Online Crowdcontribution for the Brief

“Capturing user experiences”
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Foreword

Learn from the past and try to improve... That is one of COD's drivers, we strongly believe in durable innovation. Through the method of Open Source we enable our partners to join in our network, knowledge and experience. In this way we believe that COD will be able to reach the best possible output for a better whole.

Working together with graduates and helping them to do innovative and useful research in our working field is second nature of COD. We are pleased that graduate Amber Huizinga joins our team with her creative and renewing case study. We think that in the traditional 'old fashioned' real estate industry her online involvement of users might bring spectacular innovation. We hope to explore these new methods and the renewed output together with Amber in the near future.

Ton van Oosten
Partner at COD
ABSTRACT
Abstract - English

INTRODUCTION
My belief is that new technologies combined with innovative thinking, can be deployed for providing innovation in the real-estate sector. That is the main motivation that lies as a fundament under this whole research.

The efficiency that new technologies can produce, for example an open source process, has inspired the definition of this research’s problem, scope and especially solution domain. The following figures show the changed conditions in real-estate development since the crisis.

![Figure 1.1: Previous state of affairs in development](image1)

![Figure 1.2: Current state of affairs in development](image2)

The figures show that we live in a user focused market today. The increased role of the tenant in real-estate development is a fundament for this research.

The problem: Because of current process changes in office building development projects, there is a demand for information about the needs and preferences of office users. Current practice does supply this information, but the processes for capturing this office user’s knowledge is highly time-consuming, costly, non flexible and not up to date.

Two existing methods in current practice are:
Method one has the goal to obtain personal and culture specific data that can only be used in the relevant project. Here, direct users of the office building are involved:

![Figure 1.3: schematic illustration how direct users are informed for their needs at 4Building](image3)

Method two has the goal to obtain generic data that can be used in every office building project. Here indirect users, informed in target groups are involved:

![Figure 1.4: schematic illustration how indirect users are informed at Twynstra Gudde](image4)
The goal of this research is to combine these two strengths into one method that will be less time intensive and transparently obtain up-to-date preferences and needs of office users for future building projects that can be processed in the brief.

When preferences and needs of office users are categorized per function, per sector where they work in, per age-category and per gender, this can give transparent information for every office building project.

This data will be required online because using the internet seems to be efficient and the possibilities for reaching people are comprehensive.

Office users must be able to create and think beyond existing and common work environments, but their creations must be realistic and useful as input for the brief as well. Thus in whatever form this obtaining of generic data about office users will be poured, it needs the appropriate constraints for creating a free task for users that at the same time delivers realistic and useful information for the brief. Because of the possibility for distribution through the internet, this form can be defined as a digital tool. From now on in this thesis referred to as The Tool.

Research Questions

Main Questions:
In what form can online crowd-contribution deliver generic data about the preferences of the office user in the Brief of an office project?

Sub-Questions:
1. On what aspects of the brief are preferences of office users valuable?
   A. On what aspects are office user preferences expected to be valuable for the brief?
   B. What aspects of the brief do office users want to and can have influence on?

2. How can you recognize these preferences by means of a digital Tool?

3. How must the operation and appearance of The Tool be for making it usable and desirable?

The aim of this research is to design a method that enables capturing preferences and needs of office users that are possible to categorize and therefore become valuable as input for the brief of any office building.

The products of this research are a list with the sort of information that comes in The Dataset and the flowchart for The Tool that needs to be developed in order to gather this required information.

Relevance
The scientific relevance connects to studies where the user has a significant role in the design of products. This particular research looks for the connection between product design, where users have a greater role so far than in architecture, and the development of office buildings.

The practical relevance is explained following three current trends in the office environment that are The New Way of Working, Full Service Office Concepts and a digital office buildings database called kantoorplanner.nl. The fourth issue that explains the practical relevance is based on the existing information sources where briefs are currently based on.

RESEARCH METHODS
For all sub-questions a research method is determined. Finally for verification and validation of the results a fourth method is established.

<table>
<thead>
<tr>
<th>Aspects of the Brief (Sub 1)</th>
<th>Literature Interviews</th>
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<tbody>
<tr>
<td>Operation of The Tool (Sub 2&amp;3)</td>
<td>Literature Experiments (Protocol Analysis)</td>
</tr>
<tr>
<td>Validation of Results</td>
<td>Expert Meeting</td>
</tr>
</tbody>
</table>
Literature about Open Source, Open plan processes, crowdsourcing, user participation techniques and the brief. Interviews were conducted with experts in the fields of real-estate development, full service offices, user involvement in design processes and online digital tools. (Appendix P)

The experiments are divided in two clusters of ten tests per experiment and one experiment of two tests, all conducted according the research method of Protocol Analysis. In total there were 22 participants that were observed while using pilot tool one, two and four. Every experiment resulted in changes for The Tool and the intended data to obtain for The Dataset.

The expert meeting was conducted at the end as a final validation of the research results. The Tool was subject of discussion, but more important also the value of the data for The Dataset was discussed. Conclusions have been made for the final result of this research.

