Integrating Implicit and Explicit Emotional Assessment of Pleasurable Meal Experiences

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INTRODUCTION

- Traditional sensory methods and cognitive emotional assessments are not always accurate in understanding consumer response to food.
- **Implicit** (unstated) physiological responses, such as electroencephalography (EEG), electrocardiography (ECG) and Automated Facial Expression Analysis (AFEA) may be more representative of instinctive emotional responses than **explicit** (cognitively determined) responses.
- Initial development of evaluation techniques for emotional and motivational behavior responses may provide deeper insight into how consumers respond to pleasurable food experiences.

OBJECTIVE/ HYPOTHESIS

Objective: Assess implicit emotional responses of pleasurable breakfast meals through EEG, ECG, and AFEA to measure emotional and motivational behavior tendencies and relate to explicit responses.

Hypothesis: Greater approach emotional and behavioral responses will be observed implicitly for meals with higher explicitly measured acceptability and approach term usage compared to less liked meals.

METHODS

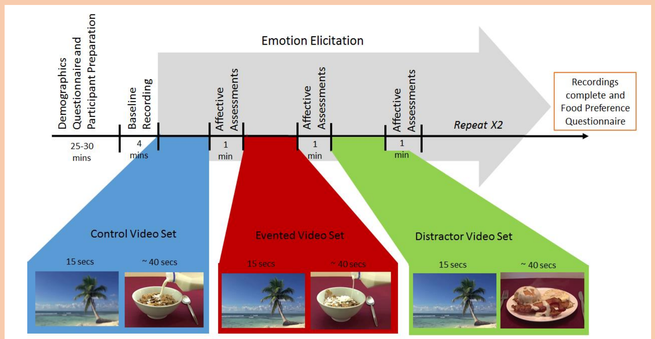


Figure 1: Single scheme of video presentation sequence.

Statistics: Cochran's q test for percent frequency of emotion terms; paired t-test for hedonic scores; sequential paired nonparametric Wilcoxon tests (10 sec interval for AFEA); paired student's t-tests for 5 sec for HR and EEG; alpha = 0.05; paired between meal and control

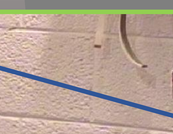
Implicit:

1. **AFEA:** Measures facial feature movements to compute intensities of expression for the six basic emotion
2. **ECG:** *Heart Rate (HR):* is the speed of the heartbeat measured by the number of contractions of the heart per unit of time.
3. **EEG:** *Frontal Cortex asymmetry:* the difference in electrical activity of the right and left hemispheres of the frontal cortex.

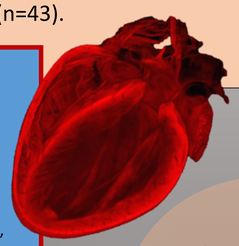
Explicit:

- Hedonic Scale (acceptability: 1 = 'dislike extremely', 7 = 'like extremely')
- Modified EsSense Profile™ Ballot: Check-all-that-apply emotion terms (n=43).

1. AFEA:
- Anger, happy, disgust, sad, scared and surprised (plus a neutral state)[3].



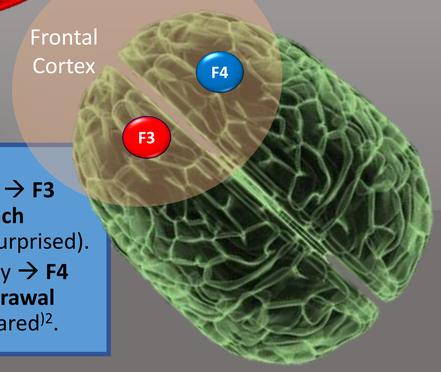
2. ECG:
- **Increase** heart rate→ anger, contentment (imaginary), fear, surprise, happiness, joy, sadness (crying) and disgust (contamination)
- **Decrease** heart rate→ sadness (non-crying or acute), disgust (mutilation), contentment (visual), and anticipatory pleasure[1].





3. EEG:
- **Left** frontal cortex activity → **F3** electrode (RED)→ **Approach** emotions (angry, happy, surprised).
- **Right** frontal cortex activity → **F4** electrode (BLUE)→ **Withdrawal** emotions (disgust, sad, scared)[2].

Figure 2: Example of a participant viewing the food stimuli during data collection.



