Color and materials in design didactics. Design of a playroom and relaxation area for children – case study

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ABSTRACT

This project was focused on providing design students with practical knowledge regarding the use of colors and CMF (color, material, finish) implementation in public space, interior, and product design. In cooperation with a textile company, they designed a space at the day care center where children and teenagers were able to relax and participate in therapeutic meetings and conversations. During project, students became familiar with the ways of defining colors and their symbolism (moodboards, graphs, semantics), CMF design, influence and use of taints in interiors (simulation of perception in different light conditions, Panton Viewing Booth Light Box), parametrization of coloring (NCS, Pantone, RAL, CMYK). The color scheme was elaborated in the process of consultations with experts and psychologists and executed with the participation of users of the facility. The idea also involved introducing young people to interesting places in Silesia. This purpose was served by the wall map of the region and original seats, which featured the landmarks marked on the map. The added value of this project was presenting students with the opportunity to work with an actual business (textile producer). This involved learning about the technological background, organizing dedicated workshops and consults with experts, and the possibility of working with materials provided by the producer. The implemented project is an example of a model program of cooperation between representatives of higher education – Academy of Fine Arts and Design in Katowice and a public utility institution – Community Day Care Center at the Gniazdo Foundation.

KEYWORDS color and design, CMF, color and education, psychological aspect of color

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1. Introduction

This article presents the findings of an educational project concerning colors design and CMF (color, material, finish) implementation in public space, interiors, and product.

The Academy of Fine Arts in Katowice conducts research and didactic program regarding color design. During lectures, case studies and practical assignments, students acquire basic knowledge and skills at parametrization and design of color.

Fig. 1. Didactic program at AFA Katowice (color design).

2. Project

Within the design and didactic activity, a pair of students executed a project of an unusual playroom and relaxation area for children and teenagers of the Katowice Community Day Care Center at the Gniazdo Foundation (Fundacja Gniazdo, 2021). The project was carried out in collaboration with a textile producer, Lech Fabrics Company (Multimedia, 2021). In accordance with the notion of corporate social responsibility (IDEO, 2015, 29), it assumed a purposeful participation of the company in young designers' education as well as improving a fraction of the world for a group of local children in the Silesia region.

2.1. *The premise of cooperation*

The headquarters of Lech Fabrics Company, the leading importer and producer of fabrics, is in Kostrzyn, Wielkopolskie Voivodship, Poland. There, one can see their modern offices, a showroom presenting their upholstered furniture and a warehouse of 14 thousand square meters. Lech Fabrics was chosen as a didactic partner of the Academy of Fine Arts and Design due to its 40 years' experience and technical potential as well as its values. It is a family business, oriented towards social activity, sharing knowledge and experience with young designers.

The cooperation between the Academy and this business partner involved a series of trainings and presentations of possible fabrics application as well as cooperation in terms of production and implementation of the designed product.

The company granted students' access to technological facilities, organized dedicated workshops and expert consultations of fabric designers regarding the selection of colors for the interior. The producer made its fabrics available to students as well. Their knowledge about color sampling and designing color tendencies was expanded by the product range offered by the brand.

Students found the entire process especially motivating due to the fact that their efforts were purposeful, oriented towards the result in the form of guaranteed application, rather than abstract student practice. Beside the possibility of their design being implemented, recognized and rightfully rewarded, both designers and producers were encouraged by the social aspect of their work – helping children and teenagers from the Community Day Care Center at the Gniazdo Foundation.

The designed interior provided these young people with a good space to read books, study, relax, conduct therapeutic meetings and meaningful conversations in small groups.

Stages of the design process resembled those of classical service design (Brown, 2009, 45–63) in permanent contact with the future users and the support of experts (representatives of the interior design industry).

