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Exploring Multisensory Qualities of Loggia Spaces for Urban Resilience to Climate Change

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Abstract

This paper presents an exploratory study about multisensory perception in the use of the urban loggia, i.e., outdoor covered space open to one or more sides integrated in the ground level of buildings, providing public shaded walkways and living areas.

Due to current temporary occurrences of extreme intensity of ultra-violet radiation and the increasing periods of heat waves, public health risks are increasing, specifically situations of skin cancer and heart attacks as a consequence of excessive sun exposure.

Loggia spaces have the potential to generate microclimates, allowing for a shadow shelter with the advantages of passive cooling on paths of pedestrian mobility in building entrances. By reducing energy consumption for indoor temperature regulation and climatization, they contribute to mitigating and adapting buildings to climate change.

In literature, the perception of the urban loggia shadow spaces has been studied mainly in two different fields, thermal comfort and visual aesthetics. Exploring spaces that are inviting for all users requires a multisensory research approach, integrating the non-visual sensory modalities beyond the mentioned perception of thermal comfort.

The urban loggia has been mainly developed for horizontal circulation on squares, in order to allow the visual perception of geometrical compositions of building facades.

Furthermore, other sensory modalities beyond vision, such as auditory and olfactory spatial qualities, are forgotten, resulting in non-stimulating spaces to use. To make the building performance of the urban loggia shadow spaces more inclusive, our research is centered on integrating the diversity of people's conditions and needs, as far as possible. To this extent, we explored empirical knowledge related with the absence of sight of blind people, keeping in mind that fully sighted and partially sighted people are temporary subjected to lacks of visual attention in the use of the space. The methods used are based on qualitative research and aim to identify a diversity of spatial perceptions, in order to achieve the understanding of the complex reality in study.

We interviewed blind people of 18 nationalities, including five continents to achieve a multicultural perception about risks in their use of cities and buildings. Furthermore we conducted participant observation in the absence of sight, in cases of urban loggias. These case studies took place in the city centre of Lisbon, characterized by a Mediterranean climate.

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The obtained results allowed to identify affordances and consequent atmospheres approaching sensory modalities beyond vision. Moreover, they allowed to identify positive and negative spatial components inherent to the urban loggia.

These spatial attributes, following inclusive and multisensory qualities, may contribute to empirical knowledge about how the urban loggia can facilitate the mitigation and adaptation of urban buildings to climate change in Portugal and other countries with similar weather conditions and vulnerabilities.

Keywords: *Climate change, health promotion, integrated invisibility, loggia, public space.*

1. Introduction

This study explores the United Nations 2030 Agenda Goal 11th "Make cities and human settlements inclusive, safe, resilient and sustainable". In this scope, three strategic objectives are pursued. The first objective is to explore how architectural morphological innovation of the loggia may help to achieve resilient and sustainable urban buildings in a context of climate change. The loggia, study object of this research, offers a microclimate, giving human comfort in hot and cold weather conditions, giving shadow, rain and wind protection in outdoor spaces to move through and reside. The transitional space of the loggia is considered as a sustainable strategy for building entrances, allowing passive temperature moderation with benefits energy consumption for both indoor cooling and heating. Moreover, the mentioned passive cooling of outdoor spaces allows resilience to climate change conditions of heat-waves, promoting health, reducing the occurrences of risks such as heart attacks. Furthermore, the loggia can be a shelter against excessive ultraviolet radiation, mainly in terraces used during midday hours. It is important to consider that shading devices, such as awnings, umbrellas, or the use of sunscreen lotions, are not considered efficient to prevent injuries as skin cancer due to sun burning.

The second objective is to explore how the architectural morphological innovation of the loggia may contribute to inclusive premises and spaces. The urban loggia has been developed throughout architectural history as a public space that invites citizens to shelter, provided by both private and public buildings. In order to increase its spatial inclusivity, this research explores the spatial perception of blind people with different nationalities, to achieve multisensory information, not limited to a single cultural context, aiming to balance the visual dominance in current architecture production which often forgets sensory needs beyond sight. To our knowledge, disability conditions have not been explored in the literature about the urban loggia design, and their inclusion through this investigation has a multisensory potential. We argue that the integration of the embodied knowledge of blind people may contribute to the spatial quality.

The third objective is to explore how architectural morphological innovation of the loggia may contribute to safe spaces of mobility in buildings and cities. The loggia is a shelter space against climate conditions, such as rain, which may reduce the occurrences of falls due to slippery floors. Moreover, this research focuses on the quality of invisibility, integrating other sensory modalities beyond vision to achieve multisensory built spaces. In this scope, this specific research, involving blind users, in order to identify spatial risks inherent to the absence of sight, aims to find safe solutions for people with and without visual impairments.

