

Neuroimaging and the Limits of Brain Imaging Techniques

Abiola BAMIJOKO-OKUNGBAYE¹

¹ PhD Researcher, University of Sofia, Bulgaria, bamijoko@yahoo.com

Abstract: Neuroimaging technique is widely received in the scientific community and experts believe that the neuroscientific concepts can be applied to our societal context. The ubiquitous use of its methodologies prompts this paper to look at this technique in relation to the mind-body-brain-society relationship. This research shall outline cogently that brain imaging technique of today is not sufficient to read all actions through a series of vignettes charted out in this paper. The dearth of conclusiveness of today's empirical data should not be seen as a roadblock but rather as a conceptual stage required in order to gain a comprehensive understanding of neuroimaging. The paper shall also put a hypothesis forward germane to the technique, contending that the advancement of technology, medicine and future scientific development will eventually in principle tease out a novel futuristic approach which would cover today's insufficiency.

Keywords: *Neuroimaging; Extrospection; Mind; Psychology; Philosophy; Psychiatry; Medicine; Society.*

How to cite: Bamijoko-Okungbaye, A. (2018). Neuroimaging and the Limits of Brain Imaging Techniques. *Postmodern Openings*, 9(3), 64-75. <https://doi.org/10.18662/po/36>

Introduction

Neuroimaging technique and other brain viewing techniques have clearly captured the imagination of the public and researchers. The quest for prediction of events is overwhelming, unsurprisingly some have called for its use in a court of law. In court, lawyers and psychologists are putting the accent on the mental status of Defendants. Brain -demented defendants are continuously observed on daily basis within the American legal system (Redding, 2006). Neuroimaging technique is positively received in the scientific community and experts believe that the neuroscientific concepts can be applied to traditional societal questions. This paper looks at this technique in relation to the mind-body-brain societal context. This paper shall suggest that brain imaging technique of today is not sufficient to read actions by showing its barriers. The paper will also put a hypothesis forward asserting that the advancement of technology, medicine and future scientific development will eventually at least in principle birth a novel approach which will cover today's insufficiency.

Neuroimaging allows the identification pattern of human brain activity associated with perceptual, cognitive emotional and behaviour process using positron emission tomography and functional magnetic resonance imaging. With this technique, researchers have been able to safely image the brain without surgical operations. This fascination results in a perception that overrates the power of the brain imaging to explain most things. For example, bullying in school, love and even a futuristic field called neuromarketing that checks how consumers react to specific stimuli like an advertisement. Neuroimaging is also used to study anti-social behaviour, violence, abnormality and so on. Neuroimaging will soon be able to reveal hidden information about consumer preferences (Ariely & Berns, 2010). Supporters are optimistic enough to predict a futuristic neuro-marketing world. Imagine a guest comes to the house, scanned employing neuroimaging technique. The result of the analysis derived is then sent to a mobile phone, this could assist the host in understanding the preference of the guest. There is substantial evidence to support the fact that neurocircuitry and cognitive-affective processes deviate once symptoms of depression reach a certain level of severity in contrast with healthy subjects (Stein, Kupfer, & Schatzberg, 2006). This idea of using neuroimaging to read mind is prevalent in our hurly-burly world, its approach is instrumental to psychopharmacology and medical diagnosis. If researchers could obtain adequate information about brain activities, will the talk of the mind-body-brain-society relationship be eliminated?

Neuroimaging and its Limitation.

Neuroimaging device is a powerful tool. It can be used to measure blood flow in the brain and the analysis of this blood flow can be used to determine when a subject is actively doing something. This principle was applied in a trial. Sixteen volunteers were chosen to judge different crime scenarios. Researchers were able to find out from the volunteers their blood flow levels during judgement of crime cases while the subjects were scanned with fMRI, Functional Magnetic Resonance Imaging. It was shown that there was an activity in a small part of the prefrontal cortex when volunteers judged homicides, assaults and robberies. The dorsolateral prefrontal cortexes were more active than during judgments of crimes where guilt was more ambiguous. The hypothesis of this empirical finding is that the emotional region of the brain was the one driving the punishment level. The conclusion from the experiment shows the actions of the volunteers are situated in the brain (Buckholtz et al., 2008).

These new findings and free access to the brain have allowed researchers worldwide to ask fascinating questions about the mind-body-brain-society relations pertaining to societal context. Neuroimaging research has given researchers the opportunity and insight into how the human brain functions and helped to rethink the psychopharmacological classifications of disorders. The idea of direct access to the brain without surgical means has resulted in changes in many areas of psychology and psychopharmacology. For example, the findings of an abnormality in the brain of some teenagers suffering from anorexia. This is fascinating because the psychopharmacologist can easily explain to the affected families that the abnormalities in the brain caused the eating disorder. Is this brain-only solution secure? Neuroimaging has also been used to study violent behaviour. It was found out that six from ten violent male had mesial temporal atrophy or periamygdaloid lesions (Chesterman, Taylor, Cox, Hill, & Lumsden, 1994).

