

Toward understanding the influence of the experimenter on BCI performance

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Toward understanding the influence of the experimenter on BCI performance

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The influence of the experimenter has been suspected but not yet studied in the field of Neurofeedback/BCIs. Further researches would be interesting to:

- Diagnose how experimenters may bias results, or potentially identify attributes that could positively impact user's experience or performance in line with recommendations about BCIs and Human Learning Principles [3].
- Extend the range of collected (and published) data about experimenters (e.g., biosocial and psychological characteristics), thus improving the replicability of experiments and the quality of meta-analyses.
- Suggest several solutions to prevent potential experimenter-related biased comparisons of the results, in line with recommendations from other fields [11].

By reviewing the literature, we extracted several potential factors of the influence of experimenters (see figure). First, their characteristics (e.g., expertise, gender, expectations) may directly affect the results (e.g., biasing the design of the protocol, data collection, or interpretation) [8]. Experimenters may also affect the responses and behavior of the subject, consciously or unconsciously, via direct or indirect interactions. Such an influence was observed in teacher-student relationship [9], researcher-subject interaction in business ethics [8] or "experimenter demand effect" in social [13] or economical [7] researches. In addition, studies suggest that the perceived characteristics (e.g., gender [12]) of both experimenters and subjects can influence their behavior. Social context and trainer-trainee relationship could benefit subjects' mood, psychology, stress, confidence [5], and motivation [10] which are significant elements improving the quality of their involvement [2; 6] but may as well be a source of bias [4].

Given that the presence of a human worker is nearly inevitable, the influence of experimenters should be considered carefully while designing experiments, for instance through a better rationalization of social bias and emotional feedback [1]. This could lead to a conjoint progress of the global performance, validity and understanding of the Neurofeedback/BCI studies.