One could distinguish:

- Building of the team and mutual inspiration:
  - Creating the team consisting of students, Academy teachers, employees and pupils of the Gniazdo Foundation, employees and experts of Lech Fabrics;
  - Defining areas of cooperation and users' needs during workshops;
  - Didactic workshops for Academy students led by Lech Company;
  - Workshops with the users (listening and forming the hierarchy of needs, drafting mood boards of ideal space, presentation of possibilities, arrangement of space, inspiration);
  - Interviews with Foundation employees and psychologists providing for designing in compliance with the users' needs.
- Generating ideas and prototyping regarding the service and the project:
  - Creating space mock-ups, color and fabric models;
  - Building usage processes;
  - Building and research of functional areas of the selected space;

- Colors research (perception of colors on fabric and the walls in changing light conditions);
- Studio visits in the manufacture and Poznań Fairs.
- Verification of the project:
- Contest method of displaying designed solutions;
- Modeling and prototyping;
- Technological consultations with the producer (implementation);
- Common application of the project in space (implementation involved pupils, employees, students) building community and shared responsibility for the project.

2.2. *Methodology*

In the process of students' projects development, where the conducted analysis translates onto the project concepts, a triple diamond methodology is often used (Design Methods Step 1: Discover, 2021). Developed by Design Council, it consists of 4 stages: discover (analyses, documentation, interviews), define (organizing information, building the brief), develop (design development, prototyping and testing) and deliver (implementation). This allows to organize the design process following the sequence: possibly the widest scope of analysis – drawing and formulating conclusions – return to unrestricted prototyping and building precise design concept.

The working group, consisting of the author and students conducting the experiments, used the following design methods:

a. defining the symbolism and taint (moodboards, graphs, semantics);
b. choice of color, materials and finish (CMF);
c. testing the effect and use of particular taints in interiors (simulation of perception of taint and fabrics in different light conditions by means of Panton Viewing Booth Light Box);
d. parametrization of coloring (NCS, Pantone, RAL, CMYK).

2.2.1. *Defining the symbolism and taint (moodboards, graphs, semantics)*

A group of students, assisted by a technologist of Lech Fabrics, created color moodboards that constituted the base for further project. A moodboard is a design method and creative tool which allows to define the character of project by visualizing its general concept (Stramer, 2007, 29). They also worked with a semantic differential, which is a type of rating scale designed to measure the connotative meaning of objects and concepts. On its opposite axes, a spectrum of contrary features is located, e.g., traditional – modern, everyday – festive, glossy – mat, chromatic – achromatic.

Students situated their project objectives in a chosen area of the spectrum built on these features. To define the features for the spectrum and the context of the project, they created a mind map – a diagram used to visually organize information. Emphasizing the semantic aspect of design makes one aware of the effect that its basic properties (shape, material, texture, color, size) have on the users' psychophysical and physical response. In the design process, these properties serve as variables and determine the form of design.

Fig. 2. Using a moodboard for defining the design color scheme.

2.2.2. *Choice of color, materials, and finish (CMF)*

The accurate selection of color, materials and their finish greatly influence the functional aspects of a designed product and its final appearance. All the properties are interdependent, and their configuration affects the entire design.

Color perception results from many factors classified by The Optical Society (OSA) as early as 1943 (Zausznica, 1959, 357–360). They are known as attributes (properties) of color perception and include i.e. brightness, tone, and saturation, but also: size, shape, location, fibrillation, scintillation, transparency, luster, glow. This classification was the first attempt to expand the three basic parameters by additional factors – the basis of the current CMF design. It must be noted that none of these aspects should be considered separately from the others. Considered all together, they allow to accurately define the character of a given color.

In the project, matching the coloring and materials to the users' needs followed from consultations and was conducted with the support of Lech Fabrics experts. They

assisted students in solving design problems by applying appropriate materials and technologies.

Enabled by the possibility of using a wide palette of fabrics made available by the producer, students could analyze every CMF aspect and become aware of their effect on the project.

The method of evaluation of individual factors (color, material, finish) and their influence on the recipient was visualized by means of the C/M/F indicator (Becerra, 2016, 49) which allows to understand the significance of each element in the following aspects: functional / emotional attributes, quantitative facts, performance / aesthetic requirements, characteristic keywords.