The scheme below shows the Research Steps in an abstract time planning.

**COMPONENTS OF THE BRIEF**
The following research question will be answered in this section:

1A: On what aspects are office user preferences expected to be valuable for the brief?

In theory several methods for writing a Brief are known, however for this research the Problem Seeking Method of Peña and Parshall (2001) is adopted to form a basis and a guideline for the research. Five steps are distinguished in the Problem Seeking Method:

A. Establish GOALS  
B. Collect and analyze FACTS  
C. Uncover and test CONCEPTS  
D. Determine NEEDS  
E. State the PROBLEM

Briefly, the five steps pose these questions:

**GOALS** – What does the client want to achieve, and Why?
FACTS – What do we know? What is given?
CONCEPTS – How does the client want to achieve the goals?
NEEDS – How much money and space? What level of quality?
PROBLEM – What are the significant conditions affecting the design of the building? What are the general directions the design should take?

The figure below shows the work-flow scheme of a current briefing process, based on the Problem Seeking Method and practice of the consultancy firms YNNO and 4Building.

The ‘Motherhood’ GOAL of the client where this research connects to is to create an optimal work environment for the office users of the new building.

Achieving this ‘motherhood’ goal depends on many factors, e.g. organizational culture, sector, function, age, gender etc. Those are the FACTS in a briefing process. When the facts are collected, they can serve as input to Uncover and test CONCEPTS.

The CONCEPTS where office users are expected to have a valuable input on are:
A. Density
B. Service Grouping
C. Activity Grouping
D. Relationships
E. Neighbors
F. Flexibility
G. Tolerance
H. Home Base

These are extracted from the 24 CONCEPTS that are described in the Problem Seeking Method.
To recap, it is expected that users produce a range of **CONCEPTS** that are possible answers to the **GOAL** of an optimal work environment for office users, depending on the collected **FACTS**.

The step in the Problem Seeking Method that is called **CONCEPTS** is used to extract **CONSTRAINTS** from. And in the **NEEDS** step, **REQUIREMENTS** are obtained. Therefore, in the sequel of this report, we speak of **CONSTRAINTS** and **REQUIREMENTS**.

<table>
<thead>
<tr>
<th>GOALS</th>
<th>Established by the brief advisor and direct office users</th>
</tr>
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<tbody>
<tr>
<td>FACTS</td>
<td>Collected by the brief advisor and direct office users</td>
</tr>
<tr>
<td>CONCEPTS</td>
<td>Uncovered and tested by the brief advisor and the crowd, 8 out of 24 concepts with help of the crowd.</td>
</tr>
<tr>
<td>NEEDS</td>
<td>Determined by the brief advisor and the crowd, measurements and area requirements with help of the crowd</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>Stated in the final brief by the brief advisor</td>
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**DEVELOPMENT OF THE TOOL**

The following research questions are answered in this section:

1. **What aspects of the brief do office users want to have influence on?**
2. **How must the operation and appearance of The Tool be for making it usable and desirable?**

The combination of theory and practice has developed the first Pilot tool. The following sources delivered input for this:
And The Tool that was tested in the first experiment on ten participants looked as follows:

The experiment, wherein ten participants are tested on the interaction with this tool, resulted in the following adjustments on the first generation tool.

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<tr>
<th>Deleted features / items</th>
<th>Kept (strong) features / items</th>
<th>Added features / items</th>
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<tbody>
<tr>
<td>Time-tags</td>
<td>All defined items</td>
<td>Pictures of the context</td>
</tr>
<tr>
<td>Hierarchy in the grid</td>
<td>The presence of undefined items</td>
<td>Walls placing (three options)</td>
</tr>
<tr>
<td>Role description of Office Manager</td>
<td></td>
<td>Interaction with computer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tags (Shared / Private &amp; Colleagues)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Simulation of situations</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Objects: Kitchenette &amp; fridge</td>
</tr>
</tbody>
</table>

The second generation tool had to be tested in an experiment with ten participants again. Pilot tool two looked as follows:
After the second experiment The Tool was adjusted into a third generation tool. The following adjustments are applied:

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<th>Kept (strong) features / items</th>
<th>Added features / items</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Undefined items</td>
<td>The option to drag created spaces as a whole over the floor-plan (replacement of human steering)</td>
</tr>
<tr>
<td>Defined items</td>
<td></td>
<td>The option to indicate what function one created space has and if that particular space has a second and possibly a third function (replacement of human steering)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A clear Roadmap that indicates certain steps that can be taken (replacement of human steering)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rotating, Moving and Transforming the objects is now possible with only using the mouse (not the keyboard). (replacement of human steering)</td>
</tr>
</tbody>
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The flowchart of the third generation tool can be found in appendix F. This flowchart was presented to the experts in the expert meeting. Discussion about the features of The Tool has resulted in the following adjustments:

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<th>Deleted features / items</th>
<th>Kept (strong) features / items</th>
<th>Added features / items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls</td>
<td>Undefined items</td>
<td>Start with activity circles</td>
</tr>
<tr>
<td>Colleague tags</td>
<td>Defined items</td>
<td>Description of context instead of pictures</td>
</tr>
</tbody>
</table>

At last, a final experiment was conducted with two participants for testing the usability of The Tool without human steering. Some last details were added in the screenshots of The Tool. The flowchart of the final tool is in Appendix L. This Tool forms a complete whole where office users are expected to easily interact with. The close observation in the experiments has step by step led to this last generation tool. Participants had fun to use it and the interaction with the digital tool (Human Computer Interaction) reached a level where the majority of participants can use The Tool without spending much time on the operation of The Tool itself. The output of The Tool can also deliver useful input for the brief.

