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Behavioral Sciences

Changing Perspectives: A simple method for improving numerical estimation and reducing overconfidence

Research Plan

Rationale

From predicting the number of minutes it will take to get to work to guessing the cost of a grocery bill, humans estimate numbers on a daily basis. However, when it comes to larger quantities and infrequently used units, it is much more difficult to estimate accurately. Large numbers, such as in the billions or trillions, are more abstract because we do not have much experience with them in personal contexts.

The term *perspective* is defined as an additional sentence tacked onto a measurement to give it context and make it easier to understand. A perspective can be expressed in the form of a ratio, rank, or unit change. Some examples are: "to put the area of France into perspective, it is about the size of Texas," or "fifteen centimeters is about equal to the length of half a foot." Previous research has concluded that perspectives improved readers' ability to recall measurements, estimate measurements, and detect errors in given statistics from news article quotes.

Additionally, people often exhibit overconfidence when dealing with numerical estimation. Research conducted by Daniel Kahneman, author of*Thinking Fast and Slow,* reveals that when people express an estimation in terms of a 90% confidence interval, the right answer only falls in that interval 50% of the time. By combining the findings on the benefits of perspectives with the issue of overconfidence, perspectives could possibly reduce both overconfidence and improve accuracy in numerical estimations.

Research Questions

Can people more accurately estimate measurements when they are provided with a perspective? When expressing their answers 90% confidence intervals, are people better calibrated (in terms of percentage of intervals bracketing the correct answer) when perspectives are present? When answering with 90% confidence intervals in terms of a reference object (e.g., I am 90% confident that New York State is between ___ and ___ times the size of Vermont), will people be better calibrated than people who answer in terms of raw numbers without a perspective? Will they be better calibrated than people who answer in terms of raw numbers and with a perspective? Will the accuracy-informativeness tradeoff be better?

Procedures

Data for the study will be collected through the distribution of an original survey on Amazon's Mechanical Turk, a crowdsourcing website which can be used to distribute surveys, until about 600 responses are provided. There are no risks involved, and privacy will be protected as the survey is anonymous. No informed consent will be necessary as participants will be made aware that their participation is voluntary and they have the right to stop at any time upon starting the survey. The survey will inform the participants that they will be asked to

provide educated guesses of certain measurements and that they are not allowed to look up answers on the internet. Three conditions have been created and will be randomly assigned to participants:

Condition A- This version of the survey will be given to 40% of participants. They will be asked to estimate quantities, for example, to estimate the diameter of Jupiter in miles. Within this condition, people are randomly assigned to answer questions with a perspective present or absent. The perspective in this example question would be the diameter of the Earth in miles.

Condition B- This version of the survey will be given to 40% of the participants. It is like Condition A but people answer in terms of 90% confidence intervals (I am 90% confident that the answer is between ___ and ___) instead of point estimates. Within this condition, people are randomly assigned to answer questions with a perspective present or absent.

Condition C- People create 90% confidence intervals in terms of a perspective (e.g. expressing the diameter of Jupiter as a multiple of the size of the Earth)

Data Analysis

Through R Studio, t -tests on OME (order of Magnitude error [abs(log10(estimate/true)]) will be used to compare the accuracy of responses influenced by perspectives vs. no perspectives. Both point estimates and midpoints of intervals will be converted to OME to compare accuracy. In interval conditions, the midpoint of the interval will be used to extract a value for judging accuracy. In condition C, intervals will be transformed back to the original units to compare them to other conditions. For example, if a participant says they are 90% confident that New York is 2 to 5 times the size of Vermont, and Vermont is 9,623 square miles, the interval would be transformed to 2*9623 to 5*9623 and the transformed midpoint would be (2*9623 + 5*9623)/2. Proportion tests will be used to compare differences in proportions of bracketing intervals. They will also be used for comparing completion rates between conditions. Graphical analyses of distributions of responses will be created but not subjected to formal statistical tests.

Bibliography

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