

Relations between multisensory languages in the design of spatiality

Úlima Souza dos Santos

Universidade Federal do Amazonas

ulima.usds@gmail.com ✉

Claudete Barbosa Ruschival

Universidade Federal do Amazonas

claudete@ufam.edu.br ✉

PROJÉTICA

COMO CITAR ESTE ARTIGO:

SANTOS, Úlima Souza dos; RUSCHIVAL, Claudete Barbosa. Relations between multisensory languages in the design of spatiality. **Projética**, Londrina, v. 13, n. 2, p. 254-276, 2022.

DOI: 10.5433/2236-2207.2022v13n2p254

Submissão: 31-05-21

Aceite: 10-11-21

ABSTRACT: *The current speed of information may bring anxiety and stress symptoms to people's lives. A space with multisensory elements where individuals feel immersed in welcome feelings may reduce these symptoms. Our objective is to list multisensory aspects for Surface Design to structure spatiality with immersive and relaxing attributes. We made a literature review to analyse the sensory elements that authors consider important and identified relevant multisensory aspects. We expect to contribute to projects that aim to promote well-being.*

Keywords: *Design of Spatiality. Surface Design. Immersion. Well-being.*

1 INTRODUCTION

Spatiality is a set of relationships and interactions between a space and its components with a moving observer. Space influences the observer and the observer is influenced by space in such a way that diverse perceptions and sensations are created by the observer as they set themselves in motion. In this subject and space relationship, perceptions are interpreted from the experiences lived by the subject and translated into the form of sensations. Such sensations can be positive or negative and are triggered by elements and languages inserted in space that have the potential to stimulate sensory receptors in each individual differently.

Given that we live most of our lives indoors today, the decisions made in an environment project become as significant to health as those of a physician, so it is important to know how to design spaces to provide mental health of those who attend them (CASACCIA, 2018).

The union of these factors with the speed of information and internet use can cause damage to the quality of life, social and occupational functioning of

individuals, triggering stress and anxiety processes (OLIVEIRA, 2018). This overload eventually affects people's mental and physical well-being, resulting in problems such as anxiety and depression. Oliveira (2018) warns that anxiety, for example, is the cause of apprehension, tension, nervousness and worry that can have a variety of health and wellbeing consequences with increased somatic symptoms, heart disease, diabetes and asthma.

In this context, Design could act to structure spatiality with multisensory elements to promote feelings of welcome and tranquility, where the individual could feel transported from his reality endowed with stressors to a more welcoming scenario, relieving the feeling of anxiety, for example. Therefore, investigations that deal with sensory languages that can be used to provide a space with multisensory elements capable of arousing wellbeing are important.

Given that this approach is related to Sensory Design and Design for Wellness, some authors have been conducting research to create environments with sensory stimuli that provide relaxation sensations, focusing mainly on hospital environments, especially those specialized in mental health, as studies of); Keeling et al. (2012); Tonetto (2012); Costa and Santos (2019); Aguiar and Farias (2014). However, for the subject to feel led to another reality, it is also necessary to work with the concept of immersion, which is widely discussed in projects related to games and virtual environments of augmented reality, as dealt by Brown and Cairns (2004).

To identify what these relationships would be, publications on spatialities with immersiveness and relaxation characteristics were revised to construct a state-of-the-art picture of these qualities, listing the most relevant multisensory elements. The research contribution is in the organization of specific information as a reference for the structuring of environments or spaces that promote the well-being of users in an immersive way.

2 THEORETICAL FRAMEWORK

For a better understanding of the topics covered, a theoretical framework is made to understand the concepts and approaches addressed in Immersion and Design for Wellness. Such subjects are developed below.

