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Aging in Place and Habitability Vulnerability: Structuring and Applying the IVH-30

Aging in Place and Habitability Vulnerability: Structuring and Application of IVH-30

Home aging and housing vulnerability: structure and application of IVH-30

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Summary

Aging in place involves a person remaining in their usual environment throughout aging, in continuous interaction with the physical, social, and technological characteristics of that environment. Contemporary literature demonstrates that functional capacity in old age cannot be understood solely from individual characteristics, since environments also contribute to the conditions that favor or restrict functional capacity. In this context, I present Habitability Vulnerability as a perspective to analyze the relationship between occupant demands and the conditions offered by the residential environment, and I present the structure of the 30-item Habitability Vulnerability Index (IVH-30), conceived as a tool for dimensional analysis of residential habitability (see Lawton & Nahemow, 1973; Luciano et al., 2020). For the purposes of this article, the IVH-30 is presented based on its structure composed of five macro-dimensions—Safety, Comfort, Equity of Use, Privacy, and Belonging—articulated within a multi-level micro, meso, and macro approach. The article also distinguishes between decisional autonomy and functional independence and discusses contributions from environmental gerontology, aging-in-place, gerontechnology, assistive technologies, smart homes, person-building interaction, and continued care. No clinical, psychometric, statistical, or predictive properties are attributed to the IVH-30 unless demonstrated. The aim is to conceptually situate the index within the international debate on aging and the residential environment, distinguishing the scientific literature, the author's research, the interpretation developed in this article, and possibilities for future investigation.

Keywords: *Aging in Place;* Habitability Vulnerability; IVH-30; Environmental Gerontology; Gerontechnology; Assistive Technologies; Housing.

Abstract

Aging in place involves remaining in one's usual home environment throughout later life in continuous interaction with physical, social, and technological environmental conditions.
Contemporary literature demonstrates that functional ability in later life cannot be understood solely through individual characteristics, since environments also contribute to the conditions that support or constrain functional ability. Within this context, I present Habitability Vulnerability as a perspective for analyzing the relationship between occupants' demands and residential environmental conditions, and present the structure of the 30-item Habitability Vulnerability Index (IVH-30), developed within my research. For this article, the IVH-30 is presented according to its structure comprising five macro-dimensions — **Safety, Comfort, Equity of Use, Privacy, and Belonging** —

articulated with a **micro-, meso-, and macro-level** approach. The article also distinguishes decisional autonomy from functional independence and discusses contributions from environmental gerontology, aging in place, gerontechnology, assistive technologies, smart homes, human-building interaction, and long-term care. No clinical, psychometric, statistical, or predictive properties are

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attributed to the IVH-30 beyond what has been demonstrated. The aim is to conceptually position the index within the international debate on aging and residential environments, distinguishing scientific literature, the author's research, the interpretation developed in this article, and possibilities for future investigation.

Keywords: Aging in Place; Habitability Vulnerability; IVH-30; Environmental Gerontology; Gerontechnology; Assistive Technologies; Housing.

1. Introduction

Population aging has increased scientific interest in the possibility of remaining in familiar environments throughout old age. The concept of *aging in place,* however, is not limited to to physical residence in a particular home. The literature shows that aging in a place It involves relationships between the person, the dwelling, the neighborhood, the available resources, and the possibilities. of participation and support that exist in these environments.

Sixsmith and Sixsmith (2008), in a qualitative study conducted with 40 people between 80 and 89 years old in In northwest England, they analyzed the benefits, problems, and challenges associated with aging in place. The authors observed that staying at home may be related to quality of life, but it can also be compromised by physical conditions of the residence and neighborhood, isolation and limitations of support networks.

This perspective finds its counterpart in the contemporary model of healthy aging. from the World Health Organization. Functional capacity is understood in relation to The person's capabilities and the environments in which they live. The WHO highlights that physical environments and social factors contribute to functional capacity and the ability of people to live a normal life. in a way that is compatible with your goals and needs.

