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The relation between perceptive comfort and the characterization of space with emphasis on internal environments

Abstract

The present study aims to show how the variations of the characteristics of the internal spaces, associated to the sight, influence the perceptual comfort of the individual. When perceiving an environment, each individual does it in a different way, therefore, it was possible to evaluate how the features of the environment can influence the users' perception of the space. For this evaluation, an experiment that sought to associate different characteristics of the built environment to the positive and negative affects of the PANAS (Positive and Negative Affect Schedule) scale was developed. The experiment consisted of displaying images to the respondents who, observing the design characteristics presented in the images, associated their perception of the environment with the related feelings. The results indicated that the variations in the features of the environment have a strong influence on the individuals' perception. The characteristics that brought greater comfort and feelings related to positive affections were the higher incidence of natural light, the use of high ceilings and the use of "cold" color. On the other hand, the antagonistic features to those had an effect on the feelings of negative affections in an almost inversely proportional way.

Keywords

Perception. Comfort. Design features. Built environment.

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A RELAÇÃO ENTRE CONFORTO PERCEPTIVO E A CARACTERIZAÇÃO DO ESPAÇO COM ÊNFASE EM AMBIENTES INTERNOS

Resumo

O presente estudo tem por objetivo evidenciar como as variações das características dos espaços internos associados à visão influenciam o conforto perceptivo do indivíduo. Ao perceber um ambiente, cada indivíduo o faz de maneira distinta, sendo assim, foi possível avaliar como as características do ambiente podem influenciar os usuários em relação à percepção do espaço. Para essa avaliação, foi elaborado um experimento que buscou associar diferentes características do ambiente construído aos afetos positivos e negativos da escala PANAS (*Positive and Negative Affect Schedule*). O experimento consistiu em expor imagens aos respondentes que, ao observarem as características de projeto apresentadas nas imagens, associavam sua percepção do ambiente aos sentimentos relacionados. Os resultados indicaram que as variações nas características do ambiente têm forte influência na percepção dos indivíduos. As características que trouxeram maior conforto e sentimentos relacionados aos afetos positivos foram a maior incidência de iluminação natural, a utilização de pé-direito alto e o uso de cor "fria". Já as características antagônicas a estas, apresentaram um efeito sobre os sentimentos de afetos negativos de uma maneira quase que inversamente proporcional.

Palavras-chave

Percepção. Conforto. Características de projeto. Ambiente construído.

1. Introduction

The built environment is perceived by the individual through their experiences, expectations, preferences and references. According to Simões (2005), the studies of perception and cognition contribute to the performance of interventions in an environment and vary according to the experience of its users. The formal, physical, and spatial characteristics of the environments that are experienced are replete with symbolic values, meanings, and are constructed throughout personal experience. For Abrantes (2004), when one interacts with the environment, the individual experiences this environment from their emotions, analysis and judgments, that is, the perception will have a direct relation with the sensation of comfort.

In order to understand and identify user preferences, researchers study the quality of the site, however, user satisfaction surveys prioritize the physical attributes of the environments, ignoring users' perceptual and cognitive characteristics, which also influence the quality of the constructed environment. These aspects, when taken to the area of project development, tend to improve the quality of the environments, providing greater user satisfaction (REIS; LAY, 2006).

Therefore, it is necessary to evaluate the impact of the characteristics of the built environment on the individual's perception from the variation of his feelings in relation to that environment. For Simões (2005), the perceptive process involves the use of the senses to know and recognize elements of the environments constructed and experienced by its users through the apprehension and spatial interpretation of the architecture. Given that each environment is perceived by its users in different ways, the perception of individuals can be translated into negative or positive feelings to thus identify how this relationship of each individual with the environment is established.

In this context, the objective of this work is to identify the intensity of the relationships between the variations of the characteristics of the built environment associated with vision and its influence on the perceptive comfort of the individual. The results of these relationships allow us to evaluate how the perceived characteristics of the built environment influence the users. In this work, "perceptive comfort" is understood as the increase of positive feelings in an individual when he maintains contact with a certain environment. It is assumed that the variation of perceptive comfort is associated with stimuli of positive or negative feelings. In this way, the research aims to help professionals so that, supported by users' perceptions regarding the characteristics of projects, they are able to develop projects that satisfactorily meet their needs.

2. Theoretical reference

For Okamoto (2002), it is through the stimuli provoked by the environment that human behavior is driven by a response to perception. The individual has the sensation of the environment by the stimuli of that environment, without being aware of it. Faced with the large number of stimuli, the selective mind selects

aspects of interest, or those that have attracted attention, it is at this stage that perception (image) and consciousness (thought, feeling) occur, resulting in a response that will lead to a behavior. In this way, perception can be considered as the response to the stimuli coming from the medium, captured through the human senses.

For Reis and Lay (2006), both in the perceptual and cognitive approaches as in the approach to environmental perception, the description of space is not only done in its formal aspects, but analyzed as to the effects of its physical-spatial characteristics on individuals. In this way, we try to understand how the perceptions of these aspects affect the behavior and the attitude of the users. The knowledge of these attitudes and behaviors becomes essential for the qualification of the projects and, consequently, to evaluate the quality of projects and the performance of the built environment.

