Visualizing Aesthetics across Two Centuries

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Abstract

Empirical aesthetics has traditionally been associated with two central research questions: how the mind assigns value to various stimuli via the senses (*aesthetic liking*), and how it represents and responds specifically to art objects (*art experience*). These questions resonate with how the word *aesthetic* is commonly defined, as both relating to a general concern with *beauty* on the one hand, or the outputs of particular *art* movements or artists, on the other. Recently though, researchers have debated whether these two phenomena share enough in common to warrant being collapsed together into a single field of study. Other foundational questions, such as whether aesthetics should remain fixated on possibly antiquated concepts such as beauty, or whether art objects are special in some way, also form part of these discussions. As the field considers its proper objects of study, it is worth asking how particular questions came to be associated with aesthetics in the first place and how they are associated today. Using a quantitative historical approach, we conducted Google Ngram analyses over a large corpus of books spanning two centuries (1800-2000). By tracing the frequency of “big questions” about *art* and *beauty*, and probing how the term *aesthetic* appears in relation to other concepts, we provide empirical evidence showing how the focus of aesthetics has changed over time. Specifically, our data show that during the early parts of the nineteenth century aesthetics was dominated by the question of “sensuous beauty”, only to then, around 1900, become overwhelmingly preoccupied with the question of “art experience.” We also show how the focus of particular affective and evaluative concepts related to aesthetics similarly change over this period. While Ngram analyses cannot speak to the root causes of these historical changes, we interpret the results with respect to contemporary art movements and scientific debates. Understanding how aesthetics is
used over time can cast light on the ways current work is being conceived and pursued.
In recent years the scientific study of aesthetics has witnessed an internal debate regarding what counts as its proper subject matter. Historically, empirical aesthetics and neuroaesthetics have been associated with research on both art and beauty. In Chatterjee’s (2011) words this is because the term aesthetics is understood “broadly to encompass the perception, production, and response to art, as well as interactions with objects and scenes that evoke an intense feeling, often of pleasure” (p. 53; our italics). A bibliometric analysis of more than 20,000 scientific papers published between 1970 and 2018 under the heading of “aesthetics” confirms that this dual nature is quite real (Anglada-Tort & Skov, 2019): keywords used most frequently to tag aesthetics research included “art”, “architecture”, and “music” (art), as well as “beauty”, “perception”, and “dental implants” (beauty) (Table 1).

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<th>Keyword</th>
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<td>Aesthetics</td>
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<td>Esthetics</td>
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<tr>
<td>Music</td>
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Table 1. List of the ten most frequently used keywords in aesthetics papers published between 1970-2018. Data reproduced from Anglada-Tort & Skov, 2019. TP=Total publications.

Many researchers, though, have questioned whether problems associated with art and problems associated with beauty or sensory liking really form one, coherent research program (Brown & Dissanayake, 2009; Pearce et al., 2016; Skov & Nadal, 2019b). First and foremost, it has been observed that sensory liking and art experience are two very different mental phenomena that involve distinct neurobiological processes and mechanisms (Brown & Dissanayake, 2009; Nadal & Pearce, 2011; Brattico & Pearce, 2013; Skov & Nadal, 2019b). Secondly, failure to distinguish them as separate scientific questions risks conflating one phenomenon with the other. For instance, as noted by Pearce and colleagues (2016), if the study of how beauty arises is limited to the consideration of art objects only it will unfairly leave out a host of non-art situations and stimuli that also elicit beauty. Similarly, if we reduce the experience of art to the artwork’s capacity to conjure feelings of beauty, the vast majority of psychological processes that happens in our encounter with artworks is neglected wholesale. Moreover, as has been argued recently by Skov and Nadal (2018; 2019a; 2019b) assumptions about what art is, inherited from philosophical aesthetics, often lead researchers in empirical aesthetics to conceive of “aesthetic” responses to art objects in idiosyncratic ways, not readily compatible with current understandings of human neurobiology. As a consequence, some researchers have argued that empirical aesthetics and neuroaesthetics must make a clear distinction between (1) an aesthetics of beauty and liking – the study of what makes us like or dislike sensory objects as a general phenomenon irrespective of whether the object is
a natural kind, artwork, or functional artifact, and (2) an aesthetics of *art experience* – the study of any psychological process that arises when engaging with an artwork, beyond beauty or liking (Figure 1). Other researchers, though, wish to retain the intimate relation between beauty, liking, and art experience (e.g., Carbon, 2018, 2019; Pelowski et al., 2017, 2018; Menninghaus et al., 2017).

