One hundred years of Empirical Aesthetics: Fechner to Berlyne (1876 – 1976)

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Abstract

In this chapter, we review the history of Empirical Aesthetics since its foundation by Fechner in 1876 to Berlyne's New Empirical Aesthetics in the 1970s. We explain why and how Fechner founded the field, and how Wundt and Müller's students continued his work in the early 20th century. In the United States, Empirical Aesthetics flourished as part of American functional psychology at first, and later as part of behaviorists' interest in reward value. The heyday of behaviorism was also a golden age for the development of all sorts of tests for artistic and aesthetic aptitudes. We end the chapter covering the contributions of Gestalt psychology and Berlyne's motivational theory to Empirical Aesthetics.

Keywords: Empirical Aesthetics, Fechner, History, Psychology

1. Fechner: the quest for the mathematical relation between mind and matter

Gustav Theodor Fechner (1801-1887), was born in Lusatia when it was still part of the Holy Roman Empire. Steam locomotives, bicycles, working telegraphs, zippers, photography, and phonographic recording had not yet been invented, and Antarctica had not been discovered. Fechner lived through the dissolution of the old Empire, the establishment of the German Confederation, the revolutions of 1848, the Seven Weeks War of 1866 between Prussia and Austria, and the founding of the German Empire in 1871. It was the time of the German Romantic composers Ludwig van Beethoven, Franz Schubert, and Richard Wagner, the Romantic painters Caspar David Friedrich and Philipp Otto Runge, and the Naturalist painters Adolph Menzel and Karl von Piloty.

Fechner studied medicine but never practiced, turning instead to physics. He began translating French chemistry and physics books into German, and later conducted experiments on electricity and magnetism, earning him a professorship of physics at the University of Leipzig. He went on to study subjective color experiences, and eventually physiology and psychology (Boring, 1950; Heidelberger, 2004). In psychology, Fechner is known as the founder of Psychophysics and Empirical Aesthetics. However, the foundational texts of Psychophysics and Empirical Aesthetics amount only to just over 5% of the pages he ever wrote (Scheerer, 1987). He founded Psychophysics and Empirical Aesthetics in the service of his philosophy, and as a means to reconcile his dual loyalty: He had become skilled in, and relied upon, the methods of materialistic science, but he was also a passionate idealist, deeply influenced by the natural philosophies of Lorenz Oken and Friedrich W. J. Schelling (Boring, 1950; Flugel, 1933). His way through this contradiction between materialism and idealism was to

affirm the identity of mind and matter, to argue that they are different aspects of reality, and to seek the laws that govern their relation. To him, the physical and psychical were two manifestations of one and the same: all consciousness had a material correspondent, and all matter—plants, the Earth, and the Universe included—was conscious (Hall, 1912; Heidelberger, 2004).

Fechner was convinced that the relation between the material and conscious aspects of reality could be formulated in exact mathematical terms. But first, he needed to understand the quantitative relation between stimulation and sensation, so he began measuring how relative increases in stimulation led to changes in sensation. Fechner realized that a geometric series of stimulations corresponded to an arithmetic series of sensations: an increase in sensation depended on the ratio of the increase in stimulation to the total stimulation. Thus, the greater the first stimulus, the greater the difference between it and the second in order for them to be discriminated (Boring, 1950; Hall, 1912). For a decade he worked on developing appropriate psychophysical methods and performing experiments on sensory thresholds, culminating in his *Elements of Psychophysics* (Fechner, 1860).

2. The founding of Empirical Aesthetics

Fechner began his investigations into aesthetics around 1840 (C. G. Allesch, 2018; Meischner-Metge, 2010). Between 1865 and 1876, he published several papers and the foundational text of Empirical Aesthetics, *Vorschule der Aesthetik* (Fechner, 1876), translated as *Preschool of Aesthetics* or *Propaedeutics of Aesthetics* (Berlyne, 1971; Jacobsen, 2006; Ortlieb, Kügel, & Carbon, 2020; Vartanian, 2014). Fechner's

goal was to lay the foundations for a fully-fledged system of aesthetics that would eventually unify and articulate general principles of beauty and art. Reflecting the value he placed on empirical knowledge and his conviction that the purpose of thought and action was to attain the greatest possible pleasure, Fechner conceived Empirical Aesthetics as part of general hedonics (Arnheim, 1992): the study of what arouses pleasure and how.

Empirical Aesthetics was to begin “from below”, with the most basic elements and facts of aesthetics, in contrast with philosophical aesthetics, which began “from above”, with general principles that could then be applied to specific cases. Empirical Aesthetics, therefore, should begin with the reasons for liking and disliking particular cases, and explain why specific objects give pleasure or displeasure. These explanations could later be integrated into a set of principles, which would, in turn, coalesce into the comprehensive system of beauty and the arts that Fechner had envisioned.

To achieve this goal, he developed three methods that required collecting and averaging the responses of groups of people (see chapter 3). The *method of choice* required participants to select the most pleasing among a number of alternatives. Using this method, he found that when people were asked to choose among ten rectangles with different ratios, most chose rectangles close to the golden section. The *method of production* required participants to produce pleasing examples of simple shapes or figures. He found, for instance, that when people were asked to move crossbars of different lengths up and down a vertical bar until they found the most pleasing position, most favored the crossbars that were placed $\frac{2}{3}$ of the way up the vertical and $\frac{4}{7}$ or $\frac{5}{9}$ of the vertical's length. The *method of use* consisted in measuring non-purposeful features of commonplace objects, under the assumption that the most common ones were the most pleasing ones. He found, among other things, that the height-width

proportions of game cards, visiting cards, picture frames, and the printed area of book pages were frequently very close to the golden section.

The results of experiments and observations using those methods led Fechner (1871) to a fundamental conclusion: Liking and disliking were determined by the interaction of a *direct* factor and an *associative* factor. The direct factor was the pleasingness or displeasingness produced by the structural object features and their arrangements (e.g, organization, complexity, proportion). The associative factor referred to the knowledge, memories, and past experiences each person brought to the encounter with the object. Liking or disliking was, therefore, not an automatic response to arrangements of object features. To Fechner, they were the result of the meaning or value those features and their arrangements have for each person, depending on their knowledge and past experiences.

Fechner (1871) proposed several principles of aesthetic pleasure. The most basic was that sensory impressions must occur above a certain *threshold* of pleasure. An object cannot be aesthetically pleasing if its features do not reach this threshold. This threshold can be reached and surpassed by the additive effect of several sensory features acting in concert, each of which might not be strong enough alone. This led him to conclude that objects that give rise to aesthetic pleasure are often composite and manifold and, therefore, to formulate the principle of the *union of diverse elements*. If the many features of an object are to pass the pleasure threshold, they should be aligned toward the same end and be harmonious. This line of reasoning led him to formulate additional principles, such as those of *clearness*, *contrast*, or *sequence*.

With the *Vorschule*, Fechner concluded his work in Empirical Aesthetics. He wrote about the topic only once again, to address some criticisms and clarify his principle of association (Fechner, 1878). He devoted the last decade of his life to

rounding off his philosophy and to the research and criticism that had grown around his *Psychophysics*.

3. The pioneers of Empirical Aesthetics

Fechner had no school or students of his own to pursue his vision for Empirical Aesthetics. Psychophysics and Empirical Aesthetics were developed in Wundt and G. E. Müller's laboratories, though severed from their ultimate philosophical purpose, and made to fit the standards of the nascent scientific psychology (Arnheim, 1992). Psychophysics and Empirical Aesthetics were no longer meant to reveal the material and conscious duality of the universe. They became fields of experimental psychology and, therefore, meant to reveal the basic elements of the conscious mind. Wilhelm Wundt (1832-1920) founded the first psychological research laboratory in Leipzig in 1879. Wundt's goal was to turn psychology into an independent science, developing general explanatory laws based on experiment and observation. The task of Psychology, in Wundt's view, was to analyze conscious processes in terms of their basic elements, and to explain how they interact. Georg Elias Müller (1850-1934) became the leading figure in psychophysics after Fechner's death. He undertook a revision and extension of the methods of psychophysics, and placed the Göttingen psychology laboratory almost on a par with Wundt's (Boring, 1950). After Fechner, Empirical Aesthetics was pioneered by Wundt and G. E. Müller's students (Figure 1), including Witmer, Stratton, Meumann, Münsterberg, Martin, and Külpe, and later by their own students.

name a new profession, and he established the world's first psychological clinic in 1896, where he supervised the first generation of clinical psychologists (McReynolds, 1987). He is less known as one of Wundt's first PhD students to continue Fechner's Empirical Aesthetics. Witmer had worked on individual differences in reaction times as James McKeen Cattell's assistant at the University of Pennsylvania, and had hoped to continue his PhD research on that topic. Wundt, however, persuaded him to examine the effects of the proportion of linear figures (crosses, vertical lines divided by dots) and simple forms (triangles, rectangles, and ellipses) on pleasingness judgments. Witmer found that rectangles conforming close to the golden section were the most pleasing. He argued that preferences for rectangles were driven by the balance between *unity* and *diversity*: Whereas squares represent the maximum degree of unity but lack diversity, and very slender rectangles represent the maximum degree of diversity but lack unity, rectangles close to the golden section represent an optimal balance between unity and diversity (Witmer, 1894a, 1894b).

Witmer (1892) conjectured that the pleasing or displeasing effects of proportion owe to the ease or unease of eye movements as they follow the figures' forms.

However, **George Malcom Stratton**'s (1865-1957) early photographic recordings of eye movements showed that this could not be the case. Stratton had also studied with Wundt at Leipzig and had conducted on himself the famous experiments on visual experiences in the absence of retinal image inversion by wearing up-down and left-right inverting glasses for several consecutive days (Stratton, 1897a, 1897b). Stratton's (1902) pioneering eye tracking studies showed that the eyes never moved smoothly, no matter how smooth the line that was followed. Eye movements were jerky, with darting movements (saccades) followed by instants of rest (fixations), creating irregular, dithering, and angular paths. Symmetrical figures did not lead to symmetrical eye

movements, and there was no appreciable difference between the eyes' path when looking at beautiful or ugly forms (Stratton, 1906). He concluded that "Since the eye's movement during the observation of a line or figure is so unlike the form which we perceive and enjoy, it seems illogical to ascribe this enjoyment to the character of the eye's movements to the sensations which arise in this way" (Stratton, 1902, p. 350).

