

Empirical aesthetics for design: An international workshop

Jointly organised by the University of Padova and Iuav / Supported by PAN(AIP), DPG, DICEA.
11th Visual Properties Driving Visual Preference meeting (www.bertamini.org/lab/vpdvp.html)

Friday 19/09/2025

Aula A, Convento delle Terese – Univerity Iuav of Venice / Dorsoduro, 2206, Venice

09-9.30 Marco Bertamini and Michele Sinico

Opening and Welcome

09.30-10.30 KEYNOTE: Paul Hekkert

Empirical Design Aesthetics

10.30-11.00 **Coffee break**

11:00-11.20 Benjamin F. van Buren, Hong B. Nguyen

Reverse correlation for design

11.20-11.40 Dhanraj Vishwanath

Solid shape, surface representation and aesthetics

11.40-12.00 Thiago Leiros Costa

Design solutions and a model for smartphone-related distraction in a 4E cognition framework

12.00-12.20 Irene Reppa

When Beauty Drives Effort: Aesthetic Value and Human Performance in Visual Tasks

12.20-12.40 Luciano Perondi, Stefano Baldassari

Typographic Variables: A Framework to Support Systematic Analysis and Experimental Design for the Study of Semantic and Expressive Qualities in Typography

12.40-14.00 **Lunch**

14.00-14.20 Nicola Bruno

Potential Viewpoint Analysis (PVA) and the aesthetics of built interiors: an ecological approach

14.20-14.40 Enric Munar, Erick G. Chuquichambi, Tobiasz Trawinski, Letizia Palumbo

Variables predicting table and chair design preference

14.40-15.00 Valentina Mariani, Luca Laezza, Margherita Pasini, Roberto Burro

The Aesthetic Foundations of Restorative Landscapes

15.00-15.20 Andrea Piovesan, Luciano Perondi, Michele Sinico, Magdalena Sliwinska

Semantic qualities in typefaces: Towards evidence-based and inclusive design

15.20-15.40 Anna Anzani, Elena Fatone

A multisensory approach to interior design regeneration

15.40-16.10 **Coffee break**

16.10-16.30 Ronald Hübner

Aesthetic Preferences for Spirals as Indicator of Creativity

16.30-16.50 Rossana Actis-Grosso

Aesthetics, design and interaction: the role of expressive qualities in shaping User Experience

16.50-17.10 Ryan Joseph Slaby, Maria Arioli, Marco Tettamanti, Zaira Cattaneo

Neural correlates of negative aesthetic evaluations in visual art: a neuroimaging meta-analysis

17.10-17.30 Aniko Illes, Bernadett Palko-Arndt

Useful and less useful ways of integrating empirical aesthetics into design education

