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Beauty in Snowflakes: Complexity and Visual Aesthetics

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BEAUTY IN SNOWFLAKES: COMPLEXITY AND VISUAL AESTHETICS

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BEAUTY IN SNOWFLAKES: COMPLEXITY AND VISUAL AESTHETICS

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Experimental aesthetics research has been conducted since the nineteenth century. Interestingly, however, few studies have examined the perceived beauty of naturally shaped objects. In the current experiment, 204 participants were presented with a set of ten snowflake silhouettes that varied in complexity (perimeter relative to area); they were similarly presented with ten randomly-shaped, computer-generated, solid objects that also varied in complexity. For each stimulus set, the participants selected the single snowflake or object that was the most beautiful (Fechner's method of choice). The results for the solid objects replicated the findings of earlier research: the most and least complex objects were chosen as the most beautiful. Moderately complex objects were rarely selected. The results for the snowflakes were different. For these visual stimuli, the least complex snowflakes were almost never chosen; only the complex snowflakes were perceived to be most beautiful, with the aesthetic preference increasing with increases in complexity.

Introduction

Why do we find certain objects to be more aesthetically pleasing than others? This question has been asked by a variety of artists, philosophers and scientists for hundreds of years. Empirical research on aesthetics was first conducted in 1876 by the founder of psychophysics, Gustav Fechner (Fechner, 1876). His answer to the overarching question of aesthetics involved the golden section. When he presented his participants with a set of differently proportioned rectangles, the largest percentage chose the rectangle with a ratio of $\varphi = (1+ \sqrt{5})/ 2 \approx 1.61$, the golden section. The golden section has been considered to be particularly aesthetically pleasing and can be found in many historical artworks, such as Salvador Dali's "Sacrament of the Last Supper" and Giotto di Bondone's "Ognissanti Madonna", and ancient architecture, such as the Parthenon (Livio, 2008). Fechner's study has been replicated with a variety of stimuli, but the preference for the golden section has not been found consistently (Green, 1995). For example, Schiffman (1969) showed his participants pairs of six different rectangles of varying ratios (including the golden section) and found no significant preference for any particular rectangle.

Other aspects of stimuli that are believed to impact aesthetic pleasure, such as symmetry, have also been investigated. Many researchers have found that symmetrical stimuli tend to be rated as more attractive than non-symmetrical stimuli (Jacobsen, Schubotz, Höfel, & Cramon, 2006; Rhodes, Proffitt, Grady, & Sumich, 1998; Tinio & Leder, 2009). Patterns consisting of geometric shapes that were arranged symmetrically were perceived to be more beautiful than those that were not (Jacobsen et al., 2006; Tinio & Leder, 2009). Rhodes et al. (1998) found that symmetrical faces were perceived to be more beautiful than non-symmetrical faces. Symmetry has consistently been found to be a factor in aesthetic pleasure, but it is not the only factor that has been investigated.

The effect of stimulus complexity on aesthetic pleasure has been examined as well. Berlyne (1970) developed a theory that describes the relationship between aesthetic pleasingness and complexity. His theory suggests that perceived aesthetic pleasingness increases with complexity until a point at which moderate arousal is achieved; with further increases in complexity, perceived aesthetic pleasingness then decreases, creating an inverted-U pattern. In his 1970 experiments, Berlyne presented his participants with sequences of non-representational line drawings and representational artwork (e.g., Raeburn's "Portrait of a Man" and Rubens's "Massacre of the Innocents") of varying complexities and asked them to judge how pleasant they were on a scale of 1 (unpleasant) to 7 (pleasant). He found that participants tended to rate the more complex stimuli higher after several exposures and rated the simple stimuli higher after fewer exposures. Complex stimuli presented fewer times induced high arousal that was not pleasing, but simple stimuli produced a more moderate arousal that was pleasing. As the number of trials increased, complex stimuli were found to be more attractive because participants could make more sense of the stimuli, reducing arousal to a moderate level that was pleasant. Arousal for simple stimuli, however, was also reduced to a lower level with repeated exposures which decreased aesthetic pleasure.

An alternative hypothesis has been suggested by Kaplan and Kaplan (1989) who stated that we are predisposed to environments that are interesting but also possess order and are understandable. In other words, people tend to like complex environments as long as those environments make sense (i.e. are not in disarray). George Birkhoff, a mathematician, developed a formula to describe the relationship between complexity (C; e.g., number of elements), order (O; e.g., symmetry), and aesthetic measure (M; equivalent to aesthetic value/pleasure): $M = O/C$ (Birkhoff, 1933). According to Birkhoff's formula, the more complex a stimulus is, the less aesthetically pleasing it is and the more order a stimulus possesses, the more aesthetically pleasing it is. Birkhoff stated that this formula only applies to the 'normal observer' and is not consistent with everyone's aesthetic taste. Also, this formula only applies to comparing objects within a specific class (e.g., compare vases to vases) and cannot be used to compare objects from different classes (e.g., cannot compare vases to paintings).

Researchers have found many different patterns describing the relationship between aesthetic judgments and complexity. Saklofske (1975) found that moderately complex paintings of human figures were rated as highly attractive (a pattern reflecting the inverted-U as Berlyne's (1970) theory suggests). Research suggests that a composite (i.e., average) of multiple faces is perceived as most attractive when compared to individual faces (Rhodes, Summich, & Byatt, 1999; Rhodes & Tremewan, 1996). Halberstadt and Rhodes (2003) also found similar results for line drawings of birds, fish, and automobiles: composites were perceived to be the most beautiful. Phillips, Norman, and Beers (2010) found that participants judged the most complex three-dimensional objects as the most beautiful, followed by the least complex objects (a U-shaped pattern, the opposite of the relationship suggested by Berlyne, 1970). The different patterns of results that have been found are not surprising when considering the multitude of various methodologies that have been used.