Hugo Münsterberg (1863-1916), founder of applied psychology (Boring, 1950), also studied under Wundt at Leipzig. Later, as head of the Harvard psychological laboratory, he supervised several experiments on the aesthetic appreciation of rhythm in music and poetry (MacDougall, 1903; Stetson, 1903), and symmetry and proportion in visual designs (Angier, 1903; Pfuffer, 1903). Under Münsterberg's supervision, **Edgar Pierce** (1870-1929) completed his PhD thesis on the relation between symmetry and liking. He presented his participants with three lines, two fixed at the extremes and one movable along the horizontal axis in between, and asked them to place the movable one in the most agreeable position. Participants tended to place the line in a position approximately consistent with the golden section. But when the test figure included more fixed lines, participants placed the movable one almost mid-way between the two closest fixed ones, resulting in symmetrical divisions. Regardless of the number of fixed lines, participants said they were striving for stability, which seemed more pleasing to them (Pierce, 1894). After his thesis, Pierce abandoned psychology to manage a hotel. His success allowed him to leave a bequest of over \$800,000 to Harvard's psychology department. Those funds have sponsored the William James lectures, the first of which was given by John Dewey, and published as *Art as Experience* (Dewey, 1934).

Hugo Münsterberg also supervised **Roswell Parker Angier's** (1874-1946) thesis, which built upon Witmer's findings on the golden section. He was critical of the assumption that group averages approximating the golden section corresponded to a

norm of aesthetic pleasingness, while deviations from it were treated as errors. He asked participants to divide horizontal lines at the place they found most pleasing. The proportion averaged across participants was close to the golden section, but only two of the nine participants regularly produced line divisions that corresponded to the golden section (Angier, 1903). This confirmed that the golden section is not a universal aesthetic norm, but rather a mathematical abstraction that results from averaging across participants (Green, 1995). Angier continued to conduct research on the psychology of vision, and was appointed Professor of Psychology at Yale University and Chairman of the Board of the Institute of Psychology, which housed, among others, Robert M. Yerkes' Primate Laboratory.

The founder of Experimental Education, **Ernst Meumann** (1862-1915), also began his career at Wundt's laboratory studying Empirical Aesthetics (Boring, 1950; Stoerring, 1923). Meumann had a broad understanding of Empirical Aesthetics: it should provide psychological explanations for aesthetic production and appreciation, it should establish aesthetic norms, and award art a key place in the history of human civilization (Meumann, 1908, 1919; Stoerring, 1923). One of Meumann's students, **Jakub Segal** (1880-1943), combined introspective and psychophysical methods to study aesthetic appreciation in a series of experiments. He presented participants with straight lines in different orientations, zigzag lines with different periods, and rectangles and triangles of different proportions. Participants were asked to choose the figures that they liked the most, the ones they found moderately pleasing, those that were displeasing, and those that were found indifferent, and to explain the impression that each figure had made on them. Segal found that the figures elicited a broad range of feelings and thoughts in participants. When these thoughts and feelings were clear, the figure pleased, but when they were unclear, the figure displeased (Segal, 1906). The

source of pleasingness was not, therefore, the figures' features, but the suggested thoughts and feelings (Segal, 1905, 1907). The two main classes of personal factors that contributed to shaping these thoughts were people's different personalities, and their moods and dispositions when encountering the object. Segal (1905, 1906) conceived these as "pre-aesthetic" factors, common to all sorts of experiences, and not specific to aesthetic experiences. Segal continued writing and teaching psychological aesthetics as Professor of Experimental Pedagogy at the Free University of Warsaw. However, a disease progressively deprived him of movement and eventually forced him to give up his work and his professorship. Ill, and almost unable to move, Segal was murdered in August 1943 at the Gestapo headquarters on Aleja Szucha, in the Warsaw ghetto (Rieser, 1962; Tatarkiewicz, 1946; Woleński, 2011).

None of Wundt and Müller's students had such a fundamental role and lasting effect on Empirical Aesthetics as **Oswald Külpe** (1862-1915). After he arrived at Würzburg in 1894, he began studying, teaching, and publishing on Empirical Aesthetics. Külpe saw psychology as the science of the facts of experience (Külpe, 1895), and Empirical Aesthetics, therefore, as the science of aesthetic experience. He conceived aesthetic experience as a special sort of receptive state elicited when encountering certain objects (mainly artworks), and aesthetics as the science that studies those objects, the effects, and the value of that receptive state. Aesthetic experiences, however, were not merely due to sensory stimulation, they were the result of the way combinations of sensory elements in space and time lead to perception, judgment, and memory. He proposed three factors that foster aesthetic experiences from sensation (Külpe, 1895): (1) The determinateness of the mental representation of a sensation: the more definitive the effect, the greater the pleasingness. (2) The degree of ease with which a sensation is represented: too easy does not elicit feeling, moderately easy

excites pleasure, and too difficult excites unpleasantness. (3) The relation between the overall representation and that of its constituents: the greater the agreement, the more pleasing. The first of these factors anticipated *fluency theory* (Reber, Schwarz, & Winkielman, 2004), the second anticipated Berlyne's *motivational theory* (Berlyne, 1971), and the third anticipated the *Gestalt's theory* (Arnheim, 1964). In addition to his refinement, systematization, and extension of Fechner's methods and principles (Külpe, 1907, 1921), Külpe had a lasting influence on Empirical Aesthetics through his students, especially those from the United States—Lillien J. Martin and Robert M. Ogden—and in the United Kingdom—Charles W. Valentine and Cyril Burt.

Lillien Jane Martin (1851-1943) spent four years at Göttingen (1894-1898), even though at that time Göttingen University did not accept women as regular students. She became G. E. Müller's assistant, and they worked together on studies on the psychophysics of lifted weights. The resulting monograph she and Müller published (Martin & Müller, 1899) became a classic in psychophysics (Boring, 1950; Stevens & Gardner, 1982). In 1898, Martin obtained a position at Stanford University with Frank Angell to form a two-person department. She was in charge of equipping and running the psychological laboratory and acted as chair during Angell's sabbatical leaves (Stevens & Gardner, 1982). In 1915 she became the first woman to head a Stanford department. She returned to Germany several summers to continue her studies and research with Külpe, at Würzburg (1907), Bonn (1908 and 1912), and Munich (1914). At Külpe's request, she was awarded an honorary Ph.D. by the University of Bonn in 1913 for her contributions to psychology. The award's citation mentioned, in addition to her contributions to psychophysics, her experimental studies of theories of aesthetics and of Fechner's aesthetic laws (Stevens & Gardner, 1982). She used a combination of introspection and several psychophysical methods to investigate people's responses to

comical images taken from newspapers and magazines (Martin, 1905) and, in a thorough examination of Fechner's principles of aesthetics, to investigate people's liking for paintings and simple figures consisting of lines that differed in orientation, length, curvature, and thickness (Martin, 1906). She found support for some of Fechner's aesthetic principles and for some of his conjectures, such as that information about artist and title increases liking for paintings (Martin, 1906, p. 204). But she also found evidence against some of Fechner's principles, such as the principle of contrast: when a liked and disliked figure are presented simultaneously, instead of liking the liked one more, participants liked it less (Martin, 1906, p. 212). In all the experiments she conducted, she found remarkable differences among participants in the extent to which their responses agreed or disagreed with Fechner's principles.

Robert Morris Ogden (1877-1959) graduated at Cornell with a major in psychology and a minor in aesthetics. Titchener, his psychology teacher, encouraged him to study at Würzburg with Külpe, who supervised his Ph.D. on the influence of the rate of reading meaningful and meaningless materials aloud on learning and memory (Dallenbach, 1959; Ogden, 1938). He took up several positions after returning to the United States, including the University of Missouri as Max Meyer's assistant, until he was hired by Cornell in 1916, where he spent the rest of his life. Two of Ogden's contributions to Empirical Aesthetics stand out. First, he was the first and main proponent of Gestalt psychology in the United States, translating Gestalt books into English, and inviting Gestalt psychologists (Koffka, Köhler, and Lewin) as visiting professors. Second, in his *Psychology of Art*, he rendered in psychological terms the basic concepts of aesthetics, and the fundamental elements of music, poetry, and visual art (Ogden, 1938).

After graduating in psychology from Cambridge, **Charles Wilfred Valentine** (1879-1964) spent 1908 at Würzburg studying Külpe's psychological methods (Burt, 1964). Upon his return to the United Kingdom, he used some of Fechner's methods he had learnt with Külpe to study the features underlying children and adults' aesthetic appreciation of musical tones and intervals. He found, for instance, that most people feel that the apparent pitch of an interval corresponds to the higher note, that the order in which people prefer intervals does not match the order of the degree of consonance, that, before the age of nine, children show no preference for concords over discords, that children over 12 prefer musical intervals in a similar order to adults, and that intelligence has no impact on preference for musical intervals (Myers & Valentine, 1914; Valentine, 1913, 1914). His most significant contribution to Empirical Aesthetics was perhaps his *Introduction to the Experimental Psychology of Beauty* (Valentine, 1913), which covered virtually every experiment conducted on preferences for color, shape, symmetry, and complex images to that date, and also on preferences for music in the second edition (Valentine, 1919). He updated and rewrote the whole book, and included two chapters on the appreciation of poetry shortly before dying (Valentine, 1962).

4. American functional Empirical Aesthetics

Wundt's structural psychological tradition focused on the *what* and *how* of consciousness: on what takes place in conscious sensation, feeling and thinking, and how it takes place. American psychology, in contrast, focused on the *why* of conscious processes, their function. Led by John Dewey and James Rowland Angell at the

University of Chicago, American functional psychology aimed to understand the causes of conscious phenomena, and more specifically, to understand how the mind enables the adaptation of humans to their environment. At Columbia, James McKeen Cattell's functional psychology focused on the traits or capacities that confer people greater or lesser advantages in their adaptation to their environment. Cattell was convinced that a practical psychology required understanding individual differences in these capacities. He invented the term *mental test*, and promoted mental testing (Boring, 1950).

Cattell offered **Edward Lee Thorndike** (1874-1949) a position at Columbia to study associative processes in animals. Thorndike is renowned for his puzzle boxes for cats, dogs, and chicks. The animals were confined in the boxes but could escape by operating certain mechanisms in the box. He observed that the animals learnt by trial and error and accidental success. The success of a correct movement caused such a movement to be learnt. From these experiments he derived his principles of *effect* and *exercise*. Cattell encouraged Thorndike to apply to children and adolescents the techniques he had developed for animals, paving the way to his contributions to educational psychology and mental testing. As part of his work on mental tests, Thorndike developed a means of measuring the merit of children's drawings based on psychophysical rules of scaling (Thorndike, 1913, 1924). He also developed a measure of aesthetic appreciation, the goal of which was to produce standardized measurement instruments that could be used to test people's ability for aesthetic appreciation in the context of instruction and vocational guidance (Thorndike, 1916, 1917). He published measures of agreement (Thorndike, 1916) and disagreement (Thorndike, 1917) of people's liking for simple figures, such as rectangles, crosses, and triangles of different proportions, differently spaced lines, and couplet endings. The measure of agreement could be used to establish degrees of aesthetic merit, and the deviations from this

consensus could be understood as the measure of people's ability for aesthetic appreciation.

