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## FEROCIOUS COLORS AND PEACEFUL LINES DESCRIBING AND MEASURING AESTHETIC EFFECTS

HANNA BRINKMANN, JANE BODDY, BEATRICE IMMELMANN, EVA SPECKER, MATTHEW  
PELOWSKI, HELMUT LEDER, RAPHAEL ROSENBERG

In art history, the description of artworks is often based on the description of the effects of lines and colors. This practice has a long tradition. In the middle of the 16<sup>th</sup> century, Venetian and Florentine art literature theorized *disegno* (drawing) and *colore* (color) as central elements of painting. In the 18<sup>th</sup> century, the notion of “effect” became a key concept in art literature, and was often used with regard to lines and colors.<sup>1</sup> The word “effect” evoked a relationship between observable properties of artworks and the responses of beholders. Specifically, it suggested a cause and effect relationship between aesthetic forms and perceptions. In this paper, we point to the fact that aesthetic effects were often described with bipolar adjective terms, such as ferocious and peaceful, in both art literature and scientific research (i. e. psychology). The interest in aesthetic effects set the stage for a sustained exchange between art literature and psychological

research that has not yet received the attention that it deserves. The historical analysis brought forward in this paper is the starting point for our own empirical studies, and was developed to critically examine historical assumptions.<sup>2</sup>

In the first section of this paper, we trace how interest in the effect of colors and lines emerged in 18<sup>th</sup> century aesthetic theory. In the second section, we show that since Goethe’s *Theory of Colors* the description of such effects was framed by conceptual polarities and we present four exemplary categories frequently used to describe the appearances of lines and colors. In section three, we describe how aesthetic and artistic descriptions were integrated in psychological investigations at the beginning of the 20<sup>th</sup> century. Our examples center on Wassily Kandinsky and subsequent scientific studies using his writings. Without being fully aware of the history of describing aesthetic effects, psychologists al-

1 H. J. SCHNACKERTZ, Wirkung/Rezeption, in: K. BARCK/M. FONTIUS/F. WOLFZETTEL/B. STEINWACHS (eds.), *Ästhetische Grundbegriffe*. Vol. VI, Stuttgart/Weimar 2010, pp. 670–693. In French: “effet”, in German: “Wirkung”. See C. WEISSERT, Effet/Effekt, in: K. THOMAS (ed.), *Emotionen im Kunstdiskurs Frankreichs im 19. Jahrhundert*. Ein Handbuch der Schlüsselbegriffe, in print. As opposed to emotional response, aesthetic effects do not necessarily entail the actual affective responses that art can elicit in beholders and that is often identified as “aesthetic emotion” by psychologists: G. HOSOYA/I. SCHINDLER/U. BEERMANN/V. WAGNER/W. MENNINGHAUS/M. EID/K. SCHERER, Mapping the Conceptual Domain of Aesthetic Emotion Terms: A Pile-Sort Study, in: *Psychology of Aesthetics, Creativity and the Arts*, August 2017, DOI: 10.1037/aca0000123 (15.12.2017). It is also important to notice that in psychology, responses to art have been far more often studied within the categories of “preference” and “liking”, rather than in regard to aesthetic effects as discussed in this paper. It remains unclear, whether and how aesthetic effects and preference relate to each other.

2 This paper is part of the cross-disciplinary research project “*Universal aesthetics of lines and colors? Effects of culture, expertise, and habituation*” (<http://linesandcolors.univie.ac.at/en/>), financed by the WWTF (CS15–036).

so applied polar categories. A case in point is the “semantic differential”, an experimental tool designed in the 1950s to measure association in a controlled manner. In section four, we give a

brief history of this tool. In the final section, we assess the use of the semantic differential against other tools and discuss our own empirical studies in this field.

## I. LINES AND COLORS AS BASIC VISUAL FEATURES

Art literature of the 18<sup>th</sup> century promoted the idea that specific visual features are structurally foundational for the perception of artworks. In particular lines and colors were analyzed for the aesthetic effects they have on beholders.<sup>3</sup> Joseph Addison was one of the first authors who developed an aesthetic theory that centered on the effects caused by aesthetic objects (art or nature) on beholders. In the essay *On the Pleasures of the Imagination* (1712) he distinguished primary and secondary pleasures.<sup>4</sup> Primary pleasures are produced from what is presented to us in the act of seeing. Addison considered the impressions great, uncommon, and beautiful as “primary pleasures”. He distinguished these from “secondary pleasures”, resulting from a mental comparison, in which the spectator compares the object under current observation with the memory of past experiences.<sup>5</sup> For Addison, observable features are structurally foundational for primary pleasures.<sup>6</sup> Beauty, for example, “consists either in the gaiety or variety of colours, in the symmetry and proportion of parts, in the ar-

range and disposition of bodies, or, in a just mixture and concurrence of all together. Among these kinds of beauty the eye takes most delight in colours.”<sup>7</sup> Addison related the specific observable features to the physiological process of perception, and especially the movement of the eyes.<sup>8</sup> “[A] spacious horizon is an image of liberty, where the eye has room to range abroad, to expatiate at large on the immensity of its views, and to lose itself.”<sup>9</sup> Despite such a description of the aesthetic effect of the horizon, Addison did not explicitly mention lines as foundational elements for primary pleasures. It was however William Hogarth who first introduced lines to the discussion of aesthetic effects.<sup>10</sup> In *The Analysis of Beauty* (1753), Hogarth argued that the pleasure of any object depends mainly on the type of its (out)lines. He defined the S-shaped serpentine line as the “line of beauty”, which “leads the eye in a pleasing manner along the continuity of its variety.”<sup>11</sup>

Just a few years later, in 1757, Edmund Burke popularized the distinction between “beauty” and the “sublime” as two different poles.<sup>12</sup> He

3 For a detailed description see especially: R. ROSENBERG, *Entdeckung der Abstraktion*, Turner, Hugo, Moreau, München 2007, pp. 17–53.

4 J. ADDISON, *On the Pleasures of the Imagination*, in: *Spectator* No. 411, June 21, 1712, cited in: *The Works of Joseph Addison. Complete in Three Volumes. Embracing the whole of the “Spectator,” & c.*, New York 1837, Vol. II, p. 138.

5 *Ibid.*, *Spectator* No. 412, June 23, 1712, ed. 1837, p. 138.

6 See J. BODDY, *Disentangling the Aesthetic Effects of Formal Elements of Art*, in: V. A. JOURNEAU/C. V. KAYSER, *Notions esthétiques: La perception sensible organisée*, Paris 2015, pp. 51–61.

7 ADDISON, *On the Pleasures* (cit. n. 4), p. 140.

8 *Ibid.*, pp. 138–140.

9 *Ibid.*, p. 139.

10 ROSENBERG, *Entdeckung der Abstraktion* (cit. n. 3), pp. 21–23.

11 W. HOGARTH, *The Analysis of Beauty*, London 1753, pp. 38–39. See also: P. GUYER, *A History of Modern Aesthetics. Vol. I: The Eighteenth Century*, Cambridge 2014, p. 142.

12 E. BURKE, *A Philosophical Enquiry into the Origin of Our Ideas of the Sublime and Beautiful*, London 2005 [1757], Vol. II, Section XV, p. 195.

emphasized the stimulation of emotions as part of aesthetic experiences and correlated specific colors to specific emotions. He considered a strong red to be cheerful, whereas brown and a deep purple were sad colors.<sup>13</sup> “Black”, he maintained, “will always have something melancholy in it, because the sensory will always find the change to it from other colours too violent.”<sup>14</sup> Archibald Alison followed Burke with his thesis *On the Nature and Principles of Taste* (1790) in the distinction of “beauty” and “sublime” as the main aesthetic effects and offered the concept of association as an explanation for the perception of these effects.<sup>15</sup> According to Alison these can not only be found in the perception of colors, but also in lines:

*“The most obvious definition of FORM, is that of Matter; bounded or circumscribed by Lines. As no straight line, however, can include Matter, it follows, that the only Lines which can constitute Form, must be either 1st, Angular Lines, or 2ndly, Curved or winding Lines. Every Form whatever must be composed either by one or other of these Lines, or by the Union of them. [...] These different Forms seem to me to be connected in our minds with very different Associations, or to be expressive to us of very different Qualities.”*<sup>16</sup>

The qualities that Alison suggested are for example the thickness and the shape of lines: “1. Even Lines are expressive to us of Softness and Smoothness, 2. Uneven Lines are either Angular or Winding. Angular Lines are expressive of Harshness, Roughness. Winding Lines of Pliancy, Delicacy, Ease.”<sup>17</sup>

The above-mentioned authors were not the first ones to discuss the aesthetic effects of colors. As early as 1584 Giovanni Paolo Lomazzo gave a systematic description of the characteristics of single colors in his *Trattato dell'arte della pittura*.<sup>18</sup> Yet the major step in this discourse came from Goethe, who published *Zur Farbenlehre*, the very first rigorous and comprehensive theory of color in 1810.<sup>19</sup> In this treatise, he considered color in its phenomenal, experiential and moral qualities, thereby distinguishing the effect of colors on the eye (physical) and on the mind (psychological).<sup>20</sup> In this context, he explicitly used the wording “aesthetic effect”.<sup>21</sup>

Goethe's *Theory of Colors* had a broad aftermath. Artists like Philipp Otto Runge, William Turner, and Wassily Kandinsky, just to name the most well-known examples, used it in artistic practice.<sup>22</sup> The text became a reference point for the scientific investigation of aesthetics. Due in large part to the substantial skepticism of Goethe's criticism of Newton, the impact within the realm of the sciences was more limited, but

13 Ibid., Vol. II, Section XV, p. 159.

14 Ibid., Vol. II, Section XVIII, p. 232.

15 A. ALISON, *Essays on the Nature and Principles of Taste*, Edinburgh 1790, p. 239.

16 Ibid., pp. 232–233.

17 Ibid., pp. 238–239.

18 G. P. LOMAZZO, *Trattato dell' arte de la Pittura*. [...] Diviso in sette libri. Ne' quali si contiene tutta la Theorica & la prattica d'essa pittura, Milano 1584, cf. Rosenberg, *Entdeckung der Abstraktion* (cit. n. 3), p. 43.