In visual aesthetic research, it is apparent that a standard measurement of complexity does not exist. When using stimuli, such as famous paintings, some have opted to obtain subjective ratings by a panel of participants (e.g., they might rank perceived complexity for a set of paintings, see Nicki & Moss, 1975; Saklofske, 1975; Wohlwill, 1968). Others have counted the number of elements (geometric shapes, lines, angles, etc.) within a stimulus to measure complexity (Tinio & Leder, 2009). Fractal dimensions have also been considered an adequate measurement of complexity, especially for stimuli from the natural environment (Spehar, Clifford, Newell, & Taylor, 2003). Forsythe, Mulhern, and Sawey (2008) found perimeters to be significantly correlated with human judgments of complexity (correlations ranged from $r = 0.45$ to $r = 0.73$) for line drawings of natural (e.g., insects) and nonsense (i.e., do not exist in the real world) objects. McLellan and Endler (1998) found the perimeter-to-area ratio to be highly correlated with fractal dimensions (good measure for natural stimuli). Some of the aforementioned measurements cannot be made for particular stimuli. For example, counting the number of elements within a stimulus is only possible for very simple patterns. Objective measurements, such as fractal dimensions and perimeter-to-area ratios, are desirable because they limit subjectivity and may lead to more accurate estimations of the relationship between actual complexity and aesthetic pleasure.

In examining the effect of complexity on aesthetic pleasure, many researchers have used a narrow range of complexity. Berlyne (1963) classified his stimuli as either “less irregular” or “more irregular”. Tinio and Leder (2009) also used only two levels of stimulus complexity: “simple” or “complex”. Nadal, Munar, Marty, and Cela-Conde (2010) used only three levels of complexity: low, intermediate, and high, as did Heath, Smith, and Lim (2000). These narrow ranges do not allow for a very extensive look at the relationship between complexity and aesthetic pleasure. A wider range, such as the ten different levels of complexity used by Fechner (1876) and Phillips et al. (2010), is more ideal.

Variability within the field of aesthetics also exists regarding the terminology used to describe stimuli. Researchers have measured participants' preferences (Boeslie, 1984; Heath et al., 2000; Spehar et al., 2003), pleasingness (Fechner, 1876), liking (Cox & Cox, 2002; Faerber & Carbon, 2012), attractiveness (Cárdenas & Harris, 2006), and beauty (Forsythe, Nadal, Sheehy, Cela-Conde, & Sawey, 2011; Nadal et al., 2010; Phillips et al., 2010; Tinio & Leder, 2009). Some of these terms are ambiguous and offer a range of interpretation (i.e. preference could be interpreted to mean beauty, interest, or something entirely different). Augustin, Wagemans, and Carbon (2012) conducted research that revealed the term, beauty (and ugliness), was used to describe a wide range of different stimuli when people were asked to judge aesthetic qualities of a stimulus. They found that beauty was more relevant for certain categories (visual art, landscapes, faces, cars, and clothing) than for others (geometric shapes and patterns, interior design, and buildings). The specificity of the term used to describe aesthetic pleasure is extremely important in order to ensure that participants are making their judgments using the same criteria.

A variety of stimuli have been used in visual aesthetic experiments. Different kinds of paintings, including abstract (Forsythe et al., 2011), figurative, and representative paintings (Saklofske, 1975), have been used. Line drawings of various objects such as animals and cars (Halberstadt & Rhodes, 2003), silhouettes of buildings

(Heath et al., 2000) and geometric shapes (Tinio & Leder, 2009) have been used. Computer-generated images have also been employed: photographs (i.e., composites of faces; Rhodes & Tremewan, 1996), three-dimensional, randomly shaped objects (Phillips et al., 2010), and even chairs (Faerber & Carbon, 2012). Forsythe et al. (2011) examined a multitude of different stimuli (natural, man-made, abstract art, and figurative art) and found that natural stimuli (pictures of natural environments, such as a forest and animals) were perceived as being more beautiful than other stimuli. The natural stimuli in their experiment also possessed the highest complexity of the various types of stimuli that were used. Therefore, it is unknown whether stimulus naturalness or complexity was the aspect that allowed them to be perceived as the most beautiful; so the effect of stimulus naturalness on aesthetic pleasure has yet to be determined.

Although symmetry and complexity are the main contributors to aesthetic pleasure, they are not the only contributors. The influence of a person's cultural background on aesthetic pleasure has also been investigated. Buijs, Elands, and Langers (2009) found that native Dutch participants rated Dutch landscapes (e.g., marshes and dunes) as more attractive than did immigrants from Turkey and Morocco. Native Dutch participants also rated natural landscapes (e.g., mixed forest) as more attractive than managed landscapes (e.g., small-scale agriculture) whereas the opposite was found for immigrants (though not significantly so). The immigrants and native Dutch participants' attractiveness ratings of managed landscapes were not significantly different. Masuda, Gonzalez, Kwan, and Nisbett (2008) found that Japanese participants preferred photographs with a larger context (wide background) and a less prominent figure in the photograph (smaller figure) than did the American participants. The impact of culture on the relationship between beauty and complexity is in need of further examination.

