The 'capacity for action' of architectural spaces: open system design strategies

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Introduction

During the COVID-19 lockdown, our homes, in a perverse and almost dystopian version of the expanded house in the city, became, suddenly and quite brutally, the compressed home and city, all at once. Our homes were transformed into schools, gyms, hospitals, centers for a range of simultaneous jobs, meditation spots; real terraces, and sometimes imaginary ones; all kinds of fictions, beaches, theatres, 3D production hubs, mask factories, or ghost kitchens. A set of situations that took place simultaneously, synchronically, or diachronically.

This new situation has given rise to new "domesticities". Following Toyo Ito's idea that homes did not require a kitchen, in the past we could say "the house is the city"; now it seems that due to COVID-19, 'the house contains the city'.

In this anything-but-simple context, we architects must identify the current design strategies that increase the "capacity for action" in the spaces we create. It is crucial to consider them in any typology, although even more so in those spaces we still call home. Housing is our greatest debt. We know that in offices and large buildings, adaptability is a more prominent feature, given that increased size and budgets help to inhabit space with flexibility.

Subjectivity, understood as an individuality that is not fixed but rather in permanent construction, has become more democratic and does not follow closed models. It becomes what José A. Sánchez calls "the performative model" in relation to dramaturgy and action[1]. That is, the domestic performance, or what we call the 'capacity for action' in our homes, is a generalized attitude. We constantly change our cohabitation situation, and while these changes are less and less linear, they lack fixed norms, which means we need spaces where we can reprogram our diverse domestic lives.

This text aims to find the design actions that are most successful in increasing the performative range of contemporary architectural spaces. Although they are not presented as descriptive recipes, they are posed as operative strategies. They do this through collaboration with others, precisely because it is these others, the inhabitants, the users in a broader sense, who develop the whole multiplicity of domesticities we refer to. These are the real agents of action, and they are the ones who finish the production of our architectural proposals.

With this purpose in mind, this article calls for a new deal, an agreement between citizens and their spaces, extending the contract proposed by Hashim Sarkis at the last Venice Biennale[2]. Contemporary architects need to draw up a 'new spatial deal', provide people with the tools to transform their environment and increase the responsibilities of users as co-producers. This would allow us a more expanded, inclusive, heterogeneous, and dynamic reality; and to build it from the motivation to intervene in it, to change it.

Open System Design Strategies

The idea of "capacity for action" interests us more than the term flexibility as the latter is closely related to the modern movement, and almost seems to 'represent' it. The word flexibility has had such rhetorical usage that it is difficult to recover. There are other authors, crucial in this research, such as Jeremy Till and Tatjana Schneider, who appropriately defend the current use of the term flexibility. Yet for this investigation, we are more interested in the capacity for action and, in particular, the gradients that stem from it, i.e., the different levels we are able to achieve so that said capacity occurs in the spaces we propose.

However, to introduce the notion of 'capacity for action' we turn to Adrian Forty and his concept of flexibility. He defines three strategies of flexibility: "through redundancy, by technical means, and as a political strategy"[3]. Forty understands redundancy as the strategy that seeks to leave a spatial margin, an excess of capacity that allows for a range of interpretations and uses, while also aiming for that feature those pre-modern buildings display, where rooms have no specified use. For us, the term redundancy has two meanings that give way to quite different design procedures. On the one hand, the strategy that seeks out spaces of excess or greater spatial abundance. On the other, the design configuration that poses indistinct spaces, almost equal in size and with no hierarchies. We extend this first category: redundancy includes design strategies that aim to increase the "capacity for action" by means of a specific spatial organization, a relationship between the spaces that broadens the potential uses of each one of them. This can be done both by extending some of them, normally those with the most undefined programs, as well as by replicating similar spaces, neutralizing the general spatial configuration.

