Charles Henry's Colour Circle (1888/1889) and his *scientific aesthetics*

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ABSTRACT

Why do colours evoke *pleasure* or *pain*? Why are red, orange, yellow considered to be *gay* and blue, green, violet *sad*? The French scientist Charles Henry (1859-1926) aimed to address just such questions. Building on the foundations of the new science of *psychophysics* and using a method of relating colours to psychomotoric reactions that were assumed to be precisely measured with especially invented instruments, Henry conceived a colour theory in which colours are associated with *dynamogeny* and *inhibition*. His theory included the representation of colours in a system: a circle in which, for example, orange is located on an upward-striving radial line to the right and blue is positioned on a downward-falling radial line to the left. Using this kind of dichotomy Henry described his approach, theory, and system in his publication *Circle Chromatique* or Colour Circle, which was initially published as eightvo in 1888 and then presented as a folio edition with footnotes and a colour plate in 1889. Henry's dichotomising *colour theory* can be deconstructed as a resultant representation of the late nineteenth century human-motor-worldview. But beyond this, what relevance might his notions still have today for architects, urban planners and other designers? Can psychomotoric understandings of colour be integrated in the contemporary discourse?

1. COLOUR CIRCLE

Charles Henry was aware of the fundamental difference between colour generated by light *[couleurs-lumières]* and colour produced through pigment *[couleurs-pigments]* as it was generalized in the second half of nineteenth century science, but which is nowadays taken for granted.

The influential German scientist Hermann von Helmholtz (1821-1894) was one of the first to distinguish between Isaak Newton's system of spectral colours as published in his *Opticks* (1704) and his own experiments of colour pigment applied to a white support.

Thereafter, distinguishing between colour as determined through light and colour as determined through pigment led to different concepts of primary colours.

Studying systems of specifying primary colours as determined through light, Charles Henry observed that various scientists described them differently. For example, Helmholtz described the primaries as purple *[violet]*, green *[vert]*, and red *[rouge]*; James Clerk Maxwell, as red *[rouge]*, green *[vert]*, and blue *[bleu]*; and Auguste Rosenstiehl as orange *[orangé]*, greenish yellow *[jaune vert]*, and blue *[bleu]*. Henry tried to set up a correspondence between these three specifications by first taking the French translations of the names of the colours from the scientists' own original languages and then setting these colours in relation to Michel-Eugène Chevreul's colour system which was considered as the colour reference in France at the time. Henry attributed the divergence in specification to physiological differences of the observers.

In response to this problem, Henry was convinced he had found a solution with his *construction of a rational colour circle [construction du cercle chromatique rationnel]*. According to Henry's system, the three colours – red, green, and blue – determined through light are positioned ideally on three equal radial divisions with one colour at the top or at 0°, a second clockwise to the right at 120° and a third further clockwise to the left at 240° exactly mid-way between the centre – which is white – and the circumference – which is black – where saturation is maximum, i.e., according to this graduated scale model which Henry presented as *Circle Chromatique*, saturation reaches its peak in a mid-range between a white centre and a black circumference. Henry distinguished between degree of saturation *[saturation]* and lightness or luminous intensity *[clarté ou intensité lumineuse]*; his model, however, presents a superposition of both, i.e., they are belonging to the same dimension.