20.00 **Social Dinner**

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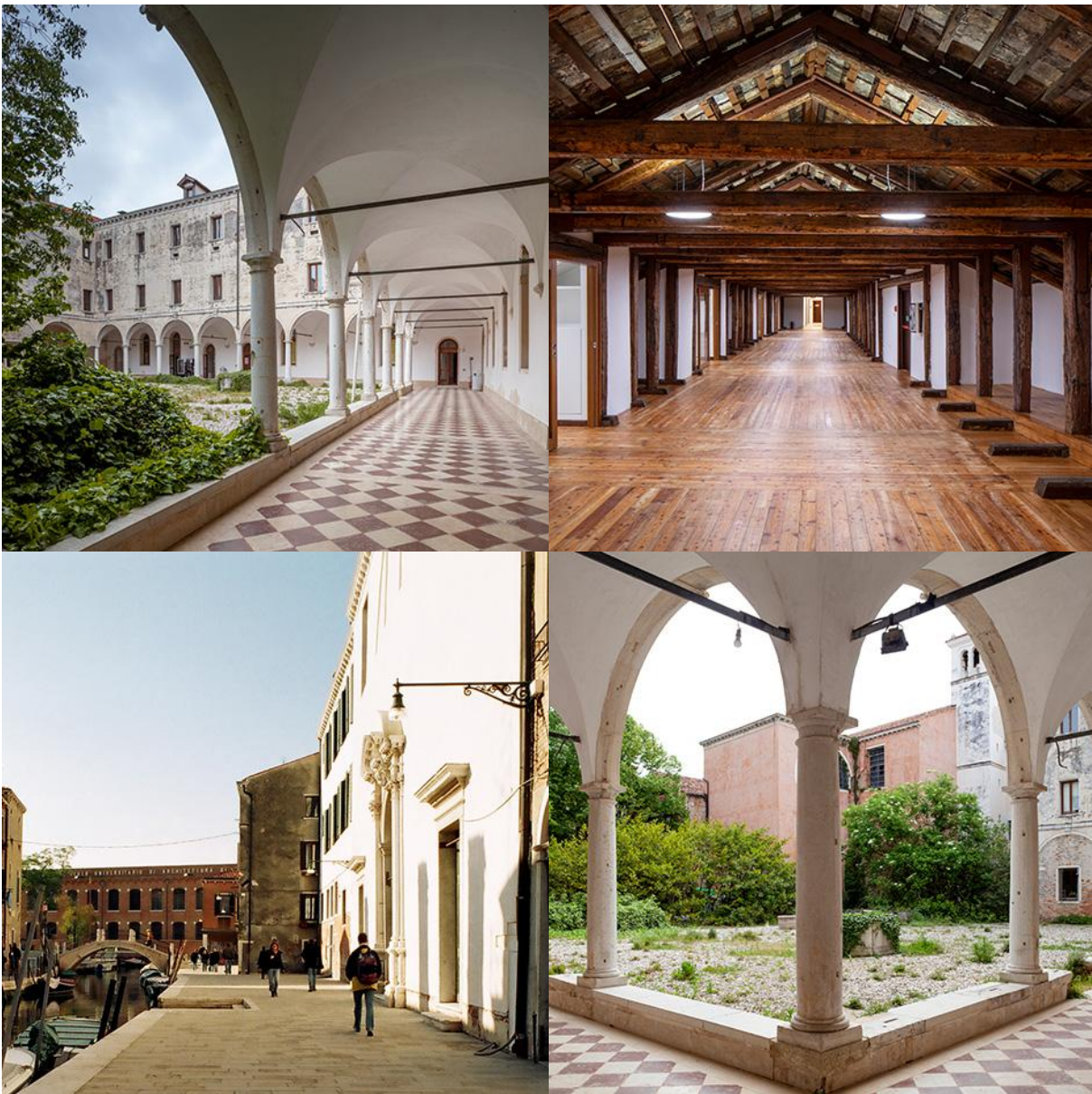
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Friday 19/09/2025

Aula A, Convento delle Terese – Univerity Iuav of Venice / Dorsoduro, 2206, Venice

The Convent of Santa Teresa was built in the second half of the 17th century. The building complex is extensive and is centered around a single large cloister, characterized by porticoes and arched loggias. The former convent was restored between the late 1990s and early 2000s, with renovations and architectural adaptations necessary to accommodate the teaching and research activities that are housed there, while respecting the formal, distributional, and structural characteristics typical of a 17th-century convent.

<https://www.iuav.it/en/node/118>



Keynote

Empirical Design Aesthetics

Paul Hekkert

Visiting Professor of Design, Politecnico Milano

Covering a timespan of almost three decades, we have studied the aesthetic experience, the pleasure we derive from processing designed artefacts through all our senses. As subjective as these experiences (by definition) are, they are subject to laws or aesthetic principles that can be experimentally tested. In my keynote, I will discuss the most prominent of these principles and explain the empirical evidence supporting them. Most experiments were governed by a unified underlying theory, the Unified Model of Aesthetics, that allowed us to formulate precise predictions. Considering the universal beauty of these aesthetic principles, they are currently leading a new search into principles for transformation.

Abstracts (alphabetical)

Aesthetics, design and interaction: the role of expressive qualities in shaping User Experience.

