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Direct Intervention in the Brain: Ethical Issues Concerning Personal Identity

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ABSTRACT

Personal identity has been the focus of philosophical and ethical debate for centuries. During the last decades, different techniques for intervening in the brain, and hence our mind, are being developed and refined. Neuromodulation techniques, such as direct stimulation of the brain via implanted electrodes (e.g., deep brain stimulation), target the brain's capacity for reorganization to exert their effects and might directly or indirectly influence our mental states. In this paper, we investigate whether the possibility of altering our personal identity provides a valid argument against neuromodulation research and treatment for severe, treatment-refractory neurological or neuropsychiatric conditions. Since narrative rather than numerical identity is at stake when considering neuromodulation research and treatment, our paper focuses on narrative identity changes. We argue that arguments against this kind of research and treatment for neuropsychiatric conditions based upon the possibility of narrative identity changes are ethically unconvincing.

Key words: personal identity; narrative identity; deep brain stimulation; neuromodulation; neuropsychiatric disorders; neuroethics.

Introduction

Several philosophical and ethical worries about personal identity are voiced in relation to direct interventions in the brain, very similar to those vis-à-vis psychopharmacological treatment and enhancement techniques in general (DeGrazia, 2005; Levy, 2007). One of the most salient worries related to personal identity is the fear of creating a *new person*, of radically changing a person's self up to the point where they can no longer be considered the same. In the introduction of *Intervening in the brain*, Merkel et al. (2007) point to the widespread philosophical worry that one's personal identity might be comprised as a result of brain interventions: "The fear is often expressed that an individual may no longer be "the same person" he or she used to be prior to an intervention in the brain. In other words (i.e. philosophical terms), these interventions are said to threaten personal identity". These worries are not restricted to direct interventions in the brain (e.g., brain implants), but equally face psychopharmacological (e.g., Prozac) and, perhaps to a lesser extent, psychotherapeutic interventions (e.g., psychoanalysis) (Levy, 2007). A lot of the philosophical worry related to identity changes revolves around the possibility of (radical) personality changes due to brain interventions (see, e.g., Glannon, 2009), rather than personal identity in general. In this paper, we discuss whether interventions in the brain threaten our personal identity, and if the possibility of identity changes provides a sound ethical argument against these techniques.

We particularly focus on one type of neuromodulation (i.e., essentially reversible, *direct* alteration of endogenous neural activity): surgical intervention/stimulation via implanted electrodes (Merkel et al., 2007). This technique involves the placement of electrodes in the brain (cortically or subcortically) to directly apply low or high-frequency electrical current to the brain tissue. These electrodes are connected to a kind of 'pacemaker' near the collarbone, the abdomen or thigh, which can be set on/off with a remote control (the intensity of the stimulation can also be adjusted by means of the remote control, and the patient can switch between several different programs for optimal efficacy depending on the situation). As such, electrical current can be applied directly to the brain tissue to reduce symptoms. A well-known example is deep brain stimulation (DBS) of the subthalamic nucleus (STN) in patients suffering from Parkinson's disease (PD). DBS as it is now being practised goes back to the work of Benabid et al. (1987) who were the first to report successful stimulation for tremor in PD. The

technique is now the most frequently performed surgical procedure for Parkinson related movement disorders that are refractory to pharmacological therapy (Hardesty & Sackeim, 2007; Merkel et al., 2007). Over 55 000 patients have been treated for movement disorders today. There are undoubtedly pros (e.g., fully reversible, flexibility of stimulation) and cons (e.g., potential risk of infection, hemorrhage or seizures during or after surgery) to be given when considering neuromodulation via implanted electrodes, many of which are related to the more technical aspects of the procedure (Chou et al., 2007). Importantly, this procedure is still experimental or investigational in nature with respect to most neuropsychiatric conditions. The FDA recently approved DBS for obsessive compulsive disorder (OCD) based on a humanitarian exemption and two clinical trials for major depression have been launched in the past year (Miller, 2009). There are long-term successful results for OCD and promising results have been obtained for, among others, Tourette syndrome, major depression, and cluster headache. It is important to mention that this technique targets treatment-resistant disorders, resulting in high success rates and often involving dramatic and durable benefits. Moreover, certain other techniques, such as electroconvulsive therapy, show higher relapse rates compared to stimulation via implanted electrodes (Bussone et al., 2007; Greenberg et al., 2006; Hardesty & Sackeim, 2007; Mayberg et al., 2005; Wichmann & DeLong, 2006).