2.2.3. Influence and use of taint in interiors (simulation of perception of taint and materials in different light conditions by means of Panton Viewing Booth Light Box)

The choice of colors was elaborated in the process of consultations with experts and psychologists and carried out in the participation process with users of the day care center. The process included taking pictures of specific color combinations in the context of particular spaces, choice of materials and temperature of light, and accounted for the color preferences indicated by the users.

Students made coloring samples and used them for several simple experiments to observe the correlation of change of lighting and color impression depending on the type of object (flat / three-dimensional), kind of pigment (print, acrylic paints) and the substrate (paper, textiles).

The first analysis concerned observing the chosen color on a simple three-dimensional object (cube). It was intended to make the young designers aware of the difference in appearance of the tested taint when used on the 3D rather than flat surface. The next experiment regarded the selected set of wall acrylic paints. The observation of how natural light influences color perception in the interior was expanded by testing the color samples in the Panton Viewing Booth Light Box. Another analysis, carried out in the same conditions, used the selected fabric samples from the palette of materials provided by the producer. Due to different types of light in the interior (natural daylight, artificial light: neutral and warm), students were able to observe the phenomenon of metamerism on all tested surfaces, textures, and color variants. This experiment helped them understand the design issue of appropriate lighting of color on textiles and acrylic paints. The described analysis was intended as observation and visual experience of the changes without taking measurements or cataloguing the results. Such an approach allowed the young designers to learn how to correlate and evaluate

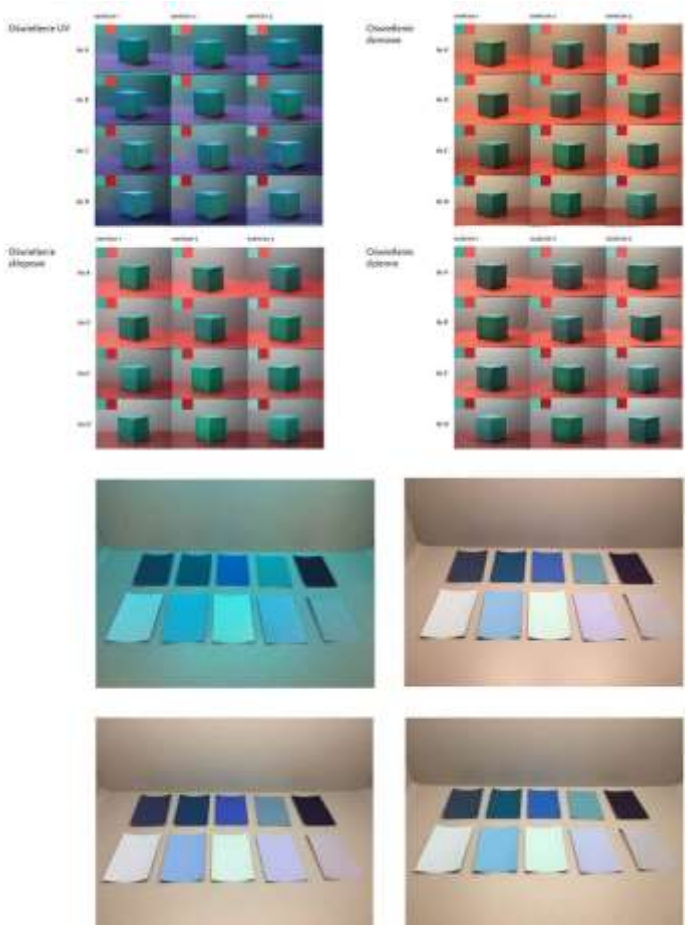

Fig. 3. Simulation of specific light conditions for selected color samples.

