

Black-listed: Why colour theory has a bad name in 21st century design education

KEYWORDS:

Colour theory, design education

ABSTRACT

Higher education design-focussed institutions often shy away from teaching colour theory despite colour's existence as an essential element in art, design and architecture. Anecdotal evidence suggests that colour theory has a bad name and three key reasons are herein suggested for the marginalization of colour theory and its subsequent no-show in higher education curriculum. The first relates to the diversity evident among colour theories and linked to the range of different domains (physics, psychology, linguistics, art and design) from which theories of colour have evolved. This diversity of origin has led to a lack of commonality among colour theories especially in terms of the embedded theoretical paradigms and ontological assumptions. Secondly, theories of colour have not on the whole evolved, along with theory in general, to reflect current theoretical paradigms. Many oft-referenced colour theories rest on outdated theoretical paradigms and include constructs that are questionable, problematic or in need of review and revision. Thirdly, colour theories represent a jumbled maze of explanatory, normative and predictive colour theories coupled with colour manifestos and personal opinions masquerading as theory, plus a host of colour creation and colour combination techniques. This paper calls for a long-overdue overhaul of colour theory wherein it is revised to reflect the theoretical frameworks and ontological underpinnings of the 21st century. In addition, it is argued that theories attempting to describe and explain colour should be distinct from theories relating to the interface between colour and human response. These measures may bring greater clarity for those who attempt to apply colour in an art or design context plus those who teach colour theory in higher education.

INTRODUCTION

Colour is acknowledged as a key element in art, design and architecture (Samara 2007; Lidwell, Holden, and Butler 2003; Gatz and Achterberg 1967; Porter and Mikellides 2009). Since antiquity, a plethora of colour theories have evolved across different research areas including physics, psychology, anthropology/linguistics, art and design (Gage 1995; Kuehni and Schwarz 2008; Crone 1999). Rather reviewing these, this discussion will focus on the theoretical paradigms and ontological assumptions underpinning key Western colour theories. In doing so, it will become clear that

the diversity of theoretical paradigms and ontological assumptions evident across colour theories have resulted in ambiguity, confusion as well as a level of incomprehensibility in regard to attempts to describe colour, as well as attempts to explain the interface between colour and human response (in terms of perceptual, cognitive, affective, physiological and behavioural responses).

It is possible that this lack of clarity has provided the impetus to marginalise colour theory and downgrade its status in higher education art, design and architecture curriculum. It is proposed that three key reasons exist for the lack of clarity and these are discussed in some detail. It is proposed that the wholesale updating of colour theory will bring benefits for 21st higher education design curriculum.

I. STATUS QUO: NO ORDER FROM CHAOS

It has been suggested that four "competing paradigms" currently inform and guide inquiry and research: positivism, post-positivism, critical theory and constructivism (Guba and Lincoln 1994, 105). The diversity of origin among colour theories (eg physics, psychology, linguistics, art and design) has seen colour theories generally underpinned by two of these competing paradigms (positivism and constructivism) as well as earlier paradigms such as rationalism and the twin doctrines of reductionism and determinism. For clarification, theoretical paradigms (also referred to as epistemologies) are herein considered to be the pattern/s observable among the ideas which help to shape knowledge and which tend to underpin research and theory (Moore 1997; OED 1989).

Many early colour theories reflected a rationalist and/or a deterministic theoretical understanding of colour as well as the interface between colour and human response as summed up by the dictum: "Using musical theory, I have created order from chaos" (Ritchie 2009). This clichéd dictum reflects the Pythagorean-mathematico understanding of the universe that underscored the majority of 18th to 19th century colour theories. For example, Newton drew an analogy between colour and music to explain the phenomenon of colour plus provided a colour wheel model based on mathematical proportion (Gage 1995; Gage 2008; Newton 1704). Newton's rationalist approach set a pattern for many later colour theorists for whom rationalism segued into positivism and whose theories tended to feature both a reductionist and deterministic understanding of colour. For example, the complex phenomenon of colour has often been reduced to

simplistic colour wheel models which reduce the huge gamut of distinguishable colours to a tiny proportion as evidenced in the models that emerged in the 19th and 20th centuries (for example, Itten 1973; Munsell 1921; Ostwald 1916; Chevreul 1855; Cleland 1937). These same theorists also purported that the interface between colour and human response was both universal and deterministic irrespective of individual differences and cultural, perceptual and contextual factors.