According to Sayegh et al. (2016), the built environment can be perceived as a complex entity that results from the juxtaposition of spaces, flows, objects, experiences and events. Each environment has specific qualities, and even if shared characteristics exist, they vary from one place to another. Although there are a variety of criteria, parameters and indicators that attempt to capture key points of urban life, they are still far from describing the more subjective aspects that constitute the experiential character of built environments.

The theoretical reference of the research sought other similar works aimed at evaluating the built environment. These works evaluate the design characteristics that impact the user's mood and perception regarding the environment. The characteristics that are usually studied are related to lighting, temperature and color.

Knez's study (1995) conducted two experiments that investigated the effect of internal lighting on mood and cognitive performance. Two lighting parameters were used: lighting and illuminance levels and color temperatures. In both experiments, the same number of participants were interviewed, divided equally. The difference in the experiments occurred as a function of the lighting effect. In experiment 1, the color temperature and illuminance were manipulated in high color rendering index for. In experiment 2, these manipulations were applied in low color rendering index. This study used the PANAS scale of Watson, Clark and Tellegen (1988) (Positive and Negative Affect Schedule) as a "measure of mood". The goal of using the PANAS Scale was to relate subjective/objective assessments of the individual and to investigate the gender difference in the discriminating ability of ambient light conditions.

The results obtained in experiment 1 showed that the semi-lit environment induced a less negative mood, demonstrating better performance in long term memory, recognition tasks and problem solving. In experiment 2, on the other hand, the light environment presented better conservation of the positive mood, presenting the same effect in tasks of problem solving and free recall.

Researchers Knez and Kers (2000) present the relation of the impact of internal lighting, gender and age on mood and cognitive performance. The hypothesis

raised by the authors is that internal lighting is an affective source, which can convey differentiated emotional meanings, according to gender and age, or both.

There are a number of studies that combine lighting with visual perception. There are also non-visual studies that focus on the impact of light on the psychological through purely perceptual mechanisms. The psychological knowledge of the effects of light is studied by different authors, such as Flynn (1977), who indicates that people prefer more "warm" lighting, due to a more "reddish" type of bulb, with lower illuminance, than "cold" with bulbs of the bluish and shiny type, with greater illuminance.

Yildirim, Hidayetoglu and Capanoglu (2011) elaborated a study whose objective was to evaluate if the several colors in inner spaces, in fact, evoke different moods. During the process of color perception, an associated feeling or emotion is induced in the brain and is known as the "color emotion". The human eye perceives color through a stimulus in the form of light and the brain processes the perception and as a result the feelings and emotions are produced. In another paper by the same authors in 2007 and cited by them in this same article, they examined the effect of internal color through sex and age, in the mood and cognitive performance of 250 participants, finding that men tended to assess the most positive space in comparison with women participants. The aim of this study was to examine the associations of color emotion in reference to three digital photos with visualizations in the room and identified in three different color schemes, in two virtual models of rooms with warm colors, cold colors and achromatic colors (black, white and grey). The results also indicated that the differences between the perceptions of each one in the three different schemes of interior colors, with respect to environmental factors, were significant.

Galán-Díaz (2011) makes an extensive investigation of how the preference of the environment can be affected by variables: emotion - according to the state of mind at the time of evaluation, attention - how it can be influenced by task instruction and *perspective-taking* (the process by which the individual observes a situation from another point of view) at the time of the evaluation. The objective of this study was that the participants evaluate the environment according to the perspective-taking assigned in each task. The study was conducted at a University in Scotland and the questionnaires used followed the PANAS affect scale (WATSON; CLARK; TELLEGEN, 1988). The author performs studies and tests, observing the emotional reactions to the environment, when people are invited to use the perspective of the other (perspective-taking). The results show that mood may have an influence on environmental preference, influencing the emotional reactions people have to the environment, but that these influences vary over time.

The PANAS scale was developed by Watson, Clark and Tellegen (1988) for the evaluation of emotions according to their intensity of occurrence. In the scale, individuals receive a questionnaire containing adjectives and describe each feeling, that is, each word is related to their corresponding feeling (GONÇALVES; DORES, BENEVUTO, 2012).

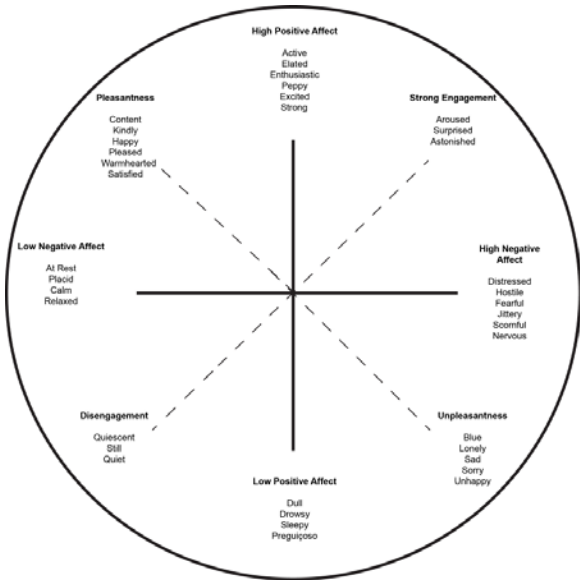


Figure 1. PANAS scale
Source: Authors (2016). Adapted from Galinha and Ribeiro (2005a)

For the PANAS model, specific emotions are considered as combinations of two basic dimensions. The affect variable represents two dimensions - positive affect and negative affect. Positive affection, insofar as a person manifests enthusiasm with life, and negative affection, insofar as the person refers to feeling unwell or disturbed (Galvão, Ribeiro, 2005a, 2005b) (Figure 1).