**OUTPUT OF THE TOOL**

The following research question will be answered in this section:

2. How can you recognize these preferences by means of a Digital Tool?

Figure 5.1 shows a summary of the output levels that were expected at the start (upper oval), the output that is obtained in the experiments (middle oval) and the output that is realistic for office users to decide upon and output that is feasible to obtain with distributing The Tool through the internet (bottom oval). The step from the middle oval to the bottom oval is made with help of the discussions in the expert meeting.

The experiments have shown that Pilot-tool one and two (those were tested by participants with human steering) can be used as generative tools, provided that human steering is present.

The expected CONSTRAINTS that were determined at the start of the research are not all achieved. Office users can have a realistic and valuable input on five of the eight levels. Those are:

A. Density  
D. Relationships  
E. Neighbors  
F. Flexibility  
H. Home Base

The REQUIREMENTS that were determined at the start of the research are not achieved by means of the office users only. Another source, in this case the office typologies of Van Meel et al. (2010) that serve as input for the PACT-tool, is needed to define exact requirements. The following diagram shows how the Output data of The Tool that is established by office users is translated into the Typologies of Van Meel et al. (2010) and subsequently inserted in the PACT-tool of Center for People and Buildings, which finally provides exact requirements for the brief.
The earlier showed figure in the Components of the brief section is now adapted into the following figure:

The PACT-tool is still dotted, because one of the limitations of this research was that the PACT-tool could not be afforded and thus the exact operation could not be investigated.

**BRIEFING WITH THE CROWD**

In this lae eerst section the final answer on the main question is given, discussed from the process-viewpoint (briefing) and the product-viewpoint (the brief).

*In what form can online crowd-contribution deliver generic data about the preferences of the office user in the brief of an office project?*

**Process**

There are two approaches known from literature how the process of briefing goes. The first method describes a fully completed brief before starting the design process:
The second method describes a continuous process between the brief and the design:

![Diagram showing continuous process between brief and design](image)

In both methods The Dataset will ease the process. In the first method the brief will be more complete before starting the design. Because of the higher completeness of the brief, the process in the second method will go faster. Less feedback from design to brief is needed.

When the steps GOALS and FACTS of the Problem Seeking Method are ran through, the CONCEPTS are being uncovered and tested. Currently the brief advisor informs reference projects and his own experience for doing this:

![Diagram showing GOALS, FACTS, and CONCEPTS](image)

When the advisor thinks of reference projects, none of those will exactly fit to the Goals and Facts of the current organization. The Concepts that are based on these references will thus be hard to perfectly fit the goals of the client.

The new process can improve the quality of the brief, because the FACTS form input for The Dataset. This again forms part of the CONCEPTS and combining this with the GOALS can form the final and better fit brief.

![Diagram showing integration of GOALS, FACTS, and The Dataset](image)

The information from The Dataset acts as a basis to start upon. This information contains preferences of, and trends within categories of office users. This data can still be refined by the advisor and the direct users by means of existing user participation methods (for culture specific requirements).
The figure of the current briefing workflow is recapped below; however The Dataset is added in the workflow for demonstrating its influence.

**Product**

The Dataset will add quality to the brief by better fitting to the GOALS of the client and processing up-to-date information about the office users of the building in it. Paragraph 6.2 illustrates this by taking an example brief from practice and showing the added value that The Dataset could have here.

So the influences of The Dataset are both beneficial on the process as well as on the product. For this graduation research the scope was narrowed down to make it feasible, but also on other sectors than only the office sector, a dataset like this can be helpful. With help of a similar tool a dataset can also be developed for buildings like schools and/or hospitals.
TERMINOLOGY
Terminology

Brief
The document with requirements for the building to be designed

Client
The client stands here for the organization that is in need for a new building to house their organization. It is generally the board or higher management of the organization.

Desirable
Wanted

Expert
A person with a high degree of skill in or knowledge of a certain subject; in this report the subject has to do with real-estate development, the brief, user participation techniques and / or user-centered tools.

Generic Data
Relating to or descriptive of an entire group or class; general data extracted from the input of individual office-users.

Office User
In this report, office user is the term that is applied for an employee (any function) of an organization (any sector) that makes use of an office building.

Participant
Participant is in this research employed for people that have participated in the Experiments of the Protocol Analysis; the experimental subjects. Also future users of The Tool are referred to as participants (or office users).

