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Scientific Literacy in the Popular Press:

How Manipulating Data Affects Perception of the Topic Presented

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Abstract

The accurate interpretation of articles in the popular press is important in developing scientific literacy. We presented such an article to undergraduates and manipulated the data contained within the article to create varying degrees of plausibility. Survey questions were asked of these participants asking if they found aspects of research within the article such as social context information, the presence of a method description, a theory, information about how relevant the research is and about related research. There was no significant difference between the groups on whether they found these categories in the article nor on how important they rated these aspects to be. The groups did not differ on how believable the data were to them, how credible the source of the data were or on basic recall of data in the article. A larger sample is needed to try and determine if this manipulation would cause a significant difference between the groups on any of these measures.

Scientific literacy in the popular press: How manipulating data affects perception of the topic presented

After the completion of formal schooling, individuals presumably acquire information about science and new research through the use of media or popular press reports. These reports would arguably have great educational value to our society. There are some, but not many, research studies that address what skills are required to evaluate items in the popular press in addition to evaluating if people, in general, have these skills (Korpan, Bisanz, Bisanz, & Henderson, 1997). The ability to read and understand these reports as well as to comfortably discuss what one has read with others are components vital to a scientifically literate individual (Glynn & Denise, 1994). Scientific literacy is loosely defined. Some of the fundamentals of most definitions are an understanding of key facts, how scientists carry out research (the scientific method) and how science connects to every day life. (Zimmerman, Bisanz, Bisanz, Klein, & Klein, 2001). Zimmerman et al. argued that all of these components are necessary when reading popular press reports about science. This is because media reports are how research findings are usually communicated to the general public.

In a study conducted on scientific literacy among university students, Korpan et al. (1997) created four news briefs describing false findings supported by relatively few indications of how these conclusions came about. Students then read the briefs and wrote requests for the types of information they would need in order to make a clear decision as to whether the findings were true or not. The researchers in this study felt that requests for any type of information indicated that the student had some ability to process new topics on the spot. After receiving all of the student responses Korpan et al. (1997) classified this information according to a taxonomy. This taxonomy included the categories of social context, theory, methods,

data/statistics, related research and relevance. Under the heading of social context were those responses that were directed toward the qualifications or credentials of the researchers, motives of the source of funding for the study, information about where the research was published and information about where it was conducted. The category of theory included requests for the theory behind the conclusion drawn in the brief. Requests for the method through which the conclusion came about were included in their own category as well as those requests for the actual data or statistics from the study. The heading of related research included those requests for other studies which have looked at similar phenomena, while the heading of relevance included those which asked for how important these findings are to the public and how they apply to our lives. Korpan et al. (1997) found that most of their participants made requests for information regarding social context, agent/theory, methods, and data/statistics on at least one occasion during the study. However, they believed that the percentages of people requesting information about social context, statistics, related research and the relevance of the research should have been higher. The findings of this study may speak about science education. The fact that the participants in this study had such a low frequency of requests for information regarding things like the data from the research or who the researchers were and what their affiliations were may mean that they didn't notice that it was missing. There were certainly some briefs that generated more questions than others and this had to do with, in part, the plausibility of the conclusion drawn in the briefs. For example the low plausibility brief discussed the benefits of wearing a dream crystal while one sleeps; this generated a lot of questions as compared to a brief on dieting which is a more plausible topic for discussion in general.

In addition to asking for additional information to decide if the conclusion was true or not the participants were asked to rate, on a seven-point scale, how plausible the conclusion was

based on what little information they were given. The researchers basically asked how much potential the conclusion had to be true. Questions regarding social context were asked with the highest level of frequency for the briefs that were rated with the lowest level of plausibility. This indicated that students requested relevant information about the researchers, funding and source of publication for those briefs that they found to be the least believable. However, as previously stated the requests for information in many of the categories was much lower than the researchers would have liked (Korpan et al. 1997). This leaves open the possibility that students are not taught to look for this information when they are in the public school systems of North America.

In addressing the school systems of the United States in particular, Champagne and Newell (1992) placed some of the blame for students' lack of knowledge in certain areas, such as science, on standardized testing. They believed that teachers are forced to teach the material that will be on the standardized tests given at the end of the year instead of teaching information that is completely relevant to the types of information the student will have to process outside of the classroom. Further, they argued that these tests do not tap into higher cognitive processes and therefore are not an accurate measure of what students know. It is apparent that this country relies heavily on standardized tests within the education system. Champagne and Newell (1992) recognized this but would like to see additional measures added to these tests or in addition to these tests. These measures would include testing the ability of the individual to apply what they have learned in a real life setting that is not staged in a classroom.

While testing students in addition to standardized tests is one solution, it is certainly something that will not occur overnight. Therefore it is important to research how scientifically literate the population is. Zimmerman et al. (2001) conducted a study in part to determine what

characteristics of the Korpan et al. taxonomy were actually found in scientific news briefs, such as those found in daily newspapers and news magazines written for the general public. The researchers then compared what they found in the news briefs to expert advice to the general public on what features to look for when critically evaluating scientific findings published in the popular press, and they also compared these findings to the Korpan et al. (1997) findings discussed earlier. The expert advice they used was taken from articles written in places such as Consumer Reports and other sources where the purpose of the article was to teach the public what to look for when critically assessing science in the media.

