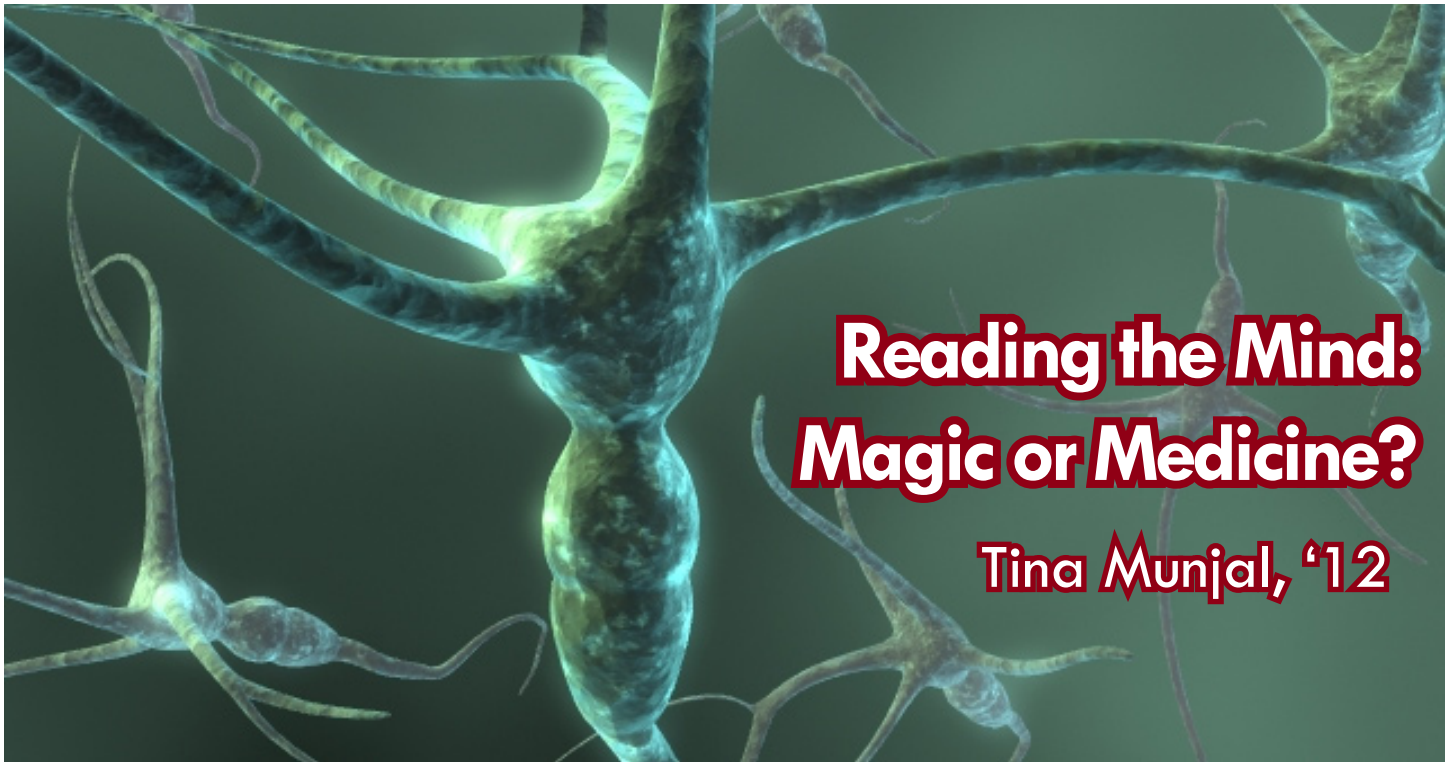

# Reading the Mind: Magic or Medicine?

Tina Munjal, '12

(Image courtesy of Gary Pawlik)

In J.K. Rowling's hit series *Harry Potter*, lead characters Albus Dumbledore and Lord Voldemort practice Legilimency, or the ability to "mind read" the emotions and thoughts of other people. Such a concept need not be dismissed simply as a crafty plot device in a children's fairy tale any longer, for radiological science has brought a sort of real-life Legilimency into the realm of possibility through functional magnetic resonance imaging, or fMRI. fMRI operates by the principle that active areas of the brain require increased blood flow due to the greater oxygen requirements of the neurons in those portions. An fMRI machine utilizes the difference in the magnetic properties of oxyhemoglobin and deoxyhemoglobin to determine which regions of the brain are active during particular cognitive tasks [2]. Although fMRI may not be entirely magical, the implications for such a technology are nevertheless vast and varied. Indeed, fMRI is creating a stir in communities of scientists, ethicists, lawyers, educators, and physicians.

For example, fMRI has the potential to be used as a legal arbiter, incriminating the guilty and vindicating the innocent, by detecting patterns of activity in the brain associated with dishonesty. While tests like the polygraph can be manipulated by the subject through altered physiological responses, fMRI read-out is more resistant to conscious control [1]. Two American companies, Cephos and NoLie MRI, have already released their prototypes of fMRI-based lie-detection systems. The founder of Cephos, Steven Laken, claims that his company's system works accurately 95% of the time. Laken predicts that information acquired through such neuroimaging technologies may be acceptable for use as evidence in court for civil cases as early as next year [5].