19 T. LERSCH, *Farbenlehre*, in: *Reallexikon zur deutschen Kunstgeschichte*, München 1974, Vol. VII, cols. 157–274.

20 J. W. VON GOETHE, *Zur Farbenlehre*, Tübingen 1810. Translated from German into English by Charles Eastlake in 1840: C. L. EASTLAKE, *Goethe's Theory of Colours*. Translated from the German: with Notes by Charles Lock Eastlake, R. A., F. R. S., London 1840. Part II (p. 59) refers to “physical” and part VI (p. 306) to “psychological”.

21 EASTLAKE, *Goethe's Theory of Colours* (cit. n. 20), § 848. In German: “ästhetische Wirkung”.

22 J. GAGE, *Color and Culture. Practice and Meaning from Antiquity to Abstraction*, Boston/Toronto/London 1993, pp. 201–204.

it did reach up until Thomas Young and Hermann von Helmholtz.<sup>23</sup> In 1829, the young Gustav Theodor Fechner, who would be later one of the founders of psychology, wrote a short and critical essay on Goethe's color theory. Similar to Goethe's discrimination on the effect of colors on the eye and mind, Fechner distinguished a direct impression ("directem Eindruck") and an associative impression ("associativem Eindruck").<sup>24</sup>

The direct impression resulted from immediate perception and was induced by the forms themselves, comparable to Goethe's effect on the eye. The associative impression was conditioned by the purpose and meaning that the viewer attributes to a given object and, according to Fechner, was induced by related recollections of any sort. It is thus similar to Goethe's effect on the mind.

## 2. THE DESCRIPTION OF AESTHETIC EFFECTS AS POLARITIES

Goethe's book on colors was a milestone in several regards. The crucial factor for us is that although he did not invent the concept of aesthetic effects, he took this discourse far beyond the discussion on colors and brought it to a new level through his high authority, his explicit and systematic discussion, and the underlining of the principle of polarities. Polarities were a central category in Goethe's worldview, a kind of world-formula. Goethe assumed that nature generally functions through antagonistic forces, opposed entities that attract and repulse each other.<sup>25</sup> He might have taken this idea from natural sciences. He may have drawn from prevailing theories concerning magnetism, electricity and chemical attraction, which were already in his time

described in polarities between a positive and a negative pole.<sup>26</sup> In Goethe's color theory, blue and yellow represented the plus and the minus pole. Yellow represented the plus side, and was attributed to warmth, to light and to strength. Whereas blue was associated with the minus side, signified to darkness, cold and weakness. Hence, colors and their aesthetic effects varied on a continuous scale between two poles, described for instance as warm or cold.

A general review of art literature since the 19th century provides numerous examples for words often used to encode aesthetic effects using such polar terms.<sup>27</sup> Such words usually do not describe the form of lines, for example a "straight" line, or the darkness or clarity of color.

23 See: J. NEUBAUER, Quellen und Wellen der Wissenschaft. Goethe und Thomas Young, in: K. MANGER (ed.), Goethe und die Weltkultur, Heidelberg 2003, S. 17–32. H. Von Helmholtz, Ueber Goethe's naturwissenschaftliche Arbeiten, in: Vorträge und Reden von Hermann von Helmholtz, 1903 [1853], Vol. I, pp. 23–45, 46–47.

24 G. T. FECHNER, Kurze Darstellung der Goethe'schen Farbentheorie, in: J. B. BIOT (ed.), Lehrbuch der Experimental-Physik, Leipzig 1829, pp. 486–488. Cf. EASTLAKE, Goethe's theory of Colours (cit. n. 20), §915 and G. T. FECHNER, Vorschule der Aesthetik, II Vol., Leipzig 1876, pp. I, 100 and II, 212.

25 R. C. ZIMMERMANN, Goethes Polaritätsdenken im geistigen Kontext des 18. Jahrhunderts, in: F. MARTINI/W. MÜLLER-SEIDEL/B. ZELLER (eds.), Jahrbuch der deutschen Schillergesellschaft, Stuttgart 1974, pp. 304–347. Goethe writes for instance „[Aus der] Anziehungskraft und Zurückstossungskraft des Wesens der Materie [...] ging mir die Urpolarität aller Wesen hervor, welche die unendliche Mannigfaltigkeit der Erscheinungen durchdringt und belebt“, in: Goethes Werke, X, Autobiographische Schriften II, München 2002, p. 314.

26 P. PROBST, Polarität, in: J. RITTER/K. GRÜNDER (eds.), Historisches Wörterbuch der Philosophie, Vol. VII, P–Q, Basel 1989, pp. 1026–1027.

27 We do not review other related subjects which are repeatedly discussed when it comes to the aesthetic effects of colors and lines, such as color combining, contrast and also the correspondences of particular lines with particular colors. Runge for example described the effect of the combination of the three colors blue, yellow and red with their "opposite" colors (orange, violet and green) as "harmonic", whereas he considered the effect of a combination with only the three pure colors as "disharmonic", see P. O. RUNGE, Farbenkugel, Köln 1999, pp. 28–39.

Rather, they describe the appearance in reference to sensory crossovers and are often emotionally connoted. In many instances, the crossover is an act of metaphor and should not be confused with actual synesthesia, which is elicited automatically, is extremely idiosyncratic and

highly stable in individuals over time.<sup>28</sup> For the sake of space, we shall limit ourselves to four examples of categories involving sensory crossovers (temperature and sound) and expressive qualities (feelings and masculinity/femininity).

## 2 a . TEMPERATURE

A pervasive category for the description of color effects is temperature – colors were often arranged on a scale between cold and warm. Indeed, Joshua Reynolds suggested this scale in his *Discourse VIII* (1778).<sup>29</sup> Although still relatively unknown, Mary Gartside (1805) was possibly the first art theorist to use temperature as a category for a systematic classification of colors. She had connections to the Royal Academy in London and was hence probably aware of Reynolds' writings.<sup>30</sup> For his part, Goethe, who was also familiar with Reynolds, suggested that the perception of warm colors was akin to the sensation of warmth: "We find from experience, again, that yellow excites a warm and agreeable impression."

Conversely, blue by Goethe's estimations "gives us an impression of cold, and thus, again, reminds us of shade."<sup>31</sup> In a similar fashion, William Turner divided his "cycloid of light" in "opposed compounds", which are warm and cold. He suggested a structure of color that progressed from warm to cold: red, orange, yellow, green, blue and violet.<sup>32</sup>

The ordering of colors along the axis warm-cold remained relevant in the twentieth century, often with references to Goethe. For instance, Adolf Hölzel's lecture at the 1. *Deutscher Farbentag* (1st German Day of Color) in 1919 was a direct plea for Goethe's color theory.<sup>33</sup> Hölzel responded critically to the color theory of Wilhelm

28 Cf. A. GOTTDANG, *Vorbild Musik. Die Geschichte einer Idee in der Malerei im deutschsprachigen Raum 1780–1915*, München/ Berlin 2004, p. 109 and R. ROSENBERG, *Die Kartographie der Aura aus dem Geist der Wirkungsästhetik. Synästhesie und das Verhältnis von Kunst und Esoterik um 1900*, in: M. NEUGEBAUER-Wölke/R. GEFFARTH/M. MEUMANN (eds.), *Aufklärung und Esoterik: Wege in die Moderne*, Berlin 2013, pp. 583–604, esp. p. 586 f.

29 J. REYNOLDS, *The Works of Sir Joshua Reynolds. Containing His Discourses, Idlers, A Journey to Flanders and Holland, and his Commentary on Du Fresnoy's Art of Painting. In Two Volumes. To Which Is Prefixed an Account of the Life and Writing of the Author*, By Edmond Malone, London 1797, Vol. I, p. 182.

30 M. GARTSIDE, *An Essay on Light and Shade, on Colours, and on Composition in General*, London 1805, p. 13, cf. ROSENBERG, *Entdeckung der Abstraktion* (cit. n. 3), p. 48, 325 and A. LOSKE, *Mary Gartside: A Female Colour Theorist in Georgian England*, in: *St Andrews Journal of Art History and Museum Studies* 14, 2010, pp. 17–30, esp. p. 18.