Zimmerman et al. (2001) found that what experts tell people to look for differed greatly from what was actually published in popular press articles and this differed from the student requests for information in the Korpan et al. (1997) study. This indicated that students may not be at fault when they do not know what types of information to ask for. It may merely mean that they are not ever presented with a particular topic category and therefore do not know what to look for. Also, the experts that are telling people what to look for are not the ones actually writing the news articles. Authors of news briefs are not required to include such information. This is a possible indication that certain information may be left out on purpose to lead the public into believing the conclusions of the articles without sufficient information to think critically about the findings. Zimmerman et al. (2001) address this issue by indicating that the goal of journalism is to get the information to the public. However, they would like to see the level of this writing increased. So far, the lack of scientific literacy in society has been attributed, by various authors, to standardized testing, the education system and the actual information that is presented in the popular press in the form of scientific findings.

Another study done on scientific findings in the popular press looked at high school seniors near graduation. Norris & Phillips (1994) aimed partially to see if students were able to determine how certain the author of a scientific news brief was of the conclusions. They sought to find how participants would view the pragmatic meaning of science reports in the media. By pragmatic meaning, they wanted to know if the reader could decipher what context the author was writing in and what the particular words being used stated about the author's purpose. It was argued that thinking critically about news articles is a key component to becoming scientifically literate. Readers should be able to determine how believable the text is depending on how it is written and what is included in it. They should not be taking the information as fact merely because it is published in a newspaper nor should they be misinterpreting the information because they are not reading it carefully and picking up on what the author is trying to communicate to them. Even expert opinions should be questioned for evidence, motives and the like. If a reader cannot determine how certain the author is about what they have written then the reader will not be able to critically think about the text and ultimately will not become scientifically literate. Norris and Phillips found that students overestimated how true conclusions were when reading scientific research in the media, despite clues in the text that would lead them to believe otherwise.

Norris and Phillips (1994) also found that when students were asked to view statements that needed to be linked to other statements within the text less than 50% of them did so correctly. By "linked to other statements" the researchers meant that the statement needed additional information in order to be properly evaluated. That information could be found elsewhere in the passage. However, when students were asked to view statements that could stand alone on meaning they correctly interpreted these statements 90% of the time. The

researchers of this study believed that the skill of making connections from one statement to another is not being taught in the schools. They argue that these students will graduate high school never having developed this skill because there is no means for it to be taught to them. Therefore, scientifically literate individuals will be few and far between if these skills are not being taught to students soon. Furthermore, if the education system chooses not to teach these skills then it cannot be expected that individuals will grow to be scientifically literate (Norris & Phillips 1994).

The present study tried to determine if when given a popular press article, if students would find those cues discussed in the Korpan et al. (1994) taxonomy. Also, we measured to what degree of importance students hold these various topic categories. However, all of the data in the article was changed to either inflate or reduce the original data in the article (depending on condition). This study wanted to determine if this manipulation would change whether or not students found the categories (social context, method, theory, relevance and related research) in the article. This served as a manipulation of the level of plausibility. As the data was inflated or reduced the plausibility was compromised. All of the categories were present in the article to some degree, so any student who reported that they do not find this information over looked it within the text. It was hypothesized that participants who read the inflated data as well as the reduced data would have a lower frequency of finding social context information in the article. This was expected because it was previously found to be true when researchers manipulated plausibility (Korpan et al. 1997). It was also hypothesized that these groups would place a higher value on social context information than the group reading the original data since they were expected to find it less, they may feel it to be more important that they are given such information.

Participants were also asked questions designed to see if the data influenced how they feel about the subject of the article. Participants were directly asked if they were concerned about the findings or not. It was hypothesized that students that received the inflated data would be more concerned about the findings than students who received the original data and those who received the reduced data. How believable the participants found the data was also assessed. It was hypothesized that those students who received the reduced data would believe the data less than those that read the original article since it seemed to have a low level of plausibility. The reduced data article had a low level of plausibility because it was unlikely the researchers would be writing the article if there were such low numbers. Students were also asked to assess the credibility of the source of the data. It was expected that those who received the original data or the inflated data would be more likely to find the source credible since they were likely to be more concerned about the situation. It was expected that those who received the data that had been reduced would find the source to be less credible since the text of the article stated the findings to be serious yet the data showed rather small consequences. Participants were also asked to recall information from the article to see if they correctly processed all of the numbers that they read. It was expected that all groups would be equally accurate in their response to the recall questions.

Method

Participants

Fifty six undergraduate students participated for research credit. There were twenty males and thirty six females. There were twenty one freshman, twenty one sophomores, eleven juniors and three seniors. Participants were enrolled in a variety of majors. Participants were randomly

assigned to one of three conditions. The conditions include two experimental groups and one control group.

Materials

Each participant was given a pre-test (see Appendix A), an article to read and a post-test (see Appendix B). The pre-tests and post-tests are identical across condition. The original article is about the melting of glaciers and was published on the "Wired News" website (see Appendix C). The different versions include two systematically manipulated versions in which the data from the original article were manipulated. These two versions make the melting of glaciers seem to be less of an immediate and severe issue than it actually is and makes up the reduced data condition (see Appendix D) or the opposite, make it seem to be worse than it is, which makes up the inflated data condition (see Appendix E).

Procedure

Participants were given a brief verbal explanation of the study indicating that they would be reading articles as well as answering survey questions. They were then handed the informed consent form which they signed and returned to the researcher. The experimental groups were randomly assigned. The participants then completed a pre-test consisting of four questions designed to assess prior knowledge the participant had about the melting of glaciers before reading the article. Following the pre-test the participants then read the version of the article they were assigned. Next, the participants took a post-test consisting of six types of questions. The first type was recall questions based on the text. These were followed by questions about the credibility of the data presented. Then, questions were asked about how concerned the participant is about the melting of glaciers. The next group of questions addressed the topics described in the Kaplan et al. (1997) taxonomy. In these questions the participant was asked to

state whether or not this information was contained in the article they read. Next, the participants were asked about the same topics, except this time they were asked to rate how important they feel it is that an article that is presenting research contains this information. In order to assess prior scientific knowledge participants were asked about the types of science classes they have taken and how many. Finally, participants were asked demographic information. All participants were handed a debriefing sheet before leaving the room (see Appendix F).

