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Published in:
Design Studies

DOI:
10.1016/j.destud.2020.04.001

Published: 30/07/2020

Document Version
Publisher's PDF, also known as Version of record

What can we share? A design game for developing the shared spaces in housing

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Demographic and economic changes challenge urban housing and highlight the need for resident-centred design. This paper discusses a design game created to study the perceptions towards shared spaces among solo living tenants. The game was based on the identification and weighing of significant home-related spaces, functions and services in a framework defined by a minimum dwelling complemented with optional shared facilities. It included an economic variable to simulate real-life choices. The design game provided a tool for gathering user knowledge, opened up different resident profiles, and guided the participants in explicating their preferences as well as negotiating the boundaries between shared and private spaces. This method could be utilised when developing new housing concepts or for reprogramming existing spaces.

Keywords: architectural design, built environment, design games, design research, participatory design

Along with the emergence of a sharing economy driven by digitalisation, environmental sustainability, and a new sense of community, the increase of one-person households, the lack of affordable housing, and the scarcity of dwelling area in densely populated urban areas suggest the utilisation of shared spaces and facilities when developing new urban housing concepts. Simultaneously, both the renovation of existing housing stock and regeneration of urban areas offer a strategic opportunity for adopting more efficient, flexible and personalised ways of utilising the spatial resources.

The gap between housing demand and supply is an ongoing discussion in the field of urban housing. Aside from rapid urbanisation and economic challenges, socio-demographic changes and the diversification of lifestyles have created a demand for more varied housing solutions (De Paris & Lopes, 2018). For instance, it seems that many people seek a more affordable, sustainable or social way of living. However, as stated by previous research, diversifying the offering of mass-produced housing is a complex systemic challenge

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www.elsevier.com/locate/destud
0142-694X *Design Studies* **69** (2020) 100941
https://doi.org/10.1016/j.destud.2020.04.001

that requires the collaboration of many actors, including the public and private sector as well as the residents (Krokfors, 2017; Majamaa, 2008).

In late modern conditions, there is a need for new methods and tools in different stages of housing design and development for gathering knowledge about the needs and wants of residents, and for involving them in design processes. A particular challenge here concerns the envisioning of new solutions that ordinary residents do not have experience of or that they cannot easily imagine. It has been noted that the existing housing stock largely determines what is considered possible and desirable by laypeople (Clapham, 2005). This means that merely asking people about their immediate housing needs or evaluating existing housing arguably is insufficient to create new solutions. Instead, it might be beneficial to use more in-depth participatory processes and concretise new possibilities through innovative concepts and pilot projects. The relationship of the private dwelling and shared facilities in mainstream urban housing, for instance, has remained rather stagnant since the modern era, shaping our behaviour and expectations. How might design-oriented research methods be developed enabling a more open exploration of domestic spatial needs, and in a manner that would render the insights useful to housing design and development?

This paper contributes to research on participatory design methods in housing by discussing a design game that was created to study the perceptions of residents towards shared domestic spaces. Shared domestic spaces are defined as home-related spaces that are "located outside the boundaries of privately controlled domestic spaces and shared with a limited number of neighbours, typically the members of a housing company, in various ways" (Hasu, Tervo, & Hirvonen, 2017, p. 6).

The design game was developed and tested by the authors in an empirical case project involving a real client. The case project was built around three interrelated, societally relevant topics: the growth of one-person households, diversifying housing needs and increasing housing costs. The main objective of the case project, as defined by the client, was to determine the conditions under which residents living alone would be interested in sharing various domestic spaces. The participants were working-aged solo dwellers living in rental blocks of flats owned by the City of Vantaa in the Helsinki Metropolitan Area, Finland.

Game-based methods have predominantly been used in product and service design (Brandt, 2006; Vaajakallio, 2012). Examples of design games from the field of housing mainly focus on community building or the architectural features in specific housing projects or types (Sanoff, 2000; Tervo & Hasu, 2017). In our case project, we wanted to develop a design game that would provide outcomes that are relevant to housing design practices when creating new

forms of urban housing. We sought to target four gaps that have been identified by previous research.

Firstly, although there is an abundance of knowledge on residential preferences and needs, this knowledge is poorly connected with actual design solutions. Housing studies, aside from some exceptions (Coolen, 2008), rarely acknowledge specific design features in individual buildings. It typically looks at needs on the scale of residential areas and neighbourhoods (e.g. Kyttä, Pahkasalo, & Vaattovaara, 2010). However, the results are often too generic to benefit housing design and development (Lapintie, 2010a). Our aim in the case project was to develop a method for studying housing needs in connection with actual dwelling spaces and features, explicitly geared towards housing design.

Secondly, there seems to be a gap between one-off innovative housing projects and a broader diffusion of novelty in the housing market (Pirinen, 2014). For instance, the expertise and methods accumulated in resident-driven pilot projects rarely benefit subsequent housing projects. Thus, it might be advantageous to shift the focus of resident involvement from the design details in individual projects to an earlier stage at which it could potentially serve the creation of duplicable, serially produced housing concepts. For this reason, we wanted to contemplate design games as a research tool for gathering "sticky", user and context-based information (as defined by von Hippel, 2005) in a manner that would render it useable for housing design and development beyond singular housing projects.

Thirdly, each person's housing needs and understanding about the possibilities of housing relies heavily on their individual housing history as well as the existing offering of housing (Clapham, 2005). For this reason, design-oriented methods for eliciting user needs and facilitating collaboration among residents and professionals are particularly needed when investigating people's perceptions of emerging new concepts and possibilities in housing of which they do not yet have experience (Gibler & Tyvimaa, 2014). A design game could enable the testing of novel and unexpected spatial combinations and assist the residents in moving beyond their immediate experiences as well as possible prejudices related to unfamiliar housing forms (Hasu, Tervo, & Hirvonen, 2017).

Fourthly, housing preference studies have a tendency to provoke unrealistic housing dreams because the research settings and methods are disconnected from the households' financial resources and the complex constraints that guiding real housing decisions (Lapintie, 2010b; Salen & Zimmerman, 2004). In an attempt to bridge the gap between housing dreams and real-life choices (stated and revealed preferences), it was considered important to embed a simple economic variable into the design game to facilitate realistic trade-offs.

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The design game presented in this paper enables the identification and weighing of significant home-related spaces, functions, and services in a simplified hierarchic spatial framework defined by a minimum-sized private dwelling complemented by optional shared spaces with different levels of access, and varying distances from the dwelling. The minimum dwelling as the core connects the game to the current Finnish debate on the minimum space standards and the lack of affordable housing (Jokinen, 2019; Kortelainen, 2017; Oksanen, 2018; Pajuriutta, 2018; Salomaa, 2018).

The theoretical framework and methodology of the study are grounded in research on human-centred and participatory design, which typically relies on qualitative, experiential, and practice-based methods, acknowledges individual persons as active agents with valuable skills and knowledge, and has an explicit orientation towards the conception of new artefacts: a "concern for *what could be*" (Steen, 2012). The notion of design game provides a practical locus for the study. The empirical case project involving a real client enabled the interweaving of hands-on development and testing of the design game with researcherly analysis and reflection.

