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Designing a model to evaluate housing privacy: Some reflections on the process

Concepção de um modelo para avaliação da privacidade habitacional: Algumas reflexões sobre o processo

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Abstract

Assessing housing privacy includes individuals' perception and the relationships created in the living spaces and in their immediate neighborhood. Based on this information and supported by a systematic literature review, this article presents a conceptual model to evaluate housing privacy. It focuses on the built environment, user behavior and human socio-spatial relationships that ensued from this interaction and was based on a multimethod evaluation which included instruments with user participation by using a panel of experts, interviews and questionnaires, and a social and physical evaluation. To define the final model, a pretest was carried out in an exploratory study which was applied on a multiple tower housing building, located in *Natal* (*Rio Grande do Norte*, Brazil). The main contributions of the article are disseminating methods related to creating conceptual models within the scope of architecture; compilation of attributes, performance indicators and instruments used to evaluate housing privacy; proposing a practical guide to evaluate housing that focuses on design process and points out potential and problems; suggest recommendations that improve the architectural product, by increasing its quality.

Keywords: Evaluation model. Housing. Post occupancy evaluation. Privacy.

Resumo

A avaliação da privacidade habitacional envolve a percepção dos indivíduos e as relações que se desenvolvem nos espaços da moradia e na sua vizinhança próxima. Com base nessas informações e respaldando-se em uma revisão sistemática da literatura, este artigo objetiva apresentar um modelo conceitual para avaliação da privacidade habitacional, com foco no ambiente construído, no comportamento dos usuários e nas relações sócioespaciais humanas decorrentes dessa interação. O modelo foi baseado em uma abordagem multimétodos, que incluiu instrumentos com a participação de usuários (utilizando painel de especialistas, entrevistas e questionários),

e avaliação física e social do local em estudo. Para concepção do modelo final, foi realizado um pré-teste do modelo preliminar desenvolvido, que recorreu a um estudo exploratório realizado em uma habitação vertical de torres múltiplas, localizada em Natal (Rio Grande do Norte, Brasil). As principais contribuições do artigo são: disseminar métodos envolvidos com a criação de modelos conceituais no âmbito da arquitetura, compilação dos atributos, indicadores de desempenho e instrumentos utilizados para avaliação da privacidade em habitações; proposta de guia prático de avaliação de habitações que incide sobre o processo de projeto e aponta potencialidades e problemas das moradias; sugerir recomendações que impliquem na melhoria do produto arquitetônico, pelo incremento da sua qualidade.

Palavras-chave: *Modelo de avaliação. Habitação. Avaliação pós-ocupação. Privacidade.*

Introduction

Home is an essential space for private life, as it seems to be the material foundation for family and social order (Perrot, 1991). On this sense, privacy is a dialectical process that involves the constant search for a balance between interaction and isolation, mediated by the control of physical and social barriers (Westin, 1967; Altman, 1975). This regulation of social interactions is influenced by factors such as the physical environment and cultural norms, which are revealed in home mainly by the arrangement of domestic space and the human socio-spatial relations developed there. In this sense, architectural research on privacy reveals that housing privacy is not an isolated phenomenon; it intersects related concepts such as crowding, loneliness, personal space, and territoriality, what makes it a complex concept that involves different scales.

On the one hand, conceptual models are essential for understanding complex concepts, as they provide a framework for analyzing the intricate relationships between different actors and scales. By employing these models, researchers can explore how elements interact and influence individual experiences, which enables a deeper comprehension of how privacy is managed in different social and spatial contexts, especially in multifamily buildings, like apartments. On a comprehensive scale, the idea of a conceptual model corresponds to the abstraction of a phenomenon in two mains ways: to understand the reality under study (Fiandanese, 2019; Jonassen; Strobel; Gottdenker, 2005; Klaasen, 2002; Vasilenko, 2020) or to prospect about its future possibilities (Fiandanese, 2019; Klaasen, 2002). To this end, designing a model includes a theoretical foundation that is consistent with the researcher's decision-making about the relevant aspects of the reality under study, as well as some researcher's subjectivity, since the modelling process also requires selecting the most appropriate type of model to represent the desired objective. In the field of architecture, the design process is closely related to developing models (Fiandanese, 2019; Jong; van der Voordt, 2002; Vasilenko, 2020), which are reflected both in theory and in practice.

This article presents a conceptual model for evaluating housing privacy, as well as focusing on human socio-spatial relations. It corresponds to an excerpt from the thesis: "Proposal of a housing privacy evaluation model: from the construction of the instrument to the application in an exploratory study" (Macedo, 2023) defended in the Postgraduate Program in Architecture and Urbanism, Faculty of Architecture and Urbanism and Design, University of São Paulo, and was based on the following topics: literature review, with elucidations on the theoretical basis applied to the models and the concept of housing privacy; construction of the preliminary model; application of the preliminary model in an exploratory study; final model; final considerations about the construction process of the model and future notes. The current investigation was approved by the University's Research Ethics Committee, process number 37102220.0.0000.5390, approved on July 12, 2021.

Contextualization and literature review

The model developed to evaluate housing privacy can be applied at different stages of the design process and was grounded in the understanding of privacy as a phenomenon in terms of human socio-spatial behavior. To support this proposal, this contextualization focuses on two themes: the notion of conceptual models applied to architecture and the concept of housing privacy.

Regarding conceptual models in architecture

The architectural design process encompasses innumerable possibilities for inserting models. They can be used to imagine, interpret, represent, calculate, and simulate existing or future ideas or reality (Fiandanese, 2019; Klaasen, 2002). Its production can assist in the qualitative, functional, and formal representation of objects (Jonassen; Strobel; Gottdenker, 2005) and in the transmission of ideas, structures, and relationships between the elements of this issue (Imai, 2007; Vasilenko, 2020). A literature review was carried out to discuss the model concept from the perspective of scientific-academic production in architecture. This discussion included the following: reviews on the concept and application of models in architecture (Fiandanese, 2019; Imai, 2007; Jonassen; Strobel; Gottdenker, 2005; Klaasen, 2002; Koch; Carranza, 2014; Vasilenko, 2020); and the use of conceptual models to evaluation processes related to architectural design process in the Brazilian context (Caixeta, 2015; Logsdon, 2019; Pandolfo, 2001; Romano, 2003; Saft, 2021).

The models are usually classified by their formal structure and their relationships with the represented reality (Klaasen, 2002). In general, they are known as: representational, mathematical, physical, or conceptual (verbal or mental). In terms of the study developed, the conceptual model proved to be the most appropriate for this research, whose main objective was to understand the phenomenon of housing privacy considering existing theoretical and empirical studies. The conceptual model represents activities or processes that visually portray the concepts and theory implicit in each reality or phenomenon (Adriaenssen; Johannessen, 2015). This allows to adequately relate the different aspects of the investigation, especially when there is an interest in also grounding the work on empirical studies (Elangovan; Rajendran, 2015).

The literature (Adriaenssen; Johannessen, 2015; Caixeta, 2015; Elangovan; Rajendran, 2015; Jonassen; Strobel; Gottdenker, 2005; Logsdon, 2019; Pandolfo, 2001; Romano, 2003; Saft, 2021) points out that to create a scientifically valid model, researchers must: raise theories regarding the phenomenon to be understood; define models' limitations; formulate an initial validation proposal; guarantee its replicability (flexibility of adaptations). Supported by these guidelines, the construction of the model in focus was anchored in preliminary analytical diagrams, that identified indicators, requirements, and performance criteria[3] for housing privacy, and in methodological procedures which were considered essential for its evaluation.

About housing privacy

From an architectural perspective, privacy regulations are critical in shaping the design and functionality of home spaces. The spatial arrangements of homes often reflect cultural standards

[3] The Brazilian Housing Performance Standard (Associação Brasileira de Normas Técnicas, 2024) defines requirements as the conditions that qualitatively express the attributes that a housing building must have to meet the user's needs; criteria, such as the quantitative specifications of these requirements, expressed in terms of measurable quantities, that is, which are objectively determined.

and social norms surrounding privacy. Perrot's (1991) insights reveal that the boundaries between public and private spaces around homes often overlapped, implying ways of living that balance individual needs with societal dynamics. This complexity calls for a deeper understanding of how houses, especially apartments, can support privacy while reflecting the broader cultural frameworks in multifamily housing.

