



Multitasking behaviour: residential experience and behavioral pattern in high-rise housing flat

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Abstract The understanding of the residential perception of their living environment, and their experience in the shanking domestic space, which are the key factors of design housing environment. The spatial perception of dwelling could be gained not only from the physical environment, but also via the residents tacit knowledge, which derived from the reflection about the surrounding or the tasks approaching. By analysis the daily routine at home, the residential behavior patterns have been revealed, furthermore, the way of task- approaching describes the phenomena that Multitasking Behavior has increasing important role in housing environment.

This research employs *Participatory Observation* as a method to approach the object. Besides the existed literature, the residents' living statues have been collected as the first hand data, which evolved both qualitative data from the in-depth survives at participants' homes, and quantitative data from the housing typology.

During the research design, cases from 4 countries were selected as the samples, namely, China, Finland, Mexico and India. By comparing these samples, we found the phenomenon of *Multitasking Behavior*, which is commonly happening during the urban living among these countries, which explained well the impact of density on residential experience in the high-rise housing living environment. The target groups of residents are the middle-class nuclear families (with one or more kids) of the countries. Since the living status and consumption style of this type of families are representing the average perception of the housing dwelling in their cities.

Therefore, the residential behavior pattern, as well as the diversities and similarities of Multitasking Behavior within different cultural contexts have been revealed in the paper, which could inspire the design practice of housing, domestic products and furniture areas. The multitasking Behavior can plays important role as criteria on the housing POE process (post-occupation evaluation).

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1. Introduction

Intensive living style is a notable feature of the high-rise housing dwelling. Since the space is shanking while the population keep growing, the residential density has forced people to count their living space from square meter (m^2) to cubic meter (m^3). The rationality and efficiency of using limited living space, therefore, become increasingly important for the spatial design professions. Then what are the residential needs for their flat? what is and how to gain the residential experience of the intensive housing? To answer these questions, it is necessary to understand the residential perception of their living environment, and their experience in the shanking domestic space.

The spatial perception of dwelling could be gained from the residents' daily routine at home. During this study we try to abandon the stand point of designers, instead, to understand the living by taking the residents' eyesight. Thus it is open-end study, without assumptions what should be observed at the beginning, however during the analysis process, we noticed that residents are highly multitasked while they were approaching housework, which resulted by many social issues and the living space. Then the Multitasking Behavior (hereafter MB) gradually emerged from the data mine.

Thus in this article, we discussed 1) the method of achieving the behavioral research, which is *Participatory Observation* 2) the causes of the MB, which is resulted by the urban density and the family structure evolution, 3) the representation of the MB, which is the behavioral pattern, and the action switching visualization, and 4) the design implantation of the MB study.

The domestic technologies and the indoor space are the given conditions for MB occurrence. With the increasing convenience, residents could finish different tasks in one place, efficiently and simultaneously, which forms MB. From another aspect, MB is growing with the result designed by the social system embedded in domestic technology, which termed symbiosis relation.

2. Methodology of this study

Participatory Observation (hereafter PO) was employed as the main method in this study. Besides the existed literature, the residents' living status quo has been collected as the first hand material, which evolved both the qualitative data and the quantitative data. The visual materials includes video recording, furniture measurement, and plan drawing. Associating interviews and ethnographical field notes, we captured actions during cooking as example and created a model of residential behavior tracks, which reviews resident's actions alternating in their daily life, which reveals inhabitants' attitude and experience objectively. There are three contents contributed for the methodology of this study at different stages, namely 1) typology from the housing flat, 2) behavioral mapping and 3) thick description. Typology of the housing flat is used to compare the physical environment, which includes the shape, size, the construction time and the locational features; the behavioral mapping is for capture the path of action; thick description seeks to finely understand the spatial organization and the interaction of man-environment.

2.1 Participate Observation

In anthropology, PO has been used widely. Hall observed people's talking distance in public space (Hall,1966), Gregson (Gregson, 2011) studied the ridding and living thing by taking in-depth interview in 16 households in Britain and the field material was used for detailed description with assisted images, and Pennartz studied "home atmosphere" by taking in-depth interviews in public housing in Netherlands (Cieraad Ed, 2006).In these studies, the culture or the society has been observed, however the domestic space is lack of description or just appeared as the background. Thus this paper has strengthened the role of space in this housing research.

Entering to the natural field (the resident's home) is required to understand the true experience and to reduce the possible distortions during the investigation. It aims to gain a close and intimate familiarity with a given group of individuals and their practices through an intensive involvement with people in their cultural environment.

