

FERNANDO MOREIRA DA SILVA



BIOGRAPHY

Full Professor Emeritus with Habilitation (Aggregation) in the Scientific Area of Design. Doctorate in Built Environment (University of Salford) and also in Architecture – Visual Communication (Lisbon Technical University). MPhil in Color in Interiors (University of Salford). Post-Doctorate in Inclusive Design and Visual Communication Design (University of Salford). Coordinator from FA/ULisboa of the International Doctoral Course in Design, together with the Universities of La Campania-Naples, Milan, Florence and Malaga. Integrated researcher at CIAUD – Research Center for Architecture, Urbanism and Design, being its President between 2009 and 2020. Honorary Researcher at SURFACE – Inclusive Design Research Centre, University of Salford (UK). Coordinator or participation in several Research Projects in the general field of Design. Supervisor of several Master Dissertations (more than 150), PhD Thesis (more than 80) and post-Doc (25). Member of numerous Masters and Doctorate Jury Panels mainly in Portugal, Brazil, Spain, Italy and UK. Member of evaluation panels to the ALBAN Program, PROTEC Program, CNPq from Brazil and the Italian Agency ANVUR, being the Panel Coordinator for the PhD and post-Doc scholarships at FCT, between 2007 and 2020. Lecturer in Design (Product, Communication and Fashion), Human Factors, Ergonomics, Inclusive Design, Fashion and Color. Coordinator of several congresses, seminars, international conferences and exhibitions. Author of 3 books, several book chapters, articles, papers and communications in Design, Color, Inclusivity, Fashion, Human Factors, Ergonomics, Research Methodologies and Accessibility. Member of several journal and books scientific committees. Member of many scientific committees of international conferences. Editor or coeditor of 5 books.

FIELD OF RESEARCH

Design – Light and Colour

CONTACTS

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2016-2026 **Colour in Contemporary ART, incident in public demonstrations of wall cladding panels.
Comparative cultural study between Portugal and Brazil.**

Research Line

Urban Planning, Architecture, Design, Colour.

Team

Fernando Moreira da Silva (coord.); Margarida Gamito (FA.Ulisboa); Cristina Caramelo Gomes (ULusiada); Cristina Pinheiro (IADE – UEuropeia).

Abstract

Since the Islamic occupation of the Iberian Peninsula, Portugal inherited the tiles techniques from the Arabs and they became an important part of the Portuguese culture, and, by the mid-20th century, numerous Portuguese Artists and Architects developed a tendency to cover large city spaces with very ornamental tile panels, created on purpose, and including various specific colours and textures, different from the usual, adding reliefs and modifying the tiles dimensions. These large panels cover the walls of viaducts, ramparts, garden walls, among other places, adding colour patches to a monotonous and almost achromatic city scenery. For their dimensions, colours, textures and significance, these panels became a landmark of the city and contribute to the transformation of the city dominant colours nowadays. Since a similar phenomenon occurred in Brazil, the project will establish a comparative cultural study between both countries.

Methodology

The methodology consists on recording and analysing the different panels, both in Portugal and Brazil, establishing cultural comparisons, used materials and finishings, colour pallets, implementing reflection and trying to determine possible similarities that may occur.

Project Relevance

This type of study was never before implemented and there are several bridges that we think it will be possible to establish between the two countries, Portugal and Brazil, and correlations between the urban space, ambiances, atmosphere and colours used on the wall cladding panels.

Results

The project aims to create a database which encompasses the two cases and launch other trans and interdisciplinary research projects within this thematic, linking researchers and research centres in the two countries.



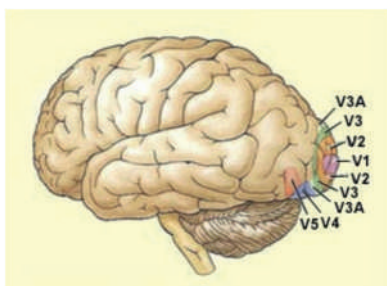
2019-2025 **Colour Processing and Human Perception**

Research Line
Design, Colour

Team
Fernando Moreira da Silva (coord.)

Abstract

For humans, cognition is the processing or interpretation produced by the brain of all information captured by the five senses, based on different capacities, such as perception, imagination, reasoning or memory, and the transformation of that interpretation into fundamental knowledge for our own way of being. However, most of our reactions are still unknown, such as those concerning chromatic cognition. Color vision is closely associated with visual processing and human perception, being the brain the organ responsible for decoding electrical signals into experiences that make sense for humans to perceive the world. Recent research has been able to identify areas of the brain that are activated during the phenomenon of chromatic cognition, just as we begin to be able to measure human behavior with regard to colour issues. The brain visual cortex is divided into at least five areas, present in the occipital lobe and designated according to their structure and function (V1, V2, V3, V4, and V5), each of these areas playing a specific role when it comes to visual processing.