2.1 IMMERSION

Immersion is a term with little consensual definition among authors, as it can encompass both the digital environment, in the case of movies and video games with augmented reality, as in the physical environment, as exemplified by a body immersed in a liquid container or by effect of being deeply involved in an activity or action (MAGALHÃES, 2008). This author defines immersion as a multidimensional product, which involves several variables that are related to both the intellectual levels of the subject, their previous knowledge and memory, and their body senses. These senses interact with each other and, according to Pallasmaa (2011), such interaction is what articulates the sense of reality. According to the Priberam Dictionary of the Portuguese Language, interaction means “reciprocal influence of two or more elements” or “phenomenon that allows a certain number of individuals to form a group, and which consists in the fact that the behavior of each individual makes stimulation for another.” (INTERAÇÃO..., 1998, authors’ translation). Thus, it is concluded that interaction is related not only to the reciprocity of the senses, but also to the influence that an action provoked by one sense will have on all the others. Pallasmaa (2011) confirms this idea by stating that all the experience provided by architecture is multisensory, that is, the characteristics of space, matter and scales are evaluated equally by the eyes, ears, skin, nose, tongue, skeleton and muscles. Alcántara-Alcover et al. (2014) agree that the senses influence each other during the perception of a product or space, and add that the sense that is first stimulated creates expectations about the experience to come and the other senses are triggered for this confirmation.

In this context, architecture provides the basis for this perception, directing the individual to a sensory immersion experience (PALLASMAA, 2011). This process of direction is divided by Brown and Cairns (2004) into three stages, adapted for this study: (i) contact: it is the first and shallowest level of immersion, when the observer is attracted and interested in spatiality, that surrounds them, and wants to explore it; (ii) involvement: is a slightly deeper level of immersion, where the user's emotions are directly affected by the sensory aspects used; (iii) total immersion: refers to the last level of immersion, where the subject feels transported to another reality, which is stimulated by the atmosphere created in space through the combination of visual, tactile and sound elements.

From this it can be concluded that the immersion process is highly related to each individual's perception of the space in question. Such perception will depend as much on the subject's life experience, memories and senses, which interact with each other and can be stimulated from products or elements inserted in the constructed space. From these observations, it is possible to notice a similarity with the concepts of spatiality discussed earlier. It is then realized that the relationship between the characteristics of such elements and the subject's perception of them is what will also determine whether the sensations experienced were positively stimulated for wellbeing or not. Thus, the main focus is not on whether the spatial elements inserted in a spatiality contribute to wellbeing, but on how this occurs.

2.2 DESIGN FOR WELLNESS AND SENSORY

The process of designing products that stimulate people's wellbeing is defined by Caetano et al. (2015) as Positive Design. The intention of this area of Design, according to the authors, is to increase the wellbeing of individuals in order to favorably enhance their appreciation of life, contributing to human flourishing. The authors affirm that Positive Design is based on principles established by positive psychology, which consists of three main components: (i) pleasure design: focused

on helping the subject to enjoy the moment, based on the belief that well-being it is conquered by the combination of momentary pleasures lived in routine situations; (ii) design for personal meanings: focused on contributing to the achievement of goals and aspirations, for example obtaining a diploma; (iii) design for personal virtues: aims to favor virtuous behaviors, encouraging the practice of integrity habits. Such principles can be worked in a spatiality through the insertion of stimuli capable of triggering the sensory and perceptual channels of the individual, providing positive sensations, as previously discussed. Sensation, as stated is the instantaneous response of sensory receptors (eyes, ears, nose, skin and mouth) to a stimulus that is absorbed and interpreted by the body. Such a process is what the authors call perception and manifests itself in different ways for each individual.

This perception is only possible thanks to the interaction between the senses, which can be planned during the spatiality construction project. Of course, to trigger different senses, it is necessary to use different stimuli (textures, sounds, colors, smells), which must be selected and organized in a logical way to be perceived and interpreted by the body, that is, it is necessary to establish a connection between the different multisensory elements (SANTOS, 2009).

In order to promote this organization, GIBSON, 1985 divides the space into three segments, based on the principles of biology and the exact sciences: (i) medium: consists of the area in which information is contained, with amplitude for free transit, relates to codes and actions, enabling the movement, illumination and propagation of sound waves; (ii) substance: which, through the diffusion property, is what enables the existence of smells, stimulating the olfactory sense; and (iii) surface: responsible for supporting and blocking the passage of substances that may interfere with the perception of the environment. It can then be interpreted that the environment consists of the area where spatiality will be delimited and organized, with the substances and the surface being the multisensory elements that can be applied in this environment, causing the stimulation of the sensations that result in immersion.