Moreover, the loggia allows a transitional space for ocular adaptation when users move between indoor and outdoor spaces, being beneficial mainly for the increasing ageing population with less visual acuity due to macular degeneration.

The most common cause of accidents involving fall occurrences are related to the built space, specifically 30-50% of them. Moreover, older people are more subjected to the risk of fall mainly in vertical circulations (World Health Organization, 2007).

In short, this research explores the following question: what are the main risks involving architecture in the absence of sight and how may the urban loggia be improved to mitigate these risks, increasing spatial resilience of buildings and cities to a context of climate change.

2. Context

Our research explores the innovation of the urban loggia, studying the spatial experience and perception of blind people. Moreover, it explores an in-depth approach of the non-visual sensory modalities, aiming to achieve multisensory spatial rules in an urban context of climate change. In several works, Pallasmaa, (Pallasmaa, 1996) and (Pallasmaa, 2017), highlights the importance of integrating people's body experience in built space design to achieve a multisensory architecture, balancing the ocular-centric production of our time, which often neglects non-visual sensory modalities, such as the tactile experience. Moreover, he advocates a unifying multisensory integration of all senses to allow a fully existential interaction with the world (Pallasmaa, 2007). In the context of non-visual sensory modalities, specifically considering the perception of visually impaired people, Peter Barker, a partially sighted mechanical engineer, proposed best practice guidelines related to the design of built spaces, aiming at the inclusion of the mentioned group of users (Barker et al., 1995). Beyond the general approach of this work to the built space, it is possible to find spatial rules that may increase multisensory stimuli and safety, also for fully sighted users. It is important to consider that people without visual impairments are also subjected to lacks of visual perception, due to inattentional blindness phenomena of a selective attention in the visual field, with consequences on partial visual absence (Mack and Rock, 1998).

Exploring an in-depth approach of specific conditions of visual impairments, this investigation follows a line of research established at the University of Leuven (KU Leuven) based on the cultural model of disability introduced by McDermott and

Varenne (McDermott and Varenne, 1995), where the absence of knowledge about disability is understood as cultural disability. It is stated that perceptions of ability structure the perceptions of disability and vice versa.

In this scope, Heylighen (Heylighen, 2010), Heylighen et al (Heylighen et al., 2013), and Baumers and Heylighen (Baumers and Heylighen, 2015) explore a symbiotic relationship between architecture and ethnographical research centred on disabled people, stating the importance of the body experience in the built environment, where the perception of physically and sensory impaired people may contribute to spatial innovation.

This investigation explores the quality of invisibility, i.e. the multisensory integration of non-visual modalities in architecture aiming to balance the visual dominance in current built space production (Pereira et al., 2017). In this scope, Pereira and Heitor (Pereira and Heitor, 2011), (Pereira and Heitor, 2013), (Pereira and Heitor, 2015), argue that people with and without visual impairment are temporarily or permanently subjected to absences of visual perception. They state the need of the conscience of this fact as a design premise, aiming to achieve safe and multisensory stimulating built environments. Moreover, Pereira et al (Pereira et al., 2018) state that the experience and perception of people with impairments may contribute to question design standards, allowing the achievement of innovative spatial rules promoting safety and comfort of users with and without disabilities.

The sensory experience and perception of disabled people is important to achieve spatial innovation in the built space (Pereira et al., 2018). Regarding urban built spaces, Devlieger et al (Devlieger et al., 2005) explore the inclusion of the perception of visually impaired people in the context of the city. Enlarging this scope, including people with and without visual impairments, Pereira and Heitor (Pereira and Heitor, 2013) analyse the pedestrian mobility of users in the seaside promenade, including the spatial transitions with transport stops and bathing facilities.

In a more enlarged scope, not specifically related to disability experience, Roesler (Roesler, 2017) presents ethnographical research as a potential to achieve the innovation of shadow spaces in a context of climate change, where the passive cooling produced by buildings may generate resilient microclimates for urban users. The space of the loggia, object of this research, is poorly developed in literature. In many languages, such as in English, it is difficult to find a direct translation of the Italian word loggia. However, it is possible to find several studies evidencing the potential of the thermal performance of transitional spaces, in order to generate microclimates of regulation of indoor and outdoor environments, reducing energy consumption related with climatization of buildings, mainly regarding extreme hot and humid urban climate contexts (Sharmin et al., 2015),(Masoumi et al., 2017).

Concerning the specific transitional spaces of the loggia, Sinou and Steemers [Sinou and Steemers, 2004] identify four types of loggia, considering morphological variations

related with the openings in their sides, specifically the types of porch – a transitional space opened only in one of its sides; arcade-passage – with openings on two opposite sides; portico – with openings on three sides; and hypostyle hall – with openings on all four sides.

