

Title	fNIRS指標を用いた食品の視覚的刺激と食欲行動の関係性に関する研究
Author(s)	頼, 科呈
Citation	
Issue Date	2025-03
Type	Thesis or Dissertation
Text version	ETD
URL	http://hdl.handle.net/10119/19917
Rights	
Description	Supervisor: 藤波 努, 先端科学技術研究科, 博士

Abstract

This study aimed to explore the relationship between visual food stimuli and appetite-related behaviors within the framework of the Stimulus-Organism-Response (SOR) model, employing functional near-infrared spectroscopy (fNIRS) to examine metabolic responses. We developed and validated a biological food preference task that simultaneously assesses physiological responses to various visual food stimuli and subjective evaluations of these foods, aiming to understand how these physiological responses relate to food preference behaviors. Specifically, we provided an in-depth analysis of how visual food stimuli influence cerebral hemodynamics, subjective evaluations, and implicit preferences. The experiment focused on the prefrontal cortex and parotid regions, examining neural responses to static and dynamic visual stimuli of ice cream in different melting states and colors. We analyzed neural activity in the left and right prefrontal cortices and parotid regions, as well as the relationship to response times (as measures of implicit preferences) in evaluating "liking" and "wanting." This approach enabled us to investigate the effects of visual stimuli on physiological responses and subjective evaluations through complex mechanisms involving the brain's reward system and appetite behaviors.

Our findings revealed that subjective evaluations varied significantly with the melting state and color of the ice cream stimuli. Notably, fresh, intact ice cream (State 1) received high ratings for both "liking" and "wanting," whereas melted ice cream (State 4) received significantly lower ratings. These results suggest that freshness and visual appeal are critical factors in stimulating appetite, emphasizing the importance of visual integrity in food presentation.

Physiological responses indicated that visual stimuli, both static and dynamic, significantly influenced hemodynamic responses in the parotid and prefrontal regions, with specific regional activations corresponding to "liking" and "wanting" evaluations. Static images elicited increased blood flow in the left prefrontal cortex and left parotid region during "liking" evaluations, suggesting that hedonic and reward processing is predominantly mediated by the left hemisphere. Conversely, dynamic video stimuli induced activation in the right prefrontal cortex and right parotid region, indicating that motivational processes related to "wanting" are more prominent in the right hemisphere. The contrast between static and dynamic stimuli revealed differential brain responses, with videos necessitating complex sensory integration and cognitive processing, leading to distinct hemodynamic patterns. These findings elucidate mechanisms by which visual stimuli affect physiological responses and behavior through both conscious and unconscious processes.

We observed significant correlations between subjective evaluations and physiological indicators. Specifically, differential correlations were identified between changes in parotid blood flow and "liking" and "wanting" evaluations across hemispheres. Furthermore, a negative correlation between reaction times and selection frequency was found, indicating that shorter reaction times were associated with more frequent selections. This suggests that intuitive preferences influence decision-making speed.

Additionally, we observed a trend in the relationship between subjective evaluations (explicit evaluations) and reaction times (implicit preferences), wherein shorter reaction times (indicating stronger implicit preferences) generally corresponded to higher subjective evaluations. This finding highlights a connection between explicit "liking" and "wanting" evaluations and unconscious response speeds. A significant correlation was also found between reaction times and physiological indicators,

with shorter reaction times associated with changes in parotid and prefrontal cortex activity. These results suggest that implicit preferences may influence appetite behaviors via physiological responses.

In conclusion, visual food stimuli influence appetite behaviors through physiological responses, subjective evaluations (explicit measures), and reaction times (implicit preferences). Utilizing fNIRS to measure brain activity, our study demonstrated that visual food stimuli (S) elicit specific physiological responses (O) that closely correlate with subjective evaluations (R), thereby providing critical empirical evidence supporting the theoretical framework of the S-O-R model. These findings offer valuable insights into how visual food cues impact physiological responses and behavioral intentions. Specifically, we confirmed that visual ice cream stimuli triggered parotid blood flow changes associated with subjective evaluations of "liking" and "wanting."

Keywords: Visual food stimuli, Appetite-related behavior, Metabolic responses, fNIRS indicators, Stimulus-Organism-Response (SOR) model, Biological food preference task