In the field of environmental gerontology, this discussion is close to the ecological model of aging, as developed by Lawton and Nahemow (1973), which highlighted the relationship between a person's capabilities and the demands of the environment. The model has become a reference for Understanding the person-environment relationship in aging.

Housing, therefore, constitutes one of the fundamental environments for the experience of aging. Luciano et al. (2020) discuss the need for a specific framework for thinking about aging. Housing suitable for the elderly, relating characteristics of the residential environment to The possibility of aging in a place with autonomy and independence. It is in this field that I situate the concept of **Habitability Vulnerability.** In the formulation of my According to research, the concept is related to the mismatch between the conditions offered by housing and the occupant's capabilities and needs.

The 30-item Habitability Vulnerability Index (IVH-30) was designed as a

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dimensional analysis tool for residential habitability (see Lawton & Nahemow, 1973;
Luciano et al., 2020) as a framework for habitability vulnerability analysis.
In this article, I present this structure in a delimited manner, without attributing any properties to IVH-30.
that are not demonstrated and without reconstructing their categories from external literature.
The objective is to conceptually situate the IVH-30 within the international debate on *aging in place.*
environmental gerontology, technologies and housing, preserving the structural information of the index
made available for this work.

2. Aging in Place and the Person-Environment Relationship

Aging *in place* is a multidimensional issue. Remaining in one's own environment throughout the
Aging depends not only on the physical conditions of the residence, but also on relationships.
social services, available services, neighborhood, and conditions that allow for the continuation of life.
everyday life.

Sixsmith and Sixsmith (2008) demonstrated that aging in place can involve experiences
Positive aspects related to familiarity and remaining in a known environment, but also challenges.
associated with housing, neighborhood, isolation, and support networks.
This understanding also appears in studies that investigate the relationship between characteristics of
residence, community characteristics, and intention to age in the place. Choi (2022), by
For example, it examined the relationship between *age-friendly* characteristics of the residence and the community.
perception of community suitability and intention to age in the place, considering processes
of belonging and agency in person-environment interaction.
Housing, therefore, should not be analyzed exclusively as a set of elements.
constructive.

It constitutes the space in which daily activities are carried out and relationships are built.
familiarity and identity are established, and different forms of interaction with other people and with
care resources.

The person-environment approach allows us to understand that the same environmental characteristic can
producing distinct effects depending on the occupant's abilities, preferences, and needs.
It is in this sense that habitability vulnerability can be understood as a condition.
relational.

3. Decision-making autonomy and functional independence

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A key distinction for the proposed discussion is that between **decisional autonomy** and **functional independence.**

Functional independence is related to the ability to perform certain activities without Direct assistance from another person. Decision-making autonomy, in turn, refers to the possibility of To make choices and participate in decisions that concern one's own life.

The two concepts are related, but they are not equivalent.

A person may need assistance with a particular activity and, at the same time, maintain... ability to decide how this activity will be carried out.

This distinction is especially important in a residential setting.

An architectural intervention can reduce a particular functional difficulty, but it can also... to limit choices, preferences, or ways of appropriating space.

In my research, this distinction constitutes an important principle for considering interventions. residential facilities geared towards the elderly. The material that underlies this article emphasizes that... Reducing limitations on functional independence should not come at the expense of decisional autonomy. of the resident.

The WHO's perspective on healthy aging also recognizes the importance of decision-making ability as a component of functional capacity.

Therefore, the goal of a home adaptation should not simply be to produce independence. absolute.

It may be more appropriate to create conditions that allow the person to perform certain activities more effectively. For safety, use support resources when needed and maintain your ability to choose.

4. Habitability Vulnerability

Habitability Vulnerability is a formulation developed within the scope of my work. research to address situations where there is a mismatch between environmental conditions residential and the capabilities or needs of the occupant.