The current study was conducted in order to further understand the relationship between beauty and complexity. In the current experiment, an objective measure of complexity (e.g., perimeter-to-area ratio, Forsythe et al., 2008; McLellan & Endler, 1998) was used as well as specific terminology (e.g., beauty) to describe aesthetic pleasure. One of the stimulus types in the current experiment has a high degree of symmetry, a wide range of objective complexity, and is natural (i.e., possesses ecological validity). These characteristics make snowflakes an ideal stimulus for this study. In addition to the snowflake stimuli, the three-dimensional, solid objects used by Phillips et al. (2010) were utilized in order to determine whether the relationship between complexity and perceived beauty is general (i.e., holds for both the two-dimensional snowflakes and three-dimensional objects) or is different for each type of visual stimulus.

Method

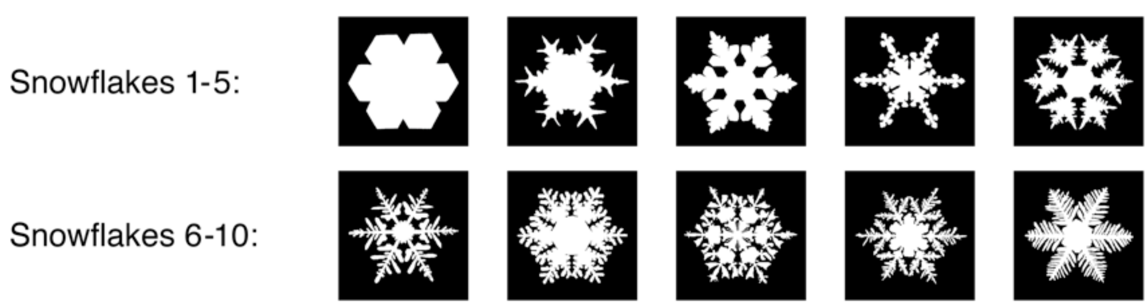

Figure 1. One set of snowflake images used as experimental stimuli -- the snowflakes vary in complexity from simplest (top left) to most complex (bottom right).

Experimental Stimuli

Photographs of actual snowflakes were taken by Wilson A. Bentley (e.g., Bentley, 1903; Bentley, 2006). Bentley dedicated his life to studying snowflakes and found them to be very beautiful (Bentley & Humphreys, 1931/1962). He carefully captured and photographed thousands of snowflakes and found no two snowflakes to be exactly alike (Bentley & Perkins, 1898). For our experiment, silhouettes of 50 of Bentley's snowflakes were created using Adobe Photoshop. The measure of complexity was the perimeter of the snowflake outer boundaries relative to their area. The higher the perimeter, the more complex the snowflake. Perimeter measurements were obtained using the NIH (National Institute of Health) program ImageJ (version 1.48v). The snowflakes were divided into ten groups based on complexity (group 1 of snowflakes being the least complex to group 10 being the most complex). Each of these groups were equally spaced in complexity so that the difference between the perimeters of groups 1 and 2 was the same as the difference between those of groups 2 and 3, 3 and 4, etc. (see Figure 1). There were five different sets of snowflakes; each set contained snowflakes that spanned the full range of complexity (1-10). It is important to note that for a given level of complexity (e.g., 1, 10, etc.) significant variations in specific shape exist (see Figure 2) within these stimuli. Therefore, if results indicate that participants possess a clear aesthetic preference for a given level of complexity, those preferences will not be due to any particular snowflake shape. Four random spatial arrangements of the five different stimulus sets created the configuration of stimuli used in the experiment. There were thus 20 different sheets of snowflake images and each participant was given a different sheet (a configuration of ten snowflake stimuli printed on paper by a laser printer has much higher spatial resolution, e.g., 300 dots per inch, dpi, than if the same stimuli were displayed on a computer monitor). The solid objects used in the experiment were the same as those developed by Phillips et al. (2010); they also possessed ten levels of complexity. As can be seen in Figure 3, these computer-generated objects were created by iteratively modulating a sphere sinusoidally in depth (the more iterations, the more complex the resulting three-dimensional shape). These solid objects were treated the same way as the snowflakes: five distinct sets of ten objects (with complexities 1-10) were randomly arranged four times, creating a total of 20 different sheets.

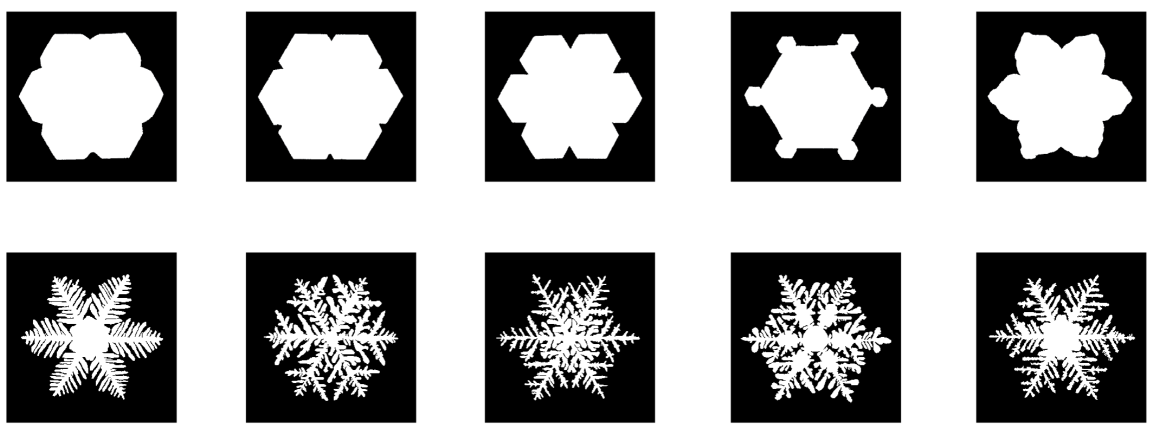

Figure 2. A depiction of the variety of specific snowflake shapes that exist within complexity levels 1 (top row) and 10 (bottom row).