2.2 Process of the Data Collection and the Analysis

Several factors were collected for the data sorting and analysis, the basic profile for the residents, the transcription of the recoding, the frequencies of the action switching, and the task to be approaching, and the time axis.

- a. **Basic Profile:** The visual materials includes interviews, questionnaires, video recording, furniture measurement, and plan drawing. Associating interviews and ethnographical field notes, we captured actions during cooking as example and created a model of residential behavior tracks, which reviews resident's actions alternating in their daily life, which reveals inhabitants' attitude and experience objectively. After stepping into the resident's flat, the researcher gathered sorted information and the measured the flat and furniture setting as accurate as possible, and then drew it down as a sketch and wrote down the resident's word about certain space. Gathering the tasks list, in this case, courses of cooking are considered as tasks, thus we gathered the course recipes.
- b. **Transcription:** According to the video, we described the behavior in detail and with time record, and wrote down as Thick Description (Geertz, 1973) of every bodily movement, action switching, touching place, objects using associated with Time Using Axis. In average, the workload is about 1:16, which means one hour video takes 16 working hour to transcript...
- c. **Counting frequency of action switching:** Then we coded action-space nodes with numbers (see table 2), which is the place behavior happened, such as stove is ①, operating-desk is ②, sink ③, fridge ⑦etc. Then the frequency action switching was calculated manually by watching video. For instance, in Katja's kitchen, she moved 13 times from ③ to ⑤, thus the width of the line is the thickest in this diagram (see Fig. 3).
- d. **Tasks and Tim Axis:** Each dish course is considered as one task, which is prepared according to the cultural recipe and local ingredients. In some servant-less cultural context, the resident also deals with another task while cooking such as parenting children or laundry, etc. Time axis is associated with tasks-interleaving and action switching.

2.3 Visualizing behavioral data

From the data collected, two data results were visualized from the materials: one is behavioral switching frequencies with spatial structure; and the other is task-approaching list with time axis.

The MB spatial constructions of the kitchen space were imitated according to video and field measurement, after that we marked the coding process; the behavioral paths were lined for linking the codes. The width of the line between codes is based on the frequencies of each action switching between two points, in other words, the wider line means the movement happened more frequently (See Tab. 2). Tab. 2 demonstrates the action path for each person inside the kitchens from the 4 countries. The time axis of MB demonstrates the tasks quantities which are presented in different colors, and the action interleaving happening time in the four countries. (See Fig. 3)

2.4 Listing residential needs and to inspire design

According to the video transcription, and frequency of action switching, the needs of residential behavior for the space could be intuitively detectable. Listing the needs of the resident's in different context we could find the content difference.



Fig. 1 A participatory observation for Multitasking Behavior in nuclear middle class living in housing flats in 4 countries, namely Finland(Katjas' in Helsinki), Mexico(LCuca's in Mexican City), India(Pomma's in Mumbai) and China(Yong's in Beijing)

Multitasking behavior: residential behavior and behavioral pattern in high-rise housing flat

