

# Furniture design for a flexible use of dwellings

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The dwellings in old city centres are usually smaller than those found in new residential areas. The usual approach to make old dwellings meet current space standards is to change their spatial configuration. These changes demand building works that are expensive and not always technically feasible. Instead, we propose to increase the efficiency of domestic space use through furniture that allows multiple (*e.g.*, cooking, dining and living at the same time) or successive (*e.g.*, living during the day and sleeping during the night) uses of domestic spaces. This option is cheap and fully reversible, being therefore more sustainable.

The paper presents a survey of furniture used to ensure the flexible use of dwellings. It focus on furniture used for sleeping, dining and living. Three research questions are addressed: What conceptual approaches can be used to design furniture that enables a flexible use of space? Which operational strategies are more frequently used to design these pieces of furniture? Are these pieces of furniture mass produced or prototypes?

The following tasks were carried out: i) set the selection criteria, ii) make an object data sheet, iii) gather and classify data, and iv) analyse results. The criteria to build the sample of furniture was the variety of type of objects (*e.g.*, bed, table, cabinet, sofa), the diversity of strategies used to ensure flexibility (*e.g.*, swivel, telescopic, assemble) and the innovation or relevance in furniture design evolution. For the analysis, each piece of furniture was classified in a table according to the object type, the dwelling function and the strategy to ensure flexibility. The classifications obtained for all items in the sample were summed up to draw conclusions.

The results are that the pieces of furniture more frequently used to ensure flexibility are room dividers for sleeping privacy, expandable/collapsible dining tables for dining, and container expanding systems for living. Multifunctional objects that maximize the use of space were found for the three functions. The strategies that are applied more frequently to promote furniture flexibility are hinging, telescopic and assembling. These strategies are applied in pieces of furniture that have robust structures and are made of long lasting materials. In contrast, the least used strategies are inflating, rolling and compressing. These strategies are applied in pieces of furniture made of soft materials and associated with objects of short term use. Finally, most used strategies are applied to mass produced objects. In contrast, less frequent strategies are applied on prototypes that serve conceptual or artistic purposes.

The main conclusion drawn from the study was that there are many past and present solutions of furniture that ensure a flexible use of the dwelling. The results shed light over a subject that is not common in mainstream furniture design. The strategies organized and illustrated in the paper, provide inspiration for more sustainable furniture designs.

**KEYWORDS:** Domestic Furniture, Design, Dwelling, Flexibility

## 1. Background

Architecture and design have been walking side by side with social and technological developments, in order to facilitate users' relationship with their home environment. Personalization and adaptability in the dwelling have been valued throughout time by many proposals of flexible architecture and design (Hertzberger, 1999; Habraken, 2000; Schneider & Til, 2001; Paiva, 2002, Lemos 2006, Morellup, 2001).

The dwellings in old city centres are usually smaller than those found in new residential areas. The frequent approach to make old dwellings meet current space standards is to change their spatial configuration. These changes demand building works that are expensive and not always technically feasible.

Family structures vary along time in an increasingly unpredictable way (Guerra, 2000). Marriage, birth, divorce, cohabitation and death are significant events. In addition, use of domestic spaces change due to new ways of living, such as the increase of professionals working from home and the new possibilities enabled by information and communication technologies.

As a result, at some moment of household life, dwellings in city centres may seem spatially unfit to their needs. Therefore, a research on furniture design is being conducted in order to study solutions that make the most of domestic space and enable a flexible use of dwellings.

The research is structured in the user centred methodology of *design thinking* (Cross, 1982; Brown, 2009). In the first phase (*empathy*) the study focused on understanding of contemporary housing challenges and collecting architecture and design proposals for a flexible use of space. The second phase (*definition*) aimed at identifying main space use constraints in dwellings and analysing furniture that enables a flexible use of domestic spaces. During phase three (*ideate*) new furniture solutions will be pursued. Phases four and five will be centred in prototyping and testing those solutions.

This paper presents results of phase two. The purpose is to answer the following research questions:

1. What conceptual approaches can be used to design furniture that enables a flexible use of space?
2. Which operational strategies are more frequently used to design these pieces of furniture?
3. Are these pieces of furniture mass produced or prototypes?

Previously, domestic activities that face more use constraints were identified (Gomes *et al.*, 2015): i) *having privacy*, ii) *receiving guests*, iii) *storing personal clothes and objects*. Therefore this paper focus on furniture used for these activities.

The following section presents the research methodology. Results are described on section three and their discussion is made in section four.

## 2. Materials and methods

To answer the research questions, a survey of furniture used to ensure dwellings flexibility was carried out. The four main steps were: i) set the selection criteria, ii) make an object data sheet, iii) collect data, and iv) analyse results.