Something similar occurs with what Forty calls "political strategies". For him, these tactics happen in opposition to the preconceived use of the space, a confrontation with the existing that opens it up to appropriation and a change of use. His text seems to argue that architects do not control this facet of flexibility, but rather that it is the users who unilaterally choose these political strategies[4]. However, our current understanding of a design project does not distinguish between the building as an object and the building as a mediator of uses, it is simultaneously both. More importantly, the project has the capacity to foresee and even induce spatial appropriation by those who inhabit it. For these reasons, we will refer to this strategy more directly as 'appropriation'.

Lastly, for the strategy using technical means, we simply widen it to include other "technification" procedures that also increase the "capacity for action". We include more general constructive solutions, such as the movement of elements, but also more sophisticated ones. First of all, the separation of infrastructure from the infill, as developed in Habraken's research[5] and known as Open Building[6]. Secondly, the separation between primary and secondary structures, systems used by many architects, such as Cedric Price or Lacaton & Vassal. And, finally, the separation and reversibility of parts of the construction elements, what Kieran and Timberlake call "chunks"[7].

Jeremy Till and Tatjana Schneider are also, as we mentioned, reference authors in this piece of research. From their first texts, Jeremy Till defends other ways of doing architecture and, along with Tatjana Schneider, they published a number of pieces on the procedures that they, with no hesitation, defend and refer to as flexibility[8]. Their work has broadened the threefold vision inherited from Forty. They consider not only how it is attained but also discuss how to assess its cost, distinguishing between what architects propose and what inhabitants use easily, which does not always coincide. They use the term "soft" when it is easy to take hold of the proposed adaptability systems, and "hard" when it involves complex mechanisms that hinder their adoption and make comfortable use difficult.

To test whether the two ways of thinking are compatible, we have found examples of built architecture and organized them in a diagram according to these categories. At the moment, this investigation, carried out to determine the specific usefulness of the chosen taxonomy, has only compiled cases of built architecture, leaving out projects that have not been built. We are aware that, sometimes, the most outstanding architectural ideas exist only in projects and not as built reality, but we will leave design thought for later, in a more extensive future investigation.

Hence, all 170 cases are organized into a diagram, grouped into these three categories and plotted according to their constructive difficulty, on the x-axis, and their complexity of use, on the y-axis.

Taxonomies serve as a way of learning about the matter and opening new avenues of thought, although the in-between spaces are most interesting. Hence, for example, there are strategies that propose mixed situations—combining two of these ways of doing—that seem particularly appealing. Projects that use a configuration of spatial neutrality while also left partially incomplete, or projects that work halfway between the separation of components and mobility.

We also find certain cases, defined as archetypical, that have the qualities of being timeless, anonymous, and part of collective culture. We lay out here, as a synthesis, some of those archetypical architectures compiled in the diagram. We include traditional Dutch houses as examples of redundant spatial configurations, lofts and artists' ateliers from the 70s as an example of concentration of fixed uses and liberation of margin space, emergent housing in developing cities as a paradigm of incremental appropriation, the appropriation of abandoned buildings as a model for interior occupation, the use of curtains to divide space as the first mobile technology, and the industrialized systems of the Japanese house and balloon framing as fully integrated and widely used solutions in their respective cultures.

Below we present the strategies that conform the three main groups already developed (redundancy, appropriation, and technification), as can be observed in the diagram. As we are unable to analyze here all the cases collected, we will only highlight those paradigmatic examples that best explain each of these design procedures.

1. Protocapacity

Once this field of the diagram is established, we identify what could be called the zero degree of our "capacity for action", which is designated as "protocapacity". These strategies are not exactly open systems, nor do they guarantee the adaptability of the architecture over time, but they do involve an initial degree of spatial flexibility and user inclusion.

