Wilhelm Ostwald's „Harmony of Colours" (1918) and Its Mixed Reception - a Reassessment

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***Abstract*—Wilhelm Ostwald's "Harmony of Colours" from 1918 was heavily contested in 1919 when he tried to demonstrate its tenets during the "1. Farbentag of the German Werkbund," in Stuttgart. Artists like Hölzel, Itten, Klee, Schlemmer, and art historians like Erwin Redslob, Paul F. Schmidt and Hans Hildebrandt were upset. Hildebrandt published a "Farbensonderheft" in 1920 where the critics of Ostwald raised their objections and later organized an action called "Verwahrung" (protest) to avoid that Ostwald's System could be taught at schools. Among others it was signed by many of the Bauhaus masters. When this proclamation was accepted by the Werkbund in 1921, Ostwald had to renounce his membership. What were the reasons for this refusal? Then again some years later the "Zeitgeist" seems to have changed. Constructivists and artists from the de Stijl-group welcomed Ostwalds ideas. Ostwald could even lecture for a week at the Bauhaus in Dessau in 1927. In the Bauhaus Moholy-Nagy and younger teachers like Hinnerk Scheper or Herbert Bayer dealt with Ostwald's doctrine, however, without adopting it wholeheartedly. In spite of this not many artists – the Swiss artist Hans Hinterreiter being one notable exception – were inclined to use Ostwald's doctrine of the harmony of colours consistently. What do we think of all this today? Are Ostwald's suggestions sound? Are the objections by Hölzel, Klee and others valid? Was it a conflict about areas of competence? Are the results obtained by using his method convincing? Is the question of the harmony of colours ill-posed? In my intervention, I will try to discuss these issues.**

The task given by the Deutsche Werkbund (German Association of Craftsmen – an organization dedicated to the improvement of industrial design) in 1914 to the famous chemist and Nobel laureate Wilhelm Ostwald **(Fig. 1)** (1853-1932) to develop a "rational colour atlas", which was useful for the purpose of industry was quite timely. The nomenclature of colours, where very different names, which were also differently understood, were in use, had to be standardized. Germany's large-scale chemical industry definitely held the lead on the world market, based on the production of new synthetic colours. **(Fig. 2)** The textile industry in particular needed clear designations and constant markings. The passionate recreational painter Wilhelm Ostwald had shown with his seventeen "Malerbriefe" (Letters to a painter) of 1903 that he understood a lot about the natural sciences of painting. He had joined the German Werkbund around 1912 and had initiated a "Freie Gruppe für Farbkunst" there. As a painter, he always remained a dilettante, who had no understanding for the avant-garde of his time, but he increasingly became the most important and influential colour theorist of his epoch.

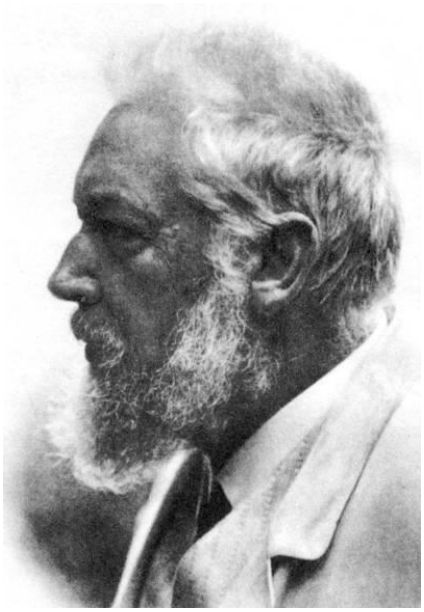

Figure 1. Wilhelm Oswald

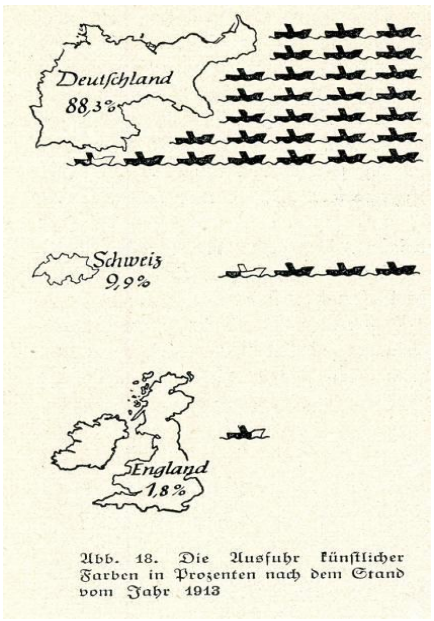

Figure 2. Ausfuhr syntetischen Farben 1913 Barth von Wehrenalp

What should a colour system do? What is to be ordered? Pigments? Light of certain wavelengths? Sensations?

Unrelated colours? Related colours? The term colour is ambiguous. First of all, one has to distinguish whether physically defined parameters are arranged, such as light sources of specific wavelength and intensity, or also, as usual in some colour manufacturers, mechanically generated mixtures of colour substances by weight. Such systems, for example, the usual RGB colour space, however, cannot claim to meet the human perception processes. Strictly speaking, they are not really *colour* systems, because they do not allow statements about colours as the creations of the human brain. Since no linear relationship exists between physically defined stimuli and corresponding sensations, such systems cannot be used to make statements about subjectively perceived colours.

But also colour systems dealing with precisely those species-specific human colour sensations cannot be determined unequivocally. If possible, they should arrange all perceivable colours in a model in such a way that the various relationships and differences become recognizable and readable. Each distinguishable colour should have one and only one location in the respective model. We also want them to allow statements about perceptual facts, such as the "equidistant intervals" of the colours, for example, whether a particular orange is perceived to be the same distance from a certain yellow as from a certain red. It would be ideal if not only the individual elements were arranged in a logical, perceptual sequence, but also the differences between the individual elements would have the same distance (for the perception of a human observer). Now a single colour system satisfying all of the above requirements is on principle not possible - at least not in a Euclidean space. Among other things, equidistant intervals cannot be added, since the sensation of equality varies according to the interval size. Non-equidistant colour spaces, on the other hand, can be fitted into any Euclidean space. Their form results from the definition of the axes and their subdivisions.

