SYN-TES: HUMAN COLOUR AND LIGHT SYNTHESIS TOWARDS A COHERENT FIELD OF KNOWLEDGE

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ABSTRACT

This paper presents a research project, addressing the lack of interdisciplinary co-ordination of knowledge in the field of colour and light. The project aims at contributing to a theoretical development transforming the field of colour and light into a coherent field of research. This includes the identification of important problems and the development of theoretical and methodological tools for the trans-disciplinary understanding necessary to solving them.

As the project is very recently started, we will here concentrate on the problems addressed and the intended methods for investigating them.

Keywords: Colour, light, trans-disciplinary

1. NTRODUCTION

Man lives in a continuously changing, three-dimensional reality. Our cognitive and perceptive systems have been formed within this context. The most important spatial sense is sight. Colour and light together construct our mental image of space.

The experiences of colour and light are interdependent and cannot be analysed separately. The colours of the surrounding room influence our experiences of light and the need for lighting, and the intensity, quality and distribution of light are essential for our perception and experience of colour. The aesthetics of colour and light play an important role in the fields of art, design and communication. Colour and light in constructed spaces influence our experiences and feelings, our comfort and our physiological well-being.

Today's increasing demand for low energy consumption, climate consideration and sustainable development could be met by optimised co-ordination of colour and lighting design. New technical options offer great potential to use colour and light to create experiences and feelings. The understanding of the new technical solutions is, however, still limited.

2. DIFFERENT SCIENTIFIC APPROACHES

A deep understanding of the interaction between colour and light demands an interdisciplinary approach, including such fields as psychology, neurology and lighting technology, as well as a deep understanding or colour and light applications in architectural spaces. Although relevant research has long been carried out within all these fields, knowledge is fragmented and lacks coordination. This leads to problems concerning both scientific development and its practical application.

The field of colour and light includes a number of disciplines, ranging from technical to philosophical. Within them we can identify three major scientific approaches based on the theories and concepts of *psycho-physics*, *biology-neurology and perception-cognition*.

The *psycho-physical approach* provides the theoretical basis for lighting technology and the instruments and algorithms of colour science. Its main foundations are experiments carried out in the early 20th century, since which time the understanding of the human visual system has advanced greatly. This has, however, not affected the basic colorimetric functions and concepts, which, although much debated, remain the same.

The *biological/neurological* approach is based on an understanding of the human visual sense, derived from investigations of nerve signals in functioning systems as well as an analysis of their microscopic design. It has implications regarding such as colour vision and contrast perceptions, as well as non-visual effects like the production of hormones.

The approach of *perception and cognition* starts from the fact that colour phenomena and significant perceptive patterns are related to an inherent constituent order and/or to perceived logical structures in the world around. Important qualities to investigate are atmosphere and spatial experience.

3. THE LACK OF COHERENT CONCEPTS

One decisive difficulty in the development of knowledge on colour and light is the diverse terminology used by different disciplines and industrial branches, and sometimes even within one and the same discipline.

For colour, Paul Green-Armytage has identified at least seven different “things that can be identified as colours” and defined them by reference to the means used for their identification. [1] For example, a *formula colour* is defined by a paint formula, a *psychophysical colour* is established with a colorimeter and an *inherent colour* is established by visual comparison with standardised colour samples placed directly on the surface (see figure 1) . None of these methods can capture the *perceived colour*, which is a visual category varying with the viewing conditions and even with the observer (see figure 2). [2]

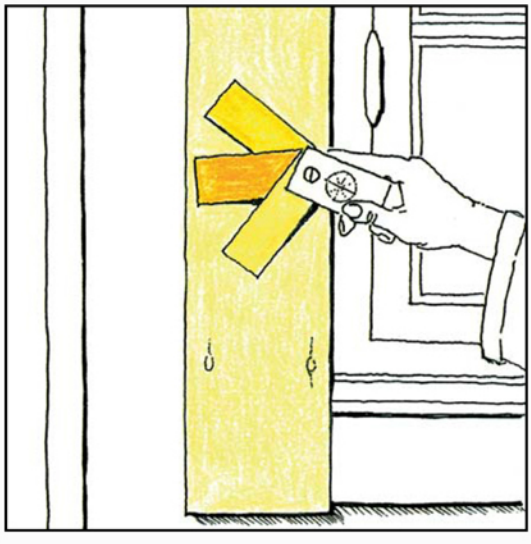

Figure 1. Method for establishing inherent colour. After Fridell Anter 2000

For light, there are similar confusions. Anders Liljefors has pointed out the need to distinguish between *physical light* and *visual light*. [3] In addition, *light* in the physical sense is used both for the radiation as such (measured by a spectroradiometer) and for various photometric entities, where radiation is balanced against the assumed properties of human vision.