Moreover, they presented evidence regarding the performance of cooler conditions during summer and warmer conditions during winter. Often, the loggia has been historically designed in building facades of the main city squares. The French model of the royal square, as the case of the 17th Century Place des Vosges in Paris, is an example in the western urban heritage, where the unifying geometrical composition of several buildings facades with loggia increases visual monumentality. Another example is the 18th Century's Praça do Comércio (Figure.1 and 2), in Lisbon. However, it is important to consider that the space of the loggia, beyond the mentioned visual aesthetics and thermal performance of buildings and outdoor environments, needs to be explored through in-depth qualitative studies. We propose to study the loggia as a multisensory stimulating space that motivates urban pedestrians to use in their main mobility and outdoor stay, during midday hours, reducing risks related with heat waves and ultraviolet radiation exposure.

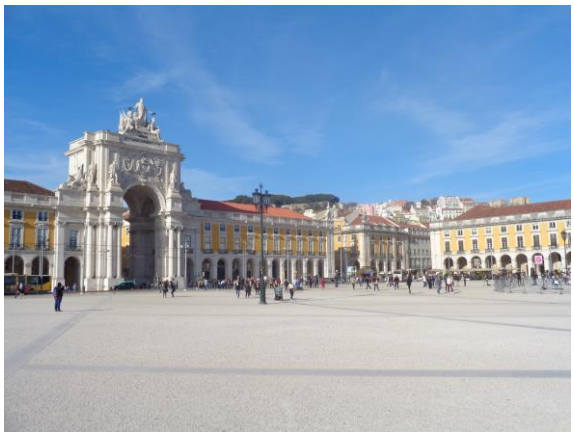
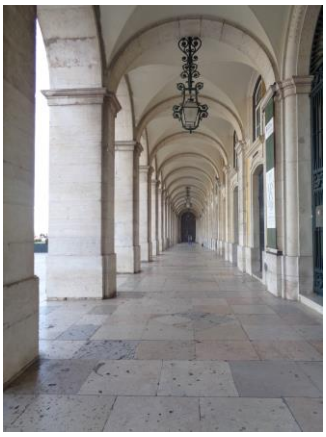

Figure 1 and 2. Urban loggias of Praça do Comércio in Lisbon (Left). Inside of a portico loggia, Praça do Comércio, Lisbon (Right).

To our knowledge, presently no investigations exist that approach the integration of non-visual sensory modalities of the urban loggia. In this scope, it is important to consider the spatial perceptions of blind people. Moreover, it is important to keep in mind that the hearing and olfactory experience of the space of the loggia is rather different than the one of a street in an open sky. Therefore, the specific group of blind users, due to their visual deprivation, and deep sensory attention to non-visual sensory modalities, may be important to find multisensory space rules which contribute to reduce risks in mobility and stay of urban users in a climate change context, with current periods of extreme ultraviolet radiation intensities and the increasing heat waves, due to global warming.

3. Methodology

This study is exploratory and follows a methodology based on qualitative research. This methodological approach explores the complexity of the reality, aiming for a holistic understanding of the phenomena in study (Flick, 2009).

In this study it was pertinent to achieve qualitative data as detailed as possible in order to understand the mechanisms of injury and the relationship between use and spatial component of risk, not limited to a specific local background of people, considering that public spaces need to be culturally inclusive.

Therefore, we interviewed 55 persons from five continents and 18 countries, namely Argentina, Australia, Brazil, Canada, Cape Verde, China, Croatia, Germany, Guinea-Bissau, India, Ireland, New Zealand, Portugal, Sao Tome and Principe, Switzerland, USA and Venezuela. In this context, we used face-to-face interviews as far as possible and phone- or audio-conference when was not possible for geographical reasons, or specific convenience of some participants.

We used an unstructured format based on the identification of the most relevant risks involving architecture used by blind people. Sommer and Sommer (Sommer and Sommer, 1997) recommend this technique to achieve unexplored qualitative information and Rheingantz et al (Rheingantz et al., 2009) point at the potential of this format in deep studies involving spatial perception. All the testimonies have been audio-recorded and selected parts have been transcribed and translated. Data were analysed using coding to identify similarities and differences of opinion expressed by the interviewees, aiming at an understanding of risks and spatial perceptions of blind people.

Direct observation is a method with the potential of increasing the evaluation of the space in study. Therefore, we used participant observation exploring cases of urban loggia located in Lisbon. This technique allows the observer to become part of the space under study, whereby the researcher's emotional apprehension can be as important as other ways of documentation (Sommer and Sommer, 1997). Furthermore, we explored the absence of sight, considering that navigation without vision involves a deeper processing and manipulation of information in other modalities than vision, over-developing attentional mechanisms and working memory (Pigeon, 2015). Moreover, in order to balance the ocular-centrism in architecture, visual impaired people, with their inherent expertise regarding bodily experience, have the potential of inspiring designing innovation (Vermeersch, 2013). Therefore, we used participant observation through the condition of blindness of the first author, using the aid of a long cane and fully sighted facilitators to avoid risks on the mobility, e.g. run over, fall or collision, in the spaces where the blind researcher was unfamiliar with. These assistants also provided visual description of the space in observation and facilitated photographs of spatial components of interest selected by the blind researcher.

