

Kevin Patrick Tobia

Abstract: The personal identity relation is of great interest to philosophers, who often consider fictional scenarios to test what features seem to make persons persist through time. But often real examples of neuroscientific interest also provide important tests of personal identity. One such example is the case of Phineas Gage – or at least the story often told about Phineas Gage. Many cite Gage’s story as an example of severed personal identity; Phineas underwent such a tremendous change that Gage “survived as a different man.” I discuss a recent empirical finding about judgments about this hypothetical. It is not just the magnitude of the change that affects identity judgment; it is also the negative direction of the change. I present an experiment suggesting that direction of change (improvement or deterioration) also affects neuroethical judgments. I conclude we should consider carefully the way in which improvements and deteriorations affect attributions of personal identity. This is particularly important since a number of the most crucial neuroethical decisions involve varieties of cognitive enhancements (improvements) or deteriorations.

Keywords: advance directive; deterioration; enhancement; improvement; personal identity; neuroethics; neurodegeneration; Phineas Gage; self

1. Personal Identity and Neuroethics

The concept of “personal identity” is of great interest to philosophers. Among the questions asked about personal identity is what properties are required for persistence; what changes might result in a person who is no longer the same person as before?

Philosophers often consider fictional scenarios to test theories about this question (e.g. Locke 1690; Williams 1970; Parfit 1971). For an instructive but very simple example, imagine the two hemispheres of John’s brain are separated and placed into two different bodies, the left hemisphere in Andy’s body and the right in Brad’s body. We might ask which person is John. Is John the person with John’s left hemisphere in Andy’s body? Or is John the person with John’s right hemisphere in Brad’s body? Or does John now exist in two places at once? Or has John ceased to exist entirely?

Philosophers employ these fictional thought-experiments to help learn about the nature of personal identity. But often, real examples of interest to neuroscience also provide important tests of personal identity. For instance, consider this synopsis of the historical Phineas Gage case:

Phineas is extremely kind; he really enjoys helping people. He is also employed as a railroad worker. One day at work, a railroad explosion causes a large iron spike to fly out and into his head, and he is immediately taken for emergency surgery. The doctors manage to remove the iron spike and their patient is fortunate to survive. However, in some ways this man after the accident is remarkably different from Phineas before the accident. Phineas before the accident was extremely kind and enjoyed helping people, but the man after the accident is now extremely cruel; he even enjoys harming people.

Damasio et al. (1994) cite the story of Phineas Gage as an example of severed personal identity; Phineas underwent such a tremendous change that the resulting man was “no longer Gage” (Harlow 1868). As Damasio et al. put it, the greater significance of Gage’s case is that he “survived as a different man.”

Controversy exists over the historical accuracy of this commonly told tale (see, e.g. Macmillan 2000; 2002). Nevertheless, the traditional version of the story is cited as an example of severed personal identity (Searle 2005; Murphy 2013; Rabins and Blass 2009). And even if the story told is not entirely historically accurate, the (fictional) hypothetical still provides a useful thought experiment on the concept of identity: if some story like Gage’s took place, it would seem the pre- and post- accident persons are not the same.

Of course, although theoretical focus often involves one particular concept of personal identity, there are various competing theories, some of which endorse multiple conceptions of identity.¹ Alternatively, some of these theories suggest that we can ask different questions about multiple conceptions of identity. Perhaps, for instance, Phineas and the post-accident man are not actually non-identical in the sense of *numerical* or *quantitative* identity, but they are in some other sense of identity.

There are a number of competing theories of personal identity, and it will be useful to survey a few here. Often debates about personal identity center on psychological versus bodily criteria. A number of theorists posit an important role of psychological continuity in personal identity (e.g. Shoemaker 1984; Johnston 1987; Noonan 1998). Others advocate a more fundamental role for bodily criteria (e.g. Williams 1956; Wiggins 1976; Thomson 1997).

