

This response was submitted to the consultation held by the Nuffield Council on Bioethics on *Novel neurotechnologies: intervening in the brain* between 1 March 2012 and 23 April 2012. The views expressed are solely those of the respondent(s) and not those of the Council.

Responses to the consultation on Novel Neurotechnologies (Nuffield Council 2012)

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Question 1 - In the decade of 1970 we tried some mild form of “electrical polarization” of the brain stimulated by encouraging reports that this was a safe, innocuous, and noninvasive procedure that could alleviate depressive symptoms. After reviewing the literature we published an analysis of the technique and some information on its effects on slow brain potentials and reaction time¹. We had previously reported empirical data at neuroscience conferences². The results were negligible, and although backed up by some animal data the possible therapeutic effects could be ruled out.

Question 3 - I believe that any technique that affects the human body should be thoroughly tested before any medical or non-medical use is envisioned.

Question 4 - Ethical challenges posed by neurointerventions have to do with: a) safety; b) accessibility if there is therapeutic potential; c) limits to which the human performance can be altered

Question 5 - Regulation should proceed, first, by illustrating the exact meaning and importance of the technology, implying education of the population and encouraging deliberation. The problem is to rush into promises that cannot be fulfilled in terms of usefulness or availability.

¹ Lolas, F. Brain polarization: behavioral and therapeutic effects. Biological Psychiatry (New York) 12: 37-47, 1977.

Lolas, F., Combeau, V. Brain polarization, reaction time, and slow cortical potential correlates of activation. World Journal of Psychosynthesis (Detroit) 9: 36-41, 1977.

Lolas, F., Combeau, V. Low level electrical currents and slow brain potential correlates of activation. Arq. Neuropsiquiatria (Sao Paulo) 3:12-22,1977

² Lolas, F. Effect of low-level DC brain polarization on vertex slow potentials performance of a reaction-time task. First European Neuroscience, Meeting Munich, Germany, Exper. Brain. Res. 23: 128, 1975.

Question 6 - Although in the 70s and 80s we did not have any possibility of really creating BCI, the work of the British researcher William Grey Walter and his description of the so-called “Contingent Negative Variation” (CNV), a vertex slow potential, in 1965 had opened up the possibility of using brain potentials for controlling devices. At about the same time, the German authors H. Kornhuber and L. Deecke had described the “Readiness Potential” (RP), electrical activity *preceding intentional movement*. In animal studies, we studied RPs in monkeys and found out that strength and amplitude of the intended movement were codified in the electrical activity before the movement was performed³ .

Studies of vertex slow potentials in human subjects were aimed at using these signals as diagnostic indicators of psychological traits and/or states. This work could then lead to a more individual form of intervention and provide useful evolution or prognostic measurements⁴ . These studies were done in the expectation that, whatever practical use within a BCI context the physiological signals might have, their exact importance and usefulness would depend on individual physiological characteristics. Thus, BCI with person A (strong nervous system) would be different from effects in person B (weak nervous system)

Question 7 - I would certainly proceed to use BCI if the individual physiology is assessed, and adequate safety measures, indicated by extensive studies, are in place.

Question 9 - I believe that BCI, as an interventional technology, poses the same challenges, ethically and socially, present in other forms of neurointerventions. One of the things that we thought would be an advantage when compared to drugs or chemical stimulation was the possibility of limiting the effects in space and time

³ Moneta, M.E., Lolas, Pinto-Hamuy, T. Response variables and motor slow cortical potentials during performance of learned movements in the squirrel monkey (*Saimiri sciureus*) Neuropsychologia. (Oxford) 12: 477-485, 1974.

⁴ Lolas, F., Araya, A., de Andraca, I., Pinto-Hamuy, T. Vertex slow potentials and classical reaction time task: specificity and directional anticipatory factors. Neuropsychologia (Oxford) 14: 499-504, 1976.

Lolas, F., de Andraca, I. Neuroticism, extraversion, and slow brain potentials. Neuropsychobiology (Basel) 3: 12-22, 1977.

Lolas, F. Event-related slow brain potentials, cognitive processes, and alexithymia. Psychother. Psychosomatics (Basel) 30: 116-129, 1978.

more accurately. Traces or molecules may remain in the body for years, while effects of currents may be more transient, but this assertion needs empirical support.

Question 10 -Regulations should be preceded by adequate empirical research and social dissemination of information in order to prevent prejudice or false hopes.

Question 11 - Aside from the effects of low-level polarizing currents mentioned earlier, I have had no experience with neurostimulation, either TMS or DBS.

Question 12 -The use of neurostimulation should proceed only if safety and sensible application are worked out properly beforehand.

Questions 13 and 14 - I do not envision any use of neurostimulation outside of the medical area, for the problems associated with enhancing cognition or preventing emotional symptoms are also medical, independently from their recreational uses.

Question 16 - The uses of stem cell therapy are controversial precisely because their concrete effects are partly unknown and may take much experimental animal work before they can be suggested in humans.

Question 17 - Risks and benefits have been extensively discussed but the nervous system has an importance unparalleled in other organs or tissues, for its modification may mean personhood changes.

Questions 18 through 20 - Any intervention on persons requires respect of the dignity of the person and of the autonomy of decisions. This is difficult to evaluate when hopes are stimulated irresponsibly by industry or markets. This may cause demands that cannot be satisfied and at this point in time this –along with the lack of experience and regulation- constitutes an ethical challenge.