**Figure 1.** Graphic illustration of how the study of aesthetic liking and the study of art relate to each other. (Adapted from Pearce and colleagues, 2016). The figure captures the fact that, while the psychological phenomena of aesthetic liking and art experience share some psychological and neurobiological processes and mechanisms, for the most part they rely on different systems and mechanisms. Research into aesthetic liking and art experience is therefore not concerned with entirely overlapping problems, and cannot be considered identical research enterprises. See also the argument advanced in Skov & Nadal (2019b).
Here, we will not concern ourselves with the rights or wrongs of this discussion, but instead consider the question of how aesthetics has come to signify both the study of beauty and the study of art. We propose that a partial answer to this question can be found in the convoluted history of “aesthetics”, which, over time, has become associated with the concepts of beauty and art, despite not originally designating the specific study of either. As most will know, the term aesthetics was first introduced into the philosophical literature by Alexander Gottlieb Baumgarten in a 1735 university thesis (Baumgarten, 1735/1954). Baumgarten coined the word from the Greek adjective aisthetikos which can be translated as “for perception of the senses”, “perceptive”, or “I perceive with my senses” (Reiss, 1994; Wessel, Jr., 1972). His aim was to use the word to name a new branch of philosophical inquiry, centered on a topic he called sensous cognition: “Aesthetics, as the theory of the liberal arts, lower-level epistemology, the art of thinking finely or beautifully, and the art of analogical reasoning, is the science of sensuous cognition” (Baumgarten, 1750-1758/2007, §1). Sensuous cognition, to Baumgarten, designated all aspects of “lower-level epistemology” (gnoseologia inferior), knowledge gained from sensory experience, in contrast to logic, the science of gnoseologia superior (Wessel, Jr., 1972; Allesch, 2018). While the question of why a sensory impression is deemed “fine” or “beautiful” would certainly be one example of sensuous cognition, Baumgarten’s new field of inquiry was not limited to this question. Similarly, whereas Baumgarten often used artworks as examples of sensory objects able to elicit “lower-level” judgments, he did not see aesthetics as specifically about art objects. Rather, in Baumgarten’s original conception aesthetics was considered a general
science, addressing questions pertaining to “sensuous cognition” that go beyond beauty and art (Allesch, 2018; Reiss, 1994; Tateo, 2018; Wessel, Jr., 1972).

The process of associating aesthetics specifically with the study of beauty and art experience began with the generation of philosophers that followed Baumgarten. These philosophers were quick to adopt Baumgarten’s new term, but did not embrace his specific conception of what aesthetics ought to be. With the exception of Kant, Baumgarten’s vision of aesthetics as a general study of sensory cognition, linked to perception rather than to reason, was never adopted by future scholars, even as they eagerly embraced the new name (Allesch, 2018). Instead, Baumgarten’s writings on “thinking beautifully” were re-interpreted as a more limited question of sensory taste, in line with the work by contemporary British philosophers (Kivy, 2003), just as Baumgarten’s discussion of poetry as a privileged form of “sensory object” was adopted by later philosophers concerned with establishing artworks as a sui generis ontological category (Kristeller, 1952; Carroll, 2008).

The primary historical scene for this reconceptualization of Baumgarten’s original ideas is the nineteenth century. Most of the ideas that have come to define the modern understanding of what aesthetics is, and what aesthetics as a field ought to investigate, have their origin in writings published during the nineteenth century. While the nineteenth century marks the period where aesthetics becomes institutionalized as an academic discipline in its own right (Beardsley, 1975; Smith, 1997), the historical trajectory of how aesthetics becomes established as a modern discipline, with a focus on aesthetic liking and art experience, is not as well understood. Historians (e.g., Munro, 1962) have suggested that aesthetics, in the early parts of the nineteenth century, was first conceived primarily as a study of beauty and
aesthetic liking, only to then, around 1900, increasingly become re-conceptualized as a study of art experiences. As Munro (1962) writes:

“Among art critics, historians, and philosophers who aspire to scientific method or objective scholarship, the terms "beautiful" and "beauty" have fallen into some disfavor in recent years. Until World War I, many books and articles appeared with titles such as "The Sense of Beauty," "The Psychology of Beauty," and "The Philosophy of the Beautiful." To define "the beautiful" correctly, and give a true account of its nature and criteria, was commonly regarded as the sole or central task of aesthetics. As a branch of philosophy, aesthetics was defined as "the philosophy of beauty." The tendency in recent aesthetics to avoid these words has been marked and notable. The concept no longer holds a central, preeminent position in aesthetics as a whole. In periodicals and bibliographies of aesthetics and criticism, it seldom appears, and when used is often intended in a derisive way, as in references to "Beauty with a capital B." Some of the reasons are obvious. Aesthetics has been developing rapidly along scientific, naturalistic lines in the past half-century. It has come to include allgemeine Kunstwissenschaft or the general science of art, which attempts a synthesis of factual information concerning the arts and related modes of experience and behavior from all available sources, including psychology, cultural history, and the social sciences.” (Munro, 1962, p. 262.)
Such historical analyses are necessarily based in subjective interpretation of the written record. While not diminishing the obvious value of such traditional approaches, in order to understand the way aesthetics was established it would also be beneficial to investigate the historical record in a quantitative way. For example, examining when key words appear in the record, their frequency of use at different time points, and their relation to other terms, can help illustrate when concepts and ideas associated with aesthetics take hold, become prominent, and how their importance changes over time. One way such quantitative analysis can be accomplished is through the use of Google Ngram analysis (Michel et al., 2011). Google Ngram analysis makes it possible to probe a large corpus of English language books spanning centuries. Data regarding frequency of use, historical change, and the relationship between words, can then be visualized as statistical figures.