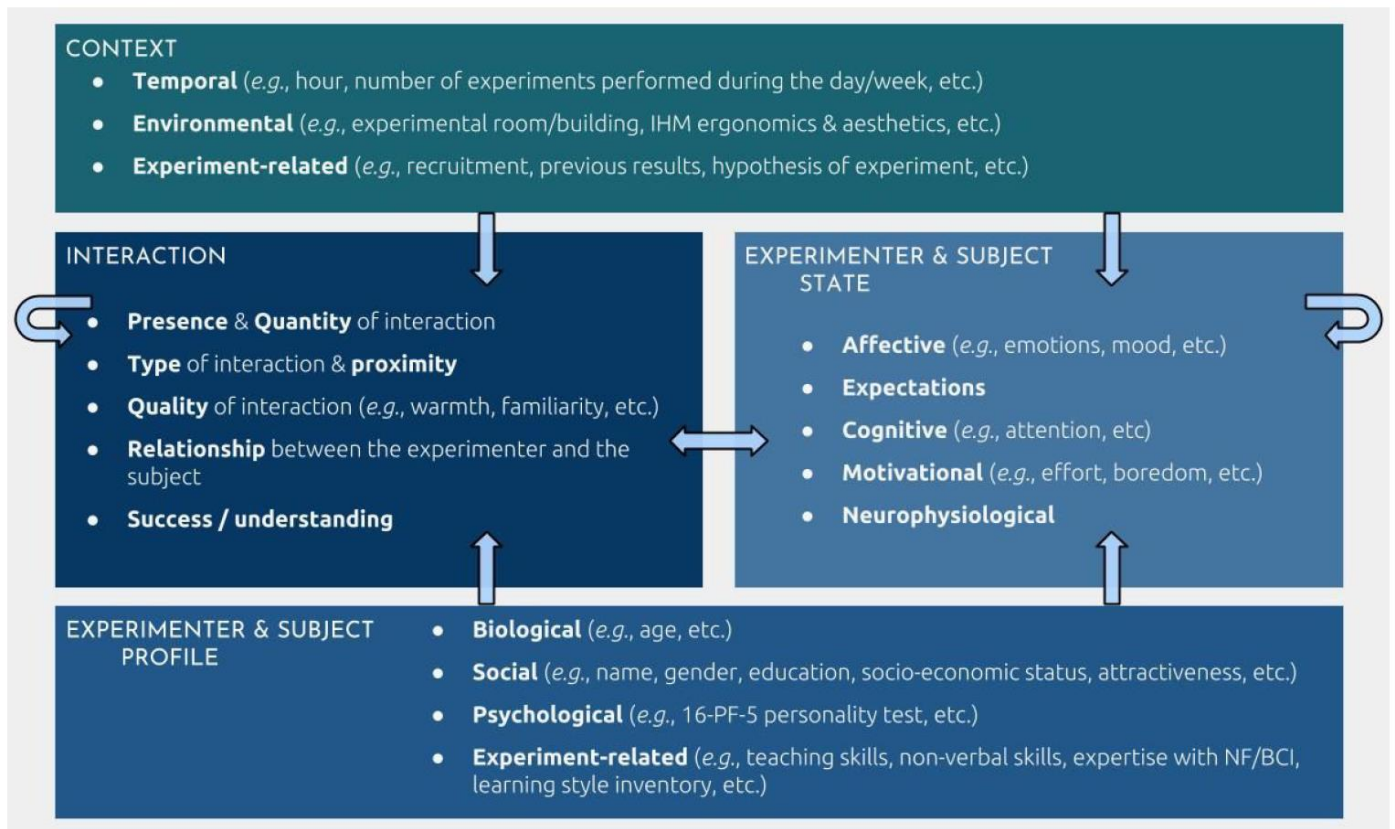


Figure Summary of under-investigated factors in NF/BCI studies, and how they could influence each other.

References

1. Pillette, L., Jeunet C., Mansencal, B., N'Kambou, R., N'Kaoua, B., et al. (2017, september). *PEANUT: Personalised Emotional Agent for Neurotechnology User-Training*. Proceedings of the 7th International Conference.
2. Kikkert, A. (2015). *Predictors of neurofeedback efficacy: An exploratory study to the influence of personality and cognitive characteristics on the efficacy of theta and beta neurofeedback training*. Dissertation, University of Leiden.
3. Lotte F., Jeunet C. (2015, january) *Towards Improved BCI based on Human Learning Principles*. 3rd International Winter Conference on Brain-Computer Interfaces.
4. Sexton, C. A. (2015). The overlooked potential for social factors to improve effectiveness of brain-computer interfaces. *Frontiers in systems neuroscience*, 9.
5. Glannon W. (2014), Neuromodulation, Agency and Autonomy, *Brain Topogr.* 27:46-54.
6. Nijboer, F., Birbaumer, N., & Kübler, A. (2010). The Influence of Psychological State and Motivation on Brain-Computer Interface Performance in Patients with Amyotrophic Lateral Sclerosis – a Longitudinal Study. *Frontiers in Neuroscience*, 4.
7. Zizzo, D.J. (2010) Experimenter demand effects in economic experiments, *Experimental Economics*, 13: 75-98.
8. Miyazaki, A.D. & Taylor, K.A. (2008) Researcher Interaction Biases and Business Ethics Research: Respondent Reactions to Researcher Characteristics, *J. Bus. Ethics* 81: 779.
9. Velez, J. J. (2008). The Relationship Between Teacher Immediacy and Student Motivation. *Journal of Agricultural Education*. 76.
10. Hinterberger, T., et al. (2004). Brain-computer communication and slow cortical potentials. *IEEE Transactions on Biomedical Engineering*, 51(6), 1011-1018.
11. Rosnow, R., & Rosenthal, R. (1997). *People studying people: Artifacts and ethics in behavioral research*. WH Freeman.
12. Levine, F. M., & de Simone, L. L. (1991). The effects of experimenter gender on pain report in male and female subjects. *Pain*, 44(1), 69-72.
13. Orne, M. T. (1962). On the social psychology of the psychological experiment: With particular reference to demand characteristics and their implications. *American Psychologist*, 17(11), 776-783.