Empirical Aesthetics

*Empirical aesthetics* is a branch of psychology dedicated to studying the nature of beauty, aesthetics, art, artistic production, aesthetic experience, and audience responses to artworks in a broad range of media. In current practice the field includes research from cognitive, perceptual, social, physiological, and clinical psychology, as well as cognitive and affective neuroscience. It is served by two professional organizations, The International Association of Empirical Aesthetics (IAEA) and Division 10 of the American Psychological Association, two general journals, *Empirical Studies of the Arts* and *Psychology of Aesthetics, Creativity, and the Arts* and specialized journals including *Visual Arts Research, Journal of Aesthetic Education, Music Perception, and Psychology of Music*. There are currently no comprehensive anthologies of work in empirical aesthetics, but see Colin Martindale’s *The Clockwork Muse* (New York: Basic Books, 1990) and Ellen Winner’s *Invented Worlds* (Cambridge, MA: Harvard University Press, 1982) for general overviews of the field.

Empirical aesthetics traces its origins to the publication of *Vorschule der Ästhetik* in 1876 by Gustav Fechner. It is, as a result, as old as the modern discipline of psychology itself. Fechner argued that without empirical support any system of aesthetics would be like "a giant with feet of clay" (Fechner, 1998 634). He drew a distinction between what he called a *speculative aesthetics from above*, which included philosophical aesthetics and art criticism, and an *empirical aesthetics from below* (see also Berlyne, 1971; Martindale, 1990). Fechner’s assessment was that speculative aestheticians use deductive methods to generalize from a priori principles and definitions derived from expert intuitions, judgments, and introspective reflections regarding individual artworks. His worry was that deductive methods were simply measures of consensus and conceptual coherence among groups of art experts, that reflected subjective tastes and aesthetic biases. The goal of empirical aesthetics was to replace deductive methods with objective measures culled from large samples of ordinary individuals responding to large numbers of aesthetic objects.

Fechner introduced three general methods that are still the bread and butter of the field. The *method of choice* consists of asking participants to indicate their preference for a range of objects. Participants might be asked to choose between two stimuli (*the method of paired comparisons*), to order a series of stimuli according to their preferences (*the ordering method*), or to identify their degree of preference (or dislike) for single stimuli on a rating scale (*the method of single stimuli*). The method of *production* involves asking participants to produce objects that conform to their preferences via drawing or some other simple manipulation of a medium. A copying or tracing variant of this method can also be used to evaluate which features they identify as depictively or semantically salient or to measure how they perceive a stimulus. The *method of use* involves a meta-analysis of large ranges of artifacts to evaluate which kinds of features appear most often -- features that appear most often are assumed to reflect the aesthetic preference of the community that produced them.

Fechner did not set out a general theory for either art or aesthetic experience. He did however propose a range of general principles that prefigured later results (ironically, evidence for these principles generally comes from this later research). *The principle of the aesthetic threshold* states that there is a minimal threshold of intensity or duration that has to be exceeded before a stimulus generates a feeling of pleasure or displeasure in a consumer. Aesthetic thresholds turn out to be very close to sensory thresholds so that preferences are determined nearly as soon as we perceive a stimulus. *The principles of repetition and fatigue* state that the several repetitions may be necessary before a participant derives maximal pleasure from a stimulus, but that repeated exposures can lead to a decrease in preference. Fechner did not anticipate the *mere exposure effect*, or the fact that distributed (as opposed to massed) repetitions of any stimulus enhance our preferences for it (Cutting, 2003). *The principle of the aesthetic mean* states that when a type of stimulus varies in complexity along some dimension we naturally prefer the mean value between simple and complex. *The principle of the*
unified connection of the manifold states that pleasing stimuli must exhibit an appropriate balance between complexity and order. This principle mirrors the influential 18th Century philosophical view that judgments of beauty and aesthetic experience are the product of a maximal proportion of perceived uniformity amidst variety. The principle of aesthetic contrast and aesthetic sequence states that preference measures for a stimulus will be higher if it follows a stimulus with comparatively lower preference ratings and lower if it follows one with higher preference ratings. This is only true for stimuli that are similar to one another along a particular dimension (e.g., preferences for a shade of red will be enhanced if it follows a shade of red that is perceived to be comparatively duller, but no such effect is produced by analogously rated shades of blue or green).

Daniel E. Berlyne (1971; 1974) reformulated many of Fechner’s views and principles in their modern form and subjected them to empirical validation. He adopted Fechner’s distinction between speculative and empirical aesthetics and, perhaps more importantly, prioritized experimental methods within empirical aesthetics over correlational approaches. He, like Fechner, did not propose a general theory, but rather sketched a heuristic framework for understanding the motivational processes that underwrite curiosity, exploratory behavior, and related responses to a broad range of aesthetic objects and event, including artworks. Arousal potential, or the degree to which a stimulus tends to increase arousal, is the critical concept in Berlyne’s approach. Organisms prefer a moderate level of arousal (confirming Fechner’s principle of the aesthetic middle). Low and high levels of arousal are both experienced as displeasurable. Berlyne argued that the natural exploratory drive associated with curiosity is driven by this asymmetry – we eschew both boredom and high levels of tension, and rather actively seek out moderate levels of arousal in any given context.

