Understanding and misunderstanding of neuroimaging: some data from first year undergraduates

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ABSTRACT/SUMMARY

•In recent years, neuroimaging research has become a popular and exciting source of news in the press and media but claims are often exaggerated and people's understanding of the techniques appears poor.

•In this study, 207 first year undergraduates in psychology completed a True/False questionnaire in which 28 statements about neuroimaging were presented

•Respondents showed a very skeptical attitude to some of the claims made for neuroimaging but showed poor understanding of the methods

•82% correctly judged that neuroimaging could not be used to read minds; 88% correctly thought neuroimaging could detect brain abnormalities; and 77% thought that newspapers and media did not report neuroimaging studies accurately

•However, 76% incorrectly thought that neuroimaging allowed us to see behaviour in the brain as and when it happens; 80% incorrectly thought that babies, children and adults could be studied with all types of imaging; 84% incorrectly thought neuroimaging could identify a person suffering from mental illness

INTRODUCTION

The past 20 years has seen a dramatic increase in the use of neuroimaging to understand the brain's role in behaviours such as cognition, memory, learning, language production and comprehension, emotion, mental illness, and many others (Martin, 2006).

Journal papers reporting neuroimaging research have increased from under 1000 in 1989 to almost 10000 in 2008 (The Wellcome Trust, 2009). This prolific publication rate has been mirrored by an enthusiastic interest in brain science and neuroimaging research by the media, and neuroimaging research is now routinely reported (Beck, 2010; O'Connor et al, 2012)

Evidence, however, suggests that the accuracy of these stories/reports is questionable and that research is oversimplified and misleadingly reported. One (US) study- the only published research- found that people's perception of the technology's scientific credibility and importance may be inflated, especially when news reports are presented with accompanying brain scans (Racine et al, 2005).

People are also more likely to find neuroscience research to be more credible when accompanied by a neuroscientific explanation (even a bad one) or a brain scan (Weisberg et al, 2008; McCabe and Castel, 2008).

What people actually do know and understand about neuroimaging has not been explored systematically, although people are generally poor at understanding neuroscience (Herculano-Houzel, 2002; OECD, 2002). The lack of understanding may underlie the tendency to regard neuroimaging research as more credible. The current study sought to examine the degree of understanding and misunderstanding of neuroimaging and neuroimaging research in a naïve sample.

METHOD

Participants

An opportunity sample of 207 first year undergraduates in psychology (158 women; 34 men; 15 did not indicate sex) with no formal instruction in biological psychology at degree level participated

Questionnaire

Participants completed a 28-item True/False measure which included correct and incorrect statements about neuroimaging. Respondents indicated whether they believed the item was true or false. Participants also indicated on a 7-item Likert-type scale how much they knew about Science, Neuroscience, Neuroimaging and Psychology (1= Very poor, I know hardly anything; 7= Very good, I know a lot).

Overall percentages for accuracy were calculated for each item and a median split was created using the responses to the science, neuroscience, neuroimaging and psychology items so that a comparison could be made between those who believed they knew a lot about these subjects and those who did not.

RESULTS

Table 1 shows the percentage correctly agreeing or disagreeing with each statement. (T)= statement is correct; (F)= statement is incorrect

Neuroimaging can detect abnormalities in the brain (T)	88%
Neuroimaging can be used on animals and humans (T)	86%
Neuroimaging can allow us to read other people's minds (F)	82%
Neuroimaging can help us learn more about human behaviour (T)	82%
Neuroimaging cannot be used to study primates such as gorillas & monkeys (T)	77%
The media (TV and newspapers) usually report neuroimaging research accurately (F)	77%
The first study of human language using neuroimaging was published in the 2000s (F)	75%
Neuroimaging can tell us how intelligent a person is (F)	71%
The first neuroimaging techniques studying brain function were developed in the 1990s (F)	71%
Neuroimaging can tell us a person's sexual orientation (F)	70%
Neuroimaging can show when a person is telling a lie (F)	68%
The first neuroimaging techniques used to study brain function developed before 1960 (F)	66%
The first study of human language using neuroimaging was published in the 1990s (F)	61%
fMRI is an example of neuroimaging (T)	57%
The first study of human language using neuroimaging was published before 1970 (F)	57%
Neuroimaging techniques measure only activity in the brain activity not structure (F)	56%
The first neuroimaging techniques studying brain function were developed in the 1970s (F)	56%
Neuroimaging involves measuring blood flow in the brain and how much oxygen it uses (T)	52%
PET is an example of neuroimaging (T)	50%
Neuroimaging can be used to study the brain, but no other part of the body (F)	39%
The first study of human language using neuroimaging was published in the 1980s (T)	39%
EEG is an example of neuroimaging (F)	36%
MEG is an example of neuroimaging (F)	35%
The first neuroimaging techniques studying brain function were developed in the 1980s (T)	32%
Neuroimaging allow us to see behaviour in the brain as and when it happens (F)	24%
We can study babies, children and adults with all types of neuroimaging techniques (F)	20%
Neuroimaging techniques can identify a person who is suffering from mental illness (F)	16%
Neuroimaging involves measuring the activity of brain cells (F)	13%

When a median split was created using the knowledge of science, psychology etc responses, no significant differences in accuracy were found between those who indicated knowing little about psychology (t (200)=.77, p=.45), neuroscience (t (200) = .73, p=.47), science (t (200), 1.25, p=.21) and neuroimaging (t (200)= .45, p=.65) and those who knew a lot. There were no significant correlations between total score and degree of self-reported knowledge (r ranged from .012 to .13, p>.05)

CONCLUSIONS

The results show that while respondents had a very skeptical view of some of the (erroneous) claims made for neuroimaging research, participants' knowledge of the techniques and what they measure is poor. This suggests that the assumptions made regarding claims may also not be evidence-based but on personal understanding or perception (the data from the self-reported knowledge items suggest this might be the case). At the extreme, 87% thought that neuroimaging measured the activity of brain cells and 84% thought that it could identify mental illness. 76% thought the techniques measured brain activity in real time and around 50% thought that fMRI and PET were not neuroimaging techniques.It is reasonable to conclude that knowledge of neuroimaging is not good. Re-examining these attitudes in the final year would be instructive.

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