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Moral responsibility after neuroscience

Responsabilidade moral depois da neurociência

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Abstract
Moral responsibility is centered on the idea that, given some conditions, people deserve blame or credit, punishment or reward. At least according to traditional readings, moral responsibility presupposes free will, understood as the ability to choose independently of previous events. The achievements of neuroscience in recent decades make a very good case for the hypothesis that the mind is a material entity, a subset of the electrochemical activity of the brain. However, if the mind is a material entity, then it is subject to physical laws. According to some interpretations, this entails the affirmation of determinism and the denial of free will and moral responsibility. This article reviews some of those achievements and their likely impact on the attributions of moral responsibility. The first section presents evidence from lesion studies, imaging techniques and direct electrical stimulation of the brain and argues that the convergence of results from these methods supports the hypothesis that the mind is the activity of the brain. The next section concentrates on studies that are usually taken as directly threatening free will – Libet's experiments and the apparent mental causation theory. The third section turns to the implications of these findings for moral responsibility, explaining determinism, epiphenomenalism, libertarianism, hard determinism and compatibilism. Finally, the last section defends that the requirement of free will as a precondition for moral responsibility should be replaced by the requirement of more naturalistic properties, such as behavioral flexibility, self-control and natural autonomy.

Key words: moral responsibility, ethics, neuroscience, neuroethics, autonomy.

Resumo
A responsabilidade moral é baseada na ideia de que, dadas certas condições, as pessoas merecem culpa ou mérito, punição ou recompensa. Ao menos de acordo com a leitura tradicional, a responsabilidade moral pressupõe o livre-arbítrio, entendido como a habilidade para fazer escolhas independentemente de eventos anteriores. As conquistas da neurociência nas últimas décadas são um forte indício de que a mente é uma entidade material, um subconjunto da atividade eletroquímica dos cérebros. Entretanto, se a mente é uma entidade material, então ela está sujeita às leis físicas. Segundo algumas interpretações, isso implica a afirmação do determinismo e a negação do livre-arbítrio e da responsabilidade moral. Este artigo analisa algumas daquelas conquistas e seus

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prováveis impactos nas atribuições de responsabilidade moral. A primeira seção apresenta evidências a partir de estudos de lesão, técnicas de imageamento e estimulação direta do cérebro, e defende que a convergência dos resultados desses métodos apoia a hipótese de que a mente é a atividade do cérebro. A seção seguinte se concentra em tipos de pesquisa que são frequentemente consideradas como ameaças diretas ao livre-arbítrio – os experimentos de Libet e a teoria da causação mental aparente. A terceira seção foca nas implicações dessas descobertas para a responsabilidade moral, explicando o determinismo, o epifenomenalismo, o libertarianismo, o determinismo forte e o compatibilismo. Por fim, a última seção defende que a exigência do livre-arbítrio como precondição para a responsabilidade moral deve ser substituída pela exigência de propriedades mais naturalistas, tais como flexibilidade comportamental, autocontrole e autonomia natural.

Palavras-chave: responsabilidade moral, ética, neurociência, neuroética, autonomia.

The dualism between mind and body is not respectable as a default assumption anymore. After the development of neuroscience and neuroscientific technologies the claim that the mind is independent of its neural instantiation could not be held without justification. Nowadays, it is the dualist who bears the burden of proof. Notwithstanding, philosophers are being remarkably slow in making the required adjustments in their theories. The purpose of the present article is to disentangle the implications of the rise of materialism as a default position for a cherished philosophical topic, the ideas of free will and moral responsibility. The next section briefly sums up three lines of evidence - lesion studies, imaging techniques and direct intervention – that elicited the change of worldview in the scientific community from dualism toward materialism. The second section presents three studies that create problems for the traditional view of free will. In the third section I show the kind of impact these scientific advances should have on the free will debate. The fourth section presents an outline of a more scientifically based conception of what was called free will: natural autonomy as the capacity to exert self-control based on a neural parameter space that ensures behavioral flexibility.