Paradoxically disagreeing with the systems of three primary colours, Henry maintained that not three, but six colours or hues constituted the primaries of colour determined through light: red *[rouge]*, orange *[orangé]*, yellow *[jaune]*, green *[vert]*, blue *[bleu]*, and purple *[violet]*. And further, he maintained that eight hues were necessary to constitute the primaries of colours for pigments. Here four fundamental colours – and not three – were positioned at the cardinal points of the circle – red *[rouge]*, yellow *[jaune]*, purplish blue *[bleu violâtre]*, and greenish blue *[bleu verdâtre]*. Red was situated at the top with yellow perpendicular to the right and purplish blue perpendicular to the left and greenish blue opposite. Four additional colours were specified, each respectively located on the circle mid-way between two of the fundamental colours. Orange *[orangé]* was placed between red and yellow; green *[vert]* between yellow and greenish blue; pure blue *[bleu franc]* between greenish blue and purplish blue; and, purple *[violet]* between purplish blue and red. The four fundamental colours – red, yellow, greenish blue and purplish blue – provided the constituent components for generating any and all other pigment colours in the system. Combining all of them together at once in any proportion tended towards the production of black. The combination of colours generated through light, on the contrary, produced white. The primaries determined through light and the primaries determined through pigments could be situated on the same graduated scale model. Here the notion of polarity was associated to the notion of totality. Henry considered all colours mixing with their neighbours to form a continuous or indefinite colour system.

2. THEORY OF DYNAMOGENY AND INHIBITION OF COLOUR

Already in 1704 Newton had compared and measured spectral colours. His conclusion was that the most luminous, as well as the brightest in intensity of all the prismatic colours are yellow and orange. These affect the senses more strongly than all the rest together. After yellow and orange, Newton considered that red and green are next in strength. In comparison, blue is not only darker, but fainter with indigo and violet being even much darker and fainter than blue. (Book I. Part I. Prop. VII. Theor. VI)

In his *Farbenlehre* 1810, Johann Wolfgang von Goethe (1749-1832) had already claimed yellow, orange, red as *plus* activity *[Plusseite]*, i.e., they were described as warm, stimulating, vivid and striving: *Sie stimmen regsam, lebhaft, strebend.* (Goethe 1:276) The colours belonging to *minus* activity or cold colours were blue, red-blue, blue-red. Green, the composite of yellow and blue, was not included in Goethe's dichotomic order. Goethe's understanding of the determination of colour was that it's appearance not only functioned through opposites, such as active/passive, negative/positive, but also considering colour as an energy, its appearance was understood as determined through augmentation or reduction of energy. Goethe based his theory upon results of his own colour experiments. Goethe developed his approach and system by distinguishing between three different categories of colours: physiological, physical and chemical colours. In 1815 Arthur Schopenhauer (1788-1860) criticised Goethe for having pursued colour research without a thorough basis or integrated systematic investigation of the human body. Schopenhauer himself considered colour as a purely physiological concern, as a specific response of the retina. (Crary:81) Schopenhauer measured colour functionally in relation to the eye with black as *zero* and white as *full* retinal activity. As well, throughout Schopenhauer's work the notions of *Schmerz [pain]* und *Wohlbehagen [well-being]* is present.

The new science of psychophysics which was rapidly developing in the second half of the nineteenth century employed a dichotomic terminology reinforcing a worldview of positive-negative polarity, subjective-objective dualism, warm-cold, pleasure-pain, etc. For example, in *Psychophysics*, a fundamental work of the new science first published in 1860 by Gustav Theodor Fechner (1801-1887) such terms were used to describe sensations, feelings, emotions, and ideas, as well, in another fundamental work of experimental psychology by Wilhelm Wundt (1832-1920) which was first published in 1874.

Henry's aim was to assign a *direction*, i.e., a specific degree of dynamogeny to each colour, which according to him, was already inherent in each colour. Basing his own approach on the results of Charles Edouard Brown-Séquard for whom light represented the elementary excitant of vision, a thesis published in 1885, Henry claimed that light was dynamogenic *per se*.