To complicate matters, colour terms exist with a high level of variance and ambiguity despite an early study of colour terminology evolution across cultures which found that certain basic colour terms exist universally (Berlin and Kay 1969). This finding, which was underpinned by a positivist and constructivist theoretical framework, has since been hotly debated and studies now indicate that key colour terms may not be universal across industrialised and non-industrialised societies (Kay and Regier 2003). More recently, it has been suggested that colour terminology is not fixed but polysemic wherein a term such as ‘blue’ exists with multiple meanings depending on context including descriptive meanings, positive connotations, negative connotations, iconic meanings or associative meanings all of which may vary among individuals and/or cultures (Sandford 2009). This approach allows for multiple meanings for colour terms across varying contexts and cultures.

However, only a handful of colour theories have emerged which reflect late 20th century theoretical frameworks. Hard and Sivik are among the few theorists who have adopted a post-positivist approach in relation to colour, providing a comprehensive description of colour while acknowledging that responses to colour may not necessarily be universal or deterministic (Hard and Sivik 2001; Hard, Sivik, and Tonnquist 1996, 1996). Furthermore, the ambiguity and apparent confusion among colour theories can also be attributed to the ontological approach embedded within these theories which bring fundamental assumptions about the nature of the phenomenon under focus (Moore 1997; Crotty 1998). Key ontological assumptions, relevant to attempts to explain colour and discussions about the interface between colour and human response, include:

- (a) Whether responses to colour are essentially nomothetic (that is, explainable in terms of general laws and universally applicable principles); or, more idiographic and therefore not explainable in terms of laws because of individual and/or cultural differences.
- (b) Whether responses to colour are basically deterministic, constantly exposed to cause and effect; or, more randomly determined, stochastic and less predictable.
- (c) Whether colour is essentially atomistic and divisible, and can be studied and explained in terms of isolated parts; or, holistic and therefore more than the sum of its parts; parts which perhaps shouldn’t be studied and explained in isolation (Moore, 1997a).

As depicted in Figure 1, opposing ontological assumptions may be viewed as continuums with the right-hand side depicting assumptions that are more post-positivist in nature.

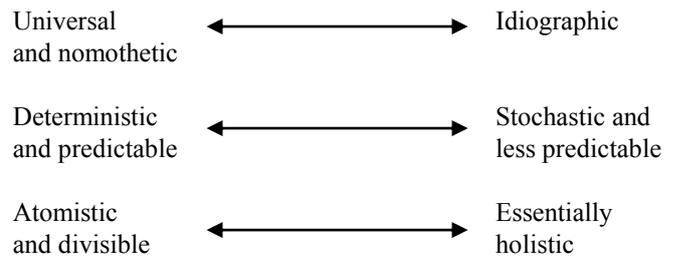


Fig. 1. Continuums depicting opposing ontological assumptions.

II. THE NEED FOR COLOUR THEORY TO EVOLVE

The diversity of theoretical paradigms and ontological assumptions evident in theories of colour has led to a relatively high degree of ambiguity and confusion in regard to understanding colour, as well as attempts to examine or explain the interface between colour and human response (including perceptual, cognitive, affective, physiological and behavioural responses) to colour. In short, colour theories have not evolved in line with theory in other domains.

In addition, constructs are often routinely recycled within theories of colour without reassessment or evaluation. For example, notions such as ‘neutral’ and ‘primary colours’ and ‘colour harmony’ frequently feature in colour theories. Not only do these constructs lack a sound theoretical foundation, but under a post-positivist paradigm such constructs should always be open to re-examination, review and revision within the context of broader theoretical paradigms.

Two examples of constructs in need of review include ‘colour harmony’ and ‘primary colours’. In regard to the former, it has been suggested that an “almost infinite” number of colour combinations is possible, making it impossible to define or predict colour harmony using prescriptive or predictive formulae irrespective of the context (Hard and Sivik 2001, p4). Despite the inherent logic of this, colour theorists continue to present predictive colour harmony formulae and guidelines (for example, see Kopacz 2003; Feisner 2000; Birren 1961; Sawahata and Eldridge 2007; Mahnke 1996; Stone, Adam, and Morioka 2006). The alternative, post-positivist approach has only been presented by a handful of theorists such as Hard and Sivik’s (2001) descriptive model of colour combination and the recently proposed colour harmony model of O’Connor (2010), depicted in Figure 2.

$$\text{Colour harmony} = f(\text{Col}_{1,2,3...n}) * (\text{ID} + \text{CE} + \text{CX} + \text{P} + \text{T})$$

Fig. 2. Post-positivist conceptual model of colour harmony.

