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# USER INNOVATION TOOLKITS IN PRODUCT DEVELOPMENT: QUALITATIVE STUDY IN SHOPPING CENTER DESIGN

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## ABSTRACT
Understanding user needs is essential in product development. Transferring the user needs from the user to the manufacturer can be, however, difficult. In other words, the need-related information is costly to transfer, i.e. "sticky". So called user innovation toolkits are designed to help this sticky information transfer more easily. Available solution space and a module library are key elements of a toolkit. In this study, a qualitative experiment on three different toolkits is carried out in the application area of shopping center design. The roles of the size of available solution space and the content of the module library are examined. We learn that contrary to assumptions, opening up either the solution space or the module library only, will not lead users to communicate their true individual needs. Only when both elements are fully opened, the sticky need-related information will transfer.

*Keywords: user innovation, user innovation toolkits, product design and development*

## 1 INTRODUCTION
Traditionally, users are seen as a source of need-related information, which the suppliers then turn into a responsive product. In a generic concept development process, customer need identification provides engineers data for establishing target specifications and generating product concepts. The data from customers (that are not necessarily users of the product under development) is interpreted and organized, and the relative importance of the needs (according to the engineers, not the users) is established. [1] Monopolizing the product development in the supplier-side means costly and often time-consuming iterations between supplier and customer, in order to reach a solution that satisfies both ends. If users are seen as innovators, i.e. sources of possible solutions and not only the source of information, the supplier can skip the costly cycle of multiple iterations. In order to do that, the supplier must provide the user with tools to design and develop the application-specific part of a product on their own. [2, 3] In this project we perform a study on a user innovation toolkit designed to help a user communicate his wishes and desires on shopping centers.
During the last decade the shopping centers have increased the variety of the services from pure shopping to different kind of amusements and even public services. The size of the shopping centers has been increasing too. Part of the shopping center management is nowadays also event management. The similar trend takes place also in Finland, however the market volume sets some limitations for the development scale. This toolkit study was designed in order to learn about Finnish consumers' attitudes towards including other than shopping-related elements in shopping centers.
Prototyping is an essential part of a product design and development process. Prototypes can be virtual or physical, and they can be simple mock-ups or refined working prototypes. [1] In user interface design, paper mock-ups are commonly used instead of running computer systems, as mock-ups are cheaper and quicker but enough for evaluating the functions in question [4, 5]. The learning-by-doing cycles of prototyping help the designer test and evaluate his design. The idea of a user innovation toolkit is to provide users with an equal possibility to "prototype" their ideas. The same way as prototypes can be simple mock-ups, user innovation toolkits do not have to be complicated. In this study, the user innovation toolkit is created in the form of a "puzzle" containing 36–44 building blocks. The toolkits we used are presented in detail in the methodology chapter.
The purpose of this study is to investigate how altering the *solution space* and the *module library* of a user innovation toolkit affect the outcome. The general assumption is that the solution space must be

limited, in order to prevent users from developing a solution that the manufacture cannot manufacture. [3, 6] On the other hand, it is assumed that users make use of the offered solution space and that toolkits that offer a large solution space allow substantial innovations [7]. The role of a module library is to provide users with existing modules, so that they do not need to start designing from scratch. [3, 6] The purpose here is to learn how users behave when offered an unlimited solution space and/or a module library consisting of both typical shopping-related modules and special modules.
We used 3 different versions of the toolkit and tested each on 5 women in age group 30–40. The first toolkit had a typical module library but unlimited solution space. In the second toolkit, the solution space was limited, but the user had access to an extended module library. The third toolkit provided the user with both unlimited solution space and an extended module library.
In chapter two, the theoretical framework for user innovation toolkits and shopping centers is presented. The methodology is explained in chapter three, and the results are discussed in chapter four. Finally the conclusions are summed up in the last chapter.