The human being interferes and modifies the surface of objects around it since prehistoric civilizations, according to Manzini (1993), it concentrates much of what is significant for the observer: sensory quality, symbolic and cultural values. According to Rubim (2005, p. 21), Surface Design is “every project designed by a designer, regarding the treatment and color used on a surface, industrial or not”. Thus, Freitas (2011) relates both ideas by stating that one of the specifics of this segment is that it must have tools to relate actively with the observer and the environment, allowing interaction in all senses, with its public, with the place and with its own volume. From this, it is concluded that the surfaces applied in a space go beyond being just envelopes or partitions, but they also function as sensory elements of interaction between the space and the user, so there is scope to study this relationship in Design of Surface and if or how we can apply it in the creation of a spatiality.

Therefore, it is necessary to identify which aspects can be used by Design to intervene or to delimit a spatiality in order to apply them to the objectives of this research. Thus, a systematic literature review was conducted to find out which of these aspects are already being recommended by the authors.

3 METHODOLOGY

A systematic literature review was performed to relate which characteristics the authors consider important for an environment to become immersive, relaxing and capable of stimulating well-being. The methodology used was based on the data mining process proposed by Blum, Merino and Merino (2016), whereby it was possible to select 20 scientific articles from the CAPES Periodicals database, from July 25 to August 16 of 2019. The words “sensory environment”, “sensory architecture”, “immersive environment”, “sensory design”, “design and wellbeing” originally in Portuguese and the English terms with the boolean operators “and” and “or”, where “sensory design and interiors” and “sensory design or interiors” were used as descriptors. The term with the highest number of significant results for this search was “sensory design and interiors”.

In the post-processing phase, 35 articles published from 2004 to 2019 were selected as relevant and, from reading the abstracts, 20 were selected for further analysis. The inclusion criterion was that the article in question should address immersion and/or well-being in the composition or creation of a physical or a virtual environment or space. All articles that did not address these topics in the context of building a space were excluded. From this, we identified the focus of study presented by each author to list what may characterize the intended spatiality, as well as the sensations they arouse.

In addition, an interview was also carried out with the psychiatrist Sebastiana Correia in order to confirm whether the information raised by the authors found converged with the psychological point of view regarding the elements raised.

The results of this research are presented in the next topic.

4 RESULTS

From the reading of the articles, the authors were first grouped according to the research focus. It has been noted that some authors have focused more on spatiality-related characteristics while others keep their attention on the positive sensations that a space can provide to the user. However, authors with similar foci, such as Caetano *et al.* (2015) and Keeling *et al.* (2012), for example, obtained congruent results in relation to the characteristics mentioned above. Therefore, the grouping was not only focused on each author's research objectives, but also taking into account the spatial attributes and sensations that they considered favorable to well-being. This grouping was organized in Table 1.

Table 1 - Literature Review.

AUTHORS	FOCUS	SPACE-RELATED CHARACTERISTICS	CHARACTERISTICS RELATED TO USER FEELINGS
Caetano et al., 2015; Keeling et al., 2012	Design for wellness -	-	Pleasure; personal virtues and meanings; compassion; understanding of reality; reduction of destructive thoughts.
Brown and Cairns, 2004;	Immersion in virtual environments (games)	Easy access; visual qualities; lighting; sound; atmosphere.	Awakening / calling and keeping attention; feeling of being somewhere else.
Alcántara-Alcover et al., 2014; Keeling et al., 2012; Tonetto, 2012; Costa and Santos, 2019; Aguiar and Farias, 2014.	Sensory and emotional perception indoors	Comfortable; relaxing; welcoming; warm; nice; familiar; precise and clear sound elements; freshness (ventilation, natural aromas); ample space.	Protection; safety; freedom; individual space; tranquility; serenity.
Burnard and Kutnar, 2015; Engineer, Sternberg and Najafi, 2018; Kerr, 2013; Clements-Croome, Pallaris and Turner, 2019;	Stress reduction indoors (the second is focused on the elderly); Sensory Design for Wellness	Aspects related to nature; natural and organic forms and patterns; natural lighting; familiarity / regionality; ample space.	Appreciation of the relationship with nature (biophilia); feeling of being somewhere else; hold attention; tranquility; relaxation.
Abreu, 2016	Creating happy places	Lightness; increased perception of space (amplitude); spirituality; contemplation; recommends the use of orange, lilac and white.	-

