

EMPIRICAL STUDIES IN AESTHETIC RESPONSES

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EMPIRICAL STUDIES IN AESTHETIC RESPONSES

by

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Dedicated to family and friends

Certificate

This is to certify that the thesis entitled “**Empirical Studies in Aesthetic Responses,**” submitted by **Sunny Bairisal** to the Indian Institute of Technology Delhi for the award of the degree of **Doctor of Philosophy** in Design, is a record of the original, bonafide research work carried out by him under my supervision. The results in this thesis have not been submitted in part or in full to any other University or institute to award any degree or diploma to the best of my knowledge.

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Abstract

The present thesis has attempted to investigate an otherwise highly subjective aspect of design called aesthetics, using empirical and neurophysiological tools. A new set of visual stimuli consisting of 27 items was developed for eliciting aesthetic responses. Self-reported aesthetic ratings were obtained from participants, while EEG neurophysiological data were collected using Electroencephalography (EEG). It was observed that the aesthetic sensitivity of individuals varies; therefore, consideration of the aesthetic sensitivity of users within product design has been recommended.

The set of 27 visual stimuli was based on three visual composition principles: golden ratio, rule of the third, and visual balance. All items were abstract geometric shapes to avoid any affective or semantic connotations. Data were collected from different groups of participants. Weighted scores of rank data of all participants across all items were computed and compared. Further, EEG was used while participants rated the aesthetic quality of the visual stimuli to investigate the underlying neural activities during the aesthetic judgment processes. Response time during ratings, Event-Related Potentials (P1, N2, P3, LPC, FN400, AND LP), and theta coherence in EEG data were calculated.

It was observed that the aesthetic assessment of less pleasing stimuli, as rated by the participants, was more time-consuming than those of pleasing ones. Further, aesthetically sensitive individuals, as decided by correct identification of the underlying visual principles, were quicker to assess the stimuli than those less sensitive individuals. The theta coherence of the brainwaves revealed that the judgment of pleasing stimuli required a more integrative approach and undivided attention when compared with the judgment of the unpleasing images. During the aesthetic appreciation task, activation of the dorsal stream was followed by the ventral stream irrespective of the aesthetic value of an image. However, the aesthetic appreciation of less pleasing images engaged the local processing and caused a delay in motor response that reflected a slower response time in image ratings. It appears that the judgment of the pleasant images was 'effortless,' 'memoryless,' and 'timeless.' In contrast, the judgment of unpleasant stimuli was more 'time-consuming.'

सार

वर्तमान शोध प्रबंध ने अनुभव जन्य और तंत्रिका क्रिया विज्ञान के उपकरणों का उपयोग करके व्यक्तिगत सौंदर्यानुभूति की जाँच करने का प्रयास किया है। सौंदर्य प्रतिक्रियाओं को प्राप्त करने के लिए 27 चित्रों का एक नया सेट विकसित किया गया था। प्रतिभागियों से सौंदर्य रेटिंग प्राप्त की गयी थी। जबकि एलेक्ट्रोएन्सेफेलोग्राफ (इ इ जी) का उपयोग करके इ इ जी न्यूरोफिसिओलॉजिकल डाटा एकत्र किया गया था। यह देखा गया कि व्यक्तियों की सौंदर्य संवेदनशीलता भिन्न होती है। यह शोधप्रबंध यह तर्क देता है कि उत्पाद डिज़ाइन के भीतर उपयोगकर्ताओं की सौंदर्य संवेदनशीलता पर विचार करने की आवश्यकता है।

27 चित्रों का सेट तीन दृश्य रचना सिद्धांतों पर आधारित था, गोल्डन रेश्यो, द रूल ऑफ़ थर्ड, और बैलेंस। किसी भी भावात्मक और अर्थपूर्ण सम्प्रेषण से बचने के लिए सभी चित्र अमूर्त जयामिति आकार के बनाये गए थे। प्रतिभागियों के विभिन्न समूहों से डाटा एकत्र किया गया था। सभी मर्दों में सभी प्रतिभागियों के रैंक डाटा के भारित अंकों की गणना और तुलना की गयी थी। प्रतिभागियों के द्वारा सौंदर्य सम्बन्धी निर्णय प्रक्रियाओं के दौरान अन्तर्निहित तंत्रिका गतिविधियों के जाँच के लिए 'इ इ जी' का उपयोग किया गया था। रेटिंग के दौरान प्रतिक्रिया समय और सम्बंधित ERP (P1, N2, P3, LPC, FN400, LP और THETA COHERENCE) की गणना की गयी। यह देखा गया कि प्रतिभागियों द्वारा मूल्यांकन किये गए कम मनभावन चित्रों का सौंदर्य मूल्यांकन, अधिक मनभावन चित्रों की तुलना में अधिक समय लेने वाला था। इसके अलावा सौंदर्य की दृष्टि से संवेदनशील व्यक्ति, जैसा की अन्तर्निहित दृश्य सिद्धांतों की सही पहचान द्वारा तय किया गया था, उन कम संवेदनशील व्यक्तियों की तुलना में उत्तेजनाओं का आकलन करने में तीव्र थे। तंत्रिका गतिविधि की थीटा सुसंगतता से पता चला के मनभावन उत्तेजनाओं के निर्णय के लिए अधिक एकीकृत दृष्टिकोण और अविभाजित ध्यान की आवश्यकता होती है।

सौंदर्य मूल्यांकन कार्य के दौरान, छवि के कम मनभावन या अधिक मनभावन होने का प्रमाण डोर्सल स्ट्रीम से वेंट्रल स्ट्रीम के तरफ जाने वाली तंत्रिका गतिविधि पर नहीं पडा। हालाँकि, कम मनभावन छवियों की सौंदर्य मूल्यांकन ने स्थानीय प्रसंस्करण को शामिल किया और मोटर प्रतिक्रिया में देरी का कारण बना जो छवि रेटिंग में धीमी प्रतिक्रिया समय को दर्शाता है। ऐसा प्रतीत होता है कि सुखद छवियों का निर्णय 'सहज', 'स्मृतिहीन', और 'कालातीत' था। इसके विपरीत, अप्रिय उत्तेजनाओं का निर्णय अधिक 'समय लेने वाला' था।

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Abbreviations

RT	R esponse T ime
ROI	R egion O f I nterest
EEG	E lectro E ncephalon G ram
ERP	E vent- R elated P otential
VAN	V isual A wareness N egativity
LPC	L ate P ositive C omponent
LO	L ateral O ccipital
AJT	A esthetic J udgment T est
VAST	V isual A esthetic S ensitivity T est
BA	B rodmann A reas
PI	P leasant I mages
UPI	U npleasant I mages

Symbols

\emptyset	Golden ratio
ϵ	Dielectric constant/permittivity
α	Cronbach Alpha (Reliability Constant)
η	Efficiency