

Kwansei Gakuin University

Report of Research Outcome

2020/03/19

To President

Department : Graduate School of Humanities
 Position : Postdoctoral fellow
 Name : Robin Orthey

I report the outcome of the research as follows.

Name of the Fund/Program	<input type="checkbox"/> Sabbatical leave with grant <input type="checkbox"/> Sabbatical leave with no grant <input type="checkbox"/> KGU Joint Research <input type="checkbox"/> Individual Special Research <input checked="" type="checkbox"/> Postdoctoral fellow ※Please report by designated form as for “International Research Collaboration”.
Research Theme	Reconstructing of emotion concepts: Innovation in psychological science research
Research Site/Venue	Center for Applied Psychological Science
Research period	2019/04/01 ~ 2020/03/31 (12 month)

◆ **Summary of the research outcome** (approx. 2,500 words)

Please write down the outcomes in detail regarding the research theme above.

My research is aimed at further developing the Forced Choice Test (FCT) to detect malingered cognitive deficits and to investigate malingerers` response strategies to avoid detection. Examples of real-life applications include fraudulent claims of working memory disorders, tone deafness, or crime amnesia. The latter application of the FCT can also be used to determine whether a suspect in a criminal investigation has knowledge about the crime that only the perpetrator can have.

The procedure of the FCT is best explained with a case of malingered working memory problems. An examinee claims to suffer from the inability to remember novel information after a work accident. Among other tests, a FCT would be applied to exclude malingering. The FCT is made to look like a genuine working memory task. For example, the examinee would be presented with a number and asked to remember it. Then after a short delay the examinee is presented with two numbers. One number is the one presented earlier and the other is a similar but unfamiliar number. Examinees are instructed to select the number they were presented earlier and if they could not recall it, they should simply guess. This procedure is repeated many times and a total score is computed that represents the number of times the correct answer was selected.

Examinees who genuinely suffer from a working memory problem are unable to remember the correct answer and can only guess. They have a probability of 50% to select the correct answer by guessing and their total score over the entire test is expected to fall within chance performance.

In contrast, examinees who feign working memory problems tend to select incorrect answers on purpose to 'demonstrate' their impairment, which leads to test scores considerably lower than expected by chance. This intentional avoidance of correct answers is referred to as underperformance and used as a criterion for malingered test performance.

In my previous experiments, I investigated the strategies malingers use in this test. One notable finding was that only a subsample of around 40% of malingers follows the traditionally assumed pattern. The remainder tends to understand the rationale of the FCT and counteracts by randomizing between correct and incorrect answers over the course of the test. It follows that the next step to increase the FCT's diagnostic accuracy is to focus on this subgroup.

The purpose of the current project was to investigate whether brain activity could be used as a diagnostic measure to distinguish genuine from malingered test performance. Participants' brain activity was recorded with Electroencephalography (EEG). In this experiment, participants were subjected to a FCT about working memory problems twice. Once they were instructed to perform to the best of their ability and once to feign a cognitive disorder and randomize between correct and incorrect answers. In addition to the standard FCT procedure, participants received feedback after each choice, indicating whether or not their choice was correct.

At three points of this procedure, differences were expected to occur between genuine and malingered performance. First, when participants select incorrect answers on purpose as opposed to genuine mistakes. Making a mistake on purpose can be considered a deceptive response, and previous research suggests that deceptive responding elicits larger Medial Frontal Negativity (MFN) following the response. Next, two differences could occur when processing feedback. During feedback processing, the Feedback Related Negativity (FRN) and P300 brain wave can be observed. The FRN is the difference waveform between the processing of positive and negative feedback, and negative feedback typically leads to a more negative waveform. Participants were expected to display a typical FRN when they performed to the best of their ability. However, when participants made mistakes on purpose, a smaller FRN should be observed, because the mistake was intentional. Finally, the P300 brain wave is a measure of attentional capture. A larger P300 wave was expected when processing genuine feedback, because when participants made mistakes on purpose, the outcome was always known and therefore not surprising.

A preliminary sample of 27 undergraduate students was collected. There were no differences in MFN or FRN between conditions, but further examination is required as the general form of both waves was aberrant compared to previously published experiments. The P300 amplitude differed between conditions, with larger amplitudes when participants performed to the best of their ability. Furthermore, the difference between processing correct and incorrect feedback was also larger when participants did their best.

To estimate the diagnostic accuracy of the difference in P300 amplitude between correct and incorrect responses, a Receiver Operating Characteristic (ROC) curve was computed. The Area Under the Curve (AUC) of the ROC can be seen as a general measure of detection accuracy. It ranges between 0 and 1, and 0.5 represents chance performance. The aforementioned P300 amplitude was associated with a moderate diagnostic accuracy ($AUC = .67$).

The preliminary results support that brain activity can be a useful addition to the detection of malingered test performance, by identifying intentional randomization. It is likely that these measures provide incremental validity to the traditional FCT criterion, as the underperformance criterion has a poor detection accuracy for this response strategy. Closer examination of the MFN and FRN and further replication of our findings is needed.

Deadline : Within two months after finishing the research period.

Sabbatical leave with grant: Submit this report to the President with confirmation by the dean of school you belong to.

※ Postdoctoral fellow is required to submit this report with confirmation by the dean of graduate school before the end of employment period.

Where to submit : Organization for Research and Development and Outreach (NUC)

◆ We put this report on the web of KGU. If there is any problem about it because of difficulties on your research, please let us know.