In the present paper we used Ngram analysis to trace the frequency of “big questions” regarding art and beauty over the last two centuries. Furthermore, we examined how the term aesthetic appears in relation to other concepts using a quasi-experimental approach, providing empirical evidence to show how the focus of aesthetics slowly changed during the nineteenth century, shifting emphasis from sensuous beauty to that of art experience. These analyses were motivated by our interest in better understanding the historical trajectories of the two central preoccupations of modern scientific aesthetics (aesthetic liking and art experience). But we also believe they help current empirical aesthetics better understand the conceptual foundations of contemporary scientific aesthetics: how ideas inherent to questions of beauty, pleasure, and liking, as well as art, meaning, and experience, combine to form the edifice of aesthetics, and how these terms have changed their relation to each other over time.
Method

To explore relations between beauty, art and aesthetics, we used the Google Ngram Viewer (https://books.google.com/ngrams) to visualize historical changes in the use of “big questions” about art and beauty, and the frequency of terms associated with aesthetic. The Ngram Viewer is a free, user-friendly online tool for visualizing the relative frequencies of words and short phrases in millions of published books over a specified time period. To do so, it tallies the number of occurrences for a particular n-gram (words, abbreviations, numbers, etc., of a specified n of 1-5) over a collection of as many as 15 million books published between 1500 and 2008. While the promise of a new field of “culturonomics” (Michel et al., 2011) has not yet fully materialized, the Ngram Viewer remains a valuable research tool in its potential for “quick-and-dirty heuristic analysis” (Chumtong & Kaldewey, 2017). Google Ngram analysis, by no means a replacement for qualitative historical methods, provides a practical quantitative complement to more traditional interpretative approaches. The results of such analyses may lend quantitative support for existing theories. As with many “big data” methods, despite the reductionist limitations of any such approach (counting changes in word frequency associations is not the same as interpreting changes in meaning), the bird’s eye view Ngram analyses provide may be useful for mapping rough trends in conceptual change across history.

When using the Ngram Viewer, several limitations and biases that are hard-wired into the corpora should also be kept in mind. For example, despite using normalization methods to account for increasing numbers of publications in modern years, there are significantly fewer entries for early centuries (1500-1800) as
compared to later ones (1800-2000). Also, automated scanning methods have introduced systematic errors for some antiquated text forms and part-of-speech tags are imperfect (Younes & Reips, 2019). Notably for the present study, there is a bias in the English Ngram corpus towards scientific literature (Pechenick et al. 2015). For an analysis such as the present one which aims at delineating trends in scientific concepts this may be considered a strength rather than a limitation (Chumtong & Kaldewey, 2017). However, the scientific bias itself begins near 1900 so, on the one hand, caution may be necessary in interpreting the significance of trends that shift around this time point, while on the other, this bias may reflect a larger cultural trend itself that is more a feature than a bug.

The present study limits its analysis to book publications beginning in the year 1800 (when the Google Book corpus becomes sufficiently large to support principled comparisons) and ending in the year 2000 (because books published between 2001-2008 are still being added to corpus) (Younes & Reips, 2019). To explore relations between beauty, art, and the aesthetic over the last two centuries we first (1) probe the corpus to observe relative frequencies for “big questions” about art and beauty (e.g., “what is art” vs. “what is beauty”) and determine if there is a relation between such grossly different philosophically-minded questions expressed in plain language with the trajectory of the term aesthetic in English. Second (2) we performed “wildcard rank analyses” (see below) probing nouns modified by the term aesthetic in order to observe how significant concepts associated with the term trend across time (e.g., aesthetic sense vs. aesthetic experience). Last, we (3) made principled comparisons of additional terms/concepts collected from the wildcard analyses to visualize more fine-grained comparative trends that are of particular interest to the present study (e.g.,
observing trends among concepts associated with “affective” aspects of the aesthetic like feeling and pleasure and “evaluative” ones like taste and judgment).

All analyses in the current study use the English (2012) corpus. The books contained in this corpus are “predominantly in the English language” and “published in any country.” It is currently the most general and up to date English language corpus available for Google Ngram analyses (About Ngram Viewer, 2013). Wherever raw data are analyzed statistically they are also depicted visually. Raw data were extracted from the Ngram Viewer using a publicly available Python script designed for this purpose (https://github.com/Bookworm-project).

Results

1. “Big Questions” about Aesthetics: From Beauty to Art

What is truth? What is love? What is beauty? Philosophical questions framed in this manner may seem clichéd by modern academic standards. However, they are clichés for a reason. Such “big questions” represent a common form for phrasing fundamental philosophical concerns in plain language. The frequency with which distinct questions in this form appear in published books can serve as an intuitive index and “quick-and-dirty heuristic” (Chumtong & Kaldewey, 2017) for visualizing the relative popularity of broad philosophical trends over a given time period.