Evidence that the mind is the activity of brain

There are at least three types of evidence in favor of the hypothesis that the mind is a material entity: lesion studies, imagining techniques and direct interventions. "Lesion studies" is a label for the set of controlled clinical observations of patients with brain injuries. We all know very well that people who had a stroke usually develop a series of impairments both motor and cognitive. The same could be said about those patients who suffered some head trauma or infection or tumor which deteriorated some portion of their brain. If the lesion affected the back of their brain, they could have vision problems. If the portion affected was the hippocampus, the short-term memory is affected. If the Broca area or Wernicke area are affected language problems should be expected. If the brain´s frontal portion is affected, we should look for cognitive or emotional abilities, as in dementia or in cases like the famous Phineas Gage. The neural basis of mental impairments was also identified in more subtle medical conditions like Alzheimer´s disease, Parkinson´s disease, and depression.

The clinical observations of lesion studies are confirmed by another method, the imaging techniques, especially functional magnetic resonance imaging (fMRI). Developed in the late nineties, this technology created the opportunity of taking

a glance at the brain doing its work in a non-invasive way. It measures the flow of blood in the various brain regions. Coupled with the knowledge that where there is more blood there is more activity – since blood carries oxygen and oxygen is the fuel of metabolism - neuroscientists begun to identify the neural correlates of many cognitive tasks. So, for instance, the role of the Wernicke and Broca areas in language was confirmed not only by its malfunction in impaired patients but also by its heightened activity in patients without language problems during linguistic tasks. The same could be said about blind patients, epileptic patients, and several other conditions during the relevant tasks. What is most noticeable is that the identification of neural correlates of cognitive impairments is not limited to those which are usually classified as neurological. These neural correlates have also been increasingly discovered in illnesses which were considered "psychological" or "psychiatric", such as psychopathy, autism and schizophrenia (these labels implicitly imply that mental illnesses are not physical events whereas neurological illnesses are).

More striking than these separated results is the convergence of data from lesions studies and imagining techniques. Even more striking than this is the further convergence of results from direct interventions. This kind of manipulation could be electrical or chemical. A small electric charge applied to specific parts of the motor cortex (the part of the brain which controls movements) of an awake patient under brain surgery gives rise to involuntary movements. If the surgeon stimulates the finger area, the finger moves. The same could be said about the somatosensory cortex, the part of the brain responsible for registering the sensory inputs. Depending of the region being stimulated the patient feels a tactile sensation in the hand, or in the face etc. (Penfield and Rasmussen, 1950). More strikingly, the patient feels pleasure when its nucleus accumbens is stimulated and retrieves memories if some regions of the temporal lobes are stimulated. If you really have something to be called a soul, it is not some immaterial and spooky stuff, it is an electrical soul.

But electrical stimulation is not the most popular way to modify your mind. There is another way which we have already mastered to a great extend: the psychochemicals. And it is not just popping pills. You drink coffee to avoid feeling asleep. You eat chocolate to cure sadness. You get moody when you are hungry (and, in my case, also early in the morning). People have a beer to be more social, smoke marijuana to relax, use cocaine to feel pleasure. If you pay close attention, we already know that our mind is a chemical machine. We already know that it is a material device and that there are very efficient material ways to change it, changing the kind of people we are.

And there are the pills. Scientists are increasingly devising more controllable ways to fine tune our minds through chemicals. We have anesthetics, sleeping pills, antidepressants, anti-psychotics, stimulants etc. We also have ways of increasing and diminishing sexual desires, and even ways to erase memories or to increase attention. On close inspection we are already in an era of mind engineering through pharmaceuticals. The means to artificially create happiness, desires, avoid pain and enhance cognition are already at our disposal. In fact, some time has already passed since we discovered that the mind is the activity of the brain.