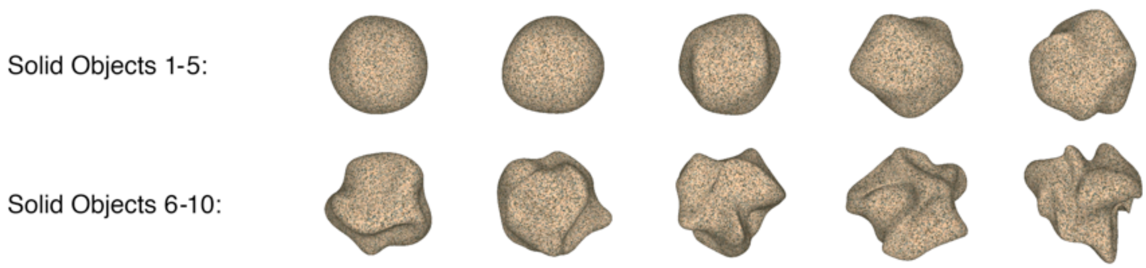

Figure 3. One set of solid objects used as experimental stimuli. These objects vary in complexity from simplest (top left) to most complex (bottom right). These objects were originally developed and used in an investigation conducted by Phillips, Norman, and Beers (2010).

Procedure

Participants were given a sheet of ten snowflake images, a sheet of ten solid object images and finally, a second sheet of ten snowflake images. We used Fechner's method of choice (1876): participants were instructed to select the single snowflake or solid object they found to be the most beautiful. The first sheet of snowflakes and the sheet of solid objects were presented in a counterbalanced order (i.e., half of the participants evaluated the snowflakes first, while the remaining half evaluated the solid objects first). The second sheet of snowflakes (which portrayed a different set of snowflakes than the first sheet) was given at the end of the experiment to assess the reliability of participants' snowflake selections. Participants were also asked to indicate the state or country in which they grew up and to identify their gender.

Participants

A total of 204 Western Kentucky University students, faculty, and staff with normal or corrected-to-normal vision (average visual acuity measured at 40 cm was -

0.08 LogMAR, log minimum angle of resolution; a logMAR value of zero indicates normal visual acuity, while negative and positive values indicate better than normal and worse than normal acuity, respectively) participated in the study. Written consent was given by all prior to participation in the experiment. The experiment was approved by the Western Kentucky University Institutional Review Board.

