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Understanding Context Change: An Activity Theoretical Analysis of Exchange Students' Food Consumption

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Abstract

Context change is regarded as an opportunity to intervene people's daily doings towards a sustainable direction. Looking at this opportunity from a product and service design perspective, in order to introduce design interventions, the question of how people actually transit their behavioural routines when they are undergoing context change. As the first step to approach this question, in the paper we present the use of activity theory as a theoretical lens to systematically describe and analyze the process and outcomes that context change has in influencing people's daily doings. First, we report in detail on how we construct an activity based analytical approach to analyze the transition and development process when people are undergoing context change. Then, we illustrate the practical use of our model in a case study for understanding the influences that context change has in South-East Asian exchange students' food consumption activities. In the end, we summarize our findings and reflections in terms of the holistic and in-depth insights the activity perspective can provide.

Keywords: Sustainable design, behaviour transition, activity theory, conference publications

1 Introduction

As the majority of the authors on this paper can attest from their past experience, moving from their countries of origin to Sweden for study or work, even if it is only for temporary, disrupts some of the daily doings that they may have been performing over years. Apart from the authors' own reflections, existing literature has also shown that context change triggered by other individual life events, such as residential relocation, transition to parenthood, leaving parents' home for the first time, can have the same effects on disrupting people's pre-existing behavioural routines (Wood, Tam, & Witt, 2005; Thompson et al., 2011; Schäfer et al., 2012; Schäfer, Jaeger-Erben, & Bamberg, 2012). These studies have pointed out that people tend to perform most of their habitual behaviour automatically under a stable interaction with the

surrounding context, when such life event transitions disturbs those contextual cues, people become more likely to reconsider and unfreeze their pre-existing behavioural routines, thus leading to the disruption of the corresponding daily doings. Therefore, context change is regarded as an opportunity to guide people's lifestyle towards a more sustainable direction (Verplanken and Wood, 2006).

Until now, most studies under this topic have been carried out with the focus on developing different approaches to intervene people's daily doings during their life event transition moments. One question needs to be asked before rushing into introducing the intervention, however, is how people actually transit their behavioural routines when they are undergoing context change. To be more specific, questions such as what the transition process is, how we can better understand and describe it, should be answered. So far, there has been little literature published on exploring the above questions. This paper presents the use of activity theory (hereinafter referred as AT) as a theoretical lens for approaching those questions. By taking South-East Asian exchange students' food consumption activities as a case study, our primary goal is to report the detail findings with regard to what behavioural routines the participants have changed, retained, and developed during the context change transition process. Based on that, we present how an activity perspective can be used to systematically describe and analyze the process and outcomes that context change has in influencing people's daily doings, and further reflect on the insights that an activity perspective can provide to support people in adopting and retaining sustainable lifestyle through context change.

The structure of the paper is as follows. In the next section we present the AT perspective we choose for this ongoing research and how we adopt and adjust the analytical framework in this study. In section 3, we briefly present the set-up of exchange students' food consumption activities used in this study. In section 4, we report in detail the research methods employed for collecting data regarding how participants carry out their food consumption activities before and after context change. Following that, results from the case study are presented in section 5. The paper concludes with discussions and reflections on the application of the AT based analytical framework in this study, and suggestions for future work.

2 Activity theoretical framework applied in this study

When it comes to the topic of understanding how context change can influence people's daily doings, most of the theoretical approaches have been applied for identifying and predicting the psycho-social factors that may influence people's behaviour (Thompson et al., 2011). However, a systematical description and analysis of the process and outcomes that context change has is missing from the existing works. Furthermore, as this ongoing research aims to identify design opportunities for supporting people's sustainable lifestyle through context change, the chosen theoretical framework need to be able to contribute to a deeper understanding for a design perspective in future research (Chu & Wever, 2017). Based on these two considerations, we have chosen AT as the theoretical lens in this study. AT has been applied in various of design research studies as analytical tools to understand complex real-world problems and inform implications for design (for instance, Rexfelt & Rosenblad, 2006; Glad, 2015; Selvefors, Karlsson, & Rahe, 2015; Woll & Bratteteig, 2018). Insights from these studies showed that the descriptive nature of AT can enable design researchers to shift their focus from understanding users' individual preferences to the activities that they carry out, thus arriving at new knowledge for reframing the problems that people have encountered within the context of activity. As this

study is design-oriented, the concept and key principles of AT used in this paper is introduced from a design perspective in the following part.

In activity theory, an activity is interpreted as subject's interaction with world to achieve their objects in real life circumstances. What distinguishes AT from other psychological conceptual theories is its' primacy of activity over the subject and object (Kaptelinin & Nardi, 2006). In other words, unlike other psychological theories which aim at providing models to predict subjects' behaviour and habits, the focus of AT is to understand why and how people carried out a specific activity in a specific context to achieve a specific object (Kaptelinin, 2014, Nardi, 1996).