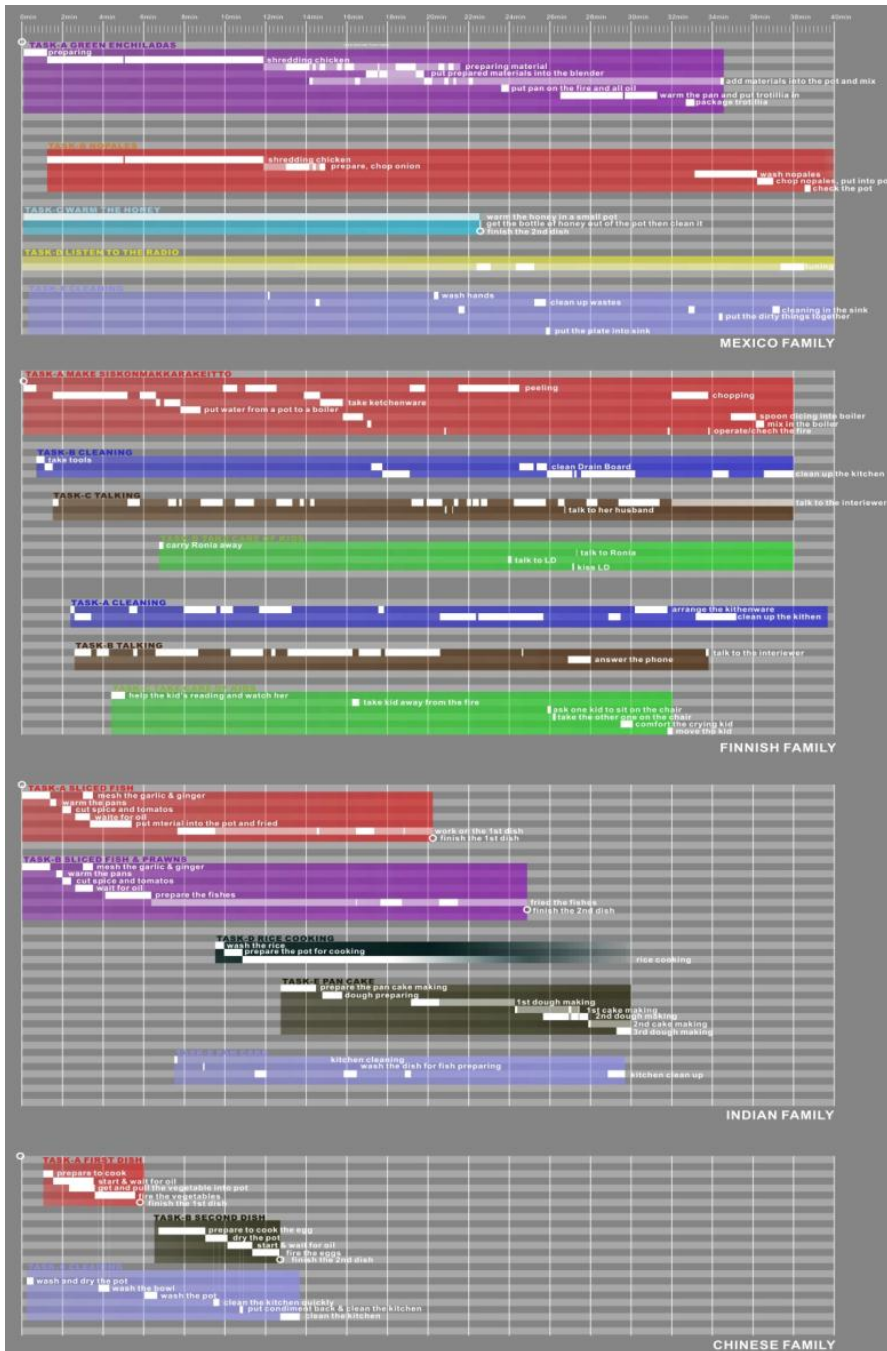


Fig. 2 The action switching during the tasks approaching of the 4 families, in the time axis. The tasks which have been achieved in the lunch-cooking process(maximum 40 mins) were marked in different colors, the white bar means the action switching during the task-approaching.

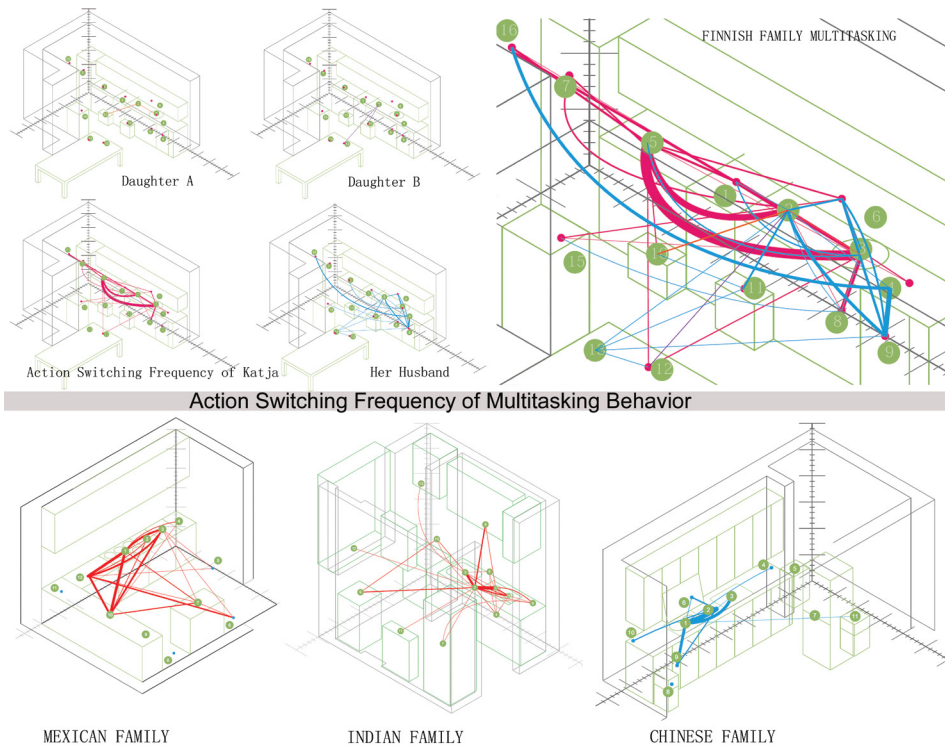


Fig. 3 The Action-Switching Frequency and movement trails of Multitasking Behavior for the 4 families