Lee, Alzoubi and Kim, 2017; Fernandes et al., 2018	Perception of environments from lighting	Bright colors, luminosity, direct light luminaire systems, organized walls.	Safety; tranquility.
McGann, 2017	Wellness in a hospital environment	Absence of "visual noise"; organized walls.	-
Platt, Bosch and Kim, 2017	Design for wellness in a mental health clinic	Large space without barriers; wide corridors; home / like atmosphere; nature-inspired visuals; soothing and non-stimulating decorative objects; let the subject control some characteristics of the environment (lighting, for example).	Involvement; comfort; personalization; interaction (between the people around); protection and support.
Ulusoy and Nilgün, 2016	Influence of colors and materials on the perception of environments	Green colored and woody materials (cause a feeling of well-being, familiarity, being at home, tranquility and calm), not necessarily combined.	-
Gentner et al., 2012	Multi-sensory perception mapping in design project	Harmony; refinement; elegant; silent; fluid; quiet.	-
Jakob and Collier, 2018	Benefits of fabrics for Sensory Design in Mental Health Environments.	Use of plain and neutral colored fabrics on the walls; localized and soft lights; soft sounds.	Comfortable; safe; significant; multi-sensory experience; relaxation and stimulation; usability; interaction and control.

Source: The authors: literature review, July to August 2019.

Regarding the results achieved by the authors, it is observed that the characteristics related to the environment, such as “visual qualities” and “lighting”, must be considered when designing spatiality and that they must also fit the project objectives (BROWN; CAIRNS, 2004; LEE; ALZOUBI; KIM, 2017). However, the authors do not make clear how such features should be applied, which makes this statement subjective. Other observations guide the discussion of the results, as presented below.

5 DISCUSSION

Some authors such as Clements-Croome, Pallaris and Turner (2019) emphasize aspects related to nature and the environment as sensory devices that provide the sensation of well-being, tranquility, relaxation and comfort. According to the authors, these characteristics would be related to the natural landscapes, the sound of running water, the singing of birds, the smell of flowers, the rustle of leaves and the sensation of fresh breeze. This more specific approach to features related to the natural environment offers a more applicable direction for this research. Platt, Bosch and Kim (2017) also agree with Clements-Croome, Pallaris and Turner (2019) in mentioning that natural aspects are important in building an immersive and relaxing environment. The authors also add features such as breadth of space, which must be wide, organized and barrier-free. It should be noted that research by Platt, Bosch and Kim (2017) and Clements-Croome, Pallaris and Turner (2019) focus specifically on wellness design in mental health clinics and is relevant to this research as considers psychological and emotional aspects for the improvement and well-being of human beings. In addition, it is possible to validate their conclusions regarding the breadth of space, as this factor is also addressed by other research on the means of stress reduction in home environments and sensory design for wellbeing.

Another approached aspect cited in the research concerns the familiar atmosphere that the space should provide. The term "home-like" is used to mean a home or home environment with characteristics related to the feeling of warmth, familiarity, safety and comfort that work to convey well-being and relaxation. According to Jakob and Collier (2018) these sensations can be obtained by using plain fabrics on the walls of the room, as well as by using neutral colors and localized, soft and yellowish lighting, as these aspects make the environment more intimate and convey the feeling of being at home with comfort and safety. It is concluded that the safety factor is an important aspect to be considered in the intervention of the physical space to be defined for application in this study, since this is the factor that activates the feelings of calm and tranquility, as explained by psychiatrist Sebastiana Lima Correia, consulted during an in-person interview to gather information related to factors that cause tranquility and wellbeing.

