Persuasion & Reasoning: The Effect of Brain Images on Reasoning

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Abstract

Since the origin of psychology, it has been difficult to be considered as credible as hard sciences given its abstract nature. Whereas in physics, chemistry and concrete medicine it is easy to quantify causal relationships and determinations in research. Psychology is difficult to measure in these terms, and its basis of understanding is often through perceived observations by researchers. This can make it difficult to determine behavioral mechanism and report such findings while maintaining credibility due to the lack of hard measurements. With the advent of fMRI and other neural-imagery researchers now have ways of making determinations that can be concretely measured and studied. This way of displaying data is often perceived as being far more credible than other research, given its concrete nature. To further understand the influence this imagery has on credibility, perception and judgment, we have carried out an experiment to test these factors. We will carry out a replication of Mccabe, D. P., & Castel, A. D. 2008 study. Using similar fictional articles accompanied by either fMRI or bar-graphs, we will conduct Likert scales to measure credibility, perception, and judgement of said articles on laypersons.

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With the advent of improved technologies for studying both the body and mind, has also created a better understanding of how biological mechanism effect cognition. Technologies such as fMRI (functional magnetic resonance imaging), and positron emission tomography (PET) have furthered the study of neuroscience, and have led to a better understandings of the mind body symbiotic relationship. The purpose of this paper is to reveal the influence of cognitive imagery in studies, on the judgement of the validity of scientific research (McCabe & Castel, 2008.).

Cognitive imaging technologies (fMRI, PET) have given a great deal of credibility to the scientific community, towards studies of cognition. These advances in technology have also led to negative impacts in the understanding of cognitive imaging studies. The general public, or laypersons tend to give more credibility towards scientific studies containing these fMRI images, etc. These studies are often generated by media outlets, leading to a great deal of misinformation among the public, and even within the scientific community. News media outlets generally look for over-simplified explanation of complex cognitive processes, as well as oversimplifying and misinterpreting the results of the study. These oversimplifications often inaccurately represent information drawn from these imaging studies. Despite this, these images are regarded as being credible sources of understanding cognitive research (McCabe & Castel, 2008.).

It is important to both to the scientific community, and the public that a better understanding of how cognitive imagery in studies influences judgement and reasoning about their validity. This understanding can lead to better research, as well as improved vetting of any future publications. A repeat of procedures previously performed in other studies, measuring the influence of cognitive imagery will further aid the progress of understanding its influence. It will also reveal any mistakes made in previous studies of cognitive imagery’s influence and how to improve such understanding. (McCabe & Castel, 2008.).

A number of psychological research findings obtain the attention of both the public, and the scientific community. People tend to agree more with the findings of research that includes images of the brain. This is despite these images not having enough information to support the conclusions of such studies (McCabe & Castel, 2008.).

Metacomprehension is also influenced by studies that include brain imaging. Often leading subjects to believe that they are more confident in their understanding of material. When tested there is no difference in performance then those subjects who were provided similar material without neuroimaging. That is to say subjects overestimate their understanding of material as being better than it actually is when images are provided. When metacomprehension actually reflects upon scoring, then it is assumed subjects are learning efficiently. This would reveal that despite subjects believing neuroimaging is aiding their understanding, it has not. The mere belief that illustrated text is better understood than other material, can affect judgement on validity, as well as perceived metacomprehension of material. Comprehension test scores were equal among subject groups. Additionally, research was perceived as more credible, when imaging was provided (Ikeda et al., 2013.).

Some studies have concluded that brain imagery is far less persuasive than other studies have argued. Although neuroimaging has been characterized as enticing, studies have concluded that there is no essential difference between neuroimaging and other imageries effect on perceived validity. It is hypothesized that expert neuroscientific language can be far more alluring than mere imagery attached to research. Although imagery had no measured effect on perceived credibility, it did effect overall “interestingness” of the research article (Hook & Farah, 2013.).