These are, of course, findings which were not necessarily available to Wilhelm Ostwald, but were acquired only in the course of time, and especially in the examination of his own colour system. According to his own requirements, it should meet scientific necessities as well as to
be useful for industry and trade. It was by no means clear that this can only be done in an approximate manner and in a sort of design compromise of contradictory requirements.

In principle, Ostwald wants to arrange sensations: "The systematics of the Atlas are to be purely and exclusively based on the order of the colour sensations, that is, on a psycho-physical basis. Physical definitions, such as wavelengths, spectral analysis, etc., can only be used as a secondary aid." That's why he opts for a colour atlas based on related colours, that is surface colours. This is to take account of the everyday situations in which we encounter colours. In this case, it is assumed that colour samples under normal conditions (to be determined) have to correspond to a (normal) human colour sensitivity, or are capable of triggering them.

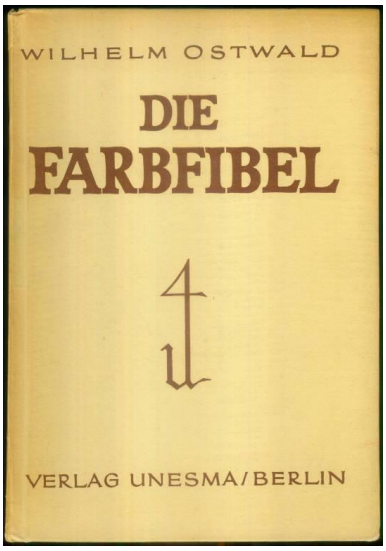

Figure 3. Oswald, Wilhelm Farbfibel

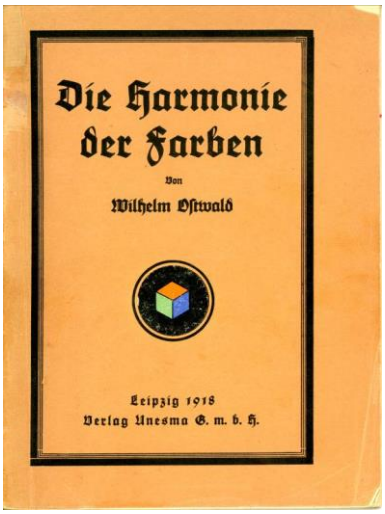

Figure 4. Ostwald, Harmonie 1918

As early as 1917 he published the results of his investigations. It consisted of a "Farbfibel" (colour primer), which contains the basic principles for the production of a colour atlas. **(Fig. 3)** It proved to be highly successful and achieved 14 editions by 1930. In the same year 1917 also appeared the first colour atlas with 2500 colours (later reduced in size as a colour norm atlas with 680 colours). A "Harmonielehre" (colour harmony manual) was added in 1918. **(Fig. 4)** He is very proud of what he has done: "I

emphasize that I believe that the creation of the measuring theory of colour is the highest achievement I have been able to accomplish." As a scientist, he had proceeded more systematically and more fundamentally as expected of him, and had overachieved the task assigned to him by not simply designing a colour atlas, but by formulating a whole colour scheme on a scientific basis. Colourimetry, colour atlas and harmonics are the cornerstones of his system. They are constantly being changed and improved so that it is difficult to keep track of the large number of their publications. I will confine myself here to the essential features.

In the course of time, several so-called 'colour organs,' i.e. collections of measured and standardized pigments are produced, which are in principle ready for use. **(Fig. 5)** The largest of them contains 2520 measured colours. However, he believes that for most practical purposes a colour organ with 680 colours would suffice. He arranges them, in fact, according to the logic of an acoustic organ. There are the 24 hues of the colour circle as a manual and 28 shades with black and white as a register. Add to this, 8 achromatic colours. In his view one should be able to assemble and use these standardized colours in the sense of a colour music.

Figure 5/a. Ostwald, Farbenorgel 1920 nach Bendin

Figure 5/b. Ostwald Farborgel in Pulverform Nachlass Alfred Adam

His system impresses with clarity and usability. He decides for the geometric shape of the double cone. **(Fig. 6)** According to him, this form is naturally based on the choice of its three parameters: full colour, white and black. All the saturated chromatic colours which he called Vollfarben (full colours), are, although they have different brightness, arranged on the largest circle, which forms the boundary between the upper and lower cones. The spindle of the double cone contains the achromatic colours between black and white. The upper tip is the white pole, the lower is the black pole. Ostwald decomposes this continuum into different stages, which, of course, means a determination *a priori*. For practical purposes, he considers eight levels to be sufficient. **(Fig. 7)** In order to determine these steps as perceptually equidistant, he refers to Weber-Fechner's law, according to which the increase of stimulus intensity in the geometrical progression causes an increase in sensation in arithmetic progression.