For Galinha and Ribeiro (2005a), based on the studies of Watson, Clark and Tellegen (1998), there are two approaches to the structure of the concept of affection, being the specific affect approach and the dimensional perspective approach.

The specific affect approach holds that there are many types of affect, each with the characteristics and patterns of specific, yet related, responses. The emotions that result from this approach, such as happiness, sadness, fear, remorse, are understood to be separate and independent of each other. This approach argues that each emotional state has patterns of specific physiological responses.

The approach from the perspective of dimensional perspective believes that there are two central affective dimensions. Specific emotions are considered as combinations of two basic dimensions. In this way, the circular model of affect, where two dimensions intersect, results in perpendicular diameters of a circle. Specific affective states are positioned somewhere in the circle at the intersection of the two dimensions.

Still, according to Galinha and Ribeiro (2005a, 2005b), the affect variable represents two vast dimensions of basic emotions that consistently emerge in the studies performed – positive affection and negative affection. They are described as being descriptively bipolar but effectively uni-polar dimensions, to reinforce that only the high level of dimension represents a state of emotional arousal (or high affection), while the reduced level of each dimension is defined in terms that reflect a relative absence of affective intensity.

In the PANAS circular model proposed by Watson and Telegen (1985), bi-dimensional and multifactorial structures may together play an important role. The two-dimensional structure is complementary rather than competitive with multifactor mood structures. Positive and negative affect is hierarchically related to the other emotions described by some scholars.

The axes that are represented by solid lines emerge as the first two factors of all the studies analyzed. The axes represented by the dashed lines – pleasure and displeasure and strong and weak commitment – appear as two secondary terms, the first two following factors of the positive and negative aspect.

The results showed that the way we observe and emotions have a range of influences on environmental preference in a constructed environment context,

that these are important at the time when architecture, design professionals, and built environments make environmental evaluations and that they make the difference between positive and negative evaluations.

3. Research strategy

For the accomplishment of the objective of this work, a research of inductive approach was carried out, with an exploratory objective. The Experimental Method was chosen as the main procedure, allowing the obtaining of primary data in a systematized form. We also opted for probabilistic sampling for convenience, because the study presented an exploratory character. According to Hair Jr. et al. (2005), this type of sample involves elements that are more available to take part in the study and that can offer the necessary information.

3.1 Development of the experiment

For the development of the experiment, the first steps were the choice of the scale that would be used to "measure" the perceptive comfort and the definition of the design characteristics that would be analyzed.

Among the scales analyzed, the PANAS scale proved to be more adequate to the objectives of this research. This scale was used in other studies related to the built environment (KNEZ, 1995; KNEZ; KERSZ, 2000; GALÁN-DÍAZ, 2011), since besides being a scale consolidated in the studies of environmental psychology, the contained feelings and the style are easily understood by the research participant. Thus, the PANAS scale provided the need for a scale that proposes and measures feelings, as it presents them divided into negative affects and positive affects.

After defining the scale, the design characteristics to be studied were defined, since the experiment also consisted of a visual stimulus study, where the images with the variations of the design characteristics were shown to the participants. In all, eight images were developed that included the following design features:

- Ceiling – high;
- Ceiling – low;
- Natural lighting – with higher and lower incidence;
- Artificial lighting – with higher and lower incidence;
- Warm color;
- Cold color.

In the process of creating the images, the environment of a living room was chosen because, in this area of conviviality, the users of the environment can rest, talk, study, among others, it usually being the space that all the residents share. The choice of furniture was also made in such a way as to have the least possible influence on the perception of the environment as a whole, so we used only a sofa and a cabinet for the television. The colors are sober, using beige

tones for the walls, white for the television cabinet and a beige-grey tone for the sofa.

In this way, the data collection instrument was divided into two parts (see Appendix). The first part consisted of questions about the participant's profile, regarding age, gender, profession, number of children and the characteristics of his/her house. The second part of the experiment contained a list of the feelings identified through the PANAS scale and together with the images, served as a basis to identify the relationship between the participant's perception and the characteristics of the internal environments.

In the second part of the research, each of the eight images generated for the experiment were presented to the participant with the questionnaire based on the PANAS model. Twenty emotions were identified, where the positive and negative affects were intercalated. The feelings used were chosen from the study by Gendera, Mattoso and Boente (2010), who validated the items in their research of evaluation of consumer emotions. For the responses of the participants, the seven-point Likert scale was used. Participants filled in the items using the scale of -3 to 3, being -3 totally disagree and 3 totally agree.

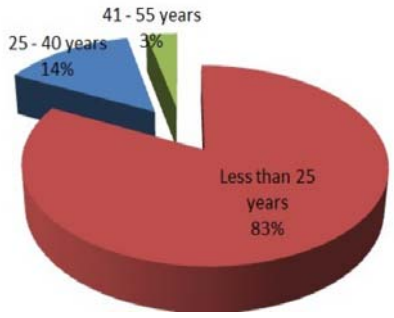
The applications of the experiment, part of a Masters dissertation, were carried out in classrooms covering students of Civil Engineering and Architecture and Urbanism of a university located in a capital of southern Brazil. Sixth, seventh and eighth period school students participated in the research in November and December 2014. Three different classrooms were used. It was decided to apply the experiment to students of courses related to civil construction, so that there would be a greater understanding of the professionals in relation to the perception of environments that will be projected by them in the future.