### *Set the selection criteria*

The criteria set to select the furniture that makes up the sample was:

1. *Having variety*: Since one of the objectives of the survey was to understand the variety of existing solutions, furniture with similar solutions was avoided.
2. *Being relevant and inspirational*: The furniture collected had to be relevant and inspirational for the research. Furniture could be mass produced, a limited edition or a prototype.
3. *Keeping an open mind*: No preconceived ideas guided the collection of the sample. A wide range of solutions was pursued.

### *Make an object data sheet*

A data sheet (figure1) was prepared to organize the data collected for each piece of furniture. The data sheet is divided in three sections:

1. *Object ID*: contains the basic information, such as name, designer, year, producer, country and photos.
2. *Contextualization*: presents a description of the object, such as social context, production, materials, cost, usability, durability and sustainability.
3. *Operationalization*: indicates in a table (figure 2) the activities for which the object can be used, the object type (*i.e., bed, space divider, seat, table, container*), conceptual approach (*i.e., multifunctional, modular, reconfigurable*) and flexibility strategy (*i.e., articular, reticular, pivoting, telescopic, assembling, pilling, compressing, folding, crease, rolling, bellows, inflating*) (Lemos, 2006) (figure 3).

### *Collect and classify data*

A sample of furniture was built according to the criteria set. The sample is made of 111 pieces of furniture. There is a wide variety on pieces of furniture: 40 for *sleeping*, 30 for *having privacy*, 51 for

storing personal clothes and other belongings, 24 for eating in group (family or guests) and 52 for recreation in group. The total of pieces of furniture per activity is more than 111 pieces of furniture because some of them are multifunctional. Each piece of furniture was described in the data sheet. The set of data sheets were compiled in a book.

#### Analyse results

Once all pieces of furniture of the sample were described, the main information was gathered in a synthesis table. Conceptual approaches and operational strategies more frequently used were summed up with this table.

### 3. Results

#### Conceptual approaches

Three conceptual approaches were found in the design of furniture that enable a flexible use of space: *modular*, *multifunctional* and *reconfigurable*. Most pieces of furniture are reconfigurable (97) (figure 4). The number of pieces that are multifunctional (62) or modular (27) is less significant. One piece can combine three conceptual solution types (figure 5), two (figure 6) or just one (figure 7).

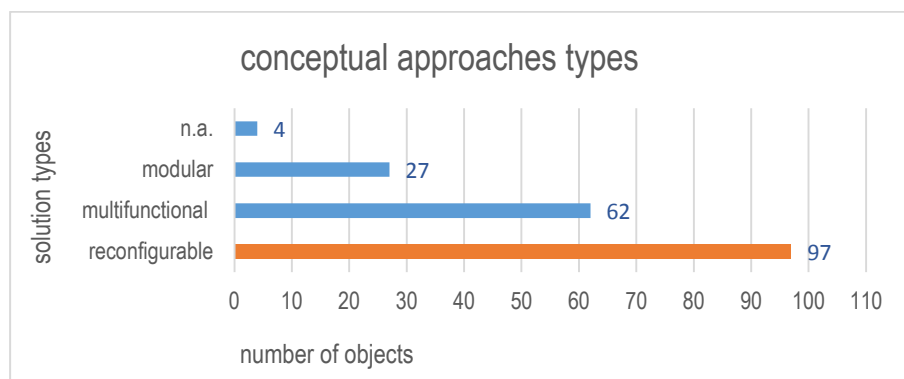


Figure 4 – Conceptual approaches types in the sample

#### Operational strategies

The operational strategies more frequently used are *assembling* (40), *articular* (31), *telescopic* (28) and *pivoting* (18) (figure 8). These strategies are used in pieces of furniture made of hard and long lasting materials. Therefore, the pieces are designed for long-term use and for being operated frequently without detrition.