Rossana Actis-Grosso

University of Milano-Bicocca

Starting from different definitions and model for of User Experience (UX) I will present a new frame for Human-Computer-interaction (HCI), where CASA theory (Computers Are Social Actors, Reeves & Nass, 1996) are expanded so to include not only social rules, prejudices, stereotypes and expectations, but also perceptual attributes, which could convey implicit attitudes and emotions in every kind of interaction (i.e. expressive qualities). Through a series of experiments, the concept of expressive qualities, rooted in Gestalt studies, will be shown to have an important effect on the UX related to very simple objects (such as washing machines) as well as more technological ones (i.e. a conversational chatbot). The importance of considering expressive qualities in a more systematic way when considering the interaction of humans with every kind of devices will be discussed also in light of studies stressing the relation between aesthetics and usability.

A multisensory approach to interior design regeneration

Anna Anzani, Elena Fatone

Design Department, Politecnico di Milano

An experimental investigation will be presented into the ways in which spatial characteristics influence human behavior, with particular attention to interiors transformed through the integration of multimodal perceptual qualities. The research involved the design and setting up of full-scale (1:1) temporary installations within a disused building, enabling direct engagement with diverse sensorial combinations and their potential impact on user experience. A range of sensory stimuli including variations in light, sound, texture, and spatial configuration were introduced to generate a range of perceptual experiences for observation. Human responses to these spatial conditions were documented through a mixed-methods approach, combining qualitative and quantitative analyses, in order to capture nuanced changes in interaction with space, emotional reactions, and patterns of movement within the regenerated interiors. From the study findings, practical design recommendations can be drawn to enhance the quality of experience in future space regeneration projects, promoting environments that are not only functional but also perceptually engaging for their users.

Potential Viewpoint Analysis (PVA) and the aesthetics of built interiors: an ecological approach

Nicola Bruno

Università di Parma

I introduce Potential Viewpoint Analysis (PVA) as a potential tool for understanding the aesthetics of built interiors. Taking stock on Gibson's notion of vision as exploratory activity supported by sampling optic arrays at viewpoints, I propose that affective responses to interior layouts may be based on the ratio of feasible to non-feasible (F/NF) viewpoints. The F/NF ratio is a higher-order property of optic arrays in interior spaces, based on the perception of possibilities of actions such as moving-through, occupying specific positions, and holding certain postures. Most importantly, F/NF ratios can be computed from the geometry of the enclosure and from

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information on the position and geometry of objects within it. Anecdotal evidence on the utility of PVA for evaluating the aesthetics of built interiors is presented based on simulations and case studies.

Reverse correlation for design

Benjamin F. van Buren, Hong B. Nguyen
New School, USA

Most research in empirical aesthetics starts with a hypothesis — e.g. about what visual features make an architectural facade look pleasing, or make a piece of furniture look comfortable. However, sometimes it is possible to generate unexpected insights by taking a more exploratory, hypothesis-free approach. In this presentation, we will discuss the use of reverse correlation measures to study how visual features drive observers' impressions of designed objects. Here, instead of systematically varying a design in order to test a specific hypothesis, one applies random visual perturbations to a base design, in order to study the effect that these variations have on observers' assessment of its attributes. We will present the results of experiments that we have run using this technique, to explore what visual features make furniture look comfortable, and what visual features make vehicles look safe. In addition to discussing the merits of this exploratory approach to empirical aesthetics of design, we will also provide some critical comments.

Design solutions and a model for smartphone-related distraction in a 4E cognition framework

Thiago Leiros Costa
Department of Neurosciences, Biomedicine and Movement, University of Verona

Today smartphones are not simply tools, but rather integrated parts of our cognitive system and play a key role in shaping it (especially with the advent of AI assistants). I argue that current models in the cognitive sciences lack both in generality and specificity when assessing our complex relationship with these devices, and consequently we are far from proposing ideal ergonomic solutions. In the context where most individuals own smartphones, multiple governments have banned phones from their schools and smartphone-related dependence is on the rise, we are in urgent need of more refined models and targeted strategies. The literature mostly proposes two mechanisms for smartphone-related disruptions. The first, a “mere presence effect”, is a concept incorporated from social psychology and used to refer to arousal effects associated with the presence of observers (when compared to being alone). Another one superficially related to the neurosciences, is referred to as “brain drain”, an unspecific cognitive decline coming from a non-specified source (sometimes speculated as inhibitory control overload). Here I propose a new more holistic and also specific view of our relationships with smartphones (both in its positive and negative outcomes), based on a 4E cognition framework, according to which cognitive functions emerge from the dynamic integration of neural activity with embodied states, ecological contexts, interactive behavioral loops, and external cognitive scaffolds. This model considers consequences when we use the phone, when we are not using the phone and also when we are deliberately trying to inhibit our use of the phone. I also propose a few design solutions for improving our relationship with smartphones based on exercises developed with design students over the last year.