The images were projected through slides, one by one, and the participants filled out the questionnaire according to the intensity of their feelings. While the participant answered the questionnaire, the image remained projected, and only after the questionnaire was filled out did the image change.

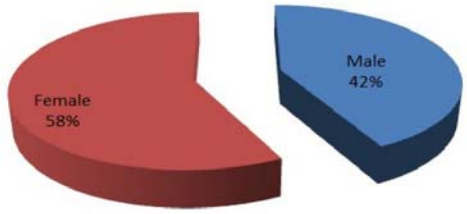
A total of 123 questionnaires were used, of which 3 could not be included in the analyzes because they were incomplete. Thus, 120 questionnaires became part of the studied universe. It is necessary to emphasize that an experiment with 120 cases focused on students of Civil Engineering and Architecture can be quite representative for this segment, but should not be generalized for the whole population. However, the pretension of this research is not to define explanatory patterns, but to verify if there is influence of the variations of the characteristics of the constructed environment on the perception of comfort in the individuals measured by means of their feelings.

For the results to be satisfactory, Hair Jr. et al. (2005) states that for analysis involving multiple variables the sample size must be equal to or greater than 100. Thus, the sample used in this study should not be considered representative of the population, and it is not possible to extrapolate and generalize the results.

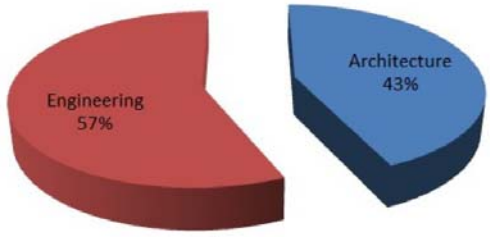
Regarding the profile of the participants, it was verified that of the 120 participants in the experiment, 83% of the participants were less than 25 years



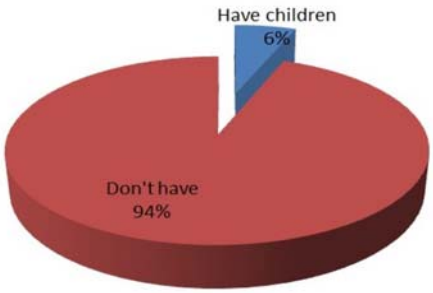
Graph 1 – Participants profile – Age
Source: Authors (2016)



Graph 2 – Participants profile - Gender
Source: Authors (2016)



Graph 3 – Participants profile – Professional orientation
Source: Authors (2016)



Graph 4 – Participants profile – Children
Source: Authors (2016)

old. Of the remainder, 14% are between 25 and 40 years of age and 3% are between 41 and 55 years old (Graph 1).

Regarding the gender of the participants, 58% are female and 42% are male (Graph 2).

Regarding professional orientation, 57% of the sample are students of the Civil Engineering course and 43% of the participants belong to the Architecture and Urbanism course (Graph 3).

Still about the participants, 94% of them do not have children (Graph 4).

3.2 Descriptive analysis

The descriptive analysis of data is a field of statistics which aims to synthesize a set of numerical data or not, in order to allow a global view of the behavior of these data (BUSSAB, 2003). Descriptive statistics, the purpose of which is to describe and analyze a particular population, without, therefore, seeking to draw conclusions of a more generic character (CASTANHEIRA, 2010).

In this study, the median was used to analyze the numerical data. The choice of this central tendency measure is justified as the data obtained are expressed in a nominal scale (PASQUALI, 2009). For the presentation of the data, the radar type chart was chosen, based on the medians of the participants' answers. This chart template, generated by the Excel program, was chosen because its format is close to the PANAS Mood Scale model, making the graphic and model visualization close.

4. Results

The results obtained in the PANAS scale of each of the characteristics tested are described below. In order to support the analysis, radar-type graphics were used to produce an overall impression to highlight the trends expressed by the medians of the feelings associated with each image.

4.1 Evaluation of the images in relation to the height of the ceiling

In the first sequence of analyzes, the design characteristics were observed as a function of the height of the ceiling. Images with elevated and lowered ceilings were shown (Figure 2).