## 2 BACKGROUND

### 2.1 User innovation toolkits

Most manufacturers and suppliers agree that a key element of designing successful products is to understand user needs. Users are specialists, when it comes to using the product. They posses information on what they want to do with the product, how, where and when, whereas manufacturers know a lot about manufacturing methods and technologies critical for the product to be able to function. The supplier-side spends significant amount of resources trying to understand user needs. Multiple methods for exploring the user needs exist varying from market research methodology to ethnography, and everything in between. Hence, transferring the need-related information from the user-side to the manufacturer requires time and money.
When information is costly to transfer from a locus to another, it is called “sticky”. The stickiness occurs, when acquiring the information requires certain tools, education, or complementary information. Cohen and Levinthal [8] call this lack of “absorptive capacity”. The stickiness of a given unit of information in a given instance is defined as the incremental expenditure required to transfer it to a specified locus in a form useable by a given information seeker. When this cost is low, information stickiness is low; when it is high, stickiness is high. [9]
Successful product development requires transferring the need-related information of the user and the solution-related information of the manufacturer to a single locus. If transferring the need-related information from the user to the manufacturer is costly, why not try to do the opposite. Thomke and von Hippel [2] and von Hippel and Katz [3] propose so called *toolkits for user innovation*. In their approach, users are seen as sources of possible solutions, not only need-related information. But in order to help users carry out the innovation task, they need to be equipped with toolkits containing relevant solution-related information.
The user innovation toolkit divides the design task into subtasks. In principle, the need-related design tasks are assigned to users and solution-related tasks are assigned to manufacturers. For example, the travel industry has invested in “unsticking” its solution-related information – airline schedules, hotel reservations, car rentals – by providing the users with possibilities to create their own solutions online. As a rule of thumb: the higher the heterogeneity of user needs faced by a manufacturer, the higher its incentive to invest in unsticking problem-related information relevant to user problem solvers and transfer that information to users in the form of a toolkit for user innovation [3, 10].
A well-designed toolkit should enable the user to create solutions through an *iterative trial and error process*. Possible *solution space* should be narrowed down to such solutions that are possible for the manufacturer to produce. The toolkit should be *“user friendly”* in the sense that users do not need to engage in much additional training to use them. Users should be able to operate the toolkit with their customary design language and skills. There should be a *module library* included in the toolkit, consisting of commonly used modules that the user can incorporate into his or her custom design. This will prevent the user from having to ”re-invent the wheel”, and allow the user to focus his or her design efforts on the truly unique elements of that design. Most importantly, the toolkit must enable fluent communication between the user and the manufacturer, i.e. *“speak the same language”*. This means ensuring that products and services designed by users with the help of the toolkit will be

producible on manufacturer production equipment without requiring revisions by manufacturer-based engineers. [3, 6]
First toolkits emerged in a primitive form in the 1980s in the high-tech field of custom integrated circuit design and manufacturing. Not understanding user needs completely, while the products became more and more complex, led the cost of the design and development work reach unbearably high levels. Significant amount of the costs went to correction work of mal-designed products. The introduction of the toolkits approach was able to cut down the development time by two-thirds or more. [10] Nestlé developed user innovation toolkits in order to enable chefs of Mexican sauces to create customized recipes that can easily be transferred back and reproduced in Nestlé's factories. By using the toolkit, the time of custom food development was cut down from 26 weeks to 3 weeks. [6] BBA (now International Flavors and Fragrances) is a producer of specialty flavors that are created to holster and enhance the taste of nearly all processed foods. Developing flavors that suit the customers was a long and complicated process, during which samples were shipped back and forth several times. To cut down the development time, BBA developed an Internet-based user innovation tool containing a large database of flavor profiles. Customers can now select and manipulate information on a computer screen and send new designs directly to an automated machine that will manufacture a sample within minutes. After tasting the sample, the customer can make any adjustments that are needed. [2]

### 2.2 Shopping centers

A shopping center consists of a commercial building in which retail outlets and services open inwards onto a walkway or concourse. The gross leasable area is generally at least 5 000 m2 and shopping centers have at least 10 retail outlets. There must be one or more anchor tenants and a number of key traders as well as other retailers and services. The services may be either commercial or public, but a single trader may not exceed 50 % of the total commercial space. This means that the shopping center is a collection of different businesses within the same space, and they have joint management and marketing. In the shopping center there cannot be companies, which commercial space is strongly dominating the area of the real estate. [11]

