Unravelling Novelty

Shivani Tyagi, Clementine Thurgood, T.W. Allan Whitfield
National Institute for Design Research, Faculty of Design,
Swinburne University of Technology, Melbourne, Australia

Abstract: *Project UMA* conceives of aesthetics as a tension between safety and risk. Safety is epitomized by typicality; that which is familiar and processed fluently. Risk is epitomized by novelty; that which is unfamiliar and processed with difficulty. However, to rely solely upon safety leads to no new knowledge acquisition; and new knowledge is essential for dealing with the world's exigencies. Unlike novelty, typicality is well understood in aesthetics, with a strong body of experimental studies underpinning it. The only underpinning for novelty resides in the work of Berlyne. It is contended that the foundation of novelty lies in categorization and information held in the brain's individual object representations. The level of variation within these representations will range from 'rich' to 'poor'. We hypothesize that objects abstracted from rich representations will be more sympathetic to novelty than those abstracted from poor ones. Furthermore, we hypothesize that novelty exists in two forms; congruent and incongruent. Aesthetic preference favours congruent novelty, which leads to further expansion of the representation without conflicting with category abstraction. Incongruent novelty conversely is in potential conflict with representation and is expected to be negatively appraised.

Key words: Aesthetic Preference, Novelty, Typicality, Categorization, Object Representation

Introduction: Typicality and Novelty as Predictors of Aesthetic Preference

Novelty is a key variable in aesthetics that came to the fore in the 1970s after receiving detailed attention in Berlyne's influential book, Aesthetics and Psychobiology [1]. However, a challenge to Berlyne's arousal-motivation perspective redirected research into the cognitive domain of categorization-typicality. Despite this shift, novelty remains an active variable, particularly in design-related aesthetics research. It is also a key variable in an emerging theory of aesthetics specific to designed objects termed Project UMA (Unified Model of Aesthetics) [6].

Attempts to arrive at a unified model of aesthetics so far have proved unsuccessful. The phenomena to be explained have resisted simple formulas based upon supposed key variables. However, certain variables have been shown to achieve predictive status, although they are derived from different models of aesthetics, and can even appear contradictory. Thus Berlyne's *Collative-Motivation Model* of the 1970s posits the variables of novelty, complexity, incongruity and uncertainty as determining affect within aesthetics, the relationship being an inverted-U, with moderate degrees of these variables being

most preferred [1]. In contradiction to this model, a later perspective found that prototypicality (since renamed typicality) had higher predictive status. Termed *Preference-for-Prototypes*, this found a linear, positive relationship between typicality and affect [18]. Typicality has since been extensively explored, its most recent manifestation being the Processing Fluency model [13]. While processing fluency overcomes some of the limitations of the earlier preference-for-prototypes position, it does not explain instances where novelty is preferred. In fact, novelty, has received very little attention since Berlyne's pioneering work in the 1970s. Most studies that use novelty as a variable simply refer to Berlyne for justification. The period in-between reveals little. Novelty, we contend, requires attention and needs to be unravelled, particularly in the continuous changing context of designed objects where its importance would seem self-evident.

The evidence indicates that both novelty and typicality are determinants of aesthetic evaluations. But this appears contradictory. How can positive novelty and positive typicality both lead to positive affect? A model is needed that can accommodate this apparent contradiction. The model proposed by the UMA project explains aesthetic preferences in terms of a conflict between two opposing instincts, the need for safety and the need for risk. Typicality would be equated with safety (i.e. that which is known), and novelty with risk (i.e. that which is not known). Within this model the need for novelty represents the need for new knowledge [6]. After all, without new knowledge, fitness for purpose is constrained. This is reflected in our everyday experiences with consumer products; people often gravitate towards those products that are innovative and new. It is hypothesized that both typicality – safety – and novelty – risk – will emerge as significant predictors of aesthetic preference.

