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This book presents the selected full papers by participants of the International Scientific Conference of the Color Society of Russia. They discuss a wide range of issues related to colour theory and its application in various socio-cultural contexts. The relevant psychological, sociological, linguistic, philosophical, pedagogical, art historian, technical and scientific aspects are considered.

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Books on Color

A colour is worth a thousand words! A colour-based tool to foster communication in culturally-plural teams

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ABSTRACT
Design institutions have increasingly adopted collaborative design-based learning in culturally plural classes, which supports the development of soft skills. In this context, teams could face differences in language, background and approaches to design, and students may find difficulties in communicating their own thoughts and feelings when evaluating teamwork, self and peers. The researchers glimpsed the possibility of conveying students' reflection by using the visual language, focusing on communication through colours. The method was designed with the idea that colours can take on very different meanings for each individual, providing a wider freedom of expression. The paper presents a visual evaluation tool, the Teamwork Colour Matrix (TCM), and its preliminary test within a plural design class. The TCM has been used by students for the spontaneous representation of teamwork by coding the experience through the personal association of feelings with eight given colours. The results showed that all the students were able to evaluate their experiences using colour communication. With the TCM, students find their own individual way of communicating to teammates, through the abstract representation of their personal experience in the team. The test of the TCM shows that even novice designers could communicate complex messages and feelings by using a language based on colours, and that a further development of colour-based tools could represent a useful resource for students and teachers beyond the design discipline.

Keywords: *colour in communication, colour psychology, design education, cross-cultural teamwork*

INTRODUCTION

In recent decades, organisations have increasingly adopted cross-cultural teamwork as an effective strategy to address complex contemporary challenges. Besides, educational institutions are also supporting international and interdisciplinary study programs (Larrick 2016) and, consequently, cross-cultural teamwork is becoming the daily reality of many students and teachers especially in design education, where collective project-based learning is widely used (Dutton 1987). Team members need to be supported to serenely contribute to the projects and express their different knowledge. Academic training should therefore provide the tools to strengthen mutual understanding by overcoming cultural and language barriers. Alternative forms of communication could be combined with the spoken language to help overcome the challenges related to cultural plurality. The visual elements are fundamental knowledge in the field of design and could be the key shared understanding to foster communication in design groups. Design and visual arts have a long history of techniques for teaching visual elements (e.g., line, shape, tone, colour, pattern, texture), which are considered as the alphabet that allows designers to develop their visual

communication skills. The need to develop a new knowledge about cross-cultural collaboration is a necessity of our time, but this new knowledge can be supported by the ancient knowledge of colours.

THEORY

Soft skills, defined as the abilities to work constructively and harmoniously with others, are widely recognised as fundamental skills to be competitive in the work field (Davies et al. 2011). A breeding ground for the development of such skills is provided by collaborative design-based learning (collaborative DBL), defined by Gómez Puente (2014) as the pedagogical approach where students learn how to design by developing a design project collaboratively. In this context learners must confront teamwork which becomes a crucial activity that runs with the project work. Hence, being trained through collaborations, students also improve their soft skills (e.g., social skills, communication skills) (Tracey et al. 2014). Students also face the challenges related to teamwork such as time management, disagreements, different working and communication styles, just to mention a few. When collaborative DBL takes place in international and interdisciplinary classes, the students face the harder challenge to perform cross-cultural teamwork, which brings together people from different ethnicity, religion, language, gender, nations, professions, religions, backgrounds (Mahadevan 2017). The presence of different worldviews in the team requires members to undertake cultural adaptation. Mattioli et al. (2019) showed that teachers can support students' critical reflection on teamwork through structured activities about team, self-evaluation and peer evaluation. These activities can provide a space for students to ask themselves some relevant questions (i.e., How did we work as a team? What could have been improved? What worked well? How did I and the others contribute to teamwork? How did I feel during the experience?), enhancing students' awareness about the individual soft-skills developed throughout the teamwork. However, it's not always easy for everybody to freely reflect and share their thoughts and feelings. This becomes even harder if it should be done in a foreign language, assuming English as *lingua franca*. In this regard, cultural barriers and language barriers could constitute an obstacle for students during this kind of activity. Referring to language as the "shared vocabulary within a specific context" (Patel et al. 2018), the researchers glimpsed the possibility of conveying the students' reflection by using a shared language among all designers: the visual language, which is the basis of design discipline. Indeed, when design concepts become visible, they acquire a shape, colour, measure and texture. In other words, visual elements are the way we really see a concept (Wong 1993). The representational or symbolic level of visual grammar is governed intensely by direct experience that goes beyond perception and, as a common, complex and intuitive language, it is conducive to breaking communication barriers through the association of concepts. The potentialities of visual language to communicate between cultures, generations, or plural groups of people, is related to our ability to deduct information and to associate feelings and emotions to images or visual elements or, as up to Dondis (1976:26), "sometimes to see a process is enough to understand how it works." We propose the use of the principles of visual communication, mainly through colour and shape, to activate the dialog inside the team, where the regularity of the 'grid' element becomes a starting point, from which the possibilities of total or partial transformation, modification and deviation can be sought through the use of colours.