To understand the main constructs and relationships essential to housing privacy, a systematic literature review was carried out (Macedo; Ornstein; Elali, 2022), showing that it involves complexities inherent to the scales and dimensions evaluated. Regarding the first, three main scales were identified (Altman, 1975; Magi, 2011; Newell, 1995; Westin, 1967): individual – desired and perceived in a particular way, by each person, and protected, as a right; collective – governed by cultural standards and social norms, which establish the rules of coexistence and the sociodemographic context in which the individual lives; environmental – places where events and interpersonal interactions take place. About the dimensions, four are considered (Burgoon, 1982; Leino-Kilpi *et al*., 2001): physical – regulates the physical accessibility (tactile, visual, auditory, olfactory) of one person (or group) in relation to another; social – ability to control (participants, frequency, duration and content) social interactions, which define contact among people; psychological – the individual's ability to control stimuli from the environment and people; informational – right to determine how, when and how much information is available to other individuals.

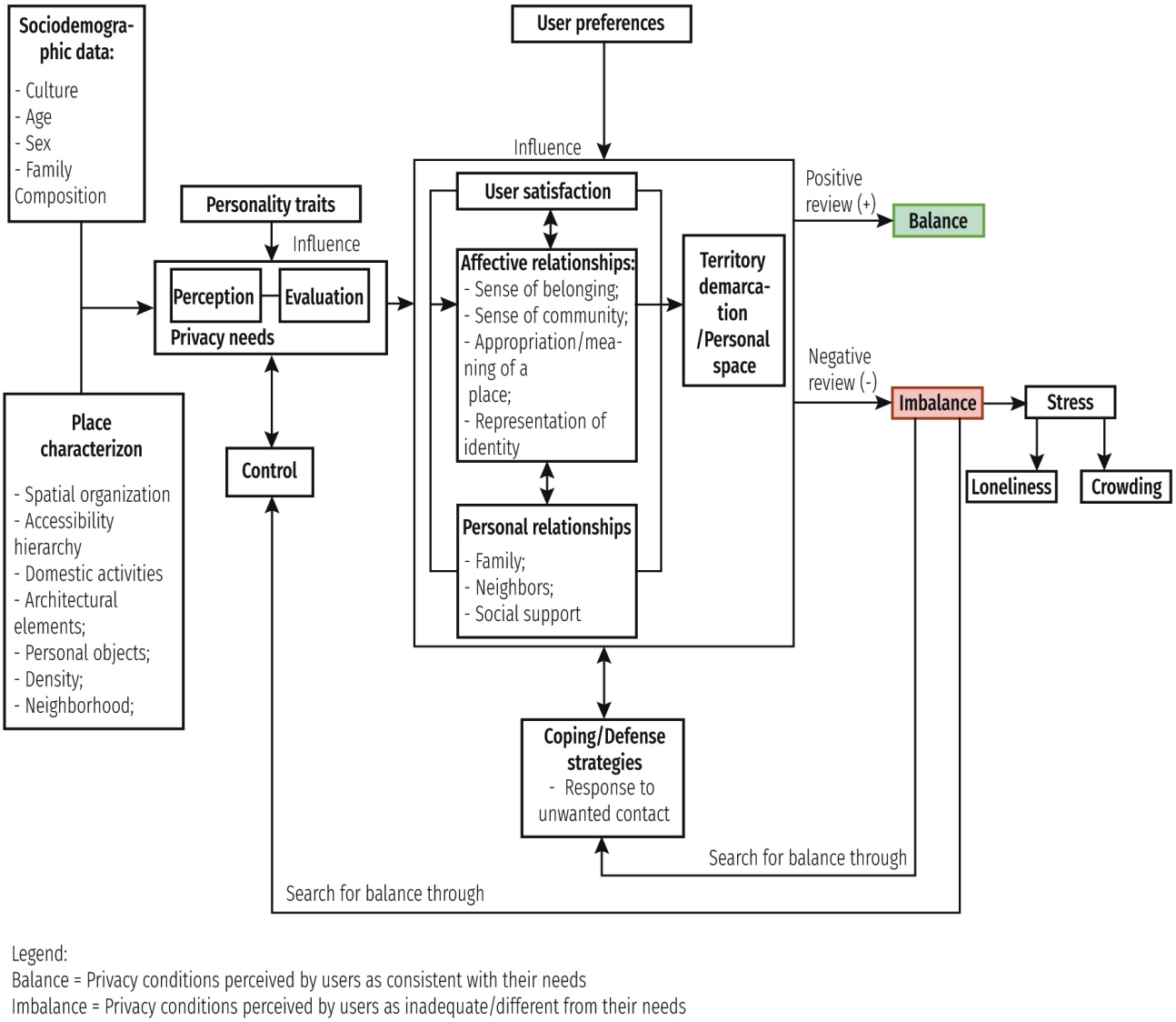
The literature (Altman, 1975; Burgoon, 1982; Dienlin, 2014; Hall, 1966; Westin, 1967; Margulis, 2011; Solove, 2006) also demonstrates that the balance of the privacy regulation system depends on aspects[4] related to territoriality, personal space, perceptions of crowding and loneliness. Thus, considering the process for regulating the physical, social, and psychological barriers of individuals and among them, housing privacy is expressed by human socio-spatial relationships (Pinheiro; Elali, 2011), affective relationships (Bomfim; Delabrida; Ferreira, 2018) with the environment and other relationships that qualify such approaches (Coelho, 2011).

In housing, these relationships can be related to characterizing the place – descriptions of the physical attributes of the unit, the building and the surrounding area; regulation of interpersonal distances – expressed by controlling physical accessibility and desired social contact with cohabitants, family/close friends and neighbors; personal relationships – reflected in family functioning, experiences with neighbors and perceived social support; environmental affective relationships – indicated by the sense of belonging to the place and community, meaning of the place, representation of identity and appropriation of spaces; balance of individuals' spatial needs – revealed by positive or negative perceptions/evaluations of privacy.

Illustrating the complexity of this process in terms of housing, a conceptual model of housing privacy was developed (Figure 1), based on the principle that the phenomenon under analysis can be defined by the users sociodemographic and individual characteristics, including their personality traits; physical attributes of the place, which determine the needs to be translated by the space.

[4] In Environmental Psychology point of view, these aspect can be briefly defined as: *territoriality*: provides limits within which individuals or groups have specific dominance (possession) and within which activities develop (Hediger, 1961), allowing individuals to claim and defend the area (Hall, 1966); *personal space*: invisible bubble that surrounds the individual (or group) and follows wherever they are, and defines the degree of distance they wish to have with others (Goffman, 1971; Sommer, 1973); *crowding*: subjective state in which individuals, inserted in a given environment, perceive restrictive aspects, generated by the feeling of "spatial limitation" in relation to the desired behaviors (Stokols, 1976); *solitude*: when the individual longs for closer contact (or a relationship) with another and this desire is not met, that is, there is no reciprocity in searching for the other, which can create unwanted isolation (Altman, 1975; Westin, 1967) *human socio-spatial behavior*: interrelationships that occur in a space, and that act "as part of the process of interpersonal communication and as one of the mediators of person-environment interaction" (Pinheiro; Elali, 2011, p. 148); *affective relationships*: affective attachment to the place that gives meaning and subjectivity to the environment, involving concepts such as spatial appropriation, attachment to place and identity (Bomfim; Delabrida; Ferreira, 2018).

Such characteristics are interdependent and define the individuals' privacy needs – who will positively or negatively perceive and evaluate them.



Legend:
Balance = Privacy conditions perceived by users as consistent with their needs
Imbalance = Privacy conditions perceived by users as inadequate/different from their needs

Figure 1 – Conceptual (initial) model of housing privacy.
Source: Macedo (2023).

However, the perception and evaluation are affected by requirements related to managing privacy in the home environment, which include possibilities to control the environment; user satisfaction; existing person-environment affective relationships; pre-existing personal relationships. This set of requirements determines the individual's desire for privacy and results in forms of communication regarding the desired type and degree of contact, which are specifically expressed by demarcating territories and delimiting personal space. Through social contact, the responses given can contain coping/defense strategies against unwanted contacts.