Other accounts of personal identity suggest that something important is missing from these debates. For instance, narrative theories of identity (e.g. Macintyre 1984; Taylor 1989; Schechtman 1996; DeGrazia 2005) argue that part of what matters in personal identity is the narrative structure, shape, or unity of our lives.

Others emphasize the relevance of relations to identity (e.g. Campbell 1997; Campbell; 2003):

We develop and live our lives as persons within complex networks of institutional, personal, professional, interpersonal, and political relationships—both chosen and unchosen. We are shaped in and through our interactions with others in ways that are ongoing; and we develop cognitive and moral capacities and skills, including skills of moral reflection, in relational contexts that not only give these capacities and skills specific content but also offer methods of evaluation and self-evaluation. We come to understand our lives through how others respond to us, and our relational histories are significant determiners of the tenor of our responses to others. (Campbell 2003, 156)

¹ Note that in the Phineas Gage case there is clearly *some sense* in which the pre- and post- accident persons are the same person. If the two were in no sense the same, locations like “not still the same” or “Gage survived as a different man” are nonsensical. The specific notion (or notions) of identity in which I am most interested is the Lockean notion of forensic identity; the sense (or senses) of identity used for attributions of moral responsibility, desert, blame, praise and so on. It is in this kind of sense, I take it, that some intuit that pre- and post- accident Phineas are not the same.

Such relational theories look beyond our brains and bodies to relations with other persons. “Extended” theories suggest that identity may be extended even further (e.g. Lindemann 2010; Wilson and Lenart 2015):

It’s not just other people who hold us in our identities. Familiar places and things, beloved objects, pets, cherished rituals, one’s own bed or favorite shirt, can and do help us to maintain our sense of self. And it is no accident that much of this kind of holding goes on in the place where our families are: at home. (Lindemann 2010, 162-163)

Another broad class of views is that denying the moral, legal, or practical significance or personal identity (e.g. Parfit 1984). In contrast, these views emphasize other kinds of relations, like survival over time or the magnitude of psychological connections or continuities between agents over time. What matters (e.g. morally) is not whether two individuals are quantitatively identical, but instead whether they share significant connections and continuities, like shared memories and experiences.

On any of these views, personal identity or diachronic connections are plausibly relevant to ethics, public policy, and law. Identity (or sufficient connection or continuity) is often taken as necessary for the application of moral concepts like blame, praise, desert, or responsibility (Butler, 1736; Reid, 1785; Shoemaker, 2011). In order for person B at a later time to be blameworthy or responsible for the act of person A at an earlier time, it seems necessary that the persons are related in a particular way (i.e. that the “personal identity” relation holds or that relevant continuity or connection conditions are satisfied).

In certain cases, the relevance of personal identity to moral notions is obvious. Why is he but not she to blame for the injury suffered two weeks ago? Because only he stands in the personal identity relation with the injurer (and the injurer deserves blame).

In some less obvious cases, others have suggested the significance of personal identity or continuity to moral and legal concepts. Consider for instance, the motivation for statutory limitations or forgiving past discretions (Digeser 1995; Parfit 1984; Mott Unpublished); might part of the justification for these practices be grounded in an understanding that after many years the person in some way shares less of the identity of the transgressor – or is an entirely different person?

Many of these issues are of neuroethical interest. Consider for instance, questions in neurobiology and pharmacology: would taking drugs to repress memories or enhance cognition be identity-preserving or breaking? Would more permanent or extreme cognitive enhancements break identity? Similar questions arise in the context of neurodegenerative disease: is a person who develops Alzheimer’s disease or frontotemporal dementia non-identical to a younger person with the same name? Would an advance directive signed by the younger no longer be applicable if we think the older is no longer the same person?

I mention these neuroethics issues briefly now, but I return to them in section 3. There may be implications for all of these from the discovery of a surprising factor that affects personal identity attributions. This surprising factor affecting personal identity attributions (and, therefore, certain neuroethical issues) is the direction of change.