The paper is structured as follows: The first section discusses the drivers behind the utilisation of shared domestic spaces. The second section provides a brief overview of design games as a participatory method, based on existing literature. The design game that was developed in the case project is explained in the third section. The discussion and conclusion section analyses the benefits, challenges, and development needs of the game method, and also summarises the research contribution of the study.

1 Drivers behind the utilisation of shared domestic spaces

Sharing domestic spaces and other resources is a natural practice for residents who live with their partners and family members, namely, multi-person households. By contrast, the sharing of domestic spaces gains new interpretations due to the increase of one-person households in developed countries, such as Finland, where the average household size has rapidly decreased (Hasu, Tervo, & Hirvonen, 2017, p. 43). In 2018, the average Finnish household size fell under two persons with one-person households already covering 44 percent of the over 2.7 million households (OSF, 2019a). The City of Vantaa, in which our case study was based, had around 44 000 one-person households equalling a 41 percent share of all households (StatFin, 2020a).

Due to the decreasing average household size, the living space per person has increased, although newly constructed dwellings tend to be smaller (Williams, 2009). Between 1970 and 2018, the average dwelling size in Finland has increased from 60 to 79.5 square metres, whereas the floor area per person

has grown from 18.9 to 40.8 square metres (OSF, 2019b). In the City of Vantaa, the average floor area per person in 2018 was only 35.1 square meters (StatFin, 2020b). This reflects the typical characteristics of urban areas, such as smaller dwelling sizes and higher housing costs. It is known that urban areas attract solo dwellers (Buzar et al., 2005); however, more knowledge is needed on their desired housing options.

Since solo dwellers are not customarily able to share domestic spaces, thus receiving related scale benefits, their housing costs are relatively high. A need for affordable housing options suitable for solo living is further emphasised by the notion that one-person households in Finland are more often low-income earners when compared with two-income households (Terämä et al., 2018).

Affordable housing is a highly political issue which is related to minimum acceptable dwelling sizes, housing allowance, and social equity. Discussion around this topic divides experts, who argue about the current trend of building small one-room apartments in the Helsinki Metropolitan Area. The ones who support the construction of small dwellings base their viewpoints on affordability, while the ones who oppose the trend argue for the well-being of the residents and the economic competitiveness of the metropolitan area (Jokinen, 2019; Kortelainen, 2017; Oksanen, 2018; Pajuriutta, 2018; Salomaa, 2018). Paradoxically, both sides defend the residents' right for better housing.

Finnish academia also nurtures opposing viewpoints. Some studies suggest, based on one-person households' relatively high living costs and low income, that the growth of solo living may entail a need for smaller and thus affordable dwellings (Terämä et al., 2018; Pyykkönen, 2016). On the other hand, the studies based on solo dwellers' own perceptions (surveys and interviews) indicate that solo dwellers would often like to have homes with more than one room (Backman, 2015; Silvennoinen & Hirvonen, 2002; Tervo & Hirvonen, 2019; Tervo & Lilius, 2017; Wulff et al., 2004).

The problems related to one-room apartments were discussed in a recently published paper (Tervo & Hirvonen, 2019) which stated that 39 percent of the solo living respondents who lived in one-room apartments, and approximately 50 percent of those who had 20 square metres or less at their disposal, experienced a shortage of space. By highlighting the particular characteristics of solo living, it was also found that the ratio between the experienced shortage of space and the apartment size was different between the solo respondents and multi-person households. While only 20 percent of the members of multi-person households experienced a shortage of space when the floor area per person was between 26 and 30 square metres, almost half of the solo respondents felt the same in a similar situation.

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In the Finnish urban housing stock characterised by relatively monotonous multi-storey apartment buildings, there seems to be little room for diversifying needs (Gibler & Tyvimaa, 2014). Indeed, the proliferation of small dwellings implies that the Finnish response to the demographic shift has been rather one-sided. As lifestyles continue to diversify, there also seems to be a growing interest towards more social and communal urban housing (Hasu, Tervo, & Hirvonen, 2017). During the last decade, several housing projects with extensive shared spaces and new service models have been realised in Finland by developers as well as by groups of residents (Helamaa & Pylvänen, 2012; Pirinen, 2014). However, the share of these concepts remains marginal in the current housing stock despite their popularity among the residents.

In these circumstances, housing concepts that are based on minimising the dwelling sizes should not be considered as the only strategy for achieving affordable housing options for the increasing number of one-person households living in cities. Another viable option could be to rethink the relationship between private and shared domestic spaces and related resources and services. Although previous studies discussing solo dwellers' housing issues have recognized this possibility (e.g. Backman, 2015), the topic has not been thoroughly covered in housing studies. In a Finnish study focusing on living alone and referring to Swedish and Danish examples, shared spaces and different types of collective housing forms have been considered as one way of increasing housing variety and diminishing the problems related to cramped apartments and lack of affordable housing options (Terämä et al., 2018). Furthermore, offering alternatives for small apartment types has been an explicit goal of the housing policy in the City of Vantaa (City of Vantaa, 2009).

In addition to providing social, secure and affordable lifestyles, collective housing solutions have been considered as a means of decreasing consumption and negative environmental impacts caused by the growth of one-person households. Since solo living increases the demand for housing units and related services, there is a need to develop more resource-efficient housing alternatives suitable for one-person households (Williams, 2007). Furthermore, the shift towards a sharing economy (see Belk, 2014), based on more efficient utilisation of material as well as immaterial assets, access rather than ownership, and peer production, challenges the current model of providing shared facilities in housing as does the growth of services in economic value creation (Lusch & Vargo, 2006). These drivers suggest perceiving housing and the built environment as a platform for services. The sharing economy has also paved the way for a "flexible production of space" (Madanipour, 2018), manifested by online marketplaces, such as Airbnb, and the global trend of temporary use of empty space in cities. Our analysis of twelve international design examples that preceded the development of the design game (see section 3) yielded a variety of service-based approaches to sharing domestic space (Tervo, Meriläinen, & Pirinen, 2018).

2 *Design games in participatory design*

The discourse on participatory design has shifted from local citizen empowerment to collective innovation for broader markets (co-design; Sanders & Stappers, 2008), from the design of singular artefacts to more strategic and systems level issues, and from consensus-building to "agonistic space" addressing controversies and creating debate (Björgvinsson, Ehn, & Hillgren, 2012). At the core remains the idea that "the people destined to use a system play a critical role in *designing* it" (Schuler & Namioka, 1993). Participation can be seen as an emancipatory "negotiation of hope" which is able to posit a better future through "acknowledgement of the potentially transforming nature of user knowledge" and provision of channels for its articulation (Till, 2005). However, it can also be used by powerholders to "educate" or manipulate people (Arnstein, 1969; Till, 2005).

Among the repertoire of methods in participatory design, design games have emerged as a particular category, grounded in the human culture of play (see Huizinga, 1955). A design game can be defined as a method or tool used in the context of design that is based on game logic (Brandt, 2006; Ehn, 1988; Sanoff, 1979; Vaajakallio, 2012). The notion of game may act as an abstract metaphor or as a concrete way of organising design activity (Brandt, Binder, & Sanders, 2013, p. 173).