## 3 METHODOLOGY

### 3.1 Pilot study

We first created a toolkit in the form of a puzzle consisting of 36 building blocks. Each block represents a particular type of store traditionally found in a shopping center: shoe store, department store, clothing store, bookstore, café, etc. There were 28 ready labeled blocks and 8 blank blocks that could be labeled as anything the user wanted. The number of certain store types in the puzzle was chosen to represent its typical share of stores in standard shopping centers. Out of the 28 ready labeled blocks, there were 4 shoe stores, 4 clothing stores, 2 cafés, and 2 restaurants, for example. Including blank blocks in the toolkit means that the user had *unlimited solution space*, as he was able to label the blank blocks as he wished.
The blocks were made out of polystyrene foam and their size was approximately 10 cm x 6 cm x 3 cm. Each block was covered with colored paper. Reason for coloring the blocks was to make each group of blocks (such as cafés and restaurants) easier to recognize, both for the user and the researcher. Use of physical blocks instead of pieces of cardboard, for example, was chosen in order to make it more concrete to the user to construct a 3-dimensional shopping center. Users were then invited to build "the shopping center of their dreams" with the help of the puzzle (see Figure 1) Users were also provided with Post-It-notes that they could use for labeling the blank blocks or if they wanted to add a brand name on a certain block. The pilot study consisted of 9 users, who first created their dream shopping center with the help of the toolkit. Then they had a chance to explain their solution.


*Figure 1 Shopping center designed by a user.*

In the pilot study, we thought that when users are given free rein in designing their shopping centers (unlimited solution space), they would come up with all kinds of imaginative solutions. Ordinarily, the solution space is kept limited, in order to limit possible solutions to those that the manufacturer can produce, but in our case, we wanted the user to create whatever solution that correlates with their own needs and wishes. Once we had analyzed the 9 shopping center models created in the pilot study, it was obvious that the method must be further developed. Although the users managed to design a shopping center, the designs were very conventional. The lay-outs and the shops chosen were typical to any regular Finnish shopping center. None of the users had wished for anything special in their designs – all elements were purely shopping-related. In the interview that followed the puzzle exercise, we learned that the users, although advised to design the shopping center for themselves, had designed shopping centers they thought would be commonly accepted and good for everybody. In other words, offering unlimited solution space was not enough to enable the users to communicate their needs and wishes.

### 3.2 Improved study

As the pilot study showed us that providing unlimited solution space does not unleash the creativity of the users, we decided to add another variable to the toolkit: We created three toolkits where the solution space and the content of the module library varied (see Table 1). The idea was to see how altering these two variables would affect the outcome.

*Table 1 Toolkits and their variables*

| | **Solution space** | **Module library** |
|---|---|---|
| **Toolkit 1** | unlimited | typical |
| **Toolkit 2** | limited | extended |
| **Toolkit 3** | unlimited | extended |

Toolkit 1 consisted of 28 typical store blocks (the same as in the pilot study) and 8 blank blocks that the user could label freely, totaling in 36 blocks. This means that the user could work with a *typical module library*, but had *unlimited solution space*. In the Toolkit 2, the user did not have a choice of labeling any blank blocks, but in addition to the 28 typical blocks, he was provided with 8 special blocks. These were blocks rarely found in Nordic shopping centers: water amusement park, spa, amusement park, children's playground, fountain, bowling alley, downhill skiing center, and indoor sports hall. Now the solution space was *limited*, but the user had access to an *extended module library*. Toolkit 3 was created by combining the other two toolkits and thus consisting of 28 basic blocks, 8

special blocks and 8 blank blocks, the total number of blocks then being 44. It provided the user with both *unlimited solution space* and an *extended module library*. (See Figure 2)