This formulation shifts attention from a perspective exclusively focused on the individual to a relational perspective.

Vulnerability, in this sense, is not necessarily located in the person's body.

It can emerge from the interaction between a given individual condition and an environment that does not It offers compatible support.

This understanding resonates with environmental gerontology and the ecological model of... aging, according to Lawton and Nahemow (1973), in which the relationship between individual competence and

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Environmental pressure is an important element in understanding the adaptation between a person and environment.

This approach is also consistent with the WHO's perspective that functional capacity is influenced by the physical and social environments in which people live.

However, habitability vulnerability should not be confused with a clinical diagnosis.

It refers to the relationship between a person and their home environment and, in this article, constitutes a category.

conceptual framework for habitability analysis.

5. Home Orthotics and Responsive Environment

The text presents the concept of the Orthotic House as an architectural formulation related to

The possibility of the residential environment offering support to the resident's abilities.

The proposal considers that the built environment can be modified to meet demands.

resulting from the aging process and functional changes over time.

The Orthotic House should not be understood, in this article, as a medical device or as...

Clinical equivalent of a body orthosis.

This is an **architectural metaphor** for thinking about the environment's capacity to provide support.

to the activities and needs of the resident.

This perspective is also related to continuity of care. The home environment can

needing to accommodate different forms of assistance, equipment, and the presence of caregivers,

especially when there is an increased need for support.

Literature on *aging in place* demonstrates that the home environment can present challenges.

related to autonomy, independence, and daily support.

Within the scope of my research, the Orthosis-House is conceived precisely from this relationship between

Environment, functional capacity, and continuity of life at home. The research document.

The basis also links the proposal to the need for spatial flexibility to accommodate

different forms of care without altering the character of the home environment.

6. Environmental gerontology, gerontechnology, and assistive technologies

The relationship between aging and the residential environment also involves the development of

Technologies designed to support everyday activities.

The field of **gerontechnology** combines knowledge about aging and technology and includes

Applications designed to support older people in different contexts.

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In the context of *aging in place,* technologies can be used for communication, monitoring,
Support for daily activities, safety, and connection to care networks.
However, the existence of a technology does not, in itself, mean that its use will produce...
a specific functional or clinical outcome.

Ollevier et al. (2020), in a systematic review of technologies evaluated to support *aging in place*
of healthy elderly people, they observed that different technologies had been investigated, but
They also highlighted the need for rigorous evidence regarding its effectiveness.
The systematic review by Ma, Guerra-Santin, and Mohammadi (2022) analyzed integration strategies.
From innovative technologies to residential modifications aimed at *aging in place.* The authors
They identified literature related to architecture, smart technology, and gerontology and analyzed it.
33 studies were selected from 2,594 records initially identified.

Assistive technologies constitute another relevant field. Yusif, Soar and Hafeez-Baig (2016), in
A systematic review on barriers to the adoption of assistive technologies by older people highlighted...
Issues related to acceptance and privacy may influence its use.
This literature is particularly relevant to the proposed approach because it demonstrates that
Technology and habitability cannot be treated separately from features and preferences.
of the users.

A technology can expand certain possibilities for using the environment, but it can also...
Introducing new demands for learning, maintaining, accepting, and protecting privacy.
Therefore, from the perspective of Casa-Órtese, assistive technologies and intelligent systems should be
understood as **potential environmental resources,** and not as mandatory or essential components.
universally effective solutions.

7. Smart Homes and Human-Building Interaction

The development of *smart homes* has expanded the possibilities for interaction between occupants and
residential systems.

Sensors, automation, and monitoring systems can produce information about the environment,
occupation and specific interaction patterns.
The systematic review by Ji et al. (2023) identified different applications of technologies
Sensing in the field of Human-Building Interaction, including occupancy monitoring,
physiological indicators, building components, built environment, consumption and systems
combined sensing. The study analyzed 127 articles.
Taherkhani and Aziminezhad (2023), in turn, analyzed the scientific production on Human-

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Building Interaction and characterized the field as an interdisciplinary area focused on relationships.
between people and buildings.