The Context
Building features (windows, location of elevators and stairs etc.) and surroundings (view, orientation).

The Crowd (-input)
The crowd in this report is referred to as people that use the developed online tool and thus deliver output for The Dataset. These people are assumed to be office users, because for other people it is presumably not interesting to deliver input through this tool.

The Dataset
This research describes the method how to obtain data about the preferences of office users. The Dataset is referred to as the intended dataset in which these preferences of office users are collected and categorized.

The Tool
The Tool is referred to as the digital tool of which the flowchart is designed in this research, in order to capture preferences and needs of office users that are valuable for the brief.

Usable
Understandable

Useful
Needed

User Participation vs. User contribution
When user participation is applied, the direct user of a project is involved and has direct influence on the project. With user contribution, any user is involved, not particularly the direct user. Their influence is broad and applicable to several projects.
INTRODUCTION
1. Introduction

Defining the subject and the scope of this research started with a strong, innovative and creative view on the world. This vision is narrowed down to the real-estate sector, without losing touch with other sectors and trying to learn from these sectors. The start of this research is characterized by exploring current trending topics, forming the motivation and inspiration of this research. Connecting to these topics that I was inspired by, a problem was found that is explained in this chapter.

1.1 Motivation and inspiration

This paragraph explains all topics that have framed this research. These topics are derived from exploring current developments mainly in the real-estate sector and guided by my professional interests.

Innovation

Today, we live in a turbulent world and face a challenging market. Headlines of real-estate magazines like PropertyNL or Vastgoedmarkt reflect a common theme: the Dutch real-estate sector suffers under the current market conditions. The predominant rigid and conservative character of this sector is not able to anticipate on the fast changing conditions. Innovation and new approaches are needed to enable flexible anticipation.

The main motivation that provides a fundament for this research is that new technologies combined with innovative thinking will lead to innovation in the real-estate sector.

Changing processes and current technology

Processes in all sectors are continuously changing; especially in times of crisis many organizations see an opportunity for improving their methods (Wilhelmus, 2011). The software industry seems to be leading by using open source processes since the 1950’s. In such a process, a product is continuously developed by more than one party or individual that wants and has the expertise to influence the product. This method of product development is later observed in other sectors as well; car design (Oscar project, 1999), house design (Open Source House, 2009) and even film design (Entertainment Experience, 2011). These examples show that with help of technology and using its strength, processes can be accelerated and improved in quality.

The efficiency that new technologies can enable, for example an open source process, has inspired the definition of this research’s problem, scope and especially its solution domain.

User-focus

Another issue that motivates me for this research is the tendency of giving more responsibility to the end-user in designing products, in its broadest sense. Unskilled people design their own shoes (Nikeid, 2012), their own clothes (SpreadShirt, 2012) and even their own homes (Solids, 2012). The responsibility of satisfaction with the end product lies with them.

‘The user is the Expert of his experience.’ (Stappers, 2010)

These examples present that we live in a user focused market today.
Real-estate sector
Translating this user-focus to the real-estate industry; the complex structure of developers, investors and end-users (tenants) should be explained first

Previously in real-estate development of office buildings, the developer first built a building at risk, sold it to an investor and the new owner looked for tenants:

![Figure 1.1: Previous state of affairs in development](image)

Currently, without first finding a future tenant, building projects are not feasible to develop these times. That is what COD, the company where I graduate, currently experiences. Part of this has to do with completing the financial circle. The financial sector is characterized by a restrictive credit market, thus to find funding for building projects is impossible if the risks are too high. When the developer has a tenant for the building before starting, it guarantees a beneficial cash flow after completion. The other part of first finding an end-user is focused on developing a building that is tailor-made and adapted to the needs and preferences of the buildings’ users.

The role of the tenants has changed; they have become more important in the process. The developer now needs to find tenants for the building first, than sells it to an investor and finally, when risks are minimized he builds the building:

![Figure 1.2: Current state of affairs in development](image)

In some cases, tenants can be the investor at the same time. In both cases, the role of the tenants has changed)

The changed role, and thus the increased importance of the tenant in real-estate development is a fundament for this thesis.

The remainder of this chapter is structured as follows: in paragraph 1.2 the problem statement is presented and a solution domain follows in paragraphs 1.3 and 1.4. The fifth paragraph covers the research questions. Paragraph 1.6 explains the purpose and the intended product of the research. In the seventh paragraph, the scientific as well as the social relevance is explained and finally in paragraph 1.8 is an overview of the involved parties.

1.2 Problem Statement

Finding tenants is not easy in a real-estate market where 14% of the office buildings are vacant (DTZ Zadelhof, 2011). That is why the promise of delivering a user focused building would be highly valuable in this situation. User focused is understood as a tailor-made building that is designed according to the requirements of the future office users. First these requirements need to be
stated in the brief, done by a brief-advisor in cooperation with the client (mostly higher management of the organization). Brief-consultancy offices do focus on the office users to capture information about their preferences in different forms.

