391

Confinement and House Use

Analysing the relation between space properties and space use during pandemic isolation

ANA MOREIRA, & FRANCISCO SERDOURA

CIAUD, RESEARCH CENTRE FOR ARCHITECTURE, URBANISM AND DESIGN,

LISBON SCHOOL OF ARCHITECTURE, UNIVERSIDADE DE LISBOA

ABSTRACT

Space use can be determined by inhabitants and their dwelling patterns, but it can also be a result of spatial configuration. This suggests that behaviour in a built environment is both cause and consequence of the characteristics of space and its layout. COVID-19 pandemic and confinement in most countries resulted in a 24/7 use of our homes and a necessary overlapping of personal, family and work life in the same (sometimes small and compact) space. During the first confinement in Portugal, an inquiry was carried out to understand house use in that context. It showed that for most dwellers the living room became a multipurpose space, where leisure, work and study took place.

This paper focuses on the analysis of dwelling units in Lisbon using justified graphs and VGA, to understand if the choice to use the living room as a multipurpose space comes from design layout (space determines behaviour) or if it is solely a consequence of living modes (behaviour determines use of space). The analysis shows that the analysed units' layout pre-determines space use, leaving little or no alternative for change and are not flexible to accommodate different functions and so, for its dimensions, location and permeability, the living area will tend to be multifunctional and the hub for different activities and family members. The research reveals that use is dependent on layout and that behaviour during confinement was determined and conditioned by home attributes, rather than a reflection of the needs and traits of the inhabitants.

KEYWORDS

House Use, Confinement, Living Patterns, Multifunctionality, Space Syntax

1 INTRODUCTION

In 1943, Churchill declared that *we shape our buildings and afterwards our buildings shape us* (Melo 1991 *apud* Canter 1975 *apud* Hansard 1943). Focusing on housing buildings, we can state that underlying this statement is the notion that dwelling programmes and layouts are a cultural and social product that reflect social patterns of space use and typical modes of living but also that the built environment (produced by a certain society and its codes) is responsible for behaviour generation, allowing or constraining use and function allocation. As Edgü e Ünlü (2003, p. 82.4) stated, *space should be treated as a relational system, in which the spatial patterns not only reproduce or accommodate patterns of behaviours and social relationships, but also generate them*, *i.e.*, behaviour in a built environment can be both cause and consequence of the characteristics of space and its layout.

In 2020, pandemic confinement that derived from COVID-19 outbreak posed new challenges to our modes of living, resulting in a round-the-clock use of domestic space by all members of the household, superimposing activities and actors in the same spaces and times. Not since the Middle Ages, before specialization of spaces and the birth of the concept of comfort, had western homes been the stage for juxtaposed functions – work, social and private activities – with the significant contrast that nowadays (during pandemic confinement period) these all seem to occur simultaneously and performed by different individuals (family members or co-inhabitants), which naturally results in conflict and in the notion of inadequacy of the dwelling to contain all necessary functions.

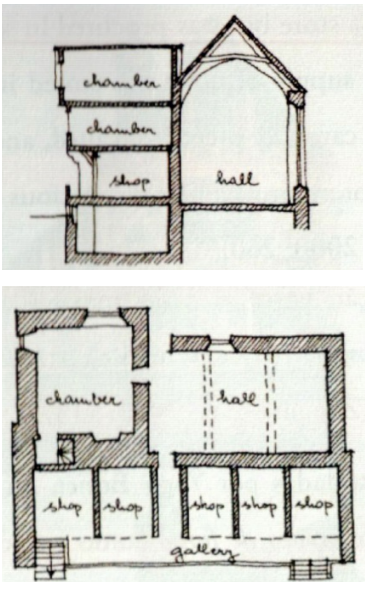

Fig.1 – Medieval *Hall* house plan and section Fig. 2 – Medieval *Hall* house depiction (Salvador, 2014, pp.130-131)

The medieval *hall* home was composed of a single dwelling space, where different uses and activities were carried out – all in the same physical space and, sometimes, at the same time – cooking, eating, entertaining visitors, conducting business, sleeping (Rybczynski, 2001). In these

homes and society, not only did the concept of *function* not exist, nor did that of *privacy*. According to Lukacs (1970, p. 624), this remained true for centuries, as *even in the richest and noblest houses before the seventeenth century there were hardly any rooms that served for specific purposes, since the notion of privacy scarcely existed.*

By the end of the modern age (17th and 18th Century) domestic interiors had become compartmentalized and new spaces to house certain functions were created. The living room, as the main and central space in the dwelling, for family leisure, entertaining visitors and eating meals, was born (Moreira and Farias, 2017). Home was no longer a place of work, but of family life, prevailing the concepts of *comfort* and *privacy*. *Domesticity, privacy, comfort, the concept of the home and the family: these are, literally, principal achievements of the Bourgeois Age* (Lukacs, 1970, p. 624).