These studies demonstrate the expansion of technological possibilities for interaction between people and built environments.

However, the incorporation of intelligent systems needs to be critically analyzed.
Monitoring can increase certain support possibilities, but it can also generate...
issues related to privacy, autonomy, acceptance, and control over data.
Consequently, a *smart home* should not automatically be considered a more modern dwelling.
suitable for aging.
Its suitability depends on the relationship between technology, user, environment, and intended use.

8. IVH-30 Structure

8.1 Presentation of the structure

The IVH-30 — Habitability Vulnerability Index was designed as a tool for
dimensional analysis of residential habitability (see Lawton & Nahemow, 1973; Luciano et al., 2020).
For this article, I present exclusively the structural elements that are defined for this
Version: **30 items, five macro-dimensions, and a multi-level approach encompassing micro, meso, and macro levels.**
The five macro-dimensions are:

- **Security;**
- **Comfort;**
- **Equity of Use;**
- **Privacy;**
- **Belonging.**

The multilevel approach considers the following levels:

- **Micro;**

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- **Meso;**
- **Macro.**

These two sets of elements are not treated as equivalent.

The five macro-dimensions correspond to the dimensional organization reported for the IVH-30.

while micro, meso, and macro correspond to the multilevel approach adopted in the research.

This article does not establish a specific distribution of the 30 items among the five dimensions.

because this information is not documented in the material available for this version.

Table 1 — Structure of the IVH-30 presented in this article

Tabela 1 — Estrutura do IVH-30 apresentada neste artigo

Elemento	Estrutura
Instrumento	IVH-30 — Índice de Vulnerabilidade de Habitabilidade
Número de itens	30
Macro-dimensões	Segurança; Conforto; Equidade de Uso; Privacidade; Pertencimento
Abordagem multinível	Micro; Meso; Macro

Source: *Prepared by the authors for this article based on structural information.*

information provided about IVH-30.

8.2 Schematic representation

Figure 1 — Schematic representation of the structural elements considered for the IVH-30 in this article

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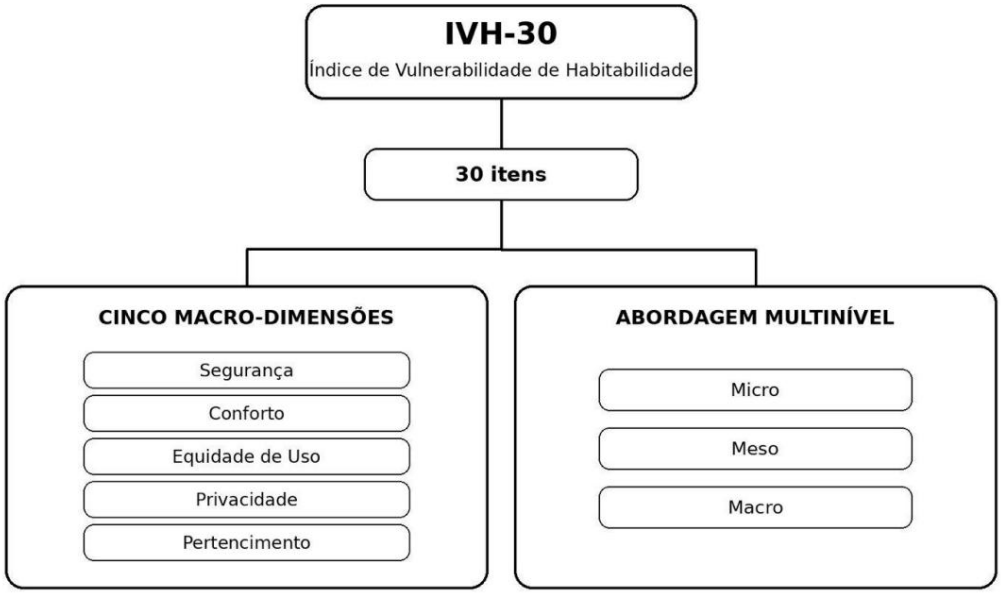
Figura 1 — Representação esquemática dos elementos estruturais considerados para o IVH-30