Results

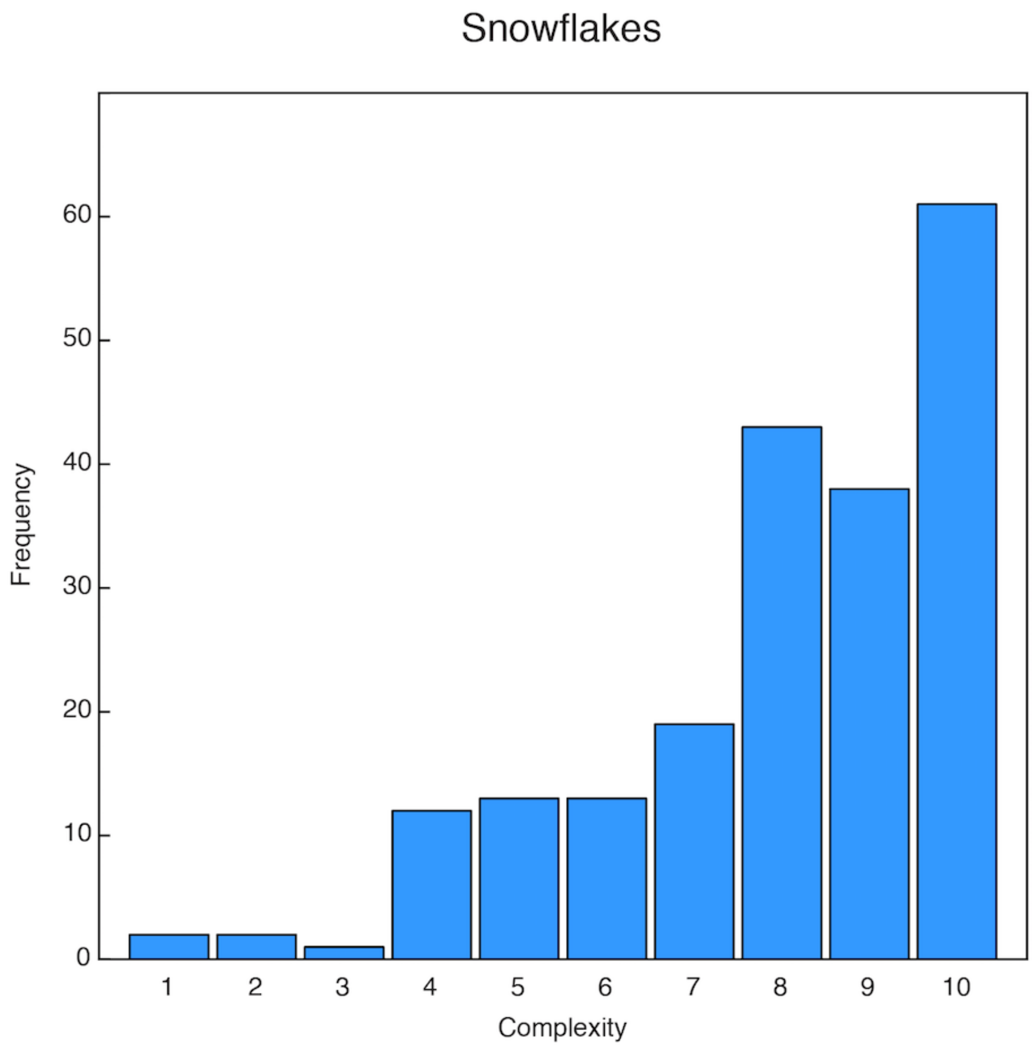

Figure 4. Overall results for the snowflake stimuli. This graph plots the aesthetic preferences of 204 participants. The simplest snowflakes possess a complexity of 1, while the most complex possess a complexity of 10. Note that approximately 30 percent of the participants (*N* = 61) found the stimuli with the highest complexity to be the most beautiful.

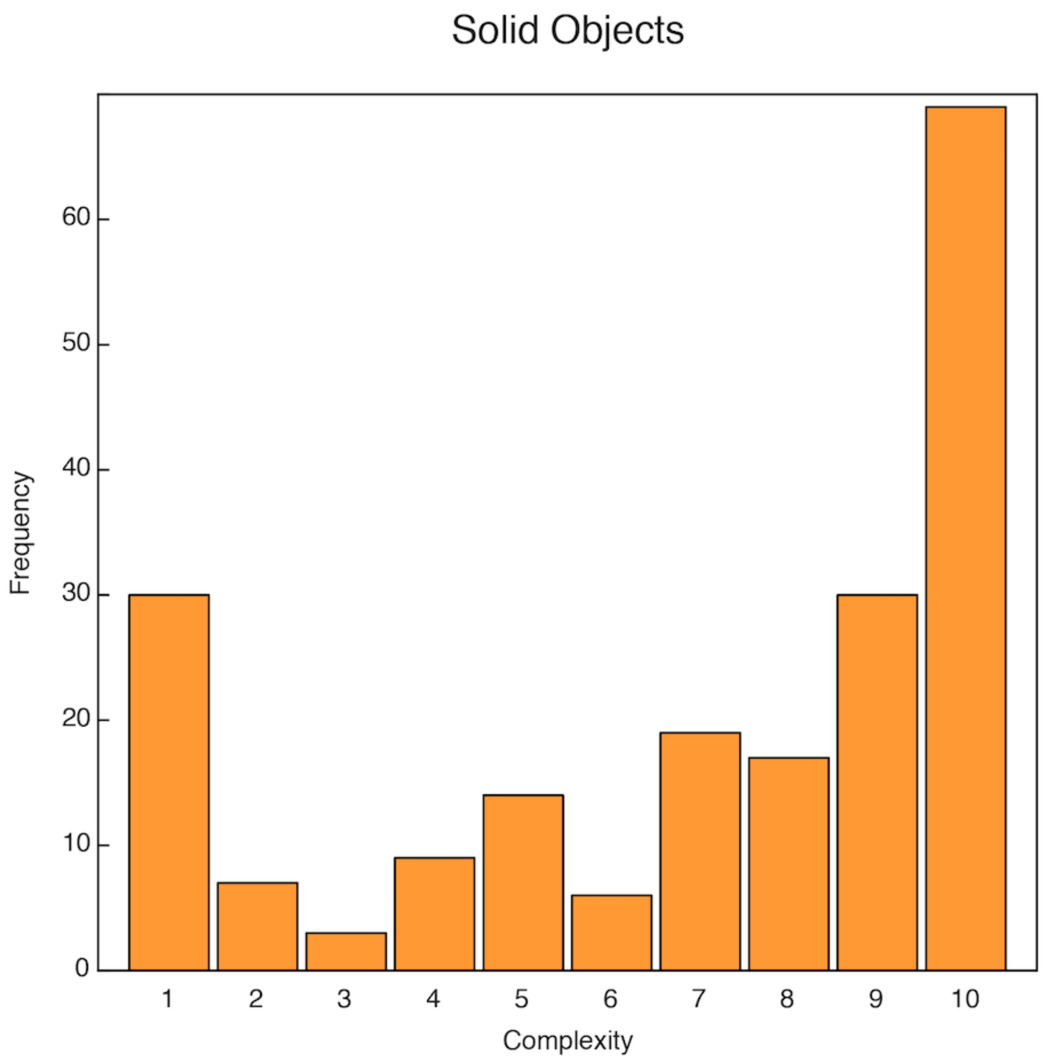

Figure 5. Overall results for the solid object stimuli. This graph plots the aesthetic preferences of 204 participants. The simplest solid objects possess a complexity of 1, while the most complex possess a complexity of 10. Note that about one third of the participants (*N* = 69) found the stimuli with the highest complexity to be the most beautiful.