Berlyne modeled arousal potential as a product of three kinds of variables: psychophysical properties (e.g., the intensity of brightness or loudness and qualitative differences among hues); ecological properties (e.g., the meaning or signal value of a stimulus which arise from associations with biologically beneficial or noxious conditions and more often than not is the product of learning); and collative properties (e.g. properties like novelty, complexity, uncertainty, conflict, or surprise which arise from comparisons among different parts of a stimulus or between a stimulus and prior expectations). Berlyne identified collative variables as the critical features underwriting aesthetic preferences. Novel stimuli are those that either fall between familiar categorizations or conflict with standard categorical expectations for a type of object or event. Complexity is a measure of the number and variation among the parts of a stimulus. Complex patterns can often be resolved into competing structural units that are in conflict with one another and so suggest different categorizations. Uncertainty is a measure of the number and relative probability of competing alternative outcomes, categorizations, or interpretations in a context. Conflict is related to uncertainty. Complex stimuli induce an unresolved sense of ambiguity when they imply different, incompatible categorizations or when they violate categorical expectations. Collative variables like novelty and complexity are therefore associated with varying degrees of uncertainty and conflict that manifest themselves as the arousal potential of an object or event.

How does this relate to art and aesthetics? We enjoy artworks, aesthetics objects, and natural scenes that are sufficiently complex, dynamic, or interpretively challenging to demand our attention, but nonetheless can be resolved into stable, less complex, interpretive or perceptual structures. This points towards a second key concept of Berlyne’s framework, reduction of uncertainty. He argued that as the complexity or uncertainty associated with a stimulus rises along a scale, a primary reward system becomes increasingly active. This generates positive affect that rewards an exploratory impulse associated with curiosity. However, at some level of complexity a primary aversion system is triggered producing negative affect. At this stage we are induced to attentively engage a stimulus in an attempt to resolve the perceived complexity into more orderly patterns. Success in this regard yields a reduction in uncertainty that is experienced as a pleasurable outcome. Berlyne therefore modeled our interactions with an artworks as an interplay between interest and pleasingness. Collative variables like complexity
and uncertainty drive aesthetic interest as a desire for reduction of uncertainty. Reduction of uncertainty is, in turn, experienced as a form of positive affect associated with the understanding of a work. Or, our interactions with artworks are driven by an active exploratory impulse to search attentively for some quality of uniformity amidst variety that enables a consumer to make sense of a novel stimulus.

Berlyne’s discussion of the role collative properties play in art and aesthetics has been enormously influential (see Jacobsen, 2006). Nonetheless, a range of difficulties have been identified for the psychobiological approach. Among the most important is what Martindale called the *isohedonic anomaly*. On Berlyne’s account any two stimuli with equal arousal potential should be equally preferred, e.g., your favorite song and white noise with an intensity that induces the same level of arousal. So, what differentiates artworks, aesthetic objects, and aesthetic experiences from their ordinary counterparts? Martindale found a potential solution in a range of studies demonstrating that meaning, or the identity of a stimulus, better accounts for aesthetic preferences than collative variables. For instance, in a study of preferences for polygons varying in color, color typicality, size, and complexity (number of sides) color typicality accounted for seventy-eight percent of the variance in preference. Complexity, on the other hand, only accounted for one percent. Similar results have been found for preferences for European Classical Music, Italian Renaissance painting, and more recently Surrealist painting (Martindale, 1990; Silvia, 2012). In light of these kinds of results, Martindale proposed a *cognitivist* alternative to Berlyne’s *motivational account* called *prototype-preference theory*. Prototype preference theory asserts that that pleasingness is an objective measure of typicality, or fit to central tendency of a category -- or that people prefer artworks and aesthetic objects that are typical of a category (e.g., a familiar historical or stylistic artistic category).

Prototype preference theory is not the only cognitivist alternative to Berlyne’s psychobiological approach. *Processing fluency theory* identifies the pleasingness of a stimulus with ease of processing, or fluency. Fluency is associated with the familiarity, figural goodness (e.g., symmetry or high figure-ground contrast), or categorical fit (e.g., prototypicality) of a stimulus. On this account cognitive processes are hedonically marked and pleasingness is a measure of smooth interaction with the environment. Processing fluency theory provides support for Fechner’s principles of repetition and fatigue. Reber (2012) has demonstrated that people have a higher preference for stimuli they have encountered repeatedly. However, if participants in these studies notice that fluency stems from repetition as opposed to familiarity with salient stimulus features this decreases fluency related positive affect. Processing fluency theory also provides a nice explanation of the influence of distributed repetitions in the mere exposure effect - familiar objects are easier to categorize.