Figure 2A presents smoothed data depicting the frequency of the 3-grams, what is art and what is beauty in proportion to frequency of all what is 2-grams for
the years 1800-2000. (Search string: [what is art/what is, what is beautiful/what is]. The “/” operator divides the expression on the left by the expression on the right.) We used the same smoothing formula employed by the Ngram viewer where for smoothing=3, each year average = ([n-3, n-2, n-1, n, n+1, n+2, n+3]/7). A visual inspection of the smoothed data in 2A clearly indicates a steady increase for what is art and decrease for what is beauty questions. These observations are supported by analyses performed on the raw data (visualized in 2B). The mean frequency of the 3-gram what is art increases 353% between the 19th and 20th centuries as compared to a -13% decrease for what is beauty for the same period. (See Table 2.)

![Figure 2](image_url)

**Figure 2. From What is Beauty to What is Art, 1800-2000.** A. Smoothed data indicate increasing frequency for big “what is” ontological questions about the nature of art while the frequency of matched ontological questions about beauty decrease over the same period. B. Raw data showing linear regression line for frequency of what is art (black) and beauty (gray) predicted by year (1800-2000).
The frequency of occurrences for the phrase *what is art* appears to increase around the year 1850. A search for 1-gram *aesthetic* between 1800-2000 shows a very similar trajectory; entering the corpus around 1850 and rising at a similar rate. The relation between frequencies of *what is art* questions and *aesthetic* across time is supported by the significant positive correlation between these Ngram frequencies over time ($r = 0.80, p<.001$). The relation between *what is art* questions and the term *aesthetic* stands in contrast to the gradual decline in complementary questions about *beauty* over the same period and the significant negative correlation ($r = -0.21, p=.001$).

**Figure 3. (Left)** Raw frequency of the 1-gram *aesthetic* from 1800-2000. **(Right)** Correlations between “big” questions about *art* or *beauty*, and *aesthetic* over the same period.

Displayed in Figure 4A are analogous smoothed results for the 3-grams *is it art* and *is it beautiful*. The mean frequency of *is it art* questions show a 444% increase between 19th and 20th centuries at a scale comparable to that for *what is art*. *Is it beautiful* questions show a significantly higher mean frequency relative to complementary questions about *art* only for the 19th century, but show only a modest
increase of 62% in mean frequency between centuries. A visible downward trend for 
*is it beautiful* 3-grams begins around the year 1950, leveling off around 1970.

Correlations with the 1-gram *aesthetic* over the same range resonate with these percentage changes (*is it art*: \( r = 0.73, p < 0.001 \); *is it beautiful*: \( r = 0.19, p < 0.01 \)).

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**Figure 4. From *Is it Beautiful* to *Is it Art*, 1800-2000.** A. Smoothed data indicate increasing frequency for “is it?” questions about the nature of art while the frequency of matched questions about beauty are relatively greater in the 18\(^{th}\) century. B. Raw data showing linear regression line for frequency of *is it art* (black) and *beautiful* (gray) questions predicted by year (1800-2000).

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<tr>
<th></th>
<th>( r_{aesthetic} )</th>
<th>Mfreq(^{19th})</th>
<th>Mfreq(^{20th})</th>
<th>Diff</th>
<th>% change</th>
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<tr>
<td><strong>what is art</strong></td>
<td>.800**</td>
<td>0.00000366</td>
<td>0.0001659</td>
<td>0.0001292</td>
<td>353%</td>
</tr>
<tr>
<td><strong>what is beauty</strong></td>
<td>-.214**</td>
<td>0.0001301</td>
<td>0.0001138</td>
<td>-.0000163</td>
<td>-13%</td>
</tr>
<tr>
<td><strong>is it art</strong></td>
<td>.734**</td>
<td>0.0000280</td>
<td>0.0001524</td>
<td>0.0001243</td>
<td>444%</td>
</tr>
<tr>
<td><strong>is it beautiful</strong></td>
<td>.192**</td>
<td>0.0000889</td>
<td>0.0001434</td>
<td>0.0000549</td>
<td>62%</td>
</tr>
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Ngram searches can also be run in a manner that is agnostic to hypotheses, allowing one to perform quasi-experiments. Within the Ngram Viewer, a “wildcard” can be indicated in place of a word in a 2 or 3-gram. This will display the top ten substitutions for that word in the context of a specific Ngram. One can also specify the part of speech for the wildcard using part of speech tags (_NOUN, _VERB, _ADJ, etc.). Using this method, the top ten replacements are computed for a defined time range yielding separate replacement results for distinct year ranges. This is useful because it allows one to visualize the rank-popularity for certain phrases during specified epochs.