METHOD AND EXPERIMENT

The method was designed to prove that visual elements could effectively support communication in culturally-plural design teams, especially when it comes to evaluating the way teamwork has been carried out. This first research was aimed at investigating if culturally-plural students could be supported by visual communication through colours for evaluating the team, self-evaluation and peer evaluation for building mutual understanding. To this extent, we designed a tool and qualitatively tested it within a plural design class. The tool consists in the realisation of a Teamwork Colour Matrix (TCM) for the spontaneous representation of the complete teamwork experience by using colours. This matrix is a blank orthogonal grid (Figure 1), intended to be the canvas where students express their personal interpretation of the experience by creating a composition with coloured paper. The grid consists of two essential parts, one for the group evaluation and other for individual performances. The group evaluation (part 1) is composed by a succession of 10 vertical rectangles, that can be interpreted as portions of time, moments or percentages aimed at dividing the teamwork experience. The individual performance (part 2), as well, presents a succession of 10 squares for each student in the team (1,2,3 … n) as the different performances can be compared with the different moments represented on the group evaluation. Together with the canvas, the students receive a selection of colours to create the visual composition inside the matrix. For a reliable reproduction of the experiment, it was decided to work with Canson Mi-Teintes pulp-dyed top-quality colour paper, which complies with the ISO 9706 standard on permanence, a guarantee of excellent colour performance and conservation. The chromatic palette consists of eight colours (Figure 1, from top to bottom): White (111 Ivory), Grey (431 Steel Grey), Violet (113 Blueberry), Green (480 Light Green), Orange (453 Orange), Red (116 Burgundy), Blue (140 Indigo Blue), Black (425 Black). Colours were selected by their heterogeneity, this is, different hues (chromatic and achromatic hues; secondary or tertiary colours); different brightness (from high to low) and different saturations (from high to low). The diversity of the chromatic palette is intended to motivate the students to visually represent different moods, moments or meanings when communicating the teamwork experience. In other words, the eight selected colours are conducive to be linked to semantic poles (Osgood et al. 1967, Valdez and Mehrabian 1994) such as positive-negative, intense-dull, active-passive and simple-complex associations, among others.