To finish this section and give more trouble to the skeptics, let me present what I regard as two of the most astonishing advances of neuroscience. In September 2011, scientists developed a way of reading the movie you see in your mind's eye (Nishimoto *et al*., 2011). In the first phase of the procedure, they registered the subject's visual cortex (the part of the brain responsible for vision) activity using fMRI while she watched 14 hours of *YouTube* videos. In this phase a computer received two streams of information, the brain´s activity and the videos the subject was watching and established correlations between them. In the second phase of the procedure, the subject, still in the fMRI machine, watched a movie new both to

her and to the computer. This time the computer received only one stream of information, the one from the subject's brain. The computer didn´t know which movie the subject was watching; and here was the trick. The software had to reconstruct the movie from its database (formed from slices of movies from the database). You can judge for yourself how mind-blowing the results were by visiting *The Gallant Lab* website (2011).

The second advance I want to mention is also from the mind reading business, but instead of decoding the activity of the visual cortex of healthy patients, in May 2012, the scientists trained a paralyzed patient to control a robotic arm solely through the activity of her motor cortex read through an electrode in her motor cortex (Hochberg *et al*., 2012). Again, you should judge how thrilling it is (see Keller, 2012).

If the evidence is as strong as I am proposing, why don't people drop dualism and embrace materialism? A full explanation would carry us away from the present subject. However, let us mention two factors. The first is the lack of introspective transparency. From the first-person point of view I do not have access to the functioning of my brain, so it was reasonable to suppose that my mental activity springs out of nowhere - I want to emphasize that *it was* reasonable. The second factor feeding dualism is the supposition that its fall would be a threat to our self-esteem. I disagree, but that is another matter.

Neuroscientific evidences against free will

You could agree with me and concede that this evidence shows: (a) that the mind is the activity of the brain, (b) that if there is something to be called your soul it is actually an electrochemical device. Nonetheless, you could still ask what this implies for moral responsibility. This is indeed a fair question. I will be there in a minute. Before that I want to bring to the fore three scientific findings, this time directly relevant to moral responsibility.

Libet's experiments (Libet *et al*., 1983) are probably the most well-known neuroscientific experiment among philosophers. They were based on electroencephalogram (EEG) readings, which record the subject´s brain activity through electrodes fixated in their scalp. The experimenter asked the subjects to move their finger whenever they wanted, all they had to do was to inform the experimenter when they felt the intention to move. The most important finding was that, just by looking at the EEG readings it was possible to predict when the subject would move 550 milliseconds *before* they felt the intention to move. The researcher knew before the subject what their intention would be.

Vast amounts of literature were generated by this amazing finding. Since then, there have been many replications of this result. Two of them are especially noteworthy. Researchers using fMRI were able to predict the subject's choice among two letters as long as 10 seconds before the subject reported their awareness of the choice (Soon *et al*., 2008; Bode *et al*., 2011). More recently, using invasive techniques to register the activity of single neurons in humans during surgery to manage epilepsy, it was possible to predict the motor decision with 90% accuracy 1500ms before the subjects' report when 1019 neurons from the supplementary motor area where being monitored. When the number of monitored neurons was reduced to 256 the prediction accuracy was greater than 80% and feasible as much as 700ms prior to the subject's awareness (Fried *et al*., 2011).

The philosophical questions raised by this line of research are scary: If the decision is made before I am aware of it, who made it? If I am only conscious of

my decisions after they were made, does that mean that I am not in control of myself? This seemed to some the death of free will. But as is often the case, many philosophers were not excited and proposed ways to demonstrate that this was not a threat to free will (Mele, 2009; O'Connor, 2009).