This will result in an assessment of the situation, which will culminate in balancing (or not) the spatial needs of the different individuals involved. In positive evaluations, the domestic environment and the relationships that ensue from their experience are consistent with the individuals' desired

level of privacy. On the other hand, in negative evaluations, individuals perceive an imbalance in this relationship, which can cause stress reactions, due to a perception of crowding or loneliness; or the search to balance out spatial needs by readjusting the coping strategies used to address the stressful situation or by changing environmental control conditions, restarting the process, or readapting privacy needs.

Considering the literature review, this initial model (Figure 1) demonstrates that the process of regulating housing privacy largely depends on physical characteristics, and when modified, these can contribute (positively or negatively) to perceptions of privacy. Under this assertion, architecture and its design process can contribute significantly to balance the system by designing spaces that are compatible with the residents' needs and, consequently, consistent with the level of privacy they desire.

It is thus understood that assessments of housing privacy must consider this set of variables to ensure their perception is adequately measured. This condition was taken as the basis for developing the preliminary housing privacy evaluation model.

Methodological Procedures

The literature about models (Adriaenssen; Johannessen, 2015; Caixeta, 2015; Elangovan; Rajendran, 2015; Jonassen; Strobel; Gottdenker, 2005; Logsdon, 2019; Pandolfo, 2001; Romano, 2003; Saft, 2021) points out some steps to develop a model, which are mainly: literature review, development of a preliminary model, validation of this preliminary model, and construction of the final model, based on results of the previous steps.

Based on this, methodological procedures were defined and included: a preliminary model, validated by specialists through an experts' panel, and a pre-test of the preliminary model, supported by instruments with user participation (questionnaires and interviews) and a social and physical evaluation (walkthrough and space syntax analysis of the unit), made by researchers. After that, a final model was built. The instruments with user participation, experts' panel, questionnaires and interviews, were applied by the researcher, after the participants' consent. The current investigation was approved by the University's Research Ethics Committee, process number 37102220.0.0000.5390, approved on July 12, 2021.

Preliminary model development

Considering the housing privacy initial model, the preliminary housing privacy evaluation model was developed based on building a methodological instrument that would serve to assess privacy in the domestic environment, at different scales and dimensions.

A wide-ranging evaluation consists of the "systematic process to determine the merit, value or significance" (American Evaluation Association, 2014) of an object or a process, which is an important instrument for assessing the effectiveness of processes or products or for supporting decision-making to improve and implement them (Wanzer, 2020). In buildings, assessments generally measure or manage the quality of the process and its products through a systemic approach of research, measurement, comparison, and evaluation carried out throughout all stages of the design process, and which are expressed mainly by Building Performance Evaluation, BPE (Preiser; Schramm, 2012).

From the point of view of Environmental Psychology and supported by previous Brazilian studies (Saugo; Martins, 2012; Elali; Pinheiro, 2013), the assessment of housing and particularly privacy, involves perceiving individuals in the housing spaces and their neighborhood. Based on this information and supported by the Systematic Literature Review (SLR) carried out (Macedo; Ornstein; Elali, 2022), a preliminary model was constructed. Through analytical diagrams, this model illustrated the possible paths to be followed in assessments on housing privacy. After its preliminary definition, the preliminary model was validated by a panel of experts, which aimed to test its scientific validity.

The beginning of construction

The literature review demonstrated that housing privacy evaluation should consider in one hand the relationships between the characteristics of the environment and user behaviors, which include the relationships that qualify privacy (Coelho, 2011), the themes under study, the dimensions of privacy (Burgoon, 1982), and the housing privacy performance indicators related to it; and on the other hand the evaluation methods procedures, which include methodological instruments and data sources, related to physical and social assessments and user perceptions.

Regarding the evaluation variables, their correlation was identified with: the scale, such as sociodemographic context, nearby neighborhood, building, housing unit, individual; the actors involved, who serve as data sources, such as residents, building managers, real estate market agents and researchers; the focus on which the study is centered (Newell, 1995), such as the person, the environment, the person-environment relationship. The interrelationships between these findings covered the physical, social, and psychological dimensions, defined as follows:

- Physical dimension: qualifies the characteristics of the place, as well as the regulation of interpersonal distances, referring to physical attributes from a functional, dimensional, and aesthetic perspective and expressed by: Spatial organization; Architectural elements; Neighborhood; Density; Personal objects; Housing typology.
- Social dimension: characterized by the regulation of interpersonal distances and personal and affective environmental relationships, and it concerns social meanings and interpersonal relationships, largely reflecting communication about the desired social contact and especially expressing itself through: Social interactions; Culture; Accessibility hierarchy; Control; Demarcation of spaces; Coping strategies to combat invasion of privacy; Domestic activities.
- Psychological dimension: qualifies the balance of individuals' spatial needs, the preservation of intimacy and personal relationships, and it is related to cognitive aspects based on the characteristics of the place, personal relationships, or environmental ties. It is expressed by: User satisfaction; User preference; Stress; Meaning of home; Social support; Personality traits.

With regards to the evaluation procedures, their choice was especially related to the research focus and the privacy qualities and themes (privacy, territoriality, personal space, loneliness or crowding). The characteristics of the place were measured mainly through walkthroughs[5], questionnaires and physical and social assessments. The regulation of interpersonal distances and the balance of individuals' spatial needs were specifically measured through questionnaires and physical and social assessments. Finally, given their degree of subjectivity, personal and affective environmental relationships were assessed using questionnaires, interviews, or walkthroughs.

[5] Walkthrough: consists of visits with a predefined script and route, carried out only by the researcher, to recognize and evaluate the location, or by the researcher with key people, in the interview-tour format.

Based on these results, it was understood that evaluating privacy would designate preliminary and sequential definitions, namely: (1) choose the key themes that will be evaluated; (2) define the research focus; (3) choose the case study: housing typology and study universe; (4) identify the actors who will participate in the evaluation process and define the scales of study; (5) choose the assessment items, considering the desired privacy relationships to study; 6) choose which procedures will be necessary to measure the data. These choices enable the researchers to define the instruments necessary to assess privacy, which would provide the information necessary to diagnose privacy in the context studied through the following steps: 7) data collection, 8) data analysis; 9) publication of results.

A preliminary model (Figure 2) was proposed based on these delimitations, which uses 9 steps and serves as a guide for preparing privacy evaluation studies.