Although, at the time, Columbia did not admit women to graduate studies, **Margaret Floy Washburn** (1871-1939) was given permission to register in Cattell's classes as a listener (Washburn, 1932). Cattell, a lifelong supporter of equal opportunities, treated her as a regular student and demanded from her the same as from men (Dallenbach, 1940; Washburn, 1932). In 1892, he encouraged her to pursue her Ph.D. studies at Cornell, where Titchener had just arrived to take over the psychological laboratory, becoming the first woman ever to be awarded a doctorate in psychology. That same year, she was elected to the America Psychological Association, and became the president in 1921 (Dallenbach, 1940; Pillsbury, 1940). Her book on comparative psychology *The Animal Mind*, initially published in 1908 and kept up to date through the 4th edition of 1936, was considered the most thorough text on the topic for decades (Boring, 1950; Pillsbury, 1940).

Her contributions to Empirical Aesthetics included studies on the conditions that influenced the pleasingness of colors, on individual differences in the strength of aesthetic pleasure, and a test of aesthetic judgment. Her work on color preferences showed that judgments of saturated colors were more extreme than the judgments of tints, and that these were more extreme than the shades, but that her participants found the tints generally more pleasing than the shades, and these more pleasing than the saturated colors (Washburn, 1911), that fatigue reduced the pleasingness judgments, especially in the case of highly saturated colors (Norris, Twiss, & Washburn, 1911), that smaller areas were more pleasing than larger areas in the case of saturated colors, and that larger areas were more pleasing than smaller areas in the case of tints and shades (D. Clark, Goodell, & Washburn, 1911), that over the course of a minute of looking at

saturated colors they became less pleasing but tints and shades became more pleasing (Crawford & Washburn, 1911), and that spoken negative adjectives about colors (e.g., “faded”, “crude”) reduced the judged pleasingness of those colors and positive adjectives (e.g., “warm”, “delicate”) increased their judged pleasingness (Powelson & Washburn, 1913).

Washburn also studied individual differences in the strength of pleasingness or unpleasantness reactions. She introduced the concept of *affective sensitiveness* to distinguish between people who strongly tended to like and dislike materials of different sorts, including tones, colors, and speech sounds, from people who were relatively indifferent to those materials (Babbitt, Woods, & Washburn, 1915; H. Clark, Quackenbush, & Washburn, 1913). Affective sensitiveness was not fixed; it depended on certain circumstances and conditions, such as fatigue, which tends to reduce affective sensitiveness (Robbins, Smith, & Washburn, 1915). Poets were more affectively sensitive than science students, suggesting that affective sensitiveness was related to experience and expertise in art and aesthetics (Washburn, Hatt, & Holt, 1923).

Finally, Washburn also produced one of the first tests of aesthetic judgment of pictures. Cattell and colleagues (1918) selected 36 reproductions of artworks that ranged from technically excellent to the popular and sentimental, and asked three experts to rank the images in the order they would like to own the originals (leaving financial value aside). They calculated the average rank for each of the 36 artworks to form a composite expert rank. They then asked 144 participants to perform the same ranking, and to answer whether they had studied drawing or painting, whether they had studied art history, whether they had visited many galleries, and whether they were especially interested in images. The average correlation between experts’ ranking and participants with artistic training was .49, participants who were artistically naïve was -

.11, and untrained participants but interested in images was .43. Cattell and colleagues (1918) concluded that even an interest in pictures was enough to lead participants to approximate expert's ranking.

Kate Gordon (1878-1963) enrolled at the University of Chicago in 1896, where she obtained her Ph.D. with a dissertation on *The Psychology of Meaning*, which provided a unified psychological account of economic, logical, ethical, and aesthetic value. The common denominator of value across these domains was, she argued, agreeableness, which she conceived as pure sensuous pleasure. The psychological measure of value, she proposed, was the intensity of this pleasant feeling and the complexity and relations of the valued content (Gordon, 1903). Gordon was awarded an Association of Collegiate Alumnae (ACA) European fellowship to study at Würzburg with Külpe during the winter of 1903-1904. After returning to the United States, she began her studies in Empirical Aesthetics on the topic of color. Her study of the aesthetics of color aimed to understand the reason for placing some colors toward the center of an area and others toward the outside (Gordon, 1912). She created two basic designs that enabled some colors to be arranged closer to the center and others closer to the edge, while at the same time being appealing to the participants. Figure 2 shows the variations of these designs. She only combined two colors at a time: blue and yellow, red and green, blue and red, green and yellow, blue and green, and red and yellow. For all the color combinations, the preferred figure was the one that had the brighter color in the center and the darker color at the edges (Figure 2 III). Moreover, the greater the disparity in brightness between the colors in each pair, the greater the preference for the arrangement in Figure 2 III (Gordon, 1912).

Figure 2. Color arrangements in Gordon's (1912) study. Black triangles indicate darker colors and lined triangles indicate brighter colors. Reproduced from Gordon, K. (1912). Esthetics of simple color arrangements. *Psychological Review*, 19, 352–363. The content is in the public domain.

Gordon continued her studies of color combinations using 50 colored plates of oriental rugs. She asked three people to arrange the cards in order of aesthetic merit, and she averaged their scores. She then alternatively placed each of the plates in two series, creating approximately similar ranges of aesthetic merit. She asked 207 participants to arrange each set in order of their beauty. The results clearly indicated a vast variation in the arrangements. Without exception, every rug was placed close to the top by some participants and close to the bottom by others. She retested 38 of the participants three or more weeks later, and found an extraordinary consistency in judgments. Thus,

participants were highly consistent with their own beauty rankings, but inconsistent with the group rankings (Gordon, 1923).

Later, she examined the impact of pleasantness and unpleasantness on memory. Her goal was to ascertain whether pleasant or unpleasant sensations are more likely to be recalled. She selected 10 odors that ranged widely in affective quality, and asked her participants to smell the contents while she told them their names. She also prepared 10 similar bottles that contained only water, but she also said the name of one of the odors while participants smelled these. Two hundred participants were asked to remember the names of the odors because they would subsequently be asked to point to them, and then to arrange the bottles in order of their agreeableness. She found that participants recalled 49% of the names of the odors they had ranked as pleasant, 56% of the names of the odors they ranked as indifferent, and 50% of the names of the odors they ranked as unpleasant. However, their recall was 31% better when the bottles actually contained the odor than when they did not. The correlation between the rank order of agreeableness and the order of successful recall was $-.07$, that is to say, that the likelihood of recalling an odor is not related to its affective value (Gordon, 1925).

5. Empirical Aesthetics in the age of Behaviorism

American functionalism, comparative psychology, and the possibilities of an objective psychology in the image of Russian reflexology, came together in 1913 when John Broadus Watson initiated his quest against introspection (Watson, 1913). Interest in Empirical Aesthetics did not wane during the age of behaviorism. Quite the contrary, empirical studies on aesthetics multiplied between 1920 and 1950. Under the stimulus –

response scheme of behaviorism, a crucial issue was understanding the factors that modulate the affective value of stimuli. The study of the pleasingness of colors, shapes, musical tones, and intervals became a crucial part of understanding why some stimuli were more rewarding than others.

5.1. Empirical Aesthetics of music

A remarkable number of studies during the 1920s and 1930s examined the affective value of musical tones, simultaneous pairs of tones, simple tone sequences, various kinds of resolutions, major and minor modes, consonance and dissonance, and variations in rhythm, the effects of repetition, and the formal elements of music that modulate its expressiveness (Edmonds & Smith, 1923; Farnsworth, 1925, 1926c, 1926a; Guernsey, 1928; Heinlein, 1925, 1928; Hevner, 1935c, 1936; Ortmann, 1928, 1926).

The Empirical Aesthetics of music has its roots in the thought and work of Carl Stumpf. Stumpf had studied with Lotze at Göttingen and had befriended Fechner in Leipzig (Woodward, 2015), where he served as a participant in some of Fechner's experiments on the golden section (Boring, 1950). Stumpf wrote over 50 papers and books on acoustics and several aspects of music, including its evolution, its variations across cultures, the perception of tones, consonance, and dissonance (C. G. Allesch, 2018). Stumpf's work on music was continued by **Max Friedrich Meyer** (1873-1967), who obtained his PhD in Berlin under Stumpf and the physicist Max Planck's supervision (Esper, 1966). Later, at the University of Missouri, he produced the first completely behaviorist version of psychology (Meyer, 1911), two years before Watson's (Pillsbury, 1929). At Missouri, he continued his work on music (Meyer, 1900, 1901), studying the aesthetic effects of final tones, the intonation of musical intervals, and *quartertone* music (Esper, 1966). Meyer's behaviorism had a profound influence on

Albert P. Weiss, one of his students and assistants, who later headed the psychological laboratory at Ohio. It was there, under Weiss' supervision, that **Paul Randolph Farnsworth** (1899-1978) earned his PhD. He who would go on to conduct more than 40 studies on preference for music between 1925 and 1950, and to be the first president of Division 10 of the American Psychological Association, *The Society for the Psychology of Aesthetics, Creativity, and the Arts*.

Farnsworth's (1958) research on music was a blend of the Stumpf – Meyer approach to music and Weiss' social behaviorism: Musical preference was acquired through exposure to the music of the time and culture in which people develop, and should therefore be considered an eminently social phenomenon. Social factors, such as peer pressure and conformity, were the key to understanding musical preferences.

Meyer's (1903) work on preferences for endings had shown that people generally prefer musical endings on the tonic, as they are experienced as complete and reposed. Farnsworth (1925) showed that there is an order of preference for endings on other notes. For instance, when the tonic of a melody is C, people generally prefer endings on G to endings on E, and they generally prefer endings on E, to endings on B flat. But, if exposure to music was a key determinant of preference, as Farnsworth believed, then familiarization and training should have important effects. Indeed, Farnsworth (1926c) showed that preferences for musical endings could be changed in the direction of the least preferred. Familiarization with a particular ending through repetition during the experimental trials increased the sense of completion and repose, even for the endings that initially were least likely to be experienced as reposed and complete: the more often a person hears musical sequences ending in a certain interval from the tonic, the more that person will prefer those endings.