From then on, through the 20th century and until our times, this was the model that endured: living room as a vital space for household life, of social character, a stage for interactions within household members or between dwellers and visitors.

As mentioned, pandemic confinement necessarily altered our modes of living and patterns of space use, and the contemporary living room was the space that mostly had to be adapted in order to contain all necessary functions and activities – from leisure to work. With the aim of better understanding new patterns of space use in Lisbon, a survey was carried out during the first confinement, in the second trimester of 2020.

In this paper the results of this survey are analysed and compared with a space syntax analysis of recently built[1] dwelling units, using the methods of axial maps (justified graphs) and VGA, so to understand if behaviour modelled space or if space determined behaviour.

2 THEORY

Prior to delving into this space syntax reading of selected dwellings, it is firstly essential to address the theoretical frame for this study, starting with Hillier and Hanson's (1984) notions of *genotype* and Hillier, Hanson and Graham's (1987) description of *visibility-permeability* duality, followed by a reading on the concepts and meanings of the standard spaces that compose a contemporary dwelling and the activities that are expected to occur in the domestic space, in Portuguese reality.

With this theory in mind, it is then proposed that the survey and its findings are analysed.

[1] In the first 15 years of the 21st century.

2.1 Dwelling Genotypes and Spatial Properties

Hillier and Hanson (1984) define genotype as *abstract rules underlying spatial forms*, *i.e.*, a pattern of spatial properties which can be identical in different dwelling arrangements. Different phenotypes (*spatial forms* – spatial conformation and layout) can thus be translated into identical genotypes. This definition is especially relevant to this paper as it aims at understanding whether both phenotype and genotype of the analysed dwellings are responsible for space use, equating the veracity of the premiss stated by Hillier, Hanson and Graham (1987, p.363) *that it is primarily – though not only – through spatial 'configuration' that social relations and processes express themselves in space.* Spatial configuration then leads to spatial properties that can determine space use and function and that can be analysed using Space Syntax methods. Hillier, Hanson and Graham (1987) dwell on the duality *visibility-permeability*, which is also very significant to the present study. There is *permeability* between spaces when there is a link through which users can pass from one to another (a physical and walkable connection); visibility, on the other hand, relates to what is seen from a fixed point in space or a given space, i.e., *the visibility structure (...) tells you how much space you are aware of without moving* (Hillier, Hanson and Graham, 1987, p.384). In this paper, justified graphs are used to analyse and depict *permeability* and Visual Graph Analysis (VGA) to express *visibility* properties of space (especially via measures of *Through Vision*, *Control* and *Controllability*).

2.2 Settings and Activities

> *(...) activities are direct expressions of lifestyle and ultimately of culture. (...) meaning is not only part of function bit it is often the most important function. (...) the principal mechanism that links an activity and a setting is 'meaning'.* (Rapoport, 1990, pp. 11-12)

Laboratório Nacional de Engenharia Civil[2] (LNEC) has for long developed research on housing and housing functions and program, in Portugal, having established essential activities that are developed in different spaces inside a dwelling, or settings, as Rapoport (1990) selects to address the places where activities take place[3]. These are especially relevant in contextualizing the analysis that was executed and of the average social notions and ideas of what domestic spaces are and the functions they hold. The most recent revision was conducted by Pedro, in 1999, since republished (2014), entitled *Housing Program. Housing Spaces and Compartments* and was the basis for this contextualization. Pedro has for long developed research on Housing and housing quality evaluation and has also conducted studies on housing program definition, the latter being relevant to the present study and whose contribution is examined next.

[2] National Laboratory of Civil Engineering.

[3] *A setting is thus a milieu which defines a situation, reminds occupants of the appropriate rules and hence of the ongoing behaviours appropriate to the situation defined by the setting, thereby making co-action possible. The setting frequently provides the appropriate props for these behaviours and activities (...).* (Rapoport, 1990, p.12)

Living/Entertaining is a dual activity that Pedro (2014) describes as taking place mostly and more importantly in a common living room, in which individuals or the household as a group take part of and that occurs normally in people's free time (weekdays' evenings and nights and afternoons and nights on weekends or holydays). Regarding space use, Pedro (2014, p. 108) states that *in the living/entertaining space various activities take place, for example, living, talking, reading, playing, listening to music, watching TV, studying (…). Thus, the living room should have a polyvalent character, in environment and zoning, so to allow for different uses*.
Linked to *Living/Entertaining* is *Eating* (or *Meals*), that can occur in a designated zone in the common living room.

Study/Young People Recreation is an activity that the cited author admits can take place in the living room, advising that *these solutions could lead to conflict due to lack of privacy for the study activity or domestic peace disruption by young people recreation* (Pedro, 2014, p. 139), and informing that one of the greatest incompatibilities of this activity is with *Meals* and *Living/Entertaining*.

