

# Adapting Embedded Neuroethics for Private Neurotechnology Industry: Conceptual Foundations

## Background

To expand the practical impact of neuroethics scholarship, recommendations by the NIH and others have emphasized the need for initiatives that promote integration between neuroethicists and neuroscientists.<sup>1</sup> Such approaches, such as embedded ethics, are becoming more common in academic neuroscience<sup>2</sup> where they have led to fruitful collaborations.<sup>3</sup> However, their current scope encompasses only a limited array of opportunities within neurotechnology. We argue that full consideration of the impact of neuroethics scholarship requires developing embedded ethics approaches for a wider range of entities – specifically, the private neurotechnology industry, which is developing technologies that will be used by the public. While embedding ethics within profit-driven endeavors is fraught with challenges,<sup>4,5</sup> we argue that there are areas where better integration between ethics and industry may prove mutually beneficial.

A crucial first step towards developing an embedded ethics approach for industry is establishing a foundational conceptual framework. Yet to date there has been little work from within bioethics to consider the goals of embedded ethics,<sup>6</sup> what it entails from a practical perspective,<sup>7</sup> and how it differs from other models of ethics engagement.<sup>8</sup>

## Objectives

The aims of this project were to (a) provide a background review of embedded ethics literatures within science and technology studies, highlighting—for bioethicists—where the field has made progress and where it has been limited; (b) develop a conceptual framework for mapping models of ethicist engagement; (c) use our framework to show how embedded ethics is conceptually distinct from other approaches to ethicist engagement, such as collaborative projects and ethics consulting; and (d) consider how our framework might assist practical implementation of an embedded ethicist within a private neurotechnology space.

## Methods

We identified key literatures to ascertain how embedded ethics has been theorized and practiced, what its perceived strengths and weaknesses are, and whether (and, if so, to what extent) scholars had theorized about or conducted case studies on embedded ethics in private/corporate contexts. We identified four relevant literatures: (1) academic reflections on embedded ethics, (2) the role of ethics in private industry, (3) academic and industrial reflections on ethics consulting,<sup>9</sup> and (4) Responsible Research and Innovation (RRI) scholarship on ethics and related concepts.<sup>10</sup> Next, we developed five conceptual axes on which to differentiate existing approaches to ethicist engagement (Table 1), identifying relevant categories and subcategories. Finally, we used this framework to compare four major models within the broader embedded ethics approach to ethicist engagement. To support the project's second phase, we identified key challenges for and limitations to adapting embedded ethics to the private neurotechnology industry.

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## Results

Table 1. VIPER Framework for Approaches to Ethicist Engagement

Axes	Descriptions & Components
<u>VALUE</u>	How the ethicist, researchers, or organization view the value or importance of their relationship. a. To the ethicist b. To the researchers c. To the organization
<u>INTEGRATION</u>	The manner and extent to which the ethicist is integrated or immersed with the research team. a. Degree (fully, semi-, or non-immersive) b. Site (unity, cohesion, separate)
<u>PURPOSE</u>	The aims or goals of the ethicist, researchers, or organization. a. Predetermination (inflexibly, flexibly, undetermined) b. Deliverable (product, performance, culture)
<u>EXTENSION</u>	The temporal aspects of ethicist engagement concerning phase and duration. a. Phase (prospective, concurrent, retrospective) b. Duration (indefinite, project-conditional, phase-conditional)
<u>ROLE</u>	The extent to which the ethicist is independent, how the ethicist influences, and the size and extent of the investment required to conduct ethicist engagement. a. Independence (high, medium, low) b. Influence (authority, peer, subordinate) c. Investment (high, medium, low)

The VIPER framework was designed to compare different approaches to ethicist engagement across five key axes. They are key because they identify important theoretical or practical points of departure across major approaches to ethicist engagement we surveyed. A further benefit of VIPER is that it characterizes the “why” and the “how” of different approaches to ethicist engagement, providing a clearer sense of what the approaches are and what they are designed to do.

## Discussion

The VIPER framework facilitates a detailed comparison of embedded ethics with other approaches to ethicist engagement, such as research ethics consultations, external ethics consultations, ethics as part of team science, and ethics as compliance. It allows us to distinguish the normative goals, values, and practices of embedded ethics from these other approaches. For example, while in typical consulting approaches the ethicist becomes involved only when called upon, embedded ethicists can be involved at all research phases, or even after a project concludes. In team science, the ethicist's purpose is often highly predetermined, whereas in embedded ethics the purpose is often more flexible or undetermined. Similarly, embedded ethics differs from other approaches in its level of integration: It often moves beyond a team science collaboration or a one-off consultation in that the ethicist may be fully immersed, sometimes in the physical space occupied by researchers. It differs from ethical compliance in that the ethicist is not typically an authority with a high level of independence, but rather acts more like a collaborative peer.

The VIPER framework also provides a conceptual foundation for adapting embedded ethics for the private neurotechnology industry. From a high-level perspective, it clarifies aspects that must be elucidated by an embedded ethics program, such as the value, purpose, and role of the ethicist in relation to the company and its product. Practically, it requires outlining the extent of the ethicist's engagement as well as the scope of their integration. Ultimately, a better understanding of the relevant characteristics of embedded ethics is crucial for tailoring it to the commercial neurotechnology sector.

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