



Testing Alternative Wording of the Big Bang and Evolution Questions

The General Social Survey (GSS) included an experiment to test which alternative question wording regarding the origin of the universe (the “Big Bang”) and evolution best captures overall knowledge of science. These questions were part of the NSF’s factual knowledge of science questions until, as noted above, it was found that small question wording changes substantially improve the number of correct answers.

Asking respondents about what scientists believe, rather than implicitly what the respondent believes, increases correct responding. Asking about the evolution of elephants or whether the universe is expanding also increases the number of correct responses. This suggests the possibility that Americans may be answering these questions incorrectly due to personal views rather than a lack of knowledge about what science considers the correct answers. If so, alternative questions might be selected that could better capture factual knowledge of science.

It is important, however, to ensure that any proposed alternative questions capture factual knowledge of science better than the existing questions. The fact that people give more correct answers to a reworded question need not indicate that the reworded question better captures general knowledge. The reworded questions may have cues, such as the mention of scientists, which yield more correct responses because of reasons other than knowledge.

Also, even if people know the correct answer to the human evolution question but select the wrong answer because of personal beliefs, those beliefs might indicate a broader lack of understanding of science. For example, a question about the evolution of elephants could more accurately capture knowledge of what science says about evolution but be a worse overall indicator of knowledge of other scientific facts or understanding of the scientific process.

A key test, then, of the value of alternative wordings is whether they are more strongly associated with the current 9-item factual knowledge of science questions than the original questions. If they are, this suggests that the questions likely capture broad factual knowledge of science better. Another, less critical indicator includes the questions’ association with understanding the scientific process.

An examination of all GSS data to date containing the various question wordings finds that those questions prefaced with “According to astronomers...” or “According to the theory of evolution...” do better than the alternative questions with respect to factual knowledge of science. That is, the “According to” questions have a stronger association with factual knowledge than do the alternatives. In particular, people correctly answering either of the “According to” questions have a factual knowledge score on average about 1.7 points higher on the 9-point scale than those who answer these questions incorrectly. This contrasts with a 1.3-point difference for those correctly versus those incorrectly answering the original Big Bang question and a 1-point difference for the “universe is expanding” question. The 1.7-point difference on the “According to” evolution question also contrasts with a 1.1-point difference for the original evolution question and a 1-point difference for the elephant evolution question.

The “According to” Big Bang question also has a stronger association with understanding of the scientific process than the original Big Bang question. The “According to” Big Bang question does not have a demonstrably stronger relationship with understanding of the scientific process than *the universe is expanding* alternative. Similarly, it is not clear which of the three versions of the evolution question has a stronger relationship with understanding of the scientific process. The findings for understanding the scientific process are less definitive in part because such understanding has a generally weaker relationship with the question alternatives than does the factual knowledge score and because relatively little data are available for the alternatives.



The stronger relationship of the “According to” questions with factual knowledge of science than the original or other alternative questions suggests that these “According to” questions are better indicators of such knowledge. Also, the stronger relationship of the “According to” Big Bang question with knowledge of the scientific process provides additional evidence for this question over the original version of the question. Whether the “According to” questions should replace the original questions will depend in part on weighing their strengths against losing the long-time series available for the original questions.