Aesthetic Preferences for Spirals as Indicator of Creativity

Ronald Hübner
University of Konstanz, Germany

The interplay between universal principles and individual variability in aesthetic preferences remains a fundamental question in art and design. Considerable individual differences observed even for simple stimuli such as rectangles support Fechner's (1866) early view that preferences are due to both innate mechanisms and acquired associations. This is consistent with our recent work, which shows that the preferences for simple design elements such as different types of spirals also vary individually. In particular, we were able to identify different subgroups: Some participants preferred golden spirals over Archimedean spirals, others showed the opposite pattern, and a third group showed a slight preference for logarithmic spirals. Although personality traits did not clearly correlate with these preferences, initial evidence suggested a relationship between the preference groups and creativity. To further explore this, a subsequent study not only required participants to choose among the three spiral types but also to articulate their reason and associations. The findings strongly indicate that individuals preferring the golden spiral tend to exhibit higher creativity than those favoring the Archimedean spiral. This

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observation was corroborated by a further experiment with design experts and artists. They showed a significantly higher preference for golden spirals compared to a control group. Overall, these studies suggest that a preference for relatively simple design elements, such as spirals, can serve as an indicator of a person's creative disposition.

Useful and less useful ways of integrating empirical aesthetics into design education

Aniko Illes and Bernadett Palko-Arndt

Moholy-Nagy University of Art and Design Budapest, Budapest,

The talk will focus on the mutual interaction of empirical aesthetics with design education. The talk will refer to 20 years of experience teaching many kinds of courses for art and design students such as perception, appreciation of art and design, museum experience, creative development etc. Based on this solid experience, we will highlight some insights on which scientific results seem to be less interesting for the creators-to-be (art and designer students) and which have high relevance to their work. The completely different ways of thinking as a scientist or a designer will be described clearly; on the other hand, some fruitful examples of co-working will be presented also.

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The Aesthetic Foundations of Restorative Landscapes

Valentina Mariani, Luca Laezza, Margherita Pasini, Roberto Burro

Dipartimento di Scienze Umane, Università degli Studi di Verona

This contribution is part of a broader research project investigating how low-level visual structures contribute to the perception of restorativeness of natural scenes. Building on the Attention Restoration Theory (Kaplan, 1995) and the Scene-Centered Approach (Oliva & Torralba, 2001), we hypothesize that Basic Structural Elements (BSEs), such as horizon visibility and height, linear and aerial perspective, texture gradients, symmetry, and chiaroscuro, play a key role in shaping the perception of Basic Global Properties (BGPs) such as openness, depth, expansion, and complexity. In turn, these BGPs may influence the subjective perception of restorativeness (PRS), particularly through the fascination, a core component of ART.

To test this hypothesis, two independent samples assessed twelve images of natural scenes. First, BSEs were ranked by 21 participants using a comparative judgment procedure. Then, a separate sample of 102 participants rated the same images on 25 Likert items (7-point scale), including 11 items from the Perceived Restorativeness Scale (PRS) and 14 ad hoc items covering openness, expansion, depth, and complexity.

A k-means cluster analysis based on eight Basic Structural Elements (BSEs) revealed four visual prototypes across the twelve images: (1) *structured-expansion scenes* characterized by high linear perspective and collinearity; (2) *visually complex scenes* with low symmetry and varied structural features; (3) *a high-texture scene* with minimal structural organization; and (4) *open scenes* marked by elevated horizon visibility and aerial perspective.