This conceptual model reflects a phenomenological understanding of colour akin to Merleau-Ponty’s discussion of sensation and perception (Merleau-Ponty 1962). The model describes colour harmony as a function (f) of the interaction between a colour combination ($\text{Col}_{1,2,3...n}$) and the various factors that influence positive aesthetic response to colour:

- Individual differences (ID) such as age, gender, personality and affective state;
- Influential cultural experiences (CE);
- A broad understanding of context (CX) that includes setting, placement, ambient lighting, etc;
- Intervening perceptual effects (P);
- The impact of time (T) in terms of the effects of time as well as prevailing social trends (O'Connor 2010).

In addition, it is possible that the emerging field of network theory may provide new and unexplored perspectives on colour as well as responses to colour. Under network theory, phenomena are considered to exist within a framework of connections wherein clusters of similarities form nodes (also referred to as vertices) and connections between nodes are referred to as edges (Newman 2003; Strogatz 2001). As a means of describing non-linear, dynamic phenomena, network theory is ideal for phenomena such as colour; plus it appears well-suited to presenting the not-so-predictable nature of the interface between colour and human response as per Figure 3.

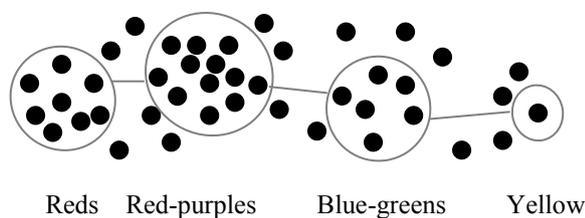


Fig. 3. Nodes representing hypothetical positive response to colour (colour harmony) clustered by similarity as per network theory.

In regard to the construct: ‘primary colours’, various definitions have evolved across different domains (physics, psychology, linguistics, art and design) over the last two thousand years. Representing conceptual hue archetypes, the idea of ‘primary colours’ may have had some merit at a time when accessibility to pigments and light-waves was limited; and may still have a role to play in colour combination guidelines. However, given the advances in pigment production of the 18th and 19th centuries, plus advances in digital technology in the late 20th century, the construct of ‘primary colour’ is long overdue for re-evaluation.

To summarise, while historical theories of colour have their purposes, colour theory in needs to be reviewed and further developed in line with the advances in philosophy and theory over the last fifty years for it to regain relevance in 21st century design education.

III. WADING THROUGH THE JUMBLE

The third key point of this discussion relates to the nature of colour theories which currently represents a jumbled maze of descriptive, normative and predictive colour theories along with colour manifestos and personal opinions masquerading as theory, intermingled with a host of colour mixing strategies and colour combination techniques. In addition, most colour theory texts of the last fifty years reproduce previous theories but generally make little or no attempt to review or analyse

these (for example, see Feisner 2000; Birren 1987; Stone, Adam, and Morioka 2006). As a result, the quality of knowledge available often lacks relevance, coherence or practical value.

Specifically, most colour theories incorporate attempts to describe and explain colour (descriptive theories); while many also include discussions about “what ought to be” in terms of procedure or practice (normative theories) such as those of Itten (1973), Munsell (2003) and Ostwald (1916) (Lang 1987). Predictive colour theories (which include a focus on colour harmony) are evident in the writings of Newton (1704), Chevreul (1855), Ostwald 1916) and Munsell (1921). In addition, some theorists present what can also be described as colour manifestos wherein colour theories are presented with an underlying bias for particular ideas as in the writings of Kandinsky (1911) and Itten (1973). Finally, the writings of theorists such as Ostwald (1916) are clearly based on personal opinion but presented as quasi-scientific theory. To further complicate matters, many colour theories incorporate colour mixing and/or colour combination strategies or guidelines, based around anecdotal evidence or personal beliefs. In summary, the jumble of extant colour theories provide little or no clear direction for those involved in practice, or for those attempting to teach colour theory in higher education.

IV. CONCLUSION AND RECOMMENDATIONS

Colour theory is currently marginalised in relation to higher education design curriculum for good reason: it is a jumbled muddle that has not evolved. For colour theory to regain its status, it needs comprehensive review and revision in terms of embedded theoretical paradigms, ontological assumptions and constructs. In addition, attempts to describe and explain colour need to be made distinct from theories that relate to the interface between colour and human response as these are separate fields of research and intermingling only leads to confusion. The current state of disarray impedes those wishing to apply colour in an art or design context plus those attempting to teach colour in higher education.

REFERENCES

- Berlin, B., and P. Kay. 1969. Basic color terms: Their universality and evolution. Berkeley: University of California Press.
- Birren, F. 1961. Color, form and space. New York: Reinhold.
- . 1987. Creative color: A dynamic approach for artists and designers. Atglen, PA: Schiffer.
- Chevreul, M.E. 1855. The principles of harmony and the contrast of colours: And their applications to the arts (Facsimile edition; Trans. C Martel). Whitefish, MT: Kessinger Publishing.
- Cleland, T.M. 1937. A practical description of the Munsell color system. Baltimore: Munsell Color Co.
- Crone, R.A. 1999. A history of color: The evolution of theories of light and color. Dordrecht, Norwell MA: Kluwer Academic.