To address the problem of colour intensity which Henry considered fundamental in his theory of dynamogeny of colour, he borrowed from the results of studies of Augustin Charpentier which were successively published in the proceedings of the *Académie des Sciences* in the 1880s. Charpentier had demonstrated that under the same light conditions red appeared to be more intense

than yellow, yellow more intense than green, and green more intense than blue. Henry aimed to integrate this variation in intensity into his system and thereby set up a correlation between colour intensity and the direction that could be attributed to a colour. Red, the most intense colour, was associated with a direction going from the bottom to the top, yellow with one going from left to right, greenish blue with one from top to bottom, and purplish blue right to left. First distinguishing four fundamental directions, Henry then reduced these to two complementary pairs: red/greenish blue (up/down) and yellow/purplish blue (right/left). (1889:21) The effects of differences of light intensity upon the senses as a proportional relationship and also the notion of movement or human reaction through stimulation of the nerves, led Henry to determine a specific correlation between colours and the terms of dynamogeny and inhibition.

In an earlier publication Henry had organized colours in a wheel according to fatigue *[fatigue]* or the tiring effect or exhaustion that a colour stimulus causes. Fatigue, a temporary physical or mental inability to respond to excitation, had become the disease of the century spawned by the non-stop motion and rapidity of the modern industrial world. (1888:78)

Thinking in terms of contradictions and complementarities was not only a common approach in physiology in the late nineteenth century, but it spread over to other disciplines as well, such as psychology, anthropology, art history, sociology, politics, etc.

3. SCIENTIFIC AESTHETICS

Henry advocated a symbolic way of reading colours according to the inherent expressiveness of their directions, virtual or real. Based on the threefold scheme of the human face correlating physiognomy, linear directions and human emotions made by Humbert de Superville and published by Charles Blanc, Henry attempted to formulate an *emotional* physiognomy of line and colour. (1885:5)

In his *scientific aesthetics [esthétique scientifique]* (1885) or *theoretical and technical aesthetics [esthétique théorique et technique]* (1889:II) Henry interpreted colour as an energy pervading the human body and influencing, animating or inhibiting reactions. This was a provocative hypothesis, not only for physiologists and psychologists, but also for artists, writers and poets. His studies on aesthetics were based upon a specific understanding of an aspect or mechanism of physiology called *dynamogenical* and *inhibitory* function, i.e., or increasing and diminishing function of sensation, a field applied to pathogeny. Henry, however, deduced normal laws of visual physiology and aesthetic expression by relating the physical, mechanical and subjective phenomena to mathematical calculations and physical formulas. The aim was to establish fixed rules whereby laws of contrast, rhythm and measurement of colour harmonies could be realized easily.

Henry's contemporary Georges Sorel cirticised Henry's approach because Sorel didn't see pleasure as an element of aesthetic emotion and he didn't agree that the principle of dynamogeny and inhibition could be used as the basis of an aestetic theory. (Argüelles, 1972:21)

4. THE HUMAN AS MACHINE

Goethe rejected mathematics and stood for nature's observation. In his essay on the abuse of mathematics *Über Mathematik und deren Missbrauch (1826)* he claimed that his own age had such a predilection for using mathematical formulas that the reliance on algebra, geometry, and calculus had become an end in itself rather than the means. Mathematical demonstration had replaced observation of nature and was increasingly used as a purely quantitative, rather than a qualitative device. In late nineteenth century the laboratory became the field of research and mathematics the foundation for explaining human activity. Henry's aim was to measure the effects of light, colour, form, temperature, etc. on the human body with specially-built instruments and a specifically-developed methodology.

Henry was extremely influential in the 1880s and early 1890s in the artistic and literary avant-garde circles of the Parisian Rive Gauche. Henry's psychophysics had an impact on Symbolist poets and writers such as Jules Laforgue and Gustave Kahn. As well, he was acquainted with the art critic Félix Fénéon and the writer Paul Valéry.

The most recent extensive study of Henry's biography and work, as well as of his intellectual genealogy, is the art historian Michael F. Zimmermann in his publication on Georges Seurat 1991. His interest, however, is primarily focused upon Henry's influence on Neo-Impressionist artists, e.g., Seurat, as well as Paul Signac. The investigation of Henry ends at 1891 with the early death of Seurat. The only exception after this point is Zimmermann's description of *Master Henry*, i.e., when he

became *maître de conférences* at the Ecole des Hautes Etudes in 1892. Here Zimmermann describes Henry's commitment and approach as tempered by attributes ranging from unrestrained passion to occultism. With equal disdain, Zimmermann also dismisses Henry's mathematically-based aesthetics as a complex and rather *schizophrenic system of thought* grounded in *a pseudo-scientific approach*.