4. Results

Preliminary results about risks and architecture, in a general approach, not specific to the urban loggia, achieved through the interviews to blind people, are presented in section A.

These results allowed the identification of risks, which are explored in a sequential approach of participant observation in loggia spaces including inherent urban surroundings, presented in section B.

4.1. Interviews with blind people

The qualitative data resultant from the interviews with blind people allowed the identification of three main risks involving architecture, specifically fall, collision and being run over by a vehicle.

Regarding falls, a few interviewees (I12, I40) did not consider stairs a space of risk - one of them (I12) mentioned "I don't consider stairs dangerous because the cane detects them".

In contrast, one of the interviewees (I2) explained that "although in theoretical terms it would be possible for the visually impaired person to do the detection of the obstacle with the cane, we know that many times we detect a certain depression on the floor and just afterwards the foot is almost inside of it."

Another interviewee (I11) mentioned: "I think stairs are dangerous (…) I have known about some people that have fallen on stairs", referring to a fall occurrence of a blind colleague in an unpredictable stair in the sidewalk. Several interviewees (I41, I42, I52, I55) stated the importance of floor indicators that may warn of the presence of stairs. One of them (I52) alerted to the risk of "stairs that aren't marked, so no track or warning strips on top of the stairs, if they are in an area where you wouldn't expect to find them". From the statement of some interviewees (I50, I55) the risk regarding the unpredictability of the presence of steps was identified.

Some interviewees mentioned the action of descent as more dangerous than the action of ascent (I49, I53).

Another interviewee (I9) identified his own daily risk inherent to ascent in his building stairs, combining narrow step with protruding step nose Also he pointed at the fact that this risk is not just for blind people, mentioning a deadly occurrence in similar stairs with a fully sighted user.

Furthermore, it was possible to identify risks related to specific components of the stairs. Some interviewees (I2, I41, I47, I53, I55) referred to the risk of stairs without handrail, as interviewee (I41) explained "(...) in lots of townhouses they'll have steps but they won't have a railing on the side, and that is very inconvenient and probably dangerous (...)".

Some interviewees (I47, I48, I51) mentioned the risk of spiral stairs. One of them (I47) highlighted the inconvenience of these stairs with only one handrail in the central side, because in this side the tread dimension is shorter, being dangerous mainly in descendant circulation.

A few interviewees (I41, I43) mentioned the risk inherent to stairs without step riser, whereas others (I44, I47) mentioned the risk inherent to the small dimension of the step treads. An interviewee (I48) identified the risk of consecutive steps with different dimensions, mentioning the danger in a situation where "If you have irregular steps for example, sometimes you have smaller steps and bigger steps, and it just changes for design reasons".

However, interviewee (I8) mentioned an occurrence of fall that happened to him in a stair without any particular design mistake: "the stair (...) had two straight flights, and had no curves. It had a flight of stairs, then a landing and another flight of stairs (…) it was very simple."

One interviewee (I6) presents feelings about stairs: "I usually say as a joke, if I were to order there would be no stairs", while another (I46) stated that "It is better not to have them if possible".

Some interviewees (I3, I4) mentioned that they would prefer to have ramps instead of stairs. A multi-impaired interviewee, blind and wheelchair user, identified the risk of curved ramps, mentioning a fall that he suffered in spite of being with an assistant, because it required much strength to balance the wheelchair at a building entrance (I1).

However, ramps without fencing were also identified as a risk upon interviewee's (I50) testimony.

Moreover, risks related with transitional spaces involving stairs, in building entrances, were identified through interviewees' statements. A problem identified from one interviewee's (I50) testimony was the existence of stairs without fencing on both sides. The risk of slippery outdoor surfaces was also identified through some interviewees' statements (I41, I43.) Interviewee (I41) mentioned that "For example in my home here, I have steps at the front, which is fine but when they are wet, they are quite slippery and quite dangerous", while interviewee (I13) also mentioned an occurrence of fall that happened to him in a slippery outdoor stair exposed to the rain.

Other aspects were identified as risk factors in access to buildings. One interviewee (I3) pointed the risk of building entrances with stairs in an inclined sidewalk, mentioning: "When the sidewalks are very steep ramps, they build little steps which are very difficult for us." While interviewee (I32) mentions the problems regarding unlevelled transitional spaces: "(...) Uneven height when we are talking about steps, that each step is not on the same height, that could be a problem (...). When the buildings are adjusted according to the terrain sometimes they are not even, they are not quite horizontal, so the steps at one end are higher than the other end because of the sloped terrain (...)."

