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Review

Possibilities and limits of mind-reading: A neurophilosophical perspective

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ABSTRACT

Access to other minds once presupposed other individuals' expressions and narrations. Today, several methods have been developed which can measure brain states relevant for assessments of mental states without 1st person overt external behavior or speech. Functional magnetic resonance imaging and trace conditioning are used clinically to identify patterns of activity in the brain that suggest the presence of consciousness in people suffering from severe consciousness disorders and methods to communicate cerebrally with patients who are motorically unable to communicate. The techniques are also used non-clinically to access subjective awareness in adults and infants. In this article we inspect technical and theoretical limits on brain–machine interface access to other minds. We argue that these techniques hold promises of important medical breakthroughs, open up new vistas of communication, and of understanding the infant mind. Yet they also give rise to ethical concerns, notably misuse as a consequence of hypes and misinterpretations.

Contents

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1. Introduction

In typical conditions, a subject has direct access to a subset of her or his own thoughts and experience. Access to other minds is perforce indirect, passing via that other individual's expressions and narrations. Under some aspects, knowledge of another mind might be more accurate than introspective thought; for example, when emotional involvement such as love, fear, repression, or self-deceit make it difficult for us to face or see in ourselves what may be more apparent to others (friends, family, psychotherapists), who are less directly involved. Nevertheless, knowledge of others is necessarily indirect in a manner that self-knowledge need not be. For human beings, who dispose of symbolic and recursive languages, the spoken word is primordial in gaining accurate knowledge about other minds. Until recently, these behavioral expressions, body language, and narrations exhausted our possibilities of interpreting other minds and their mental states, but that situation is now rapidly changing.

Several methods have been developed which can measure brain states relevant for assessments of mental states. These states need not be conscious to the subject being mind-read. Electroencephalography (EEG), magnetoencephalography (MEG), deep-electrode recordings and near-infrared (NIRs) and magnetic resonance imaging (MRI) have opened a door that was previously sealed to entering the minds of others, and to communication without 1st person overt external behavior or speech. Notably, functional magnetic resonance imaging is used to identify patterns of activity in the brain that suggest the presence of consciousness in people suffering from severe consciousness disorders and methods to communicate cerebrally with patients who are motorically unable to communicate. It is also used non-clinically to access conscious or non-conscious subjective awareness, e.g. perceptions, or intentions in adults and infants.

These new techniques hold promises of important medical breakthroughs and new knowledge about consciousness but also give rise to ethical concerns, e.g. in terms of health care and privacy. In this article we inspect technical and theoretical limits on the brain–machine interface access to other persons' minds. We begin by reviewing recent assessments of consciousness in patients with serious consciousness disorders, proceed to non-clinical attempts to access mental contents, and conclude with a discussion of the possibilities, promises and perils.

2. Detecting consciousness from brain activity in behaviorally noncommunicative patients

2.1. Functional magnetic resonance imaging as a measure of consciousness and a method of communication

Functional magnetic resonance imaging (fMRI) maps the blood oxygenation level dependent (BOLD) response associated with neural activation to study normal and disordered functions. Because it is non-invasive, it can be used to study also vulnerable subjects, such as children, who could not be studied by other functional brain imaging methods that use radiation. Today, the fMRI technique is widely used in clinical practice as an assessment tool; for example, to identify disease risk, e.g. the early identification of Alzheimer's Disease (Wierenga & Bondi, 2007); augment surgical planning (Bookheimer, 2007); monitor rehabilitation outcome and assist in drug development (Paulus & Stein, 2007). fMRI measurements have contributed considerably to our knowledge about abnormalities of brain response in many neuropsychiatric conditions (Brown, 2007).

fMRI can also be valuable to differentiate objectively patterns of cerebral activity in patients suffering from disorders of consciousness (DOC) (Boly et al., 2005). In this context, fMRI functions as method for assessment of consciousness in these patients, when the technique is used to investigate whether they may have preserved mental abilities that evade detection using standard clinical methods that exclusively rely on behavioral indexes.

Persistent vegetative state (PVS) is characterized by wakefulness without awareness and has been described as "one of the least understood and most ethically troublesome in modern medicine" (Owen et al., 2006). PVS patients can move, grimace and have their eyes open, but are considered to be by definition unaware of themselves or their surroundings.fMRI-studies have shown that substantial portions of the cortex may still function in PVS patients. A patient's own name was found to elicit a stronger cerebral response than unfamiliar names, suggesting that the patient could process auditory stimuli to a semantic level (Perrin et al., 2006). This observation per se does not demonstrate conscious processing since experiments in normal subjects using masked stimuli demonstrate that a stream of perceptual, semantic and motor processes can occur without awareness (Dehaene et al., 1998).

In fact, at the group level cerebral activation is usually limited to subcortical and 'low-level' primary cortical areas and is often disconnected from fronto-parietal network whose coordinated activity appears to be necessary for conscious processing (Laureys, 2005).