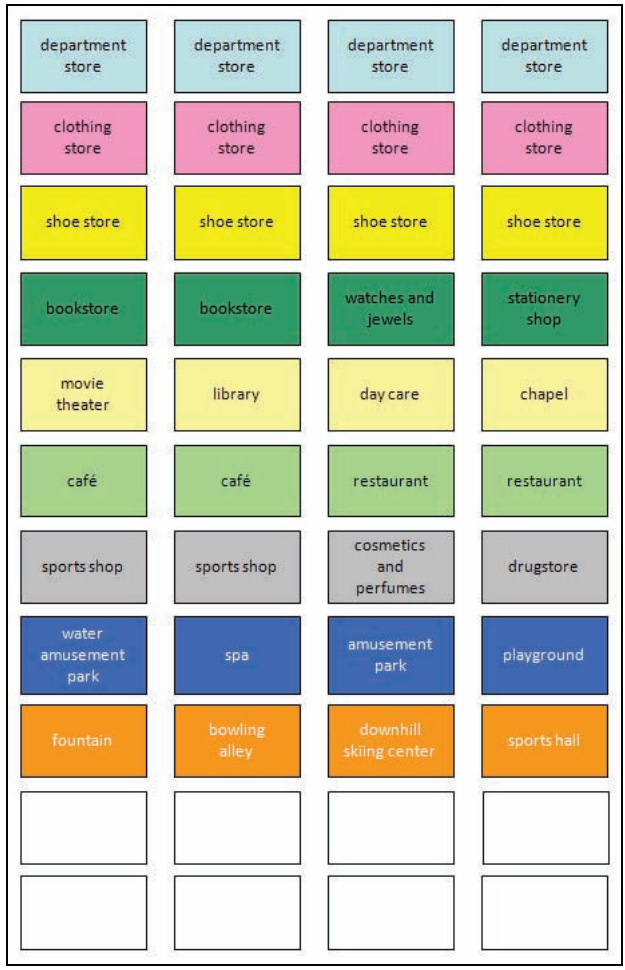


*Figure 2 Toolkit 3 with extended module library and unlimited solution space.*

Altogether fifteen 30–40-year-old women were targeted in the study, i.e. each toolkit was used by five women. Reason for choosing this age group was that we would most likely get both single women and women living in a relationship and with children. All the users that participated in our study were living or working in Helsinki area and they were all Finnish natives. The study was carried out during one week in June 2008. During this period there was a lot of public discussion about big shopping centers in the suburban and rural areas. Later after the study, in September 2008, Finland's first shopping center with large spa areas and casino was opened.

Each user was first introduced to the method and given a brief written assignment on what to do, and they were also provided with a definition of a shopping center. Users had approximately 10–15 minutes to complete the task – their custom solution. After designing their ideal shopping center, users were shortly interviewed, and they were asked to fill out a background information form. Each custom shopping center was documented with the help of a digital camera and by drawing.

# 4 RESULTS

## 4.1 Pilot study

User innovation toolkits are used, when we want to find out something new. If we want to find new custom design solutions, we cannot use traditional methods like interviewing. The pilot study of 9 users, however, showed that the pilot toolkit is not able to give away anything else than what could have been found by using traditional methods. No user really came up with anything new. 8 out of the 9 participants utilized the blank blocks, but only one of them labeled the blank block in a non-typical way. Other users used the blank blocks only to create more typical stores (clothing, decoration, goldsmith's, etc.), but this one user labeled the blank block as a bowling alley. In several shopping centers outside the Nordic countries there are elements like amusement parks, spas or indoor ski resorts, but none of the pilot study users came up with anything similar.

The shopping center layouts were very traditional, most of them copies of users' favorite existing shopping centers. Only one user wanted 4 floors, two users 2 floors but the rest wished only for one floor. The only real finding of the pilot study is that it showed some indication of most users preferring to loosely group similar stores: all clothing stores close to each other, for example.

The overall result of the pilot study was that in search for real custom design solutions, we did not get any. We would have ended up with the same results by only interviewing the users. This is the main reason we wanted to develop the toolkit exercise into 3 different toolkits.

## 4.2 Improved study

### *Toolkit 1*

In the test set up 1 the users had both basic blocks and blank blocks (totaling in 36 blocks). The size of the shopping centers the users made varied between 20 and 30 blocks. Two out of five users used blank blocks in their designs. One of them used all 8 blank blocks. All the designs resembled ordinary Finnish shopping centers with clothing stores, shoe stores, department stores, etc. The shopping centers had 2 to 4 floors. In every design the users used all four cafés and restaurants.

Although two of the users did invent new shops or services using the blank blocks, their choices were conventional and did not resemble any of the special blocks offered in the extended module libraries of Toolkits 2 and 3.

### *Toolkit 2*

In this set up the users had basic blocks and 8 special blocks, but no blank blocks (totaling in 36 blocks). The shopping center designs in this set up had 2 to 7 floors and the size of the centers varied between 15 and 36 blocks. One of the users used all the blocks she had in use, but the others managed to design their ideal shopping center with 15–25 blocks. Also in this set up users wanted many cafes and restaurants in their designs. (Only one user did not use all four cafes and restaurants.) The use of special blocks varied between 1 and 8, but all users used some or one of them in their designs. Four of the users used the fountain block and only one used all of the available special blocks.

