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## Comparative Study on the Users' Awareness and Choice Patterns on the Healthcare Environment Color Index, Focused on Koreans and Romanians

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### Abstract

*In contemporary times, there is an increasing demand for a dedicated healthcare environment, all over the world. The main motivation for this demand is the level of awareness manifested by the users and reflected on their expectations. Therefore new research strategies and design actions are investigated in order to answer to the users' needs and to provide objective design tools for the specialist. This study continues a series of previous developments of the Healthcare Environment Color Index that should be used for public facilities in Korea and abroad. The cross-cultural approach is a new opportunity for exchanging know-how and for testing and calibrating the perception of the users on the color index. The gathering of results was made based on the online survey provided in this phase in English version for the Romanian users. The survey was intended as an objective mean of research and an efficient way of disseminating information on the subject thus contributing to increasing the level of awareness of the users. A total of 86 Romanian and 89 Koreans with valid answers took part in the survey. Comparative visualizations of the results showed significant similarities concerning the patterns of color preferences but also cultural and emotional differences. As a result both categories of users proved to be aware of the relation between healthcare environment color and its effects on health. They also showed a common understanding on the potential of the color index. As a result the most appealing colors to be applied to the healthcare environment were the series G and B, and the most effective ones were proved to be the ranges of high lightness and low saturation but also the medium high lightness and medium saturation. Both the similarities and the differences of choice between Romanians and Koreans show that cultural and emotional differences of color recognition are important and that should be taken into consideration in design, in order to generate an inclusive and efficient healthcare environment.*

**Keywords:** Color Awareness, Color Index, Healthcare Environment, Cross-Cultural Study, Color Survey.

## 1. INTRODUCTION

In contemporary times and societies the demand for quality healthcare services and facilities is continuously increasing. Healthcare systems have to be updated and synchronized to the expectations of the users. The awareness of the users is the main motivation in providing know-how and new means of research and action in order to generate a better reality for the people.

In the European culture, in the past, the healthcare environment - including all the dedicated spaces, facilities and services was approached rather technically and functionally. The medical building facilities were

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complying with the idea of complex machinery that accommodates special units and that has to function as perfectly as an engine. This is explained by the importance of Modernism and its great scale of influence upon the European culture. The late failure of the “machine approach” contributes also to the impact that these spaces have upon the users. It is general known that negative emotions, such as fear and reluctance, influence people’s awareness and make them trying to avoid or to postpone medical experiences, as a first impulse. This makes obvious the need to provide better and positive experiences related to the healthcare spaces and services. Lately a new direction opened up, meaning a more holistic approach for generating a healing environment more dedicated to the users, more centered on their behavior, on their physical and psychological needs and experiences. Its aim is to generate a more comfortable and less stressful environment, with better healing outcomes and better work condition for the medical care givers. The use of color in designing spaces and services is one of the new strategies, and it becomes a more and more important subject that needs to be explored objectively and transformed into a potential tool for designers.

### **1.1 The context for the comparative study**

In the case of Romania, most of the medical facilities can be categorized in two main types, regarding their appearance and architectural morphology and functioning: facilities hosted in historic, old, buildings and in modernist – rationalist buildings. In the last 20 years in Romania, there was a clear demand for extra healthcare facilities with new standards and services and also the upgrade of existing ones. A lot of clinics and hospitals were built in urban areas and medical services networks developed rapidly. Even so, there is an even greater need for more large scale facilities as metropolitan and regional hospitals, and a plan for achieving these in the close future, is being developed by the authorities. Therefore constant research in the field is needed.

According to previous research findings the people’s interest towards well-being, wellness and welfare is continuously rising in Korea. Studies have shown that both patients and medical staff show a low satisfaction toward the public health facilities [4], also because the appearance of these facilities is dull, too simple or uniform, not appealing for the categories in need, and thus requiring design improvements.

The recent challenges in the medical field to deal with the Covid 19 pandemic are also bringing into light various important needs related to the design of the medical environment, highlighting that this field of research can be vital and should to be maintained in constant development. As Korea was a stronghold for mastering the Covid 19 pandemic, it becomes also a reference and a model for the rest of the countries, not only by exporting medical equipment, but also know-how and by establishing and developing further international collaboration and research exchanges.

