Emotion-Antecedent Appraisal Checks: EEG and EMG data sets for Goal Conduciveness, Control, and Power

Kornelia Gentsch[1], Eduardo Coutinho[2,3], Didier Grandjean[1] and Klaus R. Scherer[1]

[1] *Swiss Center for Affective Sciences, University of Geneva, Geneva, Switzerland*
[2] *Department of Music, University of Liverpool, Liverpool, United Kingdom*
[3] *Department of Computing, Imperial College London, London, United Kingdom*

December 2, 2017

This document describes the full details of the second data set (Study 2) used in Coutinho et al., to appear. The Electroencephalography (EEG) and facial Electromyography (EMG) signals included in this data set, and now made public, were collected in the context of a previous study by Gentsch, Grandjean, and Scherer, 2013 that addressed three fundamental questions regarding the mechanisms underlying the appraisal process: Whether appraisal criteria are processed (1) in a fixed sequence, (2) independent of each other, and (3) by different neural structures or circuits. In this study, a gambling task was applied in which feedback stimuli manipulated simultaneously the information about goal conduciveness, control, and power appraisals. EEG was recorded during task performance, together with facial EMG, to measure, respectively, cognitive processing and efferent responses stemming from the appraisal manipulations.

In comparison to the data collected and analyzed in the original study (Gentsch, Grandjean, and Scherer, 2013), this data set contains some differences in both EEG and EMG signals. This is due to changes in the preprocessing steps (i.e., the processing of the raw data), which have had an impact on the data and the number of retained trails. Full details, including information about data collection, are provided in the following subsections.

Participants

Twenty-four right-handed healthy female students of the University of Geneva took part for financial compensation. They were guaranteed 25 CHF for their participation. Depending on their task performance, they could additionally win up to 16 CHF (bonus money). Participants ranged in age from 18 to 30 years (M = 21.38, SD = 0.66). Inclusion and exclusion criteria were the same as in Study 1: Inclusion criteria were age between 18–35 years, right-handedness, excellent understanding of French, normal vision (no glasses or contact lenses), and good general health (no use of medication, except oral contraceptives). Exclusion criteria were psychological problems, a history of neurological disorders or head trauma, and use of hard or soft drugs. All participants provided written informed consent prior to their participation in the study, which was approved by the local ethical committee.

Materials

Gray- and black-color filled geometric shapes were used as feedback stimuli which were presented in a gambling task (see Fig. 1). In each trial, the feedback stimuli simultaneously presented appraisal information of goal conduciveness (outcome: win vs. loss) and power appraisals (power: high [two choice options] vs. low [no-choice option to decide about the outcome]). Geometric shapes (e.g., hexagon and diamond) manipulated goal conduciveness appraisal (outcome) and their color (solid gray or black fill) manipulated power appraisal. These associations were counterbalanced across participants. Across different gambling blocks, control appraisal was manipulated by varying frequencies of high and low power feedback. In high control blocks, 75% of the trials presented high power feedback (and 25% low power feedback). These blocks were expected to be perceived as high in control. In low control blocks, 75% of the trials presented low power feedback

(and 25% high power feedback). These blocks were predicted to be perceived as low in control. Across trials and gambling blocks (three high control and three low control blocks), the frequency of wins and losses, high and low power, as well as high and low control was equal (50:50). In total, the gambling task consisted of 864 trials (duration of approximately 50 min).

Method

Prior to the beginning of the experiment, participants read and signed an informed consent form and filled out questionnaires about their current health and demographic characteristics. Study 2 was conducted in the same laboratory room as Study 1. Participants sat in front of a computer screen at a 60-cm viewing distance while playing the computerized gambling task. Participants completed a practice session to familiarize with the gambling task (48 trials, 5 to 7 min). When their performance did not reach the critical threshold ($> 80\%$ of correct responses: accepting wins and rejecting losses), they had to run another practice session. Participants were told that they would play a gambling task, and should maximize the amount of bonus money they could win without telling them the maximum of possible bonus money (16 CHF). They were not informed that the type of feedback on each trial was independent of their response. At the end of the experiment, participants were reimbursed (guaranteed participation fee plus the bonus money) for their participation. Before leaving, they were debriefed about the experimental manipulations.