Personal identity

Nearly all personal identity related worries regarding direct interventions in the brain (e.g., DBS for neurospychiatric disorders) rest upon a conflation of narrative and numerical identity (DeGrazia, 2005). Issues concerning personal identity through time or the *persistence question* are about numerical identity. The persistence question asks under what possible circumstances a person who exists at one time is identical to someone (or something) existing at another time? (Olson, 2008, Stanford Encyclopedia of Philosophy). It therefore asks whether or not an individual is one and the same *despite* change (DeGrazia, 2005). Issues concerning narrative identity or the *characterization question* focus on the characteristics that truly or genuinely constitute a person's identity (Schechtman, 1996). According to DeGrazia (2005) narrative identity reflects "what is most central and salient in a given person's self-conception" (266), including personality traits and mood. Narrative identity overlaps with recent notions of personality in psychology and psychiatry, in which personality is defined as "a dynamic and organized set of characteristics in a person that uniquely influences his or her cognitions, motivations, and behaviors in various situations" (Synofzik & Schlaepfer, 2008, p. 4). While it is self-evident that altering an individual's numerical identity is wrong, it is much less clear that altering one's narrative identity is ethically problematic. Whereas unintended radical narrative identity changes are potentially problematic, unintended mild or moderate narrative identity changes are not necessarily problematic. Mild and moderate narrative identity changes are part of our daily life and may result from a variety of life-changing experiences or circumstances. For example, becoming a parent may change an individual from being somewhat irresponsible to becoming responsible. The loss of a loved one may change someone from being optimistic, to being depressed and without hope. Medication or stimulation-induced narrative identity changes come about 'differently' and more abrupt, but are essentially the same as those that come about just by living our daily lives. Whether or not such changes are found the be problematic, depends first and foremost on the person in question and his or her loved ones (Schermer, 2009).

Personal identity through time or numerical identity revolves around the necessary and sufficient conditions for a person at one point in time to be the same person (or being) at another point in time. Psychological approaches describe these conditions in terms of continuity of psychological connections or experiential contents, such as memory of earlier experiences (i.e., episodic memory) or continuity of basic psychological capacities such as a basic capacity for reasoning or consciousness. Biological approaches describe these conditions in terms of continuity of biological life. DBS for neuropsychiatric disorders does not affect the continuity of one's biological life, and it unlikely affects the continuity of one's psychological connectedness or one's basic psychological capacities. Philosophical and ethical worries about personal identity are typically about cases in which stimulation is successful in alleviating the patient's symptoms, but at the same time leads to changes in one's mental states (e.g., changes in personality traits, e.g., changing from an outgoing to a more introvert person). Hence, they are about changes in narrative identity rather than numerical identity (Glannon, 2009). Narrative identity changes may involve changes in cognition, personality traits, emotions and mood.

Neuromodulation via implanted electrodes can influence narrative identity directly and indirectly: directly only in as far as the personality and self-perception network is involved in the brain intervention. Indirectly, neurostimulation can alter personality via its modulation of the major neurotransmitter systems (serotonin (Carver & Miller, 2006), dopamine (Depue & Collins, 1999) and noradrenalin (Bond, 2001), which all influence personality. Neuroplasticity is the capacity of the nervous system to modify its organization to changing input (Bavelier & Neville, 2002) and neuromodulation techniques such as DBS are using the brain's capacity for reorganization to exert their effects (Pascal-Leone, 2006). As personality and self-perception are the result of specific brain circuits, these could be altered by changing input as well. Although narrative identity changes are possible, neurostimulation techniques for neurological and neuropsychiatric disorders target the disorder in question and do not intend to alter one's narrative identity.

