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The Seductive Allure of "Seductive Allure"

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Abstract

The idea of fMRI's "seductive allure" rests on in two widely cited studies. Upon closer analysis of these studies, and in light of more recent research, we find little empirical support for the claim that brain images are inordinately influential.

As a tool for studying the human mind and brain, functional MRI has been subject to various criticisms. One often-cited problem with fMRI is that the images are too dazzling, that is, that they cloud readers' judgment and mask the technology's limitations. As early as the 1990's neuroimaging has been described with the word "seductive" (Sarter, Berntson & Cacioppo, 1996, p. 13; Ratcliff, 1998, p. 129; see also Brammer, 2003, p. 373; Check, 2005, p. 254; Gerard & Peterson, 2003, p. 13; Gordon, 2001, p. 104; Marks, 2010, p. 4; Merckelbach, Devilly, & Rassin, 2002, p. 492; Illes, De Vries, Cho, & Schraedly-Desmond, 2006, p. W27). William Uttal (2011), a vocal critic of functional neuroimaging research in psychology, asserts "Their charm, their novelty, and their pictorial splendor tend to overwhelm critical consideration…" (p. 21). Whereas Roskies (2010) cautiously observes "Neuroimages are epistemically compelling: They invite us to believe" (p. 195), more pointed references to this problem come from Bloom (2006) who writes of "fMRI's seductive but deceptive grasp on our attentions" (para. 6) and Crawford (2008) who refers to neuroimaging as "that fast-acting solvent of critical faculties" (p. 65). According to Poole (2012), "the [fMRI] pictures, like religious icons, inspire uncritical devotion" (para. 18).

What is the evidence for the seductive allure of brain imaging? The most frequently cited findings come from two articles published in 2008. McCabe and Castel (2008) assessed the effects of functional brain images on the perceived quality of cognitive neuroscience research. Using both fictional research descriptions and a real science news article, they documented higher ratings of credibility when the texts were accompanied by functional brain images compared

bar charts, topographical maps of scalp-recorded EEG, or no image. For example, in a hypothetical study entitled "Watching TV is related to Math Ability" the result of interest was that both TV watching and arithmetic evoked activation in the temporal lobe. The conclusion of the study, which subjects were to evaluate, was that TV watching could improve math skills. Subjects did so after reading a description of the study and results accompanied by either a bar chart or a brain image.

McCabe and Castel describe the illustrations used in these two conditions as "informationally equivalent," but this was not strictly true. Figure 1 shows the sample stimuli that they included in their article, used to illustrate the hypothetical research on TV and math. The bar chart shows total temporal lobe activation, whereas the 3-D rendering of the brain shows specific regions of activation in the temporal lobe including both the shape and location of the activated areas within the temporal lobe. Given that the scientific argument in the accompanying text was based on the similarity of brain activation across the two conditions, the similarly shaped and located splotches of activation in the brain images do in fact provide more information than the equivalent total temporal lobe activation in the bar chart.

The authors also compared fMRI brain images to a different kind of data representation, a topographic map of the kind used to represent scalp distributions of electric potential in EEG and ERP research. The latter was a circular map of the head, with 21 electrode sites, and color-coded gradations of interpolated activity. Although such representations include somewhat more specific information about the shape and location of brain activity than bar charts of lobe-wide activity, the nature of the signals they depict (scalp recordings from widely spaced electrodes)

includes much less specificity than fMRI. For purposes of evaluating the persuasiveness of conclusions that rest on evidence of common anatomical substrates, this difference is relevant. Thus, like the bar charts, the maps are not informationally equivalent to fMRI. In other words, subjects should find them more persuasive, because of the information they convey, not their seductive allure.

The other study that is sometimes cited in connection with the seductive allure of imaging did not actually study the effect of brain images. Weisberg, Keil, Goodstein, Rawson, and Gray (2008) set out to examine the effect of neuroscience information on the perceived quality of explanations of psychological phenomena. They found that poor explanations for psychological phenomena were rated as more convincing when accompanied by irrelevant neuroscience information. Although some of the "With Neuroscience" explanations referred to brain imaging, no images were presented to subjects. In addition, Weisberg et al. point out that their results are "not necessarily limited to neuroscience or even to psychology. Rather, people may be responding to some more general property of the neuroscience information that encouraged them to find the explanations in the With Neuroscience condition more satisfying" (p. 476).