On the international context, Korea and Romania can show similar features if we consider that both are geographically located at the eastern part of Asia, respectively Europe. Both countries are future oriented but also show very different features if we consider the local contemporary or traditional culture. This year marks three decades since the establishment of diplomatic relations between Korea and Romania. The Republic of Korea is the first and the only Asian state with which Romania has established a Strategic Partnership, capitalizing on the potential of bilateral trade and economic cooperation but also the potential of research, education and culture. Even though, the two societies haven’t yet fully discovered the potential of their relation and need to develop further their interactions. It is notable that in the last years, there has been an important interaction between the two in the field of education. Therefore the number of students and scholars that are following academic exchanges in Romania and Korea is increasing, and for this reason young people can be seen traveling in both directions.

## **2. THEORETICAL CONSIDERATIONS**

From the perspective of this study and from previous theory related to the color of a dedicated environment, the term of cultural landscape represents a very interesting concept that can explain the differences between societies and their environments, and also a motivation for this cross-cultural approach. It refers to a complex of facts speaking about the local environment and its influence on peoples’ awareness upon their social and living conditions [3,14]. From the perspective of the architect: designing spaces and improving existing ones,

the cultural landscape is tool for analyzing, describing and understanding the man-made environment. This comprises: not only the social component but also the material component, and the interaction between the two. The material component of the cultural landscape can be useful for this study, because it includes the local architecture, the urban/rural and the natural setting. The concept can help us understand local sensibility at a global scale and explain not only differences of behavior and perception, but also surprising similarities between people living in very different conditions or territories.

Referring to the material component, there are again certain similarities and differences between the two countries. First of all the most obvious similarity is the recent layer of the build environment, meaning the large mass of the generic buildings and urban regulations that create the expression of the city. The second similarity is the layer of traditional architecture and symbolic places that have a great value for the people, along with their wish to preserve and protect this layer. Regarding the natural setting, even though Romania is located in a temperate climate and has an alternate relief of high mountains, hills, lowlands and sea, the deep green color of Korea's forest and mountains can also be recognized in Romania. This can be an interesting similarity if we consider the environmental color awareness of the two and the fact that the appearance of the natural and man-made landscape has influence on its inhabitant's perceptions and on certain life-style features.

## **2.1 A context of color environment in Romania**

As part of the European culture and people of Latin origin, Romania shares a common cultural European history. Polychromy has been manifested since ancient times [14], from Greek and Roman ancient culture to the present day, reflected in the built environment, architecture, art, objects and clothing and has been perpetuated continuously through the Middle Ages, until today. One can note that polychromy is another common feature between the two countries.

Nowadays Romanians prefer strong, vivid, optimistic colors, as can be seen in the built environment, both urban and rural, especially in the main historic cities or villages, whose legacy dates back to medieval times. As most of the traditional cultures, the Romanian culture was much more directly related to the use and meanings of colors and symbols, but these traits of the traditional culture have faded in time so the contemporary culture has lost the direct connection with this vein.

Regarding Romanian's particular preferences for color, we can identify that in some rural areas, blue was preferred both for the outside and the inside of the houses [15], along with white or various shades of green. The predominant blue appearance of the traditional rural houses is proved today by a revival phenomenon of recovering and restoring the expression of spaces given by this color, a phenomenon that brings back successfully to the attention of the public the historical, the aesthetic and the emotional value of blue color.

Today the interpretation of color (applied on built environments) is subjective and often random, so a system of classification, awareness and of strategically use of color with reference to space is necessary and recommended. Nevertheless Romanians say and recognize that especially regarding the built environment, color is an important element both for the exterior and the interior of the buildings, because it contributes to the atmosphere and to the level of representativeness of the space. This atmosphere created by color contributes also to the idea of comfort, cleanliness and modernity, and thus to the well-being of the users [9-13]. Especially in the case of medical spaces, color is recognized as an important design element and its use as a more and more conscious and necessary design strategy.

At a larger, global scale, "from the painted monasteries of Romania, recognized for their blue color exterior and interior frescoes and the peasant houses in Transylvania, to the pottery from Delft or the Portuguese ceramic tiles on buildings, named "azulejos", blue has transformed over time also into a binder of Europe and its symbol of unity" [3,15].

## **2.2 Basis of the comparative study**

The comparative study of awareness regarding the color index for healthcare environment has the purpose to test the cultural and emotional differences between countries [1], to validate and to complete previous

research on this subject [4-7] and to find new ways of analyzing and understanding the users behavior so to transform these data into objective and operational design tools.