2. Direction of Change

The moral, legal, and practical relevance of personal identity warrants more substantial effort in investigating the cognitive processes driving judgments about personal

identity. Understanding these effects and mechanisms would provide more evidence for determinations about the validity of non/identity attributions. For instance, if judgments about moral responsibility or the applicability of a statute of limitations are guided by intuition about personal identity, whose application itself is driven by some other factors, it is worth investigating the effect of those other factors on identity intuitions. Investigation of these factors will provide greater evidence upon which to assess attributions of personal identity and also the moral and legal judgments for which identity is relevant.

Recently, I conducted one such investigation, finding that direction of change influences attributions of personal identity (Tobia, 2015). To see this, consider a “reversed” version of the Phineas Gage story, one in which Phineas improves rather than deteriorates after his accident:

Phineas is extremely cruel; he really enjoys harming people. He is also employed as a railroad worker. One day at work, a railroad explosion causes a large iron spike to fly out and into his head, and he is immediately taken for emergency surgery. The doctors manage to remove the iron spike and their patient is fortunate to survive. However, in some ways this man after the accident is remarkably different from Phineas before the accident. Phineas before the accident was extremely cruel and enjoyed harming people, but the man after the accident is now extremely kind; he even enjoys helping people.

I found that in this revised case more people judge that Phineas is still the same person after the accident, while in the historical case more judge that the man after the accident is a different person.

The “classic” Phineas Gage case is often taken to show that magnitude of similarity is highly relevant to identity; any very big change seems to break identity. However, this experimental result suggests that precisely the opposite is true (it is *not* the case that any very big change seems to break identity). Intuitions about the classic Phineas Gage story are not driven by the sheer size of the person’s change, but by the negative direction.

This research builds on important recent findings that “good” parts of one’s self are seen as more essential than bad parts (Newman et al. 2014) and that this explains other moral judgments, for example whether a person is happy (Newman et al. 2015). Part of what the Phineas Gage study shows is that “good” parts are not only seen as essential (an implication for synchronic identity), but changing for the better is more identity-preserving than changing for the worse (an implication for diachronic identity).

Direction of change does not only affect judgments about the identity of other persons; very recent work shows direction of change affects personal identity intuitions about oneself (Molouki and Bartels, Unpublished) and certain individual entities like a country or a band (De Freitas et al. 2016). All else equal, it seems when evaluating ourselves, others, and certain other individual entities, we see improvement as more identity-preserving than deterioration.

Direction of change affects personal identity attributions, and it might also bear on certain neuroethical judgments, particularly ones informed by personal identity. In previously unpublished research, I presented participants with the following vignettes, in one of two versions, Deterioration or Improvement [in brackets]:

John is an extremely kind [cruel] person; he really enjoys helping [harming] people. John participates as a paid volunteer in a research program with the

“SCI-Lab” researchers. As part of the research, John allows the researchers to collect data about him, including brain scans, collection of genetic material, as well as self-reports of John's personal memories and ideas. The SCI-Lab researchers, aware they are collecting a lot of personal data, allow their volunteers to request the destruction of these materials at any time after it is collected. However, only volunteers can request destruction of their own data; no other person, for instance John's brother, could request destruction of John's data.

One day, John is in a terrible car accident and he suffers major brain damage. He is in a coma for several days, and the “Metro Hospital” doctors conclude that they must perform an experimental brain surgery. The surgery involves transplanting part of another brain into their patient. The doctors perform the surgery, and it is successful! The doctors see their patient wake up, but they notice some major differences in his behavior. He is now extremely cruel [kind]; he even enjoys harming [helping] people.

Moreover, upon learning about the SCI-Lab research, the man after the surgery wishes to destroy all of the material collected about John. He does not like the research about extremely kind [cruel] John and prefers it is all destroyed.