Despite their limitations, these two studies from 2008 have been cited hundreds of times in subsequent years as proof of brain images' power to overwhelm our judgment. Surprisingly little additional evidence has been published in support of the disproportionate persuasiveness of brain images. Specifically, to our knowledge only one subsequent published study has reported effects of functional brain images on ratings of scientific credibility, and this study did not

compare ratings with and without images: Keehner, Mayberry, and Fischer (2011) contrasted ratings of research credibility for five different types of functional brain images (glass brain, axial slice, 3-D brain, inflated brain and ERP scalp topography). Effects of rated image complexity, realism, 3-dimensionality and familiarity were examined, and only 3-dimensionality was observed to have a significant effect (uncorrected for multiple comparisons).

Other recent studies have failed to replicate the effect of functional brain images on judgments of research. Gruber and Dickerson (2012) performed an experiment much like McCabe & Castel's (2008), asking subjects to rate the quality of reasoning and other aspects of a science news article, comparing the effects of a brain image relative to no image and relative to other types of images. They report finding no significant effects of image type on subjects' ratings. Two series of as yet unpublished experiments have failed to find evidence for the seductive allure of brain images. Michael, Newman, Vuorre, Cumming, and Garry (2012, under review) reported a series of replication attempts using McCabe & Castel's Experiment 3 materials. Across nearly 2000 subjects, a meta-analysis of these studies and McCabe & Castel's original data produced a miniscule estimated effect size whose plausible range includes a value of zero. Our own work (Hook & Farah, in preparation) has also failed to find evidence that brain images enhance readers' evaluation of research in three experiments comprising a total of 988 subjects.

Given the paucity of published support for the seductive allure hypothesis, the weaknesses in that support, and the recent null results, it is remarkable that the

hypothesis has persisted. Why might this be? There are many possible answers, not mutually exclusive.

First, the idea of seductive allure lends support to the widely held concern that the behavioral sciences are being deprived of funding in favor of brain imaging research (Bloom, 2006; Fodor, 1999; Miller, 2010; Weisberg, 2008). Although we agree that behavioral science research is underfunded, the seductive allure of brain imaging is not likely to be the reason. In addition, given the visual appeal of images and their high-tech origins, the idea that they are inordinately persuasive is plausible. This a priori plausibility may have reduced scrutiny of the experimental designs and results that seem to support it. Finally, publication bias may have played a role by preventing us from learning of negative results from other, possibly better controlled, studies. As the blogger Neuroskeptic wrote in 2009 concerning Weisberg et al.'s (2008) study, there is "another kind of seductive allure, probably the oldest and most dangerous of all—the allure of that which confirms what we already thought we knew."

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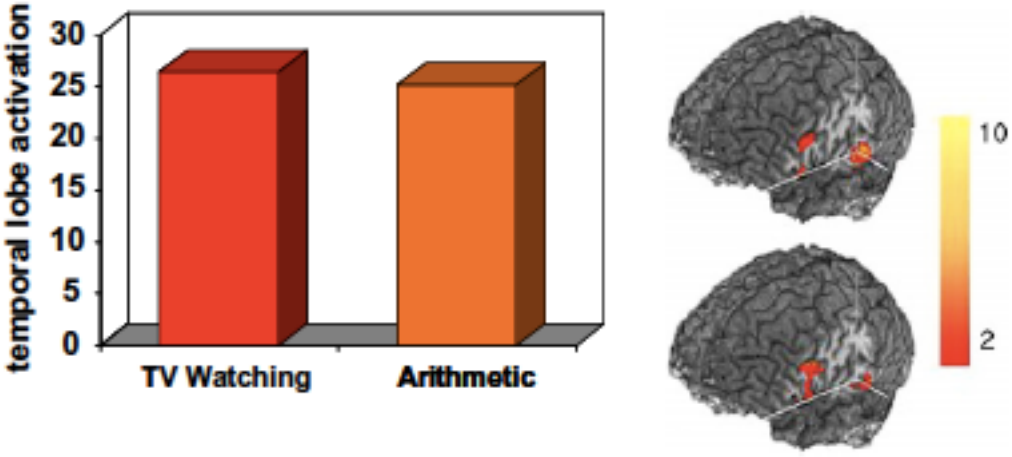

Figure 1. Sample stimuli from the article by McCabe & Castel (2008).[1]

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