Current findings on cognition, personality traits, emotions and mood

The following questions need to be answered: which aspects of our narrative identity are (likely or unlikely) altered due to stimulation for neurological and neuropsychiatric disorders? Do these alterations involve drastic changes? And if yes, are such changes common? And importantly, how do these compare to other available treatments? Let's turn to the data. We will first look at data from DBS in PD, since larger groups of individuals have contributed to studies assessing possible side effects related to narrative identity.

Parkinson's disease

Although DBS for PD is associated with possible adverse effects in terms of verbal fluency, working memory and processing speed, recent studies show that it does not lead to a general cognitive decline (Castelli et al., 2006; Contarino et al., 2007; Deuschl, 2009; Heo et al. 2008; Witt et al., 2008). Castelli et al. (2006) performed a neuropsychological assessment before and after surgery (n=72) with a mean follow-up of 15 months, focusing on a variety of items related to cognition (e.g. executive functioning, memory). The researchers conclude that the study shows that STN DBS is "cognitively safe" (the only significant change found was a small decrease in verbal fluency tasks, overall 4,5% experienced a relevant decline) (p. 136). Witt et al. (2008) compared a group of individuals receiving DBS (n=60) versus a group receiving the best medical treatment (n=63). They found no differences in scores between both groups in terms of overall cognition, although verbal fluency showed significantly greater declines in the DBS group. However, the observed cognitive impairments after DBS had no affect on the quality of life of these participants. Moreover, the authors report that DBS led to a significant improvement of motor functions and quality of life in the DBS group compared to the best medical treatment group. Weaver et al. (2009) compared an even larger group of patients (n=255) in a randomly assigned trial, and found slight decrements in working memory, processing speed, phonemic fluency and delayed recall in the DBS group (and slight improvement in the best medical therapy group). Nevertheless, the majority of measures assessing language, executive functioning, learning and memory functioning remained unchanged in both groups. Again, the DBS group experienced significantly better results in terms of motor control and quality of life assessment compared to the best medical therapy group.

A meta-analysis by Temel et al. (2006), involving 1398 patients, revealed depression in 8% of patients, hypomania in 4%, anxiety disorders in less than 2% and changes in personality traits and emotional changes (e.g. hyper-sexuality, anxiety, aggressiveness) in less than 0.5% (compared to 41% cognitive changes). Specifically with respect to personality traits, Castelli et al. (2006) found a small improvement in obsessive compulsive and paranoid personality traits (7% experienced a postoperative worsening, while 20% showed a clinically relevant improvement). Other personality traits (e.g. antisocial, schizoid) remained stable. They also found an overall small improvement in mood (although a clinically relevant mood worsening was found in 10% of patients), no overall modification in anxiety or apathy before and after surgery, while thought disorders (i.e., hallucinations and delusions) worsened significantly. One patient experienced psychosis postoperatively. Although disturbances (e.g., worsening of anxiety and mood) in individual cases are found, overall, patients experienced small improvements in mood and specific personality traits. Extreme disturbances (e.g., psychosis) are relatively rare. Houeto et al. (2006) report no changes in patient's personality traits or any adverse psychiatric effects following STN DBS, based upon self-report questionnaires, in 20 patients with PD. A more recent study by Castelli et al. (2008) (n=14) using an explorative test suggests "that there is no evidence of personality change in PD patients submitted to STN-DBS" (p. 8). Specifically, regarding personality traits, mood and related changes, Witt et al. (2008) found that anxiety was significantly reduced, and mood slightly elevated, in the DBS group (n=60) but unchanged in the BMT (n=63) group. There were no significant changes after DBS in psychiatry scale scores, and an overall improvement in depression was found (although the effect size was small). 12.8% of the DBS group and 10.3% of the BMT group experienced severe psychiatric adverse effects. 4 patients in the DBS group experienced depression, and 4 psychosis. There was one case of apathy, and one suicide. The authors conclude that *most* psychiatric side effects are transient (e.g., depressive symptoms remitted by the time of 6-month follow-up). Moreover, systematic evaluation did not reveal any psychiatric deterioration, which suggests, according to the authors, that such side-effects can indeed be managed (Witt et al., 2008). Weaver et al. (2009) similarly revealed no significant difference in psychiatric side effects. Importantly, quality of life changed significantly in the DBS group, but not in the BMT group.