Early proponents of design games in the 1970s and 1980s, notably Sanoff, Habraken, and Gross, were from the field of architecture and planning. Sanoff (1979: p. 1) defines gaming as "an approach to problem solving that engages a real life situation compressed in time so that the essential characteristics of the problem are open to examination". He proposes design games as a method for capturing user needs and values, simulating the essence of complex design problems, and facilitating an understanding of the strategies for solving them. To Sanoff, design games not only enable simulating future situations and making design decisions, but also facilitate consensus-building. A design game guides people in examining their values and beliefs as well as arguing for their standpoint, organises complex details into an overall model, and requires trial decisions, thus sharpening the participants' perception of the design problem and preparing them for subsequent design action (Sanoff, 2000, pp. 76–79).

Similarly, Habraken and Gross, whose work is grounded on Wittgenstein's notion of language games and represents a more linguistic and computational approach to design games, suggest that "[g]ames offer a means of isolating certain aspects, or concepts, of design, for purposes of scrutiny" (Habraken & Gross, 1988, p. 150). Habraken and Gross (1988) emphasise that games create an environment for actors to align their individual goals with the shared program and to transform complex configurations. They also note that an

adjustment of game parameters can be used to shift the emphasis in design. The "concept design games" presented by Habraken and Gross explore the composition of physical forms through an interactive process in which rules determine the design outcome.

During the same period, Ehn and his colleagues were developing design games in the social and organisational context of workplaces (Ehn, 1988; Ehn & Sjögren, 1991). Currently, design games, mainly grounded in the Scandinavian participatory design tradition, have been established as one of the many tools and techniques used for participatory design, particularly in the fields of product and service design (Brandt et al., 2013; Vaajakallio, 2012). Design games are characterised by a game-like visual appearance, rules, and process, utilising familiar board game techniques, such as role-playing and turn-taking, aiming to evoke a playful and engaging setting for design ideation (Vaajakallio, 2012). They are typically utilised in the early stages of design for framing participation, eliciting user needs, facilitating mutual sense-making, and envisioning new solutions.

The value of game-based methods in design seems to be related to their ability to gather diverse actors and enable them to voice their current situations and needs, as well as to collectively explore new design opportunities (Brandt, 2006; Brandt, Messeter, & Binder, 2008). The widely familiar game format provides a common frame of reference and sets guidelines for participation. Furthermore, the importance of visual and material game artefacts has been highlighted, such as systems descriptions or tangible props in facilitating collaborative "design-by-playing" (Ehn, 1992). Vaajakallio (2012) emphasises the performative, emergent nature of design games. For project managers, a design game can be a tool for identifying stakeholder expectations; for designers or facilitators, a structure for the design session; and for participants, an envisionary mindset.

Critique of design games points out that defining the scope, parameters, and rules of the game directs the outcomes and limits possible solutions (e.g. Vaajakallio, 2012, p. 128). Thus, the underlying power imbalances, worldviews, and agendas built into design games should be noted. Implementing the game outcomes is another critical issue (e.g. Ehn, 1992, p. 58).

To expand the game analogy, all creative design can be conceptualised as a reflective, game-like process unfolding over time in which the designer reacts to the opportunities and constraints in the given design situation by drawing on a repertoire of possible "design moves" developed through education, experience, and learning from precedents (Cross, 2011; Lawson, 2004; Schön, 1983). The game analogy is poignant in the present digitalised design and production system. Examples include virtual "simulation games" for enacting the form, impact, or life-cycle of designs (Scheer,

2014). Several scholars and practitioners (e.g. Nijholt, 2017; von Borries, Walz & Böttger, 2007) have explored the connections between computer games, architecture, and urbanism showing that gamification extends to the design and use of built environment. Particularly relevant to this paper are online participatory games in urban planning (Poplin, 2012; Thiel, Reisinger, Röderer, & Fröhlich, 2016) and mobile apps with game-like qualities for matching users and spatial resources in new service models based on sharing (Wegmann, 2019). These enable reaching large samples resource-efficiently.

Concerning housing design, Sanoff has worked with design games as a method for community participation in architecture (Sanoff, 1979 & 2000). He sees "participation games" as an effective way of organising group decision-making in complex design endeavours. His empirical cases largely comprise one-off participatory projects with a social and communal emphasis. Sanoff describes several design games targeted to participatory housing design, of which the "housing trade-offs" game is particularly relevant here (Sanoff, 2000, pp. 212–216). The game comprises a board with a basic layout grid, and a set of graphic symbols depicting housing-related activities (spaces) which are placed on the board during the collective play session, resulting in the identification of key activities and their relationships, that is, a preliminary spatial organisation for the building. Each activity or quality level comes at a charge, and the players are allocated a budget, forcing them to compare competing alternatives and to make compromises and trade-offs. Inclusion of an economic variable into the participatory design process is particularly valid in housing due to its high cost and long life-cycle. Sanoff points out that the trade-offs game also helps residents to discover their individual residential needs.

In the context of Finnish housing and residential environments, research on design games has been scarce. Kyttä, Kaaja, and Horelli (2004) discuss a web-based design game in which children could express their visions of an adventure forest by placing action symbols on a map. Tervo & Hasu (2017) describe a design game for developing the townhouse typology further with laypeople, based on simple scale models, and other hands-on materials (cf. Sanoff, 2000, p. 216). In this game, resident profiles were used as a starting point for housing design. The concept of design game in both papers is not clearly defined or connected with previous research. However, the studies highlight two interesting points: that the designers' role in interpreting and translating the results of design games into design solutions is crucial, and that design games can also provide a valuable research tool for gathering user knowledge. In addition, Tervo & Hasu (2017) suggest that design games can be a fruitful method when researching and developing new housing alternatives that are not yet part of the mainstream.

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To conclude, the main characteristics and benefits of design games as outlined by previous research can be summarised as follows.

- Isolation and simulation of a design problem
- Facilitation of trade-offs
- Collective sense-making and consensus building
- Design ideation beyond existing solutions
- Discovery of individual preferences and needs
- User research, data collection, and profiling
- Performing as a tool, a mindset, and a structure (Vaajakallio, 2012)

These will be returned to in the discussion section when they are reflected on with the findings of our empirical case project.

3 A design game for developing new forms of housing

3.1 The case project and participants

The case project in which the design game discussed in this paper was developed brought together the themes of solo living, affordable rental housing, and shared domestic space. The project was funded by three partners: The Housing Finance and Development Centre of Finland (ARA), VAV Asunnot Oy, a large rental housing company owned by the City of Vantaa, and the City of Vantaa which is one of the five cities in the Helsinki Metropolitan Area with around 225 000 inhabitants. The project targeted working-aged solo dwellers who lived in rental dwellings built and owned by VAV Asunnot Oy. The main objective was to determine the conditions under which shared domestic spaces might interest these residents. The target group is particularly relevant when considering that tenants in rental housing can very rarely have an impact on their residential environment (Gibler & Tyvimaa, 2014, p. 354). The project was planned and executed by the authors (with background in housing design and related research) and a third person (an architect) through private consultancy.

The case project consisted of three interrelated phases: a comparison of international design examples representing new approaches to sharing space, a survey focusing on the residents' attitudes and perceptions towards shared domestic spaces, and participatory sessions in which the design game was used to gather information and evoke discussion. The authors decided to explore the relevance and potential of design games in this context to engage the residents. Apart from the results produced by the design game, the outcomes were practical recommendations for the client as well as more general implications on the design and development of shared domestic spaces. The results were published in a final report (Tervo, Meriläinen, & Pirinen, 2018).

