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Neuroessentialism in Discussions About the Impact of Closed-Loop Technologies on Agency and Identity

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The paper "Staying in the loop: Relational Agency and Identity in Next Generation DBS for Psychiatry" by Goering and colleagues brings forward a discussion about the ethical aspects of closed-loop technologies, in particular closed-loop psychiatric deep brain stimulation (DBS) (Goering in press). Not disregarding the potential benefits of this specific technology, since patients could gain from interventions which do not require user-involvement, they voice concerns related to agency and identity. Such issues are likely to surface in different contexts since closed-loop devices stand to grow in the future in neuroscience and beyond (Bergmann *et al*. 2016; Shah *et al*. 2014). However, we bring attention to the need for greater clarity about the nature of concepts of agency and identity, notably their relational aspects, since the authors borrow indiscriminately from different accounts of these concepts that attribute more or less significance to the role of the brain therein. This confusion leads the authors to conclude that non-neural closed-loop devices do not pose significant issues for identity and agency. However, we suggest that a truly relational account of agency and identity, as well as emerging evidence about the artificial pancreas (common name for a set of closed-loop systems for insulin monitoring and delivery), show the contrary.

Neuroessentialism and the relevance of agency and identity to many closed-loop technologies

Goering *et al*. stress that relationships and contexts play a significant role in the understanding of the impact of a given closed-loop device on a person's agency and identity, notably based on the work of Barclay, Baylis, and Schectman. They state about identity, for example, that "a dynamic and relational view of self and identity can account for the ways that we change them" (Goering, in press, 8). About agency, they write that a "closed loop-device could be seen as supporting agency" (Goering, in press, 18) and that "neural devices can be tools that support agency, not wholly unlike how friends, family and others support

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agency" (Goering in press, 25). However, some of their other statements suggest that biological factors trump relational factors. For example, they write that "we tend to identify fairly closely with our brains – more so than we identify with our endocrine systems or even with our hearts, though we clearly rely on each in significant ways" (Goering, in press, 3). Furthermore, they claim that "[a]n insulin pump that operates automatically is a helpful tool, not at all a threat to our agency" (…) The same is not true of neural devices that involve cognition and mood." (Goering, in press, 2). However they do not explain or offer evidence in support of these claims and why some, or all of us, would grant knowledge about the brain or interventions on the brain greater impact on agency and identity. It appears that the authors simply take broad cultural neuroessentialism for granted, presuming that for most people the brain plays a central or greater role than other factors in the shaping of one's identity (Roskies 2002; Racine *et al.* 2005). Moreover, they leave aside the pivotal question of whether or not this particular neuroessentialist belief is indeed widely held or warranted.

The authors' twin perspectives, relational and biological, seem at face value contradictory and direct our attention to an unresolved tension between the presumed neuroessentialism of the public and expert relational accounts of identity and agency (or any account that would accommodate the interaction between biological, relational, and social factors). Indeed, based on the relational accounts of agency and identity, it should be an open empirical question as to whether neural or non-neural closed-loop technologies pose any relevant threats to identity and agency since one cannot conclusively predetermine *a priori* how a given technology will change or threaten them without actually examining those relational and contextual aspects. As we discuss below, in contradiction with a strong biological account but consistent with a relational account, non-neural closed-loop technologies such as the artificial pancreas could raise significant issues with respect to agency and identity.

The artificial pancreas and closed-loop insulin delivery

Goering *et al.* allude to the insulin pump, an open-loop medical device that continuously delivers insulin for people with diabetes. When combined with a glucose sensor, an insulin pump can function as part of a closed-loop system known as an artificial pancreas (AP). Through software installed on the pump, continuous glucose readings are used to calculate the quantity of insulin to be injected. The AP aims to optimize and simplify glycemia management for patients with type 1 diabetes (T1D) by requiring minimal user input beyond general maintenance (e.g., replacing insulin cartridges and sensors). A version of the AP developed by Medtronic was approved for commercialization in the United States by the FDA in September 2016 (U.S. Food and Drug Administration 2016), but other versions are currently being developed by academic researchers and industry. This type of non-neural closed-loop technology, according to the authors (Goering, in press) and consistently with the tenets of strong neuroessentialist accounts of agency and identity, would not pose major issues for identity and agency. However, evidence about the implications of the AP and emerging studies on patient perspectives on this closed-loop technology suggest otherwise (Barnard *et al.* 2015).