31 Eastlake, *Goethe's Theory of Colours* (cit. n. 20), §768 and §282.

32 Cited from: J. GAGE, *Colour in Turner*, London 1969, p. 210. Turner possessed the English translation of Goethe's *Theory of Colours* from 1840 and dedicated two paintings to it, (*Ibid.*, p. 18). Turner also knew Reynolds: he studied at the time Reynolds was the president of the Royal Academy. Given that Turner's lecture in 1827 included remarks on warm and cold colors, and that the first English translation of Goethe's *Theory of Colours* was published in 1840, Turner could have derived the idea from Reynolds rather than Goethe (GAGE, *Colour in Turner* (cit. n. 32), pp. 209–210).

33 A. HÖLZEL, *Rede von Adolf Hölzel auf dem ersten deutschen Farbentag. Erster deutscher Farbentag auf der 9. Jahresversammlung des deutschen Werkbundes in Stuttgart*, Berlin 1919, pp. 10–26, esp. p. 11. "Art is always a matter of feeling. This talk, therefore, should mention a few theoretical things related to sensation. As to the development of visual harmony in artworks, our circle, especially I, stands on Goethean fundaments and seeks to continue on this fundament. To us, Goethe is not outdated. Rather, he is eternal, at least as long as there are human eyes". Orig-

Ostwald who had given a talk about the failure of Goethe at the same event.<sup>34</sup> Josef Albers underlined the influence of culture on the categorization of warm and cold colors: “as to warm and cool, it is accepted in Western tradition that normally blue appears cool and that the adjacent group, yellow-orange-red looks warm.”<sup>35</sup> In a letter to Rudolf Arnheim, Albers acknowledged that his early readings of Goethe’s color theory had influenced him.<sup>36</sup> Arnheim, in turn, dedicated a whole chapter in his book *Art and Visual Perception* (1954) to the tradition of describing the effects of color with the help of temperature and referred to many artists, such as Albers, Itten, and Kandinsky.<sup>37</sup>

Temperature was also attributed to lines, but often in combination with colors. In 1827 Humbert de Superville ascribed red to an ascending

line, white to a horizontal line and black to a falling line. This opinion was followed by Paul Signac, who in 1921 recommended that artists combine rising lines with warm colors and falling lines with cold colors.<sup>38</sup> Similarly, Kandinsky claimed in 1926 that the horizontal line is flat and cold, the vertical line is warm, whereas the diagonal line unites both poles.<sup>39</sup> August Endell in 1898 took an even more comprehensive approach by composing a table with 64 emotion words that showed that lines can consistently induce feelings in us.<sup>40</sup> He ordered the words on the dimensions tempo (“Tempo”) and tension (“Spannung” translated in fig. 2 as effort) (fig. 1 and 2).<sup>41</sup> Lines with medium tension and high speed are “cold” (translated as “frigid”), whereas lines with a bit less tension and almost no speed are “warm”.

## 2 b. SOUND

A typical cross-sensorial effect attributed to color is sound. Louis Bertrand Castel, the inventor of an ocular harpsichord (1725), suggested

precise relations between sounds and colors.<sup>42</sup> Goethe drew from Castel’s idea that dark and light colors corresponded to low and high tones

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inal: „Kunst ist und bleibt Empfindungssache. Hier soll darum einiges der Empfindung nahestehendes Theoretische erwähnt sein. Unser Kreis, speziell ich, stehen hinsichtlich einer bildharmonischen Entwicklung im Kunstwerke, auf Goetheschem Fundamente und suchen darauf weiterzubauen. Goethe ist für uns nicht veraltet, sondern ewig, wenigstens solange es menschliche Augen gibt“ (translation by the authors).

34 W. OSTWALD, *Farbkunde. Ein Hilfsbuch für Chemiker, Physiker, Naturforscher, Ärzte, Physiologen, Psychologen, Koloristen, Farbtechniker, Drucker, Keramiker, Färber, Weber, Maler, Kunstgewerbler, Musterzeichner, Plakatkünstler, Modisten*, Leipzig 1923.

35 J. ALBERS, *Interaction of Color*, New Complete Edition, New Haven/London 2009 [1963], p. 55.

36 Josef Albers to Rudolf Arnheim, March 14, 1973, cited in R. ARNHEIM, *A Critical Account of some of Joseph [sic] Albers’ Concepts of Color*, in: *Leonardo* 15:2, 1982, pp. 174–76. For more detail on Albers and Goethe see: B. DANILOWITZ, *A Short History of Josef Albers’s Interaction of Color*, Amherst 2015, pp. 13–28.

37 R. ARNHEIM, *Art and Visual Perception. A psychology of the Creative Eye*, Berkeley/Los Angeles/London, 1974 [1954], pp. 369, 371.

38 D. P. G. HUMBERT DE SUPERVILLE, *Essai sur les signes inconditionnels dans l’art*, Leiden 1827, p. 23; P. SIGNAC, *D’Eugène Delacroix au Néo-Impressionnisme*, Paris 1921, p. 63.

39 W. KANDINSKY, *Point and Line to Plane*, New York 1947 [1926], pp. 58–59.

40 A. ENDELL, *Formenschönheit und dekorative Kunst*, II. Die gerade Linie“, in: *Dekorative Kunst* I, 2, 1898, pp. 119–123, esp. p. 121.

41 Translation in: C. HARRISON/P. WOOD (eds.), *Art in Theory 1900–1990. An Anthology of Changing Ideas*, Oxford 1992, p. 65.

42 L. B. CASTEL, *L’optique des couleurs, fondée sur les simples Observations, & tournée sur-tout à la pratique de la Peinture, de la Teinture & des autres Arts Coloristes*, Paris 1740, p. 299–300.

FORMENSCHÖNHEIT UND DEKORATIVE KUNST							
boshaft	höhnisch	hochmütig	pathetisch	kalt	unerbittlich	grausam	fürchterlich
frivol	übermütig	herausfordernd	stolz	streng	gewaltsam	wild	grässlich
kokett	chic	prächtig	kühn	rücksichtslos	wuchtig	kolossal	scheusslich
geziert	graziös	elegant	energisch	kraftvoll	derb	ungeschlacht	roh
süßlich	zierlich	geschmeidig	feurig	stark	gedrungen	gewaltig	entsetzlich
fade	zart	hingebend	gross	vornehm	machtvoll	ungeheuer	furchtbar
nüchtern	einfach	innig	warm	ernst	tief	erhaben	grausig
stumpf	kraftlos	müde	bekümmert	traurig	schwermütig	düster	finster

Quick ↑ T E M P O ↓ Slow	Malicious	Scornful	Haughty	Pathetic	Frigid	Pitiless	Cruel	Terrible
	Facetious	Frivolous	Provocative	Arrogant	Harsh	Violent	Savage	Hideous
	Coquettish	Chic	Ebulliant	Daring	Reckless	Majestic	Awesome	Dreadful
	Affected	Gracious	Elegant	Energetic	Vigorous	Firm	Brutal	Bestial
	Sweet	Dainty	Flexible	Fiery	Strong	Rugged	Powerful	Frightful
	Insipid	Delicate	Devoted	Generous	Distinguished	Mighty	Monstrous	Awful
	Vacuous	Straight-forward	Sincere	Warm	Solemn	Profound	Sublime	Gruesome
	Dim	Weak	Tired	Troubled	Sad	Melancholic	Sombre	Desperate
	Light ← EFFORT → Heavy							

[It is impossible, of course, to translate the German words precisely: this Table is intended to give the essence of Endell's idea.]

Fig. 1 and 2: August Endell, *Table of words capturing nuances of feeling (Gefühlsnuancen)* 1898 and English translation in HARRISON / WOOD 1992

and used multiple scales describing the cross-sensorial effect of color and taste with the example of yellow-red as sour and blue as alkaline.<sup>43</sup> This was also reflected in the empirical investigation of aesthetics. Fechner, for instance, asserted in the *Vorschule der Aesthetik* (1876), that blue could be compared to the sound of a flute and red to a very loud tone like a trumpet fanfare.<sup>44</sup> In 1912 Kandinsky was more specific, differentiating the hue of blue: "In music, light blue is like

a flute, dark blue like a cello, and when still darker, it becomes a wonderful double bass".<sup>45</sup>

In similar fashion, from around 1910 on Gertrud Grunow assigned (twelve) colors to tones and to movements, stating that "[t]he tone f is the equivalent of the color green. Blue can be assigned to a bowing and yellow to a stretching movement".<sup>46</sup> Other artists connected to the Bauhaus, such as Paul Klee and Johannes Itten, also used musical terms to describe the effects of lines and colors.<sup>47</sup> While Itten focused on col-

43 J. W. VON GOETHE, *Maximen und Reflexionen*, Zürich 2001, p. 284. Goethe and Castel see: J. JEWANSKI, *Ist C = Rot? Eine Kultur- und Wissenschaftsgeschichte zum Problem der wechselseitigen Beziehung zwischen Ton und Farbe; von Aristoteles bis Goethe*, Sinzig 1999, p. 569.