This comparative approach, between two cross-national groups of people is meant to identify and analyze the similarities and the differences between the groups, to visualize the gathered data and to draw conclusions about these, for answering the design questions more effectively in the future. At the scale of the society, there are general traits of behavior but also differences that can be emotional, cultural or based on experiences and evolution as a whole [12]. Nowadays in a globalized world, societies are very dynamic, they interact and overlap and constantly redefine their standards, so a comparative research can bring new perspectives on the subject.

### 2.3 Research method and survey content

The study comparing the awareness of Korean and Romanian users regarding the healthcare environment color index was based on an online survey with the recording, processing and comparing of the valid answers of a number of 89 Koreans and 86 Romanians. The survey is developed based on previous research and relevant conclusions [4-7] and it contains a total of 31 questions that are structured as shown in table 1.

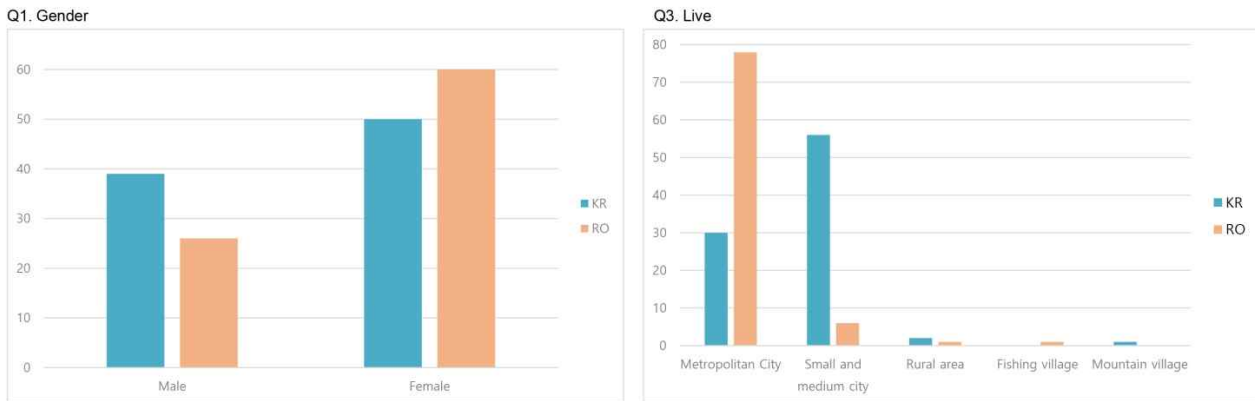
**Table 1. Survey structure**

Survey section	Contents	No	Method	Survey form
Correct	Color blindness, color weakness test	2	Multiple choice	Image
	Monitor calibration	1	Multiple choice	Image
Nominal	General (Gender, age group, change of resident status)	3	Multiple choice	Vocabulary
Consciousness	Relationship between environmental color and health	2	Multiple choice, Scale	Vocabulary
	Degree of healing function of environmental color	2	Scale	Vocabulary
Evaluation	Healing function evaluation on health theory based on color theory	7	Scale	Image
	Functional verification evaluation on health theory based on color theory- R, Y, G, B, P	5	Multiple choice	Image
Total		22		

The color index that makes the subject of testing was the result of a field survey of several Korean public health facilities that was developed during 2015-2017. Following this field survey, a representative color index mapped from the spaces of medical facilities was generated. A total of 28 colors were selected and analyzed in the first stage of the research. The same color index was made available for the Romanian public, and the online survey was provided in English from December 2019 to March 2020 ([http://www.healthcarecolor.or.kr/mobile/vote/vote\\_en.php?fbclid=IwAR2LcY2cMc5z-B5mH3hOGApSg2Umt9GxPJEXAwNP8jTWdesZInZVdVvCJGU](http://www.healthcarecolor.or.kr/mobile/vote/vote_en.php?fbclid=IwAR2LcY2cMc5z-B5mH3hOGApSg2Umt9GxPJEXAwNP8jTWdesZInZVdVvCJGU)). In order that the gathered data to be comparable to the Korean data, the respondents were selected from the age range of 20-35 years old, as students from architecture and design departments. This category of students is known to be familiarized with visual images and the relation between visuals and space design. They also represent the most dynamic social group, with high technological skills, good internet accessibility, good English proficiency, with high future oriented standards and education goals and with great mobility. Even from the start of the survey period, the students showed great interest for the subject and for the results, proving that this research can provide an operative tool for this category also. The gathered data was processed with SSP software in order to analyze it and to

produce comparative visualizations of the results.