Lastly, it is important to mention *Work/Adult Recreation*. *Work* is an activity that Pedro (2014) conceives as possible to occur in a dedicated office space, in a dedicated zone in a bedroom or in a secondary living room; the common living room (or family room) would not be suited for this use, only for *Adult Recreation* (playing, listening to music, reading, watching TV).
This insight into domestic spaces and uses reveals that the living area is perceived, programmed, and utilized as a multifunctional space, but that the activities that should pertain to it are related to leisure and therefore compatible with each other. Study and work, although possible to occur present incompatibilities with the former, more adequate uses for that setting, and cannot be performed without disruption or detriment.

2.3 COVID-19 Survey

Having examined the significations of uses or activities and equated them with the settings where they are likely to occur, it is now possible to introduce a survey that was implemented to ascertain house use during pandemic confinement, when the activities performed inside the dwelling transcended domestic usage and functions, to encompass other realms of individual life (work, study, exercise, *etc*.). This survey was carried out in the second trimester of 2020, during the first mandatory confinement, when the world practically pressed stop and people around the globe were remanded inside their homes. The aim of the survey was to understand how dwellers adjusted their styles of living (behaviour) or domestic space (use or layout) to accommodate new needs and identify which spaces were adapted or accumulated functions, but also to comprehend user satisfaction towards spaces and aspects of the lived units during confinement. The survey was available for answer online only, via google forms, and was divulged by CIAUD[4] through a

[4] *Research Centre for Architecture, Urbanism and Design,* Lisbon School of Architecture

mailing list and by word of mouth. It was composed of four parts: *Dweller and Household*[5], H*ome*[6], *Mode of Living*[7], *Individual Questionnaire*[8], with closed and opened questions. The universe of respondents was defined as individuals and households living in an urban setting (Lisbon), both in collective or single-family housing, and 80 responses were collected.
The results showed that, due to confinement, most respondents (64.5%) were working or studying (attending school) from home; 22.7% pondered moving to another dwelling, mostly due to the affirmed needs for private outdoor space, more rooms or more area or different layout.
Comparing degrees of satisfaction before and during confinement, in all aspects a reduction of the average satisfaction degree was registered, demonstrating that in a non-stop, continuous use dwellings fall short of previous impressions and expectations. Where the biggest variation is noticeable is in the following items: *space adaptability*, *family needs adequacy*, *privacy within the family* and *living room area*. Nonetheless, many respondents affirmed that the dwelling was adequate to a round-the-clock usage and that it allowed for the execution of all individuals' activities.

Regarding alterations, 36.5% stated having had to adapt space use to accommodate new needs, specifically the creation of a working/studying zone, either in the living room (for 59.1% of respondents) or the bedroom (31.8%). Despite this overlapping of uses in the same space, most respondents claimed to having been able to perform work/study activities appropriately, with privacy and adequate concentration and space.

The attained results permit to realize that the living room was the space whose use was most affected by pandemic confinement and thus, albeit already a multifunctional space, as Pedro (2014) explains, increased its polyvalence, becoming workplace and classroom, sometimes simultaneously. Although the *setting* (Rapoport 1990) may have altered and expanded, the physical space did not and could not, nor could its location move in the dwelling organizational system (layout).

3 DATASETS AND METHODS

To better understand the reasons that may have led to an increased superimposing of activities in the living room setting and its physical space and to ascertain whether layout design was

[5] Questions that permitted the characterization of the household (composition), if confined or not, if and how many individuals were working from home, if household moved to another dwelling or was considering it, which spaces or attributes would the interviewee most value in a home after having been confined.
[6] Typology, degree of satisfaction toward dwelling (areas, layout, number of rooms, layout, etc.) before and during confinement, what space is lacking, which adaptations/alterations were made (use or layout) or would like to make, which spaces accumulated functions.
[7] Spaces and tasks for family gathering.
[8] To be filled out by each member of the household; amount of time spent in dwelling (before and during confinement), space where the most time is spent (before and during confinement), in which space is work or study performed, are the conditions of that space adequate for that end.

responsible for the choice of the living room as container of all necessary but un-programmed functions in domestic space or if it was solely a reflection of households' modes of living, a Space Syntax analysis was performed in five different dwelling types and typologies. The units that were chosen are part of a housing development built between 2005 and 2009, in Lisbon, in a central location – *EPUL Entrecampos* – that provided 612 dwelling units, ranging from studios to three-bedroom apartments. For this analysis 2 one-bedroom units, 2 two-bedroom units and 1 three-bedroom units were selected, making sure different types of spatial and functional organization were selected to diversify and enrich the reading[9].