Therapists and researchers were also successful in isolating a set of brain systems where an abnormal response to rewards is associated with drug dependence. Results obtained from the above research can be used to predict whether specific treatments will be effective, as experts have created a biomarker for the function of these brain systems (Attention networks). Posner states that neuroimaging reveals a startling degree of region-specific activity and when thoughts analyzed in terms of component mental operations, a beautiful localization emerges (Posner, 1993). Even though the explication of the process of seeing the mind was not demonstrated. The

brain activity does reveal what could be obscured from the mind. Obviously, it can be described that imaging the brain activity is like seeing the mental activities. Patricia Churchland (2013), a fervent supporter of the brain-only solution recently "in touching a nerve" asserts that the Self is the brain. There is no doubt about the fascination surrounding neuroimaging. Are all the empirical findings secure? This paper shall point out the limitations of this technique and also suggest that there is more to read the mind than just reading brain activities and will attempt to push for a sophisticated approach required to improve the current state of understanding. This ampliative approach specifies a nuanced method which includes the individual interaction with the environment. So to speak, the world is governed by the principium individuationis, meaning things are recognized by Being as individual things. I shall discuss why other theories rejected neuroimaging at its present development.

One of the main barriers of neuroimaging after this entire fascinating breakthrough is that the conclusion obtained from results is not generally applicable. The results of the studies might not apply to all individuals. It is important to note this circumscription since this cannot be eschewed when making individual health decisions. Because six of ten violent male suffered from periamygdaloid lesions. This does not make all having the lesion and it could be detrimental to extrapolate such data to all subjects in a therapeutic-setting. The apparent power of neuroimaging can be overwhelming to the parent or child seeking answers to anorexic disorders or parent's personality change. However, the applications relating to the diagnosis and treatment of these disorders are still ongoing, additional research is required in the area of social context. The central norms of these disorders are likely to be medical and moral. New ethical dimensions permeating the values of the subject must be considered, informed by clinical findings. Accordingly, a structure will emerge that entails fact and value in a complementary and symmetrical clinical set-up. Consequently, this illuminates the existing evaluative and descriptive features which will eventually be a boon to users and carers because the facts remained unchanged (Bamijoko-Okungbaye, 2018). An example where the results obtained from neuroimaging can't be generalized is in the case of schizophrenia patients. It is up till now not possible to confirm the increase or decrease in brain activity in a specific area of the brain as better or worse (normal/abnormal) in schizophrenia patients. Studies from research have shown in some cases increase activity in the prefrontal cortex and others have less activity. One might suggest due to the conflicting findings that the disparity is a result of task specificity when the groups were tested.

Despite the progress surrounding neuroimaging, this technique can't practically solve all the issues surrounding the idiosyncratic nature of the Self. The assumption that the individual brain areas are solely responsible for specific mental functions is incomplete. This is the reason that those regions can't conclusively explain what a person is thinking. The psychopharmacological dimensions of the human mind spawned from different multilayers of complexities which make it multidimensional. It is definitely more than analyzing colourful pictures of the brain. There are multiple factors that need to be considered, like the relationship of the Other with nature. The assumption of using fMRI to map several key regions of the brain and using this mapped data, as well as data from other parts of the brain, resulting in developing a set of norms that help in understanding what is inside the subject's brain when exposed to particular stimuli is inconclusive and the assumption relies on a logical error. The fact that part of the brain responds to a threat does not necessarily mean that activities in that specific area are an indication of feeling threatened.

Arieli and Berns (2010) were prudent with their findings and conclude: "We return to the opening question: hope or hype? It is too early to tell but, optimists as we are, we think that there is much that neuromarketing can contribute to the interface between people and businesses and in doing so foster a more human-compatible design of the products around us". Rushing and confounding facts on neuromarketing as an enterprise, run the risk of quickly becoming yesterday's fad. The norms of this complexity of neuroimaging ought to be unpacked for its findings and methodologies to be conclusive. As already noted, neuroimaging technique can inform where a particular cognitive process was performed, the objective certainty is still vague at the present moment, hence making the reliability and validity opaque. It is apposite to continue replicating research methodologies to solidify the evidence, together with a conceptual analytical approach of the results. I shall briefly look at Descartes work on the mind-body-society problem and will attempt to suggest that Descartes with the dualist theory might have welcomed neuroimaging technique as a powerful tool to read the mind (Descartes, Cottingham, & Williams, 1996).