First, an AP user's life absolutely depends on the reliability of this system, especially because the delivery of appropriate and timely doses of insulin is life-sustaining for patients

with T1D. We know that this dependency can generate serious distress for patients, since some T1D patients report feeling powerless, fearing both hyperglycemia and hypoglycemia, and experiencing anxiety regarding their diabetes management (Fisher *et al.* 2015). Accordingly, it is possible that all the technical (e.g., malfunctioning), personal (e.g., device maintenance), clinical (e.g., access to expertise to follow-up care), and social factors (e.g., impact of societal context on current and future access to this technology) that ensure the reliability of the AP, would be implicated in one's relationship to the device itself and to one's condition. Some patients may view this as a seamless transition from current diabetes management technologies but others could be much more worried, at least in the beginning. Some patients may struggle to adjust to the new technology since it induces a significant change in their relationship to their condition. In the past, several human factors (e.g., self-perception, behavioral self-regulation) have affected adherence to diabetes treatment such that the adoption of past technologies has been shaped by a number of psychological and behavioral factors (Gonder-Frederick *et al.* 2011). In sum, although current diabetes management methods are burdensome, it is highly implausible that all T1D patients would accept the AP seamlessly and simply "as a helpful tool" without a need to carefully assess the impact of the AP on identity and agency.

Second, technologies like the AP could impact more directly, through both biological and relational processes, identity and agency. Biologically speaking, suboptimal glycemic control (e.g., frequent hypoglycemic events) in T1D patients can involve some behavioral changes, in addition to the life-threatening ones mentioned above. As a consequence, the agency of these patients can be affected episodically. Some more chronic aspects of T1D can also lead to difficulties in the activities of daily life, carrying out work, or undertaking an educational program. We have observed such relational dynamics in an ongoing project examining psychosocial aspects of the AP; some T1D patients report being worried about their ability to undertake physical activity, which increases the risks of hypoglycemia. Women in particular appear to be concerned about the impact of this technology on their body image (e.g., with respect to intimate relationships). These concerns are partly associated with the fact that the device is currently external and not internal, but are nonetheless real concerns. Other aspects to examine carefully are the potential positive impact of the AP on stress and burden of disease reduction as well as the attitudes and expectations of loved ones, notably how a family member's attitude toward the AP impacts or not the experience of the AP user and their relationship with that person. In sum, at this time, it is hard to predict which psychosocial domains could have relevance to identity and agency with respect to a non-neural device like the AP. However, it is prudent to keep our eyes open to those changes and investigate them proactively rather than to dismiss them *en bloc*.

Presuming that certain neural interventions have more impact on identity and agency than others may be a reasonable initial hypothesis; the brain has many roles related to personality and identity, in addition to cultural significance for some societies (Vidal 2009). However, presuming on these premises that other closed-loop technologies may not, seems unnecessary and likely undesirable if we are committed to investigating openly the real-world impact of different devices. Recognizing this means that the actual impact on agency and identity of a brain-related technology or a non-brain related technology should be

empirically investigated. These investigations should capture the perspective of patients themselves (Mathieu *et al*. 2011) as well as the impact of devices on relationships and other real-world outcomes. Ideally, comparisons between closed-loop devices should be undertaken to avoid attributing prematurely supremacy to biological factors and overlooking socio-cultural factors. We see this recommendation as consistent with relational accounts of agency and identity. Finally, understanding these issues concomitantly with the development of technology could offer windows of opportunity to improve the engineering of closed-loop devices, making design choices (e.g., fully automated AP versus an AP that allows some input from the user) that would be informed by a contextual understanding of agency and identity.

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