeters in different parts of the world. (1)
- Team Y: The sea level will rise between 23 centimeters and 51 centimeters in different parts of the world. (2)
- The two predictions convey the same level of uncertainty. (3)

Accuracy-focused question

Without reason for variability

Projections of future changes in temperature
Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that is the most likely to be correct.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)
- The predictions are equally likely to be correct. (3)

Projections of future changes in sea level
Two teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that is the most likely to be correct?

- Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
- Team Y: The sea level will rise between 23 centimeters and 51 centimeters. (2)
- The predictions are equally likely to be correct. (3)

With reason for variability

Projections of future changes in temperature
Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that is the most likely to be correct.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius in different countries. (1)
- Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius in different countries. (2)
- The predictions are equally likely to be correct. (3)

Projections of future changes in sea level
Two teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that is the most likely to be correct.

- Team X: The sea level will rise between 18 centimeters and 59 centimeters in different parts of the world. (1)
- Team Y: The sea level will rise between 23 centimeters and 51 centimeters in different parts of the world. (2)
- The predictions are equally likely to be correct. (3)

Questionnaire Experiment 3

Informativeness-focused questions

Conveys uncertainty

Projections of future changes in temperature

Two teams of climate scientists have made the following predictions regarding the temperature rise by 2100. Please select the prediction that conveys more uncertainty.

- ❍ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)
- ❍ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)
- ❍ The two predictions convey an equal degree of uncertainty (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team A		No difference		Definitely Team B
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about temperature rise?					
Which team do you think has better models for predicting temperature rise?					
Which team seems to be more competent?					

Projections of future changes in sea level

Two teams of climate scientists have made the following predictions regarding the sea level rise by 2100. Please select the prediction that conveys more uncertainty.

- ❍ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)
- ❍ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)
- ❍ The two predictions convey an equal degree of uncertainty (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team X		No difference		Definitely Team Y
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about sea level rise?					
Which team do you think has better models for predicting sea level rise?					
Which team seems to be more competent?					

Conveys certainty

Projections of future changes in temperature

Two teams of climate scientists have made the following predictions regarding the temperature rise by 2100. Please select the prediction that conveys more certainty.

- ❍ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)
- ❍ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)
- ❍ The two predictions convey an equal degree of certainty (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team A		No difference		Definitely Team B
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about temperature rise?					
Which team do you think has better models for predicting temperature rise?					
Which team seems to be more competent?					

Projections of future changes in sea level

Two teams of climate scientists have made the following predictions regarding the sea level rise by 2100. Please select the prediction that conveys more certainty.

- ❍ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)
- ❍ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)
- ❍ The two predictions convey an equal degree of certainty (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team X		No difference		Definitely Team Y
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about sea level rise?					
Which team do you think has better models for predicting sea level rise?					
Which team seems to be more competent?					

Accuracy-focused questions

Uncertain to be correct

Projections of future changes in temperature

Two teams of climate scientists have made the following predictions regarding the temperature rise by 2100. Please select the prediction that is more uncertain to be correct.

- ❍ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)
- ❍ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)
- ❍ The two predictions are equally uncertain to be correct (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team A		No difference		Definitely Team B
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about temperature rise?					
Which team do you think has better models for predicting temperature rise?					
Which team seems to be more competent?					

Projections of future changes in sea level

Two teams of climate scientists have made the following predictions regarding the sea level rise by 2100. Please select the prediction that is more uncertain to be correct.

- ❍ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)
- ❍ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)
- ❍ The two predictions are equally uncertain to be correct (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team X		No difference		Definitely Team Y
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about sea level rise?					
Which team do you think has better models for predicting sea level rise?					
Which team seems to be more competent?					

Certain to be correct

Projections of future changes in temperature

Two teams of climate scientists have made the following predictions regarding the temperature rise by 2100. Please select the prediction that is more certain to be correct.