1.1 Choose

A wide range of housing choices, even if definite, involves a certain degree of involvement in the process by the users and their preferences. Mies van der Rohe was the first known architect to detect the need for adaptability in usage. His housing proposal for Stuttgart's Weissenhof Estate in 1927 is truly groundbreaking, already forecasting the different interior configurations of the homes, separating the construction systems to free the inner partitioning from the shell and to allow for changes in the distribution according to each need. Among contemporary examples, we find "Habitat 67" by Moshe Safdie and "Silodam" by MRDV. Both are designs for collective building and they aim to offer a diversity of choices. The pairing is interesting as both of them are exemplars of how to respond to collective habitation in their historic context. Habitat 67 is a product of its time, for its variability while at the same time gathering a specific social group. It offers the choice between different home modules in a medium-density building, yet unifying all the modules with the same material treatment—concrete. However, the "Silodam" project from the early 2000s, despite also proposing different ways of living, accepts the high density of a single compact block and arranges the different houses using different materials on the façade, celebrating the diversity and heterogeneity of its time.

1.1 Nomad

Being able to change the location of architecture also provides a certain "capacity for action". Giedion recalls how American colonial houses prior to the Revolutionary War already moved[9]. He refers specifically to the Philip House, which joined two houses of different origins to form one, extending part of it, all thanks to its timber construction. The American tradition of mobility can be traced to the iconic Spartan Mobile Homes from the mid-twentieth century or the *minga de tiradura de casas*, a tradition in collective support practiced on the island of Chiloé in Chile. Once again, timber-frame homes, thanks to being lightweight and to their structural features, can be moved and relocated to another part of the island, or even to another island in the archipelago altogether, as needed.

1.2 Participation

Collaborating on the development of the project involves taking into account the users' criteria, even if the inclusion is only an initial one and its objective is to achieve a tailored place, not to open it to any spatial transformations over time. The engagement between inhabitants and architects in collective groups, and not in an individual project as it has usually been the norm, developed mainly during the 60s. A large-scale precursor is the project of "La Mémé", a housing project for medical students in Belgium, by Simone and Lucien Kroll in 1970. It was a participatory project built with compatible components that manage to combine the collective and the singular, the common and the diverse, repetition and exception. Other interesting proposals are the "Flatwriter" concept by Yona Friedman and "Housing Research" by Cedric Price because, although they never left the drawing board, they were ahead of their time compared to current research, such as MIT's Living Lab, where tangible interfaces provide access to design tools to users with no technical skills with, allowing them to see the results in real time.

Here we come to the heart of the matter by analyzing the "capacity for action" according to the three design strategies defined above: redundancy, appropriation, and technification. The diagram also shows different approaches used in each one of them, which we discuss below.

2. Redundancy

We understand the strategy of redundancy as the one where the disposition and the spatial relations of the whole determine the "capacity for action". It can occur by means of two different procedures:

2.1 Liberate

Designing with an excess of space reminds us of the loft or atelier typologies. The artist workshop projects from the 20s were designed using this strategy. Perhaps the most significant case is the "Maison Ozenfant" by Le Corbusier in 1922. Here, the house and the studio are still divided into different floors, although one can already sense the infrastructural relationship between both parts, both in terms of circulation as well as energetic. Regarding more recent cases, we include buildings that, although not designed to be occupied as houses, were used as such by artists in the 70s. The "capacity for action" of these places, based on accruing cubic meters, is relatively easy to imagine as architectural design, although "hard" to maintain and democratize, as it entails more space per person, more budget, and more energy consumption. However, there are some strategies that propose a more rational liberation of space. This procedure tends to involve a condensation of servant spaces, leaving as much free space as possible, which is the case in two projects of very different sizes, showcasing how this concentration of infrastructure is not a question of dimensions: Shigeru Ban's "Curtain Wall House" and Richard Rogers' "Lloyds Bank". Another similar procedure is to concentrate the predictable programs to free the unpredictable ones, like the "*Cité Manifeste*" in Mulhouse or the "FRAC Art Center" in Dunkirk, both by Lacaton & Vassal.