Figure 6. Ostwald Doppelkegel

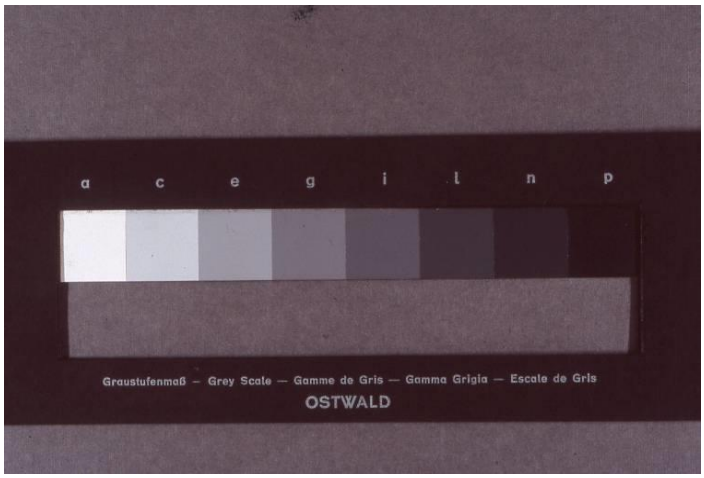

Figure 7. Ostwald, Wilhelm Graustufen

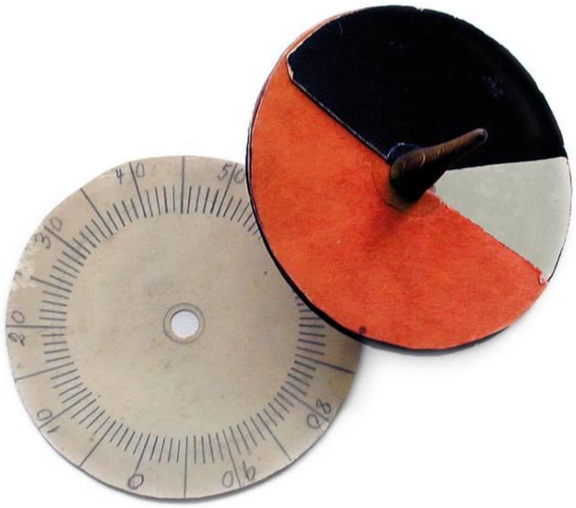

Figure 8. Ostwald, Wilhelm original Handkreisel

Between this spindle and a saturated chromatic colour on the mantle of the cone, an equilateral triangle is formed, which Ostwald calls farbgleiches Dreieck (monochromatic triangle). Its corners are formed by white, black and one of the maximum saturated chromatic colours of the colour circle. In principle, it contains all of the possible gradations of the respective chromatic colour with black and white (or grey). Here, too, he decides for a logarithmic grading of the whiteness and blackness in discrete steps, according to Weber-Fechner's law. In the determination of these shades, he uses a colour top, that is a physico-metric determination and not a psychological one. **(Fig. 8)** The upper edge of the triangle contains all the colours that result from the mixing of the colour with different amounts of white. For the lower edge, all gradations are made by adding black paint. Inside the triangle lie the blends of the full colour with different amounts of both black and white. Overall, a monochromatic triangle comprises in the reduced form 28 or together with the achromatic series 36 colours. **(Fig. 9)** Any colour tone thus consists of a partitive mixture of the full saturated colour as well as black and white. Ostwald develops a nomenclature of numbers for the full colour and letters for the black or white content, which makes it possible to characterize each colour clearly **(Fig. 10)**. Finally, horizontal sections form concentric circular rings through his colour body, in which the white and black contents of each associated colour are in the same proportion. **(Fig. 11)**