- ❍ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)
- ❍ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)
- ❍ The two predictions are equally certain to be correct (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team A		No difference		Definitely Team B
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about temperature rise?					
Which team do you think has better models for predicting temperature rise?					
Which team seems to be more competent?					

Projections of future changes in sea level

Two teams of climate scientists have made the following predictions regarding the sea level rise by 2100. Please select the prediction that is more certain to be correct.

- ❍ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)
- ❍ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)
- ❍ The two predictions are equally certain to be correct (3)

Please also indicate which team you prefer for each of the questions below.

	Definitely Team X		No difference		Definitely Team Y
	1	2	3	4	5
Which team seems more trustworthy?					
Which team seems to have more knowledge about sea level rise?					
Which team do you think has better models for predicting sea level rise?					
Which team seems to be more competent?					

Questionnaire Experiment 4

Informativeness-focused questions

Conveys uncertainty

"Projections of future changes in temperatures"
Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that conveys more uncertainty.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (2)

"Projections of future changes in sea level"
Two teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that conveys more uncertainty.

- Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
- Team Y: The sea level will rise between 31 centimeters and 43 centimeters. (2)

Conveys certainty

"Projections of future changes in temperatures"
Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that conveys more certainty.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (2)

"Projections of future changes in sea level"
Two teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that conveys more certainty.

- Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
- Team Y: The sea level will rise between 31 centimeters and 43 centimeters. (2)

Accuracy-focused question

More certain to be correct

"Projections of future changes in temperatures"
Two teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that is more certain to be correct.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (2)

"Projections of future changes in sea level"

Two teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that is more certain to be correct.

- Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
- Team Y: The sea level will rise between 31 centimeters and 43 centimeters. (2)

Ratings of fluency

Certainty-conditions (conveys more certainty and more certain to be correct)

Please rate to what extent the sentences below are easy to understand.

	Not at all easy	Slightly easy	Quite easy	Very easy	Extremely easy
It is certain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is certain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is certain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is certain that the sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below intuitively make sense.

	Not at all intuitive	Slightly intuitive	Quite intuitive	Very intuitive	Extremely intuitive
It is certain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is certain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is certain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is certain that the sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below can be quickly understood.

	Not at all quickly	Slightly quickly	Quite quickly	Very quickly	Extremely quickly
It is certain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is certain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is certain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is certain that the sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below are hard to process.

	Not hard at all	Slightly hard	Quite hard	Very hard	Extremely hard
It is certain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is certain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is certain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is certain that the sea level will rise between 31 centimeters and 43 centimeters.					

Uncertainty-condition (conveys more uncertainty)

Please rate to what extent the sentences below are easy to understand.

	Not at all easy	Slightly easy	Quite easy	Very easy	Extremely easy
It is uncertain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is uncertain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is uncertain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is uncertain that the sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below intuitively make sense.

	Not at all intuitive	Slightly intuitive	Quite intuitive	Very intuitive	Extremely intuitive
It is uncertain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is uncertain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is uncertain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is uncertain that the sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below can be quickly understood.

	Not at all quickly	Slightly quickly	Quite quickly	Very quickly	Extremely quickly
It is uncertain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is uncertain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is uncertain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is uncertain that the sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below are hard to process.

	Not hard at all	Slightly hard	Quite hard	Very hard	Extremely hard
It is uncertain that the temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
It is uncertain that the temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
It is uncertain that the sea level will rise between 18 centimeters and 59 centimeters.					
It is uncertain that the sea level will rise between 31 centimeters and 43 centimeters.					

Ratings of expertise (common across conditions)

Please rate to what extent the sentences below demonstrate that their authors have a strong expertise in forecasting climate change.

	Not at all	Slightly	Quite	Very much	Extremely
The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
The sea level will rise between 18 centimeters and 59 centimeters.					
The sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below indicate that their authors have a good knowledge of climate change.

	Not at all	Slightly	Quite	Very much	Extremely
The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
The sea level will rise between 18 centimeters and 59 centimeters.					
The sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below indicate that their authors lack experience in climate change modelling.