The Space Syntax analysis that is proposed in this paper is based on two different methods: justified graphs, using Agraph v3.0, and Visual Graph Analysis (VGA), in Depthmap X v0.70. Justified graphs, as Hanson (1998, p.24) describes, *tend to show configurational differences rather clearly. They capture significant properties of spatial configurations in an immediate, visual way,* meaning they consist of a graphic representation of the dwelling structure and the *permeability* between spaces. VGA, on the other hand, *is a means to quantify the configuration of space as regular units which can then be used to identify the relationship of that space to the behaviour of the humans that occupy it* (Koutsolampros et al, 2019), meaning it poses as a tool to examine the relationship between space and user by analysing spatial properties, namely *visibility* related ones. Both methods focused on the measures of integration and control and, in the VGA, through vision and controllability were also verified and are presented. The election of these measures aimed at understanding dwelling organization and layout and identifying the location and how integrated in the system the living room is, what people in it can control and how they are controlled by others in other spaces, to comprehend how dwellers can move and what they can see inside the unit and what the layout indicates are the preferred routes, all of which as to realize if the characteristics of the living room space were the ones the most appropriate for the new activities.

As per Hanson (1998, pp. 32-43) *integration has emerged in empirical studies as one of the fundamental ways in which houses can convey culture through their configurations. (...) the distribution of integration gives a rather good account of the relative organization of the plan. Integratio*n is then an important aspect as it demonstrates how a layout potentiates modes of living through the determination of central and segregated spaces.

Visual Control has been dissected by several authors, from Hillier and Hanson (1984) to Turner (2001), and represents the level of control of a space, depending on how many spaces it connects to (visually or physically). Higher control equates to higher connectivity. *Visual Controllability*, on the other hand, refers to (…) *how controllable a location is.* (Koutsolampros et al, 2019)

[9] No studios were chosen for the analysis due to the inherent fact that there is only one space to encompass all activities and functions (apart from kitchen and toilet) which would condition the analysis and would redeem it valueless.

Lastly, *Through Vision* is a measure that *can be used to pinpoint locations most likely to be travelled, given that they are "in the way" to get from one position to another* (Koutsolampros et al, 2019).

From a methodological standpoint, the justified graphs and VGA analysis were carried out considering the dwellings as closed systems, with no connection to the outside (building common areas), so to better convey confinement reality of at-home isolation. As Hanson (1998, p. 29) stated, *looking at houses with and without the links to the exterior is an important dimension of configurational analysis which helps us to understand the relative importance of inhabitant-inhabitant and inhabitant-visitor relationships for the planning and organization of the home.* The choice of analysing the dwellings as closed systems aims at understanding inhabitant-inhabitant and inhabitant-dwelling relationships alone and how the domestic system functions when it is closed to the outside and visitors.

The following images represent the selected case-studies (T1b, T1e, T2d, T2g and T3b) and the space syntax results of *integration* (graph and VGA), *through vision* (VGA), *control* (graph and VGA) and *controllability* (VGA). *Agraph* software was used to calculate the justified graphs and *Depthmap X* to compose the VGA.