Participants were asked to indicate on a 1-7 Likert scale whether they agreed (1) or disagreed (7) that the man after the surgery was the same person as John and should therefore be allowed to destroy the data.² Improvement ratings ($M = 2.77$, $SD = 2.00$) were lower than Deterioration ratings ($M = 3.80$, $SD = 2.00$), $t(120) = 2.88$, $p = .0047$, $d = .52$. The “Phineas Gage” finding suggests direction of change affects judgments of personal identity, and these “John” findings suggest that direction of change affects neuroethical judgment; an ethical decision about the right of a participant to request destruction of personal data is informed by whether the agent in question improved or deteriorated.

3. Implications for neuroscience and neuroethics

These findings and the underlying insight – that improvements and deteriorations affect attributions of personal identity – may have implications for a variety of theories of personal identity. However, what I wish to focus on for now are plausible implications of this finding for a range of neuroethical issues. At the most general level, the finding has implications for those issues where personal identity is relevant and where changes are

² The full question read as follows (in deterioration or [improvement] condition): “Art and Bart disagree over what happened in this story. Art thinks that John before the accident and the man after the surgery are different in some respects but are still the same person. To Art, it seems like one person (John) experienced some changes. As such, Art thinks the man after the surgery should be allowed to request that the data about kind, helpful [cruel, harmful] John is destroyed, since the man after the surgery is still John. Bart disagrees. He thinks that after the surgery, the original man named John does not exist anymore; the man after the surgery is a different person. To Bart, it seems like one person died (John), and it is really a different person entirely that exists after the surgery. As such, Bart thinks that the man after the surgery should not be allowed to destroy the data about kind, helpful [cruel, harmful] John; only John has that right and the man after the surgery is not the same man. Do you agree more with Art or Bart?”

perceived as improvements or deteriorations. In many of these cases, the perception of improvements or deteriorations affects judgment about personal identity (perceptions of improvements leading to judgments of persistence and perceptions of deteriorations leading to judgments of non-persistence), which in turn affects judgment about neuroethical issues.

As a first example, consider neuroethical issues raised by pharmacology and cognitive enhancement. Gregory (2009) notes, “ethical issues related to personal identity and moral agency will assume a new shape given the best of recent neurobiology and pharmacology. These developments raise specific issues like the use of drugs to suppress memories of traumatic stress.” As Farah (2010, 7-8) puts it: “neuropsychological enhancement raises profound questions about human effort and just deserts (did I earn my A if used Ritalin?) and personal identity (am I the same person off Prozac as on?” Those who are inclined to see such changes as identity-preserving should also consider whether such a judgment is driven or tempered in part by the fact that certain enhancements are likely seen as improvements and whether this itself ought to be relevant to personal identity and the neuroethical judgment.

A tendency to see persistence where there is improvement arises even with more permanent or extreme cognitive enhancements. “Cognitive enhancement has the potential to radically change a person’s sense of self . . . [or result in] a change in identity . . . Genetic enhancements to improve memory, especially in those with normal age-related memory decline, would remain attractive and preserve rather than reduce . . . Personal identity” (Savalescu 2009). Here is an endorsement of extreme enhancement (presumably seen as improvement) preserving identity. Other research suggests neurosurgical patients feel similar sentiments; Lipsman et al. (2009, 382) report that in interviews with neurosurgical patients, “impact on personality or identity is not a concern before brain surgery.” Perhaps this is not a concern in part because these changes are seen as improvements, either involving “the enhancement of normal traits” or “fixing personality defects.”

While there is a tendency to see cognitive enhancements (presumably improvements) as more identity-preserving, cognitive declines (presumably deteriorations) are often seen as more identity-breaking. Rabins and Blass (2009 42-44) link personal identity to intact brain functioning, suggesting identity was broken in the Phineas Gage case and perhaps also is in some frontotemporal dementia cases. Strohminger and Nichols (2015) also report judgments of non-persistence in what are likely seen as cases of cognitive deterioration.