Instead of turning to these philosophical defenses, let´s continue with the empirical literature since this is not the only experimental result to threaten free will. According to the apparent mental causation theory (Wegner, 2002), free will is an illusion created by our intuitive assumption that our phenomenal will (the conscious subjective experience of being in control) is the same thing as our empirical will (the unconscious physiological mechanisms that are causally effective, as in experiments like Libet's). The illusion is to believe that what causes our actions is the phenomenal will when the reality is that it is the empirical will that is in control. We are caught in this illusion because these two types of will actually coincide most of the time. When the principles of priority (you felt your intention prior to the behavior), consistency (the intention was compatible with what really happened) and exclusivity (there are not any other evident causes for the behavior) are satisfied apparent mental causation takes place, that is, it seems as if it is your conscious will that causes the action. Nonetheless, phenomenal will and empirical will are doubly dissociable: you may feel you are in control when you really are not and you may feel you are not in control when you really are. The second class of situations includes the supposed paranormal activity of table turning and the alien hand syndrome. The first class includes many videogames in which the movements of the character are automatic but the gamer feels as if it was him who gave the command. If this theory is right, our conscious will is epiphenomenal, meaning that it is not causally effective, it is unnecessary for our decisions and behavior.

Again, many philosophers were not satisfied (Nahmias, 2011). And again I will not evaluate their criticisms. I will illustrate a real case instead (Burns and Swerdlow, 2003). After a lifetime of normality, a 40-year-old man all of a sudden becomes addicted to pornography. Worse, he develops a taste for pedophilic pictures. Within a short time, his desires take such a toll that he makes sexual advances toward his 12-year-old stepdaughter. She tells her mother, who calls the police. He was arrested and convicted. The judge gave him the option of going through a rehabilitation program instead of being sent to jail. He had never behaved like this before. Now he cannot avoid making proposals to any woman he encounters. Even in the support group he made sexual proposals to the women in the staff. Due to a headache he was subjected to neurological examinations – where he again made sexual proposals to the women in the staff, even after he urinated himself. He told the doctor he was afraid of being unable to avoid raping his landlady. The neurological exams showed an orbitofrontal tumor. And here begins the most interesting part of the story. After the tumor removal the hypersexuality disappeared. Some months later, the behavior reappeared, along with the tumor. After a second surgery the behavior disappeared again.

This case is interesting because it is as close as one can get to an experimental manipulation. It goes beyond the simple correlational evidences between tumor and abnormal behavior and strongly suggests causality since the two tumors removals are a manipulation of the independent variable. This makes the skeptic's work much harder. It also directs our attention to a class of conditions that could be called disorders of volition.

There are conditions in which the subject is unable to resist his impulses: the fear in phobias, the desires in kleptomania, pyromania, obsessive compulsive disorder (OCD), body-focused repetitive behavior (e.g., compulsive nail biting and compulsive hair pulling – known respectively as onychophagia and trichotillomania),

substance addictions and compulsive gambling etc. Parkinson's disease patients are unable to control tremors or to initiate movements. In the opposite direction, there are conditions in which the subject is devoid of desires in general, as in depression and akinetic mutism. There are conditions in which the desires change in response to hormonal alterations, such as the testosterone and estrogen effects during PMS, adolescence and pregnancy. There are conditions in which the feeling of agency and authorship is impaired so that the subject does not recognize his actions as his own, as in schizophrenia, or is cursed by involuntary movements, as in Tourette syndrome, alien hand syndrome, and Huntington's disease. Finally, there are conditions like frontal dementia (or lesions, as in the story above) in which the patient is unable to inhibit offensive behaviors.

Together Libet's experiments, the theory of mental causation, the pedophilic tumor, and the disorders of volition make a very good case in favor of the conclusion that the notion of uncaused free will is flawed, to say the least (the ego depletion hypothesis, which we will discuss below, is another piece of compelling evidence in this direction).

What does it all entail for moral responsibility?

Let us take stock. The first section presented convergent evidence from lesion studies, imaging techniques and direct interventions toward the conclusion that the mind is the activity of the brain. The second section used Libet's experiments, the mental apparent causation theory, the case of brain tumor generating pedophilic behavior and disorders of volition to argue that the traditional conception of uncaused free will is untenable. Here a distinction becomes necessary. There are two different threats to uncaused free will:

- *Determinism*: If our mind is material, then it is subject to physical laws. If it is subject to physical laws, then previous events outside our control determine all our choices. Since for us to have free will is to be able to control our choices, we do not have free will. All the evidence offered above points toward this idea.
- *Epiphenomenalism*: It is the idea that our choices are determined by events beyond our consciousness, as sustained by Libet's experiments and the theory of apparent mental causation.