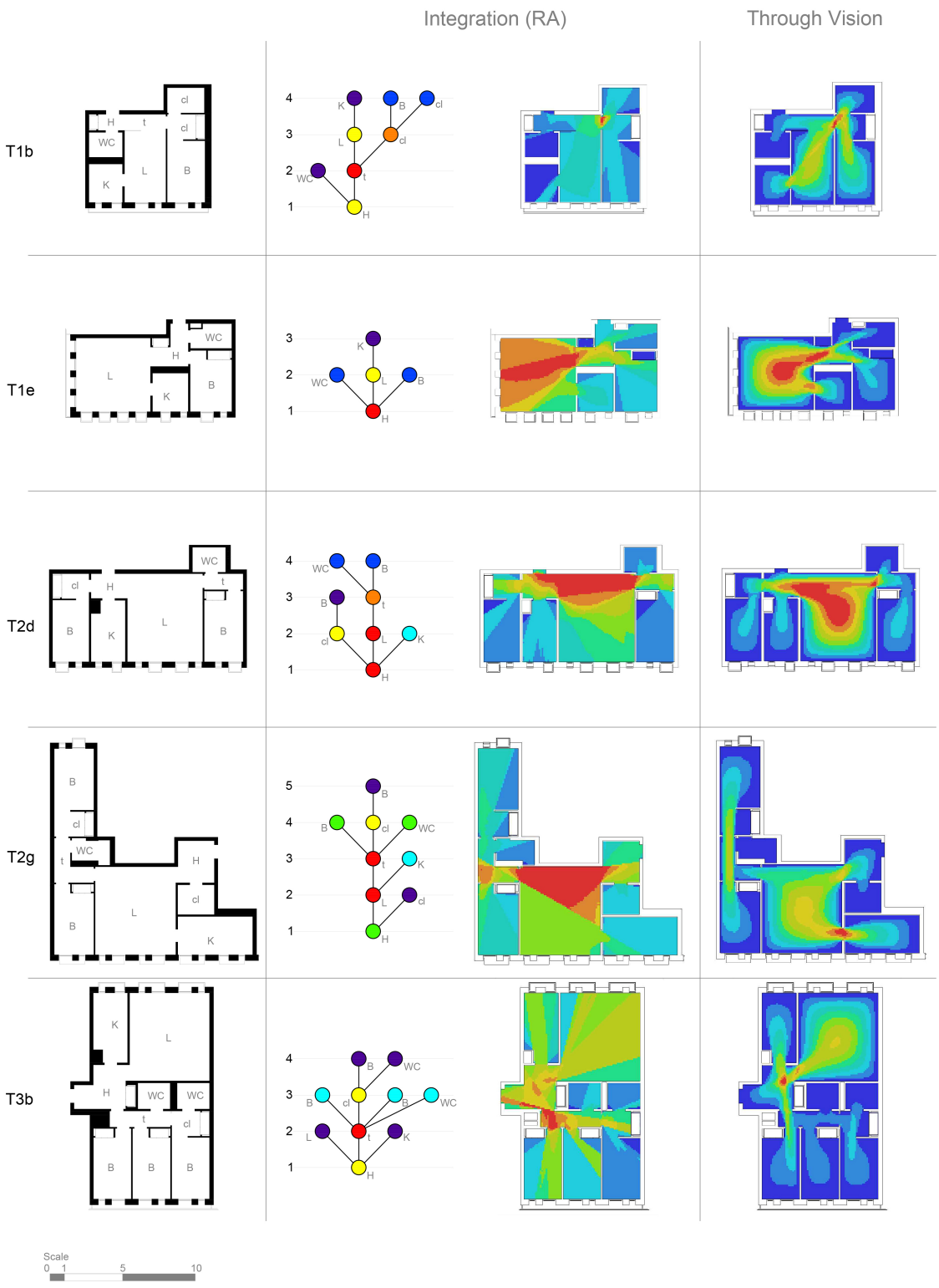

Fig. 3 – *Integration* and *Through Vision* analysis

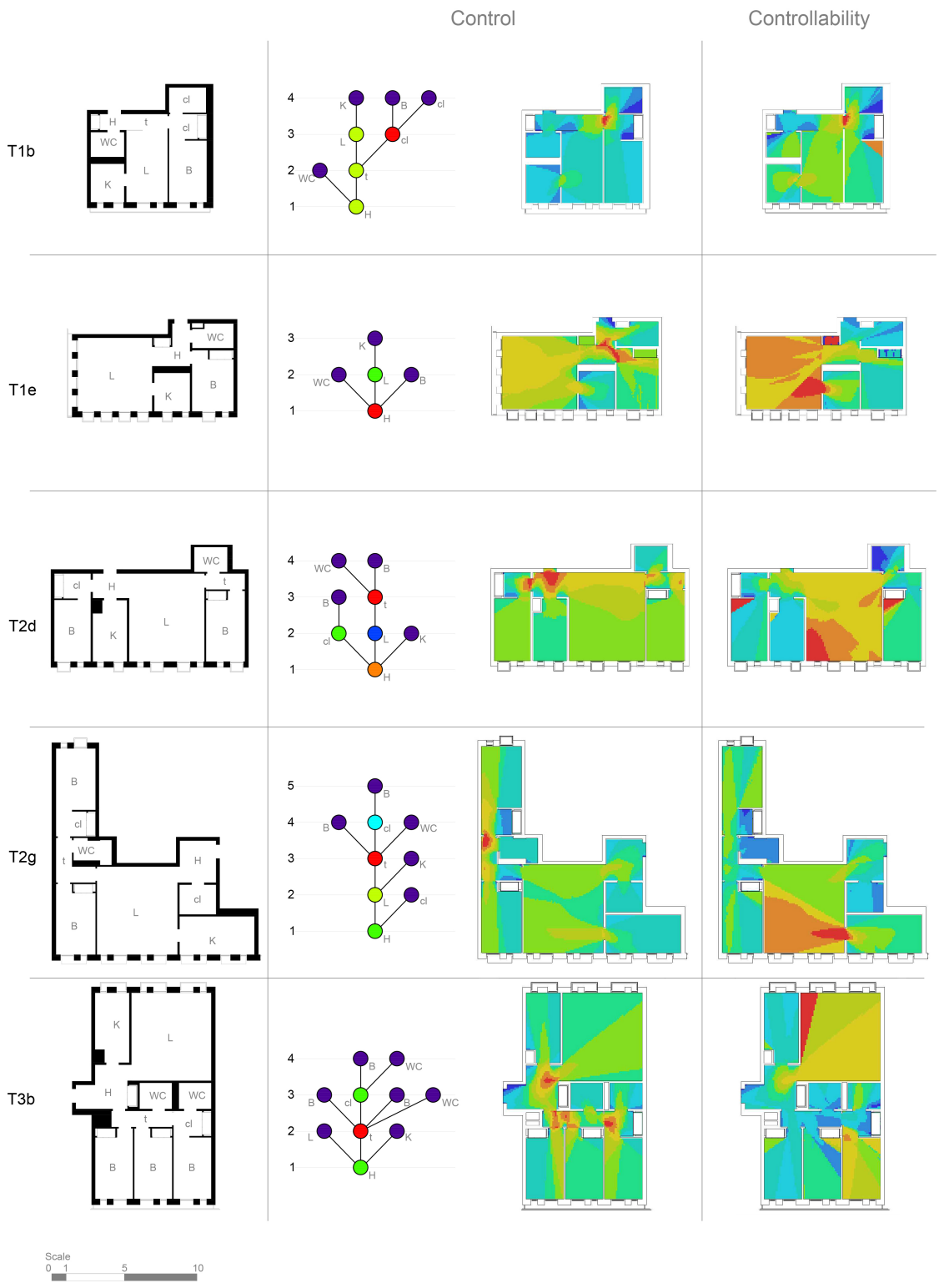

Fig. 4 – *Control* and *Controllability* analysis

Figures 3 and 4 present the simplified dwelling plan with labels[10] that correspond to space functions as well as Agraph and VGA analysis of *integration*, *through vision*, *control* and *controllability*. For *integration* and *control* measures both justified graph and VGA are displayed and compared.

Firstly, prior to analysing syntactic measures and a specific living room analysis, it is important to understand dwelling layout and its structure and organization. For all the selected units, the justified graphs, the preferred analytical method for reading space organization, are relatively shallow – ranging from 3 to 5 levels – and all present a tree-like configuration, which is indicative of a more rigid layout, with predictable functionality and little choice for route or function adaptation or allocation. According to Hanson (1998, p.278), *tree-like domestic space arrangements produce strongly programmed forms of domestic space arrangements*. And although shallow graphs favour more integrated systems, the stratification that characterizes tree-like layouts, as opposed to ringy ones, will tend to result in a higher number of segregated spaces rather than integrated ones.

Moving to space syntax measures' analysis and starting with those related with centrality – *integration* and *through vision* (fig. 3) – it is apparent that the living room tends to be the most integrated space and one that is likely to be crossed more often, indicating it functions as a hub for the residents and their activities. And, although meant to contain functions that presuppose permanence, it is a space that links other spaces and dwelling zones (seen in T1b, T1e, T2b and T2g), and so it is prone to be traversed often and regarded as passage, due to being so exposed within the system.

While there are some discrepancies between the justified graphs' results and the VGA's, the living room is shown (in the VGA and in all graphs apart from T3b[11]) as the most central habitable[12] space in all dwellings, expressing high levels of integration when compared to kitchens and bedrooms. The *Through Vision* results also reveal that the living room is central to inhabitants' paths and living patterns in all units, especially in T1e and T2d units.

