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

Article

Supplemental Material

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Experiment 1

9 **Procedure**

10   The study was part of a study taking place over 15 days, with the participants

11 responding to different questionnaires on each of the consecutive days of the study. Ninety-

12 one participants took part in the initial study when they completed a series of individual

13 differences measures, among these measures was a test of cognitive reflection (i.e., the ability

14 to override an intuitive response; Frederick, 2005). Eighty-one of these participants completed

15 a daily survey for 14 days. As explained in the main manuscript, the participants answered

16 questions about which of a narrow and a wide interval "is most likely to be correct" and

17 "conveys most uncertainty" on days 3 and 6, with the same questions repeated on day 9 and

18 11, but here, including an explanation for the variability in the expert forecasts. On day 14 the

19 participants' belief in climate change was measured using four questions taken from Heath

20 and Gifford (2006).

21 **Analysis**

22   We conducted a generalized estimating equation (GEE) for multinomial dependent

23 variables (Hardin & Hilbe, 2002), with the question ("conveys most uncertainty" vs. "most

24 likely to be correct"), the scenario, the presence of an explanation for variability, and their

25 two-level interactions as independent variables, and interval choice (narrow, wide, equal) as

26 the dependent variable. Type of question affected participants' choice: narrow intervals were

27 chosen more often as the prediction that was "most likely to be correct" than as the prediction

28 that "conveys most uncertainty" (tests of Model Effects), Wald χ^2 (1) = 6.96, p = .008.

29 Scenario did not have an effect on interval choice, nor did it interact with the question, Wald

30 χ^2 (1) < 0.01, p = .971 and Wald χ^2 (1) = 0.29, p = .588, respectively. The presence of an

31 explanation for variability did not affect interval selection, nor did it interact with the question

32 type, Wald χ^2 (1) = 2.08, p = .150 and Wald χ^2 (1) = 0.20, p = .654.

33   We conducted the same GEE with climate change and cognitive reflection as

34   covariates along with their interaction with the question manipulation (likely vs. uncertain)

35   because we hypothesized participants with higher cognitive reflection would endorse more

36   frequently the view that wide intervals are more likely to be correct than narrow intervals, and

37   to find narrow intervals as conveying more uncertainty than wide ones. Similarly, we

38   expected climate change belief to determine range selected: the wide range, which featured

39   more extreme climate change values was expected to be more often selected as likely but less

40   often as uncertain for those scoring higher on this variable. The introduction of the covariates

41   reduced the effect of the question manipulation which was no longer statistically significant,

42   Wald χ^2 (1) = 1.87, p = .171. Cognitive reflection predicted the interval selection but did not

43   interact with the condition, Wald χ^2 (1) = 4.11, p = .043 and Wald χ^2 (1) = 0.82, p = .367.

44   Specifically, participants with higher scores on the CRT less often chose the "equal" option,

45   and instead preferred any of the other two options as being "more likely to be correct", and

46   more often chose the wide interval as conveying uncertainty. Further, climate change belief

47   did not have a main effect nor interacted with the question to determine interval selection,

48   although the interaction was close to statistical significance, Wald χ^2 (1) = 0.11, p = .741 and

49   Wald χ^2 (1) = 3.43, p = .064.

50

51   **Experiment 2**

52   **Procedure**

53   The materials were the same as in Experiment 1, but with question type and reason for

54   variability varied between subjects in a 2 x 2 design.

55   **Analysis**

56   We conducted a GEE for multinomial dependent variable with question ("conveys

57   most uncertainty" vs. "most likely to be correct"), scenario, explanation for variability

58   (present vs. absent) and their interactions as independent variables, and interval choice

59   (narrow, wide, equal) as the dependent variable. The GEE showed that only the question type

60   had an effect on the interval selection, Wald χ^2 (1) = 24.13, $p < .001$. The scenario (sea level

61   vs. temperature) and the presence of a reason did not have a main effect on the interval

62   selected, Wald χ^2 (1) = 0.24, $p = .627$ and Wald χ^2 (1) = 1.06, $p = .303$, nor were any of the

63   interaction terms statistically significant, Wald χs^2 (1) < 1.02, p's > .05.