Mixed linear models were conducted to assess whether these clusters predicted differences in perceived restorativeness and fascination, accounting for subject-level random intercepts. Results revealed a significant effect of cluster on both overall restorativeness scores ($F(3, 1119) = 30.9, p < .001$, marginal $R^2 = .059$) and fascination ($F(3, 1119) = 51.7, p < .001$, marginal $R^2 = .096$). The high-texture cluster was consistently rated as significantly less restorative and less fascinating than all other clusters ($b = -1.14$ for PRS; $b = -1.68$ for fascination, $p < .001$). The openness cluster also showed significantly lower ratings than complexity on both dimensions. The intraclass correlation coefficients confirmed a moderate between-subjects variance in ratings. These findings support the hypothesis that early perceptual cues embedded in visual structure modulate aesthetic appraisals and contribute to restorative judgments. The results will be discussed within the framework of restorative theories in environmental psychology, with particular attention to the role of aesthetic preference in shaping the perceived restorative potential of visual environments.

Variables predicting table and chair design preference.

Enric Munar¹, Erick G. Chuquichambi¹, Tobiasz Trawinski², Letizia Palumbo²

¹ *EvoCog Group. University of the Balearic Islands (Spain).*

² *School of Psychology, Hope University, Liverpool (UK).*

We present a reanalysis of data from the article “Reassessing the curvature effect in tables and chairs”, in which the objectives were to assess the extent to which object curvature explains design liking in terms of object

category and, second, to analyse participants' visual inspection while performing the liking task. Now, we emphasize the stimuli, i.e., the images of the chairs and tables, to provide insight into which variables are most important in the liking of the object design. The variables recorded were: familiarity, perceived curvature, complexity, perceived weight, interest, duration of first eye fixation, number of fixations, mean duration of fixations, total time of fixations, and amplitude of saccades. Analyses were based on linear regressions in which liking was predicted from the variables above. The results show that the factor "category" was significant, indicating that the predictor variables differed for tables and chairs. Thus, the model that best predicts liking for table designs is the one that includes interest, perceived weight, and number of eye fixations (low), in that order of importance. However, the best model for predicting liking for chair designs includes interest, number of eye fixations (high), duration of first fixation, low familiarity, perceived angularity, and low complexity. Therefore, we conclude that the predictors of design liking change from object to object, and thus objects as similar as chairs and tables coincide in interest as the main factor, but not in the other factors. The most and least liked chairs and tables will be presented.

Typographic Variables: A Framework to Support Systematic Analysis and Experimental Design for the Study of Semantic and Expressive Qualities in Typography

Luciano Perondi¹, Stefano Baldassari²

¹ *Design Culture Department, IUAV University of Venice*

² *Design and Applied Arts Department, Fine Arts Academy of Catania*

The visual experience of typefaces involves both cognitive mediation and direct perceptual responses, making typography a powerful tool for communicating meanings that go beyond readability and legibility. This paper proposes a framework for investigating the expressive and semantic qualities of typefaces by distinguishing between meanings mediated by culturally acquired codes and those conveyed directly through the formal properties of letterforms. Drawing on type design theory, semiotics, and perceptual psychology, we identify a set of typographic variables that can be systematically analyzed and measured to understand their impact on perception. These include vertical and horizontal proportions, weight, contrast disposition, aperture, stroke endings, serifs, and degrees of irregularity. By isolating these variables, it is possible to test perceptual and emotional effects of design choices experimentally. To this end, the paper proposes a methodological framework that segments and systematizes the independent variables of typeface morphology, identifying those formal features that could be used in future empirical research on perception and meaning. By clarifying these variables—such as proportions, weight, contrast, and irregularities—this framework enables researchers and designers to formulate hypotheses on how typographic features might elicit consistent semantic associations (e.g., trustworthiness, modernity, strength) and how these potential associations could align with contemporary visual trends often characterized by formal homogenization.

The goal is to build a theoretical foundation for understanding why certain typefaces "work," how they resonate with the aesthetic preferences of a given time, and how their effectiveness could be described and measured in intersubjective terms. By clarifying in detail the typographic variables, this research aims to provide a structured basis for future investigations into the expressive and semantic qualities of typefaces, enabling more rigorous and systematic empirical studies.