A web-based survey (n = 170) was conducted in Autumn 2017 to recruit participants for the game sessions. The survey included a set of questions addressing the respondents' attitudes towards shared spaces. The survey link was sent via the customer database of VAV Asunnot Oy. The survey was sent to the residents of two districts, Koivukylä and Hakunila.[1]

The results of the survey were in line with earlier studies indicating that existing housing options channel preferences (Clapham, 2005; Gibler & Tyvimaa, 2014; Kaasalainen & Huuhka, 2016). The main finding was that the respondents' present usage of shared spaces predicted their interest towards new types of shared spaces. Those who currently used the shared spaces in their apartment building were also more interested in new types of shared spaces (e.g. a shared living room). The importance of privacy was emphasised by 40 percent of all respondents fully or somewhat agreeing with the statement "Shared spaces interest me only if I can book them for my own use".

Despite initial interest from 75 persons, only ten solo dwellers confirmed their participation in the game sessions. Therefore, it was deemed necessary to send out a new invitation. The second recruitment round resulted in 56 confirmed participants of the game sessions. However, due to cancellations, the final attendance was 24 solo dwellers, aged 66 or less. The small sample limits the generalisability of the results, but the sample was sufficiently large to test the game method and to provide some empirical data. In this paper, we focus on evaluating the design game as a method of fostering resident participation. The emphasis is on reflecting the design, process, refinement needs, and future potential of the game itself.

3.2 Planning the design game

The planning of the design game was driven by providing a playful, tangible, and visual method for probing the participants' housing needs and wants. Rather than focusing on a particular building or space, the method should operate on a more abstract level, yet with a connection to the built environment. Amongst the variety of game-based approaches in design, we focused primarily on design games in the meaning of a "board game": as a game-like participatory tool that can be used in the early stages of housing design and development for eliciting user needs and facilitating collaboration among residents and professionals, as well as for spatial programming and concept design (cf. Sanoff, 2000; Tervo & Hasu, 2017). Our game shares some principles with Sanoff's "housing trade-offs game" (see section 2), but also incorporates important differences which are discussed in the final section.

The design game was developed iteratively on the basis of the survey results and analysis of international design examples illustrating different approaches to sharing space (see Tervo, Meriläinen, & Pirinen, 2018). The game board

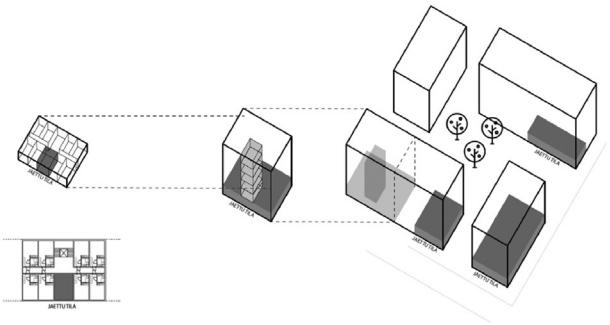

Figure 1 Shared spaces on three levels of the built environment: own floor, own building and own block

(Figure 2) was based on two dimensions. The first dimension was *the levels of built environment on which shared spaces can be located*. The notion of levels refers to Habraken's well-known model of hierarchic "levels of control" in the built environment, emphasising a nested spatial system with varying degree of user control (Habraken, 2000). Based on the international comparison and our own observations, it was evident that sharing space could happen at different architectural scales and distances from one's own dwelling. We decided to look into shared spaces on three levels: on the same floor as the participants' dwelling, in the apartment building in which their home was located, and in the surrounding block or neighbourhood (Figure 1). The game board was divided accordingly. The physical context of the game was defined as urban multi-storey blocks of flats in suburban neighbourhoods, a familiar environment for the target group and the client (Figure 1).

The second dimension of the game board was the division between *private or communal use of shared space* that was derived from the survey results and the case analysis. The cases showed that spaces can be shared either to allow several people or households to simultaneously use them, or privately by individual households, for example, by reserving a shift. This division meant that we were able to study the difference between collective and private (shift-based) use of spaces without assuming that sharing domestic spaces necessitates a strong sense of community as in many collective housing projects. This provided an opportunity to study the shared use of space also in terms of the residents who were not interested in a communal way of living. Indeed, the survey results suggested that the possibility to use shared space on one's own shift may be a prerequisite for their use. The approach also implied that shared facilities could be offered by companies or institutions, not just through residents' actions (Vestbro, 2010, p. 22).

In acknowledgement of the rise of solo living and recent trends in Finnish housing (see Section 1), we decided to take a *minimum-sized studio apartment*

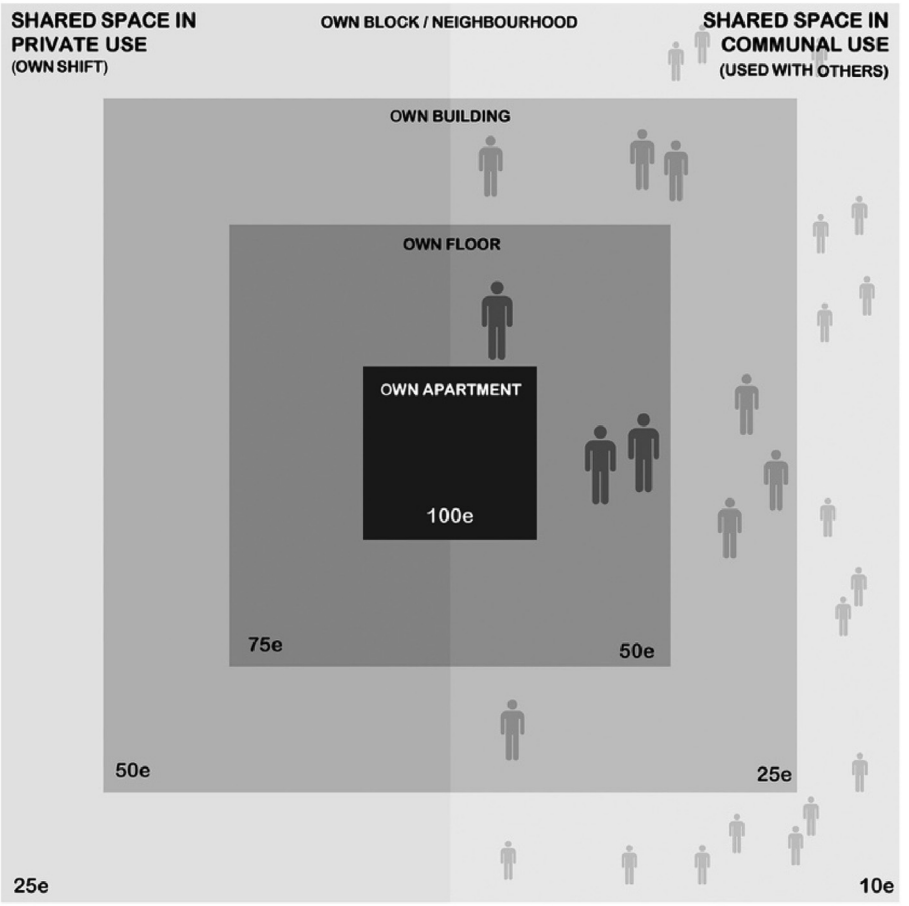

Figure 2 The game board based on two key dimensions and prices for spaces on different levels

of 20 square metres as the central element in the game (Figure 3). The dwelling size was based on the National Building Code of Finland which defines the minimum net area of 20 square metres for a one-room dwelling (Finnish Ministry of the Environment, 2017). In this way, the game was connected with the ongoing debate on decreasing dwelling sizes and minimum dwellings in Finland which was explained earlier. The idea was also to provoke the participants to question and debate about the offering of housing and prevalent design solutions. In the game, the participants could either compensate for the limited size of the private dwelling with external shared spaces, or expand the dwelling itself with additional spaces (see Figure 4).