64

65   **Experiment 3**

66   **Procedure**

67   Participants in Experiment 3 were again given wide and narrow interval predictions

68   about sea level and temperature rise, but in this case, were given either a question about which

69   prediction "conveys more [un]certainty" or which prediction is "more [un]certain to be

70   correct". In other words, question type (conveys vs. to be correct) and directionality

71   (uncertain vs. certain) was varied between subjects in a 2 x 2 design.

72   As a secondary hypothesis, Experiment 3 also investigated whether perceptions of the

73   forecaster may be influenced by the question types, which would evoke either the

74   informativeness or the accuracy mindset. Hence, after selecting which interval conveys more

75   (un)certainty or is more (un)certain to be correct, participants rated which team seemed more

76   trustworthy, seemed to have most knowledge (about temperature rise or sea level rise),

77   seemed to have the best models (for predicting temperature rise or sea level rise), and which

78   team seemed to be most competent, on scales from 1 (definitely the team with the wide

79   interval) to 5 (definitely the team with the narrow interval). Note that this hypothesis as well

80   as the results and analysis, is described in full in the main manuscript.

81   **Analysis**

4

82   We conducted a GEE for multinomial dependent variable with the question (to be

83   correct vs. convey), the directionality of the term (uncertain vs. certain) and the scenario (sea

84   level vs. temperature), and all possible interactions between them, as independent variables,

85   while interval choice (narrow, wide, equal) was the dependent variable. The analysis found

86   that interval choice was not significantly affected by the question, Wald χ^2 (1) = 1.20, p =

87   .274, but there was an effect of directionality, Wald χ^2 (1) = 13.60, p < .001, and, more

88   importantly, an interaction between the two main factors, Wald χ^2 (1) = 25.50, p < .001. The

89   scenario did not have an effect on the interval choice, nor did it interact with the question,

90   directionality, or both of them, Wald χ^2's (1) < 0.41, p's > .52.

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

92

93   **Experiment 4**

94   **Procedure**

95   Participants were given the same scenarios as in previous experiments, and told to

96   choose which of a wide and a narrow interval conveyed more (un)certainty or was more

97   certain to be correct, in three between-subjects conditions. In this experiments, there was no

98   "equal" option, so participants chose between the wide and the narrow interval in each

99   condition. After selecting which interval conveys more (un)certainty or which interval is more

100   certain to be correct, participants rated the fluency of the predictions of sea level and

101   temperature rise featuring a narrow and a wide interval. The forecasts focused on either a

102   wide or a narrow interval and featured either the quantifier certain or uncertain. Participants

103   assessed the fluency of the resulting four forecasts in the sea rise context and in the

104   temperature rise context. The fluency of each forecast was measured through four questions:

105   the extent to which it was easy to understand, how intuitively and quickly it could be

106   understood and whether it was hard to process (reverse coded). In addition, four items

107   measured the perceived expertise of the team making the prediction in terms of how much it

108   knew, whether the team had knowledge, experience and expertise (the full questionnaire for

109   Experiment 4, including the questions for fluency and expertise are provided on pages 17-22

110   in the Supplementary materials). The reliability of the fluency scale was good for certainty

111   and uncertainty and for the two interval widths (Cronbach's α > .80). The reliability of the

112   expertise was also good for the two interval widths (Cronbach's α > .80). We computed

113   difference scores for fluency and expertise by subtracting the average score of the narrow

114   interval by the score of the wide interval. Greater scores of fluency and expertise indicate that

115   participants judged the narrow interval more fluent and inferred that their forecasters had a

116   greater expertise compared to wider intervals.

117   **Analysis**

118   Participants believed that the wide interval both conveyed more uncertainty and was

119   more certain to be correct, while the narrow interval was seen as conveying more certainty.