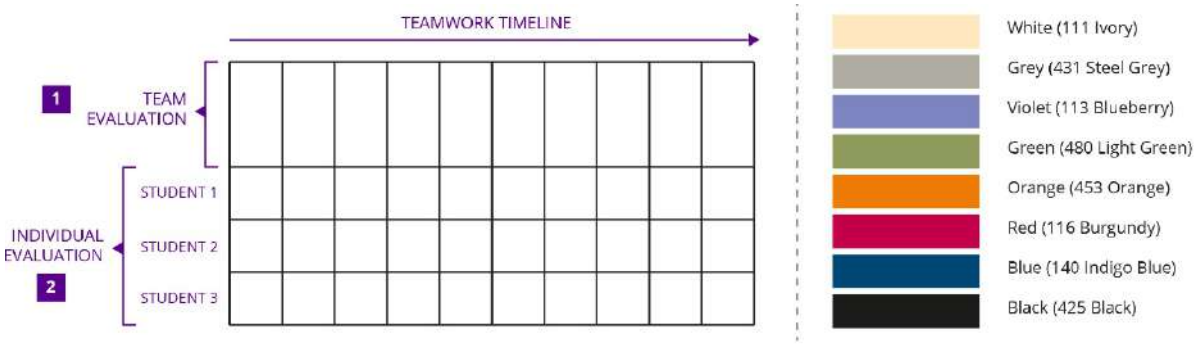

Figure 1: Teamwork Colour Matrix (detail) includes Part 1, team evaluation with teamwork timeline divided in ten units (top), and Part 2, individual evaluation divided in student 1, student 2, student 3 (right bottom, three rows). Selected palette of coloured paper Canson Mi-Teintes: white, grey, violet, green, orange, red, blue, black (left, top to bottom).

After the realisation of the visual composition (part 1), students are asked to produce a brief written document to support the chromatic representation and rationalise their feelings and associations. Then, students visually represent the self and peer performances (part 2). Again, after colouring the matrix, students are asked to write a brief explanation of their use

of colours. After the matrices are done, students gather in the teams with the purpose to explain and discuss their TCMs, as a starting point to motivate conversation about teamwork supported by visual communication. This activity is meant to discuss and share their individual experiences and to produce a shared understanding of the collective experience of the work together. Finally, every team meets with the researchers to review the results of the activity and to externalise the shared understanding, providing and receiving feedback.

The tool was preliminary tested at the end of the design studio course of the interdisciplinary one-year master program Industrial Design for Architecture of POLI.Design, Politecnico di Milano. The students, architects and designers, are trained to design high quality projects in the field of interior design and architecture, with a strong focus on industrially-produced building components. The learning path is composed of several theoretical modules (e.g. materials, architecture history, design strategy) and by three design studios, where students perform collaborative project works. The students come from different countries (i.e., Brazil, India, Lebanon, Mexico, Russia, United Arab Emirates) and they also have different levels of expertise (i.e., novice designers/architects, professionals) in different fields. The sample-class was composed of 12 students, divided into 4 teams of 3 individuals each. The teams were decided by the professors mixing origins, backgrounds and level of expertise. The teams worked for one month to design a high-end kitchen being supervised by three teachers. Data has been collected from each part of the test (Figure 2, Activities) and has been qualitatively analysed.

ACTIVITIES	DATA COLLECTION
0. Brief introduction about TCM and how to individually realise it	
1. Individual and non-guided choice of TCM colour composition	Direct observation, photo, TCM collection
2. Production of a written document to describe the TCM composition	Collection of the descriptions
3. Sharing each TCM with other teammates	Direct observation, photos
4. Team discussion about the results	Direct observation, photos
5. Review with tutors (researchers), explaining the results	Audio recordings and transcripts, participant observation, notes
6. Qualitative feedback about the activity	Audio recordings and transcripts, participant observation, notes

Figure 2: Summary of the activities run during the test and data collection strategies per each activity.

RESULTS

From the written documents produced by students, it was possible to notice some interesting ways of facing the exercise. First, about the narrative of the text; some students approached the explanation by telling a story and included colours as symbolic qualities of the different moments of it, others started by writing a list of the colours they used and describing the

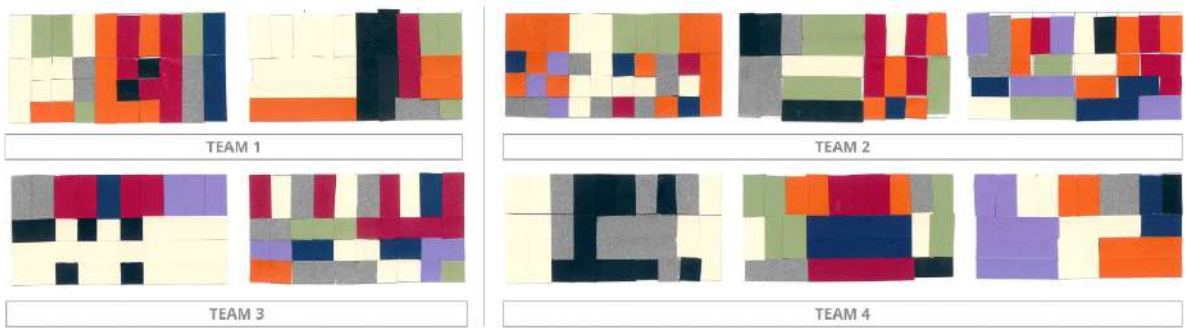

Figure 3: Overview of the results of the Teamwork Colour Matrices made by the students of the four teams. Top row: team 1 (left), team 2 (right); bottom row: team 3 (left), team 4 (right).