The results for the snowflake and solid object stimuli are shown in Figures 4 and 5, respectively. The frequencies of the snowflakes and solid objects chosen as the most beautiful are plotted as a function of stimulus complexity. As can be seen in

Figure 4, the more complex the snowflake was, the more frequently it was chosen as the most beautiful. The simpler snowflakes (the three lowest complexity levels) were almost never selected. The solid objects with the highest complexity (see Figure 5) were most frequently chosen as the most beautiful followed by the least complex solid objects (a bimodal distribution), as was previously observed by Phillips et al. (2010). Chi-square analyses demonstrated that the solid object ($\chi^2(9) = 167.67$, $p < .000001$) and snowflake frequency distributions ($\chi^2(9) = 181.59$, $p < .000001$) were not uniform; the effect of complexity was therefore significant. The patterns of results obtained for the snowflakes and solid objects possess both similarities and differences. As can be seen by comparing Figures 4 and 5, participants frequently perceived both the highly complex snowflakes and the highly complex solid objects to be the most beautiful; thus it is no surprise that a contingency correlation (a nonparametric measure of correlation, see Siegel, 1956, p. 196) revealed that there was a significant relationship between the perceived beauty of snowflakes and the perceived beauty of solid objects ($C = 0.614$, $p < .002$). Figure 6 plots a two-dimensional histogram of the participants' first snowflake selections and their solid object selections. An inspection of this plot (Figure 6) clearly shows "islands" where participants preferred snowflakes and solid objects of different complexities (e.g., four participants chose a snowflake with complexity level 4 and a solid object with complexity level 8 as the most beautiful). The most extreme difference occurred for those participants ($N = 12$, the island at the bottom-right in Figure 6) who found the most complex snowflakes to be most beautiful, but who simultaneously found the simplest solid objects (the most spherical) to be most beautiful. A chi-square analysis demonstrated that there was a significant overall difference between the snowflake and solid object distributions ($\chi^2(9) = 83.1$, $p <$ .000001).

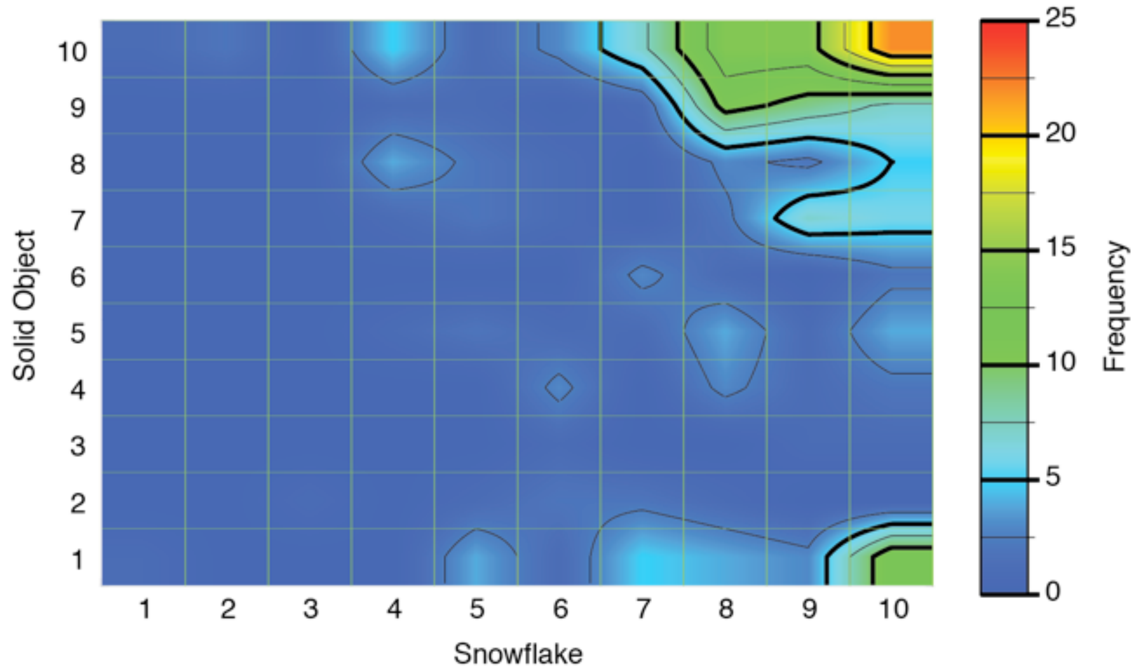

Figure 6. Each cell in this two-dimensional histogram indicates the number of participants who found that combination of experimental stimuli to be the most beautiful (e.g., consider the cell at the bottom right: 12 participants found the most complex snowflakes to be most beautiful, but simultaneously found the simplest solid objects to be most beautiful).

The reliability of the participants' snowflake selections is shown in Figure 7. The participants' second snowflake selections were subtracted from their first snowflake selections; the absolute value of this difference was plotted as their reliability (i.e., consistency of choice across different sets of snowflake images). As can be seen in Figure 7, the majority of the participants (104 out of 204) selected two snowflakes that either had the same level of complexity or differed by one level (e.g., a participant first selected a snowflake of level 5 complexity and then selected another snowflake with level 6 complexity). On average, the participants selected snowflakes that differed in complexity by 1.9 levels, so they were reliable in their judgments across different stimulus sets.