120   Thus, removing the incorrect option of "the intervals are equal" led to a majority choosing the

121   accuracy mindset when the question is focused on accuracy. The focus of the question had an

122   effect on the interval chosen in both the temperature and the sea rise contexts, $\chi^2(2, N = 302)$

123   = 75.8, p < .001, φ = .50 and $\chi^2(2, N = 302) = 77.14$, p < .001, φ = .51.

124

125   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)

126

127   *Effect of interval width on fluency and perceived expertise.*

128   As shown in Table S2, participants judged the narrow interval as reflecting more

129   expertise and to be easier to process (i.e., more fluent) than the wide interval. Further, the

130   prediction was judged harder to process if it was about uncertainty than if it was about

131   certainty. A mixed design ANOVA with interval width and scenarios as within-subject

132   independent variables and certainty word (certain vs. uncertain) as between-subjects

133   independent variable confirmed this impression, showing a main effect of the interval width

134   and certainty word on fluency, $F(1, 300) = 27.10$, $p < .001$, $\eta^2_p = .08$ and $F(1, 300) = 21.97$, p

135     $< .001$, $\eta^2_p = .07$. There was no interaction effect between the width of the interval and the

136   certainty word, $F(1, 300) < 1$, $\eta^2_p < .01$.

137
138   **Experiment 5**

139   **Procedure**

140   In Experiment 5, participants were given the same scenarios as in previous

141   experiments, but in this case, a third interval was included. This means that participants were

142   asked to select which of a (very) narrow, a "medium", and a wide interval conveyed more

143   (un)certainty or is more certain to be correct, in three between-subjects conditions.

144   Experiment 5 also included three measures of individual differences that might be

145   related to the belief that wide intervals are more uncertain and narrow intervals are more

146   certain or convey more certainty, namely a climate change belief scale (Heath & Gifford,

147   2006), a numeracy scale (Lipkus, Samsa, & Rimer, 2001), and a disjunction task (Costello,

148   2009). The climate change and disjunction scales had satisfactory reliability, Cronbach's α =

149   .83 and Cronbach's α = .98, while the numeracy scale had a reliability that was lower than

150   expected, Cronbach's α = .54. The individual difference measures were presented as one

151   block of questions (in randomized order), and the order of the individual differences block

152   and the interval selection block was randomized.

153   **Analysis**

154   ***Interval selection.*** Participants believed that the wide interval conveyed more

155   uncertainty and was more certain to be correct, while the narrow interval was thought to

156   convey more certainty. The focus of the question had an effect of the interval chosen in both

157   the temperature and the sea rise contexts, $\chi^2(4, N = 101) = 28.56$, $p < .001$, $\varphi = .53$ and $\chi^2(4, N$

158    $= 302) = 28.85$, $p < .001$, $\varphi = .49$.

159   ***Individual differences.*** There were no clear correlation patterns between interval

160   choice and the individual difference measures across groups. And since there were only 31-35

161   participants in each condition in this experiment, we did not have enough power to detect

162   effects within each condition. Thus, we do not further describe these results.

163
164   **Experiment 6**
165   **Procedure**

166   See main text.

167   **Analysis**

168   <u>Individual differences.</u>

169   Three participants did not respond to either the CRT or the numeracy test, and one

170   additional participant did not respond to the CRT (and only partially to the numeracy test). To

171   be as conservative as possible, these four participants were included in the analyses of the

172   ratings of the two mindsets as described in the main text, but were necessarily excluded in the

173   analyses of individual differences. Participants on average had 1.54 correct answers on the

174   CRT ($SD = 1.17$), with 23.8% getting a score of zero, and 29.5% getting all answers correct.

175   The CRT score did not differ between conditions, $F(1,99) = 1.369$, $p = .245$, $\eta^2_p = .014$.

176   Sixteen participants reported seeing the CRT-questions earlier, and scored higher ($M = 2.13$,

177    $SD = .96$) than those who had not seen the questions before ($M = 1.44$, $SD = 1.18$), $F(1,99) =$

178   4.854, $p = .030$, $\eta^2_p = .047$. On the numeracy test, there were also no difference in scores

179   between conditions, $F < 1$. The mean score across participants was 3.67 ($SD = 1.36$).