Farnsworth (1926a) also examined whether long-term familiarization through training had an effect on the appreciation of music. He tested whether the root position and first inversion of chords create a sense of repose and completeness, whether the second inversion creates a sense of instability, and whether the relation between the tone arrangement and aesthetic appreciation is modulated by training. He found that participants who had no musical training did not express a substantial difference in their experience of repose and completeness for the three arrangements, although they tended to favor the root position and second inversion. For participants with musical training, the more training they had, the more complete and reposed they found the first inversion, and less complete and reposed they found the second, with the root position occupying an intermediate position. He concluded from these and other studies that habit, experience, and training were the fundamental determinants of musical preferences (Farnsworth, 1926b).

Kate Hevner (1898-1984) published more than a dozen papers on preferences for musical, visual, and speech stimuli between 1930 and 1940. Her academic background was very different to Farnsworth's. Hevner obtained her Masters in Psychology at Columbia, and earned her PhD at Chicago on different methods for constructing psychological scales under the supervision of Louis Leon Thurstone (Hevner, 1930a). At Chicago, J. R. Angell had been a prolific Ph.D. supervisor. Among his students, besides the behaviorist J. B. Watson, were Harvey A. Carr and Walter V. Bingham. Carr succeeded J. R. Angell as professor of psychology and became the major representative of functional psychology (Boring, 1950). Bingham conducted several experiments on the generation of the experience of melody from discrete tones and proposed a motor theory of melody (Bingham, 1910), and reviewed studies on the comparison of music across cultures (Bingham, 1914). He established the first

department of applied psychology in the United States, the Division of Applied Psychology at Carnegie Institute of Technology in Pittsburgh, where he hired Thurstone, who had been assistant to Thomas Edison and later also studied with J. R. Angell at Chicago (Horst, 1955). Thurstone returned to Chicago in 1924 as an Associate Professor with Carr, and began teaching and researching attitude scaling, psychological measurement, and their applications to different situations (Gulliksen, 1968).

Thus, Kate Hevner had joined America's foremost functional psychology department with an emphasis in developing systems for psychological measurement. She studied the appreciation of painting—testing, for instance, the effects of different kinds of information on the pleasantness of paintings (Hevner & Mueller, 1939)—and of poetry—examining, for instance, the contributions of vowel sounds, consonant sounds, meter, and voice inflection on the affective responses to poems (Hevner, 1937a). But it is to our understanding of the appreciation of music that she contributed to most. Her first studies aimed to develop a test of music appreciation that included actual musical compositions as items, and not merely simple tones or tone sequences. The initial version of the test (Hevner, 1930b) included 25 items. Each item consisted of a fragment of classical music played in its original and three altered forms: eliminated, which omitted many of the tones creating a bare version, elaborated, which introduced additional tones, and changed, which altered the phrasing or melody. Participants had to say which version of each item they had liked best or found most pleasing, and which the second best. Two points were given when the original was liked best, and one when it was liked second best. She found that several of the items lacked diagnostic value, and that having to listen to four versions for each item meant that performance relied excessively on memory. A simpler version of the test that included only two alternatives for each item proved to be easier for participants, to have psychometric properties as

good as the version with 4 alternatives, and to produce results in agreement with tests for basic musical abilities, such as consonance discrimination or memory for tones (Hevner, 1931).

She later turned to studying the elements of music that contribute to its expressiveness. Some of those elements suggest motion, such as tempo and rhythm, while other elements suggest tension, such as melody (pitch rises and falls, and variations around the tonic), harmony (consonance and dissonance, smoothness and harshness, position, degree, successions of harmony), and mode (Hevner, 1935b). In her studies on musical expressiveness she manipulated each of these elements in isolation, while controlling the rest. Hevner (1935c), for instance, presented participants with two identical versions of each composition, except for the fact that one was written in the major and the other in minor mode. She found that the pieces in major mode were considered happier, brighter, lighter, more triumphant, more exalting, and more satisfying than the pieces in minor mode, which were considered darker, sadder, gloomier, more frustrating, more melancholic, and more depressing, and that participants who had more musical training and ability discriminated the modes better.

In a later series of studies, she built on this method, and developed stimuli that varied solely in mode, rhythm, consonance, or direction of melody (Hevner, 1936). Her results confirmed that the major mode is experienced as happy, graceful, and playful, whereas the minor mode is experienced as sad, sentimental, and dreamy. She also found that firm rhythms are experienced as vigorous and dignified, compared to flowing rhythms, that are experienced as happy, graceful and tender, that complex and dissonant harmonies are experienced as exciting and agitating, while simple and consonant harmonies are experienced as happy, serene and lyrical, and that rising or falling melodies do not lead to notable differences in the expressiveness of music.

5.2. Empirical Aesthetics of visual forms, color, and art

During this period, researchers also conducted many studies on preferences for simple lines and forms, on the consistency and variability in people's responses to paintings, on the effects of different kinds of information on the appreciation of paintings, and on the effect of age and development, among other issues (Barnhart, 1940; Brighthouse, 1939b, 1939a; Cahalan, 1939; Clair, 1939; Davis, 1933; Farnsworth, 1932; Hevner, 1935a; Hevner & Mueller, 1939; Israeli, 1928; Lundholm, 1921; Poffenberger & Barrows, 1924; Voss, 1939; Weber, 1931; Yokoyama, 1921).

Preference for color was an especially prolific research area. Dozens of studies investigated general patterns in color preferences, individual differences in color preferences and their relation to personality, the effects of age and development, and cross-cultural agreement, among other topics (e.g., (G. J. v. Allesch, 1925; Garth, 1924; Garth & Collado, 1929; Geissler, 1917; Katz & Breed, 1922; Michaels, 1924; Staples, 1931; Stratton, 1923; Washburn, Haight, & Regensburg, 1921). Chandler's (1934) review of the literature on color preferences highlighted the enormous differences among people. He concluded that "the human organism is not so constituted as to react in a definitive way to each color or each combination of colors. No color is invariably and unconditionally pleasant or unpleasant, exciting or soothing, dignified or tawdry. Such effects depend on a multitude of factors that vary with individual observers and changing circumstances" (Chandler, 1934, pp. 114-115). Eysenck (1941b), however, found considerable agreement between participants in their color preferences. People preferred, in descending order: blue, red, green, violet, yellow and orange (orange and yellow, in the case of men). Eysenck (1941b) attributed the discrepancies among the different studies that had struck Chandler (1934) to the differences in the materials that

had been used (some had used colored papers, others dyed textiles, others colored lights, and others colored crayons). However, he observed that many studies had included among their colors some similar to the ones he had used (highly saturated blue, red, green, violet, orange, and yellow). He averaged the rank for each of these colors in 16 studies that had studied color preferences in Caucasians and in 10 that had studied color preferences in people from other ethnic backgrounds. The average correlation for the preference order was .82 in the first case, and .72 in the latter, and .96 together. These results led Eysenck (1941b) to conclude that the agreement among people in color preferences was, in actual fact, extremely high.

5.3. The psychology of pleasantness and unpleasantness

A major goal during the period of behaviorism was to understand the affective value of stimuli: why and how do organisms experience some stimuli as pleasant and others as unpleasant? This was the question **John Gilbert Beebe-Center** (1897-1958) set out to answer. Beebe-Center began studying psychology at Harvard in 1915, but he left for Europe during World War I to join the American Ambulance Service. Later, he served with the French army at Verdun and Aisne, and as a civilian French interpreter for the Intelligence Section of the Chief of Staff of the American Expeditionary Forces (Boring, 1959). After the war, he returned to Harvard, where he graduated in psychology, and obtained his Ph.D. in 1926, with a thesis showing that the affective value of odors depended on the pleasantness and unpleasantness of preceding odors (Beebe-Center, 1929b). He spent a year as a post-doctoral Fellow at the psychology department of the University of Berlin, where the Gestalt movement was thriving under the leadership of Max Wertheimer and Wolfgang Köhler, as we will see in section 7.

Beebe-Center (1932) conceived pleasantness and unpleasantness as the positive and negative values of the hedonic tone of experience. He distinguished three classes of variables that have an influence on hedonic tone: features of the primary stimuli (the object that is experienced as pleasant or unpleasant), features of secondary stimuli (other present and past stimuli), and variables that characterize the person's physiological and affective states, experience, goals, and mindset. Thus, the pleasantness or unpleasantness we experience from an object is a function of the object's sensory qualities, of the spatial and temporal context surrounding the experienced object, and of our past, current, and desired states. The first class of variables explains why there is a certain degree of agreement among people in what they find pleasant and unpleasant, whereas the second and third classes of variables explain why there is a certain degree of disagreement among people, and even within people at different times.

His studies on the first class of variables led him to the conviction that certain features confer objects a general hedonic value: stimuli have the potential to influence hedonic tone in the same way in all people. In practice, the influence of general hedonic value on hedonic tone can be masked by the effects of the other two classes of variables. However, by applying the same mathematical treatment that enabled separating a general factor of intelligence from specific factors, Beebe-Center (1929a) believed that the general hedonic values of stimuli could be isolated from the influence of contextual and personal influences. Such statistical procedures led to a measure of the extent to which stimuli please people, that is to say, their general hedonic value, and a measure of agreement between each person's judgments and the objects' general hedonic value, that is to say, each person's aesthetic sensitivity.

His studies on secondary stimuli were greatly influenced by the principles of Gestalt he had learnt in Berlin, and focused mainly on the effects of hedonic contrast. Beebe-Center (1929b) examined how the affective value of a set of stimuli changed as a result of the repeated presentation of extreme cases in the set. He showed that the affective value of odors in a set was greater after repeated presentations of the 10 most unpleasant ones than after repeated presentations of the 10 most pleasant ones. From these and similar results, he deduced the law of *mass contrast*: “The hedonic tone corresponding to a present stimulus varies conversely with the sum of hedonic tone corresponding to those past stimuli whose phenomenal correlates constitute with the phenomenal correlate of the present stimulus a unitary temporal group” (Beebe-Center, 1932, p. 229).

How is the experience of hedonic tone produced? Beebe-Center (1930) believed there was evidence that the experience of pleasantness and unpleasantness owed to specific processes that took place in the sensory organs. He argued that hedonic tone was a result of sensory processes because of the many parallels in the processes underlying sensory experience and hedonic tone. Both, for instance, are influenced by contrast and expectation. Moreover, he believed that the sensory processes that gave rise to hedonic tone were of a special class because they could produce, under certain circumstances, a specific class of bodily correlates not common to the experience of sensory qualities: pleasure was experienced as a bright pressure in the upper part of the body, and unpleasantness as a dull pressure in the abdomen.