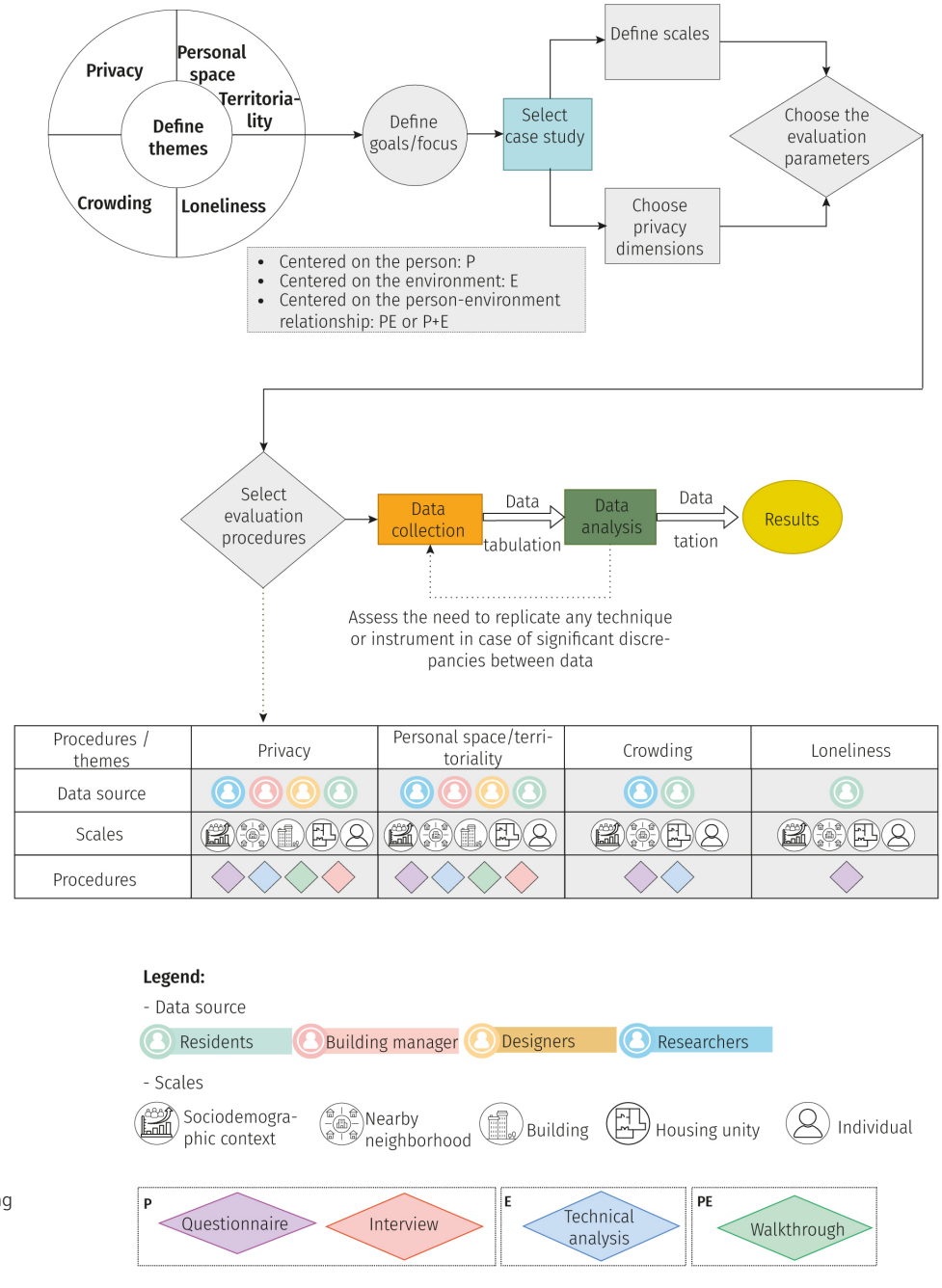


Figure 2 – Preliminary housing privacy evaluation model.
Source: Macedo (2023).

Validate preliminary model: expert panel.

A procedure used to validate a model is an evaluation by experts in the field (Caixeta, 2015; Logsdon, 2019; Romano, 2003), which corresponds to experts' opinions on a topic to guarantee greater reliability of the study (Pinheiro; Farias; Abe-Lima, 2013). By bringing together different points of view and analyses, the panel can contribute to elucidating the phenomenon or situation under study, as well as to reduce possible methodological biases (Elali; Pinheiro, 2013).

The work carried out included a panel of experts that had to verify whether the objectives set were achieved; certify the quality of the model generated; analyze whether the procedures adopted would enable incorporating new knowledge in the area. This was based on seven questions (Table 1) relating to the scope, operability, precision (or simplicity), empirical validity, importance, and replicability of the model (Elangovan; Rajendran, 2015; Holton; Lowe, 2007).

The panel included 12 university professors with a background in architecture, psychology, or engineering. They were selected based on their skills in the field of housing. They received, via email, a document with the analytical schemes (Figure 1 and Figure 2) and the questions related to the model validation (Table 1) that contained spaces for comments on potentialities and difficulties encountered in the interpretation and applicability of the model.

Table 1 – Questions raised to evaluate the preliminary conceptual model.

Assessment criteria		Paisagem
Comprehensiveness	1	Are there any parameters that could be added or removed?
	2	Are there any instruments that could be improved, added, or removed?
	3	Have the housing privacy assessment parameters been adequately identified?
Operability	4	Are the assessment procedures suitable for the different actors, scales and parameters involved in housing privacy?
Precision / Simplicity	5	Can it be used by residents, designers and/or managers to analyse privacy in homes?
Empirical validity	6	Can it help to define behavioural measures that alleviate any problems detected in the field of housing privacy in this type of development?
Empirical validity/ Importance/ Replicability	7	Can it support the development of design or space management solutions to be used in similar projects?

Source: Macedo (2023).

The panel results demonstrated the comprehensive evaluation criteria of the preliminary model – but needed further details about the items evaluated and how they were evaluated, better defining their relationships and scope. Regarding operability, it emphasized the need for greater depth in the evaluation procedure and the requirements and criteria taken into consideration. The model was deemed accurate and simple for application in different housing privacy analyses by different actors. Regarding empirical validity, experts pointed out the difficulty or unfeasibility of defining such measures to delimit behavioral measures that alleviate privacy concerns. Finally, in terms of importance and replicability, the experts state is relevant for the model to support new research and project solutions, if some adaptations are made.

Pre-test of the preliminary model: Exploratory study

After the experts validated the preliminary model, its empirical application was carried out in an exploratory study. The goal of the pre-test was to test and demonstrate the different ways of converting the model into practical applications. As the research intended to evaluate apartments, the study object was a multiple towers apartment block, whose units presented several solutions in the spatial organization (design), as well as small-sized living spaces.

The decision to consider small apartments is justified by the difficulty these spatial organizations have in achieving satisfactory quality levels, from an ergonomic point of view as well as when compared with housing quality programs (Nascimento; Tostes, 2011; Pedro; Boueri, 2012; Pereira, 2017; Macedo, 2018). This reality makes it difficult for families to adapt to this standard of apartments (Mendonça, 2015; Zago; Villa, 2017) and tends to reveal major problems related to privacy and lack of personal space for residents.

Deciding on multiple tower buildings[6] is due to the larger network of social relationships that can be developed between neighbors, the greater proximity between towers and the sharing of recreational areas, which can give rise to aspects related to territoriality. The geographic focus is a continuation of studies regarding the quality of housing projects (Macedo, 2018) in Natal (RN), Brazil. Therefore, as privacy problems and perceptions related to the neighborhood tend to be more obvious in this typology, this was the study object selected.

Through a multi-method strategy, using different analysis instruments about project, designs, behavior, perception and user satisfaction, the empirical research on screen was supported by the methodological procedures of the Post Occupancy Evaluation (POE), to execute the steps described in the preliminary model.

The Apartment complex chosen

The apartments complex chosen – study object – are in the city of Natal (RN) on a land area measuring 39450m² and has 900 units distributed across 6 towers (Figure 3). The minimum apartment program consists of at least 2 bedrooms, living and dining room, balcony, kitchen, laundry area, circulation area, and bathroom. The differences are mainly regarding the number of bathrooms or bedrooms (which could be 2 or 3), the presence of a garden or a private leisure area. Therefore, the apartment complex selected has five types of plans distribution and spatial organization (Figure 3), with built areas of 49.61m², 55.00m², 67.35m², 89.19m² and 129.97m².

The common area of the condominium (Figure 3) is located on the ground floor and offers a leisure area with: entrance with covered access, public squares, two swimming pools and deck, sports courts, two playgrounds, barbecue area, pet area and parking. The projection areas of the towers on the ground floor include party room, gym, toy/entertainment area, youth space, auditorium, and administrative areas.

[6] In Brazil, from the 2000s onwards, the real estate market adopted a housing mode called "club condominium", whose main characteristic is a vast collective leisure structure shared between different apartment towers (with apartments offered in different areas), which prioritizes offering different private utilities and selling a feeling of security when these spaces are used.