As noted, our particular interest was in testing the *economic variable* in design games and their potential role in facilitating trade-offs in housing design and development, an issue that has largely been overlooked in recent research on

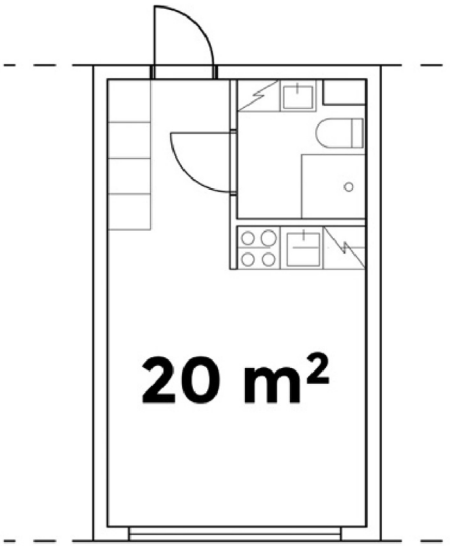

Figure 3 The minimum dwelling used as a provocative starting point in the design game

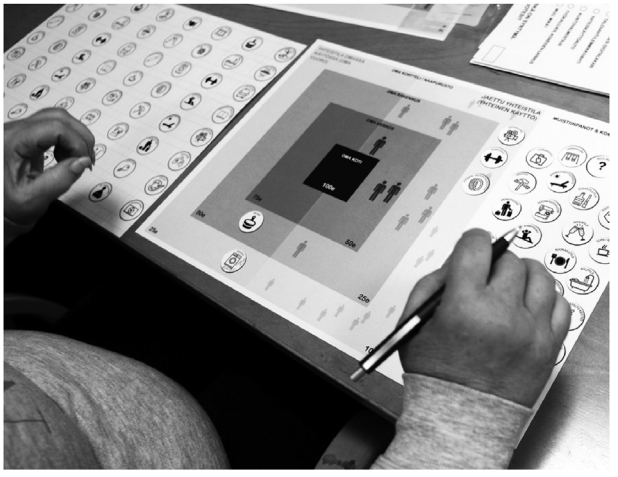

Figure 4 The game board and activity tokens. Photo from a game session

design games, aside from Sanoff's (2000) work. Thus, the design game was targeted at bridging the gap between real-life choices and opportunities and unrealistic dreams and wants. The economic variable was brought in through assigning the participants a budget that could be individually allocated to different spatial resources.

The monthly rent in the game was set at 500 euros, a somewhat low but realistic sum, following the maximum acceptable housing costs of 499 euro used when calculating the public housing allowance in the City of Vantaa (Kela,

2019). The rent was divided to ensure that 300 euros was reserved for the 20 square metre dwelling, while the remaining 200 euros could be used for optional spaces or functions that could either be shared with other households, or added as private spaces to one's home.

The price of the shared spaces was determined by two interrelated factors following the structure of the game board. The first factor was the level on which the space was situated (own floor, building, or block) with the price decreasing as the distance from one's own dwelling and the number of other users sharing the same space grew. The second factor was the way of sharing space (private or communal use). The spaces that were used on one's own turn were more expensive than the ones used simultaneously with other residents. The spaces which were added to the private apartment were the most expensive, 100 euros each. The prices for spaces on each level were indicated on the board (Figure 2).

The game tokens included a broad array of dwelling functions and home-related spaces (Figure 3). In addition to 32 pre-selected tokens, there was an empty token for emerging individual spatial needs. The tokens depicted conventional shared spaces (i.e. laundry room and sauna), spaces identified from the international design examples (i.e. guest room and library), and spaces linked with hobbies and ways of living (i.e. a gym and quiet space). With a diverse set of tokens, the aim was for the residents to reflect on their own ways of living. As one of the goals in the case project was to explore the interest towards services connected to dwelling, we also compiled a list of various home-related services, which was introduced to the participants later on during the game.

3.3 Playing the design game

The design game was tested in three sessions organised by the authors in the premises of VAV Asunnot Oy in October and November 2017. The game sessions started with an introduction to the theme of sharing. The aim was to assist the participants to think "outside the box" and to disengage themselves from preconceived ideas related to shared domestic spaces (cf. Vaajakallio, 2012). The introduction began with an image of a city block consisting of four apartment buildings with different types of shared spaces which could be used by all the residents living in the block. The participants were also shown images of international design examples analysed in the project, including affordable communal housing projects with extensive shared spaces and high-quality architecture.

The three levels on which shared spaces could be situated were then opened up with the help of a schematic axonometric drawing (Figure 1), as well as a floor plan of the studio apartment of 20 square metres chosen as the core of the

game (Figures 1 and 3). The participants were told that the floor plan was based on the minimum legal dwelling size, and that they were to think of ways to complement the small dwelling with a variety of shared spaces. Spaces could also be added to the private apartment.

As a warm-up task to help them to dive into their subjective housing needs and wants, the participants were provided with a list of activities from which they needed to select the ones which they would like to do at home and which would improve their dwellings. They were also asked to choose the three most important activities. The participants were also able to add new activities to the list.

The actual game session started with the introduction of the game rules. The participants were informed that they had a budget of 500 euros per month, of which 300 euros was reserved for the rent of the small apartment of 20 square metres, while the remaining 200 euros could be allocated for optional spaces or functions, their cost depending on two dimensions: the distance from one's own home and the way of sharing (collective or private use).

The game session lasted 25 min. During the game, the participants selected their preferred game tokens and positioned them on the board, indicating on which level of the built environment they would want the shared space or function to be, and whether they wanted to use it privately or collectively with other residents. The cost of each space was determined by the position as indicated in the game board.

After 20 min, a twist was introduced to the participants: Their monthly living cost was raised by 100 euros, which could either be used for additional space and activity tokens, or for services that were introduced on a separate list added to the game board (Figure 5). The monthly cost of each service was 50 euros. The aim of this move was to encourage participants to view housing as a totality which could also entail services. The tokens added to the board at this stage were marked with a red tag.

The game sessions ended with a discussion in which the participants shared their reflections and the results of the individual game boards. The lively debate suggested that the game method helped the participants to explicate their needs and preferences, as well as facilitated common discourse on the topic.