Based on this fundamental concept, several AT based models have been developed. According to Woll (2017), the first generation of AT model is proposed by Vygotsky (1978), which regards an activity system as a single triangle that is constituted by the interaction between a subject, an object, and mediating tools within a certain context. Build on that, Leont'ev (1981) developed the hierarchical structure of activity system, which is consisted of activity-action-operation layers. Established on these two generations of the AT model, Engtröm (1987, 1990) introduced the third generation AT with a focus on understanding collective activity rather than individual activity. Apart from the shift of focus, another significant principle in his model is the dynamic development feature of activity, which will be explained in this section later.

As this study targets at understanding activities carried out by individual participant, we have therefore chosen Vygotsky's single triangle model and Leont'ev's hierarchical structure model as the main analytical model in our analysis. The model has already been applied in product design and interaction design field, particularly in design research studies conducted by Karlsson (1996), Sundström (2003), Rexfelt (2008), and Selvefors (2017). Build on their application of the model, we have also incorporated the development principles from Engström's model to understand the transition process of the targeted activity when people undergo context change. We build our own analytical framework based on three key principles of the AT: context and mediating tools, hierarchical structure, disturbances and contradictions.

First, we see the concept of context and mediating tools of AT as an integrated whole. The definition of tools in AT are broad, it includes external tools (also named as technical tools), such as hammers and mobile phones, which are used as physical artifacts, and internal tools (also named as psychological tools), such as laws and regulations, which are used to influence people's perceptions and behaviour (Kaptelinin, Nardi, & Macaulay, 1999). Both types of tools are regarded as mediating tools in the activity model in study. However, it is not possible to find a clear distinction between internal tools and external tools in people's real-life practices (Honold, 2000). For example, recipes can be categorized as external tools when people start learning how to cook a dish by themselves, but later on after several practices, the recipes may become an internal part of people's cooking skills. The use of mediating tools cannot be analyzed separately from the context of the activity, when AT are applied as an analytical approach in product and interaction design field, understanding and modeling the context in which a tool is used by users are regarded as a central idea of AT. However, a various definition of context has been developed with different research focuses in various disciplines along with the development of AT models (e.g. Kaptelinin et al., 1999; Honold, 2000; Kaenampornpan & O'neill, 2004; Döweling et al., 2012; Allen et al., 2011). As this study takes a design perspective, we have adopted the interpretation of context from Rexfelt (2008) and Selvefors (2017) and focused on understanding the context in activity layer, which is referred as the general social, physical, and technical background of the activity.

Second, an activity is composed of three layers in a hierarchical structure: the top layer is activity, which is composed of actions, and actions are consisted by operations in the third layer (Leont'ev, 1978). The single triangle interaction between subjects, objects, and mediating tools exists in each layer of the hierarchical structure (see figure1 below). The activity layer provides the insights of why an activity is carried out, the action layer presents what and how different goals under the object are fulfilled by the subject and specific tools, and the operation layer reveals how actions are adjusted and performed in different conditions (Kaptelinin & Nardi, 2006). However, applying this activity theoretical model to analyze the activity (its' corresponding motives), actions (its' corresponding goals), and unconscious operations (its' corresponding conditions) at the same time in one study may be difficult. A suggestion thus is made to start with the intermediate layer of the hierarchical structure -- the action layer, which can enable analysis to go up to the activity layer and to go down to the operation layer (Kaptelinin, 2013). In this study, we take the action layer as the focus of the analysis, the analysis then goes up to the activity layer, it is expected to reveal information regarding the changes of goals that participants had experienced in their food consumption activities before context change and after context change. Note that, due to the scope of this study, the operation layer is excluded in order to reduce the complexity of the analysis.

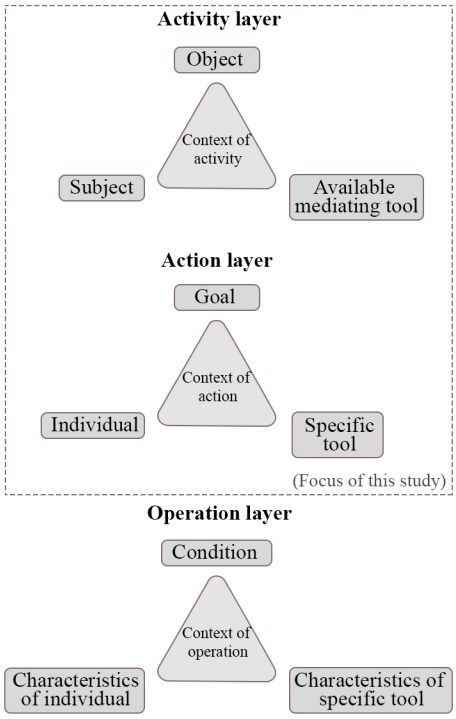

Figure 1. The hierarchical structure model of AT and the focus of this study, adopted from Selvefors (2017).

Third, activity systems are not static, but under dynamic development and transition through history and time (Kuutti, 1995). In other words, the reason why we carry out a specific activity at a specific point of time under a specific context involves the results of certain development of that and its' relevant activities. The concept of development has already been well explained and used as a basic principle by researchers from different disciplines. In general, the development of an activity system can be understood from two aspects: the development caused by disturbances, and the transition process within the activity hierarchical structure.