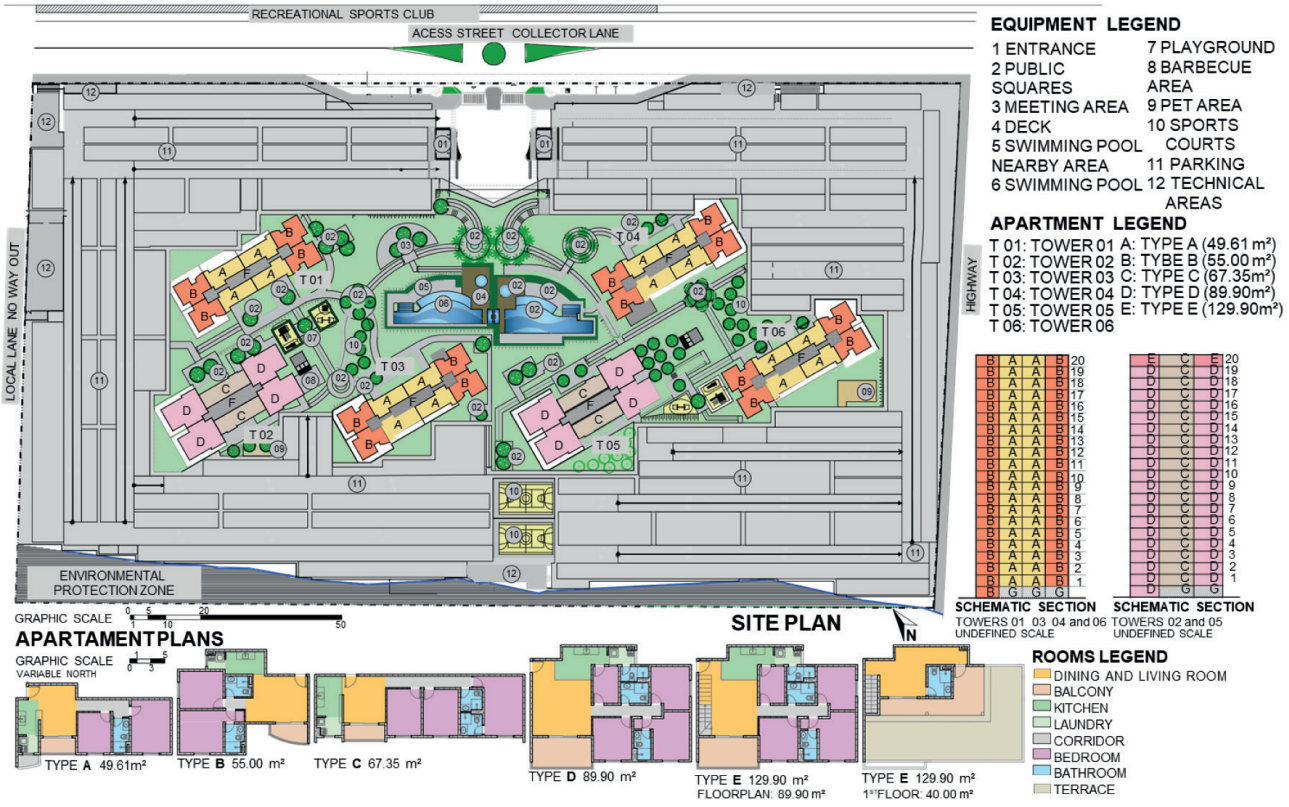


Figure 3 – Site plan and design schematic drawings of the apartment complex chosen.
Source: Macedo (2023).

Data collection

The following were methodological procedures used in the exploratory study: walkthrough, questionnaire, interview, space syntax analysis of the unit. Data collection comprised visits to the apartment complex to become familiarized with the spaces, building managers and residents; and to collect information about uses of the common areas and those responsible for the architectural design. The instruments with user participation, questionnaires, and interviews, were applied by the researcher, after the participants' consent.

The residents, in person and online, participated in the questionnaires, and the return rate was 42 valid questionnaires. The following were the main objectives of its application: identify the residents' sociodemographic characteristics and personality traits (Rammstedt; John, 2007); identify the participant's concept of privacy and home; assess the level of satisfaction with privacy and inconvenience perceived inside the unit; identify strategies to combat invasion of privacy; evaluate perceptions of crowding, by checking the inadequacies of the environment and the level of stress (Campagna, 2016), as well as measuring the participants' loneliness scale (Hughes *et al.*, 2004).

The interviews were prepared with semi-structured scripts, open-ended questions and applied in person. A total of 6 participants were interviewed, including: 4 building managers, 1 architect and 1 resident. The focus of the interview with the building managers was to understand the use of common spaces, especially in aspects related to territoriality and perceived nuisances (Pereira, 2017); identify the most used spaces and who used them; establish which privacy complaints were most recurrent among residents and whether there were conflicts related to the use of common spaces or between units. In the interview with the architect, the main goal was to identify

the most relevant criteria for designing the housing projects, and how privacy was proposed to meet the residents' needs. In the interview with the resident, issues related to privacy, personal space and territoriality were addressed. The objective was to better comprehend the residents' privacy needs, identifying personal spaces and the patterns of use related to them, and family functioning (Munro; Madigan, 1993), by understanding conflict management, neighborhood relations and the residents' needs that had not yet been met (Ozaki, 2002) in their homes and common areas. The interviews addressed questions about the impacts of the COVID-19 pandemic on the participants' perceptions of privacy. Furthermore, in the interview with the architect, technical drawings of the architectural projects were requested and in the interview with the resident, the participant described the plan and layout of her residence. This graphical information enabled physical and social assessments of the project and the built environment.

The researchers prepared the instruments for physical and social assessment, without the users' direct participation, namely: walkthrough and space syntax analysis of the unit. The walkthrough consisted of technical visits to diagnose the physical and behavioral conditions of the nearby neighborhood and common areas of the apartment complex. The nearby neighborhood was assessed in the immediate surroundings (Day, 2000) through a research evaluation of the physical features (roads, sidewalks, and adjacent accesses), the existing facilities (urban equipment within a radius of 500m), the presence of socio-environmental problems and pathological manifestations (on the sidewalks and walls of the building of the apartment complex). The common areas of the building were assessed by the access legibility conditions, presence of green areas and places where groups gathered (territoriality). Furthermore, some interpersonal distances were measured (Pereira, 2017) such as: distances between towers and their immediate neighborhood and main noise sources; distances between windows in different towers and the ground floor windows and the passage routes (circulations of common areas).

For space syntax analysis of the unit, the plan described by the interviewed resident was converted into an access graph, externally rooted. This graph was used to quantify the movement accessibility relationships (convexity)[7], measuring the syntactic measures[8] of mean depth and the RRA. The design was also used for visibility analyses, in which the isovista from the entrance and the VGA were processed. These analyses allowed the understanding of the public-private relations inside the houses and contemporary trends in the use of living spaces (Ozaki, 2002).

Discussion of the results of the empirical and exploratory evaluation based on the preliminary model.

Despite the limited number of respondents, the results of the empirical application revealed some trends regarding the participants and apartment complex under study:

- Family composition: the nuclear family predominated, made up of young adults, average age 36 years old, with children.

[7] In space syntax terms, accessibility relates to access possibilities or restrictions to a certain space (Hanson, 1998) and, therefore, does not refer to physical and informational accessibility associated with the possibilities and conditions of reach, perception and understanding by people with disabilities or reduced mobility.

[8] Syntactic measures are briefly defined as follow: *depth*: is the number of topological steps in a structure, with mean depth being the average topological distance of this configuration (Hanson, 1998); *RRA*: measures the accessibility potential of a space in relation to all other spaces in a system, so that more distant values, greater than 1.00 (reference measure) represent more segregated environments, while values closer and less than 1.00 more integrated environments (Hanson, 1998); *isovist*: the visual field of each point on a design plan, that is, the volume of space directly visible from a given location (UCL – Space Syntax, 2021); *VGA*: visibility graph that is generated when the isovists of all spaces are superimposed, representing the mutually visible points in a spatial configuration (UCL – Space Syntax, 2021).

- Density: average of 3 people/unit and the area per resident with an average above 16m²/inhabitant, which meets international parameters of minimum area per inhabitant, close to 12m²/inhabitant (Macedo, 2018). In cases where the density was 5 people/unity, the area per inhabitant was 11m²/inhabitant, which could compromise the use of space and domestic activities.
- Personality traits: respondents have high averages for extroversion and agreeableness, conscientiousness (discipline) and open to new experiences, with low averages for neuroticism (emotional instability), which may justify the low level of stress measured.
- Meaning of home and privacy: clear convergence between the two concepts (Elmansuri; Goodchild, 2019), both mostly classified as a place where the person feels comfortable. The relationship between the two concepts was identified with the idea of family and relaxation (Elmansuri; Goodchild, 2019; Maia, 2012; Munro; Madigan, 1993; Willems; Smet; Heylighen, 2020), both of which are also conceptualized from the perspective of environmental control and aesthetics.
- Satisfaction with privacy: respondents reported a high level of satisfaction, and reported low frequency of inconveniences, reaffirming the positive correlation between user satisfaction and the positive perception of privacy (Kaya; Erkip, 2001).
- Privacy invasions: the main problem inside the apartments was due to unwanted noise, followed by unwanted smells, lack of space and inadequate temperature, revealing the importance of thermal comfort (Al-Kodmany, 2000; Amole, 2005; Gosling *et al*., 2005; Hashim *et al*., 2006) and domestic activities (Al-Kodmany, 2000; Willems; Smet; Heylighen, 2020) related to privacy perceptions.
- Crowding: difficulties were identified in receiving visitors and organizing objects as desired by the person, which interferes with the possibilities of choice and control that the individual has over space (Amole, 2005; Sobh; Belk, 2011). However, as the level of stress measured was low or moderate, despite these limitations, the inadequacies were not preponderant to the point where residents felt 'crowded'.
- Loneliness: levels of loneliness were low, with only occasional mentions of feelings of lack of social support and isolation.
- Coping strategies against unwanted contact: they were related to using architectural elements such as doors and curtains (Saugo; Martins, 2012), which indicates that the regulation and control of privacy were mainly associated with the physical environment and strategies to avoid contact (Amole, 2005).
- Public-private relations in the home: the social sector continues to be the most open to external influences, with greater visual and movement accessibility. There was greater openness of the kitchen as a more integrated place, converging with contemporary dining trends. In the intimate sector, even though its characterization as a space of seclusion remains, with its visual privacy preserved, there was greater integration in the possibilities of movement, indicating families' more openness to outside world influences. The main exclusion space in the house was the laundry area, with a low degree of physical and visual accessibility.
- Relations between neighbors and sense of community: the formation of groups with similar characteristics in common use spaces was identified, which indicates territorial appropriation in the use of these spaces and may be an indication of a sense of community.