44 FECHNER, *Vorschule der Aesthetik* (cit. n. 24), p. 216.

45 W. KANDINSKY, *On the Spiritual in Art*, New York 1946, p. 65.

46 G. GRUNOW, *Der Gleichgewichtskreis. Ein Bauhaus Dokument*, Weimar 2001, pp. 42–48 (translation by authors). See also: R. RADRIZZANI (ed.), *Die Grunow-Lehre. Die bewegende Kraft von Klang und Farbe*, Wilhelmshaven 2004, p. 30.

47 H. MAKABE, *What Makes Synesthesia so Fascinating? An Overview of the History of its Study and Practice*, in: *Art and Music – Search for New Synesthesia*, Tokyo 2012, pp. 177–194.

or accords (which involved at least two different colors),<sup>48</sup> Klee is one of the few authors who linked sounds to lines. In a lecture from 1922, he attempted to translate some musical notes into a drawn line.<sup>49</sup> In 1927, the psychologist Albert Wellek published research on the history of words used to describe color-hearing. One of his conclusions was that the most usual adjec-

tive pairs used to describe acoustic analogies can be divided between a plus and a minus pole. On the plus side are high pitches and warm colors on the minus side low pitches and cold colors. In Wellek's view, high and low pitches also corresponded to happy and sad emotions. He saw the plus side as the side of life and the minus side the one of death.<sup>50</sup>

## 2 C . FEELINGS

The arrangement of plus and minus was transferred to happy and sad, and, more generally, to positive and negative feelings. In Goethe's words, "[t]he colors on the *plus* side are yellow, red-yellow (orange), yellow-red (minium, cinnabar). The feelings they excite are quick, lively, aspiring. The colors on the *minus* side are blue, red-blue, and blue-red. They produce a restless, susceptible, anxious impression."<sup>51</sup> Similarly, Fechner assigned colors to feelings: red, orange and yellow are active and exciting, blue and violet are receptive.<sup>52</sup> In 1910 August Macke wrote in a letter to Franz Marc: "After our request, our friend Job played the three corresponding sounds on the piano for me, well, she claimed to play the same important role in music. So: Blue, Yellow, Red – parallel phenomena: sad, happy, brutal (in tones as well as in colors). All the lines (or melody) determine the sequence of the colours (or sounds).

Ascending and descending melodies that are in full integration".<sup>53</sup>

A dominant theory was that the direction of lines is correlated with feelings. In 1827 Humbert de Superville stated that ascending lines are perceived as happy, descending as sad, horizontal as neutral.<sup>54</sup> Signac, who was probably aware of Humbert de Superville's theory through its reception by Charles Blanc, stated that a horizontal line elicits a calm effect, a rising line happiness, and a falling line sadness,<sup>55</sup> while Georges Seurat proposed that a happy line is above the horizontal, a calm line is horizontal and a descending line sad.<sup>56</sup> A similar idea is expressed in Endell's table of feelings (fig. 1 and 2): the 36 inner terms describe positive feelings ("Lustgefühl"), whereas the 28 adjective terms outside the square are, according to Endell, negative ones ("Unlust").

48 J. ITTEN, *Kunst der Farbe*, Ravensburg 1961, pp. 21–32.

49 P. KLEE, *Beiträge zur bildnerischen Formlehre*. Faksimilierte Ausgabe des Originalmanuskripts von Paul Klees erstem Vortragszyklus am staatlichen Bauhaus Weimar 1921/22, Basel 1979, p. 56. Cf. R. BONNEFOIT, *Die Linientheorie von Paul Klee*, Petersberg 2009.

50 A. WELLEK, *Doppelempfinden und Programmmusik*. Beiträge zur Psychologie, Kritik und Geschichte der Sinnessprechung und Sinnensymbolik, Wien/Prag 1927, Vol. II, p. 24.

51 EASTLAKE, *Goethe's Theory of Colours* (cit. n. 20), §764.

52 FECHNER, *Vorschule der Aesthetik* (cit. n. 24), p. 215.

53 English translation from W. COHEN (ed.), August Macke, New York 2013, p. 72.

54 HUMBERT DE SUPERVILLE, *Essai sur les signes* (cit. n. 38), pp. 6–7.

55 SIGNAC, *D'Eugène Delacroix* (cit. n. 38), p. 63.

56 For an English translation see: J. C. TAYLOR (ed.), *Nineteenth-Century Theories of Art*, Berkeley/Los Angeles/London 1987, p. 542.

## 2 d. MASCULINITY/FEMININITY

Characteristics of lines and colors were also often described as masculine or feminine. Runge understood the “warm side” of the color spectrum (yellow-orange) as male and the “cold side” (blue-violet) as female.<sup>57</sup> He associated “active” with “male”, but also with “warm”, whereas “passive” was associated with “feminine” and “cold”.<sup>58</sup> The same classification could be made in the opposite direction. In 1910, Marc expressed in a letter to Macke that “blue is the male principle, astringent and spiritual. Yellow is the female principle, gentle, gay and sensual. Red is matter, brutal and heavy and always the color to be opposed and overcome by the other two”.<sup>59</sup> Adolf Loos (1908) and Piet Mondrian (1914) asserted that the horizontal line is female and the vertical line is male.<sup>60</sup> And this again derived from the association with active and passive, also asserted by Kandinsky in 1926:

*“The same thing can with complete justification be said about the horizontal and the vertical – low and high. The former is lying, the latter is standing, walking, moving about, finally climbing upward. Supporting – growing. Passive – active. Relatively: feminine – masculine.”*<sup>61</sup>

Finally, Klee distinguished between a straight line and a free line. The straight line appears aggressive, active and therefore masculine.<sup>62</sup>

The various examples quoted above show that the aesthetic effects of lines and colors were often described in art literature by involving cross-modal perceptions: qualities from different sense modalities. Such perceptions are not meant to be real in a physical sense. Whereas a color may vary in luminance, none of the authors quoted so far assumed that it can physically transform into taste or sound. However, it is a common feature in art literature since the 18<sup>th</sup> century that the perception of these qualities is not purely subjective, but rather collectively shared. For instance the authors quoted so far, as well as many others, assumed that something about the impression of color is really quite similar to the impression of temperature. This idea reappears in subsequent theories and leads to two basic questions: 1) How can one assess such effects? and 2) What is the cause of the effects themselves?

Since authors in art literature considered aesthetic qualities of lines and colors as objectively given, they tended not to discuss their cause, or did so only in an implicit or transcendental way. Explanations came rather from psychologists. Fechner already explained that color associations may derive from references to objects. For Fechner, the object associations that humans are most likely to have with the color yellow are the lemon and the canary.<sup>63</sup> Kandinsky delivers a post-hoc confirmation of Fechner statement.<sup>64</sup> In 1912 he asserted that yellow can be described

57 P. O. RUNGE, *Hinterlassene Schriften*, Göttingen 1965 [1810], p. 164.

58 This is in accordance with Goethe, who also attributed “activity” to red. EASTLAKE, *Goethe’s Theory of Colours* (cit. n. 20), § 764.

59 A. MACKE/F. MARC, *Briefwechsel*, Köln 1964, p. 28.

60 A. LOOS, *Ornament und Verbrechen* (1908), in: Loos, *Sämtliche Schriften*, Vol. I, Wien/München 1962, pp. 276–288, p. 277; P. MONDRIAN, *Two Mondrian Sketchbooks: 1912–1914*, Amsterdam 1969, p. 16.

61 KANDINSKY, *Point and Line to Plane* (cit. n. 39), p. 63.

62 P. KLEE, *Notebooks*, Vol. I: *The Thinking Eye*, London 1961, p. 333.

63 FECHNER, *Vorschule der Aesthetik* (cit. n. 24), p. 101.

64 KANDINSKY, *On the Spiritual in Art* (cit. n. 45), p. 63. Kandinsky makes no explicit reference to Fechner. Still, we know that he was familiar with psychological literature of his time, for example with Wilhelm Wundt, see: A. WEISSENBACH, *Wassily Kandinsky. Unterricht am Bauhaus 1923–1933*, Vol. I, pp. 194, 508.

as being “shrill” and “sour”, which he explained with correspondences to the sound of a canary bird and the taste of lemon.<sup>65</sup> He also asserted a direct form-color correspondence, stating that “sharp colors have a stronger sound in sharp forms (e. g., yellow in a triangle).”<sup>66</sup>

Over time, the question of how to uncover and eventually measure aesthetic effects was more and more discussed. Goethe already conducted introspective experiments with various instruments to achieve this description of the effects of colors. For instance, he described how

objects seen through a yellow glass became warm and vivid and that the same objects seen through a blue glass appeared cold, sad and dead to him.<sup>67</sup> Experimental methodologies were however mainly developed in the 20<sup>th</sup> century and involved exchanges between artists and psychologists to develop experimental methodologies to study the perceptual experience of aesthetic forms. To illustrate this, in the next section we concentrate on Kandinsky, who seems to be the foremost example for such cooperations.