The proportion of persons that answered the survey shows a similar pattern between the two countries regarding gender, with a greater number of female respondents than male, and with an even more obvious gap between the two genders for the Romanian side. On the other hand the number of respondents living in metropolitan cities was far greater for the Romanians, while the Koreans showed a majority for the small and medium cities and a much lower percentage of respondents coming from metropolitan cities, as shown in figure 1.



**Figure 1. Respondents' analysis**

We consider this difference as an important clue about the level of reach, regarding the subject of healthcare environment for people living in different backgrounds as small and medium cities, as a positive aspect.

### 3. COLOR INDEX EVALUATION EXPERIMENTS AND DISCUSSION

#### 3.1 First experiment

The first experiment is based on the survey chapter investigating the awareness of the users towards the effects of color when applied to their domestic space. The color choices of the respondents are showing patterns of preferences as explained below. The recorded data are translated according to the Munsell color system, based on the parameters indicating the hue (the basic color), the lightness (clear or dark) and the saturation (color intensity).

For the R series proposed in the color index – red hue, the comparative visualization in figure 2 shows a similar pattern between the preferences of Koreans and Romanians. The preferences are for the range 5R 9.0/3.0 representing a high lightness value and a low saturation, 5R 5.0/7.0 a medium lightness and medium saturation and 5R 7.0/6.0 medium high lightness and medium saturation. This is the color range representing vitality, energy, action and motivation, activating the nervous and sensory system and blood circulation [2, 8]. The comparative results of the survey validate the fact that the proposed color index for the R series produces the same effect on the respondents and the preferences are similar for both categories. This is also a result in accordance with previous research findings [5,7].

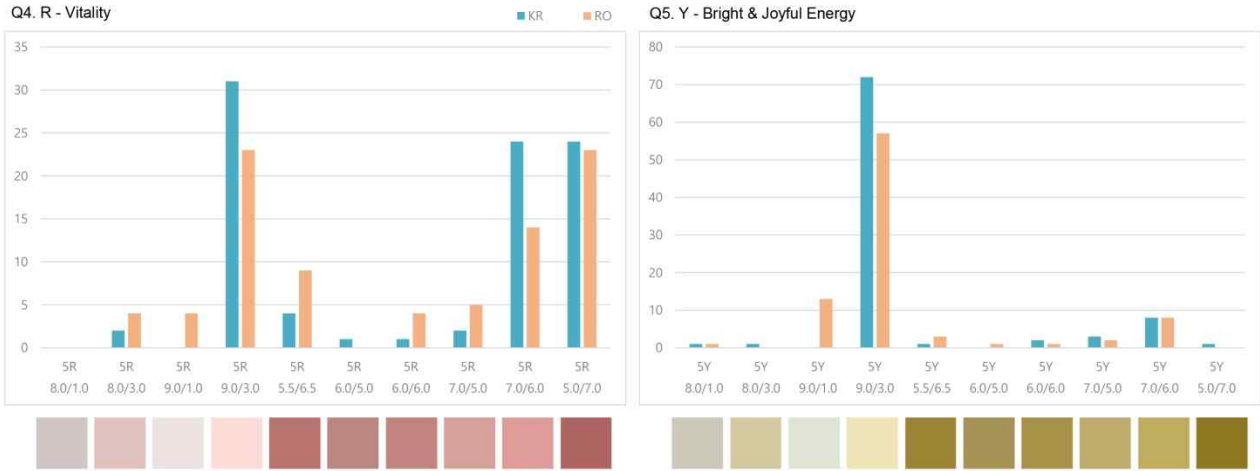


Figure 2. Evaluation of R and Y series

For the Y series – yellow hue, figure 2, again the preferences show very similar patterns for the range: 9.0/3.0 high lightness and low saturation as one major choice from the respondents and as a second but minor choice 7.0/6.0 - medium high lightness and medium saturation. This is the color range for bright and joyful energy, activating the motor nerves and the muscles [2,11,13]. The fact that both categories of users have chosen the same samples from the color index of warm colors is a significant validation of the color index and its effectiveness upon users’ perception.