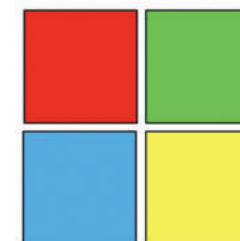
V1 and V2 areas are mainly responsible for initial visual processing. Through these areas the Human Being perceives the Colour and these, in turn, can be more or less stimulated when we see different colours. However, more recent investigations have led to the conclusion that color processing is largely associated with the V4 area, since this area becomes significantly more active when performing tasks in which color processing is necessary. We are aware that lesions in this region cause achromatopsia, a condition that affects the ability to identify or even perceive colours. Furthermore, through functional magnetic resonance studies, which we also used in our study, it was possible to prove that the V4 area becomes significantly more active when performing tasks in which colour processing is necessary. The current project aims the acquisition of scientific knowledge in the area that can be used as a projective tool for designers, besides contributing as a reference for the use of colour and for other investigations in areas related to colour and the advancement of artificial cognitive systems.

We have been developing a quasi-experience with humans, in order to help the understanding of brain reactions to different color dimensions, especially color processing and human perception and cognition, comparing the results obtained with those of other projects previously developed.

The study has also focused on color constancy, that is, the human tendency to perceive a given object as having the same color regardless of changes in lighting, angle or distance.

Methodology

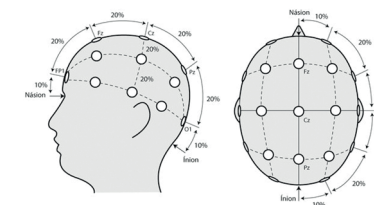
The quasi-experiment methodology was developed to understand not only color processing, but also the areas of the brain that were activated during the quasi-experience. Participants were asked to view sequences of colored squares that varied in terms of color (green, blue, red, yellow) and perceptual distance (1 or 2 hue steps). They tried to identify the colors that were displayed on the screens, always obeying the same sequence. The main aim of the present research focused on the effects of the categorization decision, main effects of hue distance and interaction between categorization and hue distance. Fifty-two individuals participated in the quasi-experience (26 males, 26 females, age range 26-42), with different ages and genders, and with normal or corrected-to-normal vision and reported no impairment in color perception. All participants gave informed consent before starting the experiment. The colors were presented on a screen, in the form of monochromatic squares, isolated or in color pairs.



Electroencephalography (EEG) was also used in order to acquire electrical signals in the scalp. For this purpose, caps made of an elastic spandex fabric with pure tin electrodes embedded in the fabric were used. The electrodes on the caps were positioned according to the international 10-20 electrode placement system. The EEG allows the graphic recording of the brain's spontaneous electrical activity over a period of time originated in the brain, through multiple electrodes applied to the scalp. The generic EEG acquisition system consists of a set of electrodes, amplifiers and a data recording medium. Since all skulls are different, a standard method of electrode placement had to be found. The 10/20 International System was chosen.

Project Relevance

Although at first glance it seems like a relatively simple human capacity, colour processing is a complex phenomenon, involving different variables – many of which are still a mystery to researchers. In addition, new discoveries are constantly being reached, recontextualizing previous knowledge and giving rise to new questions that need answers. It is these questions that guide us to important new milestones in the neurosciences. The systematicity of the results seems to prove that, in our cognitive processes of conceptual construction and categorization, humans are more synesthetes than traditionally thought. In fact, it seems that the mind seeks, as much as possible, equivalences between perceptions from the most diverse areas, trying to associate colors not only with objects, but also with feelings, ideas and emotions. It is intended to continue this work, trying to discover more about colour processing and cognition, as well as new areas and activities of the human brain that are linked to colour recognition.



Results

The research process started with a training task; the average number of attempts needed to reach the desired objectives was 7. During the color visualization task, the participants judged whether the colored pair came from one- or two-color categories. Participants had a high overall accuracy rate: 94%. The occipital, caudate and anterior regions of the insula were active when more than one hue was presented, indicating a role in perceptual processing and attentional monitoring. The dorsolateral prefrontal cortex showed greater activity when two colors were present than a single color, indicating a role in color category coding. The cognitive control regions of the intraparietal sulcus and the pre-supplementary motor area were sensitive to the interaction of decision and distance in perceptual space, indicating a role in the combination of these functions during decision making.

These results support theories that colors are categorically represented at high levels of the cognitive hierarchy and that the visual cortex is sensitive to hue rather than color category. We realized that the dorsolateral frontal regions were sensitive to color categories and not to perceptual distance, with greater activity when two color categories were present. We also asked participants to judge whether a given sequence of chromatic stimuli had been extracted from one- or two-color categories. This task allowed us to identify neural regions underlying the perceptual and decision processes in color categorization. The obtained results allow us to expand the knowledge in this area, establishing a relevant impact on society, academia, at national and international context.

Dissemination

PUBLICATIONS

- 2023 Moreira da Silva, F.
Colour processing and human perception. In: Ahran, T. et al. (Eds.). Proceedings of Intelligent Human Systems Integration (IHSI 2023) – Integrating People and Intelligent Systems. AHFE International: New York City.
- 2019 Moreira da Silva, F.
Chromatic Cognition and human behavior. In: Raposo, D. et al. (Eds.). Perspective on Design – Research, Education and Practice, pp. 215-223. Springer: Cham.

COMMUNICATIONS

- 2023 Moreira da Silva, F.
Colour processing and human perception. Intelligent Human Systems Integration (IHSI 2023) – Integrating People and Intelligent Systems, February 23-27, 2023, Venice, Italy. By submission.