Descartes might accept neuroimaging as a technique to read the mind. Descartes should get the credit for getting the debate rolling about the mind-body-brain-society problem. Descartes explained knowledge in terms of doubt. Doubt is understood as a contrast of certainty. As the certainty increases, doubt decreases. The mind can be so deceptive and susceptible to different thought-processing. Descartes questioned the existence by asking

who he was. Descartes described himself as a thing that thinks, doubts, denies and so on. The only thing that Descartes could not deny is when he was making a judgment. He can't doubt that he thinks and therefore there must be a thinker. He concluded that "I think therefore I am or I exist (cogito ergo sum). This position seems inconsistent with his writings because doubting that one thinks is denial. Nevertheless, Descartes could have embraced neuroimaging technique as a tool to read the mind. In his writing meditations, : [I]t is the soul which sees, and not the eye, and it does not see directly, but only by means of the brain. That is why madmen and those who are asleep often see or think they see, various objects which are nevertheless not before their eyes: namely, certain vapours disturb their brain and arrange those of its parts normally engaged in vision exactly as they would be if these objects were present" (Descartes et al., 1985). For this reason, Descartes believes that the soul sees not the eyes using the brain and application of neuroimaging technique could be what Descartes would embrace. The courts allow neuroscientific findings to be employed in defence of the subject from being responsible for the crime committed (Farahany, 2016).

The evidence used in court includes results derived from Electroencephalography EEG, Positron-emission tomography PET, Magnetic resonance imaging MRI, and functional magnetic resonance imaging fMRI. With this point clarification, the evidence is presented as a scientific expert knowledge to elicit consideration when the court passes its verdict. The acceptance of such evidence in court displays that the court does not view this type of evidence as an illicit evidence. In short, it is invoked to inform the court about the neurocircuitry imbalance of the subject's mental states. Libet's experiment was predicated exactly on understanding the origin of these mental states. If volition is conceived non-consciously as Libet et al put it, access to the brain might be able to tell us all about the subject's mental states in court (Libet, Gleason, Wright, & Pearl, 1983).

Objections to Neuroimaging as a solution to the mind body-society Problem.

One main objection to the neuroimaging as a possible solution to the mind-body-brain-society is the question of free will. Could it be possible that free will's decisions are being recorded in the brain activities before making the free decision, an act of information processing? Libet et al have been able to demonstrate the presence of electrical change before subjects

decide to move. This was recorded using EEG and EMG data, bear in mind evidence of EEG is permissive in the court. This is to say, that neural events caused body movements and consciousness can't cause body movement. Libet asked volunteers wearing scalp electrodes to flick their wrists or flex their fingers. Libet was able to record a signal before the movement. This signal was coined a readiness potential. The readiness potential equates the brain preparing for movement. The readiness potential occurs a few tenths of a second before the subjects said they had decided to move. Libet draws the inference that unconscious neural processes determine actions before the action emerges.

The experiment illustrates the underpinning factors governing decisions to be under the control of the unconscious Self. People make decisions every day. What to eat for breakfast? What to wear? Most people make those decisions on a daily basis based on free will and conscious of those decisions. Certainly, most shared the assertion that the freedom to make decisions might open future opportunities. The belief in free will is important in the sense that each can reify the changes desired as social interpretations. According to Libet, free will is actually not free. The *Bereitschaft* potential (readiness potential) precedes a conscious decision to perform an act. The decision to stand up and grab a water bottle, Libet et al experiment suggest that the decision to stand up was an act of information processing and that decision was hidden from the Self (Libet et al., 1983). It is clear that Libet main interest was concentrated on the time characteristics of the relation between external stimulus and internal experience. What about the "How effect", or as German counterpart put it "Wie hast du es gemacht?", that is, the conduit for the causal relationship connecting all brain activities to observable actions. This has not been fully captured, one can say it is akin to an epiphenomenalist methodology in which the mind is the result of brain processes but separate from them. If researchers assent to Libet's finding, how is it going to hold for complex behaviour? Moving a finger voluntarily still lack the "how effect", that is, the causal link that the readiness potential represents a decision to move. In fact, here lies the *petitio principii* that societal context plays a role during activity. The neuronal events before moving recorded by Libet are associated with the preparation for the movement that is, the time taken to look at the clock (Libet experiment). Libet's addendum also lacks the evidence of stronger electrophysiological signs before a decision to move and a decision not to move.

By contrast, Trevena and Miller also share this view (Trevena & Miller, 2010). The Libet's experiment was attempted, using the same scalp

electrodes but instead of allowing the subjects to decide when to move, the volunteers were instructed to wait before making a decision to tap a key. If Libet's experiment interpretation was correct, Miller reasoned, that the readiness potential should be greater after the tone when a person decides to tap the key. Millers and Trevena contend that the readiness potential precedes the time the subjects made up their mind to move. The signal taken was the same whether or not they decided to tap the key. Miller and Trevena discern the readiness potential as a sign of the brain paying attention and not a signal of decision-making. The conclusion showed the results do not provide evidence that voluntarily movements are initiated unconsciously. The findings could also be used to support the view that free will exists to a certain extent and subjects can be responsible. Access to this brain technique lacks the sufficient explanation about the prediction of the Self. If free will is not an illusion, neuroimaging would have a tough time getting to the promised land. Promised land, in this case, refers to neuroimaging as a technique to finally solve the question of what the Self thinks. The plausibility of free will weakens neuroimaging prediction capability by bringing the physical conscious Self's interaction with the society to the fore.

Desire plays a particular role when acting consciously. It is writ large that not all desires lead to conscious action. Desire can be a factor when acting consciously. In the case of normal voluntary action, movements of the agent's body have amongst their causes intentional states of that agent which are 'about' just such movements (Lowe, 1999). For instance, the action of raising one's hand if successful, the hand goes up- and amongst the causes of its going up are such items as a desire of the subject that the hand should go up. The intentional causes of physical events are always directed towards the occurrence of just such events, at least where a normal voluntary action is in play. People intuit that the action is within the parameter of consciousness. Consciousness entered into the production of action, that is, raising of the hand. The ongoing production of action contributed to the following action that is, dropping the hand. The action relies on automatic non-conscious neural control, the action still remains voluntarily. The subject is conscious of the action and not an automated reflex. Voluntary actions are not about neural activities, muscles, and movement, even though all play a part in the production of the action. All those activities were carried along by the conscious Self and the desire to raise the hand purposely. For this reason, Libet's findings that exercising responsibility can be captured completely using brain imaging technique of today and describing the findings based on its neural activities terms only are inconclusive.

Davidson puts another argument forward against neuroimaging technique as a tool to read and predict actions. The Davidson's anomalous monism theory includes the individual's rationality within a context (Davidson, 1980). Neuroimaging projects brain activities in determining the next action and this is usually under the rules of psychophysical or psychological law. Davidson anomalous monism rejects this idea. The Davidson anomalous monism is a theory of the relationship between mental and physical events. The theory holds that every causally interacting mental event is identical to some events. Specific mental tokens are the same event as particular physical events. It rejects neuroimaging technique to predict all actions by rejecting strict laws on the basis of which any mental event type can predict or explain, hence, mental properties can't be reduced to physical activities. The physical and the mental are separate entities and societal context plays role in the interaction. Consequently, it is impossible to determine what's on one's mind based on neural activities. The Davidson anomalous monism emerges from reflection on what seems to be a contradiction. It is cardinal to grasp the second principle in order to conclude with the third claim. To escape the contradiction and reach anomalous monism, the understanding of the second claim is necessary.

This theory explicates there can be no strict laws that causally interacting mental events be akin to some physical event. It depends on there should be no strict law controlling mental properties. Some physical events originate from certain mental events. This interaction is called the principle of causal interaction which simply means some mental events causally interact with some physical events. As a result, this led to the assumption that there should be kind of strict laws governing this singular interaction, a psychophysical law, given by the cause-law principle, when the event is caused by some physical events, it seems to follow by strict laws. Davidson rejects such law and calls this, the principle of the anomalism of the brain. It holds that mental properties are not suitable for inclusion in strict laws. This can be explained as no strict law exists on the basis of which mental events can predict and explain or be predicted or explained by other events. Davidson admitted that the cause-law principle needs a strict law but stated that it does not specify the vocabulary in which those laws must be stated. If a particular physical event caused a particular mental event, there is a strict law governing this interaction, since there is no strict law of the form controlling mental properties, Davidson concludes that every causally interacting mental event is token identical to some physical event. The underlying suggestion is this. The concept of understanding the totality of Being involves the subject's action in society. Some authors are sympathetic

towards the assertion that the neuroimaging at its present use today, especially in the courts is insufficient to answer the fundamental questions. The court should appropriate a mode of analytical thought that reworked motifs from a conceptual understanding of Being. In the case that the court wants to accept the neuroscientific evidence as a proof to determine whether the subject involved meets the criterion of *mens rea*. It is imperative for the court to possess an understanding of conceptual-analytic approach required for the evaluation of scientific evidence and to be sure, it is not rejected out of hand and that the evidence be analysed properly before the court makes it permissive in criminal trials, failure to analyse the evidence conceptually presages an undesired outcome (Baron & Sullivan, 2018).