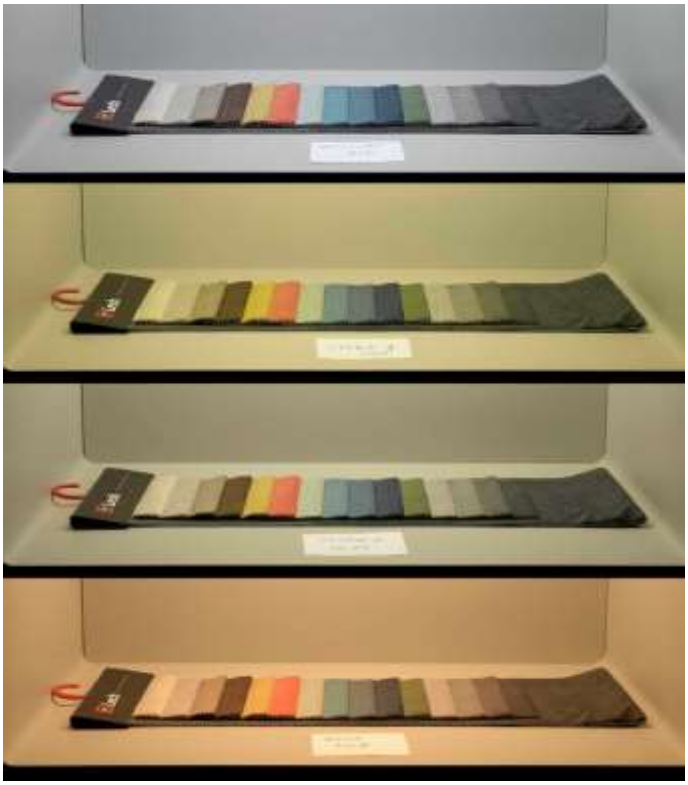

Fig. 4. Simulation of specific light conditions for selected fabric samples.

selected components of the future design and provided them with tools to verify or validate their intuitive ideas and individual preferences.

General description of research conditions: selected components of the future design and provided them with tools to verify or validate their intuitive ideas and individual preferences.

Photographs of samples were taken with a digital camera equipped with the full frame matrix type CMOS, without low-pass filter, factory-calibrated. There were fixed settings of exposure in every photograph, 100 ISO, f/14, ¼ sec. The balance of white in the camera was 5000K (daylight, D50). Pictures were taken in a darkened room, samples were lit only with Panton Viewing Booth Light Box, using the following light sources:

1) Daylight (D50) color temperature 4990K, fluorescent lamp with light intensity 2120lx.
2) Store 1 (CWF) color temperature 3806K, fluorescent lamp with light intensity 1625lx.
3) Store 2 (TL84) color temperature 3980K, fluorescent lamp with light intensity 1921lx.
4) Home (Inc A) color temperature 2847K, fluorescent lamp with light intensity 1299lx.

Measurements of color temperature and intensity for light source installed in the device (Panton Viewing Booth Light Box), were provided by the producer.

Adobe RGB was chosen as the color space of saved files; neither postproduction nor digital editing were conducted.

The above conditions of experiment record allowed students to observe the color temperature of the selected light source in comparison with natural daylight (D50) and its influence on perception of the color of materials used in the study, as well as the difference of light intensity between particular light sources. The device parameters, which determined the type of lighting, were selected for the most precise imitation of the actual changes of light color in the designed interior (daylight, and warm/neutral artificial light).

Experiments conducted by students focused on cognitive aspects and were their first experience of changes in color depending on the lighting parameters. This research, therefore, carried a good didactic value for the young designers.

2.2.4. *Parametrization of coloring (NCS, Pantone, RAL, CMYK)*

The project of an unusual playroom and relaxation area for children and teenagers of the Katowice Community Day Care Center at the Gniazdo Foundation required from students the parametrization of selected elements (furniture, walls, fabrics, finish) according to the nomenclature of numerous color standards.