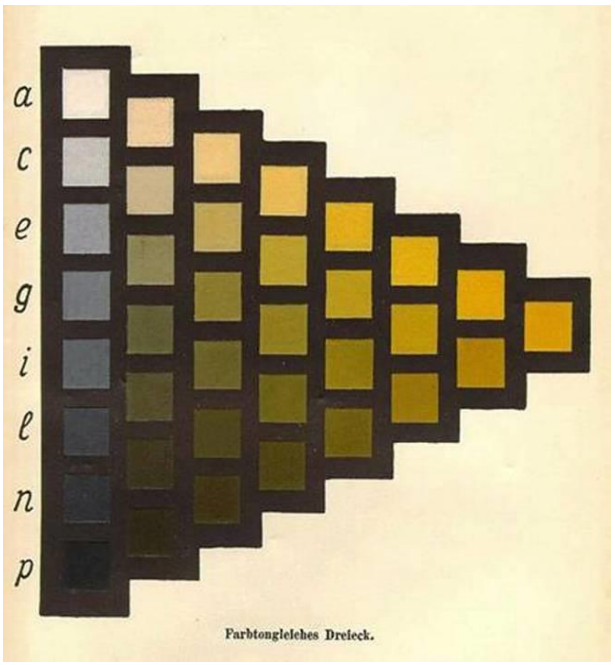

Figure 9. Ostwald, Wilhelm Farbtongleiches Dreieck

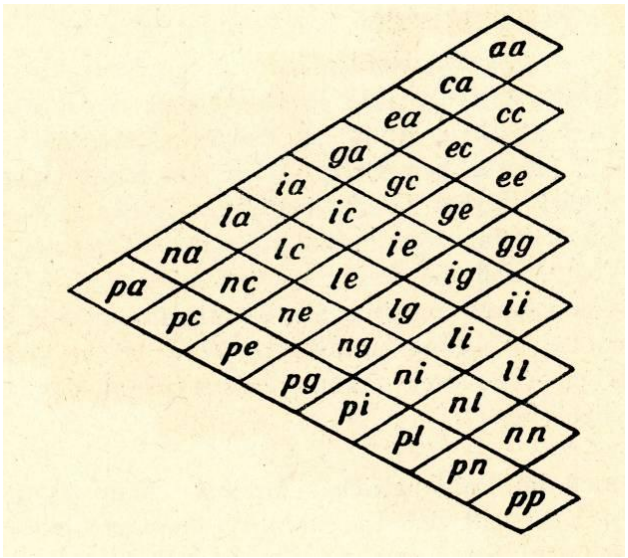

Figure 10. Ostwald, Wilhelm Farbtongleiches Dreieck Nomenklatur

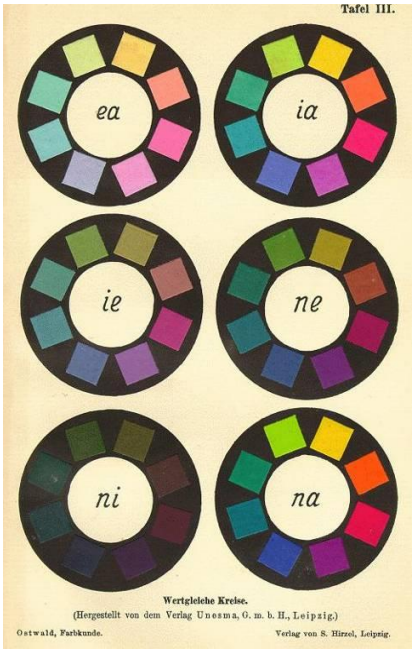

Figure 11. Ostwald Wertgleiche Kreise 1923

However, there are problems that apply to any system based on surface colours, not just Ostwald's. There would be the dependence on the lighting situation. The colour samples can only be determined under standardized conditions. The nature of the light source, its direction, the light temperature as well as the luminance should be clearly defined. Ostwald insists on daylight, which is not satisfying, since, as is generally known, both its spectral composition and intensity are subject to strong changes. If the light intensity is too low, for example, the Purkinje effect occurs. Above all, the problem of metamerism, i.e. the fact that physically speaking, different colours can look the same under a certain lighting, but different in the case of a lighting change, has not been solved satisfactorily.

In addition, the surface texture of the colour sample plays a role. It acts differently, depending on whether it is mat or glossy. Therefore, the character of the surface of a paint application should be controlled. Ostwald contented himself with the designation 'mat,' which is left to be desired in exactness. Then the size of a colour sample in the visual field has to be taken into account. The range of vision as well as the direction of view would have to be specified. The same applies to the colour of the background. Because of the simultaneous contrast, each background colour and texture influences the perceived shade. It is also necessary to consider the 'crispening effect', i.e. the fact that the perceived difference of two colours appears enlarged by a similar background. **(Fig. 12)** Since even colour-competent viewers have individual differences in their colour perception, a standard viewer is required, which is usually done by statistical means of several results of psychophysical examinations.

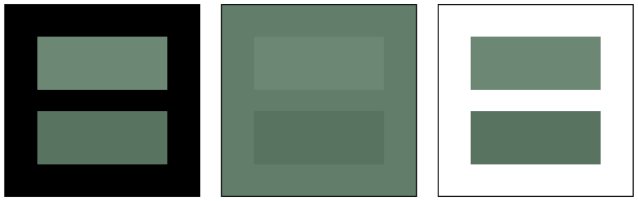

Figure 12. Crispening-Effect

Let us come to the systemic weaknesses. Instead of the determination of colours according to hue, brightness and saturation, a system based on hue, as well as black and white content, is used in his system. This raises a problem for intuitive intelligibility. The perceived brightness or darkness of, for example, tobacco brown is intuitively easier to judge than its black or white content. As a result of the choice of a double cone with the saturated chromatic hues, which have different brightness, on the circle with the largest diameter, equal positions in his monochromatic triangles do not correspond in their brightness. Horizontal cuts through his colour body show differently bright colours. Therefore, it is not possible to compare values in his system. The same is true for saturation. In his system, saturation levels cannot be specified. In the case of different hues, the perceived greying due to the admixture of white and / or black can be quite uneven. A yellow with a certain white content, appears in contrast to a blue with the same white content as quite powerful.

This is not to say that his decision for the parameters full colour, white and black is flawed or has to be criticized, but that his system is only one of the possible colour systems and other systems can be more useful for other purposes. There are more criticisms from a scientific point of view, among other things, of his measurement methods, which would take too far to list them here. I want to limit myself to his colour circle.

Ostwald is not strictly scientific in the production of his colour circle. Since it is delimited to surface colours, he cannot consider wavelengths or monochromatic light for their determination. Therefore, he proceeds from the remission and introduces for this the concept of 'colour half'. This means pigments which in half of the spectrum repel all light and swallow everything in the other half, the halves being limited by two complementary wavelengths **(Fig. 13)**. However, this is a physical definition which is based on the measurement of wavelengths and which determines which surface colours are theoretically realizable. It does not give any information about the

perceived purity of such colours.

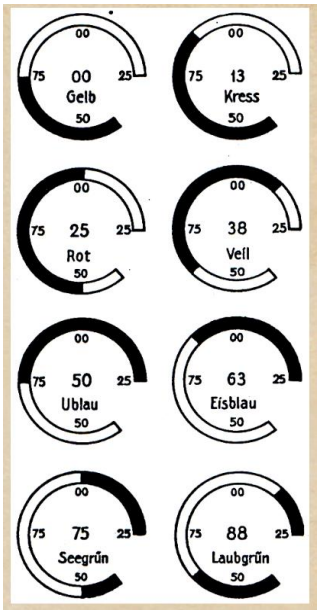

Figure 13. Ostwald Farbenhalb

Ostwald thinks that for almost all practical purposes, 24 steps in the circle of solid colours would suffice. He numbered them accordingly from 1-24. This, of course, is an arbitrary decision which he has made because of the multiple divisibility of the number 24. Their arrangement is based on three principles: "1. Complementary colours should be diametrically opposite. 2. A colour half provides the hue that lies in the centre of the colour half. 3. Principle of inner symmetry." **(Fig. 14)** However, these requirements are partly contradictory. For example, the sensitivities of human colour perception are quite different in different areas. Physically equal distances are often perceived as different. Therefore, the complementary colours would not be diametrically opposed to each other in the case of an equidistant colour circle.