Considering *Control* and *Controllability* (fig. 4), it is noticeable that the living room is not the space with the most control, those would be the transition spaces, as they normally tend to be. Nonetheless, the living room appears, once more, as the habitable space where higher levels of control can be registered, apart from T3b where the bedrooms and kitchen seem to have the same value. And even though in most of the dwellings the living room has high control (disregarding

[10] *(...) labels carry with them cultural assumptions about programmes, rules of behaviour, social rules, and cultural meanings (...).* (Peponis and Wineman, 2002, p.286)
[11] Although the T3b graph indicates that two bedrooms are more integrated than the living room, the VGA image shows us that the living room has more integrated areas than those bedrooms.
[12] Habitable spaces include all those that are programmed to include essential functions or activities, excluding transition spaces (halls, corridors), closets or storage and toilets.

the transition spaces) it is simultaneously the habitable space that is more controllable in all the dwelling.

4 RESULTS

The previous analysis, based on the justified graphs and VGA results of five dwelling units, underscores the central role of the living room setting in the dwelling system. As stated, not only does this space consist of the most integrated (among habitable spaces) of all, but it is also the habitable space where more control of others can be had and, simultaneously and by contrast, the space that can more easily be controlled by others. The analysis also reveals that the living room is a space that more likely is traversed by dwellers, and is thus, an important stage in a household's living patterns.

All these findings allow for the affirmation that the space devoted to the living room setting acts as a hub for the household, a true communal and exposed space, which is consistent with the notion that it is the more probable preferred location for household and individual activities, which, in a pandemic confinement context, include non-traditionally domestic activities, as work and study, for most of the population.