Another interviewee (I5) mentioned the risk of spatial unpredictability in building entrances." There are places in which we enter and there is a step, or even two, to descend. And it is a bit annoying because we were not thinking about it, we were thinking: "there is an entrance so most likely we won't have steps (...)", but there are many places which do. (...) I think the floor, when you go in, should be flat."

Furthermore, one interviewee (I29) identified the risk of a building entrance with access being part in stairs and part in ramp, "There weren't any safety signs at the hotel entrance. (...) As I found the stair I tripped over the steps, I was going very fast, I imagined I was heading for the ramp, tripped over the steps and I fell."

A few interviewees (I51, I54) identified the risk of ramps adjacent to stairs without fencing between them, and one of them (I51) stated that it would be better to have all the access in ramp instead of the stairs. An interviewee (I54) mentioned that if it weren't absolutely necessary, it would be better that there weren't any stairs or ramps at building entrances.

Several interviewees' testimonies referred to the risk of **collision** with the head in protruding spatial components not detected by the cane, through (I2, I4, I34).

One interviewee (I34) mentioned the risk of protruding spatial components, not perceptible in the mobility of the blind, "(...) usually when we walk with the cane, it serves as a guide as well as a protection (...) protects bellow the chest (...) from the chest up we have to walk with the hand up and that it is not usual (...)" (I34). Related to the same issue, an interviewee (I41) stated that "(...) it is quite important, that there is no head-high protrusions on the walls, in doorways or (...) anything shoulder height."

Furthermore, an interviewee (I3) pointed at the risk of specific spatial components, saying: "The vertices, you must be careful with them."

Regarding mobility using the sidewalk, some interviewees presented mobility difficulties related to obstacles positioned in the sidewalk (I3, I4, I5). One interviewee (I3) said: "Buildings placed in corners and those zigzag streets, buildings coming more inwards or more outwards(...)". Moreover, the risk of non-straight pathways was reinforced through the statement of another interviewee, who has mentioned several occurrences of collision with the head (I7): "(...) if everything was aligned, everything straight, there wouldn't be any edges."

One of the interviewees (I12) identified the requirement of a clear indicator of the presence of an accessible pathway to avoid the risk of collision. "(...) if there would be a strip, a strip large enough for to people to pass on, and if it was forbidden to place anything there (...) the blind person would be always walking straight and never hit anything."

Moreover, one interviewee (I41) said: "The most important for me it is clear pathways (...)", and another interviewee (I6) stated the need of "Having more free sidewalks, without so many obstacles. From trash cans, to terraces, to traffic sign posts. All of

them are very wrongly studied." Several interviewees statements' (I13, I36, I54) referred to the risk of collision with phone booths, as one (I13) mentioned " (...) the cane goes underneath and we hit the top, on the booth (...)" whereas another (I36) said that this risk was avoided with the old phone boxes which are perceptible with cane. An interviewee (I52) referred to the risk of collision with signage in the sidewalk, specifically "Signs that protruded into the path to travel, so you have metal sign with sharp edges on it (...)".

Another interviewee's statement (I32) allowed to identify the risk of collision with bicycles and motorcycles parked on the sidewalk, close to the building facades.

Furthermore, several interviewees (I10, I14, I29, I43) identified the risk of collision with the stairs' structure, specifically on its back side. One of them (I10) mentioned that "(…) If we don't find the stairs ending right away, we may get underneath the stairs and hit our head there."

Another interviewee (I42) identified another risk of collision with the head with spatial components, mentioning "(...) it could be an arch, if you walk under an arch and arch is curved, in the middle it is high enough but towards the sides it lowers because of the curve (...)", while another interviewee (I53) identified the risk of collision with the head on the structure inside of a loggia of a building entrance mentioning "(...) there is a new building for Engineering school, and it has these weird columns that go down in an angle (...)".

The statements of one interviewee (I3) also allowed to identify the risk of collision with protruding shading devices in the sidewalk. The interviewee (I3) mentioned that: "(...) those things that are very low, awnings, sunshade umbrellas and terraces which aren't precisely divided. The loose tables alongside the sidewalk... when there is a little fence,(...) we detect it, but loose tables are painful, distressing." Still regarding the mobility in the sidewalk, some interviewees' statements (I4, I12, I13) helped to identify the risk of collision with terraces. One of them pointed that "it is terraces which sometimes make our mobility difficult. In addition, interviewee (I13) said that "(…) sometimes even to get into the coffee shop, we have to constantly dodge from terrace's tables."