- Crotty, M. 1998. *Foundations of social research: Meaning and perspective in the research process*. Sydney: Allen & Unwin.
- Feisner, E.A. 2000. *Colour: How to use colour in art and design*. London: Laurence King.
- Gage, J. 2008. Signs of disharmony: Newton's 'Opticks' and the artists. *Perspectives on Science* 16 (4):360-77.
- Gage, J. 1995. *Colour and culture*. London: Thames & Hudson.
- Gatz, K., and G. Achterberg. 1967. *Colour and architecture*. London: Batsford.
- Guba, E.G., and Y.S Lincoln. 1994. Competing paradigms in qualitative research. In *Handbook of Qualitative Research*, edited by N. K. Denzin and Y. S. Lincoln. Thousand Oaks, CA: Sage.
- Hard, A., and L. Sivik. 2001. A theory of colors in combination - A descriptive model related to the NCS color-order system. *Color Research and Application* 26 (1):4-28.
- Hard, A., L. Sivik, and G. Tonnquist. 1996. NCS, Natural color system - from concept to research and applications. Part 1. *Color Research and Application* 21 (3):180-205.
- . 1996. NCS, Natural color system - from concept to research and applications. Part 2. *Color Research and Application* 21 (3):206-20.
- Itten, J. 1973. *The art of color*. New York: John Wiley.
- Kay, P, and T Regier. 2003. Resolving the question of color naming universals. *PNAS* 100 (15):9085-9.
- Kopacz, J. 2003. *Color in three-dimensional design*. New York: McGraw-Hill.
- Kuehni, R.G, and A Schwarz. 2008. *Color ordered: A survey of color order systems from antiquity to the present*. Oxford: Oxford University Press.
- Lang, J. 1987. The nature and utility of theory. In *Creating architectural theory: The role of behavioural science in environmental design*, edited by J. Lang. New York: Van Nostrand Reinhold.
- Lidwell, W, K Holden, and J Butler. 2003. *Universal principles of design*. Beverly, MA: Rockport Publishers.
- Mahnke, F. 1996. *Color, environment and human response*. New York: John Wiley & Sons.
- Merleau-Ponty, M. 1962. *Phenomenology of perception*. London: Routledge.
- Moore, G.T. 1997. Toward environment-behaviour theories of the middle range II: The analysis and evaluation of environment-behaviour theories. Paper read at Environment-Behaviour Studies for the 21st Century: Proceedings of the MERA97 International Conference, at Tokyo.
- . 1997. Towards environment-behaviour theories of the middle range. In *Advances in environment, behaviour and design*, edited by G. T. Moore and R. W. Marans. New York: Plenum Press.
- Munsell, A. H. 1921. *A grammar of color*. Strathmore: Baltimore.
- Newman, M.E.J. 2003. The structure and function of complex networks. *SIAM Review* 45 (2):167-256.
- Newton, I. 1704. Cited in J.Gage (2000) *Colour and Meaning: Art Science and Symbolism*. London: Thames & Hudson.
- O'Connor, Z. 2010. *Colour harmony revisited*. *Color Research and Application* (Available online in 'EarlyView'; accepted for publication in April 2009).
- OED. 1989. *The Oxford English Dictionary*. 2nd ed. OED Online: Oxford University Press.
- Ostwald, W. 1916. *Die Farbenfibel (The colour primer)*. Cited in Gage, J. (2000) *Colour and meaning - Art, science and symbolism*. London: Thames & Hudson.
- Porter, T, and B Mikellides. 2009. *Colour for architecture today*. London: Taylor & Francis.
- Ritchie, G. 2009. *Sherlock Holmes*. USA: Warners Bros. Pictures.
- Samara, T. 2007. *Design elements: A graphic style manual*. Beverly, MA: Rockport Publishers.
- Sandford, J.L. 2009. Seeing is color: The sky is blue. Paper read at 11th Congress of the International Colour Association (AIC 2009), at Sydney.
- Sawahata, L, and K Eldridge. 2007. *Complete color harmony workbook*. Gloucester, MA: Rockport.
- Stone, T.L., S. Adam, and N. Morioka. 2006. *Color design workbook*. Beverly, MA: Rockport Publishers.
- Strogatz, S.H. 2001. Exploring complex networks. *Nature* 410 (8 March):268-76.