Source: *Prepared by the author exclusively for this article.*

Note: the figure is an original schematic representation and does not reproduce any figure, table, or organization. graphic of the original research. It does not establish a specific correspondence between the five macro dimensions and the three levels of analysis.

9. The IVH-30 as an analytical framework for habitability.

The IVH-30 is presented in this article as a framework for organizing vulnerability analysis. habitability.

This definition should be kept separate from a clinical assessment.

A clinical assessment investigates aspects related to health, functionality, or clinical conditions. of the person. The IVH-30, as presented here, is related to the analysis of habitability and...

The relationship between a person and their home environment.

For this reason, **the IVH-30 is not attributed with any clinical, psychometric, or predictive properties. or statistics that are not substantiated.**

We do not claim, in this article, that the index:

- diagnoses clinical conditions;
- predicts future events;
- It has clinical validity;
- It has predictive validity;

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- It exhibits psychometric reliability;
- has demonstrated sensitivity or specificity;
- replaces clinical evaluation;
- produces a medical or functional diagnosis.

These properties could only be confirmed based on specific studies that effectively...

they investigated them.

The decision not to assign them to the instrument is fundamental to preserving its scientific delimitation.

10. Habitability, ongoing care, and home environment

The home environment also plays a role in organizing care.

Staying at home may involve support from family members, formal caregivers, and various services.
health and assistance.

The World Health Organization, in its guidance on long-term care, recognizes that
The need for integrated care systems includes interventions that can be offered in
different contexts, including the home and the community.

This perspective is important for architecture because the need for care can modify the
the way environments are used.

Circulation, privacy, assistance possibilities, and equipment accommodation can all be improved.
This is especially important when a person needs support.

However, this does not mean transforming the residence into an institutional environment.
In the formulation of the Orthosis Home, care must be incorporated in a manner compatible with the
permanence of domestic identity.

Architecture, therefore, can contribute to creating spatial conditions for care without removing it from the environment.
The resident's recognition of their home as a space for living, choice, and belonging.

11. Discussion

The literature on *aging in place* demonstrates that remaining in one's own environment throughout old age
It is an experience that involves physical, social, and relational conditions.
Environmental gerontology adds the understanding that environmental characteristics must be
analyzed in relation to the person's capabilities.
The literature on *age-friendly* housing reinforces the need to consider autonomy and
Independence in the context of residence.

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Technology adds new possibilities, but also new challenges.

Reviews on *smart homes,* assistive technologies, and technologies for *aging in place* show

Technological suitability depends on the relationship between the solution, the user, the context, and the purpose.

In this context, the Habitability Vulnerability proposal allows us to prioritize

The relationship between the characteristics of the occupant and the conditions of the environment.

The IVH-30 is presented as part of this perspective.

Its structure is based on five macro-dimensional aspects — **Safety, Comfort, Equity of Use, Privacy.**

Belonging— allows us to address habitability without restricting it exclusively to accessibility.

physical.

The inclusion of **Belonging** and **Privacy,** for example, draws attention to dimensions of

residential experiences that are not necessarily captured by a purely residential-centric approach.

in risk prevention.

Equity **of Use** also allows the discussion to move away from a conception in which residence

It is designed for a single, standardized user.

These interpretations are presented in this article as a conceptual discussion. They do not mean

that the IVH-30 has been subjected to psychometric testing or that its dimensions constitute scales

statistically independent.

The distinction between decisional autonomy and functional independence reinforces this perspective.

A residential intervention can improve a specific functional condition without necessarily

to produce greater decision-making autonomy.