The remainder of this paper outlines those conditions that are conducive to the emergence of novelty in affective evaluations of products. In other words, when will humans be receptive to risk, and find it both gratifying and useful? We begin by describing early research in experimental aesthetics, the internal representation of objects, and lead into a categorization approach for products based on a refinement of Roschian taxonomic structure. Within this categorization framework we describe two forms of novelty; congruent and incongruent. Predictions regarding the influence of typicality and novelty on aesthetic preferences for products are advanced.

Operationalizing Typicality and Novelty in Context of Aesthetic Preference

The cognitive process of categorization provides a basis by which to structure knowledge, giving it meaning and context. Without this, survival is severely impeded [14]. The conceptualization of the 'prototype' – the average, which best represents the category – and of 'typical' category members [14], was the basis of the Preference-for-Prototypes model and consequently typicality, which purports that objects that are most representative of their respective categories are preferred to those that are novel [18]. The preference for typicality has since been attributed to processing fluency – the speed at which a stimulus is identified. Prototypes are processed with greater speed and efficiency – high fluency – than atypical items. A high level of fluency is regarded as a positive, as it is an indication of the successful identification of a stimulus, as well as it being familiar and unlikely to have adverse effects or be harmful, and therein lies its hedonic value; safety [13]. From a fluency perspective a

fundamental aspect of aesthetic appraisal is the alignment of the perceptual information of an object with the existing conceptual knowledge of it in order to correctly categorize and identify it; after all, a chair, car, mobile phone or kettle cannot be aesthetically appraised if it cannot first be identified. The more closely aligned these examples are to their prototype, the faster they are processed and identified, and hence the more likely they are to be preferred.

How then do objects that are atypical which rely on their point of difference succeed in the market place? It has been proposed that if a strict preference for prototypes was true, then prototypical forms would have long since been discovered and, as a result, categories of objects would all be identical. As this not the case, it would seem that typical exemplars are more attractive by default, and while typicality is a strong contributor to aesthetic preference, it is often prevailed upon by the need for novelty [10].

Berlyne's influential Collative-Motivation Model of aesthetics [1] proposed that the aesthetic experience was largely influenced by the potential level of arousal elicited by a stimulus, a position founded upon exploratory behaviour. In application to aesthetics, this translates into: why seek exposure to 'new' stimuli and experiences? His answer was that certain variables, termed 'collative', induce changes in arousal, and these changes can be pleasurable. Key collative variables are novelty, complexity, incongruity and uncertainty, and these were considered to generate exploratory behaviour. Underpinning this is early neuroscience regarding the brain's reward systems whereby a moderate level of arousal is pleasurable, but beyond this point the aversive system kicks in and too much arousal becomes unpleasant. Effectively, there is an optimum level of arousal, and therefore an optimum level of novelty, complexity, incongruity and uncertainty. Understanding and defining this 'optimum' level of novelty has been a challenge for experimental aesthetics: what is 'preferred' novelty, how is it operationally defined and how can it be manipulated to elicit positive appraisal? The cognitive ease and efficiency of processing fluency aligns well with typicality, yet the need to acquire new knowledge is also a strong driver. How do these two seemingly opposing variables operate in relation to each other? And could the nature of the object itself dictate a preference for one over the other?

Experimental aesthetics has given little attention to the nature of objects within the appraisal process. The result of which may offer an explanation as to why there has yet to be a clear understanding of why and how typicality and novelty influence positive appraisal, and under what conditions. How objects are themselves 'conceptualized', may lead to a better understanding of the processes involved in appraising them. If novelty is a driver for knowledge expansion, and an optimal level of novelty does indeed exist and is preferred, then it is reasonable to suppose that this novelty must have significant conceptual relevance to existing knowledge in order to expand it. The role of novelty and typicality might not be as traditionally viewed - in opposition - but as knowledge integration. Determining the fundamental mechanisms of how novel instances are integrated and adopted into the existing knowledge structures requires firstly an understanding of the structures themselves.