In contrast, one of the interviewees (I11) expressed his perception about a pedestrian street with terraces in island (Fig.3), allowing a straight pedestrian pathway adjacent to the blocks facade, saying "I love that street (...) I am delighted (...) Gives me great pleasure. Gives me a feeling of freedom."

Regarding the risk of being run over, the statements of several interviewees referred to mobility problems in a sidewalk with obstacles(I44, I46). One of them (I46) said "(...) a person sometimes has to leave the sidewalk, go down a little to the traffic lane, face the risk of a car coming and being run over (...)".

One interviewee (I52) also stated the importance of a clear pathway around terraces to avoid the risk of being run over: "(...) with no detectable path to travel around the patio it makes it very difficult, (...) unless there is a clear path to travel with appropriate space to navigate around that, I may be walking onto the street or stepping into a parking area (...)".

Figure 3. Terrace in island allowing pedestrian circulation near the buildings.

Some interviewees (I48, I49) identified the risk of being run over in shared spaces of car parking, mentioning "(...) you never know what the cars are doing, if they are parking, if they are trying to exit, you never know what they are doing exactly. That's why you never know how you should react. That's the most dangerous."

Furthermore, an interviewee (I50) stated the importance of the presence of a wall to provide orientation and avoid the risk of run over, mentioning "as long as there is a wall to guide us, and we go close to it, because a place without a wall is horrible for us to orient ourselves."

4.2. Participant observations in the absence of sight

The participant observations allowed the identification of negative and positive spatial components regarding the mobility in a portico loggia. It was possible to perceive an increase of olfactory stimuli, mainly during the temporary transitions of the mobility between the loggia and the indoor, or the loggia and the outdoor. A fruit shop with a display inside the loggia was perceived as providing a pleasant olfactory experience. By contrast, in some loggia spaces, specifically in corners, unpleasant smells have been perceived, possibly due to cleaning difficulties of these spaces.

In a city with hills such as Lisbon, it was easy find steps with different forms and riser dimensions inherent to the articulation of the building entrances with the inclined sidewalks.

In several observations, it was possible to experience the increasing risk of the combination of wind and rain in the act of entering or exiting a building. In the act of

exiting, it was often possible to perceive the mentioned risks related to unpredictable steps.

Also, the sensory complexity between outdoor and indoor, with sun suddenly touching the skin, car traffic noise, olfactory presence of perfumed passerby users crossing the entrance and our kinaesthetic memory of descending steps may contribute to lacks of attention, using spatial risk components.

Unfortunately, we haven't found loggia spaces facilitating building entrances in inclined sidewalks. However, we found a building entrance with the presence of ramp and steps, the 16th century building of Jeronimo's Monastery, where the building entrance with five steps with an intermediate landing, has the presence of two recent built assistive ramps (Figs.4 and 5), one from the outdoor floor level, with the unpredictable absence of fencing on its sides, increasing the risk of fall, accessing the first two steps. However during the observation in a rainy day it was possible to perceive the shelter of loggia, keeping dry the surfaces of the mentioned vertical circulations, and enabling wind protection, giving time and space in the act of exiting to adjust clothing to face the outdoor weather.

It is difficult to perceive obstacles when descending a stair in the blind condition using a long cane, because in contrast with the horizontal mobility, the cane doesn't employ the usual scanning movement from side-to-side, maintaining a fixed central position to detect obstacles, which it is not enough to provide a full prevention.

Figure 4 and 5. Porch *loggia* at Jeronimo's Monastery in Lisbon.
Left: Outside view. Right: Vertical circulations inside the porch.

The participant observations allowed the identification of risk of collision and being run over inherent to the sidewalk mobility. In order to avoid risks of falling in a bollard, collisions with the head in a traffic sign or being run over due to a lack of attention inherent to the spatial orientation, the blind researcher always followed with the long cane the fixed reference of the building facades. However, several times the presence of protruding spatial components not detectable with the long cane, such as awnings, resulted in occurrences of collision with his head.

Furthermore often the presence of terraces occupying part of the sidewalk is an obstacle that requires to turn around. A few times it has occurred that the scanning movement of the long cane exploring the space and the unpredictable presence of the terrace's furniture resulted in collision with tables, which made the glasses on its top to shake, resulting in an embarrassing situation (Fig.6). Several times, passersby guided the blind researcher to another direction free of terrace furniture to avoid collision. Often, it resulted in spatial disorientation, and a few times the blind researcher faced the risk of walking in the wrong direction to the car traffic lane, being exposed to the risk of being run over. Often, cafeterias and their terraces are placed in blocks' corners which may increase the mentioned risk of disorientation. He doesn't usually refuse this well intentioned help from passersby, because sometimes there are unpredictable risks in the sidewalk, like a temporary hole from maintenance works without fencing, a situation that has already occurred with him, resulting in a fall. Beyond the risk of being run over due to the circulation in the sidewalk border, the navigation near the building facade was identified as multisensory advantage of providing stimuli and orientation: it is possible to explore with a long cane and find easily the building entrance, the sound of voids in the building facade, such as the sound of a loggia or an open door is recognisable, as well as olfactory references such as a cafeteria or a flower shop.