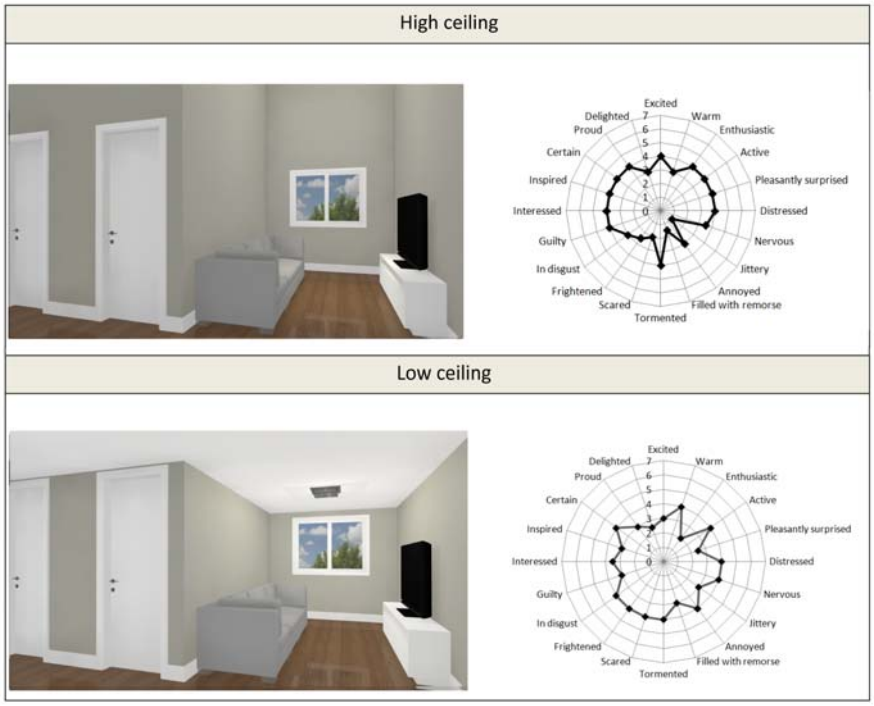


Figure 2 – Images with differences in ceiling height
Source: Authors (2016)

When the participants were presented to the environment with the elevated ceiling, with 3, 5 meters of height, the predominance of the feelings with greater values of medians (equal to 4) was in the upper part of the graph. The feelings associated with reduced negative affection, pleasure, high positive affection and strong commitment, are more relevant when the ceiling is high.

In the lower part of the graph, where the feelings related to reduced positive affects are found, the medians had values variations for most of the feelings. This variation left the graph with irregularities, unlike that with the upper part of the graph, which presented a certain homogeneity in the results.

For the low ceiling (2.2 meters in height), it was noticed that for the feelings related to reduced negative affection, pleasure, high positive affection and strong commitment the result appears with high values (equal to 4) in only three feelings, with the others varying between 2 and 3.5. The result shows an irregular graph at the top, showing that the participant does not have an intensity of positive feelings when in contact with an environment whose ceiling is low.

For the feelings related to reduced positive affects, the graph showed a certain homogeneity in the responses. The feelings associated with negative affects with higher medians represent what the individual can actually feel when in a low ceiling environment.

It can be noticed that the participants had more positive sensations regarding the environment with high ceilings. The predominance of medians with high values in feelings of high positive affect, pleasure and strong commitment,

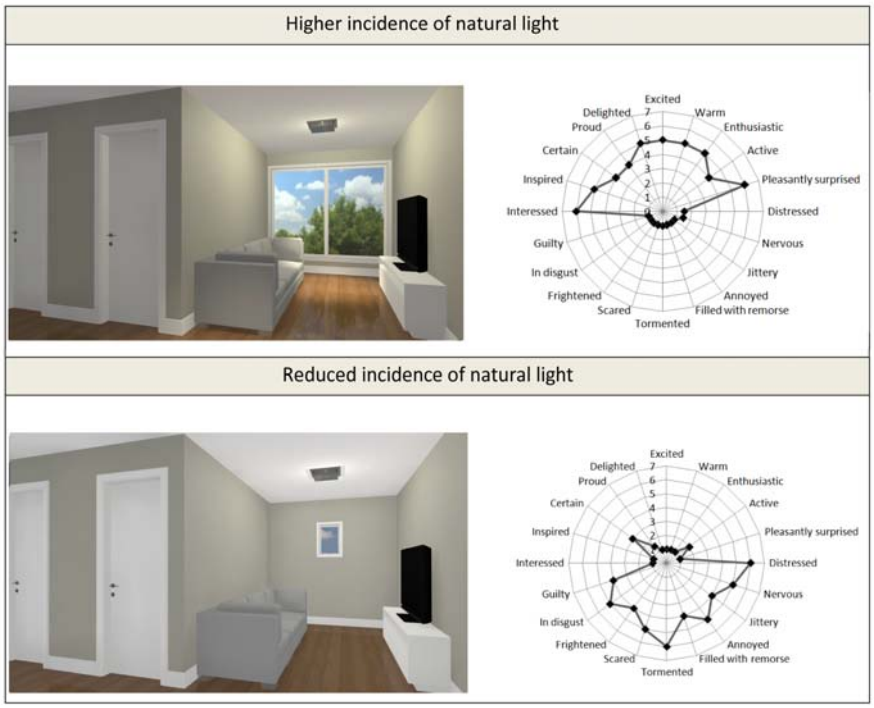


Figure 3 - Images with differences in the incidence of natural light
Source: Authors (2016)

show that the result is slightly positive in relation to elevated height, that is, people tend to feel more comfortable in environments with this design feature.

4.2 Analysis of images with differences in the incidence of natural light

The next design feature analyzed is the amount of natural light present in the environment. For this, the size of the window of the environment was increased and decreased and, consequently, the integration with the external area and the amount of natural light that entered the environment.

In relation to the higher incidence of natural light, it was observed that the intensity of positive feeling was greater. The feelings grouped in the lower part of the graph showed a homogeneity in the responses, remaining almost all with a median value of 1. In the lower part of the graph, we observe the intensity of feelings related to high negative affect, displeasure, reduced positive affect and weak commitment that obtained answers whose medians were low, raising the medians of the feelings related to reduced negative affection, pleasure, high positive affection and strong commitment.

To analyze the low incidence of natural light present in the environment, the size of the window was reduced, making it much smaller than is commonly used in buildings. The reduced size was purposeful, since the intention was to emphasize the issue of a small windowed environment and little presence of natural light.