The persuasiveness of brain images has sparked the interest of professionals across a broad spectrum of specialties. The mere presence of neuroscientific parlance conveys a sense of validity, even in the presence of poor explanations of the material. Written fMRI data when submitted to evidence can even lead to a higher conviction rates in court cases. Researchers argue that even meaningless mathematics has far more convincing aspects than the mere presence of brain imaging. The persuasiveness of such material decreases when its validity comes into question. Images do create connections to prior knowledge which reinforces perceived beliefs of credibility due to familiarity. For people who cannot connect these images to prior knowledge there is little to no effect on perceived credibility (Michael et al., 2013)

In McCabe and Castel’s (2008) study, they hypothesized that brain images can be more persuasive than other methods of measuring brain activity due to its tangible nature. Though further studies have concluded that any persuasive influence of images may be present regardless of the type, so long as it cues a connection between the neuroscientific language and the image. The intuitive, reductive approach may appear due to this connection regardless if it is an fMRI, a science fiction image, or an illustration by an artist, etc. So long as there is a semantic relation between images, and the language of the research, a perceived increase credibility of research is likely to occur (Gruber & Dickerson, 2012.).

The purpose of this study is to conclude a connection between imagery coordinated with neuroscientific language, and an increase in perceived, or judged validity of the research. Subjects will be provided with articles, both fictional, and actual research. Both articles will be presented with half providing neuroimagery, and the other bar graphs. They will then assess the validity on a Likert scale. Based upon scoring, it will be judged whether or not we can conclude that University of Louisville students in an experimental psychology course are more likely to perceive an article with brain imagery as more scientifically sound, than a similar article with a bar graph. We hypothesize due to previous research, that they will perceive the article with neuroimagery to be more scientifically valid, than those presented with a bar graph. This is due to a possible connection that may be drawn between the research language and the neuroimagery. That is more than a bar graph. While this may be due to the mere presence of familiar imagery in coordination with neuroscientific language, the extent of this study is to merely expose a correlation between brain imagery and an increase in perceived credibility. Thus, this study will follow a single-factor between subjects design as there is no way to prove a direct causation of a change. Rather, it will attempt to conclude an association between the variables (imagery, perceived credibility) we are testing. (McCabe & Castel, 2008.).

Method

**Participants**

Participants (N=78) involved with this study were 78 undergraduate students enrolled at the University of Louisville in an Experimental Psychology course. Demographic information was not considered or accounted, but given the randomized sampling it is assumed to be an equal distribution of sex. Ethnic background was not accounted for as well as age demographics, gender identity, and sexual orientation. The language of preference was English. The first group consisted of 37 randomized participants (N=37) who received a graph-imagery condition. The second group consisted of 41 randomized participants (N=41) receiving the brain-imagery condition. Students were given points for their participation in this study.

**Research Design**

The research design was a single factor between subjects design. The IV involved imagery, in which one group received fMRI brain-imagery (N=41) and the other received bar-graphs (N=37) accompanying the same fictional scientific article. Participants (N=78) were randomly assigned to each group.

**Materials**

Materials were based upon the original study performed by Mccabe, D. P., & Castel, A. D. in 2008. Participants (N=41) were given a fictional scientific article accompanied by fMRI imagery, while participants (N=37) were given the same fictional scientific article accompanied with a bar-graph. Participants (N=78) were then given a Likert Scale ranging from 1 “strongly disagree, to 4 “strongly agree”.

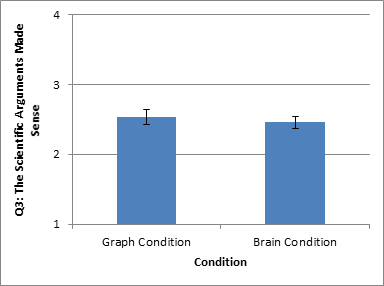
**Procedure**

The experiment took place on the University of Louisville campus, in a classroom setting. Participants (N=78) were shown a consent form, and informed that participation in the experiment was completely volunteer and could refuse to participate if they chose to. After students were aware of the volunteer nature of the experiment, they were then informed of the purpose. The stated purpose was to examine participants (N=78) opinions on a brief news article. If subjects did not wish to participate, they were informed to leave the questionnaire blank. A fictional research article was then distributed to each student at random. Half of participants (N=41) received the article with imagery of an fMRI, while the other half received the same article, but accompanied by a bar-graph image. Once all participants (N=78) had completed their Likert scales, results were then collected and participants were thanked for their cooperation. Participants (N=78) were then debriefed about the true nature of the experiment, that they had read a false research article and that experimenters were determining the effect of brain-imagery on reasoning. That it was hypothesized that neuroscientific imagery would influence people to believe an article as being more scientifically sound.