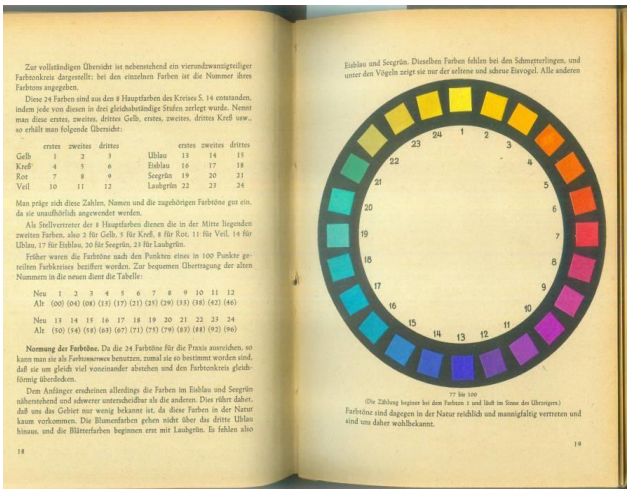

Figure 14. Ostwald Fabfibel Vollfarbenkreis

Ostwald lays out from the outset eight colours in four pairs which are complementary to one another, that is, Yellow and Ultramarin blue, Orange and Ice blue, Red and Sea green as well as Violet and Leaf green. They are distributed at the corner points of a regular octagon over the colour circle. In doing so, he proceeds from the four phenomenologically determined psychological Primaries - that is the opponent colours red, blue, green and yellow in the sense of Ewald Hering - and extends them by four intermediate colours. This arrangement - which is by no means inevitable - is intended to allow the detection of complementary colours, which then again is only approximately true. Next each of these eight colours is fanned out in three steps. Thus, there are three yellow hues, three orange hues, etc. Again, he uses a colour top, that is optical mixture to find the proper hues. Here, too, it should be noted that this method is based on a physico-metric determination and not on a psychological one. It is noticeable that the green area in his colour circle is much larger than in other colour circles. This is due to the fact that he has defined the places for red, blue, yellow and green *a priori*, and that the complementary colours are arranged diametrically opposite each other. His circle of colours is, therefore, far from being perceptually equidistant, as one can already ascertain with the naked eye. Since Ostwald, in his endeavour to introduce measure and number into the field of colour theory, fixes on a stereometrically regular body, the perceived equidistance of the individual hues relative to one another must be dispensed with. This can only be tested empirically. Further, the so-called "colour contribution," i.e. the fact that a saturated chromatic colour appears lighter to a viewer than it is physically speaking is not taken into account in Ostwald's system.

In the conflict between scientific exactness and pragmatic feasibility, he decided mostly for the latter without admitting that the scientific claim of his system had become questionable. More precisely, he was so convinced of the beauty, and thus the correctness of his model, that he had developed *more geometrico* based on his intuitions about the science of order, that he dismissed contradictory results as scholastic subtleties. This negligence, astonishing for a scientist of his rank, must be seen against the background of his monistic convictions. Criticism of Ostwald's colour system came from the beginning from physicists and natural scientists. Ostwald, who, as I said, took the beauty of his model as a proof of conformity with reality, considered their objections to be irrelevant, an attitude that is unacceptable for a scientist not only in the face of today's precision of measurement.

Yet all the justified criticism from a scientific point of view, ignores the fact that Ostwald has created a practically

useful colour atlas on colorimetric principles, which was far superior to all the other colour catalogues for surface colours that were then available. Without compromise, no colour atlas is possible. Last but not least, his product is of high quality. Because of his experience as a painter and chemist he is capable of carefully mixing and controlling the paint application. For many purposes, his colour atlas is accurate enough. One should also take into account that Ostwald, in contrast to most physicists, deals with surface colours and in so doing introduces quite original ideas to measure and arrange them. Even if his methods are inadequate in detail, he has given significant impetus to colour research. These include the clear conceptual separation between 'related' and 'unrelated' colours, as well as the concept of the 'colour half', which helps explain how the spectral locus (in which the purples are missing) can be supplemented into a closed colour circle.

Basically, Ostwald has developed a high-quality sample book, as it is still offered by colour manufacturers. Certainly, his model meant a huge simplification, but it offered a useful orientation. However, the claim to absoluteness which he raised was by no means justified. In any case, *de facto* a division into colour systems for the needs of the industry, such as the RAL-System and those for scientific purposes, such as the CIE Colour space from 1931, soon developed.

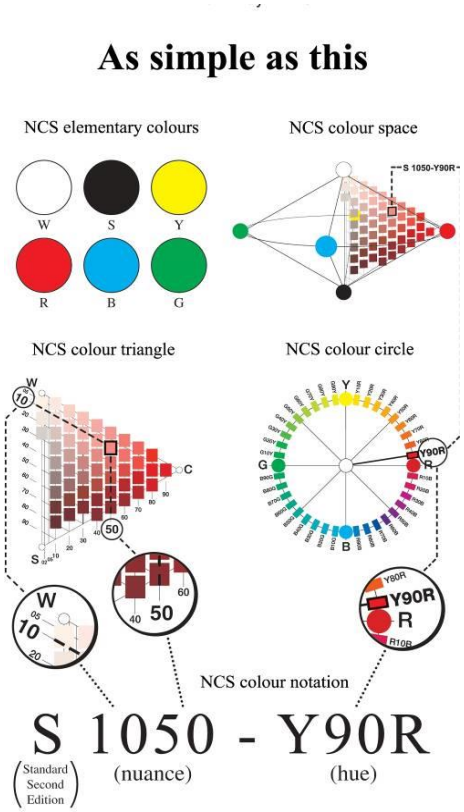

Figure 15. NCS System

After all, the Scandinavian NCS-System (= Natural Colour System), which is widely used in architecture, interior architecture, design and the textile sector, is based on the geometry of Ostwald and follows his conception. **(Fig. 15)** One can regard it as an improved and modernized version of Ostwald's colour space. In contrast to the latter, it is more empirically oriented and is based on the average judgments of a number of test people. It is equally intuitive, easy to understand and practicable. Therefore, though not by name, elements of Ostwald's theory of colour are still in use.