3. Finding and Discussion about the Multitasking Behavior

3.1 The Causes of Multitasking Behaviour:

It is a fact that at home inhabitants typically handle several tasks simultaneously, “cooking while cleaning” “watching TV while working” “toileting while blogging”, etc. residents prefer to coordinate more tasks in a time unit. Many issues such as labor price increasing, urbanization, housing flat similarity could cause the MB occurrence which besides the population density, nowadays the MB in residential space might be a global phenomenon, thus designers could put forward for the housing needs of the emerging new design.

Density: The reason of MB happened more frequently in many cultural context, on one hand because of the population density and labor price impacted on housing dwelling; and on the other hand, many relevant factor such as all the domestic technology improvement, similarity of urban lifestyle, and the culture that glamorized western kitchen. This brought the possibilities to domestic situation, and offered the affordances for MB.

Servant and Servant-less culture: From the diagram we learned that, the efficiency of tasks-approaching relates to the servant hiring of one family. The housekeepers played important role to the residence since 17centry (Rybcynski, 1987). The result was found that less assistant hiring causes higher MB. The family who hires a house keeper, the MB in this family is lower; without the helper, the MB happens more frequently. During the interviews, we also noticed that, beside Finland the three developing countries have hired servants. Since labor price is relatively low, many middle class prefer to hire a family assistant for housework, which include child care-taking, room cleaning etc. In the Mexican context Cuca has “maid” for cleaning, but she likes cooking by herself, because she does not want others to mix up the order of seasonings. For Chinese case,

Yong is sharing a cleaning maid with another family, which is common in Chinese urban cities. Since the labor price is increasing dramatically in these high speed developing countries, the domestic setting and technology which can support MB should be considered more.

Cultural diversity in Parenting Children: The above part could affect the habit of cooking with or without children, its different way of parenting children. In Finnish case, Katja was cropping next to her children who were playing on top of oven, while in some part of oriental context child is banned from kitchen, especial the boys. During the observation, Katja's children were encouraged learning of cooking and safety. Two daughters were standing on stools beside her both side, during the entire cooking process, moving frequency of daughters are very low (2-3 times), which offers the possibility for Katja for approaching more tasks: taking care of two children while preparing lunch. Oppositely, in Chinese kitchen rarely see child appear inside kitchen while cooking. Therefore, besides some directly visible reasons, the cultural behavior and habits as different contents of MB should be noticed during residential experience study and design.

3.2 Current Study for Multitasking Behaviour

MB is not a new concept, although, it seems this term has been wildly used in ICT and HCI area only since last decades. Smith that multitasking behavior arises not just after computing era, instead, "Multitasking is what makes us human", which is an ancient behavior, since the human being developed the ability to walk on two legs (Smith, 2010). Multitasking Behavior can be basically defined as the *involvement in more than one activity at a time* (Smith, 2010) it presets variously in different environment. The working-environment MB redefined the approach to model multitasking behavior in organizations, based on two interrelated primitives, action and interaction context (Zacarias et al., 2004). The lack of time is one of the motivations.

This symbiotic relation also reflectively embodies the increasing spatial similarities in the same building. Because of the same external environmental reasons, the flats of upper floor or lower floors are sharing same plans and similar furniture setting. This is a fast-paced performance of contemporary life, especially in the past decade, and media and technology had impacted deeply for peoples' life. The speed of building flats quickens MB frequency. Like the Frankfurt Kitchen, which invented in 1926 by Margarete Schütte-Lihotzky, has had a crucial impact on the urban housing architecture and cooking practices in daily life. After Frankfurt kitchen has mass-produced and installed in 10000 social housing, the modern kitchen with a standing position for improving efficiency was formulated. As a design idea, MB already has been found in this kitchen as well, for instance, the iron board also was one of components to approach more tasks during cooking, because of in 1920s a woman's time spent on housework was reduced. This renovation influenced cooking behavior not only in European-American but also in Asia and South American culture.

