

# Cognitive Tasks for use with Brain-computer Interface Systems

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The current project in EEG-based brain-computer interface aims at both reducing the training time of subjects and developing protocols that can be used by a wider group. Recent studies in the US (Wolpaw et. al.), have shown that subjects can be trained to achieve control of a cursor on a screen by adapting their thoughts to alter the mu rhythm in appropriate ways. The current study trains subjects to achieve cursor control by performing two types of cognitive task; one associated with movement planning and imagery and the other with mental arithmetic. The aim of this study is to assess whether refining and improving instructions for the subjects re: the cognitive tasks, would contribute to the achievement of more efficient cursor control.

The subjects are required to perform cognitive tasks that demand both concentration and clarity of thought. This assumes a high level of control of mental states and processes on the part of the subject. The subjects' training time may be reduced if we can find ways to make the control of the cognitive tasks easier to achieve. There is support in the literature covering previous studies for making the instructions on cognitive tasks more specific in order to help the subjects to move the cursor (Wolpaw et. al., 1991).

One way of making the instructions more specific would be to break down the cognitive tasks into components and test them separately to see:

- a. which components or combinations of components are most effective in producing discernible EEG signals and
- b. which mental states and processes are easiest for subjects to control.

In the 'imagined hand movement' task, where motor imagery is used to generate the EEG signals, it is possible to describe the task in at least the following ways:

1. imagine hand moving
2. remember the feeling of hand moving
3. plan to move hand
4. intend to move hand (while at the same time ensuring that it does not move)
5. picture a hand moving

There is some evidence for drawing a distinction between the use of a first person perspective (2.) and the use of a third person perspective (5.) (Decety 1996). The literature on this and other possible distinctions will be explored at this review stage.

There are also other mental states that may be relevant to achieving cursor control. These include notions, used by philosophers in discussions of voluntary action, such as 'will' and 'intention', (Decety and Ingvar 1990, Decety 1996).

Following the literature, the cognitive tasks will be investigated further and ways of improving them will be explored in preparation for the 'hands-on' study.

## References

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