Results

It was hypothesized that those participants who read the article with the inflated data as well as those with the reduced data would indicate a lower frequency of finding social context information in the text of the article. For this study social context was broken up into three categories (who did the research, where the research was conducted, and where the research was published).This was done to prevent having to explain to participants what social context means. Table 1 demonstrates the percentages of participants who found these items within the article they read broken up by condition. The hypothesis was supported for one of the social context items. The first item on social context addressed whether or not the article provided information about who did the research. A Chi-square was significant for condition at the .05 level, X^2 (2, N = 56) = 6.833, p = .033. As seen in Table 1, the condition that had the highest percentage of "yes" answers was the group that received the original data. The other two groups had a lower percentage of "yes" responses to the same question. No significant difference was found on the next item which asked if the article provided information about where the research was conducted, X^2 (2, N = 55) = 1.922, p =.369. The same result occurred on the last social context item which asked if the article provided information about where the research was published. There was no difference between the groups, X^2 (2, N = 56) = 2.939, p = .230.

It was also hypothesized that the groups would be equal with regard to whether or not they found the categories of theory, methods, data/statistics, related research and relevance categories in the articles. The hypothesis was supported for the theory, methods and data/statistics questions. For the item asking if the article provided the method used to collect the data, there was no significant difference between the groups, X^2 (2, N=56) = .638, p =.727, with most people answering "no" in all three groups. Following this was the question asking if the article provides a theory to which most people answered "yes" despite condition. There was no significant difference between the groups on this measure, X^2 (2, N=56) = .338, p =.845. The same result occurred on the question that asked if the article provided data/statistics. Most individuals answered that they did find statistics in the article and there was no difference found across condition, X^2 (2, N=56) =1.983, p=.371.

Responses to the final two categories, related research and relevance did not support the hypothesis that there would be no difference between the groups. For the item about related research there was a significant difference between the groups, X^2 (2, N=56) = 6.291, p=.043. Participants who read the article with the reduced data had a lower percentage of "yes" responses, indicating that they found related research information less often than the other two groups. There was also a significant difference between the groups for the question asking if the article provided information about why the research was relevant. As seen in Table 1, the percentage of people who found it was close for the original article condition and the reduced data condition with the inflated data condition slightly higher. This difference in responses was significant, X^2 (2, N=56) = 11.449, p = .003.

It was hypothesized that participants reading the inflated data as well as those reading the reduced data would place a higher value on social context information than the group reading the

original data. There was a lack of support for this hypothesis. As seen in Table 2, there was no significant difference between the groups on responses to the first question about social context which asked how important it was to the participant that any research article provided information about who did the research presented, $F(2, 53) = .436$, $p = .880$. Also visible in Table 2, there was no difference between the groups on the question that asked how important it was that a research article mentioned where the research was conducted, $F(2, 53) = .776$, $p = .465$. The final social context item asked how important it was that an article provided where the research was published, $F(2, 53) = .586$, $p=.560$. This item also showed no significant difference between the groups (see Table 2).

It was expected that the groups would be virtually the same in their responses to how important the remaining categories were to them (method, theory, data/statistics, relevance and related research). As seen in Table 2, this hypothesis was supported. There was no significant difference between the groups with regard to how important it was to them that they were provided with information regarding the method used to collect the data, $F(2, 53) = 1.684$, $p = .498$. There was no significant difference between the groups with regard to how important it was that an article provided a theory, $F(2, 53) = 2.927$, $p = .062$. There was no significant difference between the groups with regard to the importance of receiving data/statistics, $F(2, 53) = .451$, $p=.640$. There was also no significant difference between the groups with regard to relevance, $F(2, 53) = .432$, $p=.652$, or with regard to related research, $F(2, 53) = .682$, $p=.510$.

The students who received the inflated data were expected to be more concerned about the findings presented in the article than the other two groups. There was a lack of support for this hypothesis. When asked if they were concerned about the rising sea levels due to melting glaciers and ice shelves before reading the article, there was no significant difference between

the groups as shown by a one-way ANOVA, F (2, 51) = 1.421, p = .251. When asked if they were concerned after they read the article, there was also no significant difference between the groups, F (2, 52) = .213, p =.809.

Participants in the reduced data condition were expected to believe the data less than those in the other two groups. There was, however, no significant difference between the groups, F (2, 53) = .436, p= .649. When asked if they believed the data, there was a significant difference for gender with males rating their level of believing the data higher than the females, F (1, 54) = 5.518, p =.023. On a five-point scale males averaged 3.85 (S.D.=1.137) while females averaged 3.25 (S.D.=.770).

Participants in the original data condition and the inflated data condition were hypothesized to find the source of the data more credible than those in the reduced data condition. There was a lack of support for this hypothesis. There was no significant difference between the groups, F (2, 53) = .510, p = .603. It was also expected that assessment of how credible the source of the data is would vary by grade in school. There was a significant difference between the grade levels on this item, F (3, 52) = 2.826, p = .048. Means for the various grades (with standard deviations in parentheses) for the freshman through seniors were 2.90 (0.831), 3.76 (1.091), 3.45 (1.036), and 3.00 (1.000) respectively. Sophomores found the source of the data the most credible and freshmen found it the least credible.