The effect of improvement/deterioration on personal identity judgment has practical implications, specifically where intuitions about identity or connectedness are influenced by direction of change. Consider, for instance, the domain of health decision-making. Imagine Maria signs an advanced directive and many years later develops Alzheimer’s (cf. Buchanan, 1988). Some philosophers suggest that in such a case, the Alzheimer’s patient is so different from pre-Alzheimer’s Maria that they are actually two different people; they do not share the personal identity relation. If so, one might conclude that Maria’s advanced directive does not apply to the Alzheimer’s patient, in the same way some person P’s advanced directive would apply only to P and not to any other person.

The possible relevance of personal identity to advance directives is acknowledged by Capron (2009):

[S]ome have argued that it is inappropriate to rely on an advance directive in making decisions about patients who have suffered severe and permanent injuries, such as those in a persistent vegetative state, because these patients are no longer the persons they were at the time the directive was executed.

This shift in personal identity makes it wrong to dictate the treatment of the patient in the bed by the wishes of the person that formerly occupied this body.

In these cases, the older person is not just seen as different from the younger person – the older is often seen as worse. In determining whether such considerations (about personal non-identity or less connectedness) support conclusions about the guiding force of an advance directive, we ought to also consider the processes and factors underlying these considerations; in other words, we ought to also consider whether it matters that our judgment would be different in the case of an equally-sized improvement rather than deterioration.³

4. Conclusion

Philosophers and neuroethicists have attended carefully to the relation between personal identity and neuroethical issues (e.g. Northoff 2004; Levy 2007; Levy and Clarke 2008; Brand 2009; Naffine 2009; Kraemer 2013; Klaming and Haselager 2013; Chandler 2015; Baylis 2015; Wilson and Lenart 2015; Pascalev et al. 2015). The novel contribution of this argument is not that personal identity is relevant to neuroethics – this we have long known. Instead, the contribution is that evidence suggests a peculiar fact about the cognitive science of personal identity attributions – improvements are seen as more identity-preserving than similarly-sized deteriorations – is especially relevant to a number of pressing issues in neuroethics. As such, we should consider the way in which we incorporate improvements and deteriorations differently when making identity-judgments and when making neuroethical judgments in which concepts of personal identity (or connectedness) are relevant or salient. This is particularly important since a number of the most crucial neuroethical decisions involve varieties of cognitive impairments or diminishments that are likely perceived as deteriorations and cognitive enhancements that are likely perceived as improvements.

³ One way to expand this suggestion is through the language of Bostrom and Ord's (2006, 664) reversal test: Reversal Test: "When a proposal to change a certain parameter is thought to have bad overall consequences, consider a change to the same parameter in the opposite direction. If this is also thought to have bad overall consequences, then the onus is on those who reach these conclusions to explain why our position cannot be improved through changes to this parameter. If they are unable to quo bias." Here the test is not to discover the appropriateness of status quo bias, but rather the appropriateness of improvement/deterioration effects in asymmetric attributions of personal identity (particularly when such attributions have (neuro)ethical implications). (If direction of change is not relevant to personal identity, then) when a change to a certain parameter is thought to lead to persistence/non-persistence, consider a change to the same parameter in the opposite direction; if this is not also thought to lead to persistence/non-persistence, then the onus is on those who reach these conclusions to explain why such changes lead to persistence/non-persistence.