180   Neither CRT ($r = .005$, $p = .958$) nor numeracy ($r = .093$, $p = .355$) correlated

181   significantly with the average difference score. However, we did find positive correlations

182   between CRT and the average separate ratings of the informativeness and the accuracy

183   mindsets, $r = .204$, $p = .040$, and $r = .208$, $p = .037$, respectively. Similarly, numeracy

184   correlates positively with the informativeness mindset, $r = .243$, $p = .014$, and the accuracy

185   mindset, $r = .141$, $p = .161$.

186
187
188

189 **References**
190
191
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203
204

Questionnaire Experiments 1 and 2
206

207 <u>Informativness-focused question</u>
208   <u>Without reason for variability</u>
209 Projections of future changes in temperature
210 Two teams of climate scientists have made the following predictions regarding the
211 temperature rise by 2099. Please select the prediction that conveys the greatest level of
212 uncertainty.
213 ⭘ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
214 ⭘ Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)
215 ⭘ The two predictions convey the same level of uncertainty. (3)
216
217 Projections of future changes in sea level
218 Two teams of climate scientists have made the following predictions regarding the sea level
219 rise by 2099. Please select the prediction that conveys the greatest level of uncertainty.
220 ⭘ Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
221 ⭘ Team Y: The sea level will rise between 23 centimeters and 51 centimeters. (2)
222 ⭘ The two predictions convey the same level of uncertainty. (3)
223
224   <u>With reason for variability</u>
225 Projections of future changes in temperature
226 Two teams of climate scientists have made the following predictions regarding the
227 temperature rise by 2099. Please select the prediction that conveys the greatest level of
228 uncertainty.
229 ⭘ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius in
230   different countries. (1)
231 ⭘ Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius in
232   different countries. (2)
233 ⭘ The two predictions convey the same level of uncertainty. (3)
234
235 Projections of future changes in sea level
236 Two teams of climate scientists have made the following predictions regarding the sea level
237 rise by 2099. Please select the prediction that conveys the greatest level of uncertainty.
238 ⭘ Team X: The sea level will rise between 18 centimeters and 59 centimeters in different
239   parts of the world. (1)
240 ⭘ Team Y: The sea level will rise between 23 centimeters and 51 centimeters in different
241   parts of the world. (2)
242 ⭘ The two predictions convey the same level of uncertainty. (3)
243
244 <u>Accuracy-focused question</u>
245   <u>Without reason for variability</u>

246   Projections of future changes in temperature
247   Two teams of climate scientists have made the following predictions regarding the
248   temperature rise by 2099. Please select the prediction that is the most likely to be correct.
249   ❍ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
250   ❍ Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)
251   ❍ The predictions are equally likely to be correct. (3)
252
253   Projections of future changes in sea level
254   Two teams of climate scientists have made the following predictions regarding the sea level
255   rise by 2099. Please select the prediction that is the most likely to be correct?
256   ❍ Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
257   ❍ Team Y: The sea level will rise between 23 centimeters and 51 centimeters. (2)
258   ❍ The predictions are equally likely to be correct. (3)
259
260   With reason for variability
261   Projections of future changes in temperature
262   Two teams of climate scientists have made the following predictions regarding the
263   temperature rise by 2099. Please select the prediction that is the most likely to be correct.
264   ❍ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius in
265   different countries. (1)
266   ❍ Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius in
267   different countries. (2)
268   ❍ The predictions are equally likely to be correct. (3)
269
270   Projections of future changes in sea level
271   Two teams of climate scientists have made the following predictions regarding the sea level
272   rise by 2099. Please select the prediction that is the most likely to be correct.
273   ❍ Team X: The sea level will rise between 18 centimeters and 59 centimeters in different
274   parts of the world. (1)
275   ❍ Team Y: The sea level will rise between 23 centimeters and 51 centimeters in different
276   parts of the world. (2)
277   ❍ The predictions are equally likely to be correct. (3)
278
279

280 **Questionnaire Experiment 3**

281

282 <u>Informativeness-focused questions</u>

283   <u>Conveys uncertainty</u>

284 Projections of future changes in temperature

285 Two teams of climate scientists have made the following predictions regarding the

286 temperature rise by 2100. Please select the prediction that conveys more uncertainty.