These parallels that Beebe-Center (1930, 1932) drew between hedonic tone and sensation, together with the general premises of Carr’s (1925) functional psychology, became the starting point for **Henry N. Peters**’ (1908-1963) work on the psychology of pleasantness and unpleasantness. Peters obtained his Ph.D. at Chicago under the

supervision of Harvey A. Carr, and became a supporter of functional psychology. To Carr, psychology was the study of "the acquisition, fixation, retention, organization, and evaluation of experiences, and their subsequent utilization in the guidance of conduct" (Carr, 1925, p. 1). Central to his approach was the *adaptive act*, which consisted of a motive, a setting, and a response that satisfied the motive. Adaptive acts enable learning and the adaptation of the organism to its environment: the successful responses are repeated whenever the motive arises in that setting.

From this functional perspective, Peters (1935) understood pleasantness and unpleasantness as attributes that organisms, humans included, assign to objects based on their tendencies to react to them. An object is labelled as pleasant when the organism normally has a positive reaction to it, such as when it approaches it or prolongs its experience of it, and unpleasant if it normally has a negative reaction to it, such as when it avoids or cuts the experience short. Although the reaction is elicited by the object, the nature of the reaction (to approach/remain or avoid/withdraw) is determined by the organism's motives. Thus, people—organisms in general—make value judgments about objects, that is to say, judgments of pleasantness and unpleasantness, but also of good or bad, attractive or repulsive, and so on, based on what they learnt about their own tendencies to react toward them depending on their motives. Even the meaning of pleasant and unpleasant is gained fundamentally through experience and learning. Even though some reaction tendencies are inherited or instinctual (Peters, 1955), it is mostly through approaching or avoiding certain objects that organisms learn that some are pleasant and others unpleasant because they are congruent or incongruent with their motives.

Peters tested his theory in a series of experiments in which he asked participants to judge the pleasantness or unpleasantness of several kinds of stimuli, including colors,

pictures, and Japanese words phonetically written in English (Peters, 1938b, 1938a, 1939b, 1939a, 1943b, 1943a; Peters & Rodgers, 1947). In a series of trials, participants were then presented with the stimuli, one at a time, and had to implicitly learn, using certain cues, to react positively to some of them by naming the colors, reaching for the pictures, or pronouncing the words, and negatively to others by doing nothing. After the learning phase, participants were asked to judge the pleasantness or unpleasantness of all the stimuli again. His results showed that the stimuli the participants had learnt to respond positively to were now judged as more pleasant than on the first occasion, whereas the stimuli the participants had learnt to respond negatively to were judged as less pleasant. He also found that these effects were still present after a week, though weaker, and that the pleasantness effect of approach was stronger than the unpleasantness effect of avoidance.

His theoretical and empirical work on value judgements served as the foundation for his views on aesthetic experience (Peters, 1942). To him, aesthetic experience was the affective state which is operationalized in terms of value judgments. To Peters, these affective states were responses and, therefore, the product of the same determinants that produce any kind of response: inherited predisposition, motivational selection, and association. Peters believed that people responded not to the physical aspects of objects but their psychological or conceptual meaning. Consequently, he believed that it was wrong to conceive of unity, complexity, simplicity, balance, symmetry, and other qualities, as attributes of the physical stimulus, because they are meaningless except in terms of human reactions. The aesthetic experience was the product of three elements: attitudes (personality, motives, and sets), perception, and experience. He conceived of aesthetic experiences as a form of perceptual experience, one in which people's set is to

observe and judge value rather than other perceptual qualities. In addition, experience included the effects of repeated presentations and learning.

6. Psychometric Empirical Aesthetics

The decades of behaviorist hegemony were also the golden age of tests for all kinds of mental processes involved in aesthetics, such as sensitivity to visual balance and complexity, discrimination and memory for musical pitch, intensity, consonance, and rhythm, aptitude in design, and the appreciation of visual art, literature, and music (Adler, 1929; F. X. Barron & Welsh, 1952; Carroll, 1933; Farnsworth, 1931; Graves, 1948; Guilford & Guilford, 1931; Heinlein, 1925; Logasa & Wright, 1930; Madison, 1942; McAdory, 1933; McCarthy, 1930; Meier, 1926, 1942; Meier & Seashore, 1929; Stanton, 1928; Welsh & Barron, 1949; Williams, Winter, & Woods, 1938; Wing, 1941).

Work on developing these sorts of tests was so abundant and varied during the decades of behaviorism that it deserves its own section. Chandler and Barnhart's (1938) bibliography provides more than 70 papers published between 1910 and 1937 on tests of visual aesthetics alone. The tests measure general art talent, drawing ability, talent for design, discrimination of composition, harmony, and balance, art appreciation, and aesthetic sensitivity. Lehman's (1969) selected bibliography on musical testing alone is 15 pages long. It includes more than 50 different tests, most of which were developed and published before 1950, and more than 100 papers and unpublished materials analyzing different aspects of those tests. They include measures of general music appreciation, such as Hevner's (1930b, 1931) noted above, preference, and taste, of general musical talent, singing talent, musical performance, musical expressiveness,

auditory imagination, musical memory, sensitivity to cadence and phrasing, discrimination of tones, of intervals, and consonance and dissonance, and rhythmic performance and discrimination. Among the most influential and sustained programs to develop valid and reliable measures of abilities for art and aesthetics, and to understand the nature of individual differences, were those of Seashore and Meier, Burt, Eysenck, and Child, and Barron and Eisenman.

6.1. The measurement of musical and artistic talent

Carl Emil Seashore (1866-1949) graduated at Yale under the guidance of George Trumbull Ladd, and received his doctorate in 1895 under the supervision of Edward Wheeler Scripture. Scripture had studied with Wundt at his Leipzig laboratory at the same time as Külpe, Meumann, Frank Angell, and Titchener. In 1897, Seashore arrived at the University of Iowa and stayed there until his retirement (Metfessel, 1950). In 1910, he began his lifelong project on music, which led to the *Seashore Measures of Musical Talents* in 1919, two books on the psychology of music, and more than 100 papers on several aspects of music production and appreciation (Bathurst & Sinclair, 1928). He believed that several aspects of music made it possible to develop valid and reliable measurements: (1) The formal idiom of music enabled an exhaustive identification of the factors contributing to musical talent. (2) All aspects of production were carried through sound waves, enabling the faithful recording of all relevant aspects of the stimuli. (3) Musical beauty emerges from artistic deviations from rigidity, and ugliness from unartistic deviations, enabling tangible means for the expression of beauty. (4) Music enabled the classification of psychological factors that are responsible for musical performance and appreciation. (5) Measures of abilities make it possible to identify impediments in certain capacities, and to determine whether they are

remediable. (6) Musical education could be improved, because training was conceived as the acquisition of a series of skills, and because students could become aware of their skills and work on them (Seashore, 1930). He recorded six fundamental measures of music, standardized the procedure, and published group measurements. The Seashore Measures of Musical Talents provided a good index of the receptive side of musical talent. Such measures were understood as specific and as a sample of a broader set of musical factors.

Seashore continued this line of work with Norman Meier, one of his PhD students. Together they developed the Meier-Seashore Art Judgment Test (Meier & Seashore, 1929), based on some of the same principles that had guided the development of his earlier musical talent measures. **Norman C. Meier** (1893-1967) began his professional life as a draftsman in Pittsburg, eventually working for the United States Geological Survey. During World War I, he served at the American Expeditionary Forces headquarters in Chaumont, France. After returning to the United States, he resumed his work as a draftsman and enrolled at the University of Chicago. He earned his Ph.D. at the University of Iowa with a thesis on the use of aesthetic judgments as a measure of art talent (Meier, 1926).

Meier (1939) believed that artistic aptitude rested on six factors: manual skill or craftsman ability, energy output and perseveration in its discharge, general and aesthetic intelligence, perceptual facility, creative imagination, and aesthetic judgment. The first three he believed were largely innate, and the last three largely acquired. Of these six, he argued that aesthetic judgment, or the ability to recognize the aesthetic quality in the relation among elements of an organization, had the greatest potential for success as the grounds for a measure of artistic talent (Meier, 1927, 1928). He selected 200 artistic etchings, mezzotints, and dry-point images, and produced pairs of faithful and altered

versions of each (G. Clark, 1987). He discarded the pairs that were least discriminant, ending up with 50 items consisting of pairs of faithful and altered versions and 10 items consisting of a faithful and three altered versions. Participants' task was to choose the best version in each item. The result was the Meier-Seashore Art Judgment Test (Meier & Seashore, 1929).

He later issued a new version, known as the *Meier Art Tests: I. Art Judgment* (Meier, 1940). This test is premised upon the notions that the aesthetic character of art resides in the organization of parts according to universal principles common to all good art, and that the function of aesthetic judgment is to detect these relations. It contains 100 items, of which 94 are based on artworks and 6 on designs for vases. Each item contains a pair of similar black and white images, one of which has been altered to deteriorate its composition. Participants have to select the better version. Meier later published the second part of the test, the *Meier Art Tests: II. Aesthetic Perception* (Meier, 1963). It was conceived and designed to measure the perceptual facility factor of artistic talent, that is to say, the ability to detect subtle aspects that have aesthetic significance. This test has 50 items, each consisting of 4 versions of the same artwork. One of these is the original, while the other three resemble the original but their form, design or composition has been altered, sometimes quite subtly. Participants are asked to compare the composition and design of each of the 4 sets, noting how the versions differ, what makes one aesthetically better, and to rank them in descending order.

6.2. The measurement of aesthetic sensitivity

In the United Kingdom, interest in individual differences in aesthetic judgment and their measurement grew out of **Cyril Burt's** (1883-1971) studies of children's artistic competence in London, during the 1920s and 1930s. Burt had spent a year

studying with Külpe at Würzburg, at the same time as Valentine. Burt was strongly influenced by Francis Galton's interest in individual differences, mental testing, correlations, and eugenics (Boring, 1950; Burt, 1962; MacKenzie, 1976). To Burt, it was incontrovertible that intelligence and mental abilities were genetically based, that they were the main determinants of social position within the hierarchy of occupational classes, and that they could be measured objectively and accurately using mental tests (Norton, 1981). He introduced mental tests and psychometrics into the education system and systematically studied the distribution of intelligence, mental abilities, and achievements of the London school population. He determined averages and normal ranges; he developed standardized measures and compiled test batteries. And he used children's performance on such tests to set them along the vocational path fitted to their natural aptitudes.