Analyzing the participants' responses, there was a drop in positive feelings and a marked rise in negative feelings. Even with an irregular shape, with alternating median values, the feelings of negative affection were higher,

characterizing in this way that the interviewees feel greater intensity of negative feelings when exposed to an environment with almost no incidence of natural light.

The fact that a larger window increases the incidence of natural light in the environment, making it more pleasant and providing comfort to the individual who will use this environment, could be observed and proven through the results obtained with the application of the experiment.

The reduction of negative feelings in this design feature clearly shows that when exposed to environments with high natural light intensity, the individual tends to be more satisfied with the place and thereby the levels of positive feelings increase. Due to the intensity of its impact on the users emotions, natural light is a prominent feature in architectural projects (BARNABÉ, 2008).

However, the result of the characteristic with lower incidence of natural light was practically the opposite of the result obtained in the previous image, whose incidence of natural light presented a much higher level. It is observed that people do not feel well in environments with little incidence of natural light.

4.3 Analysis of images with differences in the incidence of artificial light

After evaluating the incidence of natural light in the environment, the next characteristic shown to the participants was the incidence of artificial lighting in the same environment. In order to evaluate this incidence of luminosity in the environment, lamps were placed at several points, giving the research participant the feeling of a well-lit environment. The environment with opposing characteristics had no illumination, becomes dark, leaving the space with a semblance of penumbra (Figure 4).

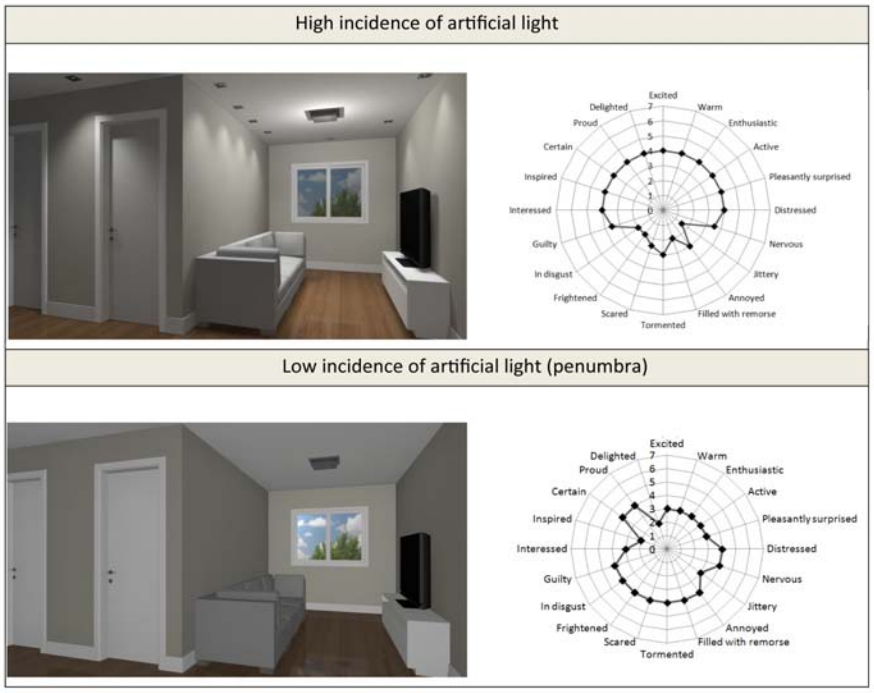


Figure 4 – Images with differences in the incidence of artificial light
Source: Authors (2016)

When analyzing the responses for the highest incidence of artificial light, the result is similar to that of the image with a higher incidence of natural light in relation to the higher intensity of feelings of positive affect. But in the other image, the result does not appear so homogeneous in relation to the participants' answers. This fact can also be seen in the lower part of the graph that presents smaller values of the medians.

It can be said, through the results, that an environment with a greater incidence of illumination, in this artificial case, brings positive sensations to its users, providing pleasant sensations to the individuals that interact with the environments where the illumination is privileged.

For the lower incidence of artificial light, it was concluded that the feelings related to the negative affections represent a greater part in this sample. The graph presented irregular shape and tended to negative affections, whose medians were larger. However, still in the lower part we can see that almost most of the values tended to 4. The lower part of the graph with the feelings related to the negative affection had more significant medians and appears with greater intensity of response. It can be said that the penumbra or low incidence of artificial lighting does not bring good feelings in the users of the environment.

Lack of ambient lighting causes discomfort to users. This fact can be proven, since the two images that lacked illumination, both natural and artificial, had a greater negative area in the graph.

4.4 Image analysis using color

The design characteristic analyzed is in relation to the use of colors in the internal environments. To analyze the individual's feeling when exposed to warm color environments, the image of the same environment was projected, but all walls were painted red. It was decided to present an environment with a predominance of red, to emphasize the use of colors and, thus, the participants could perceive clearly the intensity of the feelings. In contrast to the use of warm color, an image was used with all the walls in cold colors. For this analysis, the same model of the previous image was followed, but with all the walls painted blue, leaving the environment also with the feeling of colder (Figure 5).

When the responses regarding the use of the warm color were analyzed, it was verified that the part related to the positive affections presented irregularity in its form, being that in the part related to the negative affections, the values were more uniform. The feeling with a higher median value, value equal to 5, was "disturbed". This shows that the participants did not feel well in an environment with a predominance of warm color, red in this case.