2.2 Neutralize

If we understand redundancy as the repetition of spaces that are relatively equivalent, without hierarchies or halls, defined and qualified by their use and furnishings, we think of the archetypical model of the Dutch canal house, which is always the same and yet always different. This way of working is nothing new; Palladio's villas followed the strategy of interconnecting similar spaces and not even the staircase was prominent. There are many models that use this procedure, currently relevant since Kazuyo Sejima brought to the fore the idea of working with discrete elements, as with the spaces of the "Kanazawa Museum" at the end of the twentieth century. The most extreme example of this procedure could be Thomas Jefferson's "Land Ordinance" from 1785, a square grid proposed across all scales, from territory to bedroom.

3. Appropriation

We call designing for "appropriation" to that architecture which is left somehow unfinished, to be completed by the occupants. It can also occur in two different ways:

3.1. Increment

In some cities, it is common to see signs with "air for sale", which means they are selling the cubic meters of buildable space on top of the existing, i.e. the potential extension. The buildings grow as tall as their structures can hold, until it is impossible to build above or unworkable to live so high. The interest in incremental housing is well-known since the twentieth-century vanguards, when industrialization was joined by temporality. In 1931, Gropius and Hirsch Kupfer proposed highly innovative incremental houses that combined standardization and variability. In 1932, Martin Wagner launched the Berlin-based competition

"Das Wachsende Haus" with 12 of the most important architects taking part. However, the most paradigmatic project in this sense, both for its precursory approach and for the size of the proposal, is PREVI (1965), which emerged from an international experimental housing competition in Lima where more than 25 kinds of incremental housing units were built. Other projects that have garnered recent attention are those by the Dutch structuralists at the end of the 60s, most notably the "Diagoon experimental houses" by Hertzberger. The well-known "Quinta Monroy" by Alejandro Aravena in Chile (2000) also uses this strategy.

3.2 Refill

Filling a given container is a powerful design strategy in terms of "capacity for action". It has quite a lot of advantages compared to incremental proposals, with users being able to appropriate the interior over time, avoiding perimeter problems—the most complex when building—and giving a more collective and cohesive exterior image. The archetypical case of this strategy is the office building, which in this sense is without a doubt a more developed typology than housing. The invention of the open office, sold by the square meter, came from the Chicago School, specifically the pioneering building "Marquette", by Holabird & Roche in 1894, with stripped-back open interiors. There are good examples of this approach, although a wonderful lesser-known case is "*Comunidad Andalucía*" by Fernando Castillo Velasco in Santiago de Chile, a low-budget collective housing project from 1990. The proposal leaves the inside of the houses completely empty, with heights of up to three floors, for them to be occupied over time.

4. Technification

Technification is interpreted as the use of construction as the main tool to increase the "capacity for action" of spaces. Here we distinguish three strategies:

4.1 Industrialize

To industrialize is virtually an essential step towards a current architecture that works with open systems. Looking at the history of architecture, a highlight would be Walter Gropius's proposal for the 1927 Weissenhof Estate, although there are many other architects working along these lines based on different systems; for example, the "Dymaxion House" by Buckminster Fuller is from that same year. Beyond these orthodox cases, there are two archetypical models that showcase well the potential of assembly: the Japanese house and balloon framing. The first is more sophisticated given the artisanal skills required, while the second is a simpler, less complex approach; another reason for their success is that they are both anonymous and part of a shared knowledge. Opening avenues ahead is the "Cellophane House", the noteworthy proposal by Kieran and Timberlake that relies on unprejudiced industrialization, reversibility, and zero waste.

4.2 Split

To physically separate architectural elements is a resourceful strategy that allows the different parts to transform independently. Collective elements can be isolated from private ones, hence also the separating responsibilities. The more permanent parts can be detached from the more contingent ones, and thus change only those strictly needed, making the infrastructure last longer than a life experience. A part of these approaches has been pioneered by the Open Building movement, a legacy of Habraken's theory on "supports". The most attractive and graphically clear built examples are two collective housing projects: Frei Otto's "Ökohaus", a project for the 1986 International Building Exhibition in Berlin, and "Next21" by Utida in Osaka. In both buildings, each home follows a different design and model. Other projects take this strategy to the extreme in a "plug-in" exercise that clearly separates the infrastructure from the infill, as is the case in Kurakawa's still surprising "Nagakin Capsule Tower".