Quiel Beekman, employee at 4Building, explained how they involve direct users in the briefing process. In real-estate development this is a relatively new approach. They organize workshops where they capture the latent needs of the direct office users by means of contextmapping (Sleeswijk Visser et al., 2005). When the advisor takes all responsibilities for the brief, these workshops (Figure 1.3) are time consuming and the personal steering of the consultant/advisor can make it costly as well. The information that the consultants obtain is hard to use in other projects, because the organization specific culture and the very personal dreams and visions of users are processed in this data.

![Figure 1.3: schematic illustration how direct users are informed for their needs at 4Building](image)

Gert-Wim Bos, developer at COD and previously employed at Twynstra & Gudde (TG) explained the method how TG collects generic office user data:

They organize gatherings of typical employees (e.g. secretaries, lawyers, directors etc.) and ask them in group sessions how they prefer to work. This data is derived by presenting several predefined options to the groups of employees. The employees can choose their preferred option. It delivers generic data about the preferences of categories office users. The benefit is that preferences of office-users are captured for processing in the brief. One disadvantage is the time consuming and costly character of the method (those office users need to be gathered on a specific day and probably expect a reward for their effort, because they have no direct benefit of the sessions). A second disadvantage is, because of the time consumption, the sessions can not be held frequently. Latest trends and/or changes in preferences can not be captured in this way. Thirdly, the fact that the office users get predefined options presented does not give them the opportunity to state exactly what and how they want it. It dampens their creative ability. One last remark about this approach is about different sectors within office users. Taking a look at figure 1.4; how do the brief advisors know that what these secretaries proclaim is what all secretaries in all sectors prefer? Expected is that a secretary to a bank director has different preferences than one to an architect.

![Figure 1.4: schematic illustration how indirect users are informed for their needs at TG](image)
The problem: Because of current process changes in office building development projects there is a demand for information about the needs and preferences of office users. Current practice does supply this information, but the processes for capturing this office user’s knowledge is highly time-consuming, costly, non flexible and not up to date.

1.3 The Dataset

Now we have seen the importance of gathering office user needs and preferences and the different approaches of how to obtain them. The value of the needs is high, because it helps making buildings more user-focused and thus brings a higher quality for the user.

The difference between the two mentioned methods is important to understand before continuing about possible improvements. The second method, where the generic data is obtained, captures the preferences of office users. These preferences do not contain very personal information about the users, because the data should be suitable for more projects with different users; it must be generic. You could say this data is less exhaustive than the data of the second method.

The first method’s data is on a deeper level where the latent needs of users are discovered. This is very personal, and in this case valuable, because the users that are involved in the process are also the direct users of the building. One could say their dreams are being performed.

Recap:
Method one has the goal to obtain personal and culture specific data that can only be used in the relevant project.
Method two has the goal to obtain generic data that can be used in every office building project.

The strength of the first method lies in the latent needs level: this answers the question of why people have the preferences they state. The strength of method two lies in the generic part: the information can be used more than once.

The ambition is to combine these two strengths into one method that will be less time consuming and obtain up-to-date preferences and needs of office users for future building projects that can be processed in the brief.

The greater plan is to create a Dataset wherein all office users are categorized with their specific preferences and needs for an office environment. These categories will avoid the too generic character of method two. The office users in method two are categorized in functions, but not in sectors. The sector will be added as a characteristic of the office user in The Dataset. It is further expected that age and gender influences their preferences as well, so another distinction can be made in these factors.

A transparent dataset for every office building project is created when preferences and needs of office users are categorized per function, job sector, age and gender,

The greater plan of a Dataset is now explained. How the office users are reached and how the right information is obtained is described in the following paragraph.
1.4 The Digital Tool

As explained in the first paragraph (motivation and inspiration), new technologies can help substantially in any current situation, when applied smart. So these technologies are also the starting point for obtaining the required data for The Dataset, especially for the way to reach the office users. Different ways exist to reach office users. The earlier mentioned two methods show workshop-based techniques, but more and more people are currently accessible via the internet. Especially the office users are typically people that are already working in an office environment and that should have access to the internet. Not only current office users, but the full crowd that has access to the internet can be reached in this way. ‘The crowd’ can deliver surprising outcomes, since not only current office users, but also future or past office users can be reached through the internet. In this way the whole range of people is reached and can contribute to the bigger whole. That is why it is called online crowd-contribution. Moreover, using the internet is less time consuming than workshops. Also, it is easier to reach people in case of changing environments and needs to update The Dataset.

To recap: We are now at a point where is decided to obtain the required data (preferences and needs of office users about their work environment) online, because this seems to be efficient and the possibilities for reaching the crowd is extensive.

This digital Tool should combine both strengths of the two earlier mentioned methods and should be less time consuming and more up to date.

Matters that played a crucial role in deciding how to inform the office users through the internet are described below:
First I wanted to give the office users the freedom to create. To create the environment they are used to and pleased with, to create the environment they dream of, or they have seen and want to try and explore. They must get the possibility to combine their experience, dreams and wishes into one creation. Those aspects are hard to describe in words, thus a questionnaire-like option with predefined options fall outside the scope. Predefined work environment options, like in the Twynstra & Gudde method (two), are not considered either, because office users have to choose between the options and are not able to reason beyond these options. This implies that the office user is not able to create, or dream.