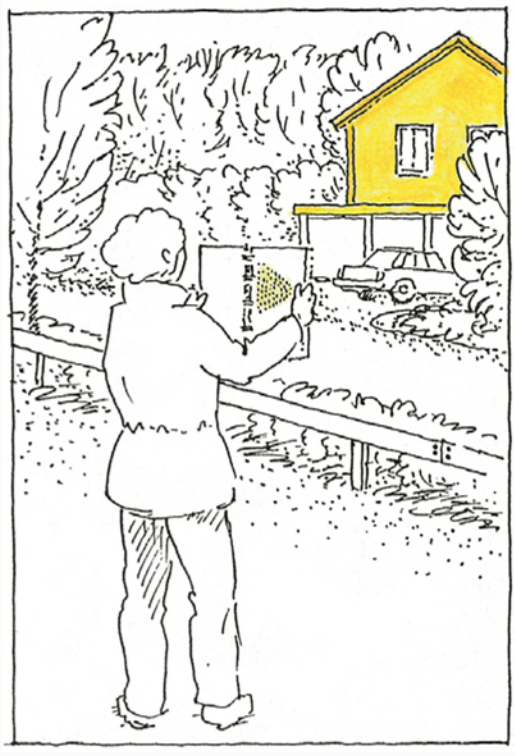

Figure 2. One method for establishing perceived facade colour. After Fridell Anter 2000

4. EFFECTS IN RESEARCH AND APPLICATION

The different scientific approaches and the confused terminology are severe obstacles in communication between researchers working with colour and light, and as a result the general understanding of these issues is not developing in an optimal way.

As there is no coherent field of knowledge, practitioners’ efforts to gather and use relevant knowledge risk leading to random results. Consequently, colour and light are not used effectively to create positive experiences, but rather tend to give poorly integrated spaces creating disrupting experiences. The already mentioned epistemological problems have led to a praxis for lighting planning that is focused on the measurable intensity of light rather than on visual qualities like contrast and colour rendering, or non-visual effects like hormone production. Qualities like atmosphere and spatial experience are considered even less.

5. WORKING METHODS OF THE SYN-TES PROJECT

The project will gather internationally acknowledged scientific and technical experts within a number of disciplines in colour and light, including architecture, art, psychology and medicine, as well as practitioners from leading companies working with lighting, colour and window glass (Philips, Alcro-Beckers, Scandinavian Colour Institute and Saint Gobain).

The main work will be conducted in seminars where the participants will present front-line international research within their own disciplines and together identify coordination problems and suggest solutions. Some of the identified problems will be further investigated in sub-projects including theoretical work, experiments and analyses of existing architectural spaces (see figure 3). The project time is jan 2010 – dec 2011.

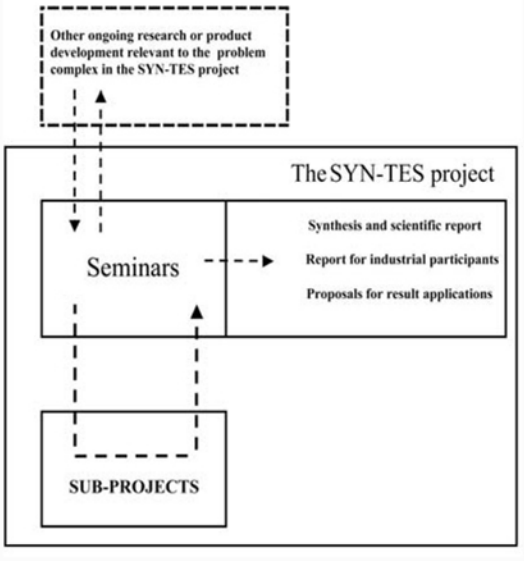

Figure 3. Working plan for the SYN-TES project.

5.1 Sub-project A, The epistemology and concepts of colour and light

Sub-project A aims at presenting the different scientific approaches in a broader epistemological perspective, clarifying the conflicting use of concepts and discussing possible ways of improving inter-disciplinary understanding. The work will be based on the seminar discussions and extensive reading of literature, including philosophy and epistemologically-oriented aesthetics.

5.2 Sub-project B: Analysis of the colour and light qualities in real architectural spaces

Sub-project B aims at increasing the understanding of how colour and light interact in creating the experienced spatial context. A number of architectural spaces that are deemed “good” by the architectural profession will be measured and evaluated with regard to a number of physical and experiential parameters, using technical instruments as well as questions to observers.

5.3 Sub-project C: Pilot studies regarding optimised energy saving, spatial experience and function in lighting planning

Subproject C aims at identifying problems and possibilities arising when products for colour and light are used together in realistic settings. Full scale test rooms will be designed by experienced light and colour designers to match the demands specified by the seminar group. The qualities of the rooms will be measured and evaluated with regard to a number of physical and experiential parameters, using technical instruments as well as questions to observers.

5.4 Sub-project D: Artistic means for creating interest and understanding

Sub-project D aims at finding ways of utilising artistic skill and creativity for the presentation of research results. The work will be based on the results from the seminars and other sub-projects.

6. EXPECTED RESULTS

The expected scientific results are:

- theoretical models and concepts that can improve the understanding among different relevant disciplines and fields of practice.
- increased understanding of some specific problems regarding the interaction of colour and light. One crucial issue is the colour rendering qualities of new light sources; another is the potential for energy saving interaction between daylight, artificial light and the form and colour of the room.
- identification of areas in need of further research.

The project will also result in proposals and instructions addressed to both the industry and to the purchasers, prescribers and executers of the building trade.

REFERENCES

1. Green-Armytage P (2006). The Value of Knowledge for Colour Design. *Color Res. Appl.,* **31**(4), 254ff.
2. Fridell Anter K (2000) *What colour is the red house? Perceived colour of painted facades.* Architecture, Royal Institute of Technology, Stockholm.
3. Liljefors A (1999). The V/P lighting theory – basic knowledge of lighting design on Vision and its physical stimulus. CIE 133-1999 *Proceedings of 24th CIE session, Warsaw, Vol.1, Part 1*.

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