The goal of providing housing suitable for the elderly must therefore be understood as

In a broader sense: to offer conditions for safety and functionality without eliminating choice.

privacy, identity and belonging.

12. Limitations

The presentation of the IVH-30 in this article is deliberately limited to structural information.

available for this version.

The following are known and used in this article:

- the name of the instrument;
- Its composition consists of 30 items;
- the five macro-dimensions;
- The multi-level approach: micro, meso, and macro.

The following are not presented due to a lack of available documentation for this work:

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- Distribution of the 30 items across the dimensions;
- scoring system;
- weights;
- response scale;
- classification criteria;
- Psychometric parameters;
- predictive properties;
- clinical validity;
- sensitivity;
- specificity;
- sample used for validation;
- undocumented statistical results.

These elements are neither inferred nor reconstructed from the literature.

The same caution is applied to Casa-Órtese.

The concept is presented as an architectural formulation of the research, without attributing equivalence to it. medical or clinical.

13. Possibilities for future research

The structure presented allows for different possibilities for future research.

Among them are studies aimed at empirically evaluating the properties of IVH-30, its applicability in different residential contexts and its relationship with environmental characteristics and of the users.

The relationships between habitability, assistive technologies, and *smart homes can also be investigated.* continued care and residential adaptation processes.

In the case of technologies, future studies may evaluate not only their functional effectiveness, but also... also its usability, acceptance, privacy and compatibility with user preferences.

In the case of the residential environment, longitudinal studies could investigate how changes in The resident's capabilities and the characteristics of the dwelling modify vulnerability to habitability over time.

These issues constitute the **research agenda.**

These are not presented in this article as proven results.

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Final considerations

Aging *in place* requires a broader understanding of the relationship between person and environment.
International literature demonstrates that remaining in one's own home involves certain conditions.
physical, social, relational, and technological factors, and the environment contributes to the conditions that foster...
or restrict functional capacity.
Environmental gerontology provides an important basis for this understanding by considering the relationship
between a person's capabilities and the demands of the environment.
In this context, I present **Habitability Vulnerability** as a perspective for analyzing
situations in which there is a mismatch between the conditions of the residential environment and the demands or
Occupant capabilities.
The IVH-30 — Habitability Vulnerability Index, designed as a tool for
dimensional analysis of residential habitability (see Lawton & Nahemow, 1973; Luciano et al.,
(2020), is presented in this article according to the structural elements provided: 30 items, five
macro dimensions — Safety, Comfort, Equity of Use, Privacy and Belonging — and
A multi-level approach encompassing micro, meso, and macro levels.
The presentation preserves this structure without reconstructing or supplementing the items from the literature.
external.
The international literature used in this article situates the discussion of IVH-30 within the broader field of
aging in place, environmental gerontology, *age-friendly housing,* gerontechnology,
Assistive technologies, *smart homes,* Human-Building Interaction, and continuous care.
These fields offer foundations and perspectives for discussing the relationship between person, environment, and
Technology, but they are not used to redefine the original structure of the IVH-30.
The distinction between **decisional autonomy and functional independence** also constitutes a principle.
important aspect of the approach.
A person may need assistance with certain activities without losing their ability to...
to decide about their own life and their environment.
The **Orthosis House,** in turn, is presented as an architectural formulation in which the environment
residential properties can support the resident's abilities and accommodate changes related to...
aging and care, without this implying transforming the residence into a space
institutional or to attribute clinical properties to architecture.
Finally, scientific rigor demands that IVH-30 be presented only based on its properties.
effectively documented.

Therefore, this article does not attribute clinical or psychometric properties to the instrument.

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Statistical or predictive statements that have not been demonstrated.

The contribution of this version lies in **conceptually situating Habitability Vulnerability.**

and the IVH-30 in the international debate on aging, environment and housing, preserving the

Available structural information and establishing a basis for future empirical investigations.

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