There was, however, another group which had nothing in common with the scholars, but who nevertheless fought Ostwald's colour scheme immediately after its appearance, namely the artists and art historians. They had little to do with the alleged scientific nature of Ostwald's system, but balked at the consequences which, according to him, were to be drawn from it for the domain of free and applied arts. Their criticism was almost exclusively directed to Ostwald's advice on the production of colour harmonies, which he sketched out in his colour primer, but also expounded more or less extensively in countless publications. Last but not least, they objected to the fact that some of their areas of competence were being disputed, since Ostwald was not satisfied with having produced a standard colour atlas with which one can determine other colours by comparison but wanted to raise his 680 standard colour cards to norm colours, which should be applied uniquely. He even imagined that students were made familiar with these standard colours, and that colour associations would be founded to play out the possible combinations and produce colour harmony.

Only a few colour researchers have resisted the temptation to deduce from their results suggestions for the harmonious composition of colours, but they were generally ignored by the artists, or modified to the point of being unrecognizable. This is the case, for example, for Eugène Chevreul, Ogden Rood, or Wilhelm von Bezold, not to mention Goethe and Runge. In the case of Ostwald, the situation is somewhat different in that only normalized paints (produced by him) could be used. This was the real stone of the offense.

In 1919, it came to a confrontation during the 'First German Colour Day' (within the annual meeting of the German Werkbund in Stuttgart), when Ostwald gave the lecture "Die Grundlagen der Farblehre und Farbkunst" (the basics of colour theory and the art of colour) and was so imprudent to illustrate his ideas of a colour harmony by his own works, which the artists, by virtue of their obsolete style, found rather fussing ("paintings of little flowers") and their colours unpleasant too hideous. **(Fig. 16)** Oskar

Schlemmer recalls that Ostwald "tried to crown his lecture by revealing an art-product, the application of his research results. It contained, in spite of his will, the impossibility of making art with the help of the scientific recipe." The painter Adolf Hölzel held the accompanying lecture. Most of the comments - as far as they were published - were extremely critical of Ostwald. For example, the art historian and Reichskunstwart Erwin Redslob contradicted: "These colour combinations [propagated by Ostwald] can never produce a work of art, they are calculated, and they lack every humanly warm inspiration."

Figure 16. Ostwald Blumenstudien (nach 1920)

The opponents of Ostwald then took over the "free group for colour" which Ostwald had created within the Werkbund, in a coup-like manner, and elected the art historian Hans Hildebrandt as chairman. Hildebrandt, whose wife had studied with Hölzel, later proved to be the main agitator of the protest against Ostwald. But also, the art historian Paul Ferdinand Schmidt titled his report on the Werkbund conference in the influential magazine 'Der Cicerone' with "Werkbund-Krisis." There he does not save with sharp words: "But the most emphatic protest is to be raised against one thing: this is the way in which the nonsense of Ostwald was given space and importance at the conference." He considers the introduction of the Ostwald colour standard as "militarism in art," which is a very fierce accusation in the face of the just ended World War, and even calls for the exclusion of Ostwald from the Werkbund: Ostwald's propaganda for the application of his colouring in art was an "arrogance which can only be answered with a complete exclusion from the Werkbund."

In October 1920, a "Special issue on colour," was published by the "free group for colour", within the German Werkbund, where the positions of the opponents of Ostwald as Adolf Hölzel, Paul Klee and others were represented. Paul Klee wrote at the suggestion of Hildebrandt a short text titled "Colour as Science," in which he exposed sarcastically the naiveté in Ostwald's theory of colour, indicated the low relevance of the exact pigment mixtures for artists, who would also work with different paint application modes and emphasized the relativity of the colour values. He maintains that a scientific colour theory is unnecessary for artists and emphasizes the qualitative uniqueness of colours: "All the infinite mixtures will never produce an emerald green, a Saturn red a cobalt violet." In the same booklet, as well as a few aphorisms by Adolf Hölzel, an essay by the art historian Emil Utitz appeared, who emphatically denied the existence of binding laws for colour choice for artists. At most, an *artistic* theory of colour like the one developed by Goethe, was helpful. This publication had to annoy Ostwald and alienate him from the Werkbund. He drew the consequences and left at the end of the year.

Finally, the signing operation "Verwahrung" (protest), sent to all the German ministries of education, to famous artists, art colleges, and other institutions became a tremendous success. In this declaration made by Hildebrandt in 1921, he objected to the introduction of Ostwald's theory of colour in the schools. At the annual meeting of the Werkbund in Munich 1921, the "Verwahrung" (protest) was accepted. Thus, the separation from Ostwald was carried out.

Figure 17. Ostwald Farbtonharmonie

What was it that made the artists and art historians so angry? In his book The Harmony of Colours of 1918, Ostwald postulates the following principle of colour

harmonics: "only such colours can appear harmonically or coherently, whose characteristics show certain simple relations." Since his system is based on the three parameters full colour as well as black and white, these can be systematically modified and their similarities or differences clearly recognized. In particular, he refers to his colour circle. In addition to complementary colours, he knows triple groups and groups of four or even five, etc. **(Fig. 17)** The distances in the colour circle are to be kept regularly according to Ostwald. The individual colours of a triad are thus each 1/3 of the circle apart, the four-group ¼ of the circle etc. Ostwald followed here well-known models. This, however, means that all the colours are centred on Gray, which would amongst others exclude almost all landscape paintings. New is - apart from the claimed, 'scientifically ascertained' greater accuracy - in reality only that he also includes the respective black and white contents. According to him, the achromatic components of mixed colours must also be in a simple lawful relationship.