The driven forces of development are disturbances within the activity system (Engström, 2000), according to Engström, disturbances in AT are defined as deviation from standard scripts, they are mainly caused by contradictions within and between different components of one or multiple activity systems. Those contradictions include misfits, problems, tensions, incoherencies, and inconsistencies that subjects encounter when they carry out an activity and they can be identified at different contextual levels of an activity system (Kuutti, 1995; Blackler et al., 1999). Engström (1987) further identified four levels of contradictions ranging from the contradictions within each constituent component of the activity system to the contradictions between central activity and its neighbor activities. Within the scope of this study, we put our focuses on the secondary contradictions -- the contradictions between the different components of the activity system. In other words, tensions and misfits within the interaction between participants (subjects), their goals in food consumption activities (objects), and internal or external tools they use to fulfill the goals (mediating tools). When disturbances become materialized at a given point in context and time, the activity systems may undergo a transition process in which the subject attempts to find temporary solutions to address the contradictions that trigger the disturbances (Huysman & Baalen, 2003). It is under these moments that the activity system develops and adapts itself to fit into the new environment.

One potential consequence of disturbances is its influences on the hierarchical structure of the activity. The development and transition process within the hierarchical structure of an activity can move in both bottom-up and top-down directions depending on the where the contradictions take place. For instance, in the activity layer, when new possibilities of fulfilling a certain motive are presented and adopted, the pre-existing actions that subjects performed may be changed and transformed into new series of actions, this would also lead subjects to experiment and form new operations in the operation layer. When the changes take place in the operation layer, the previous unconscious operations that subjects used to perform may be transformed into conscious actions, the subjects might also adopt and create new actions, which in turn can influence the motive and object of the activity (Kuutti, 1995).

3 Case study description

To illustrate how AT can be used to present and analyze the development and transition process when people go through context change, we have taken an explorative case study which aims to understand Asian exchange students' food consumption activities when they were studying at XXX University. Asian exchange students were chosen as the target group of this study based on two considerations: first, as pointed out in the beginning of the paper, the majority of authors can attest from their real-life practices that moving to Sweden constitutes a life event transition which disrupts some of their pre-existing daily routines and habits. It was assumed by the authors that exchange students who come from Asia, specifically South-East Asia, would undergo relatively significant cultural, social and physical environment changes when they are studying in Sweden. Second, exchange students are expected to have a similar duration of stay for their exchange study period, and by the time this research was conducted, all participants had been in XXX city for approximately one to two months, they were already able to reflect on their past and ongoing experience and the difficulties they had experienced in adopting to the new environment. Food consumption activity is chosen as the subject of the research because it is the activity that students have to perform in their everyday life, it is expected to yield rich data about how specific daily doings can be influenced by context change.

4 Research Methodology

Activity theory does not prescribe to a particular research method, but it allows the method to be chosen based on the research context and questions (Kaptelinin & Nardi, 2006). Answering the research questions of this study from an activity theoretical perspective requires descriptive data about participants' interaction with their chosen mediating tools in their everyday life context, especially in the action layer of the activity system, which is expected to reveal the key development and transition process of their food consumption activity patterns through context change. Therefore, a qualitative approach that is constituted of in-practice studies of everyday human activity and diary probes were applied as the data collection methods in this study. Our rationale behind using the methods is not only to learn about what and how participants carry out their food consumption activities before and after context change, but also to understand the reasoning behind participants' specific behaviour by encouraging them to describe and reflect on their own ways of carrying out activities.

4.1 In-practices studies and diary probes

The in-practice studies of everyday human activity method used in this study were adapted from design ethnography research approaches developed by Pink et al. (2017). One strength that makes the method applicable in this study is that, it allows researchers to go into the field and observe people when they perform their daily doings within their live settings. Specifically, in this study, this method refers to an integration of filed observation and semi-structured one-to-one interview conducted under the circumstance when participants were carrying out their shopping, cooking, and eating activities. An interview guide was tested and revised in a pilot study, which was conducted with an EU exchange student who arrived in XXX city in the same period of time as the other participants. After the pilot study, the in-practice studies were conducted with each participant individually at a supermarket in student residential area and participants' kitchen. The study started with an interview in participants' accommodation for approximately 30 minutes, the intention is to gather verbal descriptions about what and how the participants carry out their food consumption activities in the context of their original university and XXX University. After that, we went to supermarkets with participants to purchase food ingredients, and then after that we jointed in their cooking process and eat the meal with participants. AT was used to inform the questions we asked during the in-practice studies, a sample of questions include: *How do you decide what to buy? What are the problems or difficulties you have encountered during the shopping process? What are the differences between the food products here in XXX city and where you come from? How do you decide what to cook and eat? What are diet differences that you have experienced here in XXX city compared to where you are from?* All the interviews were recorded and the observations were documented on notes.