For responses to the recall questions it was expected that there would be no difference between the groups. This hypothesis held true for the first two recall questions (see Table 3 for number of correct and incorrect answers to all recall questions). On the first recall question (post-test question 1) there was no significant difference between the groups, X^2 (2, N=56) =.581, p=.748. The second recall question (post-test question 3) showed similar results and there was

also no difference between the groups, X^2 (2, N=56) = 2.355, p = .308. For the final recall question (post-test question 5) there was a significant difference between the groups with those in the reduced data condition having a greater number of wrong answers than those in the other two groups, X^2 (2, N=56) = 7.826, p=.020. However, there was no significant difference between these groups and their overall accuracy score for the recall questions, F (2, 53) = 1.097, p =.341.

Discussion

The present study was designed to assess if data manipulation affected the scientific literacy of the participants. This was measured by deciding if participants could pick up on various vital components of the article as outlined in the Korpan et al. (1997) taxonomy. Participants were also asked how important these categories are to them. What they recalled about the passage they read and how much they believed the data was assessed. How credible they found the source of the data was also measured. All of these are things that a scientifically literate person is expected to pick up on.

Participants were presented with a science article found in the popular press which addressed the melting of glaciers. Plausibility was manipulated to create conditions. Plausibility was operationally defined by how believable it was that this data was actually collected and the fact that the news article resulted from the data. In this study, plausibility was manipulated by changing the data within the text of the article. There were three groups total, one received the original article as published on the "Wired News" website. The second group received inflated data which made the melting of glaciers seem like more of an immediate and severe issue than it actually was. The final group received reduced data which made the melting of glaciers seem like less of an immediate and severe issue than it actually was. It was expected that as data was inflated or reduced it compromised the plausibility. The inflated data condition could either make

participants feel that the conclusions drawn are implausible because the data was so high or it could make them feel it was completely plausible by generating a sense of immediacy. The reduced data condition was expected to seem to have a low level of plausibility because the article addressed the melting of glaciers to be a problem, however the numbers were small.

In general, the findings did not support the hypotheses. When participants were asked if social context information was included in the article it was expected that those in the low plausibility conditions, which are the inflated data condition and the reduced data condition, would have a lower frequency of finding social context information within the article despite its presence. This was true for one of the social context items. Responses to the question about whether the article included information about who did the research differed by condition. As seen in Table 1, the original data condition had the highest percentage of affirmative responses followed by the inflated data condition and lastly the reduced data condition. For the other two social context questions there was no significant difference between the groups. Even though there was a significant result on one of the components it was only one third of the social context section. This was not a strong enough result to imply anything about the effect the varying data had on these groups perception of social context in the article.

There was also no significant difference between the group on whether or not they found a method, a theory and data/statistics, this partially supported the hypothesis. However, there was a significant difference for the final two items: related research and relevance which partially did not support the hypothesis since these categories were expected to be the same across condition. For related research the "yes" responses were highest for the inflated data condition, closely followed by the original data condition and far behind these two was the reduced data condition (see Table 1 for percentages). A different effect occurred for the item about relevance where, as

seen in Table 1, the inflated data condition responded with the highest percentage of "yes" responses followed by the reduced data followed by the original data condition. Since none of these results were consistent with regard to which conditions were higher than the others it also doesn't appear to imply anything about the actual data manipulation that caused these differences.

It was also expected that those groups that received the inflated data and the reduced data would place a higher value on social context than the original data condition. There was no significant difference between the groups on this measure. There was also no significant difference between the groups on how important they found the presence of a method, a theory, data/statistics, related research and relevance. Across conditions the average ratings were basically the same.

It was hypothesized that the group that received the inflated data would be the most concerned about the melting of glaciers after reading the article. While the mean level of concern was highest for this group it was not significantly higher. So there is some indication that the inflation of the data did cause a sense of urgency to develop in participants but not enough for them to be significantly more concerned than those in the other two groups.

When directly asked how much the participants believed the data on a five-point scale with five being the highest, there was no significant difference between the conditions. However, males gave significantly higher ratings than females. This indicated that regardless of condition males were more likely to believe the information presented in the article than females. More research would be needed to determine the basis for this.

When participants were asked an open ended question as to why they gave the rating they did on the previous item (how much they believed the data) responses were extremely varied.

Some responses by those who gave a 4 or 5 indicated prior knowledge of the subject as a reason while others indicated the fact that they had no prior knowledge, which is why they believed it. Some cited the presence of experts in the articles, others stated the sheer number of facts lead them to believe it. For those who gave 1, 2 or 3 ratings some reasons were: it is blown out of proportion, some had never heard of the journal it was published in, and some felt scientists were always wrong. Since there was no significant difference between the groups on the five-point ratings naturally the responses to this question did not show a pattern for condition either.

The recall questions did support the hypothesis for the most part. Overall, accuracy was not significantly different across condition. This was a good sign since not only was there no difference as predicted but the majority of answers were correct answers. One implication of this is that the participants carefully read the article and understood the large amount of data presented to them. This is a key component to scientific literacy.

There were some limitations to this study that may have prevented significant results. For instance, the sample was small (only 56 participants) and it was limited to Hofstra University undergraduate Introductory Psychology students. A larger and more broad, representative sample would be necessary in determining anything about the general population.

A possible reason for the lack of significance was the questions being asked. Maybe additional questions could be added to the existing ones or the existing ones could be modified based on results from other studies as well as the results of this one. One type of question could be open recall questions asking the participants, for example, if the article stated who the researcher was, and then asking what the name of the researcher was and what their affiliation was. This may provide more information then the participant stating that they found the information without them telling what it was they found.

