

Ethical Challenges of Neurotechnology with an Emphasis on Privacy

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1. Round 1

1.1. Reviewer 1

Reviewer:

In the section discussing responsibility, the sentence “If implants influence a person’s decisions and behaviors, do they diminish that person’s autonomy?” introduces a central issue but remains theoretically underdeveloped. The manuscript should distinguish more carefully between influence, persuasion, cognitive enhancement, behavioral modulation, and coercive control, as each carries different implications for autonomy and responsibility attribution.

The paragraph defining moral responsibility relies heavily on classical philosophical assumptions concerning voluntariness and knowledge. However, the authors do not adequately explain how these traditional conditions are transformed in technologically mediated environments. A more detailed engagement with contemporary debates on distributed agency and technologically assisted decision-making would significantly strengthen this section.

The paragraph examining personality changes following deep brain stimulation is one of the strongest sections of the manuscript. However, the discussion would be enhanced by incorporating empirical evidence regarding the prevalence, severity, and reversibility of personality alterations observed in clinical populations rather than relying primarily on conceptual analysis.

The discussion of personal identity and narrative continuity is insightful, particularly the reference to Helmut Dubiel’s experience. Nevertheless, the manuscript should acknowledge that narrative theories of identity are not universally accepted and that alternative accounts, including psychological continuity theories and biological theories of identity, may produce different ethical conclusions.

Authors revised the manuscript and uploaded the document.

1.2. Reviewer 2

Reviewer:

In the subsection entitled “Multiple Causes,” the authors argue that adverse outcomes from brain implants involve numerous actors, including engineers, manufacturers, clinicians, users, and policymakers. This argument is persuasive, yet it remains largely descriptive. The manuscript should incorporate a structured analytical model demonstrating how responsibility might be apportioned among these actors under different hypothetical scenarios.

The discussion of the “many hands” problem contains several important observations, but the analysis would be stronger if supported by concrete examples from existing neurotechnology applications. For instance, case studies involving deep brain stimulation, adaptive neurostimulation systems, or commercially developed BCIs could illustrate how responsibility attribution becomes practically complicated.

In the section “Attention to Consequences,” the authors note that even developers may not fully understand the decision-making processes of machine-learning-enabled implants. This important claim requires further elaboration regarding the distinction between algorithmic opacity, unpredictability, and epistemic uncertainty. These concepts are often treated differently in legal and ethical literature and should not be conflated.

The sentence “Brain implants add a complex layer to determining whether the individual has acted freely or autonomously” introduces a critical conceptual issue. However, the manuscript does not sufficiently engage with competing philosophical theories of free will, such as compatibilist and incompatibilist approaches. Including these perspectives would deepen the analysis of autonomy and agency.

In the section on shared responsibility, the manuscript raises the question of whether human and nonhuman actors can share responsibility. This is an important theoretical proposition, but the authors should clarify whether they are referring to moral responsibility, legal responsibility, causal responsibility, or accountability mechanisms. The distinctions among these concepts are essential for analytical precision.

The discussion of agency includes the statement that agency refers to “the ability to do something that counts as an act or action.” While useful as an introductory definition, the manuscript should engage more thoroughly with contemporary debates concerning artificial agency and whether sophisticated neurotechnological systems can genuinely satisfy the criteria for moral agency.

In the section “Brain Implants as Moral Agents,” the authors present arguments suggesting that increasingly autonomous systems may generate a “responsibility gap.” However, the manuscript would benefit from a more balanced treatment of opposing perspectives. Several scholars argue that responsibility gaps can be addressed through institutional accountability structures rather than by attributing agency to technologies themselves.

The paragraph beginning “Rafael Yuste, the neuroscientist, states that ethics is necessary...” effectively introduces the human-rights dimension of neurotechnology governance. Nevertheless, the article does not sufficiently discuss emerging concepts such as cognitive liberty, mental privacy, psychological continuity, and neurorights. These concepts have become central to recent international policy debates and deserve dedicated attention.

In the discussion section, the authors write that “The integrity and dignity of a person are the most relevant criteria for the ethical evaluation of technological interventions.” This normative assertion is important but requires stronger philosophical justification. The manuscript should explain why dignity and integrity are prioritized over other ethical principles such as beneficence, justice, or nonmaleficence.

Authors revised the manuscript and uploaded the document.

2. Revised

Editor’s decision: Accepted.

Editor in Chief’s decision: Accepted.