3.4 The game outcomes

The 24 individual game boards produced during the game sessions (Figure 5) were photographed at the end of the sessions, after which the material was gathered and analysed by the authors. The outcomes were collected in a table showing all the game tokens (spaces, functions, and services) chosen by each

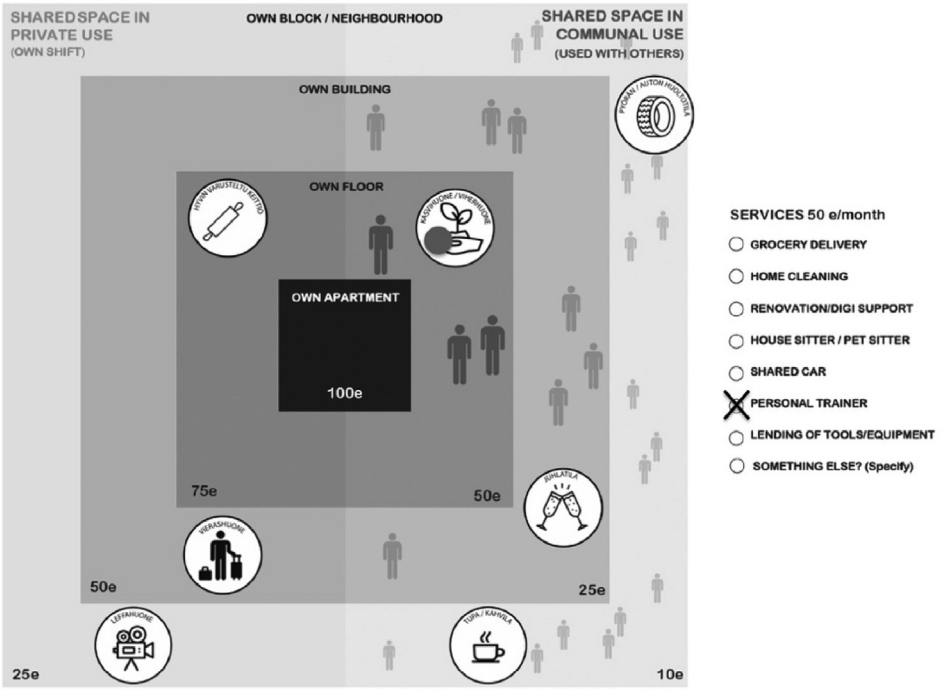

Figure 5 Reproduction of a finished game board translated into English

participant as well as their placement on the game board. It should be noted that because of the limited number of participants, the game outcomes are not statistically valid. They are discussed here just to illustrate the different types of results and user knowledge that the design game yielded as a method.

First, the material provided information about the prevalence of each space or function in the game, i.e. the spaces that the participants were the most interested in and the most willing to share. The results show that the participants were most interested in shared spaces already familiar to them, such as laundry rooms (18 responses) and saunas (14 responses). These were followed by less familiar spaces, such as lounge/cafés, barbecue terraces, and greenhouses/winter gardens (13 responses each).

Secondly, the material provided the possibility to try out ways of profiling the participants based on the choices made in the game. This is similar to consumer segmentation, in which lifestyle-based profiles or segments are understood as tools for bridging the gap between housing supply and demand (Gibler & Tyvimaa, 2014). The profiling in our case was done in two steps. The game outcomes of each participant were compiled into simple visual diagrams showing their choices at one glance (Figure 6). The individual profiles were then grouped into larger segments based on their affinity. Four different

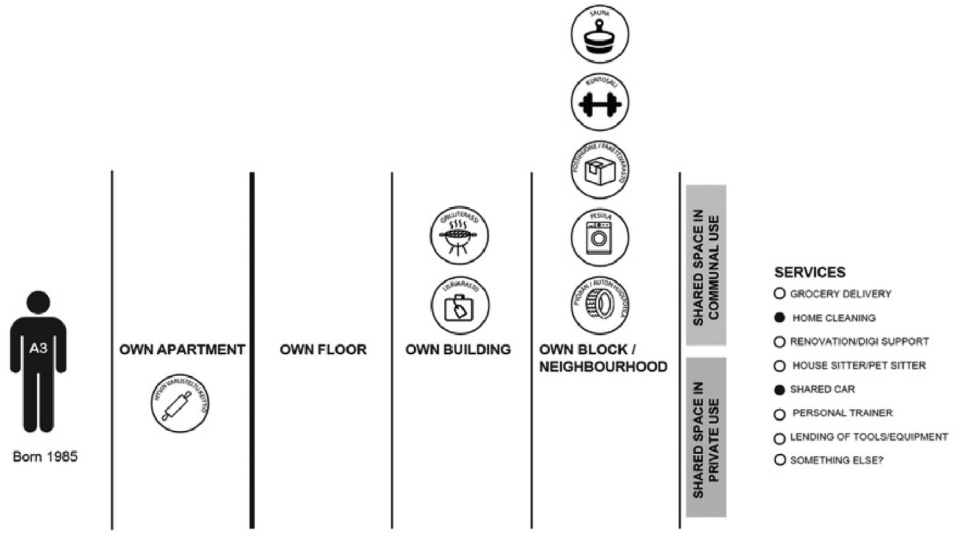

Figure 6 A "service-oriented" resident profile based on the design game

resident segments reflecting attitudes towards shared spaces were identified from the data. The segments were named "Private", "Communal", "Service-oriented" and "Practical".

Aside from household size, the only socio-demographic variable used in the analysis and the profiles was the respondents' year of birth. However, the attitudes or choices related to the shared use of home-related spaces seemed not to depend on the age of the respondents. This reflects the heterogeneity of solo dwellers (e.g. Jamieson & Simpson, 2013; Klinenberg, 2012). In recent studies (Gibler & Tyvimaa, 2014; Hasu, Tervo, & Hirvonen, 2017), resident profiling has been based on values and lifestyles, pointing out that the socio-economic characteristics of households do not necessarily predict housing preferences. Gibler and Tyvimaa (2014) approach profiles from the perspective of the profitability of construction business, whereas Hasu, Tervo, & Hirvonen (2017) see profiling as a means of connecting lifestyles and housing design. Lifestyle-based customer profiling or segmentation is commonly used by large housing developers in Finland, but mainly just for marketing purposes, without any link to housing design or concept development (Pirinen, 2014).

Thirdly, the choices made in the game and the discussions in the game sessions, largely provoked by the minimum dwelling used as the core of the game, revealed information about the solo dwellers' needs and attitudes related to dwelling size. The fact that the majority of solo dwellers (14/24) expanded the one-room apartment in the game with extra space seems to corroborate earlier studies stating that solo dwellers' spatial needs are rarely satisfied by one-room dwellings (Backman, 2015; Silvennoinen & Hirvonen, 2002; Tervo

& Hirvonen, 2019; Tervo & Lilius, 2017). This finding was supported by the discussions in the game sessions, attesting that the spatial needs of solo dwellers varied based on their life and family situation. Many participants had close and intimate relationships which were nurtured in their home and required space, as was the case with solo living grandparents taking care of their grandchildren or parents whose under-aged children officially lived elsewhere.

Finally, we tried out a tentative way of presenting the data from a design perspective. The aim here was to more closely align the results to architectural practice, thus expanding their implications for spatial programming and organisation of shared vs. private domestic spaces. The spaces chosen in the game were grouped together into "space bundles" based on interrelated functions (Figure 7). The size of each bundle was based on the combined number of occurrences that the spaces belonging to it received in the design game. The largest bundle (in the centre) contains a guest room, playroom, well-equipped kitchen, dining room, and living room. When used in conjunction with a real project, this kind of grouping, including the number of potential users, could inform the programming of shared spaces. However, at this stage, these space bundles should merely be considered an initial experiment.