The possibility does stand, as well, that the manipulation of the data was not a good manipulation of plausibility. This may be so in the event that the participants do not know what number to expect, because they have no knowledge of the topic, therefore whatever data they receive is going to be considered either plausible or implausible depending on the person. Pilot testing or extensive pre-testing may have been able to correct this. If a pilot study was done to determine which set of data were actually found by participants to have a low level of plausibility and to have a high level of plausibility results may have been more accurate. Also, if participants were pre-tested extensively to see what they expected the data to be and then they were either given data consistent with their beliefs, inflated from their beliefs or the same as their beliefs, conditions could be created this way. While the results largely were not significant the structure of the study can be easily modified to make another attempt at finding evidence for the hypotheses.

References

Champagne, A.B., & Newell, S.T. (1992). Directions for research and development: Alternative methods of assessing scientific literacy. *Journal of Research in Science Teaching, 29,* 841-860.

Glynn, S.M., & K. Denise, M. (1994). Reading and writing to learn science: Achieving scientific literacy. *Journal of Research in Science Teaching, 31,* 1057-1073.

Korpan, C.A., Bisanz, G.L., Bisanz, J., & Henderson, J.M. (1997). Assessing literacy in science: Evaluation of scientific news briefs. *Science Education, 81,* 515-532.

Norris, S.P., & Phillips, L.M. (1994). Interpreting pragmatic meaning when reading popular reports of science. *Journal of Research in Science Teaching, 31,* 947-967.

Zimmerman, C., Bisanz, G.L., & Bisanz, J. (1998). Everyday scientific literacy: Do students use information about the social context and methods of research to evaluate news briefs about science? *The Alberta Journal of Educational Research, XLIV,* 188-207.

Zimmerman, C., Bisanz, G.L., Bisanz, J., Klein, J.S., Klein, P. (2001). Science at the supermarket: A comparison of what appears in the popular press, experts' advice to readers, and what students want to know. *Public Understanding of Science, 10,* 37-58.

Appendix A
Pre-test

Please answer the questions below to the best of your ability. You will then rate how certain you are of your answer, on a scale of 1-5.

1. There are six glaciers that are presently flowing into the Amundsen Sea, which is located in the Antarctic. Should all six glaciers completely slide into the ocean and melt what is your best guess for how much sea levels would rise worldwide?

A. 1 foot

B. 3 feet

C. 9 feet

D. 12 feet

2. How confident are you that your answer to question #1 is correct?
(1=not confident at all, 5=very confident)

1 2 3 4 5

3. How much do you think sea levels are predicted to rise, due to global warming, by the year 2100?

A. 109-216 inches

B. 37-108 inches

C. 10-36 inches

D. 3-9 inches

4. How confident are you that your answer to question #3 is correct?
(1= not confident at all, 5=very confident)

1 2 3 4 5

Appendix B
Post-test

Please answer the following questions to the best of your ability. If you do not know the answer to a question, choose what you think is the best answer, based on what you just read.

1. According to the article, how much faster is the Pine Island Glacier moving, compared with the 1970's?

A. 8% faster

B. 25% faster

C. 75% faster

D. 100% faster

2. How confident are you that your answer to question #1 is correct?
(1=not confident at all, 5=very confident)

1 2 3 4 5

3. According to the article, there are six glaciers that are presently flowing into the Amundsen Sea. Should all six glaciers completely slide into the ocean and melt how much would sea levels rise worldwide?

A. 1 foot

B. 3 feet

C. 9 feet

D. 12 feet

4. How confident are you that your answer to question #3 is correct?
(1=not confident, 5=very confident)

1 2 3 4 5

5. According to the article, how much are sea levels predicted to rise due to global warming by the year 2100?

A. 109-216 inches

B. 37-108 inches

C. 10-36 inches

D. 3-9 inches

6. How confident are you that your answer to question 5 is correct?
(1=not confident at all, 5=very confident)

1 2 3 4 5

7. Do you believe the data presented in the article?
(1= don't believe it at all, 5= completely believe it)

1 2 3 4 5

8. Briefly, please state why you believe the data or why you do not.

9. Have you ever heard of the journal *Science?*

YES NO

10. How credible do you find the source of the data (the journal, *Science*)?
(1= not credible, 5= extremely credible)

1 2 3 4 5

11. On a scale of 1-5, were you worried about the rising sea levels due to melting glaciers and ice shelves before reading this article?
(1= I was not worried at all, 5= I was extremely worried)

1 2 3 4 5

12. On a scale of 1-5, having read this article, are you concerned about the rising sea levels due to melting glaciers and ice shelves?
(1=I am not worried, 5=I am extremely worried)

1 2 3 4 5

13. Do you think your generation should be taking precautions, given the projected numbers, with regard to the rise in sea level?

Yes No

14. Do you think your future great-grandchildren will be faced with this issue?

Yes No

15. Please read the following items and decide if the article you read provides this information.

a. The article provides information about who did the research. YES NO

b. The article provides information about where the research was conducted. YES NO

c. The article provides information about where the research was published. YES NO

d. The article provides the method that was used to collect the data. YES NO

e. The article provides a theory. YES NO

f. The article provided data/statistics. YES NO

g. The article provides information about related research. YES NO

h. The article provides information about why the research is relevant. YES NO

16. When you are reading any article that is presenting scientific research and you are trying to determine if the research is credible or not, how important is it to you that the following items are included in the article?
(1= not important to me, 5= extremely important to me)

a. The article provides information about who did the research.

1 2 3 4 5

b. The article provides information about where the research was conducted.

1 2 3 4 5

c. The article provides information about where the research was published.