Semantic qualities in typefaces: Towards evidence-based and inclusive design

Andrea Piovesan¹, Luciano Perondi², Michele Sinico², Magdalena Sliwinska³

¹ *Edge Hill University, UK*

² *IUAV Università di Venezia, Italy*

³ *Liverpool John Moores University, UK*

Every piece of text, whether on a website, food packaging, book cover, or delivery van, is presented with a font. Critically, typefaces convey semantic qualities such as professionalism, simplicity, or elegance, which subtly influence how readers interpret the content. Designers and other professionals routinely exploit this communicative function of fonts to align visual style with brand identity and product values, ultimately enhancing user engagement and purchasing behaviour. However, font selection remains time-consuming, and professionals must rely on their knowledge and expertise because there is no systematic, evidence-based data to guide their choices.

In this talk, we present a series of empirical studies aimed at quantifying how people perceive typefaces along key semantic dimensions. Our findings have been compiled into a free, user-friendly online tool for

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professionals and researchers (<https://tipotype.co.uk/>). We will also introduce our latest research examining how font perception, beyond its intrinsic tertiary-expressive properties, is influenced by the viewer's neurodivergence, including ADHD, autism, dyslexia, anxiety, and depression. These results suggest that each neurodivergent population interprets typographic features in systematically different ways. By highlighting these perceptual differences, we aim to encourage more inclusive design practices grounded in empirical evidence.

When Beauty Drives Effort: Aesthetic Value and Human Performance in Visual Tasks

Irene Reppa

Swansea University, UK

What role does visual beauty play in how we engage with tasks? In this talk, I will present recent findings from my research on the psychology of aesthetics that show how aesthetically pleasing visual stimuli can influence not just preference, but actual performance. Across a series of experiments, we examined how the perceived beauty of visual stimuli, such as icons, affects individuals' willingness to persevere, allocate attention, and sustain effort in cognitively demanding tasks. The results suggest that aesthetic appeal can enhance motivation and task engagement, with implications for how we design interfaces, educational tools, and other visual materials.

Neural correlates of negative aesthetic evaluations in visual art: a neuroimaging meta-analysis

Ryan Joseph Slaby^{1,2}, Maria Arioli³, Marco Tettamanti², Zaira Cattaneo³

¹ *Department of General Psychology, University of Padova*

² *Department of Psychology, University of Milano-Bicocca*

³ *Department of Human and Social Sciences, University of Bergamo*

Neuroaesthetics has focused on investigating positive aesthetic evaluations while neglecting negative aesthetic evaluations. The employment of domain-general neural systems may engender hedonic valuation across an affective space of (dis)pleasure towards artistic and non-artistic stimuli. Hence, we conducted a meta-analysis assessing neural correlates associated with negative aesthetic evaluations towards visual artwork (NAE) and with viewing or evaluating negative non-artistic images from the International Affective Picture System (N-IAPS). Literature search screenings found 16 studies and 16 experiments for the NAE and 46 studies and 47 experiments for the N-IAPS. GingerALE software employed activation likelihood estimation analyses to specify neural correlates within and between NAE and N-IAPS. Meta-analytic results from the NAE solely revealed the right fusiform gyrus encroaching the anterior cerebellum, while activations across frontal, occipital, temporal and subcortical areas were revealed for the N-IAPS. A commonality between the NAE and N-IAPS was revealed within the right fusiform gyrus. These results suggest that the domain-general neural systems are at play across negative visual affective experiences, yet the context of stimulus engagement, such as aesthetic, may modulate how these neural systems are employed. Given the scarcity of results, future research in neuroaesthetics must expand from positive aesthetic evaluations to ascertain neural correlates within negative aesthetic evaluations.

Low- and high-level factors in design aesthetics: surface shape, emotion and narrative.

Dhanraj Vishwanath

University of St Andrews, UK

An understanding of cognitive processes and factors underlying aesthetic experience and aesthetic beauty in both art and design is usually developed from the standpoint of the appreciator. I will present theoretical proposals on two ways of thinking of aesthetic beauty in design from the viewpoint of a design practitioner. One of these is developed from an alternative understanding of low-level visual representation of surface shape in visual perception. The other is developed from an alternative understanding of general aesthetics involving high-level factors such as narrative and emotion. In the process, I hope to distinguish hedonic beauty from homeostatic beauty.