Trāṭaka

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Project description and intents

Trāṭaka is a project based on a brain-computer interface (BCI). Wearing this device, the user is invited to focus his attention on a flame placed in front of him. The level of attention, detected by the interface, controls an air flow located under the flame: higher level corresponds to a more intense air flow. This process aims to the flame extinguishment, by reaching an high level of concentration.

Trāṭaka is a Sanskrit term which means “to look” and it refers to a meditation technique, which consists in concentrate the attention in a flame. Similarly to this technique, the interaction proposed by this project is based on attention and not in mental thought.

The aim of this work is creating an experience in which the user is stimulated to take awareness of its concentration (limitedly to the interaction period). Using a feedback loop, the interaction tends to construct an emphatic relation between the user and the whole system.

It is important to notice that Trāṭaka is specifically designed and conceived according to the limitations and qualities of the device used. In terms of precision and reliability, the BCI employed is not suitable for scientific purpose (Sałabun 2014). However this device is acceptable for certain applications: Trāṭaka intends to suggest one of them.

Technical description

The attention data is sent to a computer from the BCI. A customized software interpolates the data in order to obtain linear values. Subsequently, this values are scaled and sent to Arduino, which drives a circuit that controls the speed of a fan. Those components are located under the flame, inside a wooden structure. The flame is simply fueled by a lighter placed outside the structure.

The BCI used in Trāṭaka is NeuroSky MindWave, a consumer product which is able to detect and provide values of eight types of brainwaves (EEG), eye blink, and values of attention and meditation (eSense™)[1]. Unfortunately, the producer company does not provide any information about how eSense™ values are calculated (NeuroSky 2009). However the attention is generally supposed to be related to the oscillations of EEG beta waves (Varada et al. 2013). MindWave is a headset equipped by two electrodes: one located in a short arm, which must be placed on the forehead to get EGG signal. A second electrode, in a ear clip, is used to filter the noise created by myoelectrical activity (Sałabun 2014).

Design choices and problems solving

Considering several art and design projects based on BCI, two main methodologies were identified, here called: speculative and interactive. BCI Speculative are the projects that uses data provided by the interface to generate patterns of events: for instance, visual and/or audio. Differently, BCI Interactive projects aims to exploit the interactive potentials of these interfaces. This last case is the one which drove the Trāṭaka development. Testing and analyzing the qualities of MindWave, emerged that the data which offers a more visible correspondence to the interaction is Attention eSense™ value. The development of Trāṭaka started from this observation.

The feedback system proposed in Trāṭaka, is supported by two main elements: first of all, the rotation speed of the fan that change according to the attention level, causes an higher or lower movement of the flame. Secondly, the tiny noise produced by the fan motor, change in intensity according to the speed settled.

Several problems are encountered using Trāṭaka. Most of the technical problem are related to MindWave: issues related to the adaptability to the individual user EEG patterns were detected (Kim et al. 2012). Moreover, a strong presence of non-EEG biometric noise can cause system errors[2]. Noise is a relevant issue also in environments: places which have strong electrostatic noise can afflict the use of the BCI[3]. From a user perspective, an environment which presents acoustic noise, moving lights or objects, can easily determines a lost of concentration.

The software made for Trāṭaka control the interaction process in order to support the user experience during the time of interaction. First of all, was noticed that during the initial period, the user can easily reach and sustain a high level of concentration. For this reason, and in order to provide training time to the user, a limitation to attention

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1 NeuroSky. ThinkGear Data Values. on ThinkGear Serial Stream Guide, NeuroSky Inc. http://developer.neurosky.com/docs/doku.php?id=thinkgear_communications_protocol - accessed on 15/10/2014

2 Ivi.

3 Ivi.

value is applied for the first two minutes. This limitation prevents the flame extinguishment.

In ideal conditions, a medium-high level of difficulty is perceived by the users. However, was observed that a relevant part of users are able to extinguish the flame in the period between two and five minutes of interaction. Nevertheless, in many cases, users shows more difficulty in accomplish the goal. For this reason three steps are defined to help the user to extinguish the flame. If the attention value is low, each step increases the value of a certain amount. The first step start after five minutes of interaction, the second after seven and the third after ten. These helps stabilize the values in a medium-high position, facilitating the achievement of highest levels.

References

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