1 2 3 4 5

d. The article provides the method that was used to collect the data.

1 2 3 4 5

e. The article provides a theory.

1 2 3 4 5

f. The article provides data/statistics.

1 2 3 4 5

g. The article provides information about related research.

1 2 3 4 5

h. The article provides information about why the research is relevant.

1 2 3 4 5

17. Please indicate whether or not you have taken the following science courses in high school and how many of them you have taken.

a. Earth Science	YES	NO	If yes, how many? _____
b. Chemistry	YES	NO	If yes, how many?_____
c. Physics	YES	NO	If yes, how many?_____
d. Biology	YES	NO	If yes, how many?_____
e. Other (be specific)			

18. Please indicate whether or not you have taken the following science courses in college and how many of them you have taken.

a. Earth Science	YES	NO	If yes, how many _____
b. Chemistry	YES	NO	If yes, how many _____
c. Physics	YES	NO	If yes, how many _____
d. Biology	YES	NO	If yes, how many _____
e. Other (be specific)			

19. What is your grade level in school (please circle)

Freshman

Sophomore

Junior

Senior

20. What is your major? _____

21. What is your gender? (Please circle) MALE FEMALE

Appendix C
Original Article Condition

Glaciers Quicken Pace to Sea
By: Stephen Leahy

A number of massive glaciers in the West Antarctic are sliding into the ocean at an accelerating rate and raising sea levels, according to new data released Thursday.

The new study, published Thursday in the journal *Science*, found that six glaciers flowing in to the Amundsen Sea have quickened their march into the ocean over the past 15 years, and the pace has accelerated recently. The fastest of these, the Pine Island Glacier, is ripping along at a six-yards-a-day pace—25 percent faster than it was moving in the 1970's—making it one of the fastest-moving glaciers on Earth.

"The rates of glacier change remain relatively small at present," said Eric Rignot of NASA's Jet Propulsion Laboratory who worked on the study.

Ice-penetrating radar onboard research aircraft discovered that these glaciers were, on average, 430 yards thicker than previously thought, dramatically increasing the volumes of ice flowing into the seas. Should all six glaciers completely slide into the ocean and melt, sea levels would rise worldwide by more than three feet, Rignot said.

"That amount of fresh water is enough to disturb the global ocean-current circulation," he said.

The Antarctic continent measures 5.4 million square miles—nearly 1.5 times the size of the United States—and 98 percent of it is covered in ice year-round. This ice is nearly three miles thick in places and locks up more than two-thirds of the planet's fresh water.

Vast floating ice shelves fringe half of the continent and comprise 11 percent of its total area. Ice shelves are the long fingernails of glaciers, averaging 500 yards in thickness. The sea gradually melts the bottom of these shelves, thinning them until storms or waves break off pieces, calving icebergs.

Glaciologist Robert Thomas of EG&G Technical Services at NASA's Wallops Flight Facility in Virginia has long believed that the ice shelves act like a cork in a bottle, greatly slowing glaciers' procession to the sea. However, in this area the bottom of the ice shelves are melting rapidly, becoming thinner at a rate of 10 to 15 feet each year since the early 1990's.

The "corks" have been loosened, allowing the glaciers to flow more quickly, Thomas said. "The climate is warming up in this region, and many ice shelves are thinning and some are breaking up," he said.

Most surprising is that while warm coastal water thins the floating ice shelf, the main trunk of Pine Island Glacier is also thinning—by four feet a year, as far as 185 miles inland.

"These thinning rates are double those seen in the 1990's and extend much further inland," Thomas said.

If this continues, within five years at least 270 square miles of very thick ice from Pine Island Glacier will be floating in the ocean. And that will further accelerate the flow of the rest of the glacier. "It could double its current speed within five years," he said.

Glaciers flowing into another part of West Antarctica that lost their ice shelf in 2002 are indeed flowing faster, according to another study released this week. Not long after much of the Larsen B Ice Shelf broke up in the Weddell Sea, nearby glaciers began to flow up to eight times faster than before, said Ted Scambos, a glacier expert who headed the study at the University of Colorado's National Snow and Ice Data Center.

The speed of change was surprising and strongly supports the idea that ice shelves act as brakes on glacier movement, Scambos said.

The West Antarctic region, and in particular its far northern tip just south of Chile and Argentina, has seen a rise in mean annual temperature of up to 4.5 degrees Fahrenheit in the past 60 years—faster than almost any region in the world. In the past 30 years, ice shelves in the region have decreased by more than 5,200 miles.

However, there are far larger and more important ice shelves. The Ross Ice Shelf, the main outlet for the West Antarctic Ice Sheet, bottles up several large glaciers; sea levels could rise by 16 feet if they melted completely.

"Ice-shelf thinning could be happening elsewhere in the Antarctic, but we just don't know," Scambos said.

It's a difficult place to do research, and there is very little data on how much the oceans around the frozen continent may be warming or currents changing. What is certain is that this new evidence means current predictions, which estimate that global warming will cause global sea levels to rise 10-36 inches by the year 2100, will have to be revised upward," Thomas said.

"It is cause for concern and that we need to pay much more attention to what's happening in the Antarctic," said Rignot. "But it's not necessary to start running for the hills yet."

Appendix D
Reduced Data Condition

Glaciers Quicken Pace to Sea
By: Stephen Leahy

A number of massive glaciers in the West Antarctic are sliding into the ocean at an accelerating rate and raising sea levels, according to new data released Thursday.

The new study, published Thursday in the journal *Science*, found that six glaciers flowing in to the Amundsen Sea have quickened their march into the ocean over the past 45 years, and the pace has accelerated recently. The fastest of these, the Pine Island Glacier, is ripping along at a two-yards-a-day pace—8 percent faster than it was moving in the 1970's—making it one of the fastest-moving glaciers on Earth.