RESULTS

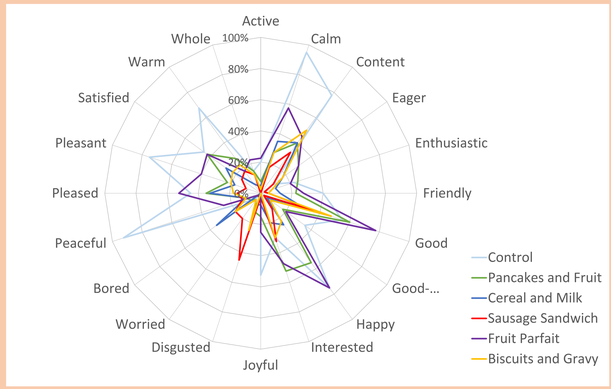


Figure 3: Percent frequency of frequently selected emotional terms for breakfast meals and the control (n=40).

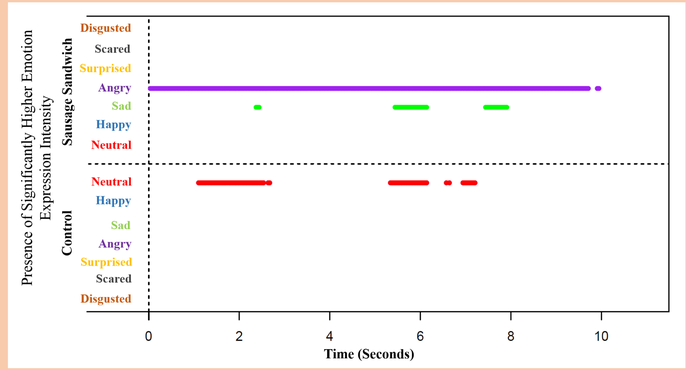


Figure 4: Sequential paired Wilcoxon test comparison for presence of statistically significantly greater emotion expression intensities between the sausage sandwich meal and the control(α=0.025; n=40)



Figure 5: Hedonic scores for breakfast meals and beach scene control.

RESULTS

Table 2: Paired student's t-test comparison of mean heart rate (bpm) between breakfast meals and the control (n=40, p<0.05).

HR	Mean Meal	Mean Control	Diff.	t	p
Pancakes and Fruit vs. Control	71.28	72.63	-1.35	-1.92	0.062
Cereal and Milk vs. Control	73.68	72.63	1.05	1.18	0.247
Sausage Sandwich vs. Control	71.91	72.63	-0.72	0.22	0.443
Fruit Parfait vs. Control	74.45	72.63	1.82	2.37	0.023
Biscuits and Gravy vs. Control	74.24	72.63	1.61	1.75	0.088

Table 3: Paired student's t-test comparison of mean frontal cortex asymmetry scores (F4-F3) between breakfast meals and the control (α=0.05).

Frontal Cortex Asymmetry Scores: F4 - F3	Mean Meal	Mean Control	Diff.	n	t	p
Pancakes and Fruit vs. Control	0.052	-0.019	0.071	40	0.868	0.391
Cereal and Milk vs. Control	0.063	-0.019	0.082	40	0.995	0.326
Sausage Sandwich vs. Control	0.014	-0.019	0.033	40	0.449	0.656
Fruit Parfait vs. Control	-0.055	-0.018	-0.037	39	-0.316	0.754
Biscuits and Gravy vs. Control	0.080	-0.036	0.115	39	1.498	0.142

DISCUSSION/ CONCLUSIONS

- Significant difference (p<0.05) in acceptability scores were seen across meal types.
- Meals containing fruit received significantly higher acceptability scores and were considered "liked moderately," in comparison to meals containing meat which were "neither liked nor disliked."
- **Approach term usage:** Fruit-containing meals (fruit parfait; pancakes and fruit) received more approach terms: good (75.0%, 60.0% relative frequency, respectively); happy (75.0%, 55.0%); friendly (27.5%, 22.5%); pleased (57.5%, 35.0%); joyful (25.0%, fruit parfait only).
- **Withdrawal term usage:** Disgust was highly chosen (p<0.05) for meat-containing meals (biscuits and gravy; sausage sandwich breakfast meals (25.0%, 45.0% relative frequency, respectively); cereal and milk breakfast meal had a high (p<0.05) relative frequency for bored (35.0%).
- **AFEA** results showed all breakfast meals saw significant presence of the expression anger and sad compared to neutral for the control (beach scene). Little variation of emotion expression type was seen across stimuli. [reject hypothesis]
- The fruit parfait saw a significant increase in **HR** compared to the control→ based on positive explicit responses, this HR response could be indicative of a physiological response of contentment, happiness or joy. [accept hypothesis]
- **Frontal cortex asymmetries** were not different between meals and control.
- Implicit measures, EEG, ECG and AFEA, provided additional supportive data to more traditional explicit measures for understanding pleasurable meal experiences.

ACKNOWLEDGEMENTS

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