The battery that Burt devised to measure children's abilities included several tasks of literary, musical, and visual appreciation and creation, consisting in ranking fragments and images, paired and triple comparisons, composition, and drawing. He believed—following Spearman's approach to intelligence—that there existed a unitary aesthetic ability, inherited and unalterable, that could be measured by means of responses to simple tests. Burt referred to this as the *general factor for artistic ability*, and believed it underlay the ability to appreciate relations among elements in art, combinations of lines and colors, sounds, or words (Burt, 1933, 1949). Burt's main interest shifted from educational psychology to statistical theory after 1932, when he succeeded Spearman as Professor of Psychology at the University College London (Wooldrige, 1994).

Burt's PhD student, **Hans Jürgen Eysenck** (1916-1997), continued this psychometric approach to aesthetics. Eysenck assembled 18 sets of pictures, including

portraits, photographs of statues of Roman emperors, pencil drawings by Claude Lorrain, photographs of vases, Malayan masks, Japanese paintings, reproductions of colored embroidery, and curves of mathematical functions. He then asked 18 participants to rank the materials in each set in order of liking. Eysenck's (1940) factor analysis of participants' rankings revealed a factor accounting for 20.6% of the variance across sets, which he called the *general objective factor of aesthetic appreciation*. Faithful to Galton and Burt, he asserted that this factor was responsible for performance on virtually any conceivable test of aesthetic appreciation, that it was common to all humans, determined largely by biological factors, and innate (Eysenck, 1941b, 1941c, 1942, 1981).

Eysenck believed this factor, *T*, corresponded to the ability to appreciate objective beauty, that is, people's *taste*, or *aesthetic sensitivity* (Eysenck, 1941c, 1942). In Eysenck's view, aesthetic sensitivity was a distinct, general, and stable ability. It was distinct because it was unrelated to other personal traits ("[this ability], independently of intelligence and personality, determines the degree of good or bad taste" (Eysenck, 1983, p. 213), general because it explained performance on virtually all measures of artistic ability ("it covers a large number of, probably all, pictorial tests" (Eysenck, 1940, p. 100), stable because it was biologically determined and innate ("[it] presumably [has] a genetic foundation in the structure of the nervous system" (Götz, Borisy, Lynn, & Eysenck, 1979, p. 801), and insensitive to experience ("[it] is independent of teaching, tradition, and other irrelevant associations" (Eysenck, 1940, p. 102).

Eysenck identified a second factor when the influence of *T* was minimized. This factor, *K*, was bipolar and distinguished "those who like modern art, bright, sunny photographs, and Kolbe statues, from those who like the older masters, cloudy,

foreboding photographs, and the statues of Maillol and Barlach” (Eysenck, 1941a, p. 266). The main characteristic of the *K* factor is “one of brightness or intensity as opposed to darkness or lack of intensity,” (Eysenck, 1983, p. 91).

In Eysenck’s (1941a, 1942) view, aesthetic sensitivity scaled as the degree to which liking approximated *true aesthetic value*. True aesthetic value could be estimated by averaging people’s preference or by resorting to experts’ opinion. Aesthetic sensitivity could thus be calculated by simply subtracting people’s average liking ratings from group averages or from experts’ judgments. Eysenck used different kinds of materials to measure aesthetic sensitivity. He first correlated liking ranks of artworks (e.g., portraits, drawings, landscapes, statues) and objects (e.g., vases, mathematical functions, flowers, clocks) with the average rankings (Eysenck, 1940). He later used simple geometric designs (Eysenck, 1972; Eysenck & Castle, 1971) taken from Birkhoff (1933) and the *Barron-Welsh Figure Preference Test* (F. X. Barron & Welsh, 1952; Welsh & Barron, 1949). Finally, he developed the Visual Aesthetic Sensitivity Test (VAST) in collaboration with the German artist and designer Karl Otto Götz (Chan, Eysenck, & Götz, 1980; Götz et al., 1979; Iwawaki, Eysenck, & Götz, 1979).

Eysenck’s notion of the general, independent, and biologically-determined factor of aesthetic appreciation rested on the assumptions that the average ranking of images in a set represented their aesthetic value, and that the extent to which people’s preference agreed with the average constituted a valid measure of their aesthetic sensitivity. **Irvin Long Child** (1915-2000) was skeptical of these assumptions and set out to test them experimentally. Child’s perspective on aesthetic sensitivity was very different to Eysenck’s. He looked at it through the lens of learning theory, humanistic psychology and anthropology. Child earned his PhD at Yale in 1939 (Machotka, 2002), where Clark Hull awoke his interest in learning theory, and where O. Hobart Mowrer, Neal E.

Miller, John Dollard, and others were using animal learning paradigms to study the roles of drive, cue, response and reward in the sort of phenomena that were crucial to Freud's psychoanalyses, such as conflict, frustration, and repression (Coons, 2002; Myers, 1973). From his analysis under John Dollard, he learnt about personality theory, and through his research collaboration with the anthropologist—and brother-in-law—John W. M. Whiting, he became sensitive to the role of culture in structuring cognition and personality (Whiting & Child, 1953).

Child (1962) assembled 12 sets of 60 reproductions of artworks depicting groups of people, landscapes, abstract art, still lives, religious content, and so on. He asked 14 art or art history students to divide each of the sets into 10 piles of approximately 6 pictures each according to their aesthetic merit. He then asked 2 different groups of 22 students with little or no artistic training to distribute each of the sets into 10 piles of approximately 6 pictures each, from those they liked least to those they liked most. His results revealed only very small correlations between aesthetic merit rank and preference rank, and no clear relation between individuals' agreement with group preferences and their agreement with the external criterion of aesthetic value. From these results he concluded that it was wrong to equate, as Eysenck had, group averages of preference with aesthetic value, and similarity to average preferences with aesthetic sensitivity. Aesthetic sensitivity, Child (1962) concluded, is properly measured in relation to an external standard set by experts, not in relation to group averages. Individual differences in aesthetic sensitivity reflect differences in familiarity with and acceptance of the tradition of aesthetic evaluation. In Child's (1962, 1965) view, aesthetic sensitivity is cultivated with practice and is the result not of a specific ability, but of general cognitive style and personality. High aesthetic sensitivity is the manifestation of an "actively inquiring mind, seeking out experience that may be

challenging because of complexity or novelty, even alert to the potential experience offered by stimuli not already in the focus of attention, interested in understanding each experience thoroughly and for its own sake rather than contemplating it superficially and promptly filing it away in a category, and able to do all this with respect to the world inside himself as well as the world outside” (Child, 1965, p. 508).

Child subsequently conducted one of the most extensive cross-cultural research programs on aesthetic sensitivity (Che, Sun, Gallardo, & Nadal, 2018). In a series of studies, he showed that people from different parts of the world who are interested in art tend to show agreement as to what constitutes good artworks. He attributed this high agreement in aesthetic valuation among experts from different cultures to the commonalities among the traditions of aesthetic assessment around the world, and to the openness of art experts to the aesthetic features of other cultures (Child & Siroto, 1965; Ford, Prothro, & Child, 1966; Iwao & Child, 1966; Iwao, Child, & García, 1969). Moreover, he found that despite cultural differences, people who have an interest in aesthetic values and art around the world show similar personality trends that lead them to develop interest in art: tolerance for complexity, independence of judgment, regression in the service of the ego, and preference for autonomy, variety, and intellectual and perceptual challenges (Anwar & Child, 1972; Child & Iwao, 1968; Haritos-Fatouros & Child, 1977).

6.3. Simplicity-complexity as a factor of perceptual preference

Frank Barron (**Francis Xavier Barron**, 1922-2002), president of APA’s Division 10, The Society for Psychology of Aesthetics, Creativity, and the Arts (1971-1972), and Division 32, Humanistic Psychology (1989-1990) (Arons, 2003), arrived at the study of aesthetic preferences through his lifelong interest in creativity. Barron

obtained his Bachelors' at the University of Minnesota, after serving as army medic in Europe during World War II (Montuori, 2003). With his PhD in 1950 from the University of California, Berkeley, he began his seminal research on creativity (F. X. Barron, 1963, 1969) at the Institute of Personality Assessment and Research, University of California, Berkeley, under the direction of Donald W. MacKinnon. The Institute had its roots in Harvard's Psychological Clinic, where MacKinnon had been supervised by Henry A. Murray, and in the personnel assessment centers of the Office of Strategic Services (Handler, 2001; Smith & Anderson, 1989), the forerunner of the Central Intelligence Agency, where MacKinnon and Murray worked together during World War II (Murray & MacKinnon, 1946). The Harvard Psychological Clinic had been established in 1926 by the Harvard physician Morton Prince (Triplet, 1992; White, 1992). The Clinic was part of Prince's endeavors to separate the field of psychopathology from psychiatry (he had founded the *Journal of Abnormal Psychology* in 1906 with the same goal). If psychopathology were taught only in medical schools, Prince believed, then scientific research would become secondary to the practical issues involved in running a psychiatric ward (White, 1992). In 1926, Henry Murray was hired as Prince's assistant and, when Prince retired in 1928, he took over the Clinic (Smith & Anderson, 1989; Triplet, 1992). At the Clinic, he introduced psychopathology and European personality and clinical theories into American academic psychology, systematized the study of personality, and developed research and assessment methods, such as the Thematic Apperception Test (Morgan & Murray, 1935; Smith & Anderson, 1989; Triplet, 1992).

At the Institute of Personality Assessment and Research, and influenced by the humanistic perspectives of Murray and MacKinnon, Barron focused on understanding creativity and the characteristics of creative people in different domains, including

science, philosophy, art, religion, and entrepreneurship. What made creative people distinct was their disposition to originality, independence of judgment, ego-strength, psychological health, aesthetic sensitivity, and their preference for complexity (F. X. Barron, 1963, 1969; Montuori, 2003).

Barron saw a correspondence between his views on the relation between creativity and complexity and Welsh's approach to the assessment of psychological disorders. Welsh (1949) had constructed a test consisting of 200 drawings and administered it to large groups of psychiatric patients and healthy controls. The Welsh Figure Preference Test required participants to indicate whether they liked each of the drawings. The factor analysis revealed a general *acceptance factor*, related with the general tendency of the participant to either like or dislike the drawings, and a *bipolar factor*, orthogonal to the previous one, related to the preference for simple-symmetrical figures or for complex-asymmetrical figures. Healthy participants tended to form two distinct groups with markedly different personality traits. Those who preferred simple and symmetrical figures were conservative and conventional, while those who preferred the other kind of stimuli were eccentric, cynical, and radical (Barron, 1952). Welsh and Barron (1949) enlarged the test to 400 stimuli and included a specific scale which could discriminate between the preference of artists and non-artists and used independently.