4 *Discussion and conclusions*

This paper explores the potential of design games in identifying and developing opportunities for alternative housing typologies that integrate various types of shared space. The focus on shared spaces was suggested by the growth of one-person households, the emergence of a sharing economy, and interest in more communal forms of urban living. The target group (one-person households) and the starting point in the design game (a minimum-sized apartment) connected the game to current demographic trends and housing discourses in Finland. The game was developed as part of a R&D project and empirically tested with 24 solo living residents in the City of Vantaa. The game sessions confirmed that the design game was relatively easy to grasp by laypeople participants, and according to feedback from the client and our own professional experience, it produced knowledge useful for housing design and development. We shall next discuss the benefits and limitations of the design game, summarising the key findings and contribution of the study.

4.1 *Evaluating the game method*

The design game shares some features with Sanoff's (2000) "housing trade-offs game", notably a game board with spatial layout and activity tokens with an associated cost. However, the games have fundamental differences. Most importantly, our game was targeted at supporting conceptual level design rather than detailed design decisions in one-off participatory housing projects.

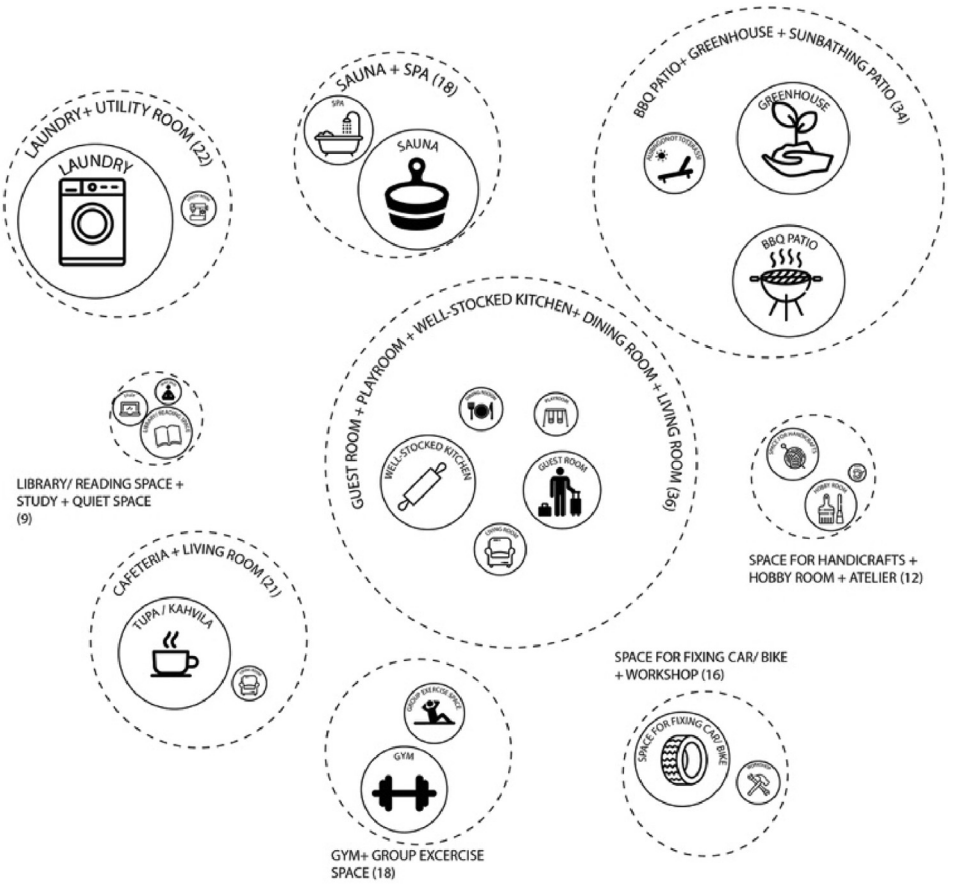

Figure 7 Space bundles resulting from the game material

The game board does not represent a floor plan, but a more generic spatial system, extending from the apartment to the scale of the block/neighbourhood. As our game focuses on shared spaces, the way of sharing provides an additional dimension. Another new feature was the inclusion of services into housing. Furthermore, in contrast to Sanoff's consensus-building approach, our game was initially designed for probing the needs of solo dwellers. In addition, the cost variable works in a different way, as in our case, the cost of the spaces or activities is dynamic, depending on the distance from one's own dwelling and the way of sharing. Thus, our design game offers a new type of method to the field of housing.

Returning to the key characteristics of design games derived from literature (see Section 2), the gaps in housing studies discussed in the introduction, and the drivers for sharing domestic spaces (see Section 1), the key findings of the study regarding the design game method can be summarised as follows:

4.1.1 Isolation and simulation of a design problem, and facilitation of trade-offs

The design game isolated the design problem of shared domestic spaces into a simplified model (cf. Habraken & Gross, 1988; Sanoff, 1979). The simple economic variable in the game enabled the simulation of real-life choices related to shared spaces with some degree of accuracy, although more data collection and iteration of the variable is needed to validate this. The introduction of economic constraints (a housing budget) to limit choices and the pricing of spaces (based on the distance from one's own dwelling and the way of sharing) provided the participants with a framework for valuing the dwelling features and achieving trade-offs, thus leading to an optimisation between available resources and housing dreams (cf. Sanoff, 2000). This targets the problem of an unrealistic "well of wishes" in research on housing needs, discussed in the introduction (Lapintie, 2010b; Salen & Zimmerman, 2004).

4.1.2 Collective sense-making and consensus building

In line with Sanoff's (2000) housing design games and the studies on product design games (Brandt, 2006; Vaajakallio, 2012), the game facilitated collective sense-making between laypeople and professionals, who in this case were managers of a rental housing company, city housing authorities and consultants (the authors). The game format and play-like atmosphere in the sessions, as well as the floor plan of the minimum apartment and other visual and tangible elements used in the game, reified the issue of shared space, thus facilitating common discussion and debate. In contrast to previous housing design games, the core emphasis in our game is not on collaborative decision-making or consensus-building, but on eliciting individual needs. An evident question here concerns the suitability of the game for multi-person households. Nevertheless, in this case, the household members could play the game together. The game could potentially assist in situations requiring negotiation or consensus among resident communities.

4.1.3 Design ideation beyond existing solutions

This aspect was not explicit in the design game as it focused on mapping the solo dwellers' needs without specific design goals, even if the international design examples shown to the participants were intended to sensitise them to think "outside the box". The discussions were largely rooted in the everyday experiences of the solo dwellers in their present living environment. Nonetheless, as the game deals with ideal choices, studying ways in which it could support creative ideation might be interesting in the future.

4.1.4 Discovery of individual preferences and needs

Based on our observations in the game sessions, the design game efficiently facilitated the discovery of the solo dwellers' individual preferences and needs related to sharing domestic spaces. This was supported by the game mindset

and process which led the participants to consider their needs, the physical game which visually presented the choices, and the rules which forced the participants to weigh the relative importance of functions. Comparing the finished game boards with others in their table evoked comments in which the participants reflected on themselves as residents. It seems that the sessions provided an arena for contemplating personal housing wishes and the realities of the housing market. As noted, the game outcomes and discussions in the sessions corroborated earlier studies suggesting that the spatial needs of solo dwellers are not determined by household size (Tervo & Hirvonen, 2019).