However, with the concern that participants might behave differently when we as researchers were participating and learning about their daily doings, we employed diary probes to provide a complementary view regarding participants food consumption activities without any interferences from the researchers. Approximately three weeks after the in-practice studies were conducted, we sent out a seven-days handwritten diary notebook to each participant. In the notebook, we covered the questions that we felt the participants were unavailable to give accurate answers during the in-practice studies process. The diary probes were consisted of three parts: (1) An instruction about how to use the notebook. (2) A seven-day diary in which participants need to document their everyday food consumption patterns by answering the pre-set questions distributed over the seven-day period. A sample of common questions we put in

this part includes the frequency of shopping in one week, the category of food that is consumed in one week, and so on. In addition to the general questions listed above, the preliminary results from the in-practice studies were used to formulate tailored questions for each participant. The diary probes were thus used to further investigate some of the themes that had already emerged from the preliminary analysis, such as "consideration for healthiness", "influence of price discounts in shopping", "choices for frozen food", and "choices for microwave meals". (3) The third part of the diary notebook was a series of reflective questions in regard with the experience of using the diary notebook to document food consumption related behaviour and habits. The diary notebooks were collected by researchers after seven days.

4.2 AT informed analytical approach

The collected data from interviews, observation notes, and diary notebooks was analyzed in an abductive approach. We first used affinity diagram to summarize and identify themes that emerged from the raw data. The data was processed following the steps described by Holtzblatt et al. (2004). An affinity diagram was built from bottom-up direction, themes with similar patterns were organized into a same group, then we put themes such as "time spent on each meal", "learning for cook", "price is an important consideration", "product information matters" to categorize the group in a higher level. Then the themes emerged from the affinity diagram were abstracted in the form of activities and actions that participants performed, after that, each theme was analyzed through concept of object and goals, mediating tools, contradictions, and solutions from activity theory.

An AT informed analytical approach was applied in this study to interpret the themes, the aim is to use a step by step framework with a specific focus on understanding the transition and development process of people's activity system through context change. Although there is no existing AT based analytical approach that can be directly applied into this study, several methodological approaches for interpreting and designing people' activity system were borrowed as inspirations and further adjusted as guidelines for developing the analytical approach in this study. Specifically, our analytical approach was built on the AT based methodologies proposed by Mwanze (2001), Uden (2006), and Boer et al. (2002). Although the research settings and activity system model used in these studies varied from each other, the analytical methodologies mentioned above are consistent in two features: First, all the proposed approaches mentioned above have a similar systematic step by step procedures for analyzing an activity system, starting from translating the activity settings into a selected activity system model, to describing the interaction between different components within the activity system, to interpreting the disturbances and contradictions that the activity system has. Second, the activity systems analyzed in those studies were not regarded as a static picture, but a dynamic transition process involving subject's constant search for solutions to contradictions within the system, in other words, they all emphasized the importance of taking the principles of context and development into the analysis of an activity system.

Based on the methodological approach used in the above existing studies, the analytical approach applied this study was thus adjusted as below:

1. Choose the settings of participants' food consumption activity and translate the settings into the single triangle and hierarchical structure of the activity system model used in this study.
2. Define the corresponding context (macro level), activity layer (meso level), and action layer (micro level) of the activity system.

3. Present the overall changes that took place in participants' activity system before and after context change.
4. Identify disturbances and contradictions that took place within each level of the activity system.
5. Analyze how the identified disturbances and contradictions were resolved by the participants.

5 Results

In total, 6 South-East Asian bachelor exchange students in XXX University were recruited as the participants of this study. All the recruited participants arrived in XXX university in January, 2017, at the time they arrived, they were going to begin their exchange study for the spring semester of 2017. Therefore, when this study was conducted, all participants were in a same time frame adopting to the new environment. The participants were recruited through two ways: personal network of the researcher and recruitment advertisement on XXX university exchange student's page on social networks. All participants have been informed the purpose of the research in a brief project introduction session before the study began. Although the limited number of participants might make the results hard to be generalized to a wider population, however, since our goal is to explore how to use AT to systematically describe and analyze the process and outcomes of context change, we believe the small number of participants can bring the benefit to yield more descriptive and in-depth knowledge for us to reach the goal of this study.

5.1 Behavioural routine transition from ordering food to cooking food

General activity system: By focusing on the activity layer in the hierarchical structure of participants' food consumption activity system, we found their food consumption activity underwent a transition process from ordering food in student canteens and restaurants in their original university to cooking own food regularly in XXX university – for example, Ms. S stated:*" In Taiwan I eat in student restaurant or outside, or take away from convenience store, I never cooked. In Sweden, I almost always cook"*. Note in this study, participants' definition of cooking ranged from making a simple meal such as boiling instant noodles to making more time-consuming dishes in which a variety of materials and ingredients were used. **Object:** We found the overarching object of participants' food consumption activity in both of the contexts can be summarized as to eat affordable meals, which were retained through context change. **Mediating tools:** In the context of their original university, student canteens and restaurants were the mediating tools that participants used to achieve the food consumption activity, however, when they were in the context of XXX university, the mediating tools shifted to supermarkets and their own kitchen.