Also, the situation of navigating in the middle of a large sidewalk was experienced, through a tactile reference of a floor grid (Fig.7), easily perceived with a long cane. By contrast, orientation difficulties to find a building entrance were experienced, resulting in less autonomy, which implied to ask passersby for guidance. However, the floor grid was perceived as a useful indicator of the limit of the main sidewalk circulation area, which also allows mobility using the reference of the building facade.

Regarding the stay in a terrace, specifically taking a meal, two different spatial situations were observed, the stay in a terrace in the sidewalk shaded by an awning (Fig.8), and another terrace inside of a loggia, adjacent to the sidewalk, shaded by the building's structure (Fig.9). These participant observations revealed the tactile advantage of the terrace inside the loggia, allowing a more efficient shelter to sun, wind or rain exposure. By contrast, regarding aural perception, the disadvantages are similar. The urban noise of car traffic was perceived unpleasant in both cases. The reverberation evidences the claustrophobic presence of a textile ceiling, too low, provided by the awning, and in the case of the loggia an increasing of noise was also perceived, however without the mentioned claustrophobic discomfort.

5. Discussion

The results achieved suggest the potential of the use of loggia, in the context of mitigating and adapting buildings and cities to climate change. We argue that it is important to consider that an efficient building performance, including as widely as possible the satisfaction of the users, may result in less spatial obsolescence and higher life span of buildings, contributing for less energy consumption inherent to demolishing and rebuilding efforts. Aiming to balance the ocular-centrism present in current loggia design, we strategically explore the perception of a key users group, of blind people, for whom the space needs to have sensory qualities beyond vision. Moreover, we state that this sensory integration may contribute for the health and wellbeing of people with and without visual impairments.


Figure 6 and 7. Left: Terrace at a block corner, on the sidewalk.
Right: Sidewalk with terrace and free pathway adjacent to building facade, with tactile reference through a floor grid.

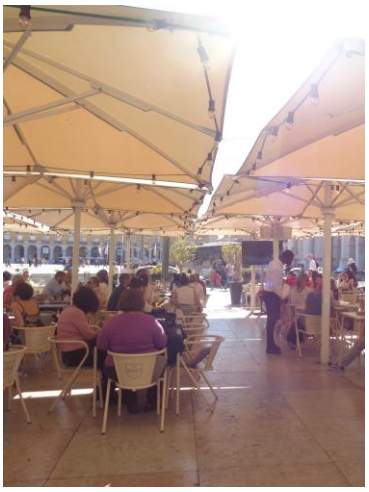


Figure 8 and 9. Left: Terrace with awnings in a city square.
Right: Terrace inside an urban loggia.

This research is exploratory and is in line with Roesler (Roesler, 2017), which states the need of ethnographical research applied to urban microclimates, in order to achieve information pertinent to the innovation of buildings and cities facing climate change. Foruzanmehr (Foruzanmehr, 2015), explored qualitative research to achieve information in order to improve the innovation of loggia spaces in domestic environments, aiming to achieve pleasant spaces to use and thermal regulation, reducing dependence on electromechanical climatization. Following this premise, however in a public urban context, we explored spatial perceptions centred in non-visual modalities. Therefore, our findings with a multi-cultured perception, of risks involving architecture and participant observations in the absence of sight, involving the space of the urban loggia, may contribute to achieve in-depth insights to inform the improvement of resilient buildings and cities.

Current architecture production evidences the need of design innovation regarding loggia. As an example, in an iconic building of contemporary architecture (Figs.10 and 11), it is possible to find a building entrance with protruding inclined structures, not possible to be perceived with a long cane, where there is a high risk of collision with the head, a situation mentioned by the blind interviewees. Specifically, an inclined sharp edge presents the risk of collision with the head regardless of the height of the users.

In literature, specifically in the field of health promotion, it is stated the use of stairs instead of elevators, as an efficient strategy to do physical exercise and to reduce obesity and its inherent diseases (Pate et al., 1995), In this scope, several studies explore spatial solutions which encourage users for the mentioned moderate physical activity (Nicoll, 2006), (Nicoll and Zimring, 2009).