- Neighborhood relationships: the absence of socio-environmental problems, the presence of green areas, good conditions of access and maintenance of common use equipment positively influenced users' perceptions of privacy and the existence of a sense of community among residents, which points to a possible relationship between the perception of a safe neighborhood and territorial appropriation (Brunson; Kuo; Sullivan, 2001). On the other hand, the urban facilities in the nearby neighborhood, such as a recreational club and a highway, the setbacks among towers, and the unfavorable placement of tower related to conditions of environmental comfort, negatively impacted the perceptions of nuisance among some residents.
- Impacts of COVID-19: there were only a few indications regarding an increase in the frequency outdoor spaces were used, which reveals few impacts on the respondents' perception. This does not prevent, for example, that a greater temporal distance from the event changes the perception about this differentiation.

Despite the limitations regarding the number of respondents, the results indicate that the apartment complex under study satisfactorily met the privacy needs of a portion of the participating residents, despite highlighting the inadequacies that could be lessened by other design solutions. This relative satisfaction was based on the positive results of satisfaction with privacy, the relatively low frequency of all nuisances, the low perceptions of stress, crowding and loneliness and the peaceful coexistence between neighbors, with apparent personal bonds between neighbors and environmental affections with the place.

However, as Munro and Madigan noted, it is true that most people have positive images of their home, which could be sometimes "[...] unhelpful as an indicator of how they live their lives" (Munro; Madigan, 1993, p. 43). So, it is noteworthy that the satisfaction detected may not necessarily reflect that the housing project fully and satisfactorily met the privacy desires and needs of all residents regarding this type of housing development. As it involves two closely related themes to the self (privacy and the home, as a primary territory), there may be biases related to the 'social expectation of responses' or the 'cognitive dissonance' of the respondents, which did not allow detecting negative opinions. This indicates that the study of the correlation between satisfaction and adequacy of the project to the needs of residents should be expanded in future research.

Final Model

On the one hand, the comments obtained by the panel of experts suggested nomenclature adjustments, changes in the sequencing of the model's steps and, mainly, greater detail of the evaluated items and their evaluation procedures, to better describe performance indicators, evaluation criteria and requirements. On the other, the pre-test showed how to prepare the evaluation instruments and clarified how to measure criteria and performance requirements necessary to evaluate privacy in homes. Based on these evaluations, the preliminary model was improved, and a final model (Figure 4) was created that went from 9 to 12 steps, incorporated semantic changes, and included more details about the aspects evaluated.

Explanatory tables (Figure 5, 6,7, 8 and 9) were created for each performance indicator to better detail the evaluated items in an advisory card with theoretical and methodological explanations about their relationship and their forms of measurement when applied empirically. Each card contains: (a) definition of the indicator; (b) main relationships it is involved with; (c)

its focus; (d) evaluation methods, indicating the instruments to assess them; (e) data sources; (f) possible performance criteria or evaluation requirements; (g) main interactions with other indicators. The tables developed for consultation reflect the generic results of the SLR and the exploratory study.

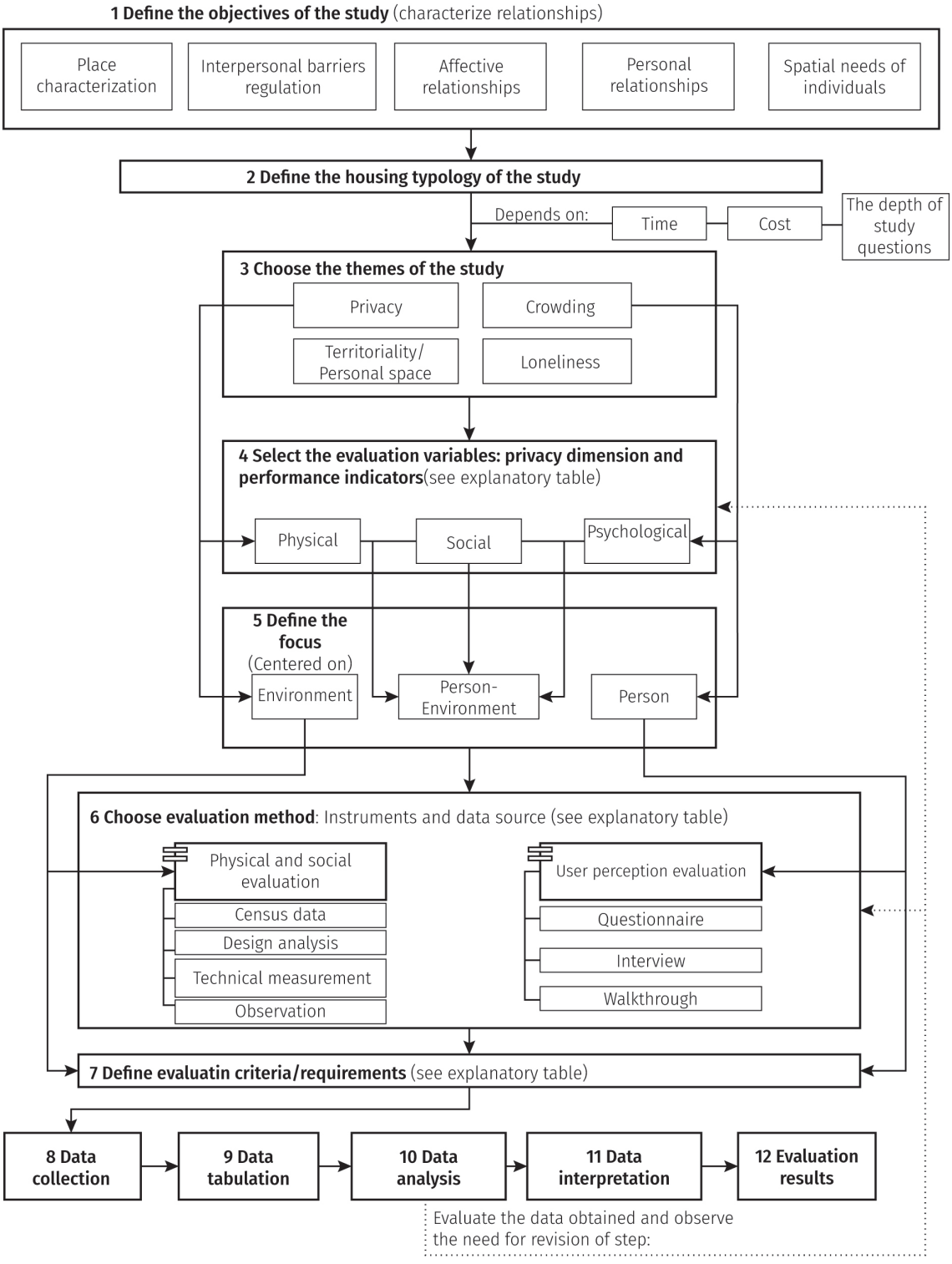


Figure 4 – Housing privacy evaluation model

Source: Macedo (2023).