### *Toolkit 3*

In version 3 there were basic blocks, special blocks, and blank blocks, totaling in 44 blocks. Although there were more blocks available than in the other toolkits, the users designed shopping centers of roughly the same size as in two previous set ups. The size varied between 16 and 33 blocks in total. The users made the centers with 1 to 3 floors. A distinctive feature of these designs was that they could be considered quite personal for the first time in the whole study. Unlike in the case of the pilot toolkit and toolkits 1 and 2, users spoke about *"my shopping center"*.

The designs differed from each other remarkably. For example, one of the shopping centers (user no. 4) was made for a mother who leaves her children in childcare, which enables her to do the shopping very efficiently and independently. In that design there were no special shops or entertainment facilities but a lot of clothing and shoe stores as well as a bag store, interior stores, and a gift shop. In another design (user no. 5) there were only one clothing store and one shoe store. The user said after using the toolkit that one big department store covers all her needs, if it is good enough. *"All I need can be found from Stockmann"* (Stockmann is a Finnish department store.)

4 out of 5 users used blank blocks. 3 out of those 4 users generated shops or services that resembled the special blocks in the extended module library, unlike in the case of Toolkit 1, where an unlimited solution space (i.e. blank blocks) was also available.

### 4.3 General notions

Regardless of different sets of blocks, results concerning the layout of the shopping center were quite similar. In the end there were only two layout alternatives, end even these two resembled each other a great deal. One was a square shaped plan where there was a plaza in the middle and all the shops were placed around the open area. In the second version of the popular layout the basic form as also square shaped but there was one major corridor or gallery instead of a plaza. The corridor was surrounded with the shops and services. The main difference between these two layouts was that in the gallery layouts there were clear direction and logical place for main entrance whereas in the plaza-layouts there were several possibilities for main entrance. In the gallery-layouts the most important or the biggest stores (department stores) were placed in the other end of the corridor. Majority of the users made their ideal shopping centers only two or three floors high, but there was also one design where the user wanted seven floors. The size of the shopping centers the users designed had no relation to the toolkit in use. Majority of the designs consisted of about 20 stores. Every design had at least one department store, two cafes or restaurants, and several clothing and shoe stores.

### 4.4 Puzzle as a toolkit

The toolkit was easy and pleasant to use. At first the users were a little bit afraid of how to manage the toolkit due to the novelty of the situation. None of them had ever used this kind of toolkit, but in the end all of them enjoyed playing with the puzzle. 10–15 minutes was enough time for the users to come up with their design. All users felt that using the toolkit was easy and that they had no trouble communicating their wants through it.

## 5 DISCUSSION AND CONCLUSIONS

The toolkit was created in order to learn about shopping center preferences of Finnish consumers. As non-shopping-related elements in Finnish shopping centers are rare, the purpose was to learn if and what non-shopping-related elements Finns would like to include in the shopping center of their dreams. We altered two elements in the toolkit: solution space and module library. The idea of limiting the solution space is to prevent users from creating solutions that the manufacturer is not able to realize. The role of module library is to provide users with ready-made elements that they can user in their design. It was assumed that unlimited solution space would lead users to design solutions beyond the existing ones. It was also assumed that offering a module library leads users automatically to use the available modules in their design.

In Toolkit 1 the solution space was unlimited, which means that users were provided with blank blocks that they could make into any imaginable element in their design. The module library of Toolkit 1 was “typical”, i.e. only shopping-related blocks that are generally found in Finnish shopping centers were offered. Only 2 out of 5 users ended up using the blank blocks, but even though the solution space was unlimited and they could have designed whatever elements, they used this opportunity only for adding very typical shopping-related elements in their design.

In Toolkit 2 solution space was limited, i.e. no blank blocks were offered, but on the other hand, the module library was extended and comprised of non-shopping-related elements that are usually not found in Finnish shopping centers. In the group using Toolkit 2 there was one user who used up all the available blocks. This behavior was very different from all other 23 users that we had in the study (9 in the pilot study and 14 in the improved study), therefore we decided to exclude this design. What comes to the remaining 4 users who designed their solution with Toolkit 2, they used few (1–4) non-shopping-related blocks from the extended library, and chose mostly blocks that are not very radical, such as a fountain.