Contradiction between mediating tools (student canteens and restaurants) and object: According to participants, price difference was the major factor that caused the transitions, the cost of one meal in student canteens and restaurants in XXX university was higher than what participants were used to spend in their original university. As a consequence, the functions and services provide by the potential mediating tools in the new context -- student canteens and restaurants in XXX city, was not available for participants to meet their object to have meals in a similar affordable price as what they had in old context. **Solutions for addressing the contradiction:** Therefore, in order to retain the object of having affordable meals, participants started to cook their own food as cooking was regarded by participants as a relatively cheaper alternative to avoid the costs in canteens and restaurants – "*When coming to Sweden I felt forced*

to cook as an out way to the expensive life" (Ms. H), "*In Sweden I save money if I cook*" (Ms. E). However, we found in this transition process, more contradictions within participants food consumption activity system were first recognized and then solved by the participants.

5.1.1 The lack of cooking knowledge and experience

Contradictions between subject and mediating tools: In order to carried out cooking activities, participants had to interact with their cooking skills and experience as an internal mediating tool. However, none of the participants had enough cooking experience before they started their exchange studies. Some participants did not have a kitchen in their student dorms, others regarded cooking as more time consuming and inconvenient than eating in student canteens and restaurants. As a result, when participants were in the context of XXX university, most of them had to learn how to cook a meal from scratch, using the terms from AT, **this** phenomenon can be interpreted as participants' internal mediating tool was unable to provide adequate information for them to fulfill the goal of cooking. **Solutions for addressing the contradiction:** To solve this contradiction, participants adopted their own ways to develop cooking related knowledge and skills in XXX university, which includes (1) sharing recipes with friends -- "*I share recipes with Asian friends, because it is hard for my family back home to give advice*" (Ms. S), (2) watching online cooking tutorial videos -- "*I use YouTube*" (Ms. S), "*I taught myself how to cook by YouTube videos, where I will look up how to prepare a dish*" (Mr. R), (3) checking information on product packaging to find out how a particular dish has to be prepared -- "*I learned to cook a bit via google and via the instructions on the packaging of frozen food*" (Ms. K), and (4) searching recipes on internet -- "*I downloaded an app to find recipes, western and Asian*" (Ms. H). All the above approaches acted as external mediating tools which can enable participants to fulfill the goal of developing adequate cooking skills and experiences, so that they can use the cooking skills as internal mediating tools to fulfill cooking activity. As participants gradually learned and applied their cooking skills in practice, they started to further develop their cooking routines, for example, Ms. S stated that she only followed recipes in the first period when she arrived in the new context -- "*I followed recipes in the beginning when I had no experience with cooking at all. Now I use them in case of a special occasion or when I want something different*" (Ms. S).

5.1.2 The time concern for cooking

Contradictions between subject and mediating tools: Participants' concern of time spent in cooking process was another leading factor that influenced the cooking routines they performed. One of the questions we asked in the diary probes was the average time that participants spent for having a daily meal in both of the contexts. The results showed that the time spent at XXX university was significantly longer than the time at their original university: *"In XXX city, I spend at least two to three hours on cooking and eating. In Singapore I spend as less as possible"* (Ms. K). Furthermore, we found when participants were at their original university, as they mostly ate in student canteens and restaurants, there was no need for them to take time spent for cooking into account. However, when they were in the context of XXX university, the way how participants carry out their food consumption activities were depend on the time that they estimated each specific meal cooking process would take – for example, as Mr. R stated: "*What I decide to eat* [in the context of XXX university] *depends on time. If I have time I will check out the discounts and see what I make with it. Otherwise I eat frozen food, like fish, meatballs or potatoes*". **Solution for addressing the contradiction:** to address this particular contradiction, new actions along with potential solutions thus were developed

with the goal to reduce time spent in cooking process, which can be summarized as: (1) the improvisation of cooking activity and (2) the search of other alternatives to cooking.

5.1.3 The improvisation of cooking activity: A shift to recipe-less cooking

As mentioned in the preceding section, after participants had gained the basic skills and experience they need for carrying out cooking activity, they felt cooking by following recipes can sometimes be over restricted. Apart from that, some participants seldom cooked dishes in accordance with the traditional style in their countries of origin as cooking those dishes were perceived as time consuming – for example, Ms. S stated: "*I know many meals from Taiwan, but they are too difficult and need a lot of work*". As participants gradually adapted to the new context, they also started to improvise their cooking. In this process, the mediating tools that participants interacted in cooking activity shifted from the external online or shared tutorials and recipes to the internal knowledge of subjects' familiar recipes and cooking procedure, a stable cooking pattern was thus formed and solidified – for example: *"Now I often make similar meals, wherefore I don't need a recipe"* (Ms. S), *"Most of time I cook a meal with the same basis that I keep varying"* (Mr. J), *"I choose what I cook based on what is in the fridge and then I improvise. Normally I make a dish with which I am familiar and with familiar ingredients"* (Ms. H).

5.1.4 Other alternatives to cooking: ready-made microwave and frozen food

Apart from the transition to recipe-less cooking, some participants also formed new behavioural routines of eating ready-made microwave and frozen food. The goal of eating convenient and cheap food was the driven factor that led participants to adopt this eating pattern. In most of the cases, the microwave and frozen food products were relatively cheaper and easier to cook compared with the fresh ones that were sold in local supermarkets – for example, Mr. J stated: *"I eat much more frozen, can, or jar food instead of fresh, because of the price"*, Ms. K stated: *"I started buying microwave meals when it was on sale, they are not very nice, but they are easy* [*to make*]. *It is a good deal*", and Mr. R stated: "*I only buy fresh vegetables if there are no frozen ones. They* [refer to the frozen vegetables] *are cheaper and easy to cook via microwave.*" (Mr. R). However, in the context of their original university, they didn't consider eating those types of food as an alternative. When participants were under time pressure, for example, during examination period, cooking own meals was not their first option to go as they didn't want to spend too much time and energy in cooking, some participants thus adopted other alternatives to solve the tension, such as "*Drink milk or be hungry*" (Ms. S), "*Order pizza, cook ramen or buy bakery or salad*" (Ms. E), "*Instant food*" (Ms. K), "*When I have little time I make frozen food, like meatballs or potatoes*" (Mr. R), *"When I do not have time, I will eat at campus or take it away"* (Ms. H).

5.2 Behavioural routine transition to purchasing food materials and ingredients

General activity system: In addition to the direct transition in participants' cooking activity, an indirect transition took place in participants' grocery shopping activity, shifting from mainly purchasing dairy products in the context of their original university to raw food materials and ingredients such as vegetables and meats in the context of XXX university. In both of the context, the participants had to interact with the local grocery stores and supermarkets to achieve their goal to buy food products. Therefore, the local grocery stores and supermarkets can be regarded as the **Mediating Tools** in participants food purchasing activity system. **Contradiction between subject and mediating tools:** All the participants reported that there was a significant distinction between the type of food products that were sold in supermarkets

at their original university and supermarkets at XXX university, which brought difficulties for them to recognize and distinguish different products. This contradiction can be further broken down into two segments: (1) the unfamiliarity with product information, and (2) the concern of product price.

5.2.1 The unfamiliarity with product information: use of translation tools in shopping

In the context of XXX city, the product information presented on food product packaging was mostly written in Swedish, as participants didn't have Swedish language education before their exchange studies, it was hard for them to get the correct product information out of the packaging. As a consequence, when participants went for shopping in the first several times, they had to spent more time at the supermarket to figure out which products were their most desired ones -- for example, Ms. E stated: "*Here* [refers to the context of XXX university], *there are many variants of one product for sale, many different variants of rice and milk. This is confusing and let me buy the wrong products.*" **Solution for addressing the contradiction:** To solve the contradiction, participants developed a new goal which was to understand the information of food product that were sold in local supermarket, this new goal was partly fulfilled through using Google Translation application on mobile phones as the new mediating tools to translate the key information on product packaging, and then made decision based on the translation results, for example, Mr. R stated: "*They* [refer to the local supermarket] *have many kinds of sausages... So, I still have to take a picture to translate, because otherwise I don't know what to choose*", and Ms. H stated: *"If the google translation is not good I don't buy it"*. However, in some cases, some pieces of key information that participants looked for were still missing – for example: "*With lactose free milk, it is not clear from the packaging what it is, even though I use google translate for all the names*" (Ms. E).

5.2.2 The concern of product price: reduce expenses with affordable or on sale products

The quality of food product was the most important factor that participants considered when they went shopping in the context of their original university. However, in the context of XXX university, the concern of product quality came after the concern of product price -- *"I look mostly at the price and a little bit to taste in Sweden. In Taiwan, I would only consider freshness and quality for fish and vegetables, and only price for rice"* (Ms. S). There are two reasons behind this transition: the high price of food products and participants' trust of the food quality at the local supermarkets in the context of XXX university. For example: *"I first check price and then the brand. In Malaysia, I would never buy store brand, but here in Sweden they are fine*" (Mr. J), *"In China I look at the quality of (cabbage) products on the market, here in Sweden all cabbage is the same, so I don't look at it"* (Mr. R). **Solutions for addressing the contradiction:** As a result, participants formed the new goal to reduce the food shopping expenses, most of the participants purchased food material and ingredients that were affordable or on sale, and afterwards they would decide what they would cook out of it. For example: *"I buy something if it is cheap and if I think I will like it, afterwards, I will decide what I will make with it."* (Ms. K), *"I try new things when it is on discount. When I get home, I look on the Internet what I can cook with it."* (Mr. R). Furthermore, as motioned in the previous section, the concern of price was one of the factors that led participants to buy ready-made microwave and frozen food. And we found in some cases, participants went to local supermarkets only for checking what products were on sale, for example, as Ms. K stated: *"I have a large stock so I don't go* [to local supermarket] *often. If I go, I go for fun, to check what is on discount."*

6 Discussion and reflection

So far, although we have applied an activity theoretical lens with the concept of objects and goals, mediating tools, contradictions, and solutions in the analysis of the empirical results, the results still seem to be scattered, a holistic picture of how participants transit their food consumption activity through context change is needed. We found the transition process of participants' food consumption activity system is in line with the conceptual model proposed by Blackler et al (1999), who describe the development of an activity system as a cyclic process that includes different stages, from the recognition of contradictions within pre-existing activity systems, to the search for new approaches for achieving the object of the activity, to the development of possible solutions, and to the consolidation of revised activity patterns. Inspired by their conceptual model, we have adopted the similar developmental structure to depict the process and outcomes that context change has in influencing participants' food consumption activities. As illustrated in figure 2 below, the activity layer (meso level) and action layer (micro level) within the hierarchical structure are represented on the vertical axis, a macro level is added to represent the general contextual differences in the activity system. The disturbances and contradictions that participants have experienced are represented on the horizontal axis. Note that the development stages on horizontal axis should be interpreted as discontinuous and uneven, however, for illustration purposes, the stages are presented as leaner and are evenly distributed on the horizontal axis.

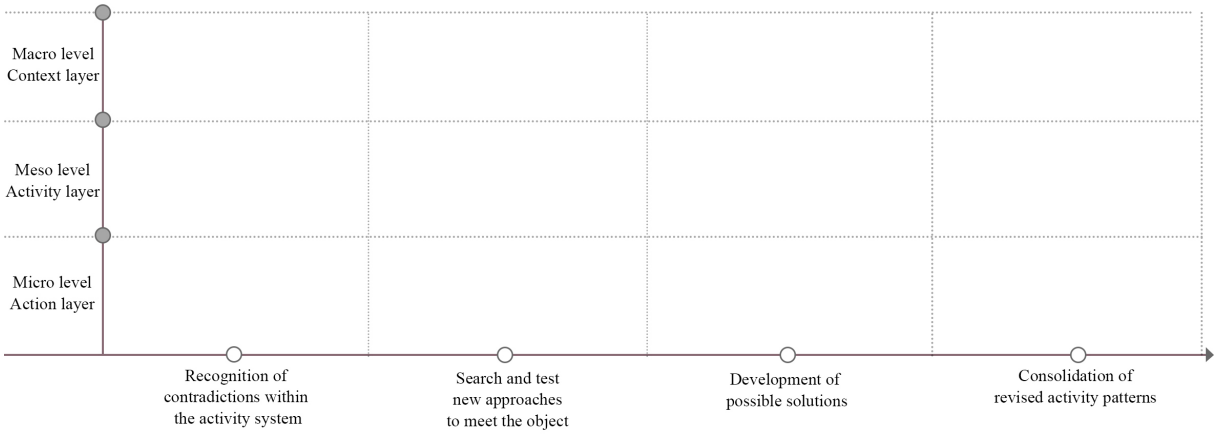

Figure 2. The activity development model used in this study.

Putting the results on the activity development analytical model presented above, in activity layer, the way participants carried out their food consumption activity in XXX university was completely different from what they did in their original university. In general, their food consumption activity system shifted from ordering food at student canteens and restaurants in the old context to purchasing food ingredients and cooking their own meals in the new context. The motivation behind this transition was mainly due to the food price differences between the two context, the cost of having a meal at student canteens and restaurants in XXX university was much higher compared with their original university *(see contradiction (i) in figure 3 below)*, therefore, in order to retain the object of having affordable meals through the context change, participants had to adopt cooking as a new way of carrying out their food consumption activity. Moving down to the action layer of the activity system, we can find that in the transition process when participants underwent context change, their food consumption activity system didn't leapfrog from the old context to the new context without progressing through any stages in between. To be more specific, several disturbances took place in the transition process, these disturbances were triggered by the contradictions that emerged in the interaction between subjects and mediating tools, and between mediating tools and objects, which includes: (1) the lack of cooking knowledge and experience *(see contradiction (ii))*, (2) the time concern for

cooking *(see contradiction (iii))*, (3) the unfamiliarity with product information *(see contradiction (iv))*, (4) the concern of product price *(see contradiction (v))*. Those contradictions further led to the emergence of new goals within participants' food consumption activity system, and those goals were developed as new actions which includes: (1) the use of tutorials and recipes in cooking process, (2) the improvisation and shift to recipe-less cooking, (3) the search of other alternatives to cooking, (4) the use of translation tools in shopping process, and (5) the tendency to purchase affordable or on sale products.