For the G series – green hue, and for the B series – blue hue proposed, the choices of the respondents are significantly different between Koreans and Romanians. It seems that the cold colors have a different appeal for the users that manifest a greater variety of choices as it can be seen from the comparative visualization in figure 3. Also the level of awareness concerning the cold colors seems to be higher for both categories. The most relevant choices of the Koreans for the G series are 5.0/7.0 medium lightness and medium saturation, 5,5/6,5, 6.0/6.0 both in the medium range and 9.0/3.0 and 8.0/3.0 both with high lightness and low saturation. The Koreans have chosen also a second type of color samples, like: 7.0/5.0, 6.0/5.0, 7.0/6.0 in the medium lightness and saturation, covering the total number of 10 proposed color samples. On the other hand Romanians have as major preferences the following color samples: 8.0/3.0 high lightness and low saturation along with 9.0/1.0, 9.0/0.3 and as secondary preference 7.0/6.0, 5.0/7.0 samples. Similarly to the answers given by the Koreans, the Romanians find appealing the whole range of 10 samples of green hue as shown in the figure 3.

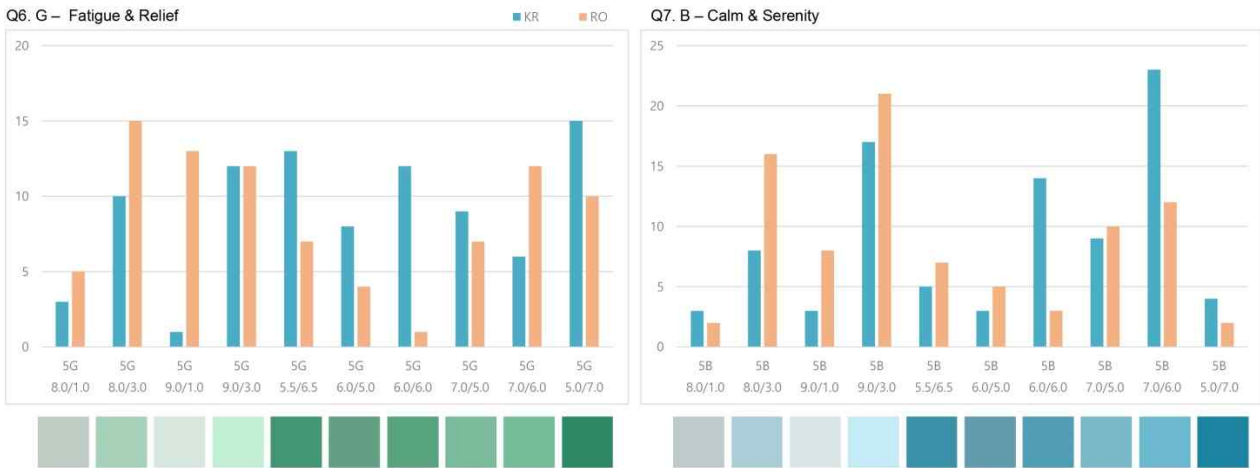


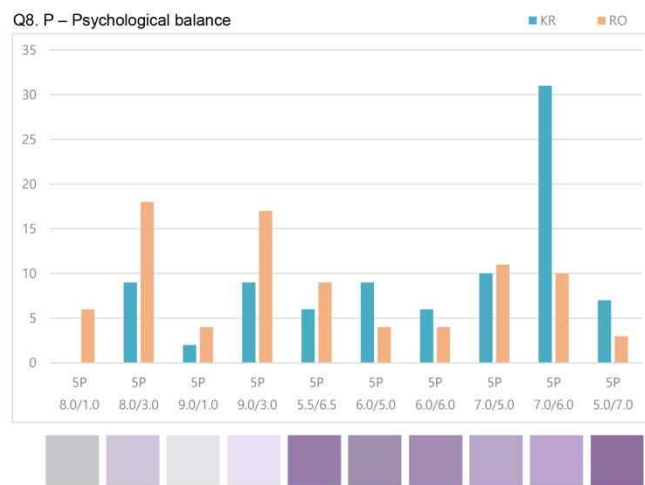
Figure 3. Evaluation of G and B series

The variety of choices shown by both categories, prove that the green hue is very appealing for the users. For the G series, meaning the color with effects on fatigue relief, balance and harmony it can be noted that the Koreans prefer the spectrum of medium high lightness and medium high saturation, while the Romanians have chosen as their main preference, the opposite samples with high lightness and low saturation.