The approach adopted here uses the cognitive process of categorization to define the conditions under which novelty manifests and influences aesthetic appraisal. As previously outlined,

categorization is fundamental to survival in that it provides a framework in which to contextualize sensory information. As designed objects sit within this contextualization, aesthetic appraisal is viewed within this framework as an acceptance or rejection of what is permissible for the object category in question.

The Internal Representation of Objects and its Influence on Appraisal

The way in which objects are internally represented in the brain may hold insights into how they are appraised aesthetically. Neuroimaging studies have established that information about an object's properties including visual appearance, movement, and use are stored in multiple brain regions including those associated with language, colour and motor movement. These findings suggest that objects, rather than being represented discretely, are in fact represented using features or property-based models [8, 9]. That is, there are no known brain regions that represent 'chair' or 'cat'. Rather there exist areas that represent information about shared object features within an object category e.g. chairs – legs, straight, curve, back, seat, wood, leather, fabric, pattern, black etc. When identifying specific category members more information is required, and it has been proposed that this information is ordered hierarchically [8] e.g. seat, back, leg, wood, and curve leg – rocking chair. Referred to as 'object concepts', these representations allow cognitive processes such as categorization to take place. Categories are derived or abstracted from concepts. With regards to aesthetic appraisal, it is contended that there is a significant link between how an object is represented and how it is aesthetically appraised. The main premise of this assertion is based on the amount and nature of information held in individual object representations.

It is proposed that the breadth of an object representation is dependent on knowledge acquisition; the greater the amount of knowledge the richer the representation. This richness enables a greater number of category abstractions to take place. If, for example, an object such as a chair can be further abstracted to identify and name specific category members, including armchair, office chair, and rocking chair etc., it is reasonable to presume that many types of chair exist. They look different from each other, have different features from one another, have been named in order to identify each example, are possibly found in specific contexts, and are encountered with some frequency in order for this level of differentiation to occur. From this perspective it can be deduced that the concept of chair contains a considerable amount of knowledge: it is therefore comprised of a rich representation. An object such as a piano on the other hand, may only be abstracted to one or two exemplars - upright and grand - and may consist of a few specific properties or features: therefore from an aesthetic perspective it is comprised of a poor representation. Within this proposition, the richness of an object representation is defined by the amount of features or properties stored within and associated with the object category.

Experience is a strong determinant of organization of information in the brain. When objects are repeatedly viewed together, it is learnt that they belong together [12]. This has been demonstrated in association studies which have shown that semantically unrelated pairs, e.g. apple/ lion [12], are recalled with significantly more neural activity, and are slower to process than related pairs, e.g. snow/

shovel, which are recalled with greater speed [3]. The conceptual relevance of features to object categories and specific exemplars is hypothesized to play an integral role in the aesthetic appraisal process. Some features are conceptually more relevant to certain objects than others, especially with respect to identifying specific exemplars. In fact some features may be essential in defining an object, e.g. the curved legs of a rocking chair, a feature shared only with a rocking horse. It is this idea of shared features, and their interchangeability between object exemplars of the same category as well as objects in different categories, that promises some insights into the acceptance of novelty, and the conditions under which it is positively and negatively appraised.

The Role of Categorization in Evaluations of Aesthetic Preference and Novelty

The basic cognitive ability to differentiate features and categorize objects is considered a fundamental requirement of survival [15, 16]. That is, the ability to group objects together as similar, and thereby to distinguish between safe and dangerous objects, between hot and cold objects, rabbits and tigers etc. Roschian taxonomy outlined three levels of category abstractions [15]. The first level, the *superordinate*, is the broadest e.g. furniture, animals, plants. The second level, the *basic*, groups exemplars based on prototypes *e.g.* chairs, dogs, trees. And the third level, the *subordinate*, differentiates exemplars within the basic level into specific instances e.g. armchairs, Dalmatians, palm trees.