Prototype preference and processing fluency theories, not surprisingly, have difficulties of their own (see Silvia, 2012). For instance, the presence of collative properties yields straightforward predictions about our interactions with and preferences for artworks and aesthetic objects. However, the same object may be typical or atypical of a range of different categories (e.g. the depictive content of a work, its representational content, or its identity as a member of historical period). More needs to be said to determine the constraints on the appropriateness of different kinds of categorizations before prototype-preference theory can make adequate predictions about responses to artworks and aesthetic objects. Furthermore, prototype-preference and processing fluency theories are accounts pleasingness. However, interest (which Berlyne demonstrated is correlated with collative variables like complexity, uncertainty, and conflict) and pleasingness are different, contrasting aspects of our engagement with artworks (Berlyne, 1971). Arguably it is interest, the challenge of resolving the meaning of a complex novel stimulus, and not pleasingness that drives preferences for artworks, particularly in the case of challenging modernist and contemporary styles of art that are not canonically beautiful (e.g., the complex fractured surfaces of analytic Cubism). Neither prototype preference nor processing fluency theories provides an adequate account of aesthetic interest.
The recent development of hierarchical theories represents a third cognitivist approach (Bullot and Reber, 2013; Chatterjee, 2012; Leder, Belke, Oeberst, and Augustin, 2004; Nadal, Munar, Capo, Rossello, and Cela-Conde, 2008). These theories model our engagement with artworks as a multi-stage process that involve perceptual analysis, implicit and explicit classification, decision making and reward, and affective responses. Leder and his colleagues have proposed the most worked out hierarchical model to date. They argue that perceptual analyses includes sensitivity to collative variables and other stimulus features; implicit memory integration underwrites sensitivity to the familiarity and typicality of a stimulus; explicit categorization judgments are meshed with the outputs of perceptual analyses and implicit memory integration to yield an interpretation of the meaning of the work; and the aesthetic evaluation of an artwork is a measure of the relative fit among the outputs of these processes which is experienced as a state of pleasingness or dissatisfaction defined as an aesthetic emotion. Critically, these processing levels are integrated via top-down influences of previous experience, categorization processing, domain specific expertise, and attention. Consequently the proposed integrated networks of perceptual, cognitive, and affective processes provide a mechanism to flexibly model the influence of a broad range of semantic variables (e.g., art historical and contextual information) on aesthetic judgments and preferences.

One virtue of this kind of account is that aesthetic interest can be treated as a product of the computational demands of various processing stages -- or, as a product of the process of distilling the information required for explicit classification and aesthetic evaluation from complex and dynamic sensory inputs. A second virtue is that they can account for variance between expert and art historically naïve consumers. Leder mentions results demonstrating that the content responsiveness of consumers lies on a continuum between experts and naïve readers, listeners, viewers, and spectators. Consider, for instance, Western landscape paintings or portraiture. Viewers who lack well-developed art historical knowledge evaluate the success of these works relative to their depictive success. The aesthetic evaluations of expert viewers, on the other hand, exhibit a sensitivity to the formal, expressive, and semantic features of a work responsible for its art critically salient content.

One final note about the relationship between empirical aesthetics and neuroscience. There has been an uptick of interest in recent years in what, if anything, neuroscience can contribute to our understanding of art. This interest has been fueled in the popular press by what has come to be called neuroaesthetics. The narrow, original use of this term was introduced by Semir Zeki (1999). The central assumption of neuroaesthetics in this sense is that artists’ productive methods are directed at the same sets of environmental features that human cognitive systems have evolved to detect and exploit in perception, object recognition, and action planning. It is argued consequently that we ought to find correlations between artists’ formal-compositional strategies and the operations of cognitive systems that Could help explain both how artworks work to convey their content and produce a range of aesthetic effects in consumers and why we find some scenes, natural objects, and artifacts beautiful. Although this is a promising approach in principle, it has yet to produce much fruit. Neuroaesthetics also has a broader use which simply refers to any research applying neuroscientific methods to explore standard problems in empirical aesthetics (Skov and Vartanian, 2009). Recent examples include Beatriz Calvo-Merino, Emily Cross, and Corrine Jola’s work in neuroscience of dance, Thomas Jacobsen’s studies of aesthetic preferences for complex geometric patterns, Anjan Chatterjee and Marcos Nadal’s hierarchical models for aesthetic judgments and appraisals, Stephan Koelsch’s book Brain and Music (New York: Wiley-Blackwell, 2013), and the research collected in Martin Skov and Oshin Vartanian’s edited volume Neuroaesthetics (Baywood Publishing, 2009) or Arthur Shimamura and Stephen Palmer’s edited volume Aesthetic Science: Connecting Minds, Brains, and Experience (New York: Oxford University Press, 2012).
References: