ARTICLE



Size matters. How does the number of dwellings affect housing co-production?

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Abstract

This paper investigates the influence of size when co-producing housing. Based on Olson's logic of collective action and a literature review of collaborative housing, the research builds an analytical framework comparing small, moderate and large co-produced housing projects. The research is based on a cross-disciplinary qualitative study of collaborative housing projects in Nantes, Brussels and Zurich. The analysis of the projects links a spatial investigation of the dwelling spaces with in-depth field observations and interviews to bring to light housing configurations, residents' practices and settlements' populations. Larger collaborative housing projects yield two major benefits. On the one hand, size reduces spatial particularisms, thereby allowing for a multiplicity of dwelling practices. On the other hand, the benefits generated by critical mass and the possibility for residents to avoid mandatory interactions with others can favour social inclusion both within the project and in the neighbourhood. Given their greater spatial diversity and social mix, largescale collaborative projects tend to offer more resilience to familial and societal changes. Size could hence be a valuable asset in new sustainable design, provided some precautions are taken, viz: ensuring solidarity despite heterogeneity, preventing oversizing and establishing the cultural and legal conditions for alternative developments.

Keywords Collaborative housing \cdot Collective action \cdot Group size \cdot Housing co-production \cdot Specificity \cdot Social inclusion

1 Co-producing housing, the effects of size

Recent decades have seen a renewed interest in collaborative housing (Fromm, 2012; Lang et al., 2018; Tummers, 2016; Vestbro 2010; Czischke, 2018) in Western Europe. One of the reasons is that traditional housing developers produce top-down 'supply-driven' housing, which rarely meets users' needs (Bouchain, 2010; Ring, 2013). In contrast, collaborative housing features bottom-up participatory procedures, leading to 'demand-driven' housing (Van Geest, 2013). Indeed, collaborative housing emerges

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from co-production, a notion defined as 'the process through which inputs used to produce a good or service are contributed by individuals who are not in the same organisation' (Ostrom, 1996). By directly determining their living environment (both spatial and social) at all stages of the planning process, residents are able to produce a more adequate response to their actual needs (Lang et al., 2018).

The size of a collaborative project can deeply affect its spatial dispositions and social dynamics. This has not received much scientific attention, however (Vestbro 2010). The goal of this paper is to evaluate the effects of size on spatial dispositions and social patterns when co-producing housing. In the case of collaborative housing, size refers both to the number of people working together to create these dwellings and to the number of dwelling themselves. Although there is a very strong correlation between them, those two aspects do not always coincide. For instance, in recent Swiss cooperative projects (Blum et al., 1993; Boudet, 2017; Kalkbreite, 2015), the people involved in a housing development were not always interested in living in the project later on. Many took part in the process out of self-interest or to improve their knowledge and gain experience (Carina Heye, ETH Wohnforum).

In terms of method, research was carried out in three stages: (1) a desk research on the effect of size; (2) an analysis of the scientific literature on collaborative housing in relation to size; and (3) a qualitative investigation of three case studies.

1.1 Effects of group size when producing a collective good

Scientific literature on the effects of size in the field of collaborative housing is very scarce, but economists have addressed the issue of group co-production thoroughly.

First, a group is defined as an assembly of at least three individuals (Anzieu & Martin, 2006) 'in a relevant population who have a positive interest in (a) good' (Oliver & Marwell, 1988).

Second, referring to group sizes when producing a good through collective action, Olson points out three thresholds relating to the interest of group individuals in producing that good (Olson, 1965). In small – 'privileged' – groups, some individuals are able to provide a significant part of the good. In medium – 'intermediate' – groups, no group member is able to produce a substantial share of the good, but any member could make a noticeable difference in its provision. In large – 'latent' – groups, no group member can make a noticeable contribution (Olson, 1965). Olson argues that large groups should fail while small groups might succeed (Hardin, 1982), but several scholars argue that 'larger groups have more resources and more people who might contribute to collective action' and the 'positive effects of group size increase with group heterogeneity and non-random social ties' (Oliver & Marwell, 1988).

Third, in addition to collective-action theories, in terms of social interactions, the optimum size of a group 'is determined by its social function' (Kohr, 1951). Kohr identifies two factors defining this optimum size: the purpose for which individuals choose to congregate, and the benefits those individuals might derive from not being alone. In the case of housing, the central goal of social interactions is conviviality, since it ensures 'both variety of contacts and constancy of relationships in addition to the upkeep of communal meeting places such as a public house or commons' (Kohr, 1951). According to Kohr, the optimum size to ensure conviviality is a group of 80 to 100 adults.

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1.2 Collective action and housing co-production

Expanding directly on Olson's theory in terms of group thresholds, the research focuses on collaborative housing as a co-produced good. Collaborative housing is understood as a 'collective self-organised form of housing' (Czischke, 2018). Based on these premises, the research aims to analyse the effects of collaborative housing size in terms of spatial dispositions (what kind of spaces are produced?) and social interactions (who lives there and what are their relationships?).

Olson's threefold taxonomy was transferred to collaborative housing through preliminary desk research based on scholarly and practitioners' literature. This literature review assembled comprehensive data on 60 collaborative housing projects built in Europe over the last 25 years, featuring the number of dwellings and inhabitants, the surfaces of the private and collective spaces, and the variety of collective amenities (Table 1).