287 ❍ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)

288 ❍ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)

289 ❍ The two predictions convey an equal degree of uncertainty (3)

290

291 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?					

292

293 Projections of future changes in sea level

294 Two teams of climate scientists have made the following predictions regarding the sea level

295 rise by 2100. Please select the prediction that conveys more uncertainty.

296 ❍ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)

297 ❍ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)

298 ❍ The two predictions convey an equal degree of uncertainty (3)

299

300 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?					

301

302   <u>Conveys certainty</u>

303 Projections of future changes in temperature
304 Two teams of climate scientists have made the following predictions regarding the
305 temperature rise by 2100. Please select the prediction that conveys more certainty.
306 ❍ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)
307 ❍ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)
308 ❍ The two predictions convey an equal degree of certainty (3)
309
310 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?					

311
312 Projections of future changes in sea level
313 Two teams of climate scientists have made the following predictions regarding the sea level
314 rise by 2100. Please select the prediction that conveys more certainty.
315 ❍ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)
316 ❍ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)
317 ❍ The two predictions convey an equal degree of certainty (3)
318
319 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?					

320
321 <u>Accuracy-focused questions</u>
322   Uncertain to be correct
323 Projections of future changes in temperature
324 Two teams of climate scientists have made the following predictions regarding the
325 temperature rise by 2100. Please select the prediction that is more uncertain to be correct.
326 ❍ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)
327 ❍ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)
328 ❍ The two predictions are equally uncertain to be correct (3)
329
330 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?					

331
332 Projections of future changes in sea level
333 Two teams of climate scientists have made the following predictions regarding the sea level
334 rise by 2100. Please select the prediction that is more uncertain to be correct.
335 ○ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)
336 ○ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)
337 ○ The two predictions are equally uncertain to be correct (3)
338
339 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?					

340
341   Certain to be correct
342 Projections of future changes in temperature
343 Two teams of climate scientists have made the following predictions regarding the
344 temperature rise by 2100. Please select the prediction that is more certain to be correct.
345 ○ Team A: The temperature will increase between 1.5° Celsius and 5.5° Celsius (1)
346 ○ Team B: The temperature will increase between 2.5° Celsius and 4.5° Celsius (2)
347 ○ The two predictions are equally certain to be correct (3)
348
349 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?					

350

351 Projections of future changes in sea level

352 Two teams of climate scientists have made the following predictions regarding the sea level

353 rise by 2100. Please select the prediction that is more certain to be correct.

354 ○ Team X: The sea level will rise between 20 centimeters and 60 centimeters (1)

355 ○ Team Y: The sea level will rise between 30 centimeters and 50 centimeters (2)

356 ○ The two predictions are equally certain to be correct (3)

357

358 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?					

359

360 **Questionnaire Experiment 4**
361
362 <u>Informativeness-focused questions</u>
363
364   <u>Conveys uncertainty</u>
365
366 "Projections of future changes in temperatures"
367 Two teams of climate scientists have made the following predictions regarding the
368 temperature rise by 2099. Please select the prediction that conveys more uncertainty.
369   ❍ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
370   ❍ Team B: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (2)
371
372 "Projections of future changes in sea level"
373 Two teams of climate scientists have made the following predictions regarding the sea level
374 rise by 2099.   Please select the prediction that conveys more uncertainty.
375   ❍ Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
376   ❍ Team Y: The sea level will rise between 31 centimeters and 43 centimeters. (2)
377
378   <u>Conveys certainty</u>
379
380 "Projections of future changes in temperatures"
381 Two teams of climate scientists have made the following predictions regarding the
382 temperature rise by 2099. Please select the prediction that conveys more certainty.
383   ❍ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
384   ❍ Team B: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (2)
385
386 "Projections of future changes in sea level"
387 Two teams of climate scientists have made the following predictions regarding the sea level
388 rise by 2099. Please select the prediction that conveys more certainty.
389   ❍ Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)
390   ❍ Team Y: The sea level will rise between 31 centimeters and 43 centimeters. (2)
391
392
393 <u>Accuracy-focused question</u>
394
395   <u>More certain to be correct</u>
396 "Projections of future changes in temperatures"
397 Two teams of climate scientists have made the following predictions regarding the
398 temperature rise by 2099. Please select the prediction that is more certain to be correct.
399   ❍ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)
400   ❍ Team B: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (2)
401