These two ideas are compatible, but it is possible to be a determinist without being an epiphenomenalist and vice versa. But both, separated or conjoined, challenge free will and moral responsibility. Although it has tremendous metaphysical interest, for the most part the free will debate is motivated by a concern about moral responsibility. To be morally responsible is to deserve praise/reward or blame/punishment for what we do. It is generally agreed that we should be held responsible only for those actions that we can control, meaning those ones that we freely choose to do or not to do. Because the monitoring of wrongdoers and the stimulation of well-intentioned people are quintessential for social development, we need to get clear about attributing moral responsibility. For this reason, deep threats to free will like the ones we have been reviewing are of utmost relevance.

The free will debate is inhabited by some complex positions. They all presuppose that determinism means something like "given the past events and the laws of nature, there is just one possible future". Roughly, the main contenders could be presented thusly:

- *Hard determinist*: If determinism is true, we do not have free will, and determinism is true.

- *Libertarian*: If determinism is true, we do not have free will; but, in fact, we have it, thus determinism must be false.
- *Compatibilist*: If determinism is true, we still could have control, since, as Frankfurt-style cases show, we do not need control in the sense of the Principle of Alternative Possibilities (see below) to be held responsible. And even if we are not exactly the ultimate source of our actions, we have guidability control of them, and that is what matters for responsibility.

Thus, according to hard determinists we do not have free will, whereas libertarians and compatibilists argue that we indeed have it, but these last two differ in accepting or denying determinism. My deepest concern with hard determinism is the suspicion that universal determinism is not the most interesting way in which moral responsibility is challenged. Although it is still cherished by philosophers, universal determinism is not a scientifically very sound notion anymore given that particle physics is based on quantum indeterminacy. However, since there is no compelling evidence of relevant quantum events in neural circuits, this complication should not bother us for now. Furthermore, speculating about universal determinism runs the risk of being a poor endeavor because the world is such a complex place, with so many interdependent variables, that science fiction machines capable of predicting the future in all its details probably will never exist.

Nonetheless, even bearing this in mind, we are already capable of predicting many future events including mental ones, such as the effects of education, fear, beer, coffee, or some psychiatric drugs. Seen from the standpoint of contemporary science things are so complicated that neuron firing is actually considered a stochastic event. Thus, the kind of determinism that moral philosophy should be concerned with is not universal determinism, but an attenuated neural determinism.

Concerning libertarians, at the end of the day, free will as an uncaused choice is just a straw man. In fact, contemporary libertarians argue in favor of indeterministically caused choice (Kane, 1996). But this is not a very good solution either, since in the same way that supposedly we are not responsible for them if our actions are determined, if they are the result of random events, we are not responsible for them either.

To understand compatibilism we need some explanation. Libertarians usually defend that free will requires the Principle of Alternative Possibilities (PAP, or, to put it more poetically, the Garden of Forking Paths), which is the idea that when the moment of choice comes the subject could have done otherwise – a possibility blocked if there is just one possible future, given past events and the laws of nature.

Frankfurt-style examples are thought experiments in which a ill-intentioned person A will control the choice of person B by a secretly implanted brain device, but which will be used only if person B chooses option 1 instead of option 2 (Frankfurt, 1971). However, as the story unfolds, person B willingly chose option 2 and so person A did not need to intervene. Did person B make a free choice? People usually answer yes and compatibilists usually take this as evidence against the PAP type of control, because the subject did not actually have an alternate possibility.

Compatibilists also argue against Ultimate Source (US) control, which is the idea that nobody could be free and morally responsible without being the ultimate source of their decisions or behavior. Instead of PAP and US control compatibilists propose some form of what could be called guidability control (Fischer and Ravizza, 1998), based on the idea that all that free will requires is that we make choices in a way that is responsive to reasons and not coerced by other people or by something inside us that we do not recognize as our intentions, desires, beliefs or values – such as the cravings of an addict.

