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GKT-Enhanced Applications

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Introduction: The Guilty Knowledge Test (GKT) is a method for detecting knowledge, or an associated reaction of the brain, that is relevant to a given task. GKTs have been extensively studied in psychology and are used in laboratory experiments, field studies [1] and court trials [2] to detect concealed information. GKTs are also known as Concealed Information Test (CIT) or the closely related Brain Fingerprinting [3, 1]. The achieved estimations (information present and information absent) vary according to the test subject and the method used for analysis from 80-95% [4, 5] to 100% [1, 6, 3].
We introduce the concept of GKT-enhanced Applications (GKTeA) where general applications and games are improved by combining them with GKTs [7]. In this way we are creating and adding an additional physiological input paradigm to the cognitive state [8] to improve HCI. GKTeA focus on passive BCIs [9, 10, 11] for healthy users. As an example, we present a GKT-enhanced treasure hunt game, where players try to find hidden locations or places by solving riddles and so collecting GKT-relevant clues. The GKT adds new element to the game, opens the door for new challenges and renders cheating nearly impossible.

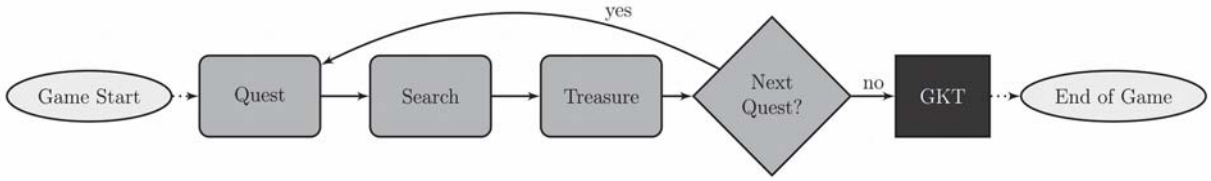

Figure 1. The schematic course of a possible implementation of a GKT-enhanced treasure hunt game executing the GKT after the hunt.

Material, Methods and Results: In combination with GKTs, a non-invasive portable and wireless BCI based on electroencephalography is most practical. To support the idea of a gaming scenario, we use a commercial gaming BCI, the Emotiv Epoc. The Emotiv BCI is not optimal for a variety of reasons, but our previous work [12] showed acceptable results and good usability. The underlying framework to perform the GKT is given by [6, 7, 13, 3]. The basic treasure hunt game performs as normal, but every treasure contains a GKT-relevant Object (GKTrO). While in the game or after the hunt is finished (see Fig. 1), the proof of every solved riddle can be prompted by a GKT asking for the GKTrO without disclosure of information to other competing players. This game can be realized as an online (multiplayer) game or real life (geocaching) experience.

Discussion and Significance: We introduce the novel term GKTeA and utilize the GKT as an additional factor to the cognitive state of the user. We transfer the concept of GKT as a useful benefit into the world of general applications and games for healthy users. Dependant on the game design cheating can be very hard, because of various different ways to select and present the GKTrOs and there meaning. Thus not only reaching the final goal is checked, but each step on the way. A more complex game design may increase the number of elements in the GKT, but the effort stays nearly constant. The example game and our experiments show the validity of the GKTeA assumption and functions at least as a proof of concept.

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