Recently it has also been shown that DBS in PD can improve drug induced narrative identity changes. Dopamine and especially D3 receptor agonists (such as pramipexole or ropinirole) might be responsible for the development of pathological gambling and hypersexuality in 18.4% of pharmacologically treated PD patients (Bostwick, Hecksel, Stevens, Bower & Ahlskog, 2009). The PG and hypersexuality abates when decreasing the dose or stopping the use of pramipexole or ropinirole. When DBS is successful, and medication can be tapered down this can result in remission of the pathological gambling (Bandini, Primavera, Pizzorno & Cocito, 2007; Smeding et al., 2007; Gallagher, O'Sullivan, Evans, Lees & Schrag, 2007).

Neuropsychiatric disorders

The first study on DBS for severe, treatment-refractory OCD by the Leuven-Antwerp group, involving three patients (two of which were successful at improving symptoms), did not reveal any additional personality disorders other than the ones already present before stimulation, or adverse personality traits after one year of stimulation (Gabriëls, Cosyns, Nuttin, Demeulemeester & Gybels, 2003). In fact, case three failed to fulfill criteria for dependent personality disorder after stimulation, which was diagnosed at baseline. These findings were assessed both by using self-rated personality inventories, as well as by interviewing close family members or peers. A recent study on DBS in severe, treatment-refractory Gilles de la Tourette syndrome, involving eighteen individuals, reports no serious permanent adverse effects (Servello, Porta, Sassi, Brambilla & Robertson, 2008). All four components of the Yale Global Severity Rating Scale improved significantly postoperatively (social impairment is one of them). Co-morbid symptoms such as anxiety and obsessive compulsive symptoms decreased after DBS. Mallet et al. (2008) found no significant effects of stimulation on measures of depression and anxiety in a double-blind, crossover trial of STN stimulation in 17 individuals with OCD. Serious adverse effects (e.g., anxiety, hypomania) were reported in 7 of the patients during stimulation, but none of these persisted. McNeely et al. (2008) found no adverse neuropsychological effects except for transient manual motor slowing (i.e., finger tapping) after DBS for treatment-resistant depression in a 12 month follow-up of 6 individuals. In most cases, performance on various cognitive tasks improved after stimulation. Lozano et al. (2008) report robust improvements in depression in these and 14 additional patients undergoing DBS for treatment-

resistant depression. After 12 months, 55% of participants were 'responders' and 35% of these were in or close to remission. Neuropsychological testing found no cognitive adverse effects.

There are few studies to date on neuropsychiatric conditions that specifically investigate changes in personality traits and cognitive, emotional and mood-related side-effects. Overall, many studies report that possible adverse effects of stimulation, such as an increase in anxiety, are mostly transient and/or subtle (e.g., Greenberg et al., 2006). Greenberg et al. (2010) discuss worldwide findings on DBS for OCD obtained collaboratively over 8 years in four centers, and report that acute stimulation-induced changes in mood, anxiety, cognition, and sensory and motor effects are rapidly reversed with parameter changes (except for one case where hypomania persisted over days). Of course, despite preliminary promising results in terms of cognitive, emotional and mood-related side-effects, promising results from large(r)-scale randomized controlled trials are needed. It is crucial that a standard battery of neuropsychological tests, as well as standardized personality tests, and interviews with patients and family members are conducted pre- and post-operatively. Long-term monitoring of possible changes in personality traits and cognitive, emotional and mood-related side-effects is needed to ensure that patients receive as much information as possible on possible side effects during the informed consent process. Moreover, the patients need to be aware of the possibility of unforeseen side-effects in terms of cognition, personality traits and mood.