### 3. THE EXPERIMENTAL INVESTIGATION OF AESTHETIC EFFECTS

Having been an academic researcher before starting an artist career at the age of 30 in 1896, Kandinsky was even as an artist, eager to conduct empirical experiments and inspired a number of psychological investigations. In 1920, he tried to set up a department for psychophysical aesthetics at the Institute of Artistic Culture (INChUK) in Moscow. This was part of a larger project, in which psychologists, philosophers, and other thinkers from various domains worked together on a program to establish a science of art.<sup>68</sup> In this context, Kandinsky mobilized the color theory that he had developed in *Über das Geistige in der Kunst* (1912) for a questionnaire on painting. It aimed to investigate how feelings and forms correlated and included questions about similarities between forms and colors. Kandinsky claimed that three elementary plane-shapes – the circle, the triangle, and the square – correspond to the colors blue, yellow and red respectively. For Kandinsky, these colors and shapes connected on a fundamen-

tal level for following reasons: Yellow manifested a centrifugal movement, coming toward the viewer. This movement expressed madness and impurity. The link to the triangle was clear, Kandinsky insisted, because both yellow and the triangle expressed sharpness and acuity. In similar fashion, blue manifested effects that were equivalent to the circle; passive, round and serene. Finally, red possessed expressive properties that can be described in similar terms to the square, which made their fundamental connection evident. With the questionnaire, Kandinsky reached out to a wider audience and asked his colleagues to write down their impressions as accurately as possible:

*“For example, how do you see a triangle? Would you say that it moves and, if so, in which direction? Would you say that it is smarter than a square? Is not the sensation elicited by a triangle more similar to that elicited by a lemon? What is the singing of a canary more like, a triangle or a square?”*<sup>69</sup>

65 KANDINSKY, On the Spiritual in Art (cit. n. 45), p. 40.

66 Ibid., p. 46.

67 J. W. VON GOETHE, Betrachtungen über die Farben, geschrieben vor Mainz im Juni 1793, zit. nach: Beiträge zur Optik und Anfänge der Farbenlehre. 1790–1808, Weimar 1951, pp. 125–126.

68 It drew on the work of Wundt and Fechner. See: M. VÖHRINGER, Avantgarde und Psychotechnik. Wissenschaft, Kunst und Technik der Wahrnehmungsexperimente in der frühen Sowjetunion, Göttingen 2007, p. 77; Weissenbach, Wassily Kandinsky (cit. n. 64).

69 W. KANDINSKY, Questionnaire (1920). Translation from Russian: J. E. BOWLT, in: Experiment 2002, pp. 157–160, here p. 158.

With such questions, Kandinsky asked people to connect seemingly unrelated objects in their minds and to reflect on the feelings that this elicited. His objective was to establish “how frequent the same answers are” and to find “conformities in impression and observation.”<sup>70</sup> This was not only meant to refer to the attribution of correspondences, but also to the rationale that people offered for these attributions. A year later, in 1921, Kandinsky continued this approach at the RAKhN (Russian Academy of Sciences) and incorporated it in his pedagogical work at the Bauhaus in 1923. He taught his color-shape-correspondences to first semester students and his assignment became widely used at the Bauhaus.<sup>71</sup> Together with the wall painting workshop, Kandinsky distributed a questionnaire to verify the relationship between the three basic shapes and the three primary colors, but, unfortunately, he never published any results. 27 completed questionnaires still exist today.<sup>72</sup>

This obviously raises the question: Is the matching of color-shape-correspondences, such as the system Kandinsky postulated, something which people should agree on? The scien-

tific experimentation with Kandinsky's theory continues today. In the last fifteen years, several psychologists attempted to test the Bauhaus questionnaire with contemporary spectators.<sup>73</sup> Those studies showed that most test persons proposed different combinations from the ones that Kandinsky had assumed and that those combinations are rather driven by object associations: for example, the sun is yellow, hence round; triangular street signs are red.

Even before Kandinsky set up psychological studies at art academies, psychologists started to integrate his paintings into experimental studies to test the perception of similarity relations between visual forms and the perception of expressive properties. The psychologist Helge Lundholm examined Kandinsky's *Composition VI* as a topic for psychological investigation as early as 1917.<sup>74</sup> In 1921, Lundholm published an experiment that studied “the emotional quality” that people ascribed to different types of lines.<sup>75</sup> He wanted to answer the following questions: “Is the affective character of the line a quality which is bound to the line itself, or is it suggested by the literary subject of the masterpiece? Further-

70 Ibid. p. 160.

71 WEISSENBACH, Wassily Kandinsky (cit. n. 64), p. 205; M. DROSTE (ed.), Bauhaus, Köln 2006, pp. 90, 146.

72 The Bauhaus-Archiv in Berlin holds one completed questionnaire (inv. nr. 991). It was mistakenly attributed to Alfred Arndt. It remains unclear who actually filled out the questionnaire. We thank Nina Schöning of the Bauhaus-Archiv for this information. For a reproduction, see: GAGE, Color and Culture (cit. n. 22), p. 261.

The Centre Pompidou in Paris holds 26 more completed questionnaires. Two in the Cabinet d'art graphique (inv. nr. 04-515919/AM81-65-1249(1) and inv. nr. 04-515920/AM81-65-1249(2)) and 24 in the Fonds Kandinsky (inv. nr. CP, FK 9200). For a reproduction of the first questionnaire, see M. Tupitsyn, Gegen Kandinsky/Against Kandinsky, Ostfildern 2006, p. 45. For those in the Fonds Kandinsky see: A. WEISSENBACH, Wassily Kandinsky (cit. n. 64), Vol. II, pp. 131-142.

73 T. JACOBSEN/C. WOLSDORFF, Does History Affect Aesthetic Preference? Kandinsky's Teaching of Colour-Form Correspondence, Empirical Aesthetics, and the Bauhaus, in: The Design Journal 10/3, 2015, pp. 16-27; T. JACOBSEN, Kandinsky's Questionnaire Revisited: Fundamental Correspondence of Basic Colors and Forms?, in: Perceptual and Motor Skills 95, 2002, pp. 903-913; A. V. KHARKHURIN, Is Triangle Really Yellow? An Empirical Investigation of Kandinsky's Correspondence Theory, in: Empirical Studies of the Arts 30, 2012, pp. 167-182; A. D. J. MAKIN/S. M. WUERGER, The IAT Shows no Evidence for Kandinsky's Color-Shape Associations, in: Frontiers in Psychology 4, 2013, pp. 1-7; N. CHEN/K. TANAKA/K. WATANABE, Color-Shape Associations Revealed with Implicit Association Tests, in: PLoS ONE 10, 2015, pp. 1-15.

74 B. LÄRKNER, “Humbug” or “genius”? When Kandinsky came to Sweden, in: A. ROSDAHL (ed.), Nya perspektiv på Kandinsky. New perspectives on Kandinsky, Konsthall & Sydvenska Dagbladet, Malmö 1990, pp. 23-35, here p. 31.

75 H. LUNDHOLM, The Affective Tone of Lines: Experimental Researches, in: Psychological Review 1921, pp. 43-60.

more, is this quality a phenomenon that appears equally to different observers?"<sup>76</sup> In his experiment, he asked eight participants to "draw lines, each of which was to express the affective tone of an adjective given verbally."<sup>77</sup> He used 48 adjectives, divided into 13 groups of synonyms, which represented feelings such as sadness, tranquility, cheerfulness and anger. He classified the lines that the participants produced in groups of ones with angles and ones with curves and specified the interval of the angles and curves (big, medium, and small: fig. 3).<sup>78</sup> He found that lines that matched with the emotions sad, quiet, lazy, etc., had large curves, whereas emotions such as merry were expressed with lines with short waves (e.g., type c in fig. 3).<sup>78</sup> Lundholm found consensus among observers, which, he thought, was "probably dependent upon the suggestion of movement in the lines."<sup>79</sup>



Fig. 3: Helge Lundholm, *Examples of types of lines used in the experiment published in 1921*

Building on Lundholm's experiment, Poffenberger and Barrows (1924) used a set of similar adjectives to examine the relation between emo-

tions and lines; however, they gave their participants a different task.<sup>80</sup> Lundholm had asked them to produce drawings that resemble particular feeling states. Poffenberger and Barrows looked at the interaction in the opposite direction and asked participants to match words to a set of lines. Similar studies were pursued in the 1930s. Kate Hevner (1935) for instance asked participants to match a list of adjectives to linear patterns and colors (red and blue). Her results showed that "curves are found to be serene, graceful, and tender-sentimental. Angles are robust, vigorous, and somewhat more dignified."<sup>81</sup>

Gertrud Grunow is another example of an artist with affiliations to psychology's methods and ideas. In 1911, she developed a theory about color-tone-movement-correspondences and later cooperated with the psychologist Heinz Werner to test her assumptions. In her essay *Von der Wirkung der Farbe auf das sehende Auge* (The effect of color on the viewing eye), Grunow claimed that the eyes behave differently when viewing different colors. Looking at red elicits a "mode of beholding", while looking at yellow leads to a "mode of observing". She wrote that she had studied "several hundred human beings".<sup>82</sup> Werner referred to this experiment and further collaborative studies with Grunow in his book *Einführung in die Entwicklungspsychologie*.<sup>83</sup> Werner cited biographical statements and theoretical proposals from artists, which, for him, were a valuable source for investigating a mode

76 Ibid., p. 43.

77 Ibid.

78 Ibid., p. 49.

79 Ibid., p. 60.

80 A. POFFENBERGER/B. BARROWS, The Feeling Value of Lines, in: *Journal of Applied Psychology* 8, 1924, pp. 187–205.

81 K. HEVNER, Experimental studies of the affective value of colors and lines, in: *Journal of Applied Psychology* 19/4, pp. 385–398, here p. 398. Another example is Krauss who asked participants to match lines to gold, iron and silver (R. KRAUSS, Über graphischen Ausdruck. Eine experimentelle Untersuchung über das Erzeugen und Ausdeuten von gegenstandsreichen Linien. Beihefte zur Zeitschrift für angewandte Psychologie, Leipzig 1930, cited by H. Werner, *Einführung in die Entwicklungspsychologie*, München 1959, pp. 46–47).