For the B series – blue hues, the awareness pattern is again distinct from one category to the other as shown in figure 3. The Koreans preferred the color samples with 7.0/6.0 medium high lightness and medium saturation, but also 9.0/3.0 high lightness and low saturation and 6.0/6.0 medium lightness, medium saturation. Also similarly to their pattern for the G series, the Koreans have been aware of all the 10 color samples from the blue hue.

On the other hand the Romanian respondents have preferred mainly 9.0/3.0 and 8.0/3.0 both with high lightness and low saturation and as a secondary choice the 7.0/6.0 and 7.0/5.0 meaning medium high lightness and medium saturation. They have also manifested interest for all the 10 samples of the proposed blue hue, similarly to the Koreans and to their pattern for G series as well.

The blue hue is associated with serenity and calm, soothing effects on the muscles and metabolism [2, 8].



**Figure 4. Evaluation of P series**

Regarding the P series proposed in the color index from figure 4, the differences between the two categories are again significant. This is the color associated with psychological stability, regulating emotions and sensitivity [2]. The results show that Koreans have as main preference the 7.0/6.0 medium high lightness and medium saturation while Romanians prefer 9.0/3.0 and 8.0/3.0 both with high lightness and low saturation. All the 10 samples from the purple hue seemed to be appealing for both Koreans and Romanians.

### 3.2 Second experiment

The second experiment was exploring the awareness through the preferences for the most important healing effect of the color index, when applied to the public health environment.

For the PB series – purple blue samples proposed, the pattern of choices of Koreans and Romanians was very much alike: 9.5/3.0 high lightness and low saturation as the main choice, 7.5/5.0 – medium high lightness and medium saturation as the second choice and 8.5/3.0 high lightness and low saturation as the third choice, and again 9.5/1.0 high lightness and low saturation as the fourth choice. All the other samples were also chosen in similar proportions by both Koreans and Romanians showing that these series of samples are interesting and have potential on the users' perception.



Figure 5. Evaluation of PB and B series

For the B series – blue color samples proposed for the medical environment, the preferences of both categories are showing a similar pattern with the same preferences but in small different proportions. First option was 9.5/3.0 high lightness and low saturation, 8.5/3.0 and 9.5/1.0 but also 7.5/5.0 high medium lightness and medium saturation. All the rest of color samples from the B series were proportionally appealing for both categories.

For the YG series – yellow-green hue, the awareness pattern of the users from both countries shows great similarity, having as the first preference the 9.5/3.0 sample, meaning high lightness and low saturation and the 7.5/5.0 sample with medium high lightness and medium saturation. The next major preferences were: 6.5/5.0 from the medium range and 9.5/1.0 and 8.5/3.0 for the high lightness and low saturation range. Again all the rest color samples from the proposed series were chosen by the respondents in smaller proportions.



Figure 6. Evaluation of PB and B series

For the Y series proposed by the color index for the health environment, the pattern between Romanians and Koreans shows as the main preference is manifested towards the sample 9,5/3.0 high lightness low saturation and as second choices the 9,5/1.0 and 8,5/3.0 from the same range. In this series, it is also visible that not all the other hues are appealing for the users, even though Koreans show more interest of Romanians for the medium and darker samples.



## 4. DISCUSSION

The Romanians have chosen the following color ranges from the color index, as having the maximum effect: 5R 9.0/3.0 (26,7% respondents from the total), 5R 5.0/7.0 (26,7% respondents from the total), 5Y 9.0/3.0 (66,3% respondents from the total), 5G 8.0/3.0 (17,4% respondents from the total), 5G 9.0/1.0 (15,1% respondents from the total), 5G 9.0/3.0 (14% respondents from the total), 5G 7.0/6.0 (14% respondents from the total), 5B 9.0/3.0 (24,4% respondents from the total), 5B 8.0/3.0 (18,6% respondents from the total), 5P 8.0/3.0 (20,9% respondents from the total) and 5P 9.0/3.0 (19,8% respondents from the total).

