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博士（人間科学）
概要書

An Experimental Study of the Perceptual Features that
Influence Multicolor Aesthetic Evaluation

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In empirical aesthetics, with the paradigm shift from behaviorism to cognitivism and the development of neuroaesthetics, information-processing psychological models were built to explain humans' sense of beauty for visual objects. Helmut Leder's model is the most comprehensive. According to the model, during the psychological process of multicolor aesthetic evaluation, certain perceptual features innate to multicolor stimuli are able to influence aesthetic evaluation of multicolor stimuli. Specifically, physical color information is transformed into these perceptual features at the Perceptual Analyses Stage in the visual information processing module. The features are then transformed into an aesthetic evaluation in the affective evaluation module. Using Leder's model as the theoretical framework, our research aimed to clarify, through psychological experiments, what perceptual features influence multicolor aesthetic evaluation and how these perceptual features exert their influences.

Chapter 1 introduces the background and objective of the research. Chapter 2 investigates the multicolor-level perceptual features (i.e., perceptual features that are attributes of the multicolor stimuli themselves) involved in multicolor aesthetics. Chapter 3 investigates the influence of color focality, which is a component-level perceptual feature (i.e., a perceptual feature that is a property of the component colors of the multicolor stimuli), on multicolor aesthetics. The experiments were conducted in Japanese, and all participants were students of Waseda University. Chapter 4 summarizes the results of Study 1 and Study 2 and proposes three links between the two studies. Chapter 5 introduces the implications for future work.

In Study 1 (Chapter 2), we first conducted two psychological experiments using the semantic differential method. The experimental stimuli were thirty-five 4×4 color grids. The aesthetic score of each stimulus was defined as the inverse of the factor score on the factor "Pleasure" extracted in the first experiment. In the second experiment, three factors, "Stability," "Heaviness," and "Presence," were extracted and each was regarded as a multicolor-level perceptual feature. Then, a neural network model was constructed to explicate how the three perceptual features

influence aesthetic evaluation of multicolor stimuli. The psychological appropriateness of the model was validated through two simulations. A post-training microstructure analysis revealed that Heaviness exerted a large and negative influence on the aesthetic evaluation, Stability a small and negative influence, and Presence a small and positive influence.

In Study 2 (Chapter 3), we experimentally investigated the continuous relationship between focality and preference of single colors and the psychological variable(s) that mediated this relationship. Literature has suggested that the focality of the component colors of a multicolor stimulus can affect the aesthetic evaluation of the stimulus by first influencing the aesthetic preference of the component colors. The experimental stimuli were 30 Munsell chips. The candidates for the mediating variables were fluency of psychological information processing (PPF) of colors and 22 color impressions. In the first experiment, Session 1 measured the PPF of each stimulus by testing its short-term memory accuracy because short-term memory accuracy reflects multiple PPF-related perceptual properties. Session 2 quantified the focality of each stimulus based on the subjects' categorization of the stimuli. In the second experiment, the subjects rated the stimuli on 23 Likert scales representing the color impressions and color preference. We found a negative linear relationship between focality and color impression *gracefulness* and a positive linear relationship between *gracefulness* and preference. This implies that color focality has a negative impact on color preference, which is mediated by *gracefulness*. We found no other color impression having such relationship chains. PPF's role as a mediating variable was also not supported.

In conclusion, our research found that three multicolor-level perceptual features (i.e., Stability, Heaviness, and Presence) and one component-level perceptual feature (i.e., color focality) can influence multicolor aesthetic evaluation, at least in modern Japanese culture. These results refined Leder's model and could help promote automation in such areas as generative art, kansei engineering (affective computing), industrial design, and human-computer interface.