meanings they associated to them. This means, some of them started from the lived experience and the others started from colour as a trigger to communicate. Secondly, regarding the comparison between the 'teamwork' and the 'individual' visual representations, some students expressed similarities between the colour palette they applied to part 1 and part 2 of the TCM, visually and in terms of meaning while others codified part 1 and part 2 very differently, emphasizing a different perception of the teamwork and the individual performances (Figure 3). Other noticeable results regarding colour associations is that most students attributed a particular meaning to a colour hue and maintained it during the entire composition (e.g., red used for representing several moments of tension), but one used the same hues with different meanings every time (e.g., red means focussing on hard work, evolution and changing, depending on its position), extending the consideration of the meaning of hues to the harmonisation with other colours. Another interesting case is a student, who decided to attribute meanings to the achromatic colours of the palette by using brightness (e.g., associating positive moods to white, regular moods to grey, and negative moods to black), simplifying the exercise and not using variations of hues as a vehicle to communicate meaning in a more specific way (Figure 3, team 4). In a less radical way, the majority of the students noticeably used brightness and saturation variations to differentiate associations and feelings.

During the review (activity 5), it was evident that students used the TCM to communicate, between each other and then to the researchers, the outcomes of the previous discussion (activities 3 and 4). Most students were using the TCM as a support for their storytelling of the experience, by directly pointing to the grid and making references to the different colours applied. In one case (Figure 3, team 1), students summarised their teamwork by using one of the TCMs (the most accurate, according to them), showing agreement and shared understanding of the experience. All the teams were able to establish some comparisons between their TCMs or to recognise analogies and differences based on colour and shape. In all the cases, the TCM worked as a trigger for students to share their own perception of the teamwork experience.

Some of the most relevant feedback by students regarding the use of visual communication, was about how the TCM has helped them to organise the ideas, to build a discourse, to understand the teamwork process, to communicate the emotions felt, and to explain their feelings by "using more than just words". Additionally, some students declared that they would have wanted to receive a "colour code" (i.e., predefined or cultural associations of colour and meaning) before the activity, because they were a bit lost at the beginning, not being used to communicating through colours.

CONCLUSION AND DISCUSSION

The results show that all the students were able to evaluate teamwork by using visual communication through colours. The TCM allowed a certain degree of freedom in the approach to the evaluation process because students created their individual abstract representation of the teamwork experience. During the sharing activity, students relied very much on their TCMs to tell to others their own experience within the team. Pointing, confronting, making analogies and finding differences between TCMs, students showed that mutual understanding of a shared experience could be supported by visual communication. Being also students' feedback about TCM very positive, we do think that this preliminary test showed the potential of colours to foster communication in culturally plural academic and professional contexts.

Regarding colour, the documentation of the activity resulted in a great amount of data (e.g., recordings, transcripts, photos, observations), and most of it related to associations of colours with emotions and feelings. While the same hues received very opposite meanings, even from the same student, the importance of brightness and saturation is evidenced in the relation to the semantic poles as positive-negative (brightness), active-passive (saturation) associations, among others. These results confirmed that the future analysis of colour associations should no longer be related only to hue, but should also consider the importance of brightness and saturation. For this reason, further trials of the tool could include a modified colour palette (other hues and more levels of brightness and saturation), to study in detail the relationships between meaning and the three properties of colour.

This is leading to further development of the research; after this preliminary test, during 2020, the TCM has been optimised, adapted to remote activities and tested with around 100 students. The results so far can be considered as a first positive contribution to address the initial research questions.

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