Using the Barron-Welsh (1952) Art Scale, Barron (1952) found that people who prefer simple-symmetrical drawings also prefer paintings portraying etiquette, religious motifs, and scenes reflecting a certain degree of authority, and rejected paintings with esoteric, unnatural and openly sensual contents. Conversely, people who prefer more complex drawings also prefer modern, experimental paintings, those with primitive or sensual content, and disliked those related to religion, aristocracy, tradition, and emotional control. Barron (1952) suggested that these differences might be explained by

the different views both groups of participants have of themselves and the world. The analysis of their responses on a checklist of adjectives they used to describe themselves revealed that they had different attitudes towards the perception of stability, predictability, balance, symmetry, and the use of simple general principles, as well as towards tradition, religion, authority, and sensuality. The group that preferred simple-symmetric figures described themselves as contented, gentle, conservative, unaffected, patient, and peaceable, while the group who preferred complex-asymmetric figures described themselves as unstable, dissatisfied, pessimistic, emotional, pleasure-seeking, and irritable. These results add to the increasing consistency of the suggestion that the extroversion-introversion and conservatism-radicalism dimensions contribute to the preference for visual stimuli varying in complexity.

In sum, Barron (1953) showed that people differ according to whether they prefer perceiving and dealing with simplicity or with complexity, and that this factor predicts differences in originality and intellectual independence, interpersonal relationships, social conformity, and views on politics, economics, religion, authority, and tradition. What is the origin of these differences in preference for complexity? Barron (1972; 1976) began exploring the genetics behind this factor in two pioneering studies on monozygotic (MZ) and dizygotic (DZ) twins. MZ twins are genetically identical, and DZ twins are on average 50% identical. Comparing the degree of similarity in the performance of MZ and DZ pairs on tests of a certain capacity allows estimating the impact of genetics on that capacity: If the performance of MZ twins is more similar than the performance of DZ, it can be assumed that genetics has a strong influence on that capacity (Bignardi, Ticini, Smit, & Polderman, 2020). Barron (1972) tested 59 pairs of Italian twins, 30 MZ and 29 DZ, and 57 pairs of American twins, 29 MZ and 28 DZ, on several measures of creative thinking and aesthetic appreciation,

including the Barron-Welsh Art Scale as a measure of preference for complexity (F. X. Barron & Welsh, 1952). Barron (1972) reported an intraclass correlation of .58 among the Italian MZ twins' preference for complexity, and of .66 for the American MZ twins preference for complexity. In contrast, the intraclass correlation was close to 0 for DZ twins from both countries. Barron's (1972) results would, therefore, suggest an important genetic influence on preference for complexity. In a similar study, Barron and Parisi (1976) tested 61 pairs of Italian twins, 36 MZ and 25 DZ, on several measures of creativity and two measures of aesthetic judgment: The Barron-Welsh Arts Scale and Irvin Child's Test of Esthetic Judgment, consisting in 100 pairs of similar pictures, one of which is superior to the other. Barron and Parisi (1976) reported similar intraclass correlations for MZ and DZ twins: For the Barron-Welsh Arts Scale, the MZ correlation was .16 and the DZ correlation was .29. For Child's Test of Esthetic Judgment, the MZ correlation was .57 and the DZ correlation was .69. Barron and Parisi's (1976) results, therefore, questioned Barron's (1972) earlier results, and suggested that genetics has little impact on both of these measures of aesthetic judgment. Despite this contradiction in results, these studies showed the promise for a behavioral genetics of aesthetic appreciation (Bignardi et al., 2020).

Russell Eisenman (1940 -) corroborated and extended these conclusions in a series of experiments: high-school and college students who are more creative prefer more complex polygonal figures and find them more meaningful than less creative peers (R. Eisenman & Robinson, 1967; R E Taylor & Eisenman, 1964). However, subsequent studies showed that the relation between preference for complexity and creativity is not straightforward. First, preference for complexity-simplicity seems to be modulated by mental health: Eisenman (1965) showed that schizophrenic patients preferred less complex polygons and less novel poems than healthy control participants.

Second, the relation between preference for complexity and creativity is modulated by sex and personality traits linked to birth order. Eisenman's (1965) results showed that first-born participants were more anxious and more likely to prefer simpler polygons than later-born participants. Subsequent studies showed that the effect of birth order interacted with sex: Later-born women generally preferred highly complex polygons, whereas later-born men generally preferred the simplest polygons. First-born men and women preferred polygons of intermediate complexity (R Eisenman, 1967a). Eisenman (1967; Taylor & Eisenman, 1968) postulated that these results might have to do with the impact of socialization patterns on people's personality. Finally, Eisenman's (1967b) results questioned Barron's (1963) treatment of complexity and asymmetry as part of the same dimension: preferences for complexity and symmetry are not necessarily the same. In fact, there was evidence that even complexity was not a singular dimension: different forms of complexity have different effects on preference (Russell Eisenman & Rappaport, 1967; Grove & Eisenman, 1970).

7. The Gestalt school of psychology

Almost at the same time as when Behaviorism was developing in the United States (Watson, 1913), the Gestalt school of psychology began taking shape in Germany. Gestalt rejected Wundt's division of conscious experience into elements: the key to understanding the mind was in the study of organized and dynamic wholes, or fields, in which each part interacts with all the others. The movement grew out of the work of Wertheimer, Köhler, and Koffka. Max Wertheimer was one of Stumpf's students in Berlin and, after graduating, he earned his PhD in 1904 at Würzburg, under

Külpe's supervision. Köhler and Koffka earned their PhDs in Berlin under Stumpf's supervision in 1909. The three of them were in Frankfurt by 1910. After World War I, word arrived at the United States of the new school. As noted above, Ogden, one of Külpe's students, did much to promote Gestalt psychology in the United States, especially with the rise of the Nazi party in Germany during the 1930s. Koffka visited the United States in 1924 and, in 1927, he earned a position at Smith College. Köhler visited in 1925 and 1927 and, in 1935, he earned a position at Swarthmore. In 1933, Wertheimer earned a position at the New School for Social Research in New York.

One of Gestalt's most significant contributions was their explanation of perception and understanding of objects and scenes as emergent processes that go beyond the mere recording of the elements in the stimulus. From the Gestalt perspective, perceiving was not about passively receiving sensations, it was about actively exploring and organizing perception. They suggested a number of grouping principles, such as proximity, continuation, similarity, or closure, which organized parts of the visual scene into wholes, such as objects, clusters, and overall scenes. These principles were subordinate to, or specific manifestations of, the general principle of *Prägnanz*: we tend to perceive the most concise and structured configuration consistent with the information presented.

Although art and aesthetics were never a primary concern for Wertheimer or Köhler, Koffka (1940) explored Gestalt's implications for the appreciation of art and beauty. Koffka (1940) openly rejected the psychophysical approach whereby beauty is defined in terms of the physical properties of the stimulus. From the Gestalt point of view, appreciation of beauty and art emerges from the interaction of the viewer's psychological processes and the artwork's features. Koffka (1940) considered works of art to be special kinds of good gestalts, in that their constituents are placed by the

demand of the whole and that the dynamic forces are particularly well balanced. An artwork is appealing as a structure, not as a collection of parts, but as a consistent entirety where each constituent requires the others. This structure is in close dynamic interaction with the viewer, who is actively organizing the artwork in one direction, and being affected by it in the other.

Rudolf Arnheim (1904-2007) was responsible for the most thorough application of the Gestalt principles to artworks and aesthetics. Arnheim had been Max Wertheimer's assistant and PhD student. He too moved away from Germany, where the Nazi party had seized power. He first went to Rome, then London and, finally, the United States, where he joined Wertheimer at the New School for Social Research in 1940 (Verstegen, 1996). In 1968, he became Professor of Art Psychology at Harvard University's Carpenter Center for the Visual Arts, and from 1974 to 1984, he taught art psychology at the Art History Institute of the University of Michigan at Ann Arbor (Verstegen, 1996).

Arnheim's fundamental thesis, developed in detail in his book *Visual Thinking* (Arnheim, 1969), was that perceptual processes are analogous to the processes of productive thinking: "The elementary processes of perception, far from being mere passive registration, [are] creative acts of grasping structure even beyond the mere grouping and selecting of parts. What happens in perception [is] similar to what at a higher psychological level is described as understanding or insight" (Arnheim, 1947, p. 70). The resulting percepts have several attributes, two of which are the most important to Arnheim's approach because to him they are what art is about. The first is *directed tension*, or *expression*: the upward striving of a tree, or the rise and fall of a musical scale. The second attribute is *intensity*: the strength or weakness of that directed tension (Arnheim, 1961). The overall configuration of these dynamical visual forces constitutes

what Arnheim (1974) referred to as the structural skeleton of the design. The essence of an artwork is to create a dynamic whole by integrating this structural skeleton with the depicted subject matter. Viewers spontaneously balance parts and wholes in search for the integrated structure of the artwork.

Apprehending artistic expression is not about perceiving such measurable features as shape, size, hue, or pitch, but about perceiving the directed tensions conveyed in the stimuli. The perception of directed tensions, Arnheim (1961) argued, is essential to aesthetic appreciation, but not specific to it: apprehending artistic expression is achieved through general perceptual processes. In addition to the apprehension of directed tensions, appreciating art involves two other processes. First, it involves the ability to evaluate balance, rhythm, and unity to judge the goodness of compositional structure. Again, these abilities are not specific to art, but general abilities involved in the perception of directed tensions. Second, because artistic expression has a semantic function, appreciating art involves evaluating the meaning, relevance, and truth of the artwork's message. This second kind of evaluations rely on the spectators' life experiences, memories, values, and preferences.

Thus, to Arnheim (1964, 1966, 1969), aesthetic appreciation arises essentially from dynamic perceptual processes. Perception is not the mere automatic and passive recording of aspects of the visual field. Rather, perceiving means becoming aware of dynamic forces inherent to the stimuli. This awareness is attained by the integration of two sources of information: the structured configurations received from the image and the patterns towards which individuals are oriented by virtue of their own experience and disposition.