In the same stage of the experiment the Koreans have chosen the following color ranges from the color index as having the maximum effect: 5R 9.0/3.0 (34,8% respondents from the total), 5R 5.0/7.0 (27% respondents from the total), 5R 7.0/6.0 (27% respondents from the total), 5Y 9.0/3.0 (80,9% respondents from the total), 5G 5.0/7.0 (16,9% respondents from the total), 5G 5.5/6.5 (14,6% respondents from the total), 5G 9.0/3.0 (13,5% respondents from the total), 5G 6.0/6.0 (13,5% respondents from the total), 5B 7.0/6.0 (25,8% respondents from the total), 5B 9.0/3.0 (19,1% respondents from the total), 5P 7.0/6.0 (34,8% respondents from the total) and 5P 7.0/5.0 (11,2% respondents from the total). The differences in preferences reflect the choice for high lightness and low saturation of the Romanians compared to the choice for medium lightness and medium saturation of the Koreans, with clear differences concerning the cold hues: G, B and specifically P.

Romanians' preferences show that the most effective color applied to the healthcare environment are the ones with highest lightness and lowest saturation: 5PB 9.5/3.0 (26,7% respondents from the total), 5PB 7.5/5.0 (23,3% respondents from the total), 5B 9.5/3.0 (23,3% respondents from the total), 5B 9.5/1.0 (16,3% respondents from the total), 5GY 9.5/3.0 (22,1% respondents from the total), 5GY 9.5/1.0 (18,6% respondents from the total), 5Y 9.5/3.0 (37,2% respondents from the total), 5Y 9.5/1.0 (31,4% respondents from the total).

Koreans' preferences show that the most effective color are the ones with highest lightness and lowest saturation but also medium lightness and medium saturation: 5PB 9.5/3.0 (30,3% respondents from the total), 5PB 7.5/5.0 (20% respondents from the total), 5B 9.5/3.0 (23,6% respondents from the total), 5B 7.5/5.0 (21,3% respondents from the total), 5GY 9.5/3.0 (24,7% respondents from the total), 5GY 7.5/5.0 (22,5% respondents from the total), 5Y 9.5/3.0 (38,2% respondents from the total), 5Y 9.5/1.0 (16,9% respondents from the total). The differences in preferences reflect again the predominant choice for high lightness and low saturation of the Romanians similarly to the Koreans, which on the other hand constantly choose also the medium lightness, medium saturation for the B and GY hues.

The most appealing colors and the greatest awareness concerning the effects on the health environment remain the G, B and GY hues.

## 5. CONCLUSIONS

The cross-cultural survey on the color index for healthcare environment is a tool that proved useful first of all for raising the awareness of the public towards the subject. It is also an objective mean for testing and processing the users' answers and for disseminating information in a fast and accessible way.

The awareness on the connection between environmental colors and their health promoting effects can be an important tool for the medical staff and for the designers. Environmental colors are also perceived as providing psychological stability and the effect of environmental colors from public health facilities upon health and treatment is also significant. Following the discussion of the survey results the following conclusions are outlined below.

First, the comparative study is completing a series of similar research that were developed in the previous phases, among different countries, considering the lack of previous studies between Asian and East-European culture on the subject.

The research is confirming that even though color psychology theory does apply universally, there are cultural and emotional differences of color recognition that are important and that should be taken into consideration in design. Universal space design principles are valid but can be updated to a glocal scale reflecting both local and global considerations based on users analysis, as healthcare services are already a

glocal product.

Second: the study outlined a common understanding on the effect of color when applied to the health environment between Koreans and Romanians, given the similar patterns of preferences but also emotional and cultural differences concerning the effect of color when applied to the personal/domestic environment. The awareness for improving the domestic space towards a health-promoting environment was significant for both countries.

Third, the awareness for improving the healthcare environment towards a health-promoting one was significant for both countries as expressed by results.

Forth, the similarities and differences shown in this study between the two countries reflect the fact that the healthcare environment has to be inclusive and dedicated, with a common understanding for the users, at a glocal level.

Considering the objective value of the survey, further steps should be developed for testing the practical design measures and guidelines that can be applied based on this color index for healthcare environments. Interactive design renderings and 3D simulations, with samples from the color index applied, are to be developed and disseminated for feedback via the web site of the project: [www.healthcarecolor.or.kr/](http://www.healthcarecolor.or.kr/) .

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