	Not at all	Slightly	Quite	Very much	Extremely
The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
The sea level will rise between 18 centimeters and 59 centimeters.					
The sea level will rise between 31 centimeters and 43 centimeters.					

Please rate to what extent the sentences below indicate that their authors know a lot about climate change.

	Not at all	Slightly	Quite	Very much	Extremely
The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius.					
The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius.					
The sea level will rise between 18 centimeters and 59 centimeters.					
The sea level will rise between 31 centimeters and 43 centimeters.					

Questionnaire Experiment 5

Informativeness-focused questions

Conveys uncertainty

Projections of future changes in temperature

Three teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that conveys more uncertainty than the other two.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)
- Team C: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (3)

Projections of future changes in sea level

Three teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that conveys more uncertainty than the other two.

- Team X: The sea level will rise between 18 centimetres and 59 centimetres. (1)
- Team Y: The sea level will rise between 23 centimetres and 51 centimetres. (2)
- Team Z: The sea level will rise between 31 centimeters and 43 centimetres. (3)

Conveys certainty

Projections of future changes in temperature

Three teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the prediction that conveys more certainty than the other two.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)
- Team C: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (3)

Projections of future changes in sea level

Three teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the prediction that conveys more certainty than the other two.

- Team X: The sea level will rise between 18 centimetres and 59 centimetres. (1)
- Team Y: The sea level will rise between 23 centimetres and 51 centimetres. (2)
- Team Z: The sea level will rise between 31 centimeters and 43 centimetres. (3)

Accuracy-focused question

More certain to be correct

Three teams of climate scientists have made the following predictions regarding the temperature rise by 2099. Please select the team that is more certain to be correct than the other two.

- Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
- Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)
- Team C: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (3)

Three teams of climate scientists have made the following predictions regarding the sea level rise by 2099. Please select the team that is more certain to be correct than the other two.

- Team X: The sea level will rise between 18 centimetres and 59 centimetres. (1)
- Team Y: The sea level will rise between 23 centimetres and 51 centimetres. (2)
- Team Z: The sea level will rise between 31 centimeters and 43 centimetres. (3)

Questionnaire Experiment 6

Condition 1: Focus on wide intervals

About climate forecasts

When climate scientists provide forecasts about what will happen in the future, they sometimes use intervals. This means that the researchers estimate an expected minimum value and an expected maximum value for a given outcome. Below are two forecasts of expected sea level rise in the Oslo Fjord using intervals:

- Forecast A: "The sea level in the Oslo Fjord will rise by a minimum of 20 cm and a maximum of 60 cm by 2100"
- Forecast B: "The sea level in the Oslo Fjord will rise by a minimum of 30 cm and a maximum of 50 cm by 2100"

Notice that Forecast A provides a WIDER interval (a larger span between the minimum and maximum value) than Forecast B. In this questionnaire, we are interested in how people understand intervals such as these, and especially how people think about interval width and uncertainty. There are two different ways of thinking about the interval width and uncertainty:

- On the one hand, WIDE intervals indicate that it is MORE UNCERTAIN what the outcome will be (the sea level could rise by anything from 20 to 60 cm, compared to 30 to 50 cm for the narrow interval)
- On the other hand, it is MORE CERTAIN that projections using WIDE intervals will be correct (the forecast is correct if the sea level rises by anything from 20 to 60 cm, compared to 30 to 50 cm for the narrow interval)

How would you rate these two ways of thinking about the intervals and uncertainty? Please answer the questions below.

How INTUITIVE do you find these two ways of thinking to be?

	Not intuitive at all						Very intuitive
	1	2	3	4	5	6	7
Wide intervals are UNCERTAIN (because it is more uncertain what the outcome will be)							
Wide intervals are CERTAIN (because it is more certain that the forecast will be correct)							

How NATURAL do you find these two ways of thinking to be?