The cold-colored image was displayed shortly after the image in warm colors. In this way, the user perceived more clearly the change of the colors used and was able to answer with more precision the questions of the experiment.

From the responses obtained with the use of blue color at the top of the graph, where feelings of reduced negative affect, pleasure, high positive affect and strong commitment, the feelings remained almost all with the same values. This fact can be proven, because in the image with the use of warm color, the feeling

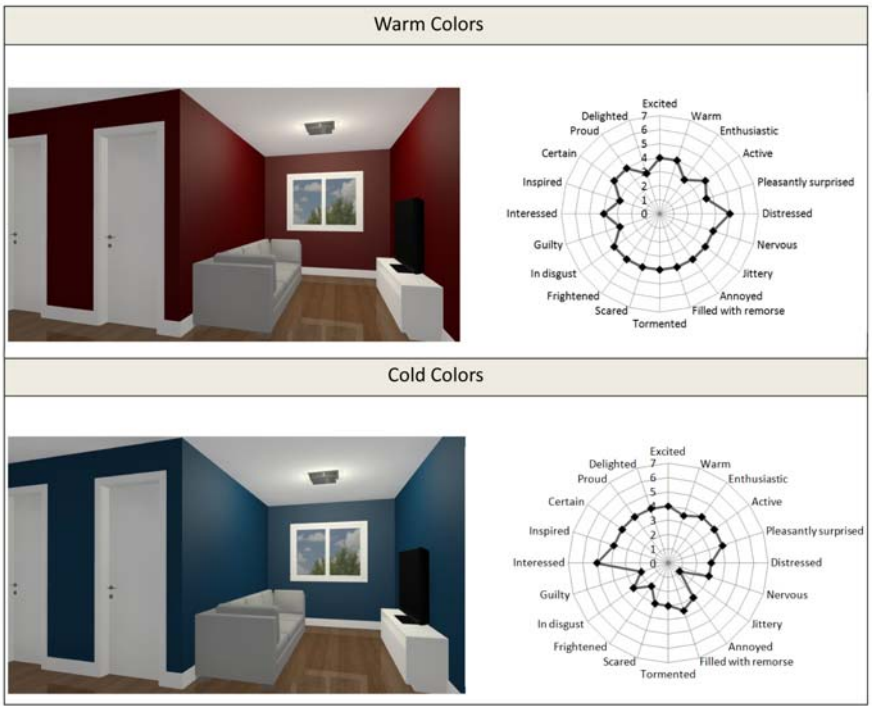


Figure 5 – Images with color usage
Source: Authors (2016)

with greater median was "disturbed", while in the environment with cold color, the feeling was "interested".

This makes it clear that individuals feel more comfortable in environments where colors tend to cool tones.

It can be said that color influences people's behavior. And with that the use of warm colors in work or rest environments, for example, is not recommended. Users tend to be disturbed by the presence of this type of feature. In the case of the experiment, the red tint was placed on all walls, precisely to emphasize the use of colors, but this may be common in some homes or work environments. This can bring discomfort to the user without his knowing, in fact, the real reason for his discomfort.

This difference in median values shown in the graph indicates that, for use of cold colors in projects of constructed environments, the tendency of users is for feelings of positive affect. This shows that in terms of colors, cool ambient colors provide a greater sense of comfort.

5. Joint analysis of data and discussions

In order to make a joint analysis of the variation of perception, as well as the graphic results already described, the median value of the positive affects and negative affects was used as a base, in addition to the graphic results already described. Table 1 shows the median of positive and negative affects, the difference between them and their sum. The difference between the medians

	Image 1	Image 2	Image 3	Image 4	Image 5	Image 6	Image7	Image 8
Median - Positives	**4**	3	**5**	1	**4**	3	**4**	**4**
Median - Negatives	3	**4**	1	**5**	2.75	**4**	**4**	3
Median difference	1	-1	4	-4	1.25	-1	0	1
Sum of the medians	7	7	6	6	6.75	7	**8**	7

Table 1 - Synthesis of median results of positive and negative perceptions per image
Source: Authors (2016)

shows, in a certain way, the amplitude between the positive and negative affects in relation to each image. The sum of the medians expresses the intensity of the feelings in relation to each image.

From the analysis of the intensity of the perceptions, it is possible to verify that the values obtained for all the other images reflect a greater intensity regarding the perceptions of the participants.

The image that illustrates the use of the "warm" color was the one that obtained the highest value for the intensity (sum of perceived values). However, it is also the one that has the smallest difference between the positive and negative means, which indicates that the discomfort in environments with warm colors is not so intensely perceived.

In the case of the use of "cold" color, the difference between positive and negative perceptions is more significant. This result is in line with the results obtained by Yildirim and Hidayetoglu (2011). They have shown that warm colors provoke feelings of greater excitement and stimulation compared to fresh and achromatic colors.

The lower incidence of natural light and the lower ceiling too show a high intensity with highlight to the negative affections. They are characteristic elements of projects that certainly displease their users more.

The values of medians related to positive affects are higher for images related to higher ceilings, higher incidence of natural light, higher incidence of artificial lighting and use of "cold" color. On the other hand, the values of medians related to negative affects are higher for the images related to the lower ceilings, the lower incidence of natural light, the lower incidence of artificial lighting and the use of "warm" color. This shows that medians are similar for images that represent an opposing feature of the constructed environment, but with a reversal in the sense of affect (positive to negative). The antagonism of the form of the constructed environment is reflected in the antagonism of the individual's feelings in a proportional way.