For example, one can observe the most frequent “big questions” over the nineteenth century by using the wild card search “what is * _NOUN”. This search yields the ten most frequent noun completions for the “what is NOUN” 3-gram. Figure 5A displays the results of this query for the time period spanning 1800-1900. In the present context, the results of this wild card search also serve to validate the current methods, showing that “what is NOUN” formulations do indeed capture “big” philosophical concerns over time. For comparison, Figure 5B shows the relative frequencies for what is art, what is beauty, what is truth, and what is love over the same time period.
Figure 5. “Big Questions” Wildcard Search 1800-1900. (A) Between 1800-1900, man, life, truth, God, death, matter, law, love, duty, and sin were the ten most frequent completions in “what is NOUN” 3-grams. In (B) frequencies for what is art and what is beauty are displayed with frequencies for what is truth and what is love for comparison.

2. Associations with Aesthetics

We were interested in providing empirical evidence to show how the focus of aesthetics has changed over time. We used wildcard rank analyses exploring nouns modified by the term “aesthetic” in order to determine significant concepts and trends across time. Because these searches are agnostic to hypotheses they may serve as quasi-experiments to further interrogate how trends in “big questions” about art and beauty relate to changing uses of the aesthetic concept over time.
To do this, we used another advanced tool included in the Ngram Viewer which allows one to analyze words with respect to “dependencies” rather than exact sequences. For example, one can visualize “how often tasty modifies dessert” including counts of “tasty frozen dessert, crunchy tasty dessert, tasty yet expensive dessert, and all the other instances in which the word tasty is applied to dessert” (About Ngram Viewer, 2013).

Dependencies can be combined with part of speech wildcards allowing for queries like, “*_NOUN=>aesthetics” and “*_NOUN=>aesthetic”. This creates a ranked list of nouns modified by the term to the right of the arrow for a defined year range, visualizing the frequencies of significant dependencies across time. For example, Figure 6 displays the top ten nouns modified by aesthetics from 1800-2000. Note that art is the second-ranked word modified by aesthetics over 1800-2000 in the wildcard search. Beauty is unranked so was included here manually for comparison.)

Figure 6. Ngram Viewer Wildcard Search Output. Top ten nouns (blue) and beauty (red) modified by aesthetics from 1800-2000. (Search string: *_NOUN=>aesthetics, beauty=>aesthetics, Smoothing=0).
The *_NOUN=>aesthetic query described by Figure 6 would tally instances of *aesthetics of art*, and *aesthetics and art* among other dependencies. And although this analysis further supports the general idea that aesthetics has increasingly become focused on art more than beauty, for present purposes we were more interested in characterizing the extent to which the rise of the *aesthetic* is related to other meaningful concepts.

Queries for *_NOUN=>aesthetic* for 4 epochs over the period 1800-2000 yields the rank-ordered results displayed in Table 3. A dependency search in this case would be sensitive to 2-grams like “aesthetic pleasure” and 3-grams like “aesthetic of pleasure”. From these analyses it is possible to notice certain trends. Note that because Ngram wildcard analyses are sensitive to the specified range (e.g., *_NOUN=>aesthetic* queries restricted to distinct 1, 5, 10, 50, or 200-year ranges will yield distinct results) the epoch-defined queries used here are useful for identifying important concepts within more restricted time periods that do not necessarily retain a high rank when queried over larger time periods (e.g., *culture* is the top ranked *_NOUN=>aesthetic* completion 1800-1850 but is not ranked in the top 10 when queried from 1800-2000).

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</tr>
<tr>
<td>1</td>
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<td>sense</td>
<td>experience</td>
<td>experience</td>
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<td>character</td>
<td>pleasure</td>
<td>theory</td>
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Table 3. Top-ranked nouns modified by aesthetic (*_NOUN=>aesthetic) over four epochs, 1800-2000. In cases where a lexeme appeared twice (e.g. because of pluralization), the less frequent listing was removed and subsequent terms were shifted up in rank. Most frequent, or primary completions for each epoch are underlined.

By capturing important terms associated with aesthetic in earlier and later epochs, we can then chart their frequency over longer historical periods (Figures 7-9). We looked at a selection of dependencies identified in Table 3, restricting the range of visualizations and analyses for these concepts to the years 1850-2000. This range reflects the period when aesthetic entered the corpus and became relatively frequent. From these four top-ten lists, we were interested in three main clusters for further analyses: Primary concepts (culture, sense, experience) were dependency completions (*_NOUN=>aesthetic) ranked first for a particular epoch (Figure 7); the Affective (pleasure, emotion, feeling) and Evaluative (taste, judgment, value) terms were selected from the rank lists to further probe how the frequency of particular dependencies of interest changed over time (Figures 8 and 9).
2A. Primary Concepts: From Sense to Experience

Primary concepts (Figure 7) are defined here as the top ranked NOUN-aesthetic dependencies across four epochs. As such, between 1850-2000, overall trends suggest an age of aesthetic sense followed by one of experience. Although culture was the top ranked aesthetic dependency from 1800-1850, aesthetic was most frequently used to refer to a sense by the end of the nineteenth century (while beauty still reigned), up until approximately 1920. However, by the end of the twentieth century, aesthetic most frequently appears with respect to an experience (as art becomes the focus of aesthetic inquiry). Frequency changes calculated between early (1851-1900) and late (1951-2000) epochs support visual inspection with culture showing a small decrease in frequency (-67%), sense a small increase (73%), and experience showing a massive inflation (5500%) between early and late epochs. Note that this increase in the frequency of the aesthetic experience reflects its virtual nonexistence prior to 1900 as much as it does its meteoric rise observed around this same time.