**Results**

Our group of researchers hypothesized, based on Mccabe, D. P., & Castel, A. D. results, that when laypersons were given fictionalized scientific articles they would perceive the same article as being more credible when associated with fMRI imagery, than the same article presented with bar-graph imagery. Participants (N=78) were randomly given either the article accompanied with a bar graph (N=37) or the same article with a fMRI image (N=41). To accurately measure these differences in perception and credibility our researchers conducted a single factor between-subjects t-test. The first question participants (N=37) who were given the graph condition (M=2.86, SD=0.481), and participants (N=41) were given the brain imagery condition (M=2.76, SD=0.489) it was determined, based on these results, that there was no difference between groups on how well written either article was perceived to be, *t (76) =0.989, p=0.326*. Our second question examined whether the title of the article was a better description. Our results for the bar graph condition (M=2.5676, SD=0.72803), or the brain imagery condition (M=2.3171, SD=0.60988), these results concluded no difference between groups, *t (76) =1.653, p=0.103.* For question 3, participants in the graph condition (M=2.5405, SD=0.64956) did showed no significant belief that the arguments in the article made more sense than those with the brain-imagery (M=2.4634, SD=.55216)*, t(76)=.567, p=0.573.* These results disprove our initial hypothesis, that brain imagery influences perceived credibility, and confirms the null hypothesis. Results of question three are seen below.

Figure 1



The following graph represents scores for question 3 on whether “The scientific arguments made sense” For the same article under each condition.

**Discussion**

The purpose of this research was to conduct an experiment replicating Mccabe, D. P., & Castel, A. D. (2008) experiment, to examine the influence neuro-imagery has on perceived credibility. The purpose also was to test Mccabe, D. P., & Castel, A. D. (2008) results and hypothesis, and to conclude if results reconfirmed their hypothesis. Our experiment was conducted in a classroom environment on the campus of the University of Louisville. We randomly assigned groups to two conditions; one with a bar graph, the other with fMRI imagery. Both conditions received the same fictitious research article corresponding to imagery, regarding meditations ability to enhance creative thought. Students were given instructions on how to fill out the Likert scale provided, to answer 3 questions corresponding to the article. After each group responded to a Likert scale data was collected, and then measured to show results that disproved our hypothesis, and confirmed the null hypothesis. These results were different from Mccabe, D. P., & Castel, A. D. (2008) findings that supported their hypothesis (as well as ours), that brain imagery influences judgements on perceived credibility of scientific articles, and research articles. Our results could show support for Hook, C. J., & Farah, M. J. (2013) findings that neuro-imagery is far less convincing than McCabe and Castel (2008) concluded. Michael et al. (2013) writes about how the mere presence of neuroscientific terminology can be far more influencing than neuro-imagery. While Ikeda et al. writes that the mere presence of this imagery makes students believe they have heightened metacomprhension when associated with neuroimaging, as opposed to material with bar graphs. Gruber & Dickerson (2012) concluded from their research that imagery in-of-itself is influential, especially when the imagery is familiar and pervasive within pop culture, science-fiction, etc. In conclusion, the perception on neuroimagery’s influence upon judgement is not agreed upon across the scientific community. Our findings seem to disprove the analysis and findings of Mccabe, D. P., & Castel, A. D (2008). But, other studies previously mentioned seem to elaborate in a broader context that imagery, neuroscientific terminology and familiarity of the imagery influence judgements on credibility, as well as perceived comprehension on material being studied. Whether this perception of validity is due to brain imagery or just the presence of imagery itself is beyond the scope of this experiment, but would prove a worthwhile venture for future research. The results of our experiment, one could believe, is that Mccabe, D. P., & Castel, A. D. (2008) experiment lacks in external validity, more so than outright disproving their conclusions and hypothesis. A combination of testing should be conducted, in which researchers measure the differences between all the factors that contribute to comprehension, and judgement instead of just imagery alone. It would be through this more concise understanding the scientific community could develop ways of improving research articles and their influence upon the community at large.

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