The event sequence of a gambling task trial is presented in Fig. 1. Each trial started with a centrally presented fixation cross (randomized duration between 300 and 700 ms; 1° high, 1° wide). Next, two horizontally aligned circles appeared (Fig. 1, screen "Choice of circle"; 3.8° high, 4.6° wide). Here, participants guessed which of these two circles concealed the win (win: $+0.05$ CHF; or loss: -0.05 CHF) by choosing one circle. No cues were provided indicating which circle masked the win. To choose the left or the right circle, participants used the fingers of their dominant (right) hand to press number 1 (left circle, with their index finger) or 3 (right circle, with their middle finger) on a numeric keypad, respectively. Then, the chosen circle was highlighted (Fig. 1, 300 ms) and the feedback stimulus appeared at its center (Fig. 1, screen "Feedback"; 500 ms). After feedback presentation, the screen went black (1 s), and a screen with one letter on the left and one on the right side followed (Fig. 1, screen "Choice about outcome"; A = accept, R = reject; 0.8° high, 6.6° wide; Arial font, size 28). Here, participants made the final choice about the outcome of that trial. In high power trials, they had the choice of accepting or rejecting the outcome (presentation of "A R" or "R A": randomized order with the same number of presentations). In contrast, in low power trials, they had no choice meaning that they had to accept the available option of either rejecting (presentation of "R R") or accepting ("A A") the outcome (randomized selection with the same number of presentations). Finally, on the last screen of the trial, the participant's decision was highlighted and the total sum of the accumulated money until then was presented (Fig. 1, screen "Monetary and response feedback"; 300 ms; Arial font, size 52 bold). The next trial started shortly after. Stimulus delivery and responses were controlled by E-prime software (Version 2.0, Psychology Software Tools, Inc., Pittsburgh, PA).

EEG and EMG Recordings and Pre-Processing

EEG (64-channel electrode cap) and EMG were recorded from the same scalp and face regions as in Study 1. Both types of signals were simultaneously recorded (bandwidth 0.1–417 Hz, sampling rate: 2048 Hz) with the same BIOSEMI Active-Two amplifier system as in Study 1 (BioSemi Biomedical Instrumentation, Amsterdam, the Netherlands). The EEG data were preprocessed offline. First, they were downsampled to 256 Hz using the Biosemi decimeter software package (BioSemi Biomedical Instrumentation, Amsterdam, Netherlands). Next, in EEGLAB (version 11.0.4.3b; Delorme and Makeig, 2004), implemented in MATLAB R2012a (The MathWorks, Inc., Natick, MA), the data were high-pass filtered (0.1 Hz), noisy channels were removed, and horizontal and vertical eye movements were corrected (based on individual component maps, extracted by Infomax independent component analysis implemented in EEGLAB (see Delorme, Sejnowski, and Makeig, 2007). Then, the data were exported to Brain Vision Analyzer software (BVA, Brain Products, Gilching, Germany). In BVA, the topographic interpolation of channels (using spherical spline; Perrin et al., 1989), low-pass filtering (30 Hz) and segmentation (-200 ms pre-stimulus and 1500 ms post-stimulus) was performed (similar to Study 1). Trials in which artifacts exceeded $\pm 110\ \mu V$ were removed (2.62% total amount of excluded trials across all participants). Finally, the segmented data were baseline corrected (-200 to 0 ms relative to stimulus onset) and the single trials were separated according to their experimental condition. The EMG data were preprocessed in BVA following the standard procedure Fridlund and Cacioppo, 1986, and the artifact removal procedure used for Study 1. All other processing steps were also the same as in Study 1. The final number of EEG and EMG trials retained amount to 20185 and 18480, respectively.

Bibliography

Coutinho, Eduardo et al. (to appear). "Evidence of Emotion-Antecedent Appraisal Checks in Electroencephalography and Facial Electromyography". In: *PloS ONE*.

Gentsch, Kornelia, Didier Grandjean, and Klaus R Scherer (2013). "Temporal dynamics of event-related potentials related to goal conduciveness and power appraisals". In: *Psychophysiology* 50.10, pp. 1010–1022.

