TALES – Tech, Analysis, Legal, Ethics, Social: A Comprehensive Impact Assessment Framework for Responsible Neurotech Innovation

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Introduction: Neurotech is a rapidly growing sector with extraordinary potential for improving human health and wellbeing, providing novel tools for basic research, and generating commercial and economic benefits. However, the development and application of neurotech also raises important legal, ethical, and social considerations. Recently, international organizations (e.g. OECD, UNESCO) have published consensus reports highlighting recommendations for responsible innovation in neurotech [1] and the risks and challenges of neurotech for human rights [2]. Health Canada has convened a Working Group on Responsible Innovation in Neurotech to develop an appropriate implementation of these strategies in Canada [3]. Furthermore, neurotech is increasingly utilizing methods from machine learning and artificial intelligence, which raise additional legal, ethical, and social considerations [4]. An emerging strategy aligned with these ethics recommendations is the development and usage of impact assessment frameworks throughout the innovation process, which serve to identify and assess benefits, concerns, and risks of emerging technology and provide guidance about risk prevention and mitigation [5,6,7].

Material, Methods and Results: We present the TALES neurotech impact assessment tool, which facilitates the evaluation of tech specifications, analysis methods, and legal, ethical, and social considerations related to the development and application of a neurotech device. We developed TALES for an educational context – as an integral part of the 'Ethical Considerations for Neurotech' course within the Queen's University Neurotech Microcredential Program. The course consists of four modules and a final project. In the first module, learners are (re-)introduced to foundational neuroscience and ethics concepts and explore a variety of types of neurotech devices (neuroimaging, neuromodulation, and brain-computer interfaces). In subsequent modules, learners explore various use-case sectors (medical, consumer, organizational) with practical case-studies and learn to use the TALES impact assessment framework. In the final project, learners apply TALES to analyze a new case-study of their choice.

Figure 1: *Queen's University Neurotech Microcredential Program. Coming soon (2025): Ethical Considerations in Neurotech course.*

Conclusion: The TALES neurotech impact assessment tool is a novel educational resource for learners in the 'Ethical Considerations in Neurotechnology' Microcredential course. In the future, adaptations of TALES could have further potential applications across industry and the public sector to guide, promote, recognize and set standards for responsible neurotech innovation.

References:

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