"The rates of glacier change remain relatively small at present," said Eric Rignot of NASA's Jet Propulsion Laboratory who worked on the study.

Ice-penetrating radar onboard research aircraft discovered that these glaciers were, on average, 143 yards thicker than previously thought, dramatically increasing the volumes of ice flowing into the seas. Should all six glaciers completely slide into the ocean and melt, sea levels would rise worldwide by more than one foot, Rignot said.

"That amount of fresh water is enough to disturb the global ocean-current circulation," he said.

The Antarctic continent measures 5.4 million square miles—nearly 1.5 times the size of the United States—and 98 percent of it is covered in ice year-round. This ice is nearly three miles thick in places and locks up more than two-thirds of the planet's fresh water.

Vast floating ice shelves fringe half of the continent and comprise 4 percent of its total area. Ice shelves are the long fingernails of glaciers, averaging 167 yards in thickness. The sea gradually melts the bottom of these shelves, thinning them until storms or waves break off pieces, calving icebergs.

Glaciologist Robert Thomas of EG&G Technical Services at NASA's Wallops Flight Facility in Virginia has long believed that the ice shelves act like a cork in a bottle, greatly slowing glaciers' procession to the sea. However, in this area the bottom of the ice shelves are melting rapidly, becoming thinner at a rate of 1 to 5 feet each year since the early 1990's.

The "corks" have been loosened, allowing the glaciers to flow more quickly, Thomas said. "The climate is warming up in this region, and many ice shelves are thinning and some are breaking up," he said.

Most surprising is that while warm coastal water thins the floating ice shelf, the main trunk of Pine Island Glacier is also thinning—by 1 foot a year, as far as 62 miles inland.

"These thinning rates are double those seen in the 1990's and extend much further inland," Thomas said.

If this continues, within fifteen years at least 90 square miles of very thick ice from Pine Island Glacier will be floating in the ocean. And that will further accelerate the flow of the rest of the glacier. "It could double its current speed within fifteen years," he said.

Glaciers flowing into another part of West Antarctica that lost their ice shelf in 2002 are indeed flowing faster, according to another study released this week. Not long after much of the Larsen B Ice Shelf broke up in the Weddell Sea, nearby glaciers began to flow up to eight times faster than before, said Ted Scambos, a glacier expert who headed the study at the University of Colorado's National Snow and Ice Data Center.

The speed of change was surprising and strongly supports the idea that ice shelves act as brakes on glacier movement, Scambos said.

The West Antarctic region, and in particular its far northern tip just south of Chile and Argentina, has seen a rise in mean annual temperature of up to 1.5 degrees Fahrenheit in the past 180 years—faster than almost any region in the world. In the past 90 years, ice shelves in the region have decreased by more than 1733 miles.

However, there are far larger and more important ice shelves. The Ross Ice Shelf, the main outlet for the West Antarctic Ice Sheet, bottles up several large glaciers; sea levels could rise by 5 feet if they melted completely.

"Ice-shelf thinning could be happening elsewhere in the Antarctic, but we just don't know," Scambos said.

It's a difficult place to do research, and there is very little data on how much the oceans around the frozen continent may be warming or currents changing. What is certain is that this new evidence means current predictions, which estimate that global warming will cause global sea levels to rise 3-12 inches by the year 2100, will have to be revised upward," Thomas said.

"It is cause for concern and that we need to pay much more attention to what's happening in the Antarctic," said Rignot. "But it's not necessary to start running for the hills yet."

Appendix E
Inflated data Condition

Glaciers Quicken Pace to Sea
By: Stephen Leahy

A number of massive glaciers in the West Antarctic are sliding into the ocean at an accelerating rate and raising sea levels, according to new data released Thursday.

The new study, published Thursday in the journal *Science*, found that six glaciers flowing in to the Amundsen Sea have quickened their march into the ocean over the past 5 years, and the pace has accelerated recently. The fastest of these, the Pine Island Glacier, is ripping along at a eighteen-yards-a-day pace—75 percent faster than it was moving in the 1970's—making it one of the fastest-moving glaciers on Earth.

"The rates of glacier change remain relatively small at present," said Eric Rignot of NASA's Jet Propulsion Laboratory who worked on the study.

Ice-penetrating radar onboard research aircraft discovered that these glaciers were, on average, 1290 yards thicker than previously thought, dramatically increasing the volumes of ice flowing into the seas. Should all six glaciers completely slide into the ocean and melt, sea levels would rise worldwide by more than nine feet, Rignot said.

"That amount of fresh water is enough to disturb the global ocean-current circulation," he said.

The Antarctic continent measures 5.4 million square miles—nearly 1.5 times the size of the United States—and 98 percent of it is covered in ice year-round. This ice is nearly three miles thick in places and locks up more than two-thirds of the planet's fresh water.

Vast floating ice shelves fringe half of the continent and comprise 33 percent of its total area. Ice shelves are the long fingernails of glaciers, averaging 1500 yards in thickness. The sea gradually melts the bottom of these shelves, thinning them until storms or waves break off pieces, calving icebergs.

Glaciologist Robert Thomas of EG&G Technical Services at NASA's Wallops Flight Facility in Virginia has long believed that the ice shelves act like a cork in a bottle, greatly slowing glaciers' procession to the sea. However, in this area the bottom of the ice shelves are melting rapidly, becoming thinner at a rate of 30 to 45 feet each year since the early 1990's.