Actually, nothing is particularly exciting. Hölzel and Itten were proposing more or less the same in their colour harmonics even though less precisely. Artists have often invoked the principle of complementary colours or worked with the triad of the (alleged) basic colours. Even the correct gradation of the values, was for a long-time part of the academic training. It is only Ostwald's claim that his system produces an exact order based on scientific methods, which cannot be deviated from, which implied an impertinence. Ostwald argues that instead of qualitative rules, which allow a certain freedom of design, he now has established quantitative determinations which, 'scientifically proved,' would be irrefutable. This, in connection with his standardized pigments was seen as an attack on the freedom of art, which had to be rejected with all determination. Apparently, it was feared that Ostwald would be able to impose a kind of 'painting by numbers' in art and design. Hardly an opponent who did not use the concept of "freedom" and thought that he had to reject any curtailing of the self-determination of the artist. In the discussion, Erwin Pazaurek says: "The artist needs the most extensive freedom, no tight fetters" and Erwin Redslob even fears "Kasernenhofdrill" (drill of the barracks).

It was understandable that the artists did not like the whole direction, but they did not arrive at a substantial and well-founded discussion of Ostwald's theses. If Ostwald was indeed right, the summons of artistic freedom would be insufficient. The validity of a natural law cannot be denied because it limits freedom. The subsequent strategy of looking at art as an area *sui generis*, which has nothing to do with science, cannot satisfy either. A refutation of Ostwald would have to prove that his rule system is inapplicable, inadequate or faulty in the field of art. The real conflict between Ostwald and the artists is, in my opinion, that physically determined stimuli should replace the subjectively experienced sensations. Artists rely more on the experience of seeing than on measurements, and consider art as a matter of sensory perceptions, not of prescriptions. In this sense, Cézanne maintains: "there is a colour logic. The painter owes her obedience. He is lost when he surrenders to the logic of the brain. Always follow the logic of the eyes."

On the other hand, some years later Constructivists and artists from the de Stijl-group welcomed Ostwalds ideas. They opposed individuality and took standardisation as a desirable token of modernity. Ostwald could even lecture for a week at the Bauhaus in Dessau in 1927. Here Moholy-Nagy, who famously developed the idea of a Telefonbild, (phone image), where all the relevant characteristics of an art work could be transmitted via telephone (which depends on a colour atlas like Ostwald's) and younger teachers like Hinnerk Scheper or Herbert Bayer dealt with Ostwald's colour atlas, however, only as a practical tool and dismissed his theory of colour harmonics. The emancipation of dissonances was in full swing.

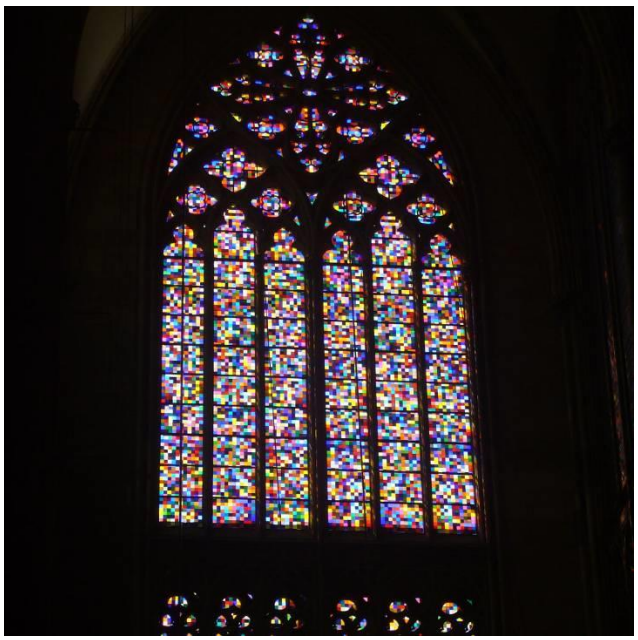

Figure 18. Richter, Gerhard Richter Fenster Kölner Dom Südquerhausfenster 2007

How do we face this problem today? If one searches for the hashtag "Harmony of Colours" on the Internet, one notes that rules in the fashion of Ostwald are still quite common and even taught. On the other hand, the whole area of harmony of colours has lost its importance, and several artists, such as Gerhard Richter, are making fun of any rules that dictate which colours fit together. **(Fig. 18)** In the

meantime many theoreticians like Rolf Kuehni also flatly deny that there are universal laws. But this is, in my opinion, a little bit too pessimistic.

Ostwald, on the other hand, was sure that he was the first to have solved the problem of colour harmony once and for all: "In the meantime, I have reworked the theory of colours from scratch and am now so far in the quantitatively justified chromaticism that I have also solved principally the old problem of the harmony of the colours." In his 1918 colour atlas, he states that" the designation system used for the first time in the colour atlas is, in a word for colour what scripture is for thought." Later on, he asserts that the standardization of the colours he has introduced is comparable to the achievement in music theory 2500 years ago, where instead of allowing all sounds, only a limited selection would be used. He is also not afraid to criticize the works of well-known artists if they deviate from his postulates. For example, he announced that Titian had once used a blue "two tones too high." Instead of following good scientific practice and check his rules on empirical findings, he proceeds axiomatically. His reflections on a general theory of beauty, which he calls Kálik, are based on the principle of "law = harmony = beauty." Gropius and Moholy-Nagy would have agreed.

In his harmony theorem, he essentially assumes that shades of the same perceptual distance from each other would work harmoniously. Since equidistance was not achieved in his system, concrete statements as to which colours these should be, are, of course, uncertain. There is no reliance on the geometrical accuracy that his model suggests. But also, improved, scientifically less vulnerable systems than Ostwald's have contributed nothing decisive to the solution of the problem of colour harmony - if it is one. Equidistance, irrelevant according to whatever system it is determined, does not appear to be necessary to perceive a colour combination as pleasant. In any case, the sensation of equidistance can only be assessed at small intervals and fails at longer distances.