Olson's theory defines three categories of co-production groups: small, where each individual makes a significant contribution to the housing development; medium, where that contribution can be noticeable; and large, where no individual makes a noticeable contribution. In collaborative housing projects, the size ranges from two to 200 dwellings (Vestbro 2010), which is confirmed by the quantitative analysis. Within this range, small groups are resident-led initiatives in which everyone is needed to produce housing and has an active part in its production. These are usually projects of ten dwellings or fewer. Medium groups are projects where an individual's action can be noticed, but is never compulsory. These are usually projects developed by the middle class as a means to reach home ownership, ranging from ten to 30 dwellings. The third scale refers to projects in which no individual has a noticeable impact on the overall project, which relies on external coordination and complementary funding. They range from around 75 to 100 dwellings and more.

1.3 A qualitative and interdisciplinary survey

Based on this analytical framework, a qualitative survey was set up to investigate the differences brought about by size. Three case studies were selected from the quantitative preliminary analysis based on two criteria: the relevance of collaborative housing in their environment and the size of the project, one per category.

The research set out to explore three cities where a renewed interest in collaborative housing has been observed from both an academic point of view and by a broader audience: Nantes, Zurich and Brussels (Dessouroux et al., 2016; Nantes Métropole, 2015; Boudet, 2017). While Nantes has received much attention for recent developments on the Ile de Nantes, Zurich has produced numerous innovative housing projects that claim unambiguously to do 'more than housing' (Hugentobler et al., 2015). Brussels, for its part, is facing a considerable housing challenge due to a recent demographic boom. A collaborative project was selected in each city for its representativeness according to Olson's thresholds: a small project, *La Boîte Noire* in Nantes; a medium project, *Brutopia* in Brussels; and a large one, *Kalkbreite* in Zurich.

In terms of qualitative methods, given that the goal of this research was to assess the effects of size in terms of spatial dispositions and social interactions when co-producing housing, a cross-disciplinary investigation was conducted by scholars in architecture and the humanities.

Table 1	Quantitative	analysis of	collaborative	housing	projects ir	n Europe
		-				

Project	Location	Year	Dwellings	Inhabitants	Collective surfaces	Collective/person	Private surfaces	Private/person	Shared amenities Type 1.i.	Shared amenities Type 1.ii.	Shared amenities Type 2
Sandberghof	Darmstadt	2007	5	10	108	10.80	447	44.70	х		
Villa van Vijven	Almere	2008	5	20	0	0.00	1300	65.00	х		
La Boîte Noire	Nantes	2014	6	17	114	6.71	506	29.76	x		
Kithier semi-detached Houses	Diessen	2007	6	24	77	3.21	1323	55.13	x		
Annagarten	Orianenburg	2019	8	35	118	3.37	1093	31.23	X		
Mischen Possible (oderberger strasse 56)	Berlin	2010	9	17	155	9.12	566	33.29	X	v	X
Karthago	Zurich	1997	10	54	1360	25.19	1005	18.61	X	x	
Ustend Residential Building	Frankfurt am Main	2011	10	27	560	20.74	1202	44.52	X		
Inklusiv wohnen	Koln	2017	11	154	140	2.59	1387	25.68	X	v	v
Hunziker Areal, house A*	Zurich	2015	11	154	286	1.85	4372	28.39	x	x	X
Neutrankengasse 18	Zurich	2015	11	30	105	3.50	1146	38.19			x
Sredzkistrasse 44	Berlin	2017	11	21	0	0.00	1124	40.95	v		
Chase Beiege	Diesuen	2015	12	40	104	9.00	1134	28.00	~		
Clidsd Nelsga	Podia	2010	13	40	104	4.00	1920	20.00	~		
L'espoir	Bruccolc	2011	15	45 90	0	0.00	1050	42.30	^		
Cara Nova	Brussels	2010	14	50	221	4.62	1907	27.94	v		
Octallolinda	Milano	2015	15	25	231	6.20	1052	12 71	×	v	
Bärenfelserstrasse 34	Rasel	1984	17	34	26	0.25	1209	35.56	x	^	
Echannée	Brussels	2017	18	47	123	2.62	1740	37.02	x		
Baugruppe B50 (Bitterstrasse 50)	Berlin	2017	19	62	125	2.02	2037	37.02	x		
Alte Schule Karlshorst	Berlin	2008	21	60	80	1.33	1902	31.70	X		x
New ground	High Barnet	2016	25	42	00	0.00	1681	40.02	x		X
Heizenholz (Kraftwerk2)	Zurich	2010	26	85	935	11.00	2485	79.24	x		x
Brutopia	Brussels	2013	29	80	80	1.00	3237	40.46	X		x
VinziRast-mittendrin	Vienna	2013	30	27	540	20.00	375	13.89	x		x
Refueio	Berlin	2015	30	40	200	5.00	950	23.75	X		X
New Hamburg Terrassen	Hamburg	2013	32	96	62	0.65	3500	36.46	х		
Trudeslund	Copenhagen	1981	33	100	450	4.50	2950	29.50	х		
Que(e)rbau	Vienna	2017	33	67	200	2.99	2115	31.57	х		х
Tila Housing	Helsinki	2009	39	136	128	0.94	3048	22.41	х		х
Krakauer Strasse	Vienna	2013	39	92	660	7.17	3300	35.87	х	х	х
ro*sa Women's living project	Vienna	2009	41	100	699	6.99	2627	26.27	х	х	
Färdknäppen	Stockholm	1993	43	55	650	11.82	2490	45.27	х	х	
Wohnart 3	Darmstadt	2010	44	86	300	3.49	3500	40.70	х		х
Big Yard (Zelterstrasse)	Berlin	2010	45	135	275	2.04	6624	49.07	х	х	
Zollhaus	Zurich	2020	52	190	500	2.63	6100	32.11	х	х	х
Vrijburcht	Amsterdam	2008	52	151	375	2.48	7650	50.66	х		х
Kreuzberg	Berlin	2007	53	56	325	5.80	2735	48.84	х	х	
Bofaellesskabet Lange Eng	Albertslund	2008	54	200	955	4.78	5740	28.70	х		
Dreieck	Zurich	1996	58	142	850	5.99	2965	20.88	х	х	х
Warmbächli	Bern	2020	60	190	240	1.26	7300	38.42	х	х	х
Grandhotel Cosmopolis	Augsburg	2013	66	95	620	6.53	2640	27.79	x	x	x
Spreeteld	Berlin	2014	67	150	920	6.13	5265	35.10	x	x	x
Sargtabrik	Vienna	1996	73	210	350	1.67	5510	26.24	x	x	x
WohnSinn 1 and 2	Darmstadt	2003	/3	150	500	3.33	6200	41.33	x	x	
Lagerplatz 141	Winterthur	2018	80	120	365	3.04	6150	51.25	x	x	x
Pain-wonnpark	vienna	2013	93	2/9	252	0.90	7946	28.48	X	v	X
Naikoreite	Zurich	2014	5/	200	1224	4./1	7785	29.94	A V	A V	A
Wagnisa	wunich	2009	9/	228	245	1.07	/165	31.43	X	X	X
Die Bremer Stadtmusikanten	vienna	2010	100	2/1	1028	3.90	9413	34./3	X	v	v
Antag Ant Voligut	Zusiek	2017	121	100	300	2.00	1300	12.07	×	× v	×
Zwicky Suu (KrattWerk3)	Lunich	2015	129	220	2280	1.00	12510	41.70	×	×	×
Ciescorei	IVIUNICh	2016	158	320	3/9	1.18	9565	29.89	X	×	X
Tanthaf	winterthur	2013	171	120	4923	14.92	11400	34.73	×	×	A V
Talition De alla aus	Dent	1981	1/1	130	1800	14.31	2222	27.19	A V	A V	A V
Poolinaus	менла	2007	252	5UZ.4	930	5.U8	9030	51.85	^	^	^

The bold refers to the 3 projects that have be examined in the paper

*The data are slightly biased for the Hunziker Areal, house A as it displays 11 very large cluster apartments for a total of around 154 people

From an architectural point of view, the collaborative projects were studied by means of a typo-morphological analysis (spatial relations, hierarchy and typological variety in terms of individual and shared spaces). To be able to compare them objectively, all projects were redrawn with the same graphic codes. Additionally, interviews were carried out with the projects' architects and urban planners to comprehend their attitudes towards housing. The goal of this spatial analysis was to understand the characteristics of the co-produced space with a focus on individual and collective spaces.

From a social point of view, an ethnographic approach was taken. The researchers made two extended stays in the Nantes and Zurich projects (a preliminary stay of



Fig. 1 Catalogue sample of the qualitative analysis

four days in April 2016 followed by a one-week stay in each project in July 2016). Researchers explored the Brussels' project eleven times between April 2016 and May 2017. These visits allowed the researchers to make field observations complemented by photos, drawings and notes. They also conducted interviews with several inhabitants and various stakeholders (activists, project managers and academic researchers) based on Kaufmann's 'comprehensive approach' (Kaufmann, 2011). Inhabitants were approached using a door-to-door strategy in Nantes, while in Zurich they were approached in the shared spaces, leading to twelve interviews in the first case and fourteen in the latter. Those interviews, lasting about an hour and a half, took place in the residents' dwellings. At the end of each interview, the interviewees were asked to draw their dwelling. In Brussels, the analyses were complemented with master's theses carried out by students from 2016 to 2018. The ambition of the social analysis was to comprehend the social dynamics and the socio-cultural composition of the projects.

The outcomes of the research were reported in a catalogue (Fig. 1) combining spatial and social analyses.

2 Analysis of spatial and social dispositions in housing co-production

2.1 Spatial dispositions

2.1.1 Description of the projects

All three selected projects are set in urban contexts. *La Boîte Noire* (Fig. 2S) began in 2011 when a group gathered to set up a resident-led housing project in the suburbs of Nantes (Nantes Métropole, 2015). The plot is located at a crossroads, enabling an

S La Boîte Noire

Architect: Claas architectes Year: 2014 Dwellings: 6 (17 residents) City: Nantes, éco-quartier Bottière-Chénaie Tenure : ownership Origin : private self-promotion

M Brutopia

Architect: Stekke + Fraas Year: 2015 Dwellings: 29 (80 residents) City: Brussels, quartier Saint Antoine Tenure : ownership Origin : private self-promotion

L Kalkbreite

Architect: Müller Sigrist architekten Year: 2014 Dwellings: 97 (260 residents) City: Zurich, Aussersihl Tenure : cooperative Origin : right to the city movement (activist citizens + housing experts)



Fig. 2 The case studies based on three thresholds

L-shape building with two street façades. The project is organised around a communal garden accessed through an open-air collective hallway. All collective spaces are located in a volume adjacent to this hallway (bicycle storage, a laundry, a shared studio and a collective attic). The project consists of six private dwellings around the garden: four terraced houses and two single-storey apartments.

Brutopia (Fig. 2M) was initiated in 2008. It is set on a former industrial site in a disadvantaged neighbourhood of Brussels (Lenel et al., 2020). The plot is located on a closed urban block that can be accessed from two streets. The project revolves around a central collective garden closed off from the street by two volumes housing 29 private dwellings on the upper floors. Entrances, commercial spaces and two collective spaces (a laundry and a collective room) can be found at street level. Each building features exterior galleries on the first and third floors leading to duplex apartments while single-storey apartments are accessible through the vertical circulation.

Kalkbreite (Fig. 2L) was initiated in 2006 by a group of 50 citizens who established a cooperative in order to redevelop an urban brownfield in Aussersihl, Zurich (Kalkbreite,

2015; Schindler, 2014). The project encompasses an entire city block. It is set on top of a tram depot enclosed by commercial and office spaces. A public garden is located on the roof of the depot. It is surrounded by dwellings (97 apartments) organised along an interior street. Collective spaces are scattered throughout the entire building (cafeteria, dining room, library, laundries, DIY workspace, bicycle garage, spare '*joker*' rooms, '*boxes*', sauna, summer kitchen, etc.) as well as outside through a series of terraces.

To understand the spatial specificities of the three projects, they have been compared at two different scales, from domestic to collective spaces.

2.1.2 Domestic spaces

The individual housing arrangements in La Boîte Noire are conventional in terms of surfaces and layouts compared to most projects of similar size (Boer and Minkjan 2016). They display a standard night/day division, organising the dwelling between two poles: the living-dining-kitchen on the one hand and the bedrooms-bathroom on the other. Moreover, the architect states that the plans 'tend to be very specific in small developments' (Boris Nauleau, Claas Architectes, April 2016).¹ This specific character is obvious in the design of the row houses (Fig. 3S): within a traditional distinction between day functions on the ground floor and bedrooms upstairs, each household has adapted its dwelling very personally. None of the kitchens, staircases or toilets is alike, leading each time to a specific disposition of the shafts. 'I decided to design my living room as open as possible and chose to place the kitchen on the street side ... my neighbours chose a completely different layout' (Sandrine, La Boîte Noire, July 2016). Each domestic space was designed very carefully according to the needs expressed by the inhabitants. 'I wanted a closed-off kitchen...my breakfast table and main seat had to have a direct view on the garden' (Monique, La Boîte *Noire*, July 2016). Furthermore, in terms of typological diversity, the project displays only two different housing types: individual row houses and single-storey apartments (Fig. 3S). These two characteristics – highly specific dwelling layouts and low typological diversity - can be seen in most small-scale collaborative developments (Masson et al., 2015; Nantes Métropole, 2015).

In the case of *Brutopia*, the general dimensions of the apartments remain similar to today's dwelling provision in Brussels, largely a developer-led model based on the nuclear family, displaying two to three bedrooms within a clear night/day division of space (Ledent, 2014). All apartments present the same characteristics: they are through apartments delivered as raw-space with a few à *la carte* choices (Fig. 3M). Once delivered, each household oversaw its interior with its own architect. Hence, even though every apartment is tailored to its resident, the overall structure is more generic (regular shafts, etc.) than in *La Boîte Noire*. Furthermore, the typologies are more diversified than in *La Boîte Noire*. They range from one to four-bedroom apartments in duplex or simplex mode (Fig. 3M).

In *Kalkbreite*, the apartments are not designed according to the needs of individual users but rather to house a wide range of household profiles (Kalkbreite, 2015). Additionally, the project presents several innovations – including fewer private amenities, often no exterior spaces and smaller surfaces – in order to enhance collective spaces and services (Ledent et al., 2019a). Hence, within *Kalkbreite*, the residents tend to 'use the home, not the flat'

¹ All interviews that were carried out in French have been translated into English by the author. Inhabitants are identified by first names, which have been anonymised, while architects and scholars retain their first and last names.



Fig. 3 Domestic spaces-layout specificity and typological diversity

(Hugo, *Kalkbreite*, July 2016), living in the entire building rather than solely in their individual housing unit. Moreover, innovative layouts such as 'cluster apartments' were produced to enable and support new lifestyles (Boudet, 2017). Those clusters form groups of up to 11 rooms combined around shared living rooms and kitchens (Fig. 3L). Overall, the spatial layouts are less conventional and specific than in the small to medium-sized projects. Furthermore, *Kalkbreite* displays a tremendous diversity of dwelling typologies (29 across 97 dwellings) ranging from very small ($27m^2$) to very large apartments ($253m^2$) for a total of 260 residents (Fig. 3L). This great typological diversity can also be noticed in other large-scale collaborative developments (*Sargfabrik* in Vienna with its numerous combinations of $45m^2$ modules to generate 73 dwellings, *Zwicky Süd* in Zurich with 18 different housing types across 129 dwellings, etc.).

2.1.3 Communal spaces

Collaborative housing is known for producing an eclectic mix of shared amenities such as laundries, collective rooms, common gardens, spare bedrooms, etc. (Schmid et al., 2019).

In terms of communal spaces, both *La Boîte Noire* and *Brutopia* offer similar shared amenities: a common garden, a laundry, bicycle parking and a collective room (Table 2). These are the basic common functions found in similarly sized collaborative housing (Table 1). Such functions can be seen as 'extras' that would not usually be part of the dwelling itself but in immediate relation to it (Eleb & Simon, 2014), such as 'places to organise a birthday party for the kids, to play music...without disturbing my household' (Jos, *Brutopia*, October 2016). Interestingly, any non-residential spaces in these small to medium-sized projects have great difficulty finding tenants. In *Brutopia*, for instance, such spaces are used by the architects' own office and as facilities for the municipality.

In the case of *Kalkbreite*, two kinds of collective spaces can be found (Table 2). On the one hand, a series of communal spaces are intended for the residents (1). Those spaces are of two kinds. First, similarly to small and medium-sized developments, some act as direct extensions of the dwelling's functions (1.i). Second, some collective spaces shelter functions that are traditionally part of the dwelling (1.ii) such as sleeping, gathering, eating, cooking, washing and working (Nishihara, 1968). That is the case of the communal dining room where a group of residents has daily dinners instead of taking them at home, which is 'very practical because my husband works a lot...and I'm alone with the kids' (Maria, Kalkbreite, July 2016). Other spaces act in a similar fashion by replacing what used to be inherent to the dwelling: a common library, 'joker' rooms, etc. (Table 2). The joker room is a recurring feature of collaborative housing projects. This detached room is an interesting asset to replace the assessment process when future tenants are unknown or when these needs (privacy, independence, etc.) evolve. This room is made available to residents for various uses for a limited period. *Kalkbreite* includes six joker rooms allowing their occupants a certain independence from the household: they can accommodate a teenager getting ready to leave home, a grandparent, a home medical aide, etc. As residents testify, this configuration allows the independent person to do 'what she wants...it's her thing', far from the household apartment (Martin, Kalkbreite, July 2016).

On the other hand, a series of collective spaces are not solely intended for the residents (2). The central garden, for instance, is genuinely a public amenity; it is accessible not only to residents but also to the neighbourhood. In *Kalkbreite*, other communal facilities are open to the neighbourhood, including a childcare facility, several restaurants, shops and even a cinema. According to the quantitative analysis, providing collective amenities for both the

 Table 2
 Taxonomy of collective spaces

		S	М	L
		La Boîte Noire	Brutopia	Kalkbreite
		(17 residents)	(80 residents)	(260 residents)
residents	1.i. Spaces usually found outside the domestic realm	common garden laundry bicycle parking collective room	common garden laundry bicycle parking collective room	terraces laundry bicycle parking collective rooms cafeteria sauna summer kitchen boxes
for		114 m2 int. + 270 m2 ext.	80 m2 int. + 753 m2 ext.	701 m2 int. + 1189 m2 ext.
1. Spaces	1.ii. Spaces usually found inside the domestic realm			'joker' rooms library living room dining room (+ grosshaushalt) kitchen
		/	/	525 112 111
2. Spaces for residents	and non residents		offices municipal facilities	central garden childcare facility offices restaurant shops cinema
		/	546 m2 int.	4982 m2 int. + 2300 m2 ext.

residents and the neighbourhood is a distinctive feature of large-scale projects (*Hardturm-strasse (Kraftwerk 1*): restaurant, shops; *Sargfabrik*: swimming pool, cultural centre, bar, seminar centre, crèche; *Die Giesserei*: performance hall, organic restaurant; etc.).

Altogether, large-scale projects tend to offer a wider range of collective amenities of three different types rather than more space per resident (Table 2).

2.2 Social interactions

2.2.1 Group relationships

Social interactions were examined both in the projects' implementation and in the management of the collective realm, since collective action is present in both stages of collaborative projects (Id22 2012; LaFond & Tsvetkova, 2017).

In order to implement La Boîte Noire, one of the residents became the project holder and the spokesperson of the group. He was thus very visible and became an indispensable asset for the project, meaning that 'all the weight of the project was on his shoulders at some point' (Sandrine, La Boîte Noire, July 2016); he eventually chose to step aside because of the constant pressure, 'jeopardising the equilibrium' of the group. Additionally, in La Boîte Noire, the size of the group is such that all members came to know one another very intimately. They are very aware of one anothers' personal lives as they 'used so see each other every week for several years' (Monique, La Boîte Noire, July 2016). Relationships became, and still are, very personal between the six households, generating a form of solidarity among them: 'being terrible with finance, I was lucky that Arnaud was there to help me' (Sandrine, La Boîte Noire, July 2016). In their everyday lives, contacts tend to be very personal: 'they are not friends, they are more than neighbours; we should invent a word for that' (Sandrine, La Boîte Noire, July 2016). In such a small project, the role of the 'primary stakeholders' (Czischke, 2018) is central and they become very acquainted. Conversely, however, these strong personal relations can also become problematic. For instance, the desertion of a single member during the project's definition phase threatened the group's fragile balance: 'when Joseph dropped out, it felt like my sidekick in the project had left, it was quite a shock' (Monique, La Boîte Noire, July 2016). Moreover, this very personal community lifestyle can be hard to live with at times, as some decide to 'stay inside to avoid the others from the community' (Carine, La Boîte Noire, July 2016).

In the case of *Brutopia*, the six founding members can still easily be pointed out even though they do not act as leaders on a day-to-day basis. Every now and then, when the story of the project is told, almost as a founding mythology, they appear as 'the pioneers'. Mark Vandendries, known as the backbone of the project, is even referenced on LinkedIn as 'Marc-Brutopia Vandendries'. This visibility is also present in similarly sized projects, where 'a central nucleus can always be found and some kind of leadership appears' (François Demonty, Université Saint-Louis), distinguishing clearly individual opinions. However, whereas individuals from the primary stakeholder's group appear distinctively, the community appears less fragile than in La Boîte Noire. Indeed, several changes were made in the group along the way, 'several couples dropped out, others divorced, [but] the balance was not disrupted' (Jos, Brutopia, October 2016). Moreover, contrary to La Boîte Noire, there is less spatial obligation to meet the others frequently. 'If you don't like someone within the community, you don't have to meet all the time' (Fred, Brutopia, August 2016). Nevertheless, there is a high level of solidarity among residents and a genuine friendship has developed among several of them, as some even 'escape for a weekend with other "Brutopia beauties" (Ingrid, Brutopia, December 2016).

While the other two projects were elaborated to provide affordable housing for a given group of people who ended up living there, *Kalkbreite* emerged from a different dynamic. It was primarily initiated by a group of activists (Schindler, 2014) to develop a vision for the conversion of an urban brownfield. The cooperative that was consequently founded included not only future residents but others whose initial goal was neighbourhood renewal. Most of them never intended to live or even work in the future project, as 'of the initial 50 persons, only 30–40 percent are living or working in *Kalkbreite*', and many people got 'involved because they were interested in the project' (Carina Heye, ETH Wohnforum). Moreover, implementing such a large project implied organising nine working groups to coordinate various themes (participation, social mix, indoor space, cluster space, space for children, exterior space, management and central services, sustainable living and commercial spaces (Kalkbreite, 2015)). Although a project leader oversaw the development, it was nevertheless impossible to hold anyone personally accountable for any decision. In this

large-scale project, co-production tasks were more shared and there was clearly stronger involvement from 'secondary stakeholders' (researchers, local activists, members of the new cooperative, etc.) and 'stakeholders in the wider environment' (city officials, representatives, etc.) (Czischke, 2018).

This principle of collective responsibility continues today in the building's management, since all decisions are taken on a collegial basis: 'once an idea is presented, a single person can stop the decision; if it does not pass, it is discussed a month later where only a majority is needed' (Hugo, *Kalkbreite*, July 2016). Additionally, this collegial vision is reinforced by the fact that relationships among residents are a lot less personal: 'one day I met someone in town. He told me he was living in *Kalkbreite* too, but I had never seen him before!' (Lucia, *Kalkbreite*, July 2016). As Masson puts it, group relationships are not experienced the same way in small, medium-sized or large projects (Masson et al., 2015) and 'collective levers and the obligation to encounter others are particularly influenced by the total number of inhabitants'.

In terms of group relationships, two elements can be noted. On the one hand, the relevance of individual roles in the projects' production and its subsequent management decreases with the size of the project. On the other, the intensity of inter-personal relationships grows as the size of the project decreases.

2.2.2 Population

No comprehensive statistical examination could be made of *La Boîte Noire*'s population. However, the researchers met almost all the residents (four out of six households) during their stays and had a comprehensive overview of the residents' socio-economic status. In this project, inhabitants share a common socio-cultural basis, stemming from the French (or Swiss) educated middle class and being all 'financially stable' (Sandrine, *La Boîte Noire*, July 2016). Although households' configurations and ages vary, the population is nevertheless very homogenous. Moreover, no intention to encourage socio-cultural variety could be noticed in the residents' discourses.

Conversely, this intention is present in *Brutopia*. Indeed, the project initiators boast relentlessly about the great variety among residents in age, language and financial resources. From an economic point of view, 'important purchase-price variations were anticipated' (Serge Fraas, Stekke + Fraas) to make apartments affordable for various house-holds. A similar claim about population diversity is made when several residents insist on the fact that they 'temporarily host refugees' (Fred, *Brutopia*, October 2016). However, despite those claims, the population of *Brutopia* remains very homogenous in terms of socio-cultural background and does not include very low-income households. The settlement is made up of primarily educated and progressive people from the creative scene. Furthermore, as noted in similar cases (Ruiu, 2014), the project is sometimes perceived in the neighbourhood as a kind of gated community, despite its efforts to engage with the surroundings.

The population pattern is very different in the case of *Kalkbreite*. Whereas the project developers coincide almost exactly with the future residents in the other two case studies, this cooperative development followed a different logic. The 'social mix' working group was expressly dedicated to determining the ideal residential balance, leading to a population that reflects the diverse sociodemographic composition of Zurich. Hence, *Kalkbreite*'s population has been heterogeneous from the start. This feature is common to many large-scale projects, such as *Die Giesserei*, which is also the 'replica of the city's variety'

(Masson et al., 2015). In *Kalkbreite*, the goal of social diversity is enshrined in its founding charter, which advocates for integrating people of different ages, incomes and disabilities. To this end, 11 affordable flats were planned from the start (Schindler, 2014) with the financial help of a local foundation, the Domicil Stiftung.

3 Discussion

Through co-production, collaborative housing enables various social and spatial innovations (Lafond, 2017). Whereas these novelties are common to most collaborative housing projects, size tends to influence two specific features: spatial multiplicity and social inclusion.

3.1 Spatial multiplicity: diversity vs specificity

The case studies feature collaborative housing spaces of different natures (Table 3).

First, the projects differ in terms of domestic-space specificity. Indeed, in the small to medium-sized projects, domestic spaces tend to be very specific and highly related to the residents' personal needs. Residents were given the opportunity to design their private spaces very precisely according to their needs. In *La Boîte Noire*, this trait is illustrated by the arrival of a new household that did not get the opportunity to design their own space and was confronted with choices made by the previous household, which contradicted their own living habits. The new owners have to live with a kitchen placed on what they considered the wrong side of the house, 'a strange decision, but we managed to adapt to it after a while' (Jérôme, *La Boîte Noire*, July 2016). In *Brutopia*, there is somewhat less specificity due to the repetitiveness of several architectural elements introduced by the raw-space

S + M Community Housing (2 to 30 dwellings)		L Group Housing (70 dwellings and above)	
high specificity in layouts low typological diversity	domestic	low specificity in layouts high typological diversity	
	SPACES		
conventional shared amenities (limited in scope)	collective	diverse shared amenities (variety of functions)	
time demanding close personal relationships	group relationships	time- or competence-free less personal, meeting others is not compulsory	
	USES		
homogeneous population middle class	population	heterogeneous population can include lower incomes	

Table 3 Comparing 'community' and 'group' housing

The bold is used to highlight the important elements and should be maintained

principle. Nevertheless, residents were able to design their own interiors according to their specific needs within these elements. Conversely, large-scale collaborative housing tends to produce dwellings that are unrelated to specific inhabitants. The dwelling layouts are therefore more generic, offering greater opportunities for appropriation. In *Kalkbreite*, the residents were not known prior to the project and the dwellings were designed according to a programme defined by the 'indoor space' working group. None of these spaces reflects individual wishes, but rather qualities common to all. Experience shows that in large groups particular interests tend to disappear, and that future residents tend to 'talk collectively about the city and new residential forms, but not about (their) own dream homes' (Ruby & Kries, 2017). This reduction in specificity in large co-production projects is similar to group decision-making processes where the search for common ground through debate tends to reduce particularisms in order to offer a common ground for all. This is especially the case for large groups. In addition, due to its size, Kalkbreite was implemented through the work of various working groups, and nobody could be held directly responsible for any decision. This aspect of large-group dynamics is underlined by Andreas Hofer: 'one principle for grassroots democratic urban planning: participation as the unweighted sum of individual interests is destructive' (Ruby & Kries, 2017).

Second, while reducing domestic specificity, large developments also produce a wider collection of spatial (and thus social) arrangements both for individual layouts and shared spaces. On the one hand, contrary to small or medium-size projects, large-scale developments provide more dwelling diversity in terms of dimensions and typologies. Whereas *Kalkbreite* is probably an unusual project, others, such as the pioneering collaborative *Harmoniehof* built in 1922 in Amsterdam, display identical features (Van Gameren and van den Heuvel 2013). On the other hand, large-scale collaborative projects offer a wider assortment of collective spaces. This characteristic also allows for a larger constellation of dwelling configurations given that dwelling spaces are organised as combinations of individual apartments and shared spaces.

In conclusion, by providing spatial multiplicity through less specific housing and more possible dwelling configurations, large collaborative housing is less subject to obsolescence. Indeed, thanks to these features, it can accommodate a greater variety of uses and allow personal evolutions, in line with today's household diversification (Van Geest, 2013). Consequently, size, by mediating specificities into commonality and enabling a diverse assortment of dwellings, is an interesting lever to co-produce sustainable housing.

3.2 Social inclusion: heterogeneity vs homogeneity

The analysis also highlights the influence of size on social inclusion (Table 3).

Small to medium-sized collaborative projects are usually a middle-class affair, bringing together cohesive and homogenous groups of people as noted in *Brutopia* and *La Boîte Noire*. This is mainly due to economic factors. Indeed, the financial benefits of such developments are limited compared to conventional housing projects, making them inaccessible to the poorest (Van Geest, 2013). Moreover, whereas social inclusion is often an initial ambition, it is often left out when projects are implemented. Indeed, when a choice must be made between compulsory energy efficiency and social inclusion, the latter is generally abandoned (Boer and Minkjan 2016). In small developments, those involved have to bear all the participatory load themselves (time, financial risks and workload) which makes it impossible for disadvantaged people (with less available time, lower incomes or fewer skills) to take part in the project on a voluntary basis (Lenel et al., 2020). Hence limited pecuniary benefits combined with

non-negotiable energy efficiency and the cost of participation usually precludes any socio-economic diversity in small to medium-sized collaborative projects.

Conversely, several factors generate a greater socio-economic variety among the population of large-scale projects. First, the projects' critical mass permits consistent economies of scale, making them affordable for lower incomes. In *Kalkbreite*, for instance, 11 dwellings could be reserved for low-income households (Schindler, 2014). This feature can also be seen in such similarly sized projects as wagnisART, Sargfabrik, Spreefeld or Mehr als Wohnen (Prytula et al., 2019). Second, in large groups, people who do not have time or skills can still be part of the project: 'as a singer, my schedule is very hectic, it was almost impossible to get involved personally' (Lucia, Kalkbreite, July 2016). In Kalkbreite, setting up the project was delegated to the working groups, not solely to future residents themselves. Third, size allows for a certain level of anonymity by allowing people to avoid one another (P.M., 1983; Simmel, 1903). In Kalkbreite as in other large projects, regularly meeting others is not compulsory. Lafond corroborates this finding when stating that 'the smaller the group is, the more homogeneous it probably has to be. If you have a co-living situation with three or four people, you cannot avoid each other...Once you get to the level of the cooperative with 140 people, not everyone has to see everyone or know everyone' (Ruby & Kries, 2017). These factors lead to a more heterogeneous group of people with more 'diverse levels of education' (Schmid et al., 2019).

The socio-economic variety of large projects is further enhanced and supported by the multiplicity of collective spaces. As mentioned above, three kinds of collective spaces are found in large-scale projects: those intended for programmes in immediate relation to domestic activities but that usually take place outside the dwelling (1.i); those sheltering activities that would typically happen within the domestic realm (1.ii); and those open to anyone, residents and non-residents alike (2). Large collaborative projects are able to produce the latter category because of their economic capacity and the increased anonymity they permit. Moreover, through a variety of collective spaces, large collaborative housing projects have two direct benefits for the neighbourhood. On the one hand, contrary to similarly sized modernist projects, they are not mono-functional. On the other hand, unlike smaller collaborative projects, publicly shared functions tend to open the project up to the neighbourhood. This hybridity fuels 'urban interaction' (Ring, 2013) and social inclusion by allowing alien activities to take place within the collaborative housing realm.

In conclusion, the fundamental differences due to size in housing co-production can be summarised as the difference between a community living together–community housing–and a group of random people living collectively–group housing (Table 3).

Large projects illustrate how a critical mass can achieve both spatial and social diversity. As Andreas Hofer reminds us, 'projects must have a certain size if they want to change the city and attain an interior complexity that enables various forms of appropriation and development' (Ruby & Kries, 2017).

4 Conclusion

Collaborative dwelling can be a key vehicle for innovation, as was demonstrated by the first cooperative housing experiments carried out in the 1920s in Europe (Vestbro 2010). Not all collaborative developments are alike, however, as the size of collaborative housing plays a decisive role in the balance between individual desires and collective interests. Indeed, large collaborative housing projects display a broader multiplicity of dwelling configurations and induce social inclusion by housing a more heterogeneous population.

Despite these benefits, several issues must nonetheless be noted. First, inclusion and social mix are not entirely self-evident. Several authors (Charmes & Bacqué, 2016; Noël, 2003; Rémy, 2017) have demonstrated that social mix is only operative in some contexts and can be counterproductive. Indeed, population diversity can be frustrating to some residents and the cohabitation of a heterogeneous population can unsettle solidarity (Chamboredon & Lemaire, 1970). The ensuing question is then whether to promote cohesive communities or diversified groups. Large operations tend to respond, through social inclusion, to the usual critique against urban gentrification, whereas small to medium-sized collaborative housing tends to produce successful like-minded communities developing natural solidarity among their members (Van Gameren and van den Heuvel 2013).

Second, a paradox lies in housing co-production between the fulfilment of the inhabitants' specific needs and the idea of reducing, through size, individual specificities. In fact, collaborative housing ventures are bottom-up initiatives instigated to counterbalance the statistic-based housing models produced by post-war modernism. Scale was an important aspect of those modernist precepts, mainly for economic and efficiency purposes. It generated housing seriation that has been severely criticised since the 1960s. The risk related to large-scale developments is thus the reintroduction of top-down processes as well as anonymous housing detached from the very wishes of future residents. Specific participatory procedures must therefore be developed to counter such risks. These elements prove that size is no guarantee of success and must be used carefully in order to avoid its potential misuse.

Third, if size can be an interesting asset in the quest for more sustainable and inclusive projects, implementing such projects raises important challenges. Developing collaborative projects depends largely on national building practices and regulations as well as on local social conventions. For instance, the vivid tradition of cooperative housing in Germany, Austria and Switzerland has played an important role in providing a framework (non-violent communication, deliberative democracy, etc.) to enable collaborative housing (Boudet, 2017; Schmid et al., 2019). Moreover, local authorities in cities such as Berlin have put in place specific incentives to sell state-owned land to groups of citizens organised in *baugruppen* (community-initiated buildings) (Ring, 2013). The nature of the tenure can also be very different from one city to another. In Zurich, for instance, where *Kalkbreite* is located, 90% of the population rents their dwelling (Boudet, 2017), compared to 61% in Nantes (Insee 2017) and 60% in Brussels (CENSUS 2011).

In terms of policy and practice implications, the findings of this research directly address two contemporary challenges: society's growing diversity illustrated by fast-evolving household configurations and domestic practices (Allan & Crow, 2001; Godelier, 2010), and decreasing support from welfare states (Milner, 2019; Moran, 1988). Facing a diversifying society, large-scale collaborative design provides an interesting answer by displaying a wide range of dwelling patterns through a multiplicity of non-personalised housing layouts and a variety of collective amenities. This enhances resilience as it can accommodate a large variety of residents' profiles and opportunities for households' evolutions. Moreover, in a time of declining welfare-state support and rising single-person households, collaborative housing can generate new forms of solidarity, replacing or complementing familial or institutional forms. All collaborative housing delivers such support, but large-scale developments provide it to wider and more heterogeneous groups of people within both the projects themselves and their neighbourhoods, thereby supporting a more inclusive society.

Furthermore, the participatory process of such projects must be stressed in two regards. First, it has modified architects' *modus operandi*. Indeed, participation has led architects to work not only for, but also with, society, modifying their design approaches by embracing bottom-up procedures. To promote this trend, additional collaboration between researchers from various fields as well as between researchers and practitioners is needed. Second, involving inhabitants in design processes is a lever for empowerment, providing keys to self-development (Ledent et al., 2019b; Ring, 2013).

Eventually, this research would need further development to expand its scope in terms of quantitative data in order to confirm that in co-production, from a spatial and social perspective, size allows for more.

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Ethics approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent In addition, informed consent was obtained from all individual participants included in the study. All the individual participants in the interviews were anonymised.

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