The "corks" have been loosened, allowing the glaciers to flow more quickly, Thomas said. "The climate is warming up in this region, and many ice shelves are thinning and some are breaking up," he said.

Most surprising is that while warm coastal water thins the floating ice shelf, the main trunk of Pine Island Glacier is also thinning—by twelve feet a year, as far as 555 miles inland.

"These thinning rates are double those seen in the 1990's and extend much further inland," Thomas said.

If this continues, within 2 years at least 810 square miles of very thick ice from Pine Island Glacier will be floating in the ocean. And that will further accelerate the flow of the rest of the glacier. "It could double its current speed within two years," he said.

Glaciers flowing into another part of West Antarctica that lost their ice shelf in 2002 are indeed flowing faster, according to another study released this week. Not long after much of the Larsen B Ice Shelf broke up in the Weddell Sea, nearby glaciers began to flow up to eight times faster than before, said Ted Scambos, a glacier expert who headed the study at the University of Colorado's National Snow and Ice Data Center.

The speed of change was surprising and strongly supports the idea that ice shelves act as brakes on glacier movement, Scambos said.

The West Antarctic region, and in particular its far northern tip just south of Chile and Argentina, has seen a rise in mean annual temperature of up to 13.5 degrees Fahrenheit in the past 20 years—faster than almost any region in the world. In the past 10 years, ice shelves in the region have decreased by more than 15,600 miles.

However, there are far larger and more important ice shelves. The Ross Ice Shelf, the main outlet for the West Antarctic Ice Sheet, bottles up several large glaciers; sea levels could rise by 48 feet if they melted completely.

"Ice-shelf thinning could be happening elsewhere in the Antarctic, but we just don't know," Scambos said.

It's a difficult place to do research, and there is very little data on how much the oceans around the frozen continent may be warming or currents changing. What is certain is that this new evidence means current predictions, which estimate that global warming will cause global sea levels to rise 30-108 inches by the year 2100, will have to be revised upward," Thomas said.

"It is cause for concern and that we need to pay much more attention to what's happening in the Antarctic," said Rignot. "But it's not necessary to start running for the hills yet."

Appendix F
Debriefing Sheet

Hofstra University
Hempstead NY, 11549
Department of Psychology

Dear Participant,

The study you have just participated in is a study on how people interpret scientific data when it is presented to them in a news article. We are looking to see if changing the data will make a difference in the answers to the survey questions. Some of you received the actual data from the original news article while others received data that was manipulated to make the glacier melting situation seem either better or worse than it actually is. Below you will find highlighted the version that you received. We are also looking to see what characteristics you are looking for when reading a scientific news article as well as if you found those characteristics in the article you read.

You are entitled to the results of the study if you desire them and if you have any questions please feel free to direct them to Kristen M. Duffy or Amy Masnick, Ph.D. (516-463-5757). We would also be happy to provide you with a copy of the original article, if you feel it necessary to know what the actual data are.

The line highlighted below will tell you which version of the article you read.

1. You received the original article

2. You received the version that makes the melting of glaciers seem to be less of an immediate and severe issue than it actually is.

3. You received the version that makes the melting of glaciers seem to be more of an immediate and severe issue that it actually is

Thank you again for your participation.

Sincerely,

Kristen M. Duffy

Acknowledgements

Special thanks to Dr. Masnick for all of your help on this project. This certainly would not have been possible without your dedication and guidance. It has been a pleasure working with you.

Also, thank you to Dr. Johnson and Dr. Levinthal for being members on my thesis committee. I appreciate it very much.

Table 1
Percentages of Participants indicating that items from the Korpan et al. (1997) taxonomy were present in the article as an effect of condition
(Percentage of "yes" responses)

Statement	Original Data Condition N=19	Reduced Data Condition N=18	Inflated Data Condition N=19
Social Context:			
15a.The article provides information about who did the research.*	89.5%	50%	68.4%
15b.The article provides information about where the research was conducted.	68.4%	64.7%	84.2%
15c.The article provides information about where the research was published.	47.4%	33.3%	21.1%
Methods and Data:			
15d. The article provides the method that was used to collect the data.	26.3%	16.7%	26.3%
15e. The article provides a theory.	84.2%	83.3%	89.4%
15f. The article provides data/statistics.	94.7%	100%	100%
15g. The article provides information about related research.*	63.2%	38.9%	78.9%
15h. The article provides information about why the research is relevant.*	52.6%	66.7%	100%

*p<.05

Table 2
Mean participant ratings of how important it is that topic categories from the Korpan et al. (1997 taxonomy be included in research articles (five-point scale)

Statement	Condition 1 (original data)	Condition 2 (reduced data)	Condition 3 (inflated data)
Social Context:			
16a.The article provides information about who did the research.	3.74	3.67	3.53
16b.The article provides information about where the research was conducted.	4.11	3.94	3.63
16c.The article provides information about where the research was published.	3.05	2.89	2.58
Methods and Data:			
16d. The article provides the method that was used to collect the data.	3.84	4.06	4.26
16e. The article provides a theory.	3.95	4.06	4.63
16f. The article provides data/statistics.	4.79	4.61	4.68
16g. The article provides information about related research.	3.42	3.78	3.58
16h. The article provides information about why the research is relevant.	4.37	4.61	4.58

*There is no significant difference between the groups on of the above items.

Table 3
Number of correct and incorrect participant responses to the recall questions

	Original data condition		Reduced data condition		Inflated data condition	
Recall Questions:	correct	incorrect	correct	incorrect	correct	incorrect
Question 1	14	5	13	5	12	7
Question 3	16	3	14	4	12	7
Question 5*	15	4	9	9	17	2

*p<.05