Thus, the characteristic of the high ceiling is preferred with greater intensity compared to its opposite – lower ceiling. The higher incidence of artificial lighting is preferred with greater intensity compared to its opposite - the lower incidence of artificial lighting.

This antagonism materializes in a more evident way in the contraposition between the environment with strong presence of natural light and the environment with important restrictions of natural illumination. The difference between the medians for the positive and negative affects of these two design features is the highest of the differences of intensity among all the characteristics surveyed.

6. Conclusions

What was sought with the accomplishment of this work was an understanding and a search for answers of how the perception can influence the design of internal environment projects. For that, we analyzed the variations of the individual's feelings, when exposed to design characteristics. Through associations with stimuli of of positive or negative feelings, such variations could be measured using a method that proved adequate and easy to use.

The research results showed that variations in the design characteristics of the internal environment significantly influence the individual's perception regarding their feelings of positive and negative affect. It has been found that feelings, related to the individual's perception of the design characteristics, make him feel more or less comfortable.

From the analyzed design characteristics, the higher incidence of natural light was the most strongly perceived characteristic related to perceptive comfort. The characteristic of the high ceiling is also perceived positively in intensity similar to the characteristic of greater incidence of artificial lighting. The difference between positive and negative perceptions in the cold color verification is greater than the difference between the positive and negative perceptions in the warm color verification, which allows to infer that the perception of cold color comfort is more intense than the perception of warm color discomfort.

Perceiving and feeling the internal environment, in a positive or negative way, causes the individual inserted in this space to present good or bad sensations, without even knowing the reason for these sensations. When it was verified that the design characteristics influence the perception of the individual, in relation to the environment, the accomplishment of projects that aim to guarantee comfort and well-being to the user tends to be facilitated.

Appendix – Questionaire

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Questionnaire - Definition of the aspects of perception that impact the characteristics of the projects of built environments

Part 1 - Respondent Profile

Gender
( ) male ( ) female

Marital Status:
( ) single ( ) married ( ) divorced ( ) widower

Age:
( ) less than 25 years old ( ) 25 to 40 years old ( ) 41 to 55 years old ( ) more than 55 years old

Education:
( ) Elementary School ( ) High School ( ) College Degree ( ) Graduate Studies

Occupation: (If you are a student, course)
_____

Children:
( ) yes ( ) no

Number of children:
( ) 1 ( ) 2 ( ) 3 ( ) more than 4

Children's age
_____/_____/_____/_____/_____

Income:
( ) up to R$ 1.449,99 ( ) from R$ 1.450,00 to R$ 2.899,99 ( ) from R$ 2.900,00 to R$ 7.249,99
( ) from R$ 7.250,00 to R$ 14.499,99 ( ) R$ 14.500,00 or more

In your youth, you lived:
( ) House ( ) Apartament ( )Two-story House ( ) Farmhouse ( ) Other

How many times have you changed your residence?
( ) 1 ( ) 2 ( ) 3 ( ) 4 ou mais

You live:
( ) Alone ( ) With parents ( ) With partner ( ) Others

Housing:
( ) House ( ) Apartament ( )Two-story House ( ) Farmhouse

Property condition:
( )own ( ) rented ( ) family ( ) others

How many years have you lived in your current residence?
( )Less than 1 year ( ) From 1 to 5 years ( )From 5 to 10 years ( ) From 10 to 20 years ( ) More than 20 years

Usually travels on weekends:
( ) Often ( ) Sometimes ( ) Sporadically
( ) Occasionally ( ) Rarely

Usually receive visitors in your house:
( ) Often ( ) Sometimes ( ) Sporadically
( ) Occasionally ( ) Rarely

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Part 2 - Perception Analysis

At this stage of the questionnaire, images will be projected that represent some of the characteristics of the most relevant projects in the elaboration of built environments. The purpose of the experiment is to find out what people's feelings are in observing the image of the environment. When displayed the images, one must mark the number that expresses as faithfully as possible its feeling about the projected image.

Image 01

Observing the image, I feel:	Totally disagree	I strongly disagree	I disagree in part	Neutral	I agree in part	I strongly agree	Totally agree
1. Interessed	-3	-2	-1	0	1	2	3
2. Distressed	-3	-2	-1	0	1	2	3
3. Excited	-3	-2	-1	0	1	2	3
4. Tormented	-3	-2	-1	0	1	2	3
5. Pleasantly surprised	-3	-2	-1	0	1	2	3
6. Guilty	-3	-2	-1	0	1	2	3
7. Scared	-3	-2	-1	0	1	2	3
8. Warm	-3	-2	-1	0	1	2	3
9. In disgust	-3	-2	-1	0	1	2	3
10. Enthusiastic	-3	-2	-1	0	1	2	3
11. Proud	-3	-2	-1	0	1	2	3
12. Annoyed	-3	-2	-1	0	1	2	3
13. Delighted	-3	-2	-1	0	1	2	3
14. Filled with remorse	-3	-2	-1	0	1	2	3
15. Inspired	-3	-2	-1	0	1	2	3
16. Nervous	-3	-2	-1	0	1	2	3
17. Certain	-3	-2	-1	0	1	2	3
18. Jittery	-3	-2	-1	0	1	2	3
19. Active	-3	-2	-1	0	1	2	3
20. Frightened	-3	-2	-1	0	1	2	3

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