Ulusoy and Nilgün (2016) state that feelings of well-being can also be achieved through the application of green color and woody materials, aspects that contribute to relate the environment with nature, as they transmit feelings of relaxation. These factors lead the user to immerse in a physical space of simulated reality.

Brown and Cairns (2004) address immersion in virtual environments, while Burnard and Kutnar (2015), Engineer, Sternberg and Najafi (2018), Kerr (2013) and Clements-Croome, Pallaris and Turner (2019) address the application of Sensory design for stress reduction in physical environments. All authors agree that the feeling of being somewhere else can make the user feel captivated, relaxed and motivated to interact with the environment. This interaction with a simulated reality physical space is recommended by authors such as Jakob and Collier (2018), as it is capable of provoking positive sensations by multi-sensory aspects applied to the space for this purpose.

Therefore, immersion when associated with the feeling of being somewhere else, such as being at home for example, makes the user feel transported to a familiar and cozy environment, even if not really in their home. To achieve this effect, it is recommended by the authors not only to use elements that refer to nature, but also to create an atmosphere of a familiar environment, where the subject can feel comfortable and safe to interact with the space in which they are inserted.

For the construction of this family environment, the authors bring us some more specific suggestions. For example, the use of spot lighting to create an immersive atmosphere, the application of nature-friendly colors such as green, and the use or simulation of materials that work for such purposes as wood and natural fibers. Regarding the material, Jakob and Collier (2018), however, follow another direction, suggesting the application of textiles, with the justification that such materials have the ability to bring lightness to the environment, giving a greater sense of tranquility. The authors also highlight the fact that textile materials offer different textures, which contributes to the observer's interaction with the environment, providing a multisensory experience by not only stimulating the sense of sight but also touch.

As for the items not recommended for creating an immersive and calming environment, the results acquired by Ulusoy and Nilgün (2016) indicates that some materials may achieve the opposite goal on to creating a calming space, such as plasterboard, for example, that gives the sensation of heaviness and hardness, with Platt, Bosch and Kim (2017) agree that are senses seen as uncomfortable when applied in a space. Their results also show that mixing materials like wood and plasterboard, for example, can stimulate the same type of feelings. It is also seen on their research that some warm colors such as red can offer warm sensations but not in the sense of cozy feelings. Clements-Croome, Palaris and Turner (2019) found similar results regarding warm colors in environments, stating that people may feel attracted to them but do not find them pleasant.

Given the discussion, the information was grouped in order to organize the elements and significant peculiarities for the structuring of spatiality with relaxing characteristics.

6 RESULTS AND ANALYSIS

The items organized in Chart 1 have been summarized to create a relationship between the aspects that spatiality for well-being should have, with the sensory attributes that each aspect is capable of stimulating. It also presents the multisensory elements that can be applied to arouse such stimuli. This relationship is in Table 2.

Table 1 - Relations between aspects of spatiality, sensory attributes and multisensory elements.

Aspects of spatiality	Sensory attributes	Multisensory Elements
Ornaments that refer to nature	Wellbeing, relaxation, tranquility.	Green colored, natural materials (wood and fibers), sounds (birdsong, rustling leaves and running water), floral or woody aromas.
Home-like atmosphere	Warmth, comfort, familiarity and safety.	Soft tones of lilac, orange and green, localized and yellowish lighting, organized space, aromas like fragrance of roses, eucalyptus, pine, orange, wood, lemon, tobacco, spices and sweets.
Immersion	Captivation, tranquility, interaction, disconnecting from the real-world.	Use of different textures and multisensory stimuli (not just vision), amplitude of space.

Source: The authors (2019).

By relating all these points, it was possible to better understand the sensations that each element is capable of providing and which context of spatiality can be constructed from this. Spatiality that refers to nature, for example, should use the green color, natural materials and sounds and aromas that refer to this environment, as it provides the sensations of wellbeing, tranquility and relaxation. But for a spatiality with a home atmosphere, the authors propose the use of lilac, orange and green colors (in soft tones), yellowish illumination, spatial organization and the application of aromas such as the fragrance of roses, eucalyptus, pine, orange, wood, lemon, tobacco, spices and sweets, which Alcántara-Alcover et al. (2014) claim to be aromas that refer to home environments by the association that is made with perfumes, routine habits and cleaning products, because they arouse feelings of warmth, safety, comfort and familiarity. As for immersion, it was found that it can be worked in spatiality from a wide space and with the application of several multisensory stimuli, through different textures, for example, and not only with the addition of the characteristics already mentioned in the previous paragraph.