82 G. GRUNOW, Von der Wirkung der Farbe auf das sehende Auge, in: *Kunst und Jugend* 15, 1935, pp. 149–150, esp. p. 149.

83 WERNER, *Einführung* (cit. n. 81), pp. 66–67.

of physiognomic perception. Despite the subjective nature of artists' perceptions, they could be mobilized for psychological inquiry.

Picking up this tradition, in 1995, Shigeo Takahashi, conducted an experiment wherein one group of participants (from an art academy) was asked to produce abstract line drawings with a specific expressive content. Then a second group (not from an art academy) was asked to assign adjectival terms to these line drawings.<sup>84</sup> The terms were anger, joy, tranquility, depression,

human energy, femininity and illness.<sup>85</sup> Takahashi found consensus among the viewers, and suggested "that many people may share a synesthetic tendency by which drawings communicate on a level of shared awareness rather than on a level of verbal expression and visual symbols".<sup>86</sup> Takahashi's study was the starting point for work by Despina Stamatopoulou, whose research investigates the influence of cultural differences on the perception of aesthetic effects.<sup>87</sup>

#### 4. CONTROLLED ASSOCIATIONS

Moving back to the mid-twentieth century, in psychology, a common experimental tool that has similar properties to the tradition discussed above is the semantic differential. It was developed by Charles Osgood in the 1950s as a way of better capturing meanings.<sup>88</sup> Broadly, it was meant to help uncover the "feeling-tones" of concepts as a part of their total meaning.<sup>89</sup> For this purpose, Osgood asked participants to rate spontaneously and as quickly as possible a stimulus for associations with a large number of popular adjectival pairs, scaled on either numerical or verbal anchors—for example, extremely cold, quite cold, neither cold nor hot, quite hot, extremely hot. The participants received the following instructions:

*"The purpose of this study is to measure the meanings of certain words of various people by having them judge each word against a series of descriptive scales. In taking this test, please judge the words on the basis of what they mean to you. Each numbered item presents a concept and a scale. You are to rate the concept on the 7-point scale [indicated for each side: very closely associated, quite closely associated, only slightly related, or both sides equally associated]."*<sup>90</sup>

Out of the ratings, any given concept may be mapped in a semantic space, which captures the global assessment of the concept along one or more axes. Osgood contextualized this type of research in the study of metaphor. He held that the "relation of this phenomenon to ordi-

84 S. TAKAHASHI, Aesthetic Properties of Pictorial Perception, in: Psychological Review 102, 1995, pp. 671–683.

85 How these terms were chosen is not described in the paper.

86 TAKAHASHI, Aesthetic Properties (cit. n. 84), p. 675. For interest in this topic from the perspective of design, see for example T. Rieke, haptic VISUALS. Oberfläche und Struktur – Farbe und ihre Beziehung zur Tastwahrnehmung, Frammersbach 2008.

87 D. STAMATOPOULOU, Embodied Imagination: Emotional Expression Perception of Dynamic Line-Drawings Created by Artists, in: Imagination, Cognition and Personality 26, 2007, pp. 213–248.; D. STAMATOPOULOU, Perception of Emotional Expression in Line Drawings, in: Hellenic Journal of Psychology 5, 2008, pp. 117–146; D. STAMATOPOULOU/G. C. CUPCHIK/T. AMEMIYA/M. HILSCHER/T. MIYAHARA, A Background Layer in Aesthetic Experience: Cross-cultural Affective Symbolism, in: Japanese Psychological Research 58, 2016, pp. 233–247.

88 C. E. OSGOOD/J. SUCI/P. H. TANNENBAUM, The Measurement of Meaning, Urbana 1957.

89 C. E. OSGOOD, On the Whys and Wherefores of E, P, and A, in: Journal of Personality and Social Psychology, 12/3, 1969, pp. 194–199, esp. p. 195.

90 C. E. OSGOOD/J. SUCI, Factor Analysis of Meaning. Journal of Experimental Psychology 50/5, 1955, pp. 325–338, here p. 328.

nary metaphor is evident: a happy man is said to feel 'high', a sad man 'low'; the pianist travels 'up' and 'down' the scale from treble to bass; souls travel 'up' to the good place and 'down' to the bad place; hope is 'white' and despair is 'black'.<sup>91</sup> Although he did not develop the semantic differential for the empirical study of art, he acknowledged that the "notion of using polar adjectives to define the termini of semantic dimensions grew out of research on synesthesia,"<sup>92</sup> especially on color-music synesthesia. In fact, the semantic differential was repeatedly used for research on art and Osgood, for his part, defined art as "a kind of human communication [that] is a perfectly legitimate area of scientific study."<sup>93</sup>

As a result of the experiments, Osgood found a reduction of adjective scales into three independent groups or factors (calculated with statistical advancements dealing with multidimensional scaling for factor reduction).<sup>94</sup> These are: "Evaluation", represented by scales such as good-bad, pleasant-unpleasant, and positive-negative; "Potency", with terms such as strong-weak, heavy-light, and hard-soft; and, "Activity", which covers fast-slow, active-passive, excitable-calm.<sup>95</sup> William Tucker, a student of Osgood, found that art appreciation required a different set of words than Osgood had used in his first studies. He derived a set of 40 adjectives from a pre-study with museum visitors and persons who saw slides of artworks. In his subsequent experiments, he asked artists and non-artists to

Table 7  
FACTOR LOADINGS FOR NON-ARTISTS ON SEVEN REPRESENTATIONAL PAINTINGS  
(TUCKER STUDY)

Scale	Factor I (Activity)	Factor II (Evaluation)	Factor III (Potency)
hot-cold	.64	-.08	.00
pleasant-unpleasant	-.02	.59	-.60
lush-austere	.64	-.16	-.23
vibrant-still	.91	-.08	.29
repetitive-varied	-.81	-.48	.29
happy-sad	.34	.38	-.71
chaotic-ordered	.55	-.84	.00
smooth-rough	-.57	.53	.00
superficial-profound	.18	-.72	-.58
passive-active	-1.00	.00	.00
blatant-muted	.80	-.28	.11
meaningless-meaningful	-.33	-.79	.28
simple-complex	-.66	.55	-.48
relaxed-tense	-.57	.39	-.54
obvious-subtle	-.23	.80	.01
serious-humorous	-.22	-.05	.97
violent-gentle	.41	-.37	.69
sweet-bitter	-.32	.23	-.67
static-dynamic	-.78	.19	-.53
clear-hazy	-.04	.85	.38
unique-commonplace	.50	.22	.72
emotional-rational	.67	.09	.40
ugly-beautiful	.12	-.51	.42
dull-sharp	-.53	-.34	-.74
sincere-insincere	.18	.80	.34
rich-thin	.56	.35	.46
bad-good	-.33	-.77	-.27
intimate-remote	.09	.45	-.46
masculine-feminine	.31	.13	.76
vague-precise	-.04	-.84	-.43
ferocious-peaceful	.39	-.46	.53
soft-hard	-.39	.09	-.84
usual-unusual	-.52	-.16	-.70
controlled-accidental	.00	.80	.34
wet-dry	-.37	-.89	.35
strong-weak	.37	.46	.81
stale-fresh	-.45	-.54	-.51
formal-informal	-.58	-.40	.24
calming-exciting	-.54	.26	-.55
full-empty	.60	.31	.52

Fig. 4: The list of terms used in the semantic differential by TUCKER 1955

rate abstract and representational contemporary artworks on this adjective list (Fig. 4).<sup>96</sup> Tucker's list overlaps with the terms discussed in section two of this paper.<sup>97</sup>

At the outset of its development, the semantic differential was reflected in art historical dis-

91 Ibid., p. 21.

92 OSGOOD/SUCI/TANNENBAUM, *The Measurement of Meaning* (cit. n. 88), pp. 20, 290.

93 Ibid., p. 291.

94 C. E. OSGOOD, *Semantic Differential Technique in the Comparative Study of Cultures*, in: *American Anthropologist*, New Series, 66/3, Part 2: Transcultural Studies in Cognition, June 1964, pp. 171–200.

