Chapter 50
Ostwald, Wilhelm 1853–1932

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Wilhelm Ostwald was born on September 2, 1853 in Riga, the capital city of Latvia, to German immigrant parents. He studied chemistry at the University of Dorpat (now Tartu, Estonia) where he received his Ph.D. in 1878 and lectured at the Polytechnicum in Riga. In 1887, he moved to the University of Dresden in Germany where he remained until his early retirement in 1906. He married in 1888, and he and his wife had five children. He was active in many fields, including philosophy; he is considered to be one of the founders of the science of physical chemistry and received the Nobel Prize for the discovery of chemical catalysis in 1909. Ostwald is the author of 45 textbooks and over 1000 articles. In his spare

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time, he was a talented painter. In 1905/06, he spent several months in the Boston area giving courses in philosophy, physical chemistry as well as techniques of painting at Harvard University, MIT, and the Lowell Institute, where he met Munsell and learned of the latter's early development of the Munsell color system. After he left the University of Dresden, the result of his lack of interest in lecturing students, he moved to his nearby country seat in Grossbothen where he spent the rest of his life primarily working on color theory, developed a large color order system and a theory of color harmony. Ostwald died on April 4, 1932 in Grossbothen [1].

50.1 Ostwald's Color Order System

Ostwald saw the place of the science of color in the total field of science to be in psychological science [2]. He was not only fully aware of the work of Maxwell, Grassmann, and Helmholtz, but was convinced that also Hering had made important contributions toward the understanding of color phenomena. His immediate predecessors had focused primarily on the relationship between lights and color experience. Ostwald made significant contributions to the understanding of object colors. His main contributions in the color field are briefly mentioned below.

Ostwald developed a color order system that combined psychological and psychophysical knowledge, resulting in *Grosser Farbenatlas* of 680 systematically ordered samples of 24 different hues, published in 1917/8 (Fig. 50.1). A version

Fig. 50.1 View of the double-cone model of Ostwald's color atlas

with 872 samples dyed on wool yarn was also produced. The largest system is the *Grosse Farborgel* (Large color organ) with 2510 samples in 24 hues. An American version of the Farbenatlas was published in the 1940s as *Color Harmony Manual* [3].

1. *Distinction between unrelated and related colors*
   Helmholtz and others of his time investigated color primarily in terms of spectral light. Ostwald demonstrated and made clear the difference between unrelated and related colors, the latter experienced from viewing objects in varying surroundings, including the existence of gray, brown, olive, and other colors in related form only [2].
2. *Non-linear relationship between wavelength differences and perceived Hue differences*
   Ostwald demonstrated the highly non-linear relationship when establishing the hue circle of his color atlas, showing that there are two spectral regions where perceived hues change rapidly as a function of changes in wavelength while near the beginning, middle, and end of the spectrum the frequency of change is much reduced [4].
3. *Farbenhalb/Vollfarben*
   Ostwald demonstrated that in case of object colors of highest saturation a relatively broad spectral portion (loosely termed *Farbenhalb*, half of the spectrum) of light is reflected, in contrast to spectral light. He used a graphic format with wavelength on the horizontal and reflectance between zero and one on the vertical axis. At the same time, he defined *Vollfarben* (full colors) as object colors of the highest saturation possible for a given hue, occupying spectral ranges with either one or two transitions in the spectrum. Full colors are the optimal object colors of a given hue at the lightness level at which they have highest saturation, varying by hue. In 1920, Schrödinger offered a mathematical proof of the concept of optimal object colors that included Ostwald's Vollfarben [5].
4. *Metamerism*
   In 1918, Ostwald demonstrated the existence of metameric object colors and introduced the term *metamerism* [4].

References

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