8. The new Experimental Aesthetics

The work of **Daniel Ellis Berlyne** (1924-1976) during the 1960s and 1970s had a substantial impact on contemporary Empirical Aesthetics (Cupchik, 1986, 2020; Day, 1977). He provided the field with a new explanatory framework based on motivational theory and grounded on neuroscience, he introduced new experimental designs and analytical procedures, and he prompted a host of new questions. Berlyne began studying modern languages at Trinity College, Cambridge, but then switched to psychology, where Fredric Bartlett was Professor of Experimental Psychology. After serving in World War II in the Intelligence Corps, he graduated in psychology in 1947 (Myers, 1973). Berlyne became more interested in the research of the American neobehaviorists at Yale than in the research being conducted at Cambridge. He was especially fascinated by Hull, Mowrer and Miller's research on motivation. In 1951 managed to obtain a fellowship at Yale, where he earned his PhD in 1953 under the supervision of Carl I. Hovland (Barnes, 2012; Myers, 1973), a decade and a half after Irvin Child. Like Child earlier, Berlyne underwent psychotherapy with Dollard, which also influenced his views on human motivation (Myers, 1973). After Yale, Berlyne held positions at Aberdeen, Center for Advanced Study in the Behavioral Sciences at Palo Alto, California, the University of California, Berkeley, Piaget's *Centre International d'Épistémologie Génétique* in Geneva, and Boston. He finally accepted a permanent position at the University of Toronto in 1962, where he stayed until his death in 1976.

Berlyne focused on motivation for most of his career. In his book *Conflict, Arousal, and Curiosity*, Berlyne (1960), he presented his motivational theory of exploration, intended to explain the motivation of perceptual and intellectual activities: curiosity, interest, directed thinking, and aesthetics. From this perspective, curiosity and

exploration are organisms' responses to the arousal caused by the uncertainty and conflict about selecting behaviors. Curiosity prompts organisms to explore their surroundings in different manners, resolving the conflict, and returning arousal to an optimal level. During exploratory behavior, the organism compares and contrasts various aspects and properties of the stimuli it encounters, collating information. The collative variables are the properties of the stimuli that are compared, such as novelty, incongruity, surprisingness, uncertainty, and complexity. Exposure to stimuli varying in such features changes organisms' arousal levels, producing pleasant or unpleasant feelings.

As he worked on his *Conflict, Arousal, and Curiosity*, and influenced by Hebb's (1949) *The Organization of Behavior*, he came to realize how important it was for psychological models to take neuroscientific findings into account (Myers, 1973). This realization, together with his continuing research on curiosity and the time he spent as visiting professor at the *Institut d'Esthétique et des Sciences de l'Art* at the University of Paris, coalesced into his landmark book in Empirical Aesthetics: *Aesthetics and Psychobiology* (Berlyne, 1971). This was followed in 1974 by *Studies in the New Experimental Aesthetics* (Berlyne, 1974), a collection of studies carried out by himself and his colleagues that explored different possible applications of motivation theory to aesthetics.

Berlyne (1971) argued that aesthetic appreciation, liking and disliking, are the result of general motivational and hedonic processes and that, therefore, the enjoyment of art and aesthetics can be explained in terms of those motivational and hedonic processes. Neuroscience had shown that the motivational state of an organism is the product of the activity of three neural systems: a primary reward system, an aversion system, and a secondary reward system, whose activity inhibits the aversion system

(Berlyne, 1971). The activity of the three systems depends on the organism's degree of arousal, which in turn depends, among other factors, on the configuration of stimuli from the environment. Given that the primary reward system is the most sensitive to the organism's arousal, moderate increases of arousal during a relatively low arousal state are usually pleasant. The aversion system's threshold is somewhat higher, such that if arousal continues to grow it becomes active, counteracting the effects of the primary reward system. If the arousal becomes very high, the activity of the aversion system can exceed that of the primary reward system. For each degree of arousal, the resultant hedonic tone can be calculated by means of the algebraic sum of the activity curves of the primary reward and aversion systems. Hence, moderate increases of arousal in a resting organism increase its positive hedonic tone up to a given point, beyond which additional increases in arousal potential do not modify the activity of the primary reward system. At a certain point, and because of the initiation of the activity of the aversion system, higher arousal decreases the overall hedonic tone. This can even lead to a negative hedonic state if arousal pushes the activity of the aversion system beyond a given threshold that corresponds to the maximum level of activity of the primary reward system.

The hedonic tone induced by a stimulus, defined as the capacity to reward an operant response and to generate preference or pleasure expressed through verbal assessments (Berlyne, 1971), depends on the level of arousal that it is capable of eliciting and the organism's current arousal level. Given that organisms tend to search for the optimal hedonic value, they will tend to expose themselves to different stimuli as a function of their arousal potential. Berlyne (1971) noted three classes of variables that determine a given stimulus' arousal potential, mainly through the amount of information transmitted to the organism. These are: *psychophysical* variables, such as

brightness, saturation, predominant wavelength, and so on; *ecological* variables, including those elements that might have acquired associations with biologically relevant events or activities; *collative* variables, such as novelty, surprise, complexity, ambiguity, or asymmetry.

These general motivational and hedonic principles explain people's aesthetic preferences, and their liking or disliking for art. People's interest in and curiosity for art are the product of arousal-regulating behaviors. In Berlyne's view, works of art are composed of assemblages of elements that possess a specific structure. Experiencing an artwork involves judging similarities and differences among the artworks' elements, their regularity and irregularity, their predictability or unpredictability, and so on; and between the artworks' elements and those experienced previously or anticipated, in terms of novelty, expectedness or surprisingness. Thus, aesthetic interest and preference, like all sorts of interest and preference, depend on how novel, complex, or unexpected an object appears to the viewer (Berlyne, 1963; Berlyne, Ogilvie, & Parham, 1968). In normal conditions, that is to say, with an intermediate level of arousal, people are expected to prefer intermediately novel, complex, or unexpected artworks over excessively or insufficiently novel, complex, or unexpected ones. When arousal level is high people will tend to prefer less novel, complex, or unexpected artworks, and when arousal level is low, they will tend to prefer more novel, complex, or unexpected artworks.

Berlyne's work has had a lasting influence on contemporary research in empirical aesthetics and the psychology of art (Jacobsen, 2006): "Modern research on experimental aesthetics still takes inspiration from Berlyne's ideas about how collative variables affect arousal, interest, and preference. The influence of the Berlyne tradition

may be best seen in the intensity of debates about alternative theories of aesthetic response” (Silvia, 2005, p. 119).

9. Concluding remarks

The year Daniel Berlyne died, 1976, was the centennial of Fechner’s *Vorschule der Ästhetik* (Fechner, 1876). Those 100 years saw the foundation of Empirical Aesthetics and its structural, functional, behaviorist, differential, Gestalt, and motivational incarnations, as we have summarized in this chapter. A comprehensive account of this rich history is well beyond the scope of a single chapter. This chapter, therefore, is necessarily selective, aiming only to provide the basic historical context for the rest of the chapters in this handbook. Given that most of them cover theories and results published since the late 1970s, we have concentrated on the first 100 years of Empirical Aesthetics (for recent trends see Cupchik, Arnheim, & Martindale, 1999; Greb, Elvers, & Fischinger, 2017; Martindale, 2007b, 2007a). We have focused on strictly empirical work, in the sense that it not only advocated for a fact-based or materialist approach to aesthetics, but actually produced and interpreted empirical observations. For this reason, we did not cover the influential writings of, for instance, Vischer and Lipps on empathy, or Bullough on “psychical distance” (C. G. Allesch, 1987, 1988; Cupchik, 2020).

Psychophysics and Empirical Aesthetics were both developed by Fechner. Psychophysics thrived and eventually merged into experimental psychology, whereas Empirical Aesthetics became a sort of specialty field. Even as early as 1910, it was apparent to Titchener (1910) that while psychophysics was progressing in leaps and

bounds, Empirical Aesthetics was almost where Fechner had left off. The reason for the slower progress of Empirical Aesthetics is that it attracted fewer researchers than other areas of experimental psychology. During its first century it did not draw the critical mass of researchers that other areas of psychology did. *Aesthetics* means different things to different people (Anglada-Tort & Skov, 2020). As conceived by Fechner, Empirical Aesthetics sought to understand sensory pleasure, generally speaking. As conceived by Berlyne, it sought to understand the regulation of hedonic tone. But the field's name lent itself to be seen by others as dealing strictly with particular issues related to beauty and art. In fact, even some of the major figures in Empirical Aesthetics portrayed the field as concerned specifically with beautiful objects (Hevner, 1937b), or with art (Kölpe, 1895). Experimental psychologists saw this as a very narrow window into the human mind, and one plagued with imprecise concepts, such as *beauty* and *art*. Such areas as perception, learning, emotion or motivation seemed better suited to reveal the general principles of the human mind. Berlyne (1971) believed that limiting aesthetics to special objects, like artworks, special qualities, like beauty, and special emotions, like awe, was the greatest impediment for progress in Empirical Aesthetics.

Although Empirical Aesthetics ebbed and flowed, there was never a period in which it dried out completely. Looking back on its history, we can see that all major psychological schools of thought, from Wundt's late 19th century structuralism to the 1960s neobehaviorism, made important contributions to Empirical Aesthetics. Moreover, some of these contributions were made by, or under the supervision of, prominent psychologists whose names can be found in any psychology textbook: Wilhelm Wundt, the founder of the first psychological research laboratory; Lightner Witmer, the founder of clinical psychology; Hugo Münsterberg, the founder of applied psychology; Ernst Meumann, the founder of experimental education; Oswald Kölpe, the

founder of the Würzburg school of psychology; James McKeen Cattell, pioneer in mental testing; Edward L. Thorndike, known for his learning principles of effect and exercise; Lillien Martin, pioneer in psychophysics; Margaret Washburn, pioneer in comparative psychology and first woman to earn a PhD in psychology; Louis L. Thurstone, pioneer in psychometrics and intelligence testing; Hans J. Eysenck, proponent of the neuroticism-extraversion-psychoticism model of personality. Daniel E. Berlyne, the neobehaviorist motivational theorist.

As practitioners of Empirical Aesthetics today, it behooves us to be aware of the history of our field. What Edwin G. Boring wrote about historical knowledge in experimental psychology is equally true about Empirical Aesthetics: “The experimental psychologist (...) needs historical sophistication within his own sphere of expertness. Without such knowledge he sees the present in distorted perspective, he mistakes old facts and old views for new, and he remains unable to evaluate the significance of new movements and methods” (Boring, 1950, p. ix).

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