95 Ibid., p. 173.

96 W. T. TUCKER, *Experiments in Aesthetic Communications*, unpub. doct. Diss. University of Illinois, USA, 1955.

97 Tucker's terms were: hot-cold, pleasant-unpleasant, lush-austere, vibrant-still, repetitive-varied, happy-sad, chaotic-ordered, smooth-rough, superficial-profound, passive-active, blatant-muted, meaningless-meaningful, simple-complex, relaxed-tense, obvious-subtle, serious-humorous, violent-gentle, sweet-bitter, static-dynamic, clear-hazy, unique-commonplace, emotional-rational, ugly-beautiful, dull-sharp, sincere-insincere, rich-thin, bad-good, intimate-remote, masculine-feminine, vague-precise, ferocious-peaceful, soft-hard, usual-unusual, controlled-accidental, wet-dry, strong-weak, stale-fresh, formal-informal, calming-exciting, full-empty.

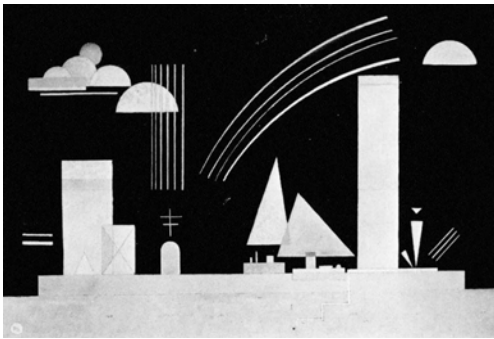


Fig. 5: Wassily Kandinsky, *Ruhe/At Rest*, 1928, New York, Solomon R. Guggenheim Museum, in GOMBRICH 1963

cussions. Ernst Gombrich, who underlined the relativity and hence context dependency of aesthetic effects, addressed Osgood's method in 1963: "I have discussed this natural equivalence between emotional states and sounds, colours and shapes in various contexts, and have drawn attention, in this connexion, to the experimental tool which C. E. Osgood has developed for their exploration."<sup>98</sup> In this context, Gombrich discussed Kandinsky's *At Rest* (fig. 5), a painting in which the painter had tried to create a peaceful and still impression by arranging the shapes and colors in a particular manner, at least according to the art historian Leopold Ettlinger.<sup>99</sup> Gombrich however, stated that he doubted that "even the most sensitive beholder would feel 'at rest' in

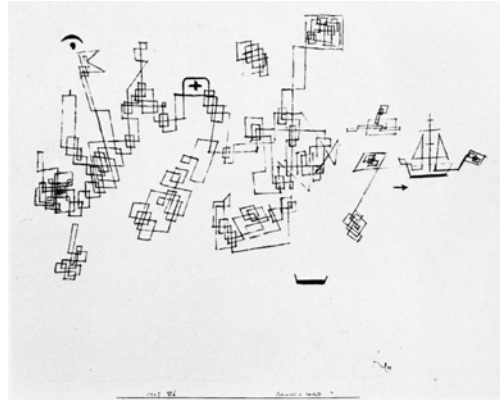


Fig. 6: Paul Klee, *Aktivität der Seestadt/Bustling Harbor*, 1927, Bern, Zentrum Paul Klee, in GOMBRICH 1963

front of this picture."<sup>100</sup> Nevertheless, he believed "that we can restore a clear expressive meaning to Kandinsky's composition by placing it in its historical context."<sup>101</sup> He contrasted *At Rest* with Klee's drawing *Bustling Harbour* (fig. 6). In comparing the two pictures, the beholder might find that the overall effect of *Bustling Harbour* was "restlessness" and that *At Rest* then appeared calm.<sup>102</sup> Gombrich's polemic was also a direct attack on slogans such as "abstract art as world language", popular after World War II, suggesting that abstract art is understandable to everyone and far more universal than figurative art.<sup>103</sup>

98 E. H. GOMBRICH, *Expression and Communication*, in: Idem (ed.), *Meditations on a Hobby Horse: and other Essays on the Theory of Art*, London 1963, pp. 55–69, p. 58.

99 L. D. ETTLINGER, *Kandinsky's "At Rest"*, New York/Toronto 1961. *At Rest* was also the main topic of a lecture by Ettlinger (*Kandinsky and the psychology of perception*), quoted by Gombrich. Ettlinger makes a link to Humbert de Superville: "'At Rest' with its strong emphasis on the horizontal, would be a fitting illustration in any reprint of Superville's fascinating essay", p. 20.

100 GOMBRICH, *Expression and Communication* (cit. n. 98), p. 67.

101 Ibid., p. 68.

102 Ibid.

103 S. BANN, *Abstract art – a language?*, in: Tate Gallery (ed.), *Towards a New Art. Essays on the Background to Abstract Art 1910–20*, London 1980, pp. 125–231; A. HOORMANN, *Die Entfernung der Inhalte aus dem Bild. Zur Konstruktion des „unschuldigen Sehens“ im Abstrakten Expressionismus*, in: HOORMANN/D. BURDORF, *Medium und Material zur Kunst der Moderne und der Gegenwart*, München 2007, pp. 262–275; S. LEEB, *Abstraktion als internationale Sprache*, in: S. BARRON (ed.), *Kunst und kalter Krieg. Deutsche Positionen 1945–89*, exh. cat. Germanisches Nationalmuseum Nürnberg und Deutsches Historisches Museum Berlin, Köln 2009, pp. 119–133; and for an empirical approach to this question H. BRINKMANN/L. COMMARE/H. LEDER/R. ROSENBERG, *Abstract Art as a Universal Language*, in: *Leonardo* 47, 2014, pp. 256–257.

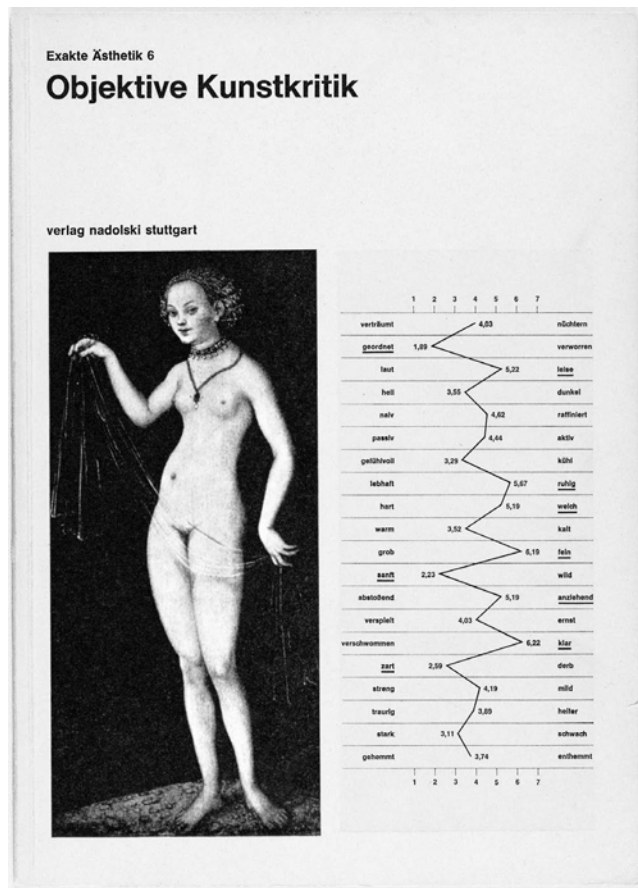


Fig. 7: Cover of the journal *Objektive Kunstkritik*, *Exakte Ästhetik* 6, 1969

The semantic differential was also used in a series of interdisciplinary aesthetic congresses organized by the psychologist William E. Simmat. These congresses were paired with the journal *Exakte Ästhetik*, edited by Simmat, who was also head of *Galerie d*, an association for modern art in Frankfurt. In 1966, the psychologist Peter Hofstätter published an article in this journal on the semantic differential as a method to capture “Anmutungsqualitäten”.<sup>104</sup> Three years lat-

er, in 1969, the journal focused on “objective art criticism” (“Objektive Kunstkritik”).<sup>105</sup> Simmat suggested to use the semantic differential for this purpose, an idea illustrated on the cover showing a *Venus* by Cranach next to a semantic differential (fig. 7).<sup>106</sup> He proposed that art appreciation requires a specific set of terms. The key challenge for him was to find a list of reasonable adjectives for this purpose. Ideally, these adjectives would be derived from art literature, but

<sup>104</sup> P. R. HOFSTÄTTER, Objektive Methode zur Erfassung von Anmutungsqualitäten, in: W. E. SIMMAT (ed.), *Exakte Ästhetik* 3/4, Stuttgart 1966, pp. 47–65.

<sup>105</sup> W. E. SIMMAT (ed.), *Exakte Ästhetik* 6: Objektive Kunstkritik, Stuttgart 1969.

<sup>106</sup> W. E. SIMMAT, Das „semantic differential“ als Instrument der Kunstanalyse, in: SIMMAT, *Exakte Ästhetik* (cit. n. 105), pp. 69–88, esp. p. 69; and TUCKER, Experiments in Aesthetic Communications (cit. n. 96).

due to time limitations, he composed a list of 20 adjectives through pilot studies.<sup>107</sup> In his actual experiment, he asked 27 students to rate 10 artworks by different artists. The terms that the group selected were then presented to another group (without the paintings), where the subjects had to match the paintings to the terms.