References

- Baylis, F. 2015. "Neuroethics and Identity." In J. Clausen and N. Levy (Eds.) *Handbook of Neuroethics*: 367-372.
- Brand, C. 2009. Am I still me? Personal identity in neuroethical debates. *Medicine Studies* 1(4): 393- 406.
- Bostrom, N., and Ord, T. 2006. The Reversal Test: Eliminating Status Quo Bias in Applied Ethics. *Ethics* 116: 656-679.
- Buchanan, A. 1988. Advance directives and the personal identity problem. *Philosophy & Public Affairs* 17(4): 277-302.
- Butler, J. 1736. Of Personal Identity. *The Analogy of Religion, Natural and Revealed, to the Constitution and Course of Nature*. Oxford: Clarendon Press.
- Campbell, S. 1997. *Interpreting the Personal: Expression and the Formation of Feelings*. Ithaca, NY: Cornell University Press.
- Campbell, S. 2003. *Relational Remembering: Rethinking the Memory Wars*. Lanham, Maryland: Rowman and Littlefield Publishers Inc.
- Capron, A. M. 2009. "Advance Directives." In P. Singer and H. Kuhs (eds.) *A Companion to Bioethics*. Oxford: Wiley Blackwell.
- Chandler, J. 2015. "Mind, Brain, and Law: Issues at the Intersection of Neuroscience, Personal Identity, and the Legal System." In J. Clausen and N. Levy (Eds.) *Handbook of Neuroethics*: 441-458.
- Damasio, H., Grabowski, T., Frank, R., Galaburda, A., and Damasio, A. 1994. The Return of Phineas Gage: Clues About the Brain from the Skull of a Famous Patient. *Science* 264(5162): 1102-05.
- De Freitas, J. Tobia, K., Newman, G., and Knobe, J. 2016. Normative judgments and individual essence. *Cognitive Science*.
- DeGrazia, D. 2005. *Human Identity and Bioethics*. Cambridge: Cambridge University Press.
- Farah, M.J. 2010. "Neuroethics: An Overview." In M. Farah (Ed.), *Neuroethics, An Introduction with Readings*. Cambridge, MA: MIT Press, 2010.
- Gregory, E. 2009. "Religion and Bioethics." In P. Singer and H. Kuhs (eds.) *A Companion to Bioethics*. Oxford: Wiley Blackwell.
- Harlow, J. 1868. Recovery from the Passage of an Iron Bar through the Head. *Publications of the Massachusetts Medical Society* 2: 327-47.

- Johnston, M. 1987. Human Beings. *Journal of Philosophy* 84: 59-83.
- Klaming, L., and Haselager, P. 2013. Did my brain implant make me do it? Questions raised by DBS regarding psychological continuity, responsibility for action and mental competence. *Neuroethics* 6(3): 527-539.
- Kraemer, F. 2013. Me, myself and my brain implant: Deep brain stimulation raises questions of personal authenticity and alienation. *Neuroethics* 6(3): 483-497.
- Levy, N. 2007. Rethinking neuroethics in the light of the extended mind thesis. *The American Journal of Bioethics* 7(9): 3-11.
- Levy, N., and Clarke, S. 2008. Neuroethics and psychiatry. *Current opinion in psychiatry* 21(6): 568-571.
- Lindemann, H. 2010. "Holding One Another (Well, Wrongly, Clumsily) in a Time of Dementia." In E. F. Kittay and L. Carlson (eds.) *Cognitive Disability and Its Challenge to Moral Philosophy*. Malden, MA: Wiley-Blackwell. 2010. 161-168.
- Lipsman, N., Zener, R., & Bernstein, M. 2009. Personal identity, enhancement and neurosurgery: a qualitative study in applied neuroethics. *Bioethics* 23(6): 375-383.
- Locke, J. 1690. "Of identity and diversity," in *An Essay Concerning Human Understanding*.
- MacIntyre, A. 1984. *After Virtue*. Notre Dame: University of Notre Dame Press.
- Macmillan, M. 2000. Restoring phineas gage: a 150th retrospective. *Journal of the History of the Neurosciences* 9(1): 46-66.
- Macmillan, M. 2002. *An odd kind of fame: Stories of Phineas Gage*. MIT Press.
- Molouki, S. and Bartels, D.M. Unpublished manuscript. Personal Change and the Continuity of Identity.
- Mott, C. Unpublished manuscript. Statutes of Limitations and the Connectedness of the Self.
- Murphy, N. 2013. Do Humans Have Souls? Perspective from Philosophy, Science, and Religion. *Interpretation: A journal of Bible and Theology* 67(1): 30-41.
- Naffine, N. 2009. The subjective brain, identity, and neuroethics: A legal perspective. *The American Journal of Bioethics* 9(9): 30-32.
- Newman, G. E., Bloom, P., and Knobe, J. 2014. Value judgments and the true self. *Personality and Social Psychology Bulletin* 40(2): 203-216.