Effect of culture on aesthetic judgments of snowflakes was assessed by dividing participants' places of origin into three regions, which included the northern United States (states located above a latitude of 36 and half degrees North), southern United States (states located below a latitude of 36 and a half degrees North), or outside the United States. A chi-square was then calculated to determine whether the different regions' frequency distributions of participants' snowflake selections were significantly different. The effect of culture on the relationship between snowflake complexity and aesthetic judgments was not significant ($\chi^2(18) = 20.10$, $p > .05$).

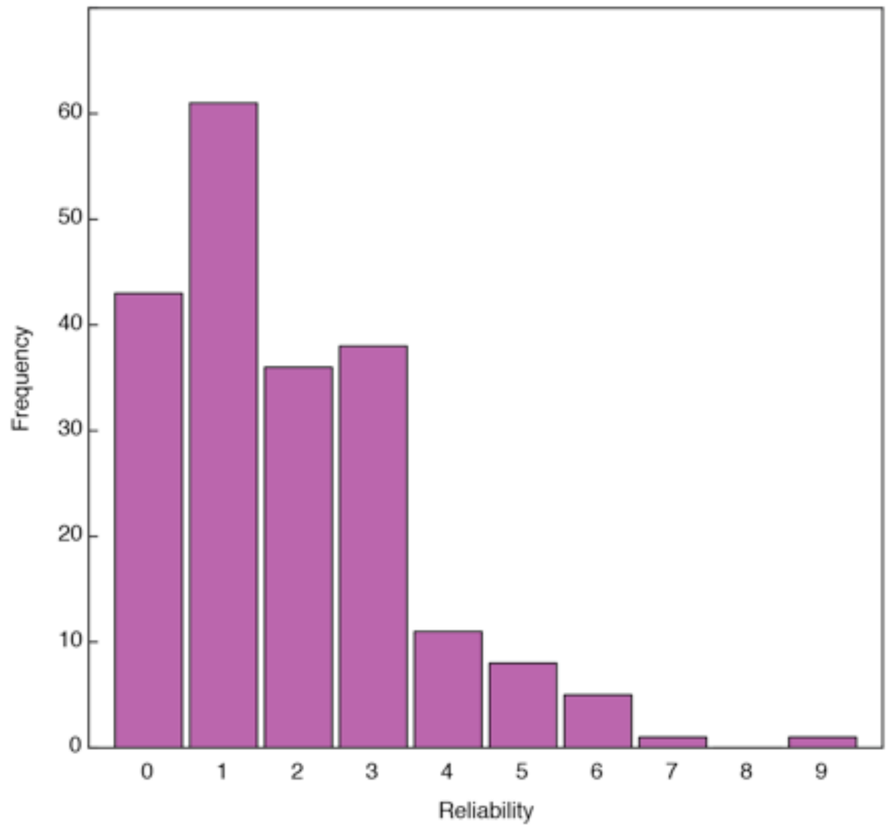

Figure 7. The consistency of participants' snowflake selections across repeated assessments. Reliability is defined as the absolute value of the difference in complexity of the two snowflakes that were selected as being most beautiful. The most reliable participants (reliability value of zero) initially selected a snowflake with a particular complexity level from one set of stimuli and selected another snowflake from a different set that possessed that same level of complexity. The least reliable participants ($N = 2$) selected as most beautiful a level 1 snowflake from one stimulus set and a level 10 snowflake from a different stimulus set.

Discussion

The current experiment was conducted in order to determine the relationship between beauty and complexity. Silhouettes of natural snowflakes and computer-generated, three-dimensional, solid objects with varying complexities were judged on the basis of their aesthetic appeal. The pattern of results for the snowflakes indicated that as complexity increases, perceived beauty also increases (see Figure 4). This approximately linear pattern is unlike the inverted-U pattern hypothesized by Berlyne (1970): moderately complex snowflakes were not perceived to be the most beautiful. The pattern observed for the solid objects was the opposite of that described in Berlyne's theory: this U-shaped pattern demonstrates that the most complex and the least complex objects were perceived to be the most beautiful (see Figure 5). The different patterns of results for snowflakes and solid objects suggest that the relationship between beauty and complexity is stimulus-dependent.

Snowflakes are not the only stimulus set whose relationship with complexity does not align with Berlyne's (1970) hypothesis. Highly complex silhouettes of buildings were also rated as more aesthetically pleasant than those with low or moderate complexities (Heath et al., 2000). Tinio and Leder (2009) presented participants with two-dimensional patterns of polygonal shapes and they assigned the highest beauty ratings to the patterns that were both highly complex and symmetrical (the snowflake stimuli used in the current experiment also had a high degree of symmetry). Nadal et al. (2010) conducted an experiment in which participants found highly complex representational images (e.g., photographs of natural landscapes) to be beautiful. The snowflake silhouettes used in the current experiment were derived from photographs of natural snowflakes (Bentley, 2006). Past researchers have found that highly complex images depicting natural environments (Nadal et al., 2010), silhouettes (Heath et al., 2000), and symmetric, two-dimensional geometric patterns (Tinio & Leder, 2009) were found to be very beautiful. Considering that the snowflake stimuli fall into each of these categories, it is not surprising that the observed relationship between complexity and aesthetic appeal was approximately linear.