In 1897 the mathematician and psychophysiologist Charles Henry founded and led the Laboratory for the Physiology of Sensations at the prestigious Sorbonne University. Later he moved his laboratory to Versailles where he died in 1926. Despite his impressive and even renowned career over the years Henry's reputation as a scientist has seemingly declined. For example, in 1995 the art historian Giovanni Lista critically labels and thereby dismisses Henry as an advocate of spiritism.

I don't quite agree with such a dismissal of Henry's rich contribution to the study and understanding of colour. Henry was an enthusiast of a way of knowledge synthesizing thought and action, of science and art. First published in 1888 and presented in a grand folio edition in 1889, Henry's colour theory represented a systematic model for exploring mathematical-musical aspects of colour harmonics combined with the psychophysiological aspect of aesthetic reactions. Built on the foundation of the new science of psychophysics, his analysis of lines and colours was enlarged to a cosmological system. In my mind, Henry's colour theory was attractive not because of its otherness or outstanding complexity and exoticism, but because of its exemplary synthesis of the new psychological and philosophical reality of late nineteenth century France. He stands for the strong belief that human sensual and intellectual response could be described through measuring human reaction. Following mathematical and psychophysiological principles, Henry developed a universal theory on continuity and discontinuity of sensation or dynamogeny and inhibition, providing a method to quantify and finally even control aesthetic expression. The mechanization of human behaviour was extended to its extreme. Rather a metaphor of the human as a machine, it is a symbol of the complete rationalization of human action and stands for the inherent disequilibrium of the Occidental philosophy and world at the time.

References

Argüelles, J. A. 1972. *Charles Henry and the Formation of a Psychophysical Aesthetic.* Chicago; London: The University of Chicago Press.

Crary, J. 1996 (1990). *Techniken des Betrachters: Sehen und Moderne im 19. Jahrhundert*. Dresden; Basel: Verlag der Kunst.

Fechner, G. T. 1907 (1860). *Elemente der Psychophysik*. Leipzig: Breitkopf & Hartel.

Goethe, J. W. 1997 (1810). *Farbenlehre*. Stuttgart: Verlag Freies Geistesleben.

Henry, C. 1885. *Introduction à une esthétique scientifique*. Paris: Hermann.

Henry, C. 1888. *Cercle chromatique présentant tous les compléments et toutes les harmonies de couleurs avec une introduction sur la théorie générale du contraste, du rythme et de la mesure.* Paris: Verdun.

Henry, C. 1889. *[Circle chromatique.] Éléments d'une théorie générale de la dynamogénie autrement dit du contraste, du rythme et de la mesure avec applications spéciales aux sensations visuelle et auditive.* Paris: Verdun.

Lista, G. 1995. Loïe Fuller. In: *Okkultismus und Avantgarde von Munch bis Mondrian 1900-1915*. Frankfurt: Schirn Kunsthalle.

Newton, J. 1704. *Opticks*. London: Smith & Walford.

Rabinbach, A. 2004 (1990 Engl.) *Le moteur humain*. Paris: La fabrique.

von Helmholtz, H. 1909 (1856/1860/1866). *Handbuch der Physiologischen Optik*. Hamburg; Leipzig: Voss.

Wundt, W. 1902 (1874). *Grundzüge der Physiologischen Psychologie*. Leipzig: Engelmann.

Zimmermann, M. F. 1991. *Seurat. Sein Werk und die kunsttheoretische Debatte seiner Zeit*. Mercatorfonds, Ed. Weinheim: VCH Acta humanitora.