It is probably time to say goodbye to the paradigm underlying Ostwald and almost all the other theorists of a colour harmony. I mean the orientation to the music. Hence Ostwald's unproven postulate, though he considers the direct comparison of colours and sounds to be nonsensical, is derived from the conditions of harmony in music. The fact that he normalizes the unmanageable many colours and thereby reduces them to a few, he also sees in analogy to music as a precondition for the recognisability of the laws of colour harmonies. The obvious reference to music, which he shares with many other theorists since antiquity, is misleading. In the case of tones, we actually hear involuntarily whether they behave in a consonant or dissonant manner, that is, whether their frequencies have a simple regularity to one another. Whether a colour triad à la Ostwald reveals a comparable law, we cannot judge perceptually.

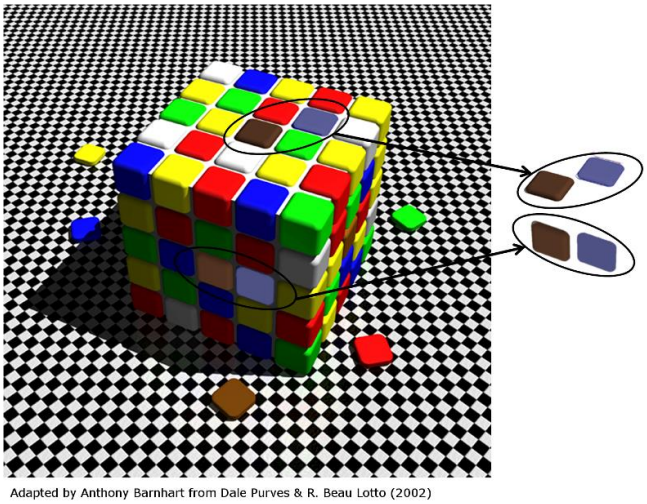

Figure 19. Farbwahrnehmung Context Dale Purves and R. Beau Lotto

Above all, Ostwald's rules are based on the assumption that we can clearly recognize and memorize individual colour stimuli without regard for their context. However, this is not the case. There is no simple relation between physical facts and perceptual facts. Humans are very bad at identifying a shade of colour unambiguously **(Fig. 19).** By the way, this is the very reason why a colour atlas is necessary. Perceived colours and their intervals vary according to the lighting, distance, size of the colour areas, changing background, and many other factors. We are simply unable to assess exact magnitudes in their relation. Furthermore, different hues have their own unique qualities, which cannot be quantified.

Ostwald proceeds deductively. He simply postulates laws on the basis of general principles, without examining them empirically. He is convinced that progress in science is achieved when qualitative statements are replaced by quantitative methods. In principle, he measures physical facts about related colours which do not allow statements about psychological issues. Ostwald assumes that science provides ideal-typical models, which are never strictly true in reality. Therefore, instead of questioning the relationship between his measurements and the sensory elements, he considers deviations to be merely insubstantial disturbances, which explains why he neglects psychophysical results which do not fit into his theory as mere "noise." For he is convinced that man, as a part of nature, cannot but carry the natural laws within himself. He takes it for granted that the physical order of colours, on the one hand, and the sensations of colour, on the other

hand, must follow a corresponding logic.

His approach is reminiscent of the Ptolemy world view, where it was considered as self-evident that the planetary orbits have to be circular since God cannot create anything imperfect. Nowadays we all know that the solar system is different. The same is true of advances in medicine. The model of Hippocrates where four different body-liquids have to be brought in a harmonious relationship with one another, is undoubtedly clearer, simpler and aesthetically more pleasing than the hotchpotch of facts conveyed in contemporary medical studies. But it does not correspond to the established facts.

The use of the term 'colour harmony' in the art field is, of course, very vague. However, this does not distinguish it from other terms such as grace, *je ne sais quoi*, taste, or even beauty that have served or are still serving to evaluate works of art over time. This indeterminacy is no coincidence, for it allows a certain communication of subjectively perceived feelings. If the criteria were objectively ascertainable, the terms would have lost their meaning. Should we give up then? I don't think so.

Figure 20. Soccer Fans Hungary June 18 2016

To understand why the human colour perception differs from physical conditions, it is useful to take into account its biological tasks. Biological systems such as human colour perception, are aligned at evolutionary success and not on purpose-free knowledge. If we feel a blossoming landscape as pleasant and soothing, then it promises a favourable habitat at least for our ancestors. The colour of fruits whose appearance reveals their maturity and stimulates appetite helps us to feed us and the attractiveness of a face is undoubtedly biologically relevant. It is difficult to imagine that the perception of equidistance à la Ostwald play a role in such cases. **(Fig. 20)** We cannot separate the pleasurable feelings colours might elicit from their meaning given the particular context. But also, the respective state of the perceptive agent and his or her interests - to keep silent about experiences and cultural imprints - determine the feelings which can be triggered by a colour composition. This does not mean that a stimulus always elicits the same response at any time and for everybody. Far from it. What is pleasant and harmonious at the present time may well be regarded as dull later on. If we cannot contemplate leisurely but have to do a challenging job we get disturbed by colour stimuli that attract undeserved attention. This is all well known, and does not need to be deepened here.

Figure 21. Vogue cover April 2016 the Kendall (Jenner) effect

We all agree that some colour combinations can have a pleasing effect, especially when no parts stand out glaringly. The experience of colour harmony occurs only when we are able to contemplate and in the absence of other pressing needs, that is when we experience some kind of homeostasis. We have to orient ourselves and can relax only when we feel secure. It seems that familiar colour combinations, which remind us of positive experiences are rewarded. Still, after a while even the most pleasing harmony tends to become uninspiring. Novelty is pleasing, but also the reassurance of belonging. **(Fig. 21)** Colour harmony has to be interesting enough to support contemplation but also to avoid the call to action, which emanates from strong, saturated colours. Sometimes some colour combinations activate the reward system of our brain. There must be an adaptive reason for this. As soon as we have understood the adaptive logic of our reward system in relation to colour we will have solved the problem of colour harmony.

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