Spatial organization

The way domestic spaces are distributed, according to the functions in the house

Related relationships	Main focus
1 2 4 5	Environment
Research method	**Data source**
◆	● ●
Criteria/requirements	**Related indicators**
-Public-private relationship inside the house (between domestic spaces)	- Architectural elements - Culture - Accessibility hierarchy - Control - Boundaries demarcation - User preferences

Architectural elements

Built elements, such as: doors, windows, Partitions, landscape elements,number of Rooms/bedrooms, ceiling height.

Related relationships	Main focus
1 3 4	Environment
Research method	**Data source**
◆ ◆	● ● ●
Criteria/requirements	**Related indicators**
- Distance between windows - Distance from noise sources - Room height - Noise level - Room temperature - Presence of green area	- Spatial Organization - Neighborhood - Control - Coping Strategies - User Satisfaction - User Preferences

Neighborhood

Qualitative and quantitative characteristics of the physical atributes of the immediate neighborhood

Related relationships	Main focus
1 2 3 4 5	Environment
Research method	**Data source**
◆ ◆ ◆ ◆ ◆	● ● ● ● ●
Criteria/requirements	**Related indicators**
- Nearby urban spaces - Presence of vandalism or Abandoned objects/ areas - Presence of green area (Afforestation) - Parking area	- Architectural elements - Social interactions - Control - Boundaries demarcation - Coping strategies

Density

Relationship between the number of people and a given area.

Related relationships	Main focus
1 2 3 5	Environment
Research method	**Data source**
◆ ◆	● ● ●
Criteria/requirements	**Related indicators**
- Density of neighborhood (People/acre) - Density of the housing unit (People/m²) - Density per room (People/room)	- Neighborhood - Housing tipology - Control - Boundaries demarcation - Stress

Personal objects

Appropriation of domestic spaces, by arranging elements such as furniture, decorative objects or photographs

Related relationships	Main focus
1 3 4	Person-environment
Research method	**Data source**
◆ ◆ ◆ ◆	● ● ●
Criteria/requirements	**Related indicators**
- Relationship between objects and personality traits - Meaning of objects and place - Appropriation patterns	- Architectural elements - Control - Boundaries demarcation - User satisfaction - Meaning of home - Personality traits

Housing tipology

Architectural solutions mainly related to the arrangement of buildings in the settlement/plot.

Related relationships	Main focus
1 2 4 5	Environment
Research method	**Data source**
◆ ◆ ◆	●
Criteria/requirements	**Related indicators**
- Public-private relationship between the house and the Neighborhood - Territorial appropriation Patterns - Desired level of privacy	- Neighborhood - Social interactions - Control - Boundaries demarcation - User preferences

Figure 5 – Explanatory table to support housing privacy assessment - physical dimension.

Note: see legend on Figure 9.

Source: Macedo (2023).

User satisfaction

Measures whether and to what extent the home's built environment meets the residents' needs and expectations

Related relationships	Main focus
1 2 3 4 5	Person-environment
Research method	**Data source**
◆◆◆	●
Criteria/requirements	**Related indicators**
- Perceived inconveniences - Desired/obtained level of privacy - Satisfaction with housing or privacy	- Spatial organization - Social interactions - Boundaries demarcations - Domestic activities - Personality traits

User preferences

Represents users' desires or the preference of one or several aspects over others

Related relationships	Main focus
1 3 4	Person
Research method	**Data source**
◆◆◆	
Criteria/requirements	**Related indicators**
- Desired level of privacy - Desires regarding the home (Ideal house) - Reasons for reforms reasons for purchasing house	- Personal objects - Domestic activities - Boundaries demarcations - User satisfaction

Stress

Result of interaction between the individual and their context, resulting in a situation where the desired privacy is not achieved.

Related relationships	Main focus
1 3 5	Person-environment
Research method	**Data source**
◆◆	●●
Criteria/requirements	**Related indicators**
- Assessment of inadequacies in the home environment or environmental stressors - Individual's stress level	- Social interactions - Control - Boundaries demarcation - User satisfaction

Meaning of home

Representation and symbolization of the people's identity, lifestyle and history and the relationships established in the home

Related relationships	Main focus
3 4 5	Person-environment
Research method	**Data source**
◆◆◆	●●
Criteria/requirements	**Related indicators**
- House concept - Privacy concept - Meaning of objects and spatial organization	- Personal objects - Social interactions - Control - Boundaries demarcation - User satisfaction

Social support

Perceived support that people have regarding the social relationships they establish with others.

Related relationships	Main focus
3 5	Person
Research method	**Data source**
◆◆	●
Criteria/requirements	**Related indicators**
- Number of known neighbors and degree of intimacy - Perception of people available for everyday situations (family or friends)	- Social interactions - Stress - Density

Personality traits

Psychological characteristics that represent tendencies in people's ways of thinking and feeling, and in the behavior expected of them.

Related relationships	Main focus
2 4 5	Person
Research method	**Data source**
◆	●
Criteria/requirements	**Related indicators**
- Personality statements - Statements about attitudes/behaviors in everyday situations	- Personal objects - Boundaries demarcations - User satisfaction - User preferences

Figure 6 – Explanatory table to support housing privacy assessment - psychological dimension.

Note: see legend on Figure 9.

Source: Macedo (2023).

Social interactions

Interpersonal relationships that are established and take place in terms of housing, especially intimate ones (family or neighbors).

Related relationships	Main focus
2 3 4 5	Person-environment
Research method	**Data source**
Criteria/requirements	**Related indicators**
- Ways of negotiating the use of spaces and its conflicts - Sense of belonging - Sense of community - Dgree of intimacy between neighbors	- Neighborhood - Culture - Accessibility hierarchy - Control - Domestic activities - Social support

Culture

Reflect desired proxemic patterns of physical privacy and social contact related to housing

Related relationships	Main focus
2 3 4 5	Person-environment
Research method	**Data source**
Criteria/requirements	**Related indicators**
- Degree of privacy desired/obtained in each domestic activity or room - Public-private relationship of living spaces	- Acessibility hierarchy - Control - Domestic activities - User preferences - Meaning of home

Acessibility hierarchy

Reveal implicit social relationships, which indicate common behaviors and privacy levels of a spatial organization

Related relationships	Main focus
2 4 5	Person-environment
Research method	**Data source**
Criteria/requirements	**Related indicators**
- Degree of accessibility [1] - Accessibility inequality [2] - Degree of access control	- Spatial organization - Architectural elements - Culture - Control - Boundaries demarcation - Domestic activities

Control

Individual or group ability to express one's desire for greater or lesser social contact.

Related relationships	Main focus
2 3 4 5	Person-environment
Research method	**Data source**
Criteria/requirements	**Related indicators**
- Presence of architectural elements - Types/patterns of demarcation - behaviors against invasions of territories or privacy	- Spatial organization - Architectural elements - Culture - Accessibility hierarchy - Boundaries demarcation - Personal objects

Boundaries demarcation

Marking ownership of an object or space, by the presence of physical or symbolic barriers

Related relationships	Main focus
2 4 5	Person-environment
Research method	**Data source**
Criteria/requirements	**Related indicators**
- Meaning of the place - Appropriation/personalization patterns - Relationship between objects/spaces and their defense	- Architectural elements - Social interactions - Control - Coping strategies - Meaning of home

1 In terms of privacy, the accessibility hierarchy is related to access possibilities or restrictions (movement or visual) to a given space. It is not, therefore, the concept of accessibility, related to universal design and associated with the possibilities and conditions of reach, perception and understanding by any people, particularly those with disabilities or reduced mobility.

2 Comparative analysis of integration values between environments, organizing them from the lowest (higher integration) to the highest value (lower integration).

Continue...

Figure 7 – Explanatory table to support housing privacy assessment - psychological dimension.

Note: see legend on Figure 9.

Source: Macedo (2023).