Our findings regarding interviews and participant observations revealed the risk of fall related with the presence of steps in building accesses, where the presence of an inclined sidewalk results in step risers of different heights. Furthermore, rain or ice exposure may increase the risk of fall. Moreover, it is important to consider that beyond lacks of visual attention, children and older people are particular groups of risk when using stairs (Boele van Hensbroek et al., 2009). Several interviewees stated the use of ramps instead of steps in the building entrances. Therefore, we recommend, as far as possible, the use of slope entrances or ramps, instead of stairs; and a porch loggia, that may allow space to build these transitional floor articulations between the indoor and the sidewalk. In this context, our findings suggest a new requirement regarding the mentioned health promotion strategy, by recommending the avoidance of stairs in building accesses changing it to indoor staircases, where able-bodied users may use them instead of elevators.

Furthermore, the space of portico loggias provides a microclimate and consequent thermal regulation, providing winter and summer comfort, which may contribute to reducing energy consumption for indoor acclimatisation.

Moreover, we argue that the loggia, has the visual advantage in light regulation, providing time and space for ocular adaptation to partially sighted users when exiting a building, where usually temporary occurrences of visual absence may occur caused by glare. It is important to consider the context of an ageing population due to the increase of life expectancy resulting in the increasing of physical and visual impairments, where a building entrance without steps, and a more sensory regulated space of the loggia may contribute for less risks and more comfort.

The participant observations revealed the power of loggia in increasing olfactory stimulus. Therefore, it is important to consider stimulating materials and avoid corners, in urban public spaces where it is difficult to maintain an efficient cleaning. In this context, we recommend the use of portico loggias with openings in three sides, and minimal porch loggias in entrances of public buildings, with the possibility of being closed during night time, to reduce cleaning efforts.

Regarding the mobility in sidewalk, we recommend the location of an accessible pathway adjacent to the building, instead of sidewalk areas near to car traffic, which increase the risk of being run over. Moreover, we argue that for the orientation of blind people in urban space, it is important to place the pathway near the buildings, providing a multisensory reference to follow, such as a wall to touch with the long cane, sounds and smells from openings on the building facade which increases the orientation for the blind, and sensory stimuli for people with and without visual impairments.

Our findings revealed the need of these accessible pathways to be free of spatial obstacles, specifically, terraces. In this context, there are two possibilities to place terraces, between the car traffic and the accessible pathway or inside the loggia. We state that the second possibility allows more prevention regarding risk of sun exposure, specifically in the stay during midday hours, where the current temporary ultraviolet radiation and increasing periods of heat waves, are relevant in a context of climate change. Furthermore, this situation avoids the presence of awnings or umbrellas, spatial protruding components, not detectable with the long cane of the visually impaired users. Also, the mentioned shading devices are risk components for passersby with or without impairments, in cases of strong winds that may move these structures.

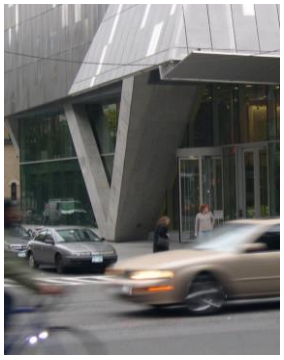

Figure 10 and 11. Risk of collision with the head in an iconic loggia.

6. Conclusion

The findings achieved with qualitative data resultant of a multicultural sample of interviewees, combined with the empirical reality of urban case studies introducing loggia, suggest the use of the portico loggia for two different uses, walkways and living areas.

We advance, for urban adaptation and mitigation of climate change, the use of transitional loggia spaces in building entrances, combining their environmental performance of thermal regulation with usability requirements of people with and without visual impairment, specifically adapting building entrances through a threshold of floor connection without steps, excluding risks of falls by allowing the use of an inclusive slope entrance or ramp in cases of inclined sidewalks.

We recommend the use of portico loggias with openings in three sides, and minimal porch loggias in entrances of public buildings, with the possibility of being closed during night time, to reduce cleaning efforts.

Furthermore, we recommend the use of terraces inside loggias, avoiding furniture obstacles in sidewalks in the mobility of visually impaired people and providing a more healthy shadow during midday hours in a context of intensive current periods of ultraviolet radiation and increasing heat waves.

We centred our study on the spatial perception of blind people, aiming to achieve deep qualitative information inherent to sensory modalities beyond vision. In this way we search to balance the ocular-centrism present in current loggia design, often used as visual facade composition, forgetting the potential of social inclusion.

It is planned for future research to develop an analytical study of urban cases of loggia with walkthrough interviews to visually impaired people and integrating other conditions of disability, such as hearing, physical and cognitive impairments.

Moreover, we have planned to do in-situ interviews to passerby users in order to include as far as possible people’s diversity.

Understanding the spatial behaviour of different conditions and needs of the people, may contribute to avoid obsolete spaces with consequent demolitions and rebuilding efforts and energy consumptions. The morphological innovation of the urban loggia, needs to achieve multisensory, health-promoting qualities in a context of climate change, to increase the life span of buildings and cities.

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