The Tool should enable office users to create and think beyond existing and common work environments, and on the other hand, The Tool should structure their creations to be realistic and useful for which appropriate constraints will exist in The Tool. Because The Tool is distributed via the internet, it is a digital tool. From now on in this thesis referred to as The Tool.

This challenge is translated into a scientific research where a main question and sub-questions form the structure, direction and methods of finding the right solution for doing this.
1.5 Research Questions

The stated problem and possible solution domain that are described above have raised many how questions. These are bundled and sorted into one main question that is central for this research:

In what form can online crowd-contribution deliver generic data about the preferences of the office user in the brief of an office project?

For answering this question in a structured way, sub-questions are created. To start with, the aspects of the brief where The Tool must connect to need to be established before creating the outlines of The Tool itself.

1. On what aspects of the brief are preferences of office users valuable?

The aspects of the brief where office users’ preferences are valuable can be established by people that are experienced in writing briefs, but it is equally important on what aspects of the Brief the office users want to and can have influence. And that provides the following sub-sub-questions:

A. On what aspects are office user preferences expected to be valuable for the brief?
B. What aspects of the brief do office users want to and can have influence on?

The following step is to establish how these preferences can be captured by means of a digital Tool. It must be digital for the online distribution.

2. How can you recognize these preferences by means of a digital Tool?

The last aspect for making The Tool attractive to use is to adapt it to its target group; the office users. Therefore the last sub-question is formulated as follows:

3. How must the operation and appearance of The Tool be for making it usable and desirable?

Outline
The Research Methods are discussed in chapter two.
Question 1A will be answered in chapter three and 1B in chapter four and five.
Question 2 will be answered in chapter five.
Question 3 will be answered in chapter four.
The main question is answered in chapter six.

1.6 Purpose and Product

The goal of this research is to design a method that enables to capture preferences and needs of office users that are possible to categorize and therefore become valuable as input for any brief of an office building.

The final purpose and product for this research is the development of The Tool, thus how The Tool must operate for capturing the preferences and needs that are valuable for the brief. This is done by a very ‘hands-on’ approach; by conducting experiments which is further explained in chapter two.. The experiments, combined with expert background knowledge of people working in current practice, and my own professional opinion together established what data can and should be categorized in The Dataset.
The products of this research are first, a list with the kind of information that will appear in The Dataset, and second, the flow-chart for The Tool that needs to be developed in order to gather the required data.

To clarify: the data for The Dataset itself will not be obtained within the scope of this research. However, the method of how to obtain the data and how to categorize is established.

1.7 Relevance

The relevance of this research is explained on the basis of both theoretical and practical relevance.

Theoretical relevance
Many researches in several disciplines have discussed the topic of involving the ‘unskilled’ user into design processes. One example is the concept of ‘Mass Customization’ where flexible computer-aided manufacturing systems produce custom output. This custom output is created by the individual customer (Tseng & Jiao, 1996). The Tool to be developed can be seen as a form of mass customization. The Tool is the computer-aided manufacturing system where the context of the building is already given; the office user only needs to customize it by creating his or her optimal work environment. The difference is that The Tool will not deliver direct output, what other mass customization processes do. However, the development of The Tool is based on principles of the concept mass customization.

Co-creation is another concept where the user gets more responsibility and freedom concerning the design of a product. However, the user is here a co-designer in the team of designers (Sanders and Stappers, 2008). There are many forms of co-designing; all where a user is part of the design team. An example is contextmapping where the experiences from practice are tried to be captured by means of intensive sessions with users (Sleeswijk Visser et al. 2005). Building is a consultant that makes use of this last method.

All these researches above try to make use of the experience and knowledge that the user possesses. This particular thesis contributes to these researches, because the focus strongly lies on obtaining the experience of the user.

Two researches that have explored the connection between co-creation in product design and the design of buildings are from Liz Sanders (2000) and Quiel Beekman (2008). Both their researches where from a ‘product-design’ perspective.

My research looks for this connection, as regards to the known user involving techniques, from an architectural perspective.

Practical relevance

Four areas are found where The Dataset can add substantial value starting with the concept of the new way of working. This concept has for example been applied in the new building of the faculty of architecture in Delft, The Netherlands. The consequences of this approach are space reduction, cost savings and more responsibility for the employees. Especially this last consequence is one where the opinions of employees differ. Some are satisfied with this responsibility, others have troubles with getting used to it. The Dataset that is subject of this research would possess the knowledge what users do prefer this (and other) ways of working and what users do not. The concept
could then be partially applied in the building, because for example students prefer this flexibility, but teachers in a certain age category do not prefer this and still want a fixed place. Currently this information is not accessible. The new way of working is a current trend, but it applies also for future trends concerning work environments.

A second concept that occurs more and more these times is that of a full service office concept. Multiple self employed individuals or small companies can rent office space where they pay for the space, but also for services included (coffee, printing, mailbox etc.). Mostly this is in monthly, half year or yearly terms. This is much more flexible than the regular five year contracts. Examples of these concepts are Regus, Spaces, DOC-work and Offices For You (OFY). The latter two have cooperated in this research. Director Paul Weenink of DOC-work and director Thijs Taminiau of OFY both indicated that The Dataset would have great value for them (Taminiau, 2012). Before designing a new establishment for the company they first conduct a market research to find out their target group. For example OFY is investigating to settle a new establishment in Amsterdam on the Zuidas. Their market research pointed out that the main target groups here are lawyers and strategy consultants. When this information is obtained, they want to know how they can anticipate on these groups with the work environment in their building. The Dataset would be of major value, because without knowing who the direct users are, the building can still be tailor-made designed.

A third party that is interested and sees the value of this Dataset is kantoorplanner.nl. This is a Dutch website where many Dutch vacant office buildings are presented. Real estate brokers can place the offices that are in their portfolio on this website where they become visible for any visitor. When visiting this page, you only have to enter the city or region, the number of employees and/or the m² that you need for a future building (See figure 1.5).

![Kantoorplanner.nl screenshot](image)

Figure 1.5: A screenshot of kantoorplanner.nl

When entered this data, the website sorts out the buildings that fulfill to your demands. You can choose a building and then the possibility of furnishing a floor appears (Figure 1.6). At the top you can choose between individual space, a combination, open space or The New Way of Working. After deciding you can click the button Make video and you will experience in 3D how you walk in your self created floorplan.

Thomas Zwart, founder of kantoorplanner.nl indicated that additional information in the form of categories office users in a Dataset would be valuable for creating the predefined layouts of the office floors (Zwart, 2012).
Finally the practical relevance for this research is also established by sources that contain predefined requirements for briefs. None of these sources contain up-to-date and transparent preferences of office users. Frequently used examples of sources for the brief are the book of Neufert (2002) and the Dutch Building Decree. For clarification we take a closer look at the Dutch Building Decree:

Building dimension requirements are stated in the Building Decree 2012 (Appendix N). The minimum requirements for a newly built office space are 5m², with a minimum width of 1.8m and a minimum height of 2.6m (Figure 1.7). There is nothing stated about preferences of office users in different functions, sectors, trends etc. It is also not transparent where these numbers come from. Former Building Decree dated back to 2003 (Appendix N). The minimum requirements in that time were 10m² per space (Figure 1.8). This proves the non flexible and outdated character of numbers like these.

These four areas show that the potential of The Dataset is high and with that makes it a relevant research for current practice in the real-estate sector.
1.8 Involved Parties

Two main parties were involved in this project: a graduation committee and the company with its employees who supported my research by offering an internship for six months. The graduation committee existed of Dr. Ir. Alexander Koutamanis, Prof. Dr. Pieter Jan Stappers, and Brian Tidball (MSE) all from TUDelft and Drs. Ton van Oosten from real-estate development company COD (Cradle Of Development). The parties will be introduced in the following sections.

1st Mentor – Dr. Ir. Alexander Koutamanis
TUDelft – Faculty of Architecture – Section Design & Construction Management
Alexander Koutamanis studied architecture at the Aristotle University of Thessaloniki, Greece. He received his PhD from Delft University of Technology, The Netherlands, for a thesis on the automatic recognition of architectural drawings. In addition to his academic research and teaching Alexander Koutamanis has worked as an architect in Greece and as a senior consultant with the Government Buildings Agency in The Netherlands. During this research he was the main mentor who guided me through the process of this graduation research.

2nd Mentor - Prof. Dr. Pieter Jan Stappers
TUDelft – Faculty of Industrial Design – Section Design for Interaction
Currently Pieter Jan Stappers plays an organizational role at a mixture of levels in the faculty of Industrial Design. Formally, he is head of the section Design Communication and Conceptualisation (DCC) and coordinator of the Master programme Design for Interaction (DFI). Pieter Jan studied Applied Physics and did a Ph.d. on Virtual Reality in Perception Research. Since 2002 Pieter Jan is full professor, chair of Design Techniques. Pieter Jan helped me to become familiar with how users of products can be involved in the design process.

3rd Mentor – Brian Tidball (MSE)
TUDelft – Faculty of Industrial Design - PhD Student Crowdsourcing
Brian Tidball has a BSE in Industrial Engineering from the University of Washington (Seattle) and MSE Degrees in Human-factors and Bio-Medical Engineering from Wright State (Dayton, OH). He joined the ID StudioLab in August 2009 to earn his PhD. under the guidance of Pieter Jan Stappers and Ingrid Mulder. His research is examining the use of crowdsourcing as an online user research tool for human centered design. During my research he provided feedback on the subjects of user involvement in design processes and crowdsourcing, since this was my starting point of the research.