Looking at the selected dwelling units it is possible to ascertain the reasons why the space dedicated to the living room is so central in the domestic system: although in all units (except T1b) it's the space with a larger conformation and better proportions, its location in the system – whether it is between kitchen and bedrooms, or separated from the bedrooms by the kitchen or even in a different 'wing' from the bedrooms – is what determines its importance. As Peponis and Wineman (2002, p. 275) describe, *(...) the social meaning of space is carried by relationships that are not shape specific but rather more topological in nature, i.e.*, the question is not the properties of shape (space conformation) but the relationship between shapes (space configuration). This leads us to the justified graph analysis of layouts and to the notion that tree-like structures are inflexible and the relationship between spaces already pre-determined and therefore immutable. Due to the programmatic and plan rigidity evidenced in all analysed dwellings, the living room assigned space will always be the one to contain that function and in 4 of the 5 units it is a space that connects other spaces and is linked to the main transition space, which means it will always be a hub of the home, where less private activities will tend to occur. Nonetheless, one could argue that space conformation can also play a big part in this setting becoming multifunctional because for a space to be able to absorb several activities in simultaneity and to have the ability to accommodate furnishings for those activities, aspects as area and configuration will tend to matter.

In addition to the question of centrality, it is essential to emphasize the importance of visual exposure as Peponis and Wineman (2002, p. 275) highlighted when citing Archea's (1977) work.

According to those authors, Archea (1977) *observed that people tend to position themselves in space on the basis of both the extent to which they can observe other occupants of space, 'visual access', as well as the extent to which others can observe them, 'visual exposure'*. The living room, being both a space of control and one that is easily controlled, but also a very likely travelled space, corresponds to this description of a preferred location according to *visual access-visual exposure* dichotomy, and so, when new activities are introduced in the dwelling and a place and setting has to be created to accommodate them, spaces of control (visual access) and spaces that are controlled (visual exposure) as is the case of the living room, could tend to be elected.

5 DISCUSSION OF RESULTS

How do the space syntax analysis findings relate to and confirm the results of the dwellers' survey? As previously mentioned, the dwellers' survey aimed at understanding house use during confinement. The conclusions of this survey were that the home had to contain un-programmed and non-domestic functions, namely workplace and classroom, to accommodate daily life activities – work and study – that were affected by pandemic isolation, and that, for most of the respondents, these new functions and activities took place in the living room space and setting. The living room, in a confinement context, became an increasingly multifunctional and polyvalent space, much like the medieval home earlier mentioned. And as in the medieval *hall*, during confinement, the contemporary living room gained functions and activities as needed throughout the day and the duration of the seclusion, and dwellers adapted its setting (as a set) to changing needs. For example, the dining table could be used for breakfast, then be turned into work and study place, which in turn had to be removed to accommodate lunch time, to become again work/study place and again dining table, as were the movable fixtures of the medieval home, that continuously changed settings (as a theatre play) to accommodate necessary activities. The space syntax analysis based on justified graphs and VGA, focusing on *Integration*, *Through Vision*, *Control* and *Controllability*, confirms the potential of the living room designated space as a multipurpose one due to its centrality – the most integrated habitable space in the analysed units and the one that is more likely to be crossed in dwellers movement patterns – and to its capability to control and be controlled. The space syntax results show that work and study, in confinement, took place in a communal and exposed space, one that allowed for several people to occupy it at the same time, enabling working parents to control and assist in offspring's studies. Moreover, the choice of this space for these new activities as opposed to a bedroom that shows high values of segregation (privacy) can be explained by the need to be present in family life, albeit having to perform work related activities, and also to protect the resting and relaxation space that is the bedroom, most times shared with others (spouses or siblings), thus choosing to add functions to an already polyvalent space, without great disturbance of the previous activities that took place therein.

As for whether space determined behaviour or behaviour determined space use, both the survey and the space syntax analysis seem to indicate that these condensed and rigid layouts, with spatial pre-assigned functions and no route choice, leave little room for adaptation to a different circumstance and, therefore, space will tend to determine behaviour, which means that layout determines the mode of living.

6 CONCLUSION

> *Increasingly, analysis will seek to pinpoint the typical ways in which different room functions and domestic activities are configured in people's homes, (...) how domestic space and its fixtures and fittings relate to explicit and tacit household practices, inter-personal behaviours, domestic habits and routines (...). Increasingly, a configurational approach will reach out to relate disciplines as sociology, anthropology and psychology in addressing the social and personal interpretation of domestic space* (Hanson, 1998, p. 270).