402   "Projections of future changes in sea level"

403   Two teams of climate scientists have made the following predictions regarding the sea level

404   rise by 2099. Please select the prediction that is more certain to be correct.

405   ❍ Team X: The sea level will rise between 18 centimeters and 59 centimeters. (1)

406   ❍ Team Y: The sea level will rise between 31 centimeters and 43 centimeters. (2)

407

408   Ratings of fluency

409   <u>Certainty-conditions (conveys more certainty and more certain to be correct)</u>

410   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.					

411

412

413

414   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.					

415
416   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.					

417
418
419   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.					

420
421   Uncertainty-condition (conveys more uncertainty)

422   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.					

423

424   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.					

425

426   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.					

427

428   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.					

429

430   <u>Ratings of expertise (common across conditions)</u>

431   Please rate to what extent the sentences below demonstrate that their authors have a strong

432   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.					

433

434   Please rate to what extent the sentences below indicate that their authors have a good

435   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.					

436

437   Please rate to what extent the sentences below indicate that their authors lack experience in

438   climate change modelling.

439

	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.					

440

441 Please rate to what extent the sentences below indicate that their authors know a lot about
442 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.					

443
444
445

446 **Questionnaire Experiment 5**

447

448 <u>Informativeness-focused questions</u>

449   <u>Conveys uncertainty</u>

450 Projections of future changes in temperature

451 Three teams of climate scientists have made the following predictions regarding the

452 temperature rise by 2099. Please select the prediction that conveys more uncertainty than the

453 other two.

454 ○ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)

455 ○ Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)

456 ○ Team C: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (3)

457

458 Projections of future changes in sea level

459 Three teams of climate scientists have made the following predictions regarding the sea level

460 rise by 2099. Please select the prediction that conveys more uncertainty than the other two.

461 ○ Team X: The sea level will rise between 18 centimetres and 59 centimetres. (1)

462 ○ Team Y: The sea level will rise between 23 centimetres and 51 centimetres. (2)

463 ○ Team Z: The sea level will rise between 31 centimeters and 43 centimetres. (3)

464

465   <u>Conveys certainty</u>

466 Projections of future changes in temperature

467 Three teams of climate scientists have made the following predictions regarding the

468 temperature rise by 2099. Please select the prediction that conveys more certainty than the

469 other two.

470 ○ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)

471 ○ Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)

472 ○ Team C: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (3)

473

474 Projections of future changes in sea level

475 Three teams of climate scientists have made the following predictions regarding the sea level

476 rise by 2099. Please select the prediction that conveys more certainty than the other two.

477 ○ Team X: The sea level will rise between 18 centimetres and 59 centimetres. (1)

478 ○ Team Y: The sea level will rise between 23 centimetres and 51 centimetres. (2)

479 ○ Team Z: The sea level will rise between 31 centimeters and 43 centimetres. (3)

480

481 <u>Accuracy-focused question</u>

482   <u>More certain to be correct</u>

483 Three teams of climate scientists have made the following predictions regarding the

484 temperature rise by 2099. Please select the team that is more certain to be correct than the

485 other two.