3.3 Model of Multitasking

In some research articles, the human multitasking models which for computing context are defined as following, Attention-to Action (ATA) and Frontal-Lobe Executive Model (FLE) (Zacarias, 2004), however with a domestic context, spatial condition and settings are required. Thus the proposed pattern is inspired by a model needed for multitasking behavior at work, and which addresses multitasking in terms of two different but interrelated concepts such as Action Context and Interaction Context, which are close to the behavioral features found within a domestic context, additionally, the environments of housing space were imitated.

Modeling residential multitasking behavior entails the study of several action spaces handled by single individual and the way how residence handles these action spaces. Tab. 2 illustrates the MB pattern in kitchen of 4 countries. The upper part represents the Finnish Katja's Family, because during the cooking, there are 4 persons—Katja, her husband, her two daughters in the same action-context, which is distinct from other three cases (lower part), and which has influenced by interactional space on task switching Finnish case has interaction between parents

and kids. (see Fig. 3). The green codes represent action-space nodes; the width of the line demonstrates the frequencies of the behavior paths.

By summing up the previous research, 1) There are three key roles about MB, viz spatial action-context, task switching and time, all elements play as actors in this situated context; 2) Tasks which embed with certain Time slot are approached simultaneously by action switching/interleaving. 3) The frequency of tasks switching is one of indexes to define the degree of tasks overlapping. Therefore, the MB pattern could be represented as this visualized diagram with time axis and task axis.

4. Design Implement

“Monitoring social networking site while watching TV; Soaking feet while reading magazine; Listening radios while cooking, having dinner while watching TV, using toilet while ipad-blogging”, those are the major ongoing MB collected in the survey. Multitasking Behavior could be one principles and criteria for the housing environment. By analyzing the behavior model of MB, this research tries to solve a realistic problem via designerly approach. According to the observation of video analysis, during the brain storming and workshop, many design concepts appeared, which were categorized as tools, system integration, and cross-cultural design. Following is summed possibilities of design:

1. Tools: Design of tools and utensils are deduced mainly during the analysis for different MB context. For instance, a knife design was deduced from the Mexico case. Through the video we notice that Cuca was unconsciously using chopping knife to mix onion inside a pot simultaneously without changing tools for convenient reasons, therefore a series of multifunction tools design could inspired. That was one of the examples for how multitasking behavior study contributes in design practice. The similar designs for tools are also inspired by the Indian cases for pot-lid design.

2. For the solutions of cultural diversity: Solutions for different culture have to be considered. Since globalization, designers have more challenges to design for other cultures, then how one design does for the locals and to cater the needs of them, which will be the potential issue to be focused on. As we mentioned above, the MB has different content for different cultures, and the design depends on knowing others life and behavior. Thus this study attempts to step out of the designers' own knowledge, knowing others lifestyle and then offer design for various culture.

3. Post-Occupation Evaluation: The efficiency are part of the reasons for this multitasking happened at housing environment. task-interleaving is constantly increasing due to the improvement of domestic technology. A better housing setting could be assist residents to achieve more tasks by its high-connection, and to reduce the labor-energy consumption. The behavioral path of task-switching is the shorter the better. Thus the multitasking behavior could the criteria to measure the efficiency of the housing environment, which is key issue to improve the housing quality and give reference for the future housing projects.

5. Conclusion

This article described the multitasking behavior in residential space, from several aspects, methodology, cause, forms and the inspiration for design respectively.

Participatory Observation in housing design research was purposed, which can be used as an important research method to multitasking argumentation. Through this pilot study, the efficiency of data analysis and the convenience of implementation could be discussed for the future. The patterns of MB were visualized. The capture and modification of MB were displayed for intuitively illustrating the interaction relationship between residential behavior and the dwelling space.

With a high-rise housing environment, dwelling density requires residents to utilized space efficiently, and the servant-less lifestyle forced residents solving more tasks in one unit time, thus the understanding of MB plays more important role to inspire design and technology, and has a

symbiotic relation with domestic technology. It forces the technological improvement to cater the needs of efficiency, in the other aspects; the technology supported is required for offering the affordances to endure the occurrence of multitasking behavior, and for upgrading the production to improve dwelling qualities. There is mutualism in between.

High density is the main characteristic for high-rise residential housing. In this environment, a sole problem might be repeated hundreds of times, and easily become a social problem; its process can be surprisingly fast. Density is, but not the only issue that we are facing in our dwelling in high-rise housing environment. This topic allows designer to offer works efficient targeting the residential needs, which benefits the residents' daily life and improve their living comfort. In cities, and most citizens live in housing flats, thus the residential perception of the housing flat is a key issue to be revealed, and it also plays important role as criteria on the housing POE process (post-occupation evaluation).

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