As each term (culture, sense, experience) necessarily appears with aesthetic by feature of the query *_NOUN=>aesthetic, the magnitude of the correlation between frequencies of each dependency and that of the 1-gram aesthetic over time can provide an index of how a particular concept relates to the steady rise of the aesthetic from 1850-2000. For primary concepts, correlations between each dependency and the 1-gram aesthetic are consistent with percentage changes between epochs (culture: r = -0.44, p < 0.001; sense: r = 0.45, p < 0.001, experience: r = 0.85, p < 0.001).
Figure 7. Primary Concepts. A. Smoothed data indicate a consistent increase in frequency for the *aesthetic experience* beginning at the beginning of the 20th century.
B. Raw data showing linear regression line for frequency of *aesthetic experience* (black), *sense* (double gray), and *culture* (solid gray) predicted by year (1850-2000).

2B. Affective and Evaluative Concepts

Because the Ngram Viewer is designed to display relative frequencies, it can be useful to isolate particular, related terms from wildcard searches (*_NOUN=>aesthetic*) that appear at frequencies similar to one another in order to explore relative changes at a finer grain over time. We observed that certain top-ten ranked words modified by *aesthetic*, like *feeling*, *emotion*, and *pleasure* relate to affective concepts generally relevant to the notion of aesthetic liking (Skov, 2019). Visual inspection of Figure 8 shows increasing frequencies for all three affective concepts with respect to their dependency on *aesthetic* from the year 1850, although the rates of increase and absolute frequencies for *feeling* and *pleasure* are greater as compared to *emotion*. However, as frequencies for *aesthetic pleasure* continue to rise
into the 20th century, feeling begins to fall before the mark of the new century.

Differences between concepts are not entirely reflected in the percentage-change scores between early and late epochs (feeling: -38%, emotion: +150%, pleasure: +143%). Correlations with each dependency and the 1-gram aesthetic, however, do reflect observable differences where the association with aesthetic (1850-2000) for feeling < emotion < pleasure (feeling: r = -0.04, p > 0.05; emotion: r = 0.35, p < 0.001; pleasure: r = 0.76, p < 0.001) with pleasure showing the largest absolute frequency as compared to other affective concepts by the end of the twentieth century.

Figure 8. Affective Concepts. A. Smoothed data indicate a consistent increase in frequency for aesthetic pleasure consistent with the ascent of aesthetic around 1850. B. Raw data showing linear regression line for frequency of aesthetic pleasure (black), emotion (double gray), and feeling (solid gray) predicted by year (1850-2000).

Similarly, the *_NOUN=>aesthetic wildcard-dependency searches across epochs also find a strong relation between aesthetics and concepts of evaluation, including top-ten ranked words modified by aesthetic such as taste, judgment, and value. Figure 9 shows changes in frequency for aesthetic taste, judgment, and value.
between 1850-2000. While the absolute frequency of taste is slightly higher than that for judgment or value from ~1850-1890, the frequency of aesthetic value continues to rise into the 20th century. Percentage-change scores between early and late epochs (taste: 0%, judgment: +225%, value: +560%) might suggest a move from a more automatic process of evaluation (like taste) to more a more deliberative process (like judgment) as it relates to art objects with identifiable properties (or value).

Correlations with each dependency and the 1-gram aesthetic are consistent with relative percentage changes (taste: $r = 0.16$, $p < 0.01$; judgment: $r = 0.76$, $p < 0.001$; value: $r = 0.88$, $p < 0.001$).

![Figure 9. Evaluative Concepts. A. Smoothed data indicate a consistent increase in frequency for aesthetic value. B. Raw data showing linear regression line for frequency of aesthetic value (black), judgment (double gray), and taste (solid gray) predicted by year (1850-2000).](image)

<table>
<thead>
<tr>
<th>culture</th>
<th>$R_{aesthetic}$</th>
<th>Mfreq1851-1900</th>
<th>Mfreq1951-2000</th>
<th>diff</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.435***</td>
<td>0.00000009</td>
<td>0.00000003</td>
<td>-0.0000006</td>
<td>-67%</td>
</tr>
</tbody>
</table>
Table 4. Summary of results for Part 2: Associations with Aesthetics.