Categorization at the basic level is the level first learnt by infants [11], most used in naming objects [14, 15, 17], and occurs when the cue validity (probability) and category resemblance is maximized [15]. It is at the basic level where the identification of objects takes place, and where the diagnostic properties or physical entities of the object are integral to the abstraction. The operational definition of the basic level lists the following four criteria: (1) shared common attributes, (2) motor movements, (3) similarity in shape, and (4) identifiability of average shapes [15]. This definition is applied to all basic level category members from tables and chairs to dogs, guitars, and shirts in order to organize any number of exemplars into a specific category. Hence, all chairs must share common attributes (e.g. legs, a seat and a back), the same bodily movements must be used to interact with them, they must comprise of similar shapes, and they should be identified using averages of shape. As a result there are typical and atypical members of the category chair. The bean bag for example belongs to the category chair, yet only retains ‘typicality’ status for (2) within the basic level criteria, and is atypical with regards to (1), (3) and (4).

Returning to the idea of an ‘optimal’ level of novelty; if this is dependent on the nature of the object itself, then it would be expected that some objects are more accommodating of novelty than others. In particular, we would suggest that if a representation consists of large quantities of information (rich) then the adoption of new knowledge into this representation is more readily accepted than into representations that are poor, as there is more relatable information present in the rich representation. Poor representations would contain a finite amount of information and as a result possess far more rigid parameters, consequently limiting the amount of new/novel information acceptable unless it were of significant relevance. For example, an object such as grand piano, which by most people is experienced

in very specific settings and with less frequency than a chair, will be assigned quite specific features. Deviating from these would be considered highly novel, and unlikely to be found pleasing.

Novel exemplars under these conditions would be appraised differently depending on which representation they belonged to. A rich representation would be more tolerant of novelty and as a result objects would be perceived as comparatively less novel than those with the same level of manipulation in a poor representation. For example, a pink bean bag could be considered novel, but perhaps not as novel as a pink grand piano. Within the 'Rich/ Poor' model, this would be attributed to the fact that the bean bag belongs to the richly represented category of chair, which contains many feature attributes resulting in a broad range of exemplars, from the very typical to the very atypical or novel. Pianos however to do not, they possess very specific feature attributes. Novel instances, therefore, are more acceptable when viewed within broader categories [4, 5], and as such the richer the representation of the object, the greater the likelihood that novelty will be positively appraised when any new information/novelty is relevant and/ or relatable to these. Hence when this new instance of a pink piano is encountered, because the object representation is somewhat constricted in terms of feature articulation, and colour (a feature) is very specifically represented, this atypicality is considered highly novel. The bean bag can accommodate this same colour with more tolerance as it is derived from a category with a broad number of features, which includes greater colour representation. Both instances, the pink piano and bean bag, are considered novel, but perhaps one is more sympathetic to this novelty with regards to preference.

Congruent and Incongruent Novelty and the Relationship with Aesthetic Evaluations

Objects are represented internally by any number of features, some that are shared, and others that are specific to the object. If novelty is to be manipulated and measured, it is essential to know what is typical for each object. In doing so, a clearer understanding of what constitutes 'optimal' levels of novelty can be determined. This 'optimal' novelty may include elements that can be shared across category members, or include attributes that are outside of category membership but have a significant or strong relationship to the object representation; for example, product metaphors – products that refer to other distinct entities with the purpose of evoking the experience of them (form, sound, movement etc.) [2]. With regards to aesthetic appraisal, the type of features required to conceptualize the object would vary from object to object irrespective of category membership.

For example, wood is a typical feature of furniture. It is also a typical feature of chairs. However, it may be considered an atypical feature for a business office chair. Hence wood is a typical feature of the basic level category chair, yet atypical for the specific exemplar office chair. Designing a wooden office chair could be considered highly novel, yet possible not aesthetically preferable. It could be concluded that typical office chairs are preferred, or alternatively that an atypical feature (wood) is considered novel, and that this novelty is incongruent with what is known or with how office chairs are represented. After all, a wooden dining chair may not be considered novel at all. Again, using colour to demonstrate the same phenomenon, green could be considered an atypical feature of chairs at the basic level, as well as within subordinate exemplars e.g. office and dining chair. Would this atypical feature