Conclusions

Neuroimaging will continue its development. The call for more empirical explanations will push researchers to advance research and greater results are expected. It is important for readers and users of this technique to be aware of its insufficiency raised by the Self. Neuroimaging has been able to show exquisite details of the brain's process. As a result of this, enhanced understanding of the Self has been beneficial to psychology, psychiatry and society. Neuroimaging technique of today is not sufficient to explain our individual-societal relationship, as some analysts in newspapers and journals often imply. Brain areas do not correspond uniquely with mental functions and all mental properties can't be reduced to physical properties yet because the locus of an agency which encompasses the dialogical state of Being is multidimensional and complex.

As noted in this paper, there are obstacles to be overcome. However, a prescient understanding is that neuroimaging is promissory to contend that there is epistemic symmetry that development in technology and other areas of medicine have shown in principle what is known in the first person can be understood in third person's spectrum. We cannot preclude these results from daily activities, a sophisticated conceptual awareness, accentuating the dialogical relationship of the Being ought to be understood in order to create a milieu of acceptance in society. This debate is far from over, as neuroimaging continues its development, definitely, new findings are on the horizon and solving the puzzle of the mind-body-brain-society relationship might be closer than anyone anticipated.

References

- Ariely, D., & Berns, G. (2010). Neuromarketing: The hope and hype of neuroimaging in business. *Nature Reviews Neuroscience*, 11(4), 284-292. doi:10.1038/nrn2795
- Bamijoko-Okungbaye, A. (2018). Does Charlie Gard deserve to be taken off life support? *Postmodern Openings*, 9(1), 7-21. doi:10.18662/po/02
- Baron, E., & Sullivan, J. (2018). Judging mechanistic neuroscience: A preliminary conceptual-analytic framework for evaluating scientific evidence in the courtroom. *Psychology, Crime and Law*, 24(3), 334-351. doi:10.1080/1068316x.2018.1428056
- Buckholz, J., Asplund, C., Dux, P., Zald, D., Gore, J., Jones, O., & Marois, R. (2008). The neural correlates of third-party punishment. *Neuron*, 60(5), 930-940. doi:10.1016/j.neuron.2008.10.016
- Chesterman, L., Taylor, P., Cox, T., Hill, M., & Lumsden, J. (1994). Multiple measures of cerebral state in dangerous mentally disordered inpatients. *Criminal Behaviour And Mental Health*, 4(3), 228-239. doi:10.1002/cbm.1994.4.3.228
- Churchland, P. (2013). *Touching a nerve*. New York, USA: W.W. Norton & Company.
- Davidson, D. (1980). *Essays on actions and events*. Oxford, USA: Oxford University Press.
- Descartes, R., Cottingham, J., & Williams, B. (1996). *Meditations on first philosophy* (2nd ed.). Cambridge, UK: Cambridge University Press.
- Descartes, R., Cottingham, J., Stoothoff, R. and Murdoch, D. (1985). *The philosophical writings of Descartes, Volume 1*. Cambridge University Press.
- Farahany, N. (2016). Neuroscience and behavioral genetics in US criminal law: An empirical analysis. *Journal of Law and the Biosciences*, 2(3), 485-509. doi:10.1093/jlb/lsv059
- Libet, B., Gleason, C., Wright, E., & Pearl, D. (1983). Time of conscious intention to act in relation to onset of cerebral activity (readiness-potential). *Brain*, 106(3), 623-642. doi:10.1093/brain/106.3.623
- Lowe, E. (1999). Self, agency and mental causation. *Journal of Consciousness Studies*, 6(8-9), 225-239. Retrieved from <http://www.newdualism.org/papers/E.Lowe/Lowe-JCS1999.pdf>
- Posner, M. (1993). Seeing the mind. *Science*, 262(5134), 673-674. doi:10.1126/science.8235585
- Redding, R. (2006). The brain disordered defendant. Neuroscience and legal insanity in the Twenty-First Century. *American University Law Review*, 56(1), 1-62. Retrieved from

<https://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1277&context=aulr>

Stein, D., Kupfer, D., & Schatzberg, A. (2006). The american psychiatric publishing textbook of mood disorders. Washington, D.C., USA: American Psychiatric Publishing.

Trevena, J., & Miller, J. (2010). Brain preparation before a voluntary action: Evidence against unconscious movement initiation. *Consciousness and Cognition*, 19(1), 447-456. doi:10.1016/j.concog.2009.08.006