As Hanson (1998) defended, it is possible to use space syntax theory and methods to research behaviour in a built environment and understand how space influences behaviour and modes of living in a system. This paper aimed at understanding domestic space use relating it with household or individual behaviour in that setting through a space syntax analysis of five dwelling units and the compared reading of these results with the findings of a dwellers' survey carried out to ascertain house use during pandemic confinement.

Both the survey and the space syntax analysis highlighted the significance of the living room, as a multipurpose, central, controlling and controllable space, a hub for household and individuals' routines, where, either topologically or intelligibly, important activities and functions take place. This notion leads to the conclusion that, in these dwellings (and dwellings with similar layouts and dwelling programmes) inhabitants' modes of living cannot modify space conformation or use and instead are conditioned and determined by them. Inflexible layouts lack the capability to be adaptable and will tend to have multifunctional spaces, not by dwellers' choice, but as a derivation of the incapacity to impose to the layout the new modes of living and new space use patterns. Behaviour is thus a result of the characteristics of space and its limitations.

AKNOWLEDGEMENTS

This work is financed by national funds through FCT - Fundação para a Ciência e a Tecnologia, I.P., under the Strategic Project with the references UIDB/04008/2020 and UIDP/04008/2020.

REFERENCES

Edgü, E. and Ünlü, A. (2003) 'Relation of domestic space preferences with Space Syntax parameters', *Proceedings of the Fourth International Space Syntax Symposium.* London, 17-19 June 2003. Available at http://www.spacesyntax.net/symposia/4th-international-space-syntax-symposium/ (accessed November 2018)

Hanson, J. (1998) *Decoding Homes and Houses*, Cambrigde, UK: Cambridge University Press

Hillier, B. and Hanson, J. (1984) *The Social Logic of Space*, UK: Cambridge University Press

Hillier, B., Hanson, J. and Graham, H. (1987) 'Ideas are in things: an application of the space syntax method to discovering house genotypes'. *Environment and Planning B: Planning and Design*, vol. 14, pp. 363-385

Koutsolampros, P., Sailer, K., Varoudis, T. and Haslem, R. (2019) 'Dissecting Visibility Graph Analysis: The Metrics and their Role in understanding Workplace Human Behaviour'. *Proceedings of the 12th Space Syntax Symposium.* Beijing, 8-13 July 2019. Available at http://www.12sssbeijing.com/proceedings/ (accessed January 2022)

Lucaks, J. (1970) 'The Bourgeois Interior. Why the most maligned characteristic of the Modern Age may yet be seen as its most precious asset.', *The American Scholar*, Vol. 39, No. 4, pp. 616-630

Manum, B. (2009). AGRAPH, Software for drawing and calculating Space Syntax Graphs. [online]. NTNU website accessed November 2014, http://www.ntnu.no/ab/spacesyntax/

Melo, R. (1991) ´Psicologia Ambiental: Uma nova abordagem da Psicologia', São Paulo: USP

Moreira, A. and Farias, H. (2017) 'A Cozinha Social. Um Novo Espaço para o Habitar Contemporâneo', 4th CIHEL – Congresso Internacional da Habitação no Espaço Lusófono: A Cidade Habitada. Covilhã, 7-10 March 2017. Covilhã: Centro de Investigação em Arquitetura, Reabilitação, Cidade, Habitat e Edificação da Universidade da Beira Interior

Pedro, J. (2014) *Housing Program. Housing Spaces and Compartments*, Lisboa: LNEC

Peponis, J. and Wineman, J. (2002) 'Spatial Structure of Environment and Behaviour', *in* Bechtel, R. and Churchman, A. *Handbook of Environmental Psychology*, New York: John Wiley & Sons, pp 271-291

Rapoport, A. (1990) 'Systems of Activities and Systems of Settings' in Kent, S. *Domestic Architecture and the Use of Space: An Interdisciplinary Cross-Cultural Study*. Cambridge: Cambridge University Press, pp.9-20

Rybczynski, W. (2001) *Home. A Short History of an Idea*, London: Pocket Books

Salvador, M. (2014) *Arquitectura e Comensalidade: A Evolução dos Espaços Culinários*, Lisboa: Faculdade de Arquitectura

Turner, A. (2001) 'Depthmap: A Program to Perform Visibility Graph Analysis', *Proceedings of the 3rd International Symposium on Space Syntax*. Georgia Intitute of technology, 7-11 March 2001. Available at http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=F6524B3B66D9FC47F6867339233566A2?doi=10.1.1.111.837&rep=rep1&type=pdf (Accessed December 2022)

Software Depthmap X (version 0.70) - https://www.spacesyntax.online/software-and-manuals/depthmap/

Agraph 3.0 - Manum, B., Rusten, E. and Benze, P. (2009). AGRAPH , Software for drawing and calculating Space Syntax "Node-Graphs" and Space Syntax "Axial-Maps", Network website. accessed November 2014, http://www.ntnu.no/ab/spacesyntax/