Discussion

The above findings show that mild to moderate changes in one's narrative identity are observed in individual cases, while radical alterations are rare. Changes in personality traits, emotions and mood due to DBS are relatively uncommon in PD and neuropsychiatric disorders, and might even be improved if changes in personality traits, emotions or mood are induced by dopamine agonists. Cognitive changes in PD are relatively common, but similar changes are present with medications and whereas best medical therapy doesn't increase quality of life, DBS does. On the one hand, it is important to keep in mind that such side effects, if not transient by themselves, can often be alleviated through parameter change (i.e., changing the site of stimulation), and if necessary, can be reversed by interrupting stimulation. Moreover, recent functional imaging studies of the brain are elucidating the autobiographical self-network (Platek, Keenan, Gallup & Mohamed, 2004; Ruby & Legrand 2007; Buckner, Andrews-Hanna & Schacter, 2008) and its associated personality traits (Gusnard et al. 2003; Turner, Hudson, Butler & Joyce, 2003). So knowing these networks and its major connections can limit the direct modification of personality traits via electrical stimulation. Increasing knowledge of the personality circuits and their modulating systems will therefore decrease the unpredictability of possible narrative identity changes occurring in brain stimulations, decreasing the perceived and real risks involved. On the other hand, it could be argued that certain changes can be beneficial by restoring rather than changing the patient's identity, similarly to what happens in PD. Chronic pain is associated with personality traits such as hypochondriasis and hysteria, and it has been demonstrated that these personality traits assessed in younger adults relate to the number of chronic pain conditions reported 30 years later (Applegate et al. 2005). However, a (chronic low back) pain condition might also alter narrative identity (Hansen, Biering-Sorensen & Schroll, 1995), based on neuroplasticity of the default networks (Baliki, Geha, Apkarian & Chialvo, 2008) which are involved in self-perception and personality networks (Svoboda, McKinnon & Levine, 2006; Buckner et al., 2008). Hence, it could be suggested that if DBS is successful in removing the narrative identity changing symptom it might restore one's identity that was altered due to the pathology. More studies are needed to fully explore this, but the possibility of restoring one's identity due to neuromodulation techniques is an important concept to be considered in the ethical debate.

We now briefly discuss more general ethical arguments against techniques that have the potential to directly alter narrative identity: (a) socio-economic inequality, (b) fear of using it frivolous reasons, (c) possibility of a slippery slope, and (d) inauthenticity.

(a) One can argue that neurological interventions might create even larger socio-economic inequality then we are faced with today. This is an important argument that might justify that certain techniques are only used under specific, limited conditions, rather than becoming widely available without restrictions. For example, because higher socio-economic status is already associated with higher intelligence, the argument is made that the availability of neurological enhancements (e.g., by means of electrode implants) will make the gap even greater. The fear exists that such enhancement techniques will only, or mostly, be available to the wealthy or wealthier individuals in society, who are already better off in terms of socio-economic status. Hence, neurological enhancements, if widely available, will add to the already existing socio-economic equality in the world, both within and between countries (Levy, 2007). However, neuromodulation for psychiatric disorders is aimed at alleviating human suffering *under very specific conditions*. Only those individuals that suffer from severe, treatment-refractory psychiatric disorders are considered as potential candidates.