This was thus a reversal of the process undertaken by the first group and all participants were able to identify the “correct” matches. Herewith, Simmat concluded that the semantic differential was an adequate tool for measuring aesthetic qualities of art.<sup>108</sup>

## 5. AN EXPERIMENTAL STUDY AND OUTLOOK ON FUTURE RESEARCH

The review sketched in this paper demonstrates that many authors of art literature and art history on the one side and of psychology on the other side share three central assumptions: the importance of lines and colors as basis of aesthetic effects, their polar description, and the often tacit assumption of a high degree of universality of such effects. For instance, Goethe did not consider the possibility of individual differences, Humbert de Superville claims in the ti-

tle of his book to reveal the “unconditional signs in art” and Fechner assumed that at least “western” humans collectively share specific object associations with the color yellow.<sup>109</sup> Authors from the arts and psychologists came together at several moments of history. However, up until now, they remain far apart from each other. With some exceptions, as discussed in this text, art historians generally do not consider the use of empirical methods to objectify their assump-

	Bipolar (Semantic Differential) <i>cold-warm</i>
Unipolar Same (e. g. <i>cold</i> )	-0.84
Unipolar Different (e. g. <i>warm</i> )	0.85
Selection Same (e. g. <i>cold</i> )	-0.75
Selection Different (e. g. <i>warm</i> )	0.77

Table 1: Correlations between the bipolar (semantic differential) and the other scales

**Note:** Correlation is a measure of the relationship between two variables. “Same” in the unipolar and in the selection method means that if the bipolar scale goes from cold to warm (i. e., a low rating reflects the idea that the painting is cold) then “unipolar same” refers to the rating on the unipolar scale of cold (not cold – cold) and “selection same” refers to the selection of the word “cold” as relevant to describe the effect of the painting. In contrast, “different” refers to the rating on the unipolar scale of warm (not warm – warm) and “selection different” refers to the selection of the word “warm” as relevant to describe the effect of the painting. The table thus shows the expected pattern for consistent ratings with high negative correlations between the bipolar scale, the “unipolar same” and the “selection same” on the one side and high positive correlations between “unipolar different” and “selection different” on the other side.

<sup>107</sup> In German: Verträumt-nüchtern, geordnet-verworren, laut-leise, hell-dunkel, naiv-raffiniert, passiv-aktiv, gefühlvoll-kühl, lebhaft-ruhig, hart-weich, warm-kalt, grob-fein, sanft-wild, abstoßend-anziehend, verspielt-ernst, verschwommen-klar, zart-derb, streng-mild, traurig-heiter, stark-schwach, gehemmt-enthemmt.

<sup>108</sup> Ibid., p. 77.

<sup>109</sup> FECHNER, Vorschule der Ästhetik (cit. n. 24).



Fig. 8: Wassily Kandinsky, *Untitled*, 1934, watercolor, ink, 31,6 × 24,6 cm, Paris, Centre Georges Pompidou

tions, and psychologists generally do not take history into account.

The central aim of our project, which joins psychologists and art historians, is to question the claim of universality of aesthetic effects. We use empirical methods from psychology to test assumptions from art literature, that are often used until today in art history. Our first step was to establish a suitable instrument to measure aesthetic effects. Due to the long tradition of polar description of aesthetic effects and to its acceptance in psychology, the semantic differential described in section four was our natural choice. To evaluate this choice, we compared the semantic differential with two other methods: a unipolar scale where every term was rated separately (i. e.



Fig. 9: Paul Klee, *Blick aus Rot / Be aware of red*, 1937, pastel on cotton on wallpaper glue on jute, 47 × 50 cm, Bern, Zentrum Paul Klee, donation Livia Klee

one rating for “cold” and another for “warm”), and a selection method, in which participants could mark every term they found appropriate to describe the artwork. Based on the analysis of historical texts described in section two of this paper, we composed a list of 20 adjective pairs of terms that occurred most frequently among the authors examined so far.<sup>110</sup> As stimulus material, we chose 10 abstract pictures.<sup>111</sup> In total, 118 people participated in our study (96 female, mean age=21.36, SD age= 3.7). We divided them in three groups and asked each of them to rate 10 artworks, but only on one of the three scales: 38 people rated the artworks on the semantic differential, 37 on the unipolar scales and 43 used the free selection method.

The comparison of the three groups shows that the type of scale did not affect the choice of terms in the ratings. In fact, the three methods strongly correlate (Table 1). This indicates

110 These are (in German): positiv – negativ, aktiv – passiv, lebhaft – ruhig, spannungsvoll – locker, beruhigt – aufgeregt, statisch – dynamisch, aggressiv – friedlich, weich – hart, stark – schwach, heiß – kalt, schwer – leicht, sanft – grob, körperlich – geistig; maskulin – feminin, aufdringlich – zurückhaltend, protzig-bescheiden, harmonisch – disharmonisch, ausgewogen – unausgewogen.

111 Two works from each of the following artists: Wassily Kandinsky, Paul Klee, Fritz Winter, Joan Miró and Richard Mortensen.

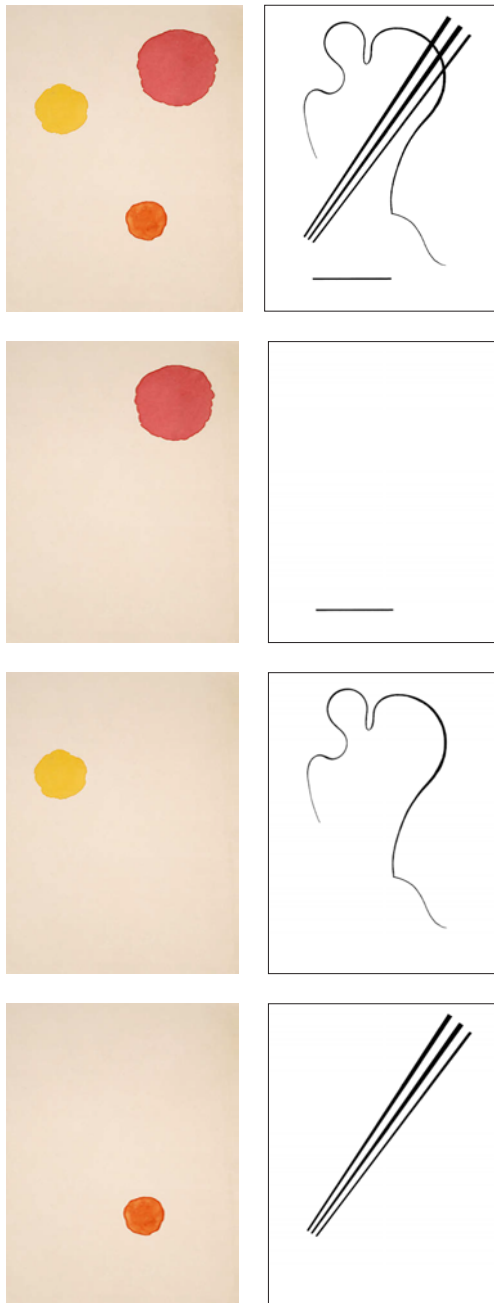


Fig. 10: Separation of lines and color of Kandinsky's watercolor

that if a painting is rated warm rather than cold on a semantic differential, it will also be rated warm and not-cold on the unipolar scales. Moreover, we found a high correlation ( $r = -.81$ ) be-

tween the ratings of the unipolar scales. Specifically, if people rated cold and warm on two different unipolar scales, these unipolar scales together result in one bipolar scale. The semantic differential is based on the binary opposition of terms and forces participants to rate their impression of any given stimulus on a scale. This raises the question how the midpoint of the scale can best be interpreted as it can mean 'neither' and/or 'both equally'. The result of our comparison shows that when people rate a painting on the midpoint of a bipolar scale, this is because they find neither of the terms relevant (rather than finding both equally relevant). This interpretation of the results is strengthened by the low occurrence of the selection of two opposing terms in the selection method. In total, people selected two opposites only in 3.1 % of all cases. Thus, we can conclude that all three scales function similarly and produce similar and comparable findings.

A closer look at the ratings of an untitled watercolor by Kandinsky (fig. 8) and Klee's *Be aware of red* (fig. 9) will clarify this point. On average, participants rated Kandinsky's work as positive, warm and feminine. Klee's painting was also rated warm and positive, but on average at the midpoint between feminine and masculine. Did participants find *Be aware of red* both feminine and masculine, or neither feminine nor masculine? The method-comparison showed that this work was perceived as not-feminine and not-masculine and, thus, confirmed that mid-scale ratings are used by participants when they want to indicate that both concepts are not suitable rather than indicating that both apply.

In the future, we will use these images to test to what extent the overall effect of paintings is a result of the sum of the effect of separable elements (lines and colors) and to what extent the claim of universality applies. In order to tackle these questions empirically, we disentangled three abstract pictures (by Kandinsky, fig. 8, Klee, fig. 9, and Miró) and isolated "their" single