be considered as novel, and if so, when would this novelty be preferred to more typical exemplars of the same objects (Fig.1). Explaining why the same feature attribute affects objects differently with regards to perceived novelty, and ultimately appraisal, may provide some insights into how novelty is operationalized within designed objects. Objects can hold typical and atypical features on a number of dimensions, and these can be perceived differently based on existing knowledge and expectations. Positively appraised novel instances are more likely to occur when existing object representations are able to accommodate information that is deemed acceptable. For example, if a particular object is represented by many features e.g. colour, a new instance of it with a novel colour is still novel but congruent with existing knowledge because it is already known to be represented by many colours. Conversely, if an object is represented by only a few colours, a novel instance of colour is still novel, yet colour variation is not aligned with the existing knowledge, hence this novelty is incongruent.

Figure. 1. Creating typical and novel instances using colour variation within both Rich and Poor object representations.

The features of objects offer important contextual information with regards to their use, function and context. Therefore, new information congruent to this is more likely to elicit preferential appraisal. Incongruent features would be unable to relate to or expand the representation, and consequently do not expand knowledge in any meaningful way, thus impeding the abstraction of the object. Thus, as a further determinant of 'optimal novelty,' we propose that two different types of novelty exist; congruent and incongruent novelty, and that these are positively and negatively related to aesthetic preference, respectively.

The MAYA principle – Most Advanced Yet Acceptable – contends that objects elicit preferential appraisal when they possess both typical and most novel information [7]. Novelty = Most Advanced. Typicality = Yet Acceptable. This principle suggests that novelty may be most effective in eliciting

preferential appraisal when it is relevant to existing information. What is ‘acceptable’ could translate to, ‘what are the parameters of this object; what is known about it’ – only then can what is ‘acceptable’ be defined. ‘Most Advanced’, may be interpreted as the permissible amount of new information that can be adopted. When an object that is richly represented encounters new information, its novelty ‘threshold’ will be high because it is accustomed to encountering and adding new additions, hence the ‘Most Advanced’ instance here will be different from an object that is poorly represented, possessing a low threshold of novelty. This is illustrated by the piano example given earlier. Again, what is known about an object i.e. its representation may play an important part in what constitutes novelty, and how it may be measured and appraised.

Novelty congruency is a concept that places the object at the center of aesthetic appraisal. It considers the aesthetic appraisal of objects as being in part mediated by the cognitive function of categorization that is essential to sense making and therefore survival. It views the processing of all sensory information as supporting this goal. As such, it eschews the notion of ‘disinterested aesthetic pleasure’ and, instead, sees aesthetics as a by-product of a more fundamental evolutionary drive. The means by which this sensory information in translated conceptually in order to give it meaning and relevance, is considered a key mediating factor in the aesthetic appraisal of objects. It is contended that objects richly represented by information will be appraised differently from those that are poorly represented. Novelty congruency aims to explain the anomalies of novel instances eliciting different preferential appraisals. Its conceptualization places the primary emphasis on the object, and to what degree it can be manipulated with regards to existing representations in order to elicit preferential appraisal. It aims to account for why some manipulations will result in positive appraisal, and others negative appraisals. Thus, it is predicted that ‘Rich/ Poor’ representation is directly linked to the congruence of novelty, and that novelty congruency will be evaluated more positively than novelty incongruence, as new knowledge can only be accommodated in the former.