486 ○ Team A: The temperature will increase between 1.1 ° Celsius and 6.4 ° Celsius. (1)

487 ○ Team B: The temperature will increase between 2.2 ° Celsius and 5.4 ° Celsius. (2)

488 ○ Team C: The temperature will increase between 3.3 ° Celsius and 4.4 ° Celsius. (3)

489

490   Three teams of climate scientists have made the following predictions regarding the sea level
491   rise by 2099. Please select the team that is more certain to be correct than the other two.
492   ○ Team X: The sea level will rise between 18 centimetres and 59 centimetres. (1)
493   ○ Team Y: The sea level will rise between 23 centimetres and 51 centimetres. (2)
494   ○ Team Z: The sea level will rise between 31 centimeters and 43 centimetres. (3)
495
496
497

498 **Questionnaire Experiment 6**

499

500 <u>Condition 1: Focus on wide intervals</u>

501

502 *About climate forecasts*
503 When climate scientists provide forecasts about what will happen in the future, they
504 sometimes use intervals. This means that the researchers estimate an expected minimum value
505 and an expected maximum value for a given outcome. Below are two forecasts of expected
506 sea level rise in the Oslo Fjord using intervals:
507 - Forecast A: "The sea level in the Oslo Fjord will rise by a minimum of 20 cm and a
508 maximum of 60 cm by 2100"
509 - Forecast B: "The sea level in the Oslo Fjord will rise by a minimum of 30 cm and a
510 maximum of 50 cm by 2100"
511 Notice that Forecast A provides a WIDER interval (a larger span between the minimum and
512 maximum value) than Forecast B. In this questionnaire, we are interested in how people
513 understand intervals such as these, and especially how people think about interval width and
514 uncertainty. There are two different ways of thinking about the interval width and uncertainty:
515
516 - On the one hand, WIDE intervals indicate that it is MORE UNCERTAIN what the outcome
517 will be (the sea level could rise by anything from 20 to 60 cm, compared to 30 to 50 cm for
518 the narrow interval)
519 - On the other hand, it is MORE CERTAIN that projections using WIDE intervals will be
520 correct (the forecast is correct if the sea level rises by anything from 20 to 60 cm, compared to
521 30 to 50 cm for the narrow interval)
522
523 How would you rate these two ways of thinking about the intervals and uncertainty? Please
524 answer the questions below.
525 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)							

526 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)							

527
528 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) | | | | | | | |

529

530 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)							

531

532 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)							

533

534 Condition 2: Focus on narrow intervals

535

536 *About climate forecasts*
537 When climate scientists provide forecasts about what will happen in the future, they
538 sometimes use intervals. This means that the researchers estimate an expected minimum value
539 and an expected maximum value for a given outcome. Below are two forecasts of expected
540 sea level rise in the Oslo Fjord using intervals:
541 - Forecast A: "The sea level in the Oslo Fjord will rise by a minimum of 20 cm and a
542 maximum of 60 cm by 2100"
543 - Forecast B: "The sea level in the Oslo Fjord will rise by a minimum of 30 cm and a
544 maximum of 50 cm by 2100"
545 Notice that Forecast B provides a NARROWER interval (a larger span between the minimum
546 and maximum value) than Forecast A. In this questionnaire, we are interested in how people
547 understand intervals such as these, and especially how people think about interval width and
548 uncertainty. There are two different ways of thinking about the interval width and uncertainty:
549
550 - On the one hand, NARROW intervals indicate that it is MORE CERTAIN what the
551 outcome will be (the sea level could rise by 30 to 50 cm, while it could rise by anything from
552 20 to 60 cm for the wide interval)
553 - On the other hand, it is MORE UNCERTAIN that projections using NARROW intervals
554 will be correct (the forecast is only correct if the sea level rises by between 30 and 50 cm,
555 compared to 20 to 60 cm for the wide interval)
556
557 How would you rate these two ways of thinking about the intervals and uncertainty? Please
558 answer the questions below.
559 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)						

560

561

562 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)							

563

564 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)							

565

566 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)							

567

568 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)							

569

570