	Not natural at all						Very natural
	1	2	3	4	5	6	7
Wide intervals are UNCERTAIN (because it is more uncertain what the outcome will be)							
Wide intervals are CERTAIN (because it is more certain that the forecast will be correct)							

How APPEALING do you find these two ways of thinking to be?

	Not appealing at all						Very appealing
	1	2	3	4	5	6	7
Wide intervals are UNCERTAIN (because it is more uncertain what the outcome will be)							

Wide intervals are CERTAIN (because it is more certain that the forecast will be correct)							

How LOGICAL do you find these two ways of thinking to be?

	Not logical at all						Very logical
	1	2	3	4	5	6	7
Wide intervals are UNCERTAIN (because it is more uncertain what the outcome will be)							
Wide intervals are CERTAIN (because it is more certain that the forecast will be correct)							

How COMPLICATED do you find these two ways of thinking to be?

	Not complicated at all						Very complicated
	1	2	3	4	5	6	7
Wide intervals are UNCERTAIN (because it is more uncertain what the outcome will be)							
Wide intervals are CERTAIN (because it is more certain that the forecast will be correct)							

Condition 2: Focus on narrow intervals

About climate forecasts

When climate scientists provide forecasts about what will happen in the future, they sometimes use intervals. This means that the researchers estimate an expected minimum value and an expected maximum value for a given outcome. Below are two forecasts of expected sea level rise in the Oslo Fjord using intervals:

- Forecast A: "The sea level in the Oslo Fjord will rise by a minimum of 20 cm and a maximum of 60 cm by 2100"
- Forecast B: "The sea level in the Oslo Fjord will rise by a minimum of 30 cm and a maximum of 50 cm by 2100"

Notice that Forecast B provides a NARROWER interval (a larger span between the minimum and maximum value) than Forecast A. In this questionnaire, we are interested in how people understand intervals such as these, and especially how people think about interval width and uncertainty. There are two different ways of thinking about the interval width and uncertainty:

- On the one hand, NARROW intervals indicate that it is MORE CERTAIN what the outcome will be (the sea level could rise by 30 to 50 cm, while it could rise by anything from 20 to 60 cm for the wide interval)
- On the other hand, it is MORE UNCERTAIN that projections using NARROW intervals will be correct (the forecast is only correct if the sea level rises by between 30 and 50 cm, compared to 20 to 60 cm for the wide interval)

How would you rate these two ways of thinking about the intervals and uncertainty? Please answer the questions below.

How INTUITIVE do you find these two ways of thinking to be?

	Not intuitive at all						Very intuitive
	1	2	3	4	5	6	7
Narrow intervals are CERTAIN (because it is more certain what							

the outcome will be)							
Narrow intervals are UNCERTAIN (because it is more uncertain that the forecast will be correct)							

How NATURAL do you find these two ways of thinking to be?

	Not natural at all						Very natural
	1	2	3	4	5	6	7
Narrow intervals are CERTAIN (because it is more certain what the outcome will be)							
Narrow intervals are UNCERTAIN (because it is more uncertain that the forecast will be correct)							

How APPEALING do you find these two ways of thinking to be?

	Not appealing at all						Very appealing
	1	2	3	4	5	6	7
Narrow intervals are CERTAIN (because it is more certain what the outcome will be)							
Narrow intervals are UNCERTAIN (because it is more uncertain that the forecast will be correct)							

How LOGICAL do you find these two ways of thinking to be?

	Not logical at all						Very logical
	1	2	3	4	5	6	7
Narrow intervals are CERTAIN (because it is more certain what the outcome will be)							
Narrow intervals are UNCERTAIN (because it is more uncertain that the forecast will be correct)							

How COMPLICATED do you find these two ways of thinking to be?

	Not complicated at all						Very complicated
	1	2	3	4	5	6	7
Narrow intervals are CERTAIN (because it is more certain what the outcome will be)							
Narrow intervals are UNCERTAIN (because it is more uncertain that the forecast will be correct)							