In the case of both Toolkit 1 and Toolkit 2, users did not really fling themselves into designing their true dream shopping center. On the contrary, when describing their design, they used phrases like *“there must be many things in order to please the whole family”*, *“the whole family will like this shopping center”*, or *“most people would like this”*. A childless woman said *“in a well-designed shopping center, there must be daycare for children”*. Instead of designing for themselves, the users designed solutions that they thought would be acceptable by most of the customers. They did not

speak about themselves as individuals but explained their solutions in a manner they thought would appeal collectively. Even though in Toolkit 1 they could have exploited the unlimited solution space and make the blank blocks into any imaginable elements, they ended up repeating shopping-related elements of existing shopping centers. In some cases it was visible from the floor plans that the users in fact copied their favorite existing shopping centers. In Toolkit 2 users were provided with an extended module library that comprised of many non-shopping-related elements, but we saw the same effect – the users copied existing solutions and included hardly any non-shopping-related elements in their design.

Toolkit 3 was a combination of Toolkits 1 and 2 and provided the user with both unlimited solution space (i.e. blank blocks) and an extended module library (i.e. shopping-related and non-shopping-related blocks). The users of Toolkit 3 utilized the available non-shopping-related blocks in a moderate manner, following the behavior of the users of Toolkit 2. But when the use of blank blocks in the case of Toolkit 1 and Toolkit 3 is compared, two significant differences can be seen: First, the number of users who utilized blank blocks in their design doubled (2 out of 5 in Toolkit 1, 4 out of 5 in Toolkit 3). Second, the users of Toolkit 1 used blank blocks only to add more typical shopping-related elements to their design, but the users of Toolkit 3 took advantage of the unlimited solution space and made the blank blocks into non-shopping related elements that are currently not found in Finnish shopping centers. When the users of Toolkit 3 described their design, they spoke in a much more personal way than the users of Toolkits 1 and 2. For the first time, we heard users talk about *"my shopping center"*. They used phrases like *"when I need to…"* and *"for me it's important that…"*

This experiment on three different toolkits shows that limiting solution space is not necessarily as important as stated in the literature [3, 6, 7]. Offering the users unlimited solution space does not automatically lead users to exploit it, nor does it mean that if they do, they will come up with substantial innovations. This was seen in the case of Toolkit 1. The role of module library is also not as straightforward as assumed. Even though users were offered an extended module library (Toolkits 2 and 3), not many non-shopping-related blocks ended up in their designs. In the case of Toolkit 3 we can see, however, that even if the extended module library failed to enrich the users' designs as such, the extended module library worked as inspiration when users exploited the unlimited solution space.

Based on the analysis of this toolkit experiment, we claim that opening up the solution space will not automatically provoke users to "get carried away" with their designs. If the users are not provided with inspiration for possible uses of the unlimited solution space, they will either not exploit the space at all, or if they do, they will only use the space to duplicate the offered modules. In other words, if only typical elements are available in the module library, the solution space does not need to be limited in fear of users designing solutions that cannot be realized by the manufacturer. We saw that the sticky, need-related information was not transferred in case of Toolkits 1 and 2, where either unlimited solution space or an extended module library was offered. Only Toolkit 3 was able to "unstick" user needs and make them visible through the toolkit. We claim that in order to ensure that the users do in fact communicate their own individual needs (in contrast to trying to please everybody), both solution space and the module library must be fully opened up. It is of course possible that some solutions will then be difficult or impossible for the manufacturer to realize, but this we see as the price for making sure that the individual needs are made visible.

This study was the first attempt to understand the roles of solution space and module library in a user innovation toolkit. Our pilot study showed that the size of the solution space and the content of the module library do not necessarily behave as stated in the literature. This led us to create the experiment presented here. We chose qualitative methods in order to learn how altering these elements of the toolkit affect users' work. Following the nature of qualitative research, the number of participants was low, as we tried through the chosen methods come to terms with the meaning, not the frequency, of the phenomenon. In retrospect, we could have enriched the data with more thorough interviews, although the effect of altering the elements of the toolkit could be made visible with the existing data only. The next step in this research is to design a quantitative study based on the findings of the qualitative one.

When it comes to the application area of this study – shopping centers – we interpret the results of Toolkit 3 so that the developed solutions show a stripped-down version of what the user really wants. Users' designs show the minimum amount of stores and other elements that they want in the shopping center of their dreams. Of course, there can be many other less important stores in the shopping center, too. The number of elements found in users' designs in this study varied between 15 and 36, the

average number of stores in Finnish shopping centers being more than 50 [11]. This finding should be considered further when designing large shopping centers: how the human scale and human adaption can be used in an effective way in the design of the shopping center. This perspective is a driver for used and experienced shopping center environment.

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