Color mapping applies various theoretical models and color charts. Developed individually, they currently co-function on the market of interior, product and visual communication design. The previously assigned areas, typical of each individual chart, are becoming increasingly composite. For instance, charts typically used in polygraphy, now have their variations dedicated to textiles; those characteristics of the paint industry, have expanded their use and are now applied in parametrization of the coloring for plastics and advertising materials etc.

Therefore, regardless of the substantive content of the project, every designer should master the use of any type of color chart and be able to correctly transpose the selected color values as accurately as possible. A real challenge of the project documentation can be indicating a particular, uncharacteristic color, which could be closely defined by means of all the above-mentioned notation standards.

In the case of this project, the students team had to define the color scheme for the color sets of wall paints, wood varnishes, plastic elements, textiles. They applied the systems of NCS (NCS Colour – Universal Language for Colour Commmuication, 2021), Pantone (Pantone Colour, Chips & Colour Guides | Colour Inspiration | Pantone UK, 2021) and RAL (erleben and Farben, 2021). Among those three, only NCS could be considered as a color model organized and described in a manner characteristic of such compilations (Munsell color system, Ostwald model etc.). Pantone and RAL are charts of ready color recipes used in design.

This experience provided students with a good and thorough training of color charts use and color translation between the charts.

Beside designing the color scheme of the room, the idea was to present interesting places in Silesia and thereby familiarize young people with history, build the identity and community of place, as well as spark their imagination. This purpose is served by the wall map and original seats, which present places marked on the map.

The resulting color layouts are composed of illustrations and characteristic typography, applied to natural fabrics and wood. Employing various variants of textiles (padded furniture, decorations, panel partitions, curtains etc.), the entire project responds to the functional needs of its users.

Fig. 5. Project of workplace. Matching materials and colors to the function of an interior.

Fig. 6. Project details. Textile elements, featuring original prints, dedicated to the relaxation area.

There were many aspects directly connected with the need for modification of the interior's function depending on the time of day, number of participants and the character of classes conducted in the room. The functional layer of the project assumed a selection of colors to allow the intensive use of the work area by several children (easily cleaned and durable materials, neutral color scheme) as well as effortless reorganization of the furniture and shelves (frequent touching).

Attention had to be paid also to the psychological aspect in reference to the relaxation area and therapy (using natural materials, pleasant to touch, calming color scheme).

The project allowed for personalization of the interior by children (textile boards with their drawings and modular poufs with interesting visual components). The interior design included original elements, such as seats combining the features of comfortable ottomans with didactic materials (each seat bears an original print and information about an important monument of Silesia or an interesting place), and the wall covered in a textile map, on which children can mark the landmarks visited in the region. The final color scheme was developed in consultation with experts and psychologists and executed in participatory process with the users of the facility.

Children articulated the need for "their own" private space, which would resemble a well decorated house rather than specialist group therapy rooms. As a result, the team of young designers and experts had to face various challenges and meet diverse expectations.

3. Conclusion

The project aims to promote the creative and innovative solutions, using textiles in public spaces, in reference to interior color design. Its added value was presenting students with the opportunity to work with an actual business (textile producer). This involved becoming familiar with technological background, organizing dedicated workshops and consults with experts, and the possibility of working with materials provided by the producer. The knowledge regarding color charts and designing color tendencies was acquired in the practical context of the product range offered by a particular brand. The project was implemented by the end of 2019 and nominated for the Śląska Rzecz 2020 – Silesian Icon 2020 award (Gołębiowska. e., 2020, 86–87) in the Service category as an example of a model program of cooperation between representatives of higher education and public utility institution.

4. Conflict of interest declaration

The author declares no conflict of interest related to this publication.

5. Funding source declaration

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7. Short biography of the author.

Anna Kmita Graduated from the Academy of Fine Arts in Katowice, majoring in design. Habilitation: “A set of three projects related to color design in visual communication”. She leads research and design programs focused on heritage and restoring forgotten elements of design, history, culture, and identity of Silesia. The programs ended with publications and implementations of results in cooperation with the local businesses.

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