(b) As DeGrazia (2005) put forward, it could be ethically problematic to pursue brain interventions for frivolous reasons. This is especially the case with respect to neurostimulation via implanted electrodes because of the invasive nature of the procedure. The risks of this procedure are warranted from a cost/benefit perspective if an individual's quality of life is very low and no other treatment is working. Neurostimulation via implanted electrodes is a last-resort technique for severe, treatment refractory disorders. It has been argued that this technique should not be used for enhancement (Kringelbach & Aziz, 2009).

(c) Opposing DBS for neuropsychiatric disorders because of slippery slope arguments (e.g., creating elite soldiers without a conscience) is not persuasive in the face of severe, treatment-resistant disorders. Moreover, as Merkel et al. (2007) mention: "As *everything* can be misused, the mere fact that it *could* be misused towards unjustified goals cannot count as an argument against it (or we would have to object to even the most banal artefacts, such as hammers)" (281). Potential misuse does not justify withholding beneficial treatments for severe disorders. It does however point to the importance of regulation to make sure that potential misuse can be prosecuted and prevented.

(d) One may oppose neurostimulation via implanted electrodes because of reasons pertaining to authenticity. This argument is, unlike the former arguments, an 'in principle' argument against DBS. DBS has the potential to 'artificially' change one's narrative identity, which runs counter to a so-called 'ethic of authenticity' (Elliot, 1998). However, authenticity arguments are to a greater or lesser extent the expression of a cultural, social or political preference, rather than a purely ethical norm (Bostrom & Sandberg, 2009). Our day to day lives are already immersed by such practices, just think of the use of all sorts of electronic devices to enhance our reasoning skills, diet pills and esthetic surgery to enhance our physical appearance, and the like. In terms of their artificial nature, what makes those kind of interventions any different from DBS? Although inauthenticity claims hold some ethical weight when presented in the enhancement debate (e.g., compromising our appreciation of the given, see, Sandel, 2007), they clearly lack any weight in the treatment debate because of the severe, treatment-refractory nature of these disorders and the potential quality of life improvements. It is therefore up to the patient whether or not the possibility of artificial alteration of his or her narrative identity poses a reason to refrain from treatment.

Conclusion

Overall, from a cost/benefit perspective, the possible benefits of DBS for treatment-resistant neurological and neuropsychiatric disorders outweigh the possible harm of narrative identity change. Even if reasonable more general arguments can be given to avoid alterations of our narrative identity (e.g., in the enhancement debate), opposing DBS for treatment-refractory disorders for such reasons is not ethically defensible. These arguments are overridden by the severity of these disorders and the amount of suffering involved, as well as the extent to which a patient's quality of life can be improved due to neuromodulation techniques. Indeed, successful stimulation can restore self-control and thereby increase a patient's quality of life tremendously. In relation to neurostimulation for PD, Glannon (2007) states that "It can mean the difference between having no control and having a considerable control over one's body and life" (p. 137). Similarly, by successfully reducing the symptoms of severe neuropsychiatric disorders, patients may regain control of their own life. In this debate, involving individuals with severe, treatment-resistant psychiatric disorders, it is the patient who should decide if the possibility of narrative identity change is a reason to refrain from treatment (provided that the individual in question is fully informed and has decision-making capacity). In order to achieve valid informed consent, potential narrative identity changes need to be comprehensibly communicated to the participants in question. In case of research, patient selection should be limited to individuals with decision-making capacity, except in very specific cases where proxy consent may be warranted (e.g., individuals with early onset dementia and combined chronic, extreme, treatment-resistant aggression). DBS research in individuals with end-stage Alzheimer's disease is ethically controversial. However, a categorical exclusion of these individuals is equally dubious if sufficient evidence for possible benefits exists (Kuhn et al., 2009). In case of Alzheimer's disease or minimally conscious individuals, advance directives may provide a partial solution. Minors should be excluded from DBS research protocols. In case of treatment-refractory disorders for which DBS has been accepted as a standard treatment, such as treatment-refractory movement disorders, parent proxy consent is warranted provided that the children or adolescents in question take part in the decision-making process according to age and competency.

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