Scholars have their reservations, however. Firstly, fMRI is not foolproof. The changes in hemodynamic response that fMRI measures can be affected by a range of factors, including age, fitness, and medications [3]. Furthermore, the majority of deception pattern studies have been conducted on subjects, frequently college students, who are asked to commit inconsequential dishonesty during their scans. The results obtained from these studies cannot necessarily be applied to real-life situations in which the nature of the lies is starkly different and the potential consequences much more grave [3]. Furthermore, the barrier between inner thought and outer communication, the sense of "mental privacy" [1], could quickly be degraded with such potentially intrusive applications of fMRI. Another significant impediment to the advancement of so-called neurolaw is the Fifth Amendment to the U.S. Constitution, which proscribes coerced self-incrimination [5]. Thus, although fMRI could one day be used to exonerate innocent individuals, this benefit would come only at the expense of the rights of the accused.

The controversy is not limited to the courtroom, however, as it could potentially also threaten the classroom dynamic [4]. If fMRI really does reveal the inner workings of the brain and mind, what could possibly serve as a better assessor of academic potential? The SAT would undoubtedly be left in the dust. However, current imaging technology is not yet sensitive to the fact that young minds are still developing and immensely plastic. Thus, the margin of error for fMRI is increased in children [4]. In other words, students ought not to throw away their preparatory books just yet. Tests like the SAT are here to stay for quite some time.

On a related note, it has been suggested that fMRI could one day be used on infants to forecast the likelihood of later brain dysfunction. Once again, however, we find that the developing brain can sometimes be very unpredictable [4]. Prematurely labeling a child as mentally deficient could cause the child to be needlessly stigmatized, as well as deprived of a full education and even of insurance coverage [6]. Perhaps it is better, then, that fMRI is not yet capable of completely accurate prognoses, seeing

as that society is yet unprepared to deal with the implications.

True, fMRI is not immediately going to change the way we govern, learn, and diagnose, but the potential is there. While we wait for technology to catch up with the ideas of our times, it is imperative that a solid ethical and logistical framework is constructed so that we can be prepared to put to our benefit, rather than to our detriment, the "magic" of functional neuroimaging once it arrives in full force.

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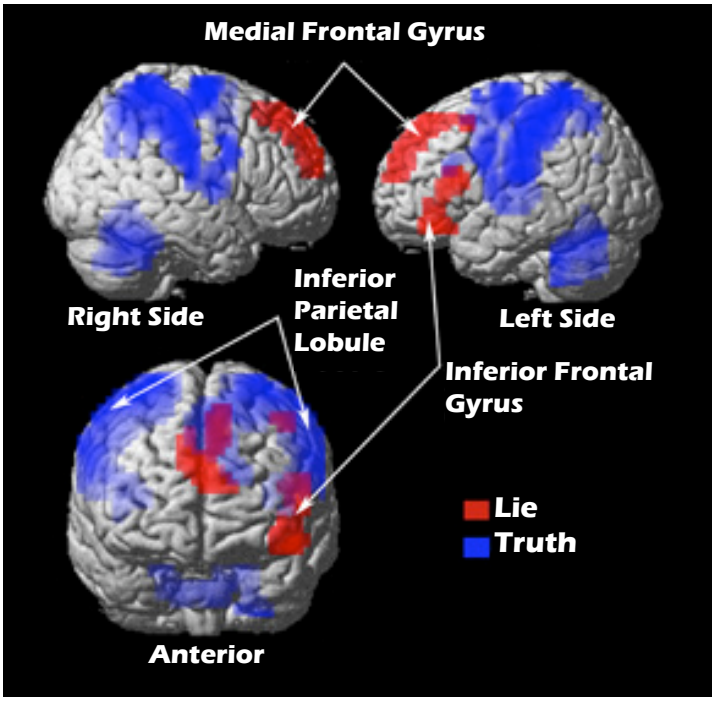


*fMRI allows for the detection of brain activity patterns associated with dishonesty. (Photo courtesy of Joel Huizenga; edited by Nicky Mehtani)*

# Fast Facts for fMRI

### What is the difference between MRI and fMRI?

MRI is generally used for visualizing anatomical structures in the brain and other parts of the body, while functional MRI does just what its name suggests—reveals functions! The underlying physical principles behind both technologies are very similar, but an fMRI machine does require some additional hardware components and specialized software [5].

### How strong is the magnet in an MRI machine?

In clinical settings, the magnetic field strength ranges from 0.2 T to 3 T. In research settings, the strength can be 7 T, 11 T, or even higher [4]. To put this in perspective, the magnitude of the Earth's field is only 0.00005 T [1]!

### How safe is an MRI procedure?

MRIs do not require the use of ionizing radiation, unlike X-rays and CT scans. Although the magnet itself is quite safe, patients should be careful to make sure that they remove all jewelry, credit cards, removable dental pieces, and other such items prior to entering the MRI room. Furthermore, patients with certain types of metal implants, medical devices, tattoos composed of metallic ink or iron dye, or embedded metal fragments in their bodies may be ineligible for MRI scans due to the hazard that such items would pose in the presence of such a strong magnet [2, 3]. In addition, because many—but not all—MRI machines require patients to lie still in an enclosed space for quite some time, individuals with claustrophobia may need a mild sedative in order to undergo the procedure [2].

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