Acessibility hierarchy		Control	
An individual's (or group) reactions in a situation of stress or discomfort when unable to achieve the desired level of privacy		How the environment functionally responds to the needs, values, objectives and lifestyle. of its residents and how they interact.	
Related relationships	**Main focus**	**Related relationships**	**Main focus**
② ④ ⑤	Person-environment	② ③ ④ ⑤	Person-environment
Research method	**Data source**	**Research method**	**Data source**
◆◆◆◆	●●	◆◆◆◆	●●●●●
Criteria/requirements	**Related indicators**	**Criteria/requirements**	**Related indicators**
- Ways of negotiating the use of spaces - Presence of architectural elements - Behaviors against invasions of territories or privacy	- Architectural elements - Social interactions - Culture - Control - Boundaries demarcations - Stress	- Activity diary - Who can participate and time spent on activities - Level of privacy desired/obtained through domestic activity	- Spatial organization - Social interactions - Accessibility hierarchy - Control

Figure 8 - Explanatory table to support housing privacy assessment - psychological dimension (continuation).

Note: see legend on Figure 9.

Source: Macedo (2023).

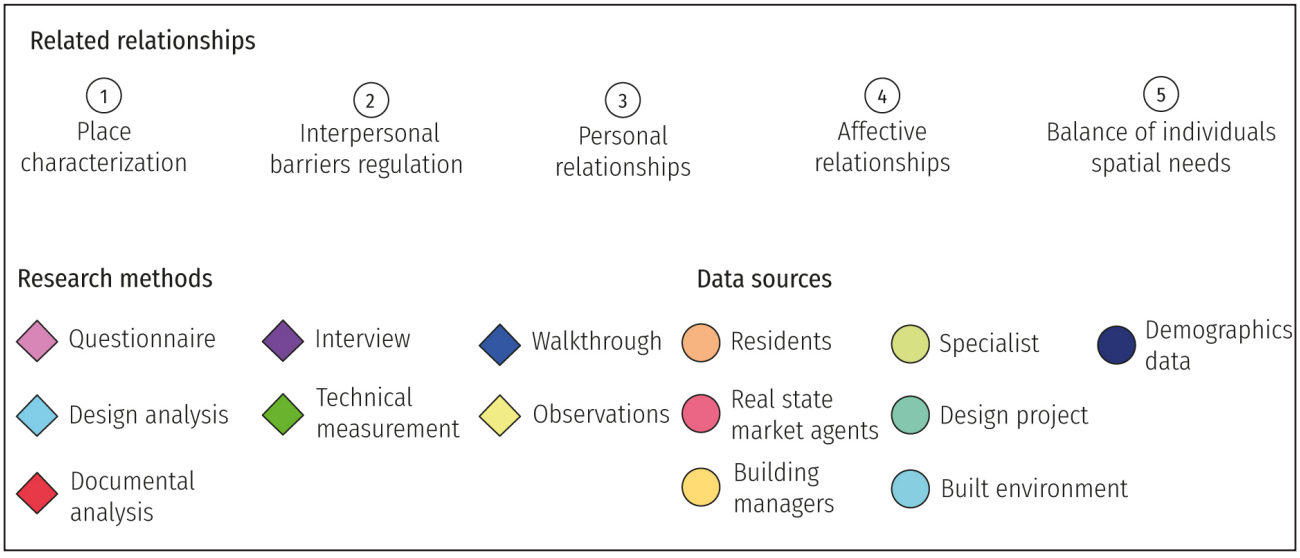


Figure 9 – Explanatory table legend.

Source: authors (2024).

Given the results, the housing privacy evaluation model can be considered a standard for future research on privacy, crowding, territoriality, personal space, and loneliness in housing, supporting future studies that want to work on each topic individually or jointly. With regards to using the model, each researcher can add suitable instruments, criteria, and performance requirements to their investigation, if they appropriately correlate them with each dimension and privacy themes.

From this perspective, developing the model elucidates on following possible paths to assess housing privacy, especially in apartments, as it illustrated possible repercussions of these assessments in the theoretical and practical spheres. From a theoretical-methodological point of view, the model developed suggests that physical, social, and psychological attributes can be

studied separately to achieve results focused on a more specific and normally quantitative objective, or combined, in studies that want to further explore the subjectivity of privacy relationships. In this process, choosing the instruments and user participation (or not) depends on the approach that is to be elucidated. The model determines that the research objective to be defined must be based on the relationships that the researcher wishes to study, and this choice will influence all subsequent stages related to the housing typology to be studied, themes of privacy, focus, variables and evaluation methods, criteria, and performance requirements. In addition to illustrating the findings of the SLR carried out, these results also be part of the theory they represent, an objective that is pursued when developing conceptual models.

From the point of view of the design practice, the results of the empirical application of the model revealed some improvements that can be considered when designing new projects or retrofit of existing buildings, such as those related to acoustic performance between units, thermal and ergonomic (dimensional) comfort. Therefore, within the scope of the post-project stages, the results of applying the model and its advisory frameworks demonstrated their potential to support creating diagnoses as regards the existing reality, and the elaboration of a framework of recommendations with design guidelines on the potentialities and difficulties found in each case study. Moreover, these assessments can support design decisions for retrofitting buildings in use or for the design of new projects, even in the pre-project stages.

However, as the objective of creating the model was to illustrate different approaches and focus for assessing housing privacy, it did not measure quantitative values related to quality measures in this field, as in other housing quality assessing initiatives.

Therefore, the emphasis on the need to expand more specific discussions on how to address privacy needs in architectural projects, defining, for example, 'minimum', 'recommended' or 'optimal' standards for distances between windows, between these and external circulation, between windows and noise sources or even distances or decibels desired by activities and rooms. By establishing these standards, it is possible to discuss design solutions to achieve each of these requirements from the pre-project stages, such as the design of solutions to locate multiple towers with suitable distances or define construction materials with acoustic performance that is suitable for different domestic activities.

By following the steps presented in the contextualization, this model reinforces the need to follow rigorous scientific procedures to understand phenomena endowed with scientific validity. It is especially noteworthy that the critical analysis of the experts' comments and the application of the pre-test constituted an important contribution to the proposal, which allowed the model to evolve.

It is therefore understood that the results found can be consistent with existing knowledge and contribute to its evolution. Therefore, the proposed model demonstrated the potential to clarify the relationships created between the main privacy constructs.

Final Considerations

Throughout the investigation and construction of the model, it is noteworthy to highlight some contributions relating to theories, methods, and practices in housing architecture. The first contribution refers to disseminating and increasing the modelling process in research on the design process. By presenting data on the steps and requirements necessary to construct conceptual models, the review contributed to expanding the ways in which models can be applied in architecture, without restricting it to just graphical representation.

The model for evaluating housing privacy presented here is wide-ranging regarding the different aspects that involve it and uses its main dimensions (physical, social, and psychological), focus (person, environment, person-environment relationship) and scales (sociodemographic context, nearby neighborhood, building, housing unit and individual) as theoretical support. Thus, it was used as a basis to define the requirements and criteria for evaluating housing privacy, which served as pillars for selecting performance indicators suitable for evaluating privacy.

The results demonstrate that developing the analytical schemes portray the objectives for which they were intended, since they illustrate the fundamental theory about the phenomenon; reduce the inherent subjectivity in these studies; create a guide to assist in research development to assess architectural objects and socio-spatial behavior, which can be replicable in different housing case studies.

By interpreting and representing the relationships that exist between the elements seen as essential to the question raised, the proposed model contributes to the practice of housing design, providing guidance on employing useful tools so as to evaluate projects and built environments, which can incorporate digital technologies to allow and facilitate different evaluation formats, such as remote or hybrid ones, thereby expanding user participation and disseminating knowledge among researchers and professionals in the field. Therefore, by pointing out potentialities and problems of the cases under study, assessments applying the model can result in recommendations that increase the quality of the housing project in the different stages of its process.

Despite this optimistic perspective, as the empirical application did not reach a statically relevant number of participants, the results obtained cannot be generalized. Currently, they are only an indication of the potential use of this instrument. Thus, the main limitations of the proposed model are the need to quantitatively define performance criteria and requirements; the need to be applied in different contexts to confirm its applicability in different realities; the low statistical accuracy of the relationships between performance indicators, due to the lack of regression or significance tests, for example. However, these limitations can be overcome by developing different pilot applications, testing whether and how instruments and variables adapt to different sociodemographic contexts, and establish statistical correlations between variables, criteria, and requirements, only testing it qualitatively with the SLR results. Notwithstanding these limitations, it is understood that the investigation met the proposed objective. It enabled defining performance indicators and methods for evaluating housing privacy, which associated with physical, social, and psychological attributes, can potentially enable developing privacy diagnoses considering the environment and users' perception.

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