4.3. Move

Mobile systems have always provided a huge "capacity for action", beginning with curtains to separate uses, intimacies and energies, widely used well into the twentieth century. Fundamental examples of interior mobility using mobile elements, both horizontally as well as vertically, are Rietveld's "Schröder House" from 1924 and its sophisticated three-way partitions, and Koolhaas's "Maison à Bordeaux", which modifies the space vertically by means of a room/lift. Parametric design today also makes it possible to imagine projects that move parts of their components in order to adapt to different situations. It is true that mobility and many of these systems are more common in architects' imagination, and have remained limited to proposals of rather theoretical than practical nature. However, technological developments are helping this shift, and the former complexity of mobile systems is increasingly becoming more accessible and simpler. A simple button can completely transform a domestic space, as already happens in auditoriums, which is why these systems in particular are being researched and developed at the moment.

Conclusions

This investigation considers the three categories proposed by Forty to still be valid, although it deems it important to specify, broaden, and above all, update them. The categories have been checked against 170 built examples, verifying their effectiveness. However, the investigation has also attempted to specify the meanings that each one of them carries. In particular, we refer to the different ways of understanding 'redundancy', although we have also specified the different procedures where 'appropriation' occurs. We have also extended the features of the categories in the three cases, but especially widening the possibilities that are inferred from 'technification', understood as a contemporary practice. Additionally, what we consider as the most interesting contribution: we have updated the design procedures that stem from the approval and incorporation of "the others" in the architectural project. In this sense, we refer especially to 'appropriation', although it is something that can be found in the other layers and in all the cases compiled in this review.

We can also conclude that it is possible to interrelate these strategies with the gradients proposed by Till and Schneider. It is also possible to gauge their effectiveness according to gradients of constructive complexity and ease of use. At this point in time, the diagram presented is static and the judgment of ease is applied in general to the group and not the individual cases. The next step would be to develop a dynamic diagram that can position each case according to these gradients.

At the moment, we can conclude the following: it is possible to achieve a greater "capacity for action" through three design strategies—redundancy, appropriation, and technification—and it is also possible to estimate their effectiveness according to gradients of constructive complexity and ease of use. The first strategy is redundancy, where the arrangement and spatial relations of the whole determine the "capacity for action" in the use of the specific spaces, either because some of them are grouped and free up a large margin space with no specified use, or because the spaces are organized non-hierarchically and offer free use of any of their parts. The second design strategy consists in designing for appropriation, which means leaving the architecture unfinished in some way and allowing the occupants to finish it, be it the interior of an existing container or by extending outwards from a minimal infrastructural nucleus. The third strategy is technification, involving the use of construction as the main tool to increase the capacity of action of spaces. It may be implemented by proposing industrialized systems that are easily disassembled; by reorganizing the space through mobile elements, or by designing from the separation between the more permanent parts and the more contingent ones.

Additionally, it is important to consider that procedures previously considered challenging for users (or "hard", following Till & Schneider's classification) may become easy ("soft") because current technologies tend to continuously simplify their use. A case in point is the previous example of automated mobile systems, which are becoming easier and easier to use. This is the reason the diagram is proposed as an open and permanently updatable system.

The next objective is to develop a multi-entry digital platform that can be reprogrammed according to the different reconfigurations that may occur. We will also open an investigation with unbuilt cases that have been or are influential enough. Another immediate aim is to broaden the diagram with cases that have been overlooked or forgotten by hegemonic architectural culture—still indebted to conventional Western-centric narratives—, as well as to keep track of recently built projects researching these ideas.

Yet the only true constant is change, so exploring these architectures while considering their "capacity for action" and the tools that facilitate I (such as design open systems), will help shape the architecture we need: from mass-produced to mass-customization, from composition to assembly, from fixed to adaptive, from exclusive to inclusive.

Biography

Professor of Design at the School of Architecture ETSAM, Universidad Politécnica de Madrid UPM. She is responsible for the Design Studio Group Ribot, also call CoLaboratorio. Her interests are focused on three interrelated fields: Industrialization, Customization and Sustainability. These aspects include the systematization, construction and use of customizable systems as a project language and collaborative processes as a pedagogical interest. This investigation was prepared for a seminar at the Department of Architecture of the Penn State University, as part of a Tenure track position, during 2018 and 2019.

1. Sánchez, J. A. "Dramaturgy in an expanded field", in *Repensar la dramaturgia: errancia y transformación / Rethinking dramaturgy: errancy and transformation* (Murcia: CENDEAC-Centro Párraga, 2010): p: 45. He specifically says "We could consider the expansion of the performative model as a symptom of a democratisation of subjectivity, as a condition of possibility of a definition of identities not submitted to closed models and a definition of situations of coexistence constantly exposed to negotiation". https://blog.uclm.es/joseasanchez/2010/01/15/dramaturgy-in-an-expanded-field-2010/
2. Sarkis, H. "How will we live together?", Statement for the 17th International Architecture Exhibition, la Venice Biennale 2021. https://universes.art/fileadmin/user_upload/Biennials/Venice/2021/2021-04-12-Hashim-Sarkis-Statement.pdf
3. Forty, A. *Words and Buildings. A Vocabulary of Modern Architecture* (London: Thames and Hudson, 2000). Forty studies the language of modern architecture, although he acknowledges the challenge involved in the flux of meanings and terms, leading him on a historical account up until the 1990s. Many of the notions from modern discourse are now being questioned, in particular those concerning functionalism and flexibility. For this reason and because he himself invites the reader to challenge him in the preface, we question him and are not always in agreement with his stance.
4. Forty, A. Op. Cit. p. 148. Forty cites as an example the transformation of the Roman basilica into the model for Christian churches. He also leans on Lefebvre's understanding of these acts of appropriation, directly against architecture. Specifically, he says "[...] the third sense of 'flexibility', which sees it not as a characteristic of buildings, but of use. As a political strategy", and later "[...] as far as Lefebvre was concerned, architects and architecture [...] had no part whatsoever to play in the realization of flexibility: 'use' was a political act to be directed *against* architecture". And then he insists, "'flexibility' is not a property of buildings but of spaces; it is a property which they acquire through the uses to which they are put."
5. Habraken, N. J. *Supports: An Alternative to Mass Housing* (London: The Architectural Press, 1972). Originally published in Dutch: *De Dragers en de Mensen* (Amsterdam: Scheltema en Holkema, 1962).
6. Open building, an idea coined by Habraken and researched since 1965 by the group SAR (Stichting Architecten Research) and followed by a number of groups later. It involves the division of collective and individual responsibilities and thus the separation between the infrastructural support—collective—and the infill—individual.
7. Kieran, S. & Timberlake, J. *Refabricating architecture. How manufacturing methodologies are poised to transform building construction*. (New York: McGraw-Hill, 2004). These authors refer to "chunks" as the independent parts or modules from the automotive and shipbuilding industries. These are in turn also collections of smaller parts or integrated components that are produced in different parts of the world by different teams and assembled in order to obtain the final result: the car, the boat, or the plane.
8. We refer in particular to the following books, articles and web content: Jeremy Till, Tatjana Schneider, *Flexible Housing*. (London: Routledge, 2007). Jeremy Till, Tatjana Schneider, "Flexible housing: opportunities and limits" *Cambridge Journals*, theory, arq, vol 9, (no 2, 2005). Tatjana Schneider, Jeremy Till "Flexible housing: the means to the end" *Cambridge Journals*, theory, arq, vol 9, (nos 3,4, 2005). Awan, N, Till J, Schneider T *Spatial Agency. Other ways of doing architecture*. (London: Routledge, 2011) https://www.spatialagency.net/.
9. Giedion, S. *Space, Time and Architecture: The Growth of a New Tradition* (Cambridge: Harvard University Press, 1959), p. 362.

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