Considering that the environment is divided between medium, substance and surface (GIBSON, 1985), it is possible to identify in which segment each element can be inserted. The elements related to the visual and auditory senses, for example, are related to the environment, as well as the objects used in the organization of the environment, such as furniture, for example. The substance is directly related to olfactory multisensory elements, such as aromas, while the surface is related to tactile sense, since it involves not only visual aspects, but also materials, shapes and textures.

From this, it is possible to relate these factors to the immersion levels studied by Brown and Cairns (2004), mentioned earlier. The user is attracted to the space from the multisensory elements, which provide a familiar atmosphere, starting the first immersion phase, the contact phase. The second phase, the

engagement phase, happens when the user begins to interact with the elements, textures, smells, sounds and starts to recognize them. This interaction takes him to the last phase, that of total immersion, where he is transported to another reality from the combination of several multisensory elements that provide the sensations listed in Table 2, responsible for relaxation and wellbeing.

Projects aimed at user welfare are supported by Positive Design, as we saw earlier with Caetano et al. (2015). Among the three pillars of Positive Design cited by the authors, the results achieved by the literature review conducted here are mainly associated with the “design for pleasure” component, since it aims to promote wellbeing with the stimulation of momentary pleasures from individual perception of a multisensory spatiality.

Some authors listed in Table 1, such as Clements-Croome, Pallaris and Turner (2019) and Jakob and Collier (2018), claim that among sensory receptors, vision is the most stimulated in most Design projects, so there is a need to project into a multisensory stimulus, that is, from the other human senses, not just sight but also touch, smell, and hearing. Thus, the user experience with the product or the space in which it is inserted, would be more complete, immersive and intimate.

The sensory attributes listed in Table 2 can also be applied through Surface Design on objects and environments, for example. This approach will be treated in the future as a continuation of this research.

7 FINAL CONSIDERATIONS

From the construction of the theoretical framework and literature review, it was noted that there are elements that can be used by Design to structure an immersive space and stimulate the feeling of wellbeing. Interpreting the collected data, it was

possible to establish a relationship between aspects of spatiality, sensory attributes and multisensory elements to build feelings of welcome and security, specially in the *home-like* atmosphere, and the feelings of relaxation and tranquility in environments that refer to nature. For the structuring of immersive spaces we have the sensations of captivation, tranquility, interaction and disconnection of the real world with the application of different textures and multisensory stimuli, as well as the amplitude of the space, thus fulfilling the general objective of this article.

As identified in studies selected by data mining, immersive spaces for the purpose of promoting wellbeing have often been designed, especially in clinical and mental health environments. Therefore, the results achieved by this research may contribute to the application of the elements listed in Table 2 to structure spaces whose purpose is to offer tranquility to reduce the action of stressors in activities that may affect the individual anxiety, such as universities and air traffic control, for example.

Thus, an applied research is necessary to test the effect of the proposed multisensory elements. In this case, the space bounding wrapper should be controlled and tested with different users, but considering not just the view. Thus, smell, for example, would be triggered by the application of specific aromas, while tactile sensations would be stimulated from textures that could be the result of a specific Surface Design project for this purpose, which will be the continuation of this research.

It is also worth investigating alternatives for the simultaneous stimulation of two or more senses within a spatiality and if such action would favor the goal of promoting immersion and well-being from a spatial intervention.