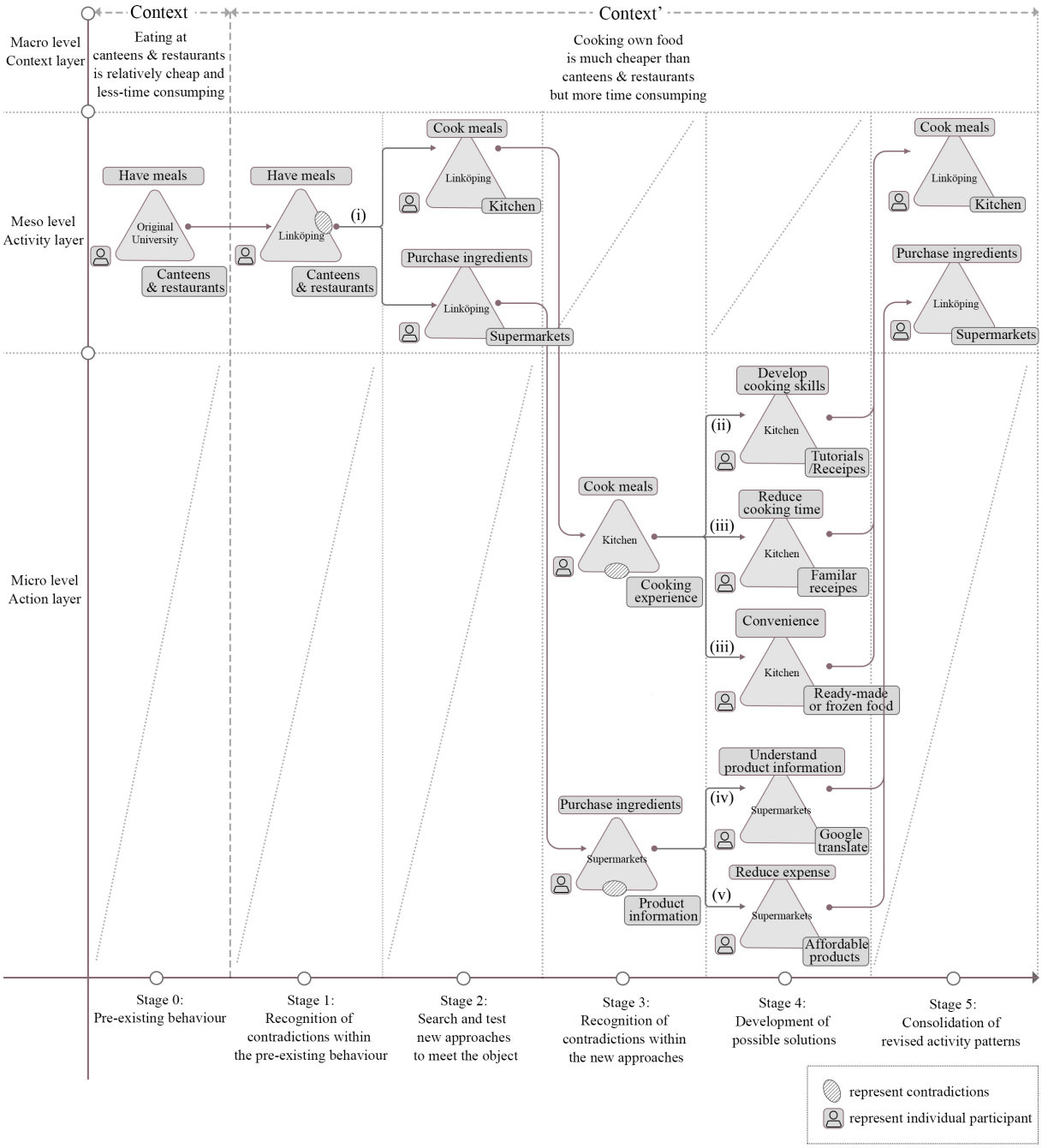

Figure3. The transition process of participants' food consumption activity system through context change

Reflecting on the above analytical model, a holistic view of the outcomes that context change has in influencing participants' food consumption patterns is analyzed in relation to the single triangle activity model and hierarchical structure with a focus on activity and action layer. The basic idea is that the model can enable researchers to zoom in and zoom out to find the most suitable layer for analysis. Apart from presenting the outcomes that context change has caused,

the development principles of activity theory is also applied in this study to help researchers to develop an in-depth understanding about the process of how and why participants' activity system was transformed through context change. By integrating those two analytical perspectives in one model, a clear picture of context change and its' influences on targeted activity system can be illustrated. In other words, the questions such as what disturbances within the activity systems are triggered by the context change, what approaches are developed by the subjects, what contradictions take place within the new approaches, and how the subject solve the contradictions, can be systematically described and analyzed.

7 Conclusion and future work

In this paper, we have presented an AT based analytical approach, which is used to describe and analyze the process and outcomes that context change has in influencing people's daily doings. Inspired by existing AT methodological approaches, this approach breaks down the activity system into three levels, the general context level (macro level), the activity layer (meso level), and the action layer (micro level). Then we tested the approach in a case study to understand how context change caused by studying aboard may influence South-East Asian exchange students' food consumption activities. After that, we further developed an activity analytical model based on the analysis of the preliminary results, as discussed in the preceding section, we believe this model can provide both holistic and in-depth view for design researchers to support people in adopting and retaining sustainable lifestyle through context change.

For the future work of this ongoing research, building on the preliminary findings of this paper, the activity theoretical framework and ethnographic informed research methods applied in this study will be further tested and revised in other case studies. Apart from being used as an analytical tool, AT is also used in various design studies as a methodological approach that enables design researchers to explore potential design solutions for solving problems in people's everyday life activities. However, it can at times be difficult for design researchers and practitioners to apply AT in their design process. For example, questions like how to effectively transform insights from AT based analysis to idea generation and design phase, how to inform and evaluate design explorations by using AT based design approach, what are the strengths and limitations of using AT as a tool in design, need to be addressed. Therefore, the focus of the following case studies will be gradually shifted from applying the activity theoretical framework to understand context change phenomenon to introducing and evaluating design interventions which targeted at guiding behaviour retention through context change.

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