Delorme, Arnaud and Scott Makeig (2004). "EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics including independent component analysis". In: *Journal of neuroscience methods* 134.1, pp. 9–21.

Delorme, Arnaud, Terrence Sejnowski, and Scott Makeig (2007). "Enhanced detection of artifacts in EEG data using higher-order statistics and independent component analysis". In: *Neuroimage* 34.4, pp. 1443–1449.

Perrin, François et al. (1989). "Spherical splines for scalp potential and current density mapping". In: *Electroencephalography and clinical Neurophysiology* 72.2, pp. 184–187.

Fridlund, Alan J and John T Cacioppo (1986). "Guidelines for human electromyographic research". In: *Psychophysiology* 23.5, pp. 567–589.

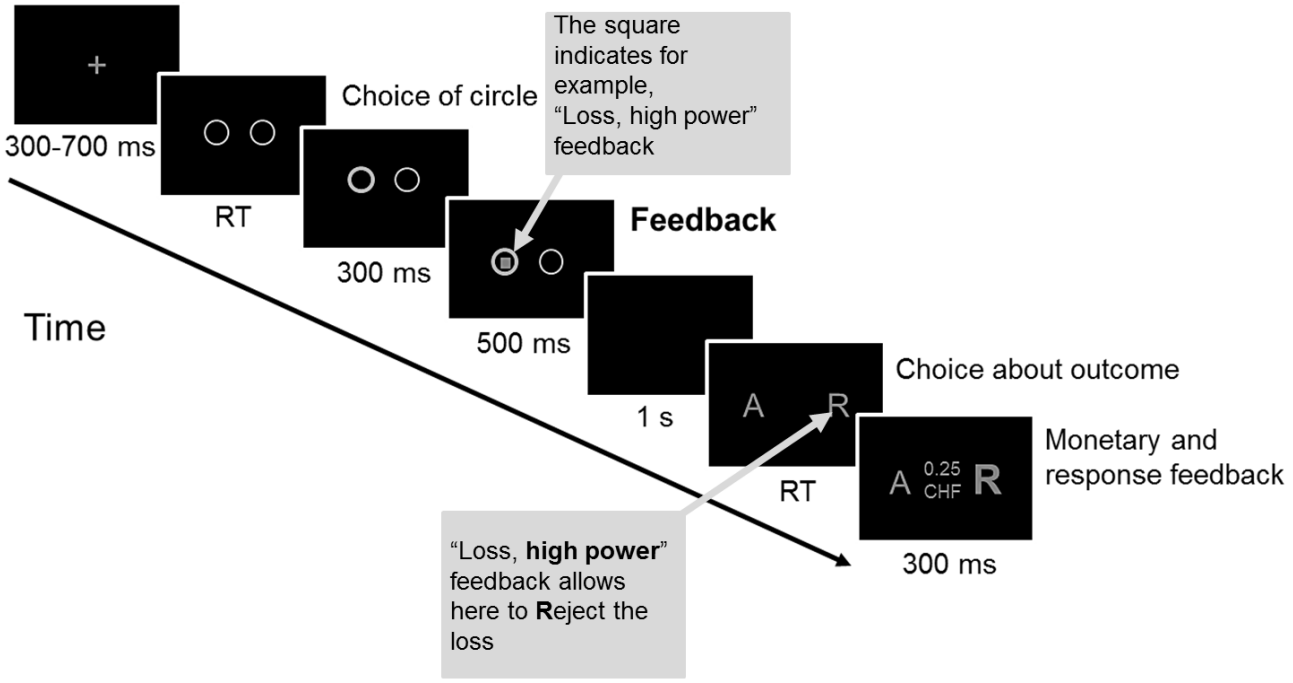

Figure 1: *Example of the event sequence of a gambling task trial. Presentation times of each event are indicated below the corresponding screen. At feedback onset, goal conduciveness and power appraisal information were simultaneously presented with gray- or black-color filled geometric shapes. Goal conduciveness and power appraisals were manipulated in each trial. Control appraisal was manipulated across trials, in each experimental block. EEG and EMG data were analyzed locked to feedback onset. Monetary feedback at the end of each trial presented the total sum of accumulated money until that trial. RT = reaction time. See text for details.*