This research led to positive results regarding the elements that can be applied in design projects in order to create or modify a space into an immersive and relaxing environment, though a major part of the authors did not mention recommendations of what could be inadvisable for this type of project. Nevertheless, it is important to emphasize that the majority of the authors, as well as the psychiatrist interviewed, stated that design for well-being is a very subjective area and different people can obtain different kinds of sensations from a specific environment depending on their personal history, once “well-being” can have a different meaning for each person. The “home-like” atmosphere is a good example once not everyone has the same sense of security and peace at home. Regarding that, it is recommended for further studies and projects to identify the target audience and which atmosphere may be more effective on them.

ACKNOWLEDGEMENTS

We thank the Federal University of Amazonas (UFAM), the Coordination for the Improvement of Higher Education Personnel (CAPES) and the Research Support Foundation of Amazonas (FAPEAM) for the assistance and the support on this study. We also thank Doctor Sebastiana Lima Correia for her assistance in data acquisition.

REFERENCES

ABREU, Ana Andreia. *Happy place: como criar locais felizes: estudo de caso*. 2016. Dissertação (Mestrado em Marketing) – Faculdade DE Design, Tecnologia e Comunicação, Universidade Europeia, Lisboa, Portugal, 2016. URL: <http://hdl.handle.net/10400.26/17233>

AGUIAR, Edvan Cruz; FARIAS, Salomão Alencar de. Estímulos sensoriais e seus significados para o consumidor: investigando uma atmosfera de serviço centrado na experiência. *Revista Brasileira de Marketing*, São Paulo, SP, v. 13, n. 5, p. 65–77, 2014.

ALCÁNTARA-ALCOVER, Enrique; ARTACHO-RAMÍREZ, Miguel Ángel; ZAMORA-ÁLVAREZ, Tomás; MARTINEZ, Natividad. Exploratory study of the influence of the sensory channel in perception of environments. *Journal of Sensory Studies*, Malden, Mass, v. 29, p. 258–271, 2014.

BLUM, A.; MERINO, E. A. D.; MERINO, G. S. A. D. Método visual para revisão sistemática em Design com base em conceitos da Mineração de Dados. *DAPesquisa*, Florianópolis, v. 11, n. 16, p. 124-139, 2016.

BROWN, Emily; CAIRNS, Paul. A grounded investigation of game immersion. *In: INTERNATIONAL CONFERENCE FOR HUMAN-COMPUTER INTERACTION – CHI*, 2004, Vienna, Austria. *Proceedings* [...]. Vienna: SIGCHI, 2004. p. 1297-1300.

BURNARD, Michael D.; KUTNAR, Andreja. Wood and human stress in the built indoor environment: a review. *Wood Science and Technology*, New York, US, v. 49, n. 5, p. 969–986, 2015.

CAETANO, Ulisses Filemon Leite; ROLDO, Liane; GRANSOTTO, Luciana Rodrigues; KURBAN, Alishir. Design para o bem-estar: uma abordagem orientada para o pensamento sustentável e para sustentabilidade. *Estudos em Design*, Rio de Janeiro, RJ, v. 23, n. 2, p. 150–166, 2015.

CASACCIA, Bia Rafaelli. O que é Design Biofílico e sua influência na saúde e bem-estar. In: *Ecotelhado blog*. São Paulo, 11 jun. 2021. Disponível em: <https://ecotelhado.com/voce-sabe-o-que-e-design-biofilico-e-como-influencia-na-nossa-saude-e-bem-estar/>. Acesso em: 27 jun. 2019.

CLEMENTS-CROOME, Derek; TURNER, Briony; PALLARIS, Kay. Flourishing workplaces: a multisensory approach to design and POE. *Intelligent Buildings International*, London, GB, v. 11, n. 3-4, p. 131-144, 2019.

COSTA, Humberto; SANTOS, Aguinaldo. Design para serviços e a estética sonora no servicescape: influência na experiência estética dos usuários. *Projética*, Londrina, v. 10, n. 1, p. 77-94, 2019.

ENGINEER, Altaf; STERNBERG, Esther M.; NAJAFI, Bijan. Designing interiors to mitigate physical and cognitive deficits related to aging and to promote longevity in older adults: a review. *Gerontology*, Basel, Suíça, v. 64, n. 6, p. 612-622, 2018.