The minimum-sized dwelling chosen as the provocative starting point raised considerable criticism and proved to be a fruitful way of bringing to the surface some of the discrepancies between the everyday needs and wants of the solo living tenants and the housing models offered to them. Regarding the underlying power structures and agendas in design games, the focus on the minimum dwelling could arguably be seen as a means of powerholders to steer the participants' perception towards small dwellings and to present decreasing dwelling space in favourable light, even if this was not the intention in the case project. However, the game sessions made evident that the participants did not accept such implicit agendas without questioning.

4.1.5 User research, data collection and profiling

The analysis of the game outcomes showed that a design game can be used for creating resident profiles and segments which elaborate the differences in people's attitudes towards shared domestic spaces. These could provide a starting point for the design and development of new housing concepts as well as for understanding the needs in existing residential communities. However, due to the small sample and manual analysis process, the segments are not statistically valid and should be seen as tentative. The design game also provided an effective research tool for gathering qualitative data on residents' needs, thus helping to overcome the recognised gap between knowledge on housing needs and actual design solutions (cf. Tervo & Hasu, 2017). The method is easily scalable to larger populations.

4.1.6 Performing as a tool, a mindset, and a structure

The design game worked differently for the stakeholders as suggested by Vaajakallio (2012). For the client, it provided a tool for gaining insight on tenants' attitudes towards shared spaces and on the architectural possibilities of sharing space. For the authors as researchers and consultants in the case project, the game acted both as a research tool and as a structure for organising the participatory sessions. For the participants, the game created a mindset which led them to recognise their own needs. Thus, the game added value to all stakeholders, supported the achievement of the project goals, and provided tool that can be utilised in further development activities by the client.

The evaluation of the game corroborates earlier studies on the benefits of design games. In this game, due to the focus and target group, the trade-offs and preference discovery aspects were emphasised, whereas collective ideation was less important. To summarise the benefits, the design game led the participants to recognise and articulate their individual needs and preferences related to shared domestic spaces, to weigh the relative importance of dwelling functions and features with some accuracy to real-life economic choices, as well as to negotiate the boundaries between shared and private space. Novel properties in the design game are its positioning on the conceptual level rendering it transportable and scalable as well as its potential in resident profiling.

4.2 Challenges and development needs

The design game experiment also revealed some problems and development needs. An obvious issue concerning the reliability of the study is the small sample. However, qualitative design research, aiming at producing knowledge that is useful to design practice, often relies on relatively small samples. In our case, the number of participants was sufficient to test and evaluate the game method. The design game is readily transferable, enabling validation of the method and outcomes through subsequent research. It should also be noted that the utilisation of the game does not depend on the number of participants. It can be applied in a specific location with few residents or as a research tool for gathering large amount of data. The reliability of the study is ensured by transparent accout of the process as well as grounding the design game to previous research and to a real-life context through the case project.

Recruiting participants and organising the game sessions as well as analysing the non-digital material turned out to be rather time-consuming. A digital version of the game would enable the gathering of a large sample resource-efficiently as well as facilitate an analysis of the data. Such a version could also provide a basis for more detailed resident profiles with more extensive and relevant background information, such as the income level of the respondents. Broader application of the method could also yield data for statistically reliable results. Creating a digital version of the design game would be the next step towards its broader diffusion. Mobile apps developed in the context of various sharing platforms could provide a valid reference (cf. Wegmann, 2019).

As mentioned earlier, the economic variable in the game also needs further development. The abstractness of the game and its disconnectedness from real-life decision-making in housing still overtly simplifies the choices. Hence, it cannot be guaranteed that the choices made in the game would materialise in real-life decision-making. Here, we could look more closely into the theories and models in economics and housing preference studies.

It should also be noted that the intention in the case project was not to utilise the game results in a particular housing project or location, but to gather resident knowledge on a more general level. Developing a truly participatory design game would necessitate a connection to a real development or renovation process and ensure that the game outcomes impact the design solutions. From the perspective of participatory design, the case project was limited to consultation of the tenants (cf. Arnstein, 1969). Translation of the design game outcomes into subsequent action remains a challenge. On the other hand, the method helped the client to gain a better understanding on the residents' needs, facilitating a shift towards more customer-centred approach.

4.3 Contribution and practical implications of the study

This paper contributes to housing studies by documenting and assessing a new design game targeted to the participatory development of shared domestic spaces. It adds to research on design games by discussing the utilisation of game-based methods in the built environment and by exploring the possibilities of using design games for simulating economic trade-offs in housing, which is a promising area for further research. Importantly, the study also opens up the potential of design games as a research tool and as a means for resident profiling and segmentation.

In a departure from previous studies on housing design games, the paper proposes a design game targeted at the conceptual level or strategic design phase, preceding architectural design. The study suggests that a design game could be utilised in housing design as well as in reprogramming the spaces in the existing buildings to meet the spatial needs of households that are interested in sharing domestic spaces. The latter is particularly relevant as the large suburban areas built between the 1960s and 1980s in the Helsinki Metropolitan Area have reached their renovation age (Kaasalainen & Huuhka, 2016).

The case project clarified that to gain outcomes that are truly linked with design processes, thus being beneficial for architects, planners, and building developers, the design game should be adjustable to specific local contexts and needs, such as a particular building or renovation project. This would also allow a more holistic examination of the dwelling in relation to its location and other environmental features, connecting the method more closely with housing preference studies (cf. Hasu, 2018; Ilmonen, 2017, pp. 42, 4; Boumeester, 2011, p. 30). In the design game described here, the economic variable (housing budget), the levels of built environment, and the functions, spaces and services (game tokens) can easily be made case-specific. Implementation of the approach by local housing authorities or developers could be supported by developing a digital version of the game.

The opportunity to share spaces on different levels of the built environment could provide one approach for solving the spatial needs of solo dwellers in a socially, economically, and environmentally sustainable way. In this context, participatory design games could be employed as a hands-on method for supporting the design and development of new housing concepts and typologies based on sharing, or as a strategic tool for adopting more efficient, flexible and personalised ways of utilising the existing spatial resources.

Submission declaration

The practical outcomes of the case project have been published previously as a non-scientific report: Tervo, A., Meriläinen, S. & Pirinen, A. (2018). *Jaetut tilat* [Shared spaces]. Lahti: ARA, available in https://www.ara.fi/fi-FI/Tietopankki/Julkaisut/ARAn_raportteja_julkaisusarja/Jaetut_tilat(46150). This article focuses on the design game method, providing an original scientific contribution.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: This work has received funding from The Housing Finance and Development Centre of Finland ARA, VAV Asunnot Oy and the City of Vantaa. The participants in the study were tenants of VAV Asunnot Oy. The funding agencies have not been involved in study design, development of the design game method, analysis or interpretation of data, or writing of the article.

Acknowledgements

The authors should like to thank architect Sanna Meriläinen for her contribution to planning the design game and executing the case project together with the authors, as well as The Housing Finance and Development Centre of Finland ARA, VAV Asunnot Oy and the City of Vantaa for funding the work.

Notes

1. Vantaa is divided into seven districts and 61 neighbourhoods (www.vantaa.fi).

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