Compatibilism comes in many flavors and it is really difficult to catch their ideas, so I prefer to put its standard version aside and end presenting the naturalistic trend in the free will debate.

Natural autonomy as a neural parameter space

In recent years some researchers have been proposing understanding free will in more natural terms, as the capacity of self-control. According to this trend, the responsiveness to reasons proposed by compatibilists as the property which characterizes free will should be understood as the behavioral flexibility exhibited by some organisms which are capable of evitability – the capacity to adapt behavior to a range of changing contexts (Dennett, 1973, 1984, 2003; Baumeister *et al*., 2011; Waller, 2011). These capacities include emotional and unconscious processes (Damasio, 1994). Thus, although humans possess free will a higher degree, it is not something exclusively human – which is a very welcome implication from an evolutionary perspective. In this regard, human beings in general possess relative freedom (Baumeister *et al*., 2011) in a higher degree, that is, they could exert self-control more effectively, delaying immediate gratification in favor of more valued future goals. The vocabulary of responsiveness to reasons, agency and other folk psychological notions which comprise the "intentional stance" (Strawson, 1962; Dennett, 1973, 2003; Levy, 2007) is adopted when the relation between input from the situation and behavioral output is unpredictable since it is too complex due to the mediation of the organism´s internal mechanisms.

Clear experimental evidence that our ability to choose is not spooky unconditioned free will comes from the ego depletion hypothesis, according to which self-control is a finite resource. Its central prediction is that people perform relatively poorly at almost any self-control task if they had recently performed a different self-control task. And that is exactly what experiments have shown (Baumeister *et al*., 1998; 2011). Furthermore, it has been experimentally demonstrated that (a) acts of self-control reduce levels of glucose, that (b) low levels of glucose are strongly correlated with poor self-control on subsequent tasks, and (c) that administrations of glucose through lemon juice with sugar, but not sweetener, counteracted some of the ego-depletion effects (Gailliot *et al*., 2007).

The main points of this view of natural autonomy are the following:

- *Autonomy as a neural parameter space*: To be held responsible for his actions the agent must be responsive to reasons - that could be done only if certain neural conditions were in place (such as no damage to cortical and limbic structures, normal corticolimbic pathways, levels of dopamine, serotonin and other neurotransmitters within a certain range, normal activity in decisive structures such as the amygdala, the hippocampus etc.). Being in control is being inside this parameter space and enjoying the kind of flexibility and capacities it offers. All behavior is caused; voluntary behavior is simply caused in a different way (Churchland, 2002).
- *Degree thesis*: The difference between voluntary and involuntary behavior is not sharp (Churchland, 2002).
- *Threshold thesis*: Inside the parameter space, individual differences do not matter. Do not look close and do not look back (Dennett, 2003).
- *Default responsibility principle*: Everyone is responsible for his/her acts and states, unless someone else is or if there is some other excuse (Dennett, 2003).

From this point of view, the brain abnormalities that should exempt the person from moral responsibility are those which preclude the adoption of the intentional instance toward her; in other words, when it entails the bypassing of the rational capacities (Nahmias *et al*., 2007, 2010), making it possible to predict her behavior in mechanistic terms, as was the case with the patient's pedophilic behavior mentioned above. This is in accord with the common way of explaining some criminal

acts as something beyond the agent's control: "It was stronger than him, "It was not him", "It was not his fault" etc.

Concluding remarks

A lot of work needs to be done until we are able to identify all the implications of neuroscience for moral responsibility. Philosophical work though will be innocuous if it perseveres in trying to be empirically immune. It is a story already told many times, in which experimental science invades the philosophical province. We have lost this battle so many times that it is time to learn to work in tandem. As the preceding sections tried to show, the notion of uncaused free will is unsustainable nowadays. It is time for philosophers to help scientists devise scientifically sound notions of autonomy, self-control, moral responsibility and "free" will.

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