Similar to the snowflakes, the most complex solid objects were found to be very beautiful. However, so were the least complex solid objects. It is important to note that the current results for the solid objects replicated findings from a previous experiment by Phillips et al. (2010), so this U-shaped pattern (exact opposite of Berlyne's 1970 hypothesis) is consistent for the solid objects. Taylor, Spehar, Donkelaar, and Hagerhall (2011) also discovered a pattern that was dissimilar to that hypothesized by Berlyne. Participants were presented with Jackson Pollack paintings, computer-generated fractals, and natural landscape fractals. The computer-generated fractals that were rated as very beautiful possessed a low to moderate complexity (i.e., fractal dimensions range from 1 to 2, and 1.3 - 1.5 was the optimal level of fractal complexity for aesthetic appeal). Evidently, it is not just simple solid objects that are perceived to be beautiful, but fractal patterns as well.

There was no significant effect of culture on the relationship between perceived beauty and complexity for the snowflake stimuli. Highly complex snowflakes were perceived to be the most beautiful by the majority of participants from the northern United States, southern United States, and outside the United States. The lack of an observed effect of culture was especially surprising due to the diverse nature of the group of participants from outside the U.S. (e.g., places of origin included Afghanistan, Australia, Brazil, Germany, Nigeria, Thailand, etc.). However, upon examination of Figure 8, it is easy to see that the same pattern emerged between complexity and aesthetic judgments of snowflakes for participants from each region. It is important to note that even though the sample sizes of participants from each region differed (e.g., the northern U.S. sample was more than four times larger than the sample of participants whose place of origin was outside the U.S.), the simple snowflakes were still rarely selected and the largest percentage of each sample all perceived the most complex snowflakes to be the most beautiful.

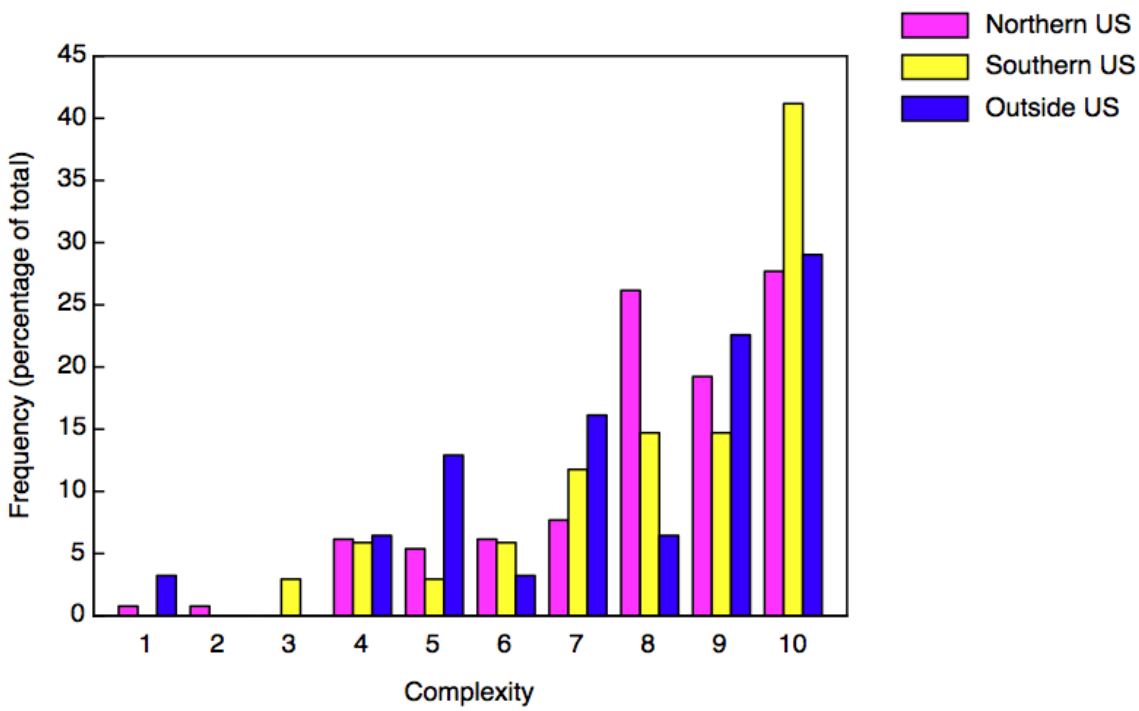

Figure 8. Overall results for the snowflake stimuli based on place of origin. The frequency of snowflake selections is plotted as a percentage of the total number of participants from each region. For example, snowflakes with a level 9 complexity were chosen to be the most beautiful by approximately 19% of participants from the northern U.S., 15% from the southern U.S., and 23% from outside the U.S.

Conclusions

As snowflake complexity increases, perceived beauty increases as well. Highly complex and very simple solid objects are perceived to be most beautiful as opposed to objects with moderate complexity. Culture has no effect on the aesthetic judgments of snowflakes. The nature of the relationship between perceived beauty and complexity is stimulus-dependent.

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Appendix

WKU

INSTITUTIONAL REVIEW BOARD
OFFICE OF RESEARCH INTEGRITY

DATE:	December 8, 2014
TO:	Olivia Adkins
FROM:	Western Kentucky University (WKU) IRB
PROJECT TITLE:	[691506-1] Human Visual Aesthetics
REFERENCE #:	IRB 15-240
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	December 8, 2014
EXPIRATION DATE:	December 8, 2015
REVIEW TYPE:	Expedited Review

Thank you for your submission of New Project materials for this project. The Western Kentucky University (WKU) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a *signed* consent form. Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All UNANTICIPATED PROBLEMS involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of December 8, 2015.

Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Paul Mooney at (270) 745-2129 or irb@wku.edu. Please include your project title and reference number in all correspondence with this committee.