<table>
<thead>
<tr>
<th>PRIMARY</th>
<th>sense</th>
<th>0.454**</th>
<th>0.00000011</th>
<th>0.00000019</th>
<th>0.00000008</th>
<th>73%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>experience</td>
<td>0.854**</td>
<td>0.00000001</td>
<td>0.00000056</td>
<td>0.00000055</td>
<td>5500%</td>
</tr>
<tr>
<td></td>
<td>feeling</td>
<td>-0.042(ns)</td>
<td>0.00000008</td>
<td>0.00000005</td>
<td>-0.00000003</td>
<td>-38%</td>
</tr>
<tr>
<td>AFFECTIVE</td>
<td>emotion</td>
<td>0.347**</td>
<td>0.00000002</td>
<td>0.00000005</td>
<td>0.00000003</td>
<td>150%</td>
</tr>
<tr>
<td></td>
<td>pleasure</td>
<td>0.764**</td>
<td>0.00000007</td>
<td>0.00000017</td>
<td>0.00000010</td>
<td>143%</td>
</tr>
<tr>
<td></td>
<td>taste</td>
<td>0.161*</td>
<td>0.00000006</td>
<td>0.00000006</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>EVALUATIVE</td>
<td>judgment</td>
<td>0.761**</td>
<td>0.00000004</td>
<td>0.00000013</td>
<td>0.00000009</td>
<td>225%</td>
</tr>
<tr>
<td></td>
<td>value</td>
<td>0.879**</td>
<td>0.00000005</td>
<td>0.00000033</td>
<td>0.00000028</td>
<td>560%</td>
</tr>
</tbody>
</table>

Figure 10. Summary of correlations for primary concepts, and selected affective and evaluative wildcard dependencies and aesthetic.

Discussion
The word *aesthetic* as commonly defined, relates to both a general concern with *beauty* (e.g., “aesthetic surgery”) or the outputs and conventions of a particular *art* movement or artist (e.g., “Bauhaus aesthetic”). Contemporary scientific aesthetics is dominated by two similar questions: (1) How does the human brain assign value to sensory stimuli (*aesthetic liking*), and (2) How does it represent and respond to art objects (*art experience*)? By virtue of historical contingency these two questions are today often assumed to be related, if not simply identical, even if they appear to address rather different psychological phenomena (Pearce et al., 2016; Skov & Nadal, 2019b). Other foundational questions, such as the extent to which aesthetics should remain focused on concepts such as beauty, or whether art objects are special in some way, are extensions of this divide. The current paper uses a quantitative approach to examine how these two kinds of questions are associated with the study of aesthetics across time, and what other concepts appear to change in frequency in relation to this history of ideas. We used Google’s Ngram analysis to survey millions of books published in English from 1800-2000, examining how the relation between beauty, art, and related aesthetic concepts have changed over time.

*From an “Age of Beauty” to an “Age of Art”*

We first show that nineteenth century writings on aesthetics are associated with a gradual increase in “big questions” about the nature of art and art objecthood. This increase in art-focused inquiry is accompanied by a simultaneous decrease in an analogous index for beauty over the same time period. The historical turn from beauty to art also appears to be linked with shifting associations between “the aesthetic” and other particular concepts: an “Age of Beauty” is associated with an “aesthetic sense”
while an “Age of Art” is associated with the “aesthetic experience.” Furthermore, historical periods associated with either beauty or art may also shed light on how approaches to aesthetics with respect to affective and evaluative concepts change over time. Thus, our data show that the era of beauty is strongly associated with writings on sense or taste, whereas later periods focused on art adopt a greater preoccupation with more objective epistemologies (i.e., the aesthetic experience while focused on pleasure, is still more demanding of a judgment of some real and measurable value of the art object). It is likely not a coincidence that certain theoretical ideas that combine earlier intuitions about taste with novel interests in mapping objective factors of aesthetic appreciation and artistic ability, such as Burt’s and Eysenck’s notion of aesthetic sensitivity, really started to take off post-1920 (Che, Sun, Gallardo & Nadal, 2018; Corradi et al., 2019).

Specifically, our data suggest that the “Age of Beauty” reigned from 1800 to 1900. As previously observed by Munro (1962), this suggests an inflection point, where aesthetics shifts from being mainly associated with ideas relating to sense and beauty to becoming mainly about experience and art, located early in the twentieth century. Together, our findings lend quantitative support to previous qualitative findings from historical analyses. Both describe a similar trajectory in how thinkers have conceived of aesthetics: an increasing importance accorded to questions of art, and the way “big questions” about beauty and art correlate with shifting interest from an aesthetics of sense to one of experience.

It is of course of great interest why the conception of aesthetics has undergone this specific change. The current data cannot speak to such causes, but it cannot be an accident that aesthetics is accorded a greater emphasis on the questions of what art is, or what an art experience is, at a time in Western history when art acquires a greater
importance as a cultural phenomenon. For example, Shiner (2001) has described how art attains greater significance during the nineteenth century as it allows the emerging bourgeoisie to improve its social status and partake in an expanding leisure economy. We find it likely that, as a corollary to this social change, art increasingly becomes an object of scrutiny, leading to a flurry of debates about what art is, what constitutes “good” or “fine” art, and how to properly consume art (Shiner, 2001). It has been proposed that this re-conceptualization of art is the impetus behind the development of the concept of a special “aesthetic experience”, which, as our data show, takes place during the late nineteenth century (Carroll, 2008; Skov & Nadal, 2019b). Furthermore, because the concept of fine art becomes associated with notions of genius and inspiration, art is increasingly seen as ontologically special, requiring an equally special form of appreciation (Carroll, 2008).

