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The quantified cook - Physiological responses during cooking food associated with different levels of valence and arousal

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Introduction: Physiological measures could potentially inform us about an individual's emotion in a continuous fashion without requiring distracting questions about currently felt emotions. Considering that positive emotions are critical for the success of foods in the market place, one of the potential application areas is examining emotions during the food cooking process and consumption. The goal of the present study is to explore physiological responses during 'out of the lab' cooking and consumption in a simulated home environment. We compared electrodermal activity (associated with arousal), heart rate and EEG frontal alpha asymmetry (associated with pleasantness, or more specifically, approach or avoidance motivation) during cooking two dishes that were expected to elicit distinct emotions during the cooking and consumption experience.

Material, Methods and Results: 41 participants were asked to cook and taste two stir-fry dishes, following auditorily presented instructions that were equal for both. One of the dishes contained chicken (expected to evoke pleasant emotions/approach and intermediate arousal), the other one mealworms (expected to evoke unpleasant emotions/avoidance and high arousal). The order of dishes was counterbalanced between participants. EEG, skin potential and ECG were recorded using an ambulant system (Mobita, TMSi). EEG electrodes were water based. Physiological variables were extracted relative to a resting baseline from four intervals that followed the following instructions: 1.'remove the lid from the bowl', (either exposing chicken or mealworms); 2.'Add the contents of the bowl to the pan and keep on stir frying'; 3.'Use the spatula to place a scoop of the dish on the plate'; 4.'Take a bite'. After cooking each dish, participants were asked to rate arousal and valence scores during these intervals. Dependent variables were evaluated using ANOVAs with condition (chicken versus mealworm) as a within participants independent variable, and order (chicken versus mealworm first) as a between participants independent variable. Subjective ratings confirmed that participants experienced high arousal and low valence in the mealworm condition compared to chicken, especially at the first (exposure) interval. As expected, skin potentials were larger for mealworms than for chicken at the exposure interval. For heart rate, there were interactions between condition and condition in all intervals, such that heart rate was much lower in the mealworm compared to the chicken condition when chicken was presented first, while it tended to be the other way around when mealworms were presented first. For the exposure interval, first EEG results show a close to significant effect of condition on prefrontal alpha asymmetry in the expected direction (relatively low alpha in the right hemisphere which is consistent with an avoidance motivation). Using SVM classification analysis (10-fold cross-validation across subjects) we could distinguish with up to 82% accuracy between cooking chicken and mealworms using ECG and skin potential variables.

Discussion and significance: In our first analyses, we found the expected effects in skin potentials and a trend for prefrontal alpha asymmetry, as well as reliable classification between the two conditions under relatively difficult experimental circumstances. Firstly, physiological signals were affected by noise from movements and secondly, we could present the participants each condition only once. This study adds to the literature showing that counter to what is often assumed, arousal is not associated with heart rate acceleration under all circumstances. Different studies have found disgust to increase or decrease heart rate, or to not affect heart rate at all. The present study fits in a range where we use physiological responses to distinguish between different emotional conditions in (simulated) 'out of the lab' situations, such as reading arousing and non-arousing sections in a novel [1]. This study also provides new insights into the role of emotions in the cooking and consumption experience and includes a new approach in this area for creating innovative, healthy products and dishes.

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References

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