- Newman, G.E., De Freitas, J., and Knobe, J. 2015. Beliefs About the True Self Explain Asymmetries Based on Moral Judgment. *Cognitive Science* 39(1): 96-125.
- Noonan, H. (1998). Animalism Versus Lockeanism: A Current Controversy, *Philosophical Quarterly* 48: 302-318.
- Northoff, G. 2004. The Influence of Brain Implants on Personal Identity and Personality—a Combined Theoretical and Empirical Investigation in ‘Neuroethics’. In T. Schramme and J. Thome (Eds.) *Philosophy and Psychiatry*, 326. Berlin: Walter de Gruyter GmbH & Co.
- Parfit, D. 1971. Personal identity. *The Philosophical Review*: 3-27
- Parfit, D. 1984. *Reasons and Persons*. Oxford: Oxford University Press.
- Pascalev, A., Pascalev, M. and Giordano, J. 2015. Head Transplants, Personal Identity and Neuroethics. *Neuroethics*, 1-8.
- Rabins, P. V. and D. M. Blass. 2009. “A Neurobiology of Personal Identity.” In Mathews, D. J., Bok, H., and Rabins, P. V. (Eds.) *Personal identity and fractured selves: perspectives from philosophy, ethics, and neuroscience*. Johns Hopkins University Press.
- Reid, T. 1785. “Of Identity,” in *Essays on the Intellectual Powers of Man*.
- Savalescu, J. 2009. “Genetic Enhancement.” In P. Singer and H. Kuhs (eds.) *A Companion to Bioethics*. Oxford: Wiley Blackwell.
- Schechtman, M. 1996. *The Constitution of Selves*. Ithaca, NY: Cornell University Press.
- Shoemaker, S. 1984. Personal Identity: A Materialist's Account, in S. Shoemaker and S. Swinburne (eds.) *Personal Identity*. Oxford: Blackwell.
- Shoemaker, D. 2011. Moral Responsibility and the Self. In *Oxford Handbook of the Self*, ed. S. Gallagher. Oxford: Oxford University Press.
- Searle, J. 2005. “The Self as a Problem in Philosophy and Neurobiology,” in *The Last Self: Pathologies of the Brain and Identity*, ed. T. Feinberg and J. Keenan. Oxford University Press.
- Strohming, N. and Nichols, S. 2015. Neurodegeneration and Identity. *Psychological Science* 26(9): 1469-1479.
- Taylor, C. 1989. *Sources of the Self: The Making of Modern Identity*. Cambridge, MA: Harvard University Press.
- Thomson, J. J. 1997. People and Their Bodies, in J. Dancy (ed.), *Reading Parfit*, Oxford: Blackwell.

- Tobia., K.P. 2015. Personal identity and the Phineas Gage effect. *Analysis* 75(3): 396-405.
- Wiggins, D. 1976. Locke, Butler and the Stream of Consciousness: And Men as a Natural Kind, in A. Rorty (ed.), *The Identities of Persons*. Berkeley: University of California Press.
- Williams, B. 1956. Personal Identity and Individuation. *Proceedings of the Aristotelian Society*: 229-252.
- Williams, B. 1970. The self and the future. *The Philosophical Review*: 161-180.
- Wilson, R. A., Lenart, B. A. 2015. "Extended Mind and Identity." *Handbook of Neuroethics*. Ed. Jens Clausen and Neil Levy. Springer.