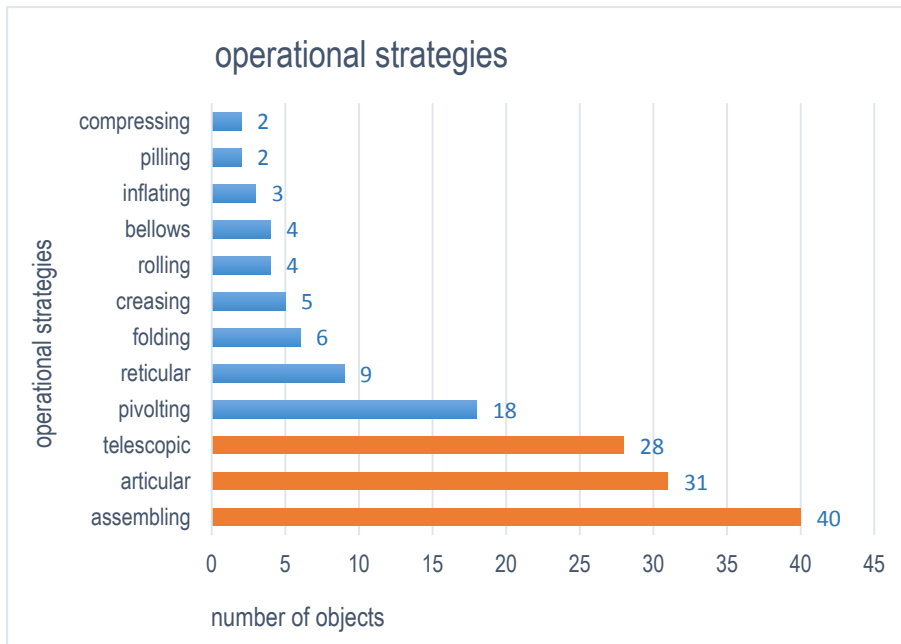


Figure 8 – Operational strategies in the sample

*Assembling* means joining several elements in one piece of furniture, which may be disassembled later for storing or to have a different configuration. An example is *Tandem*, a sofa-based system, for seating, sleeping and eating. Its parts are assembled and disassembled in order to assume different configurations, according to the user's needs (figure 9).

*Articular* means joining two elements or more by flexible junctions that can be moved. It is mostly seen with the use of hinges. An example is *Ospite*, a collapsible seat from Vico Magistretti (figure 10).

*Telescopic* means enabling components to slide with minimum detrition in the contact areas. This strategy is often found in drawers. An example is the *transformer shelf* from Martin Seamer (figure 11), which has multiple sliding shelves that allow different configurations.

*Pivoting* means that a pivot holds many components overlapped that can be rotated and exposed. A sample of the use of pivoting is the *360° container*, a set of drawers by Konstantin that enables the drawers to rotate 360° degrees (figure 12).

The less used strategies in the sample are *compressing*, *pilling*, *inflating*, *bellows*, *rolling* and *creasing*. These strategies are associated with soft materials. The exempt is *pilling*. Although there are many pieces of furniture that use this strategy, most of them have an identical approach (e.g., pilling chairs).

## Production type

Most of pieces of furniture of the sample are mass produced (93). Prototypes and author pieces are less frequent (figure 13). More frequent strategies are applied to mass produced objects. In contrast, less frequent strategies are applied on prototypes that serve conceptual or artistic purposes.

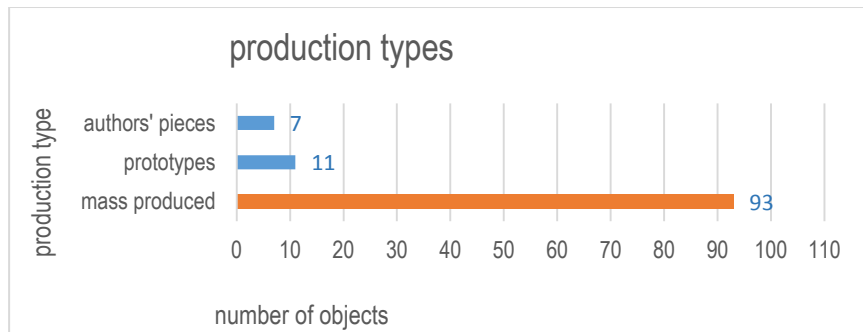


Figure 13 – Production types in the sample

## 4. Discussion

Beyond enabling the flexible use of space, furniture should be: i) sustainable, ii) inclusive, iii) reconfigurable, iv) durable, and v) able to be upgraded. Furniture that adapts to dwellers' needs over time is more *sustainable*, since it is in line with a policy of non-disposable objects (Manzini, 1993). To accomplish this goal, furniture should be made of long lasting materials, *i.e.* should be *durable*. It is not easy to predict future changes of users' needs or aesthetics preferences, hence furniture should be *reconfigurable* to accommodate these changes. Furthermore, it should also be *upgradable*, enabling users to acquire pieces of the system over time. Finally, furniture should be *inclusive*, since capabilities of users vary along time.

Some of the most innovative pieces of furniture collected in the survey are prototypes. This finding raises three questions: i) What is the commercial viability of those proposals? ii) Do the proposals need further developed to go into production phase? iii) Is the furniture industry keen to invest in innovative concepts? Whatever the answers, the innovative pieces of furniture are importance to trigger creative thinking.

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