Conclusions

In this paper we have outlined two seemingly opposing determinants of aesthetic preference: typicality and novelty. While the domain of aesthetics has traditionally been concerned with typicality, the lesser-known novelty is particularly relevant for designed objects, especially consumer products. In order to understand the aesthetic appraisal process and how this accommodates novelty, we propose a modified categorization model based on the earlier work on superordinate, basic, and subordinate levels proposed by Rosch [15]. Our model extends the existing literature by proposing that the internal representation of objects influences category abstraction, and that feature based representations [7, 8] affect aesthetic appraisal in relation to these abstractions. It is proposed that the amount of features attributed to object categories across the three levels of category abstractions can have either a rich or a poor representation, whereby we predict that rich representations are more accommodating of novelty than poor representations. In incorporating Berlyne’s optimal novelty [1], we also propose that two distinct types of novelty exist: congruent and incongruent, with the most acceptable levels of novelty present in the former. Our model and predictions are about to be put to the test through a series of experiments based on the experimental procedures outlined in Roschian categorization research [3, 10,

14,16]. It is anticipated that the findings will offer insights into the contributions of typicality and novelty to the aesthetic evaluation of objects. We hope to demonstrate empirically why some objects permit more aesthetic novelty than others. Thus, we seek to develop a framework in which to better understand the aesthetic appraisal of designed objects and consumer products.

References

[1] Berlyne, D. E. (1971). *Aesthetics and Psychobiology*. New York: Meredith Corporation

[2] Cila, N., Hekkert, P., & Visch, V. (2012). The role of designer expertise in source selection during product metaphor generation. *Design and semantics of form and movement*, 79.

[3] Fazendeiro, T., Winkielman, P., Luo, C., and Lorah, C. (2005). False Recognition across Meaning, Language, and Stimulus Format: Conceptual Relatedness and the Feeling of Familiarity. *Memory and Cognition, 33 (2)*, 249–60.

[4] Förster, J., Liberman, N., & Shapira, O. (2009). Preparing for novel versus familiar events: shifts in global and local processing. *Journal of experimental psychology. General*, *138*(3), 383.

[5] Förster, J., Marguc, J., & Gillebaart, M. (2010). Novelty categorization theory. *Social and Personality Psychology Compass*, *4*(9), 736-755.

[6] Hekkert, P. Aesthetic Responses to Design: A Battle of Impulses, The Cambridge Handbook of the Psychology of Aesthetic and Arts [In press]

[7] Hekkert, P., Snelders, D., & Wieringen, P. C. (2003). 'Most advanced, yet acceptable': typicality and novelty as joint predictors of aesthetic preference in industrial design. *British Journal of Psychology, 94(1)*, 111-124.

[8] Martin, A., & Chao, L. L. (2001). Semantic memory and the brain: structure and processes. Current opinion in neurobiology, 11(2), 194-201.

[9] Martin, A. (2007). The Representation of Object Concepts in the Brain. Annual Review of Psychology, 58, 25-45.

[10] Martindale, C. (1996). A Note on the Relationship Between Prototypicality and Preference. Empirical Studies of the Arts, 14, 109-113.

[11] Mervis, C. B., & Crisafi, M. A. (1982). Order of acquisition of subordinate-, basic-, and superordinate-level categories. Child Development, 258-266.

[12] Miller, E. K. (2000) Organization through experience. Nature Neuroscience, 11 (3), 1066-1068.

[13] Reber, R., Schwarz, N. & Winkielman, P. (2004). Processing fluency and aesthetic pleasure: Is beauty in the perceiver's processing experience? Personality and Social Psychology Review, 8, 364-382

[1**4**] Rosch, E., Mervis, C. B., Gray, W. D., Johnson, D. M., & Boyes-Braem, P. (1976). Basic objects in natural categories. Cognitive psychology, 8(3), 382-439.

[1**5**] Rosch, E. (1978). Principles of categorization. Concepts: core readings, 189-206.

[16] Sigala, N., Gabbiani, F., & Logothetis, N. K. (2002). Visual categorization and object representation in monkeys and humans. Journal of Cognitive Neuroscience, 14(2), 187-198.

[17] Tversky, B., & Hemenway, K. (1984). Objects, parts, and categories. Journal of experimental psychology: General, 113(2), 169.

[18] Whitfield, T. W. A. and Slatter, P. E. (1979), The effects of categorization and prototypicality on aesthetic choice in a furniture selection task. British Journal of Psychology, 70, 65–75.