

Neuroethical considerations on Brain Computer Interface research in Latin America

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Introduction: Neuroscientific research in Latin America (LA) focuses on biology, psychology, and neurology, often guided by a clinical perspective. The countries with the most significant contributions in international neuroscientific literature are Argentina, Brazil, Chile, Colombia, and Mexico [1]. Research on brain-computer interfaces (BCI) has become increasingly significant over the past 20 years. EEG presents advantages compared such as being a non-invasive, relatively low-cost, easy-to-use technique, that does not require special facilities to function. Furthermore, open-access datasets facilitate complex computational processing methods, sparing the purchase of the acquisition device. However, experts from LA highlight the lack of legal means to protect brain data and its integrity [2]. In this sense, our aim is to highlight the main ethical considerations related to BCI research in LA, according to the acquisition method, signal processing, application, and training paradigm.

Material, Methods and Results: Previous scientometric research collected 1458 publications on BCI from Pubmed, Science Direct, IEEE, Scopus, and Redalyc databases authored by scientists affiliated in LA and the Caribbean (unpublished data). Results for *number of publications* for these countries showed Brazil (515), Mexico (292), Colombia (197), Argentina (128), and Chile. Five subcategories were considered for scientometric purposes: *Acquisition* (EEG, fMRI, MRI/MEG, ECoG, and fNIRS), *Signal processing* (feature extraction, classification models, and filtering), *Application* (rehabilitation, robotics, neuroscience, robotics, and human-computer interface), and *Paradigm* (P300, MI, SSVEP, and other). In this study, EEG represented the acquisition method in 85% of the publications, while MI was used in 62% of them. The most common *Application* found was *neuroscience* (41.38 %), followed by *rehabilitation* (25.61%). *EEG Acquisition* must consider privacy, agency, and data protection. Privacy guarantees anonymity, by protecting the identity of the participants. Agency refers to the right of individuals to preserve their personality. The *Paradigm* of MI has raised questions on how much control/intention/responsibility is attributable to the user and to the coding/decoding algorithm [3]. Nowadays, no country in LA, except for Chile, explicitly mentions the protection of neural data on a fundamental legal document. On *Signal processing* and *Application*: Informed consent must clearly explain the use and purpose of brain information. It should also state the clinical benefit of the application and/or how it contributes to humanity. About brain open datasets, we found poor dissemination of the FAIR requirements (Findable, Accessible, Interoperable, and Reusable), that promote data integrity, identity protection, and liability.

Conclusion: BCI research in LA has grown significantly, primarily utilizing EEG and employing motor imagery (MI) with fundamental neuroscience applications. Ethical considerations regarding these aspects of BCI must be incorporated during protocol planning and explicitly stated in publications. Privacy, agency, data protection, and informed consent should adhere to international guidelines while accommodating regional disparities. To address these challenges, it is crucial to promote ethical frameworks, equitable research funding, and regional collaboration to ensure that BCI research in LA progresses responsibly and inclusively.

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