Twenty-first Century Developments

Beyond aesthetic appreciation and reception, other twentieth century developments in the history of aesthetic creation also relate to the shift from beauty-and-sense, to art-and-experience. For example, Dadaism, an influential art movement often credited with subverting conventions of beauty and notions of art-objecthood, began in 1916 continuing through the mid-1920s (Chilvers, 1998). The most notorious and influential Dada artwork, Fountain (1917) by Marcel Duchamp, consists of a “readymade” urinal originally submitted to a New York art exhibition. Inspecting Figures 2 and 4, one sees that “big questions” about what is art that wonder is it beautiful spike around this time. Whereas the spike in art-questions continues upwardly, the spike in beauty-questions is followed by a downward trend
for the remaining years of the twentieth century. (This same period also marks the point at which Ngram frequencies for the “aesthetic experience” surpass those for the “aesthetics sense.”) This leads to another major inflection point, apparent around 1950, where both kinds of “big questions” about art objecthood permanently surpass those about beauty. This point, and subsequent trends further separating frequencies associated with art and beauty, loosely coincides with the imminent ascension of Pop Art, a movement best known for conventionalizing the playful incorporation of “found objects” into artworks; and the later emergence of Conceptual Art, an artform whose very purpose is to question the nature of art and stand against beauty (Chilvers, 1998; Goldie & Schellekens, 2013; Kranjec, 2015). Along these lines, it is also interesting to note that the “aesthetic object” first appears in the “top ten” during the epoch spanning 1951-2000 (see Table 3) as philosophical questions about art objecthood, and what “counts” as an art object, become a central facet of art creation.

While interpreting the present results in the context of large-scale art movements seems reasonable in the present discussion, understanding complex relations between historical trends in aesthetic meaning, art appreciation, and art production (or creativity) may not be straightforward, echoing other challenges in the empirical aesthetics enterprise (Kozbelt, 2017). The general limitations of Google Ngram previously noted (Chumtong & Kaldewey, 2017; Younes & Reips, 2019) are most likely amplified the further one moves away from descriptive analyses of interrelated word frequencies and towards broader interpretations of large-scale cultural trends. It is possible that increased representation of scientific literature in the corpus beginning in the twentieth century explains some of the trends we observe. Yet it is unclear if this bias in the corpus represents one of selection or is better understood as a reflection of a real cultural shift beginning around 1900. Despite these
limitations which are beyond our control, the present method represents a relatively novel and potentially powerful approach for doing quantitative conceptual analysis using Ngrams. The triangular approach employed here (1) starts “big” by asking broad, philosophical first-order questions, then (2) uses quasi-experimental methods to constrain second-order questions, while (3) gradually reducing its object of study for more fine-grained comparative analyses. The primary goal here was to better understand how the *aesthetic* concept is used over time.

*The Use of Historical Analysis in Understanding Contemporary Aesthetics*

If the field of aesthetics can itself be conceptualized as a tool for asking certain kinds of questions about the world, then we can better understand the extent to which that tool’s purpose has changed over time by observing how often scholars aim it at specific kinds of objects and conceptual problems. Quantifying and describing how aesthetics is used to modify other meaningful abstract concepts across hundreds of years can tell us something about what aesthetics is thought to be about at distinct time points. Understanding changes in how the aesthetic concept functions is a way of better understanding what the aesthetic concept means over time. From the point of view of contemporary research, understanding how aesthetics has been formed over time, with respect to the conceptual assumptions it has become associated with, and the scientific questions that are deemed central to its enterprise, cast light on the way current work is being conceived and pursued. We venture the hypothesis that much of the current confusion and debate with respect to what constitutes the true objective of empirical aesthetics (Makin, 2017; Pelowski, 2017, 2018; Carbon, 2018, 2019; Skov & Nadal, 2018, 2019b), and how such topics ought to be approached experimentally
(Kranjec, 2015; Makin, 2017; Carbon, 2018; Skov & Nadal, 2019a), can be traced back to the way one set of “big questions” (*what is beauty?*), associated with certain assumptions and concepts (*aesthetic sense, feeling, taste*), slowly became mixed up with, and replaced by, a very different set of “big questions” (*what is art?*), associated with its own assumptions and concepts (*aesthetic experience, judgment, value*). Whether this mixing up, and change in focus from beauty to art, best represents evidence of beneficial cross-pollination between domains of interest, or a source for conceptual and methodological confusion in framing research questions, will no doubt continue to be a matter of debate in empirical aesthetics. Either way, by providing a window into two hundred years of thinking about aesthetics, the current study shows that modern debates not only borrow much from older ideas and theories, but are deeply embedded in this history.
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References


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