FERNANDES, Ítalo Pereira; MOURA, Norberto Corrêa da Silva; COSTA, António Aguiar Impressões qualitativas em espaços urbanos noturnos por meio de ambientes virtuais imersivos. *urbe. Revista Brasileira de Gestão Urbana*, Curitiba, v. 10, n. 1, p. 95-110, 2018.

FREITAS, Renata Oliveira Teixeira de. *Design de superfície: ações comunicacionais táteis nos processos de criação*. São Paulo: Blucher, 2011.

GENTNER, Alexandre; BOUCHARD, Carole; ESQUIVEL, Daniel; FAVART, Carole. Mapping a multi-sensory identity territory at the early design stage. *International Journal of Affective Engineering*, Switzerland, v. 12, n. 2, p. 191-200, 2012.

Gibson, E.J., 1985. Percepção de desenvolvimento pessoal frso o ecologico abordagem. Dentro: Cordeiro, ME, Brpróprio, AL, Rogoff, B. (Eds.), *Avanços em Desenvolvimentoal Psicologia*, volume 3, pág. 243– 286.

INTERAÇÃO. *In: DICIONÁRIO da língua portuguesa*. Lisbon, Portugal: Priberam Informática, 1998. Disponível em: <https://dicionario.priberam.org/interação>. Acesso em: 27 jun. 2019.

JAKOB, Anke; COLLIER, Lesley. Sensory design for dementia care – the benefits of textiles. *Journal of Textile Design Research and Practice*, London, GB, v. 5, n. 2, p. 232–250, 2018.

KEELING, Trevor; CLEMENTS-CROOME, Derek John; LUCK, Rachael; POINTER, Philip. A review of how sensory design can influence wellbeing and productivity. *In: CIBSE ASHRAE TECHNICAL SYMPOSIUM, 2012, London UK. Proceedings [...]*. London: Imperial College, 2012. p. 1-8.

KERR, Cyrus Stuart. A review of the evidence on the importance of sensory design for intelligent buildings. *Intelligent Buildings International*, London, GB, v. 5, n. 4, p. 204–212, 2013.

LEE, Sangwon; ALZOUBI, Hussain H. H.; KIM, Sooyoung. The effect of interior design elements and lighting layouts on prospective occupants' perceptions of amenity and efficiency in living rooms. *Sustainability*, London, GB, v. 9, n. 7, p. 1119, 2017.

MANZINI, Ezio. *A matéria da invenção*. Lisboa: Centro Português de Design, 1993.

MCGANN, Sarah. De(sign) in patient space: user-creativity in hospital settings. *The Journal of Health Design*, Melbourne, p. 33–38, 2017.

MAGALHÃES, M.F.V.. *Corpo re-construção: ação virtual performance*. 260f Tese (Doutorado em Artes) – instituto de arte, Unicamp, Campinas, 2008.

OLIVEIRA, I. A.. *Epistemologia e educação: bases conceituais e racionalidades científicas e históricas*. São Paulo: Editora Vozes, 2018.

PLATT, Lisa Sundahl; BOSCH, Sheila J.; KIM, Daejin. *Toward a Framework for Designing Person-Centered Mental Health Interiors for Veterans*. *Journal of Interior Design*, Radford, VA, v. 42, n. 2, p. 27-48, 2017.

PALLASMAA, Juhani. *The Eyes of the Skin: architecture and the senses* translator. Porto Alegre: Bookman,; 1a edição, 2011.

RUBIM, Renata. *Desenhando a Superfície*. São Paulo: Edições Rosari, 2005.

SANTOS N. S. dos. *A construção do perfil do assistente social no cenário educacional*. São Paulo: Editora UNESP, 2009.

TONETTO, Leandro Miletto. *A perspectiva cognitiva no design para emoção: análise de concerns em projetos para a experiência*. *Strategic Design Research Journal*. São Leopoldo, RS, v. 5, n. 3, p. 99-106, 2012.

ULUSOY, Begüm; NILGÜN, Olguntürk. *Understanding responses to materials and colors in interiors*. *Color Research & Application*, New York, US, v. 42, n. 2, p. 261-272, 2016.