Company Mentor – Drs. Ton van Oosten
Cradle Of Development (COD) – Real-estate developer
Ton van Oosten studied economics at the University of Amsterdam and started his career at DTZ Zadelhoff. Next he built up ten years of experience in the development of real estate and bundled all his gained knowledge and experience to start the initiative of COD in 2010. COD allows for ample expression of both quality and creativity. The open source philosophy brings today’s new ways of working and thinking in project development within reach. He has a natural talent for leading a purposeful and knowledge-intensive team. Ton supported my creative and open ideas about innovation in the development sector throughout the whole graduation process.
COD – Cradle Of Development
Graduation Company – Real Estate Development
COD is a real-estate developer with the operating area of The Netherlands. Rich in experience because of realized projects, but with the innovative approach of a young and creative team, modern complex issues are addressed. One of the goals of COD is to add value in creating solutions for the high vacancy rate of buildings in The Netherlands. They create innovative solutions for redeveloping those buildings and transform those into spaces where people want to work, live and reside.
During my graduation research I was able to make use of all facilities that COD offered, their knowledge and their network of professionals and companies.
THE RESEARCH METHOD
2. **The Research Method**

In this chapter the research approach for obtaining the intended results are described with the corresponding methods. The steps to be taken and their sequence are described in the second paragraph.

### 2.1 The Research Approach

As we have seen in the first chapter there are three sub questions formulated to be able to find an answer to the main question. The sub questions chop the research in manageable parts; therefore every sub needs a method to find an answer to it. The table below shows what sub question needs to be answered and what source can be informed. It is indicated if this information already exists and thus only have to be collected or if the information is missing. This classification is of influence when defining what method to use.

<table>
<thead>
<tr>
<th>Existing Information</th>
<th>Missing Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aspects of Brief</td>
<td>Brief advisors and experts in the field (Sub 1A)</td>
</tr>
<tr>
<td></td>
<td>Office Users (Sub 1B)</td>
</tr>
<tr>
<td>2. Operation for obtaining the right output</td>
<td>Attributes for a digital tool in general: previous researches / experiments</td>
</tr>
<tr>
<td></td>
<td>Attributes for the digital tool with this specific output</td>
</tr>
<tr>
<td>3. Operation &amp; Appearance for usability and desirability</td>
<td>Attributes for a digital tool in practice: IKEA and Heijmans</td>
</tr>
<tr>
<td></td>
<td>Funfactor in a digital tool for the specific subject of offices</td>
</tr>
</tbody>
</table>

1. The aspects of the Brief where office user’s preferences are valuable can be established by experts, but it is equally important on what aspects of the brief the office users want to and can have influence. Therefore the experts need to be informed and the office users themselves.

**Research Method:** Informing the experts is done by conversations and discussions at my graduation company COD and alignment with DOC-work director Paul Weenink and separate interviews with several experts. Also literature is informed for adopting a guideline for the process of briefing and the components of the brief.

Informing the users is done in the form of a sample of 22 experimental subjects during experiments.

2. To obtain office user’s preferences the choice has fallen on an innovative approach; the use of a digital tool. Letting users of products use a tool for indicating their preferences has occurred in several researches before. Conclusions from those researches can be used for a first outline of this research’s digital tool.

**Research Method:** Literature will be informed to get information about previous researches in digital tools and letting users (in general) interact with these tools.
To find out the specific attributes that this research’s tool need for obtaining the desired results, experiments with 22 participants are conducted.

3. For the operation and appearance that serves a good usability and desirability, examples from practice can be used. 

**Research Method**: The method chosen for this sub question is observation of people that interact with two existing digital tools; the IKEA ‘keukenplanner’ and the Heijmans ‘Woonplanner’. For the missing information, again experiments with 22 participants are used to observe the Human Computer Interaction.

The experiments play a major role; they form a part of the answer to every sub question in this research. These experiments are conducted according to the method of Protocol Analysis where close observation is necessary.

For drawing deliberate and funded conclusions at the end, validation of the research results is needed. For this an expert meeting is held where the preliminary results are presented and discussed. The table below shows a summarized overview of all research methods.

<table>
<thead>
<tr>
<th>Aspects of the brief (Sub 1)</th>
<th>Literature &amp; Interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation of The Tool (Sub 2&amp;3)</td>
<td>Literature &amp; Experiments (Protocol Analysis)</td>
</tr>
<tr>
<td>Validation of Results</td>
<td>Expert Meeting</td>
</tr>
</tbody>
</table>

Below are the research methods separately discussed.

**2.1.1 Literature**

This research started with collecting information about the relevant topics. In September 2011 this started with the subject of Open Source and open plan processes. This soon evolved into crowdsourcing and user participation techniques. In this second phase, the broad scope of this research was defined; to obtain information about categories office users for the brief by means of crowdsourcing. To achieve this, techniques from user participation can be adopted. An annotated bibliography (Appendix O) was created to focus the emerging research questions. This resulted in a literature review that was performed for the second graduation presentation (P2) and done according to the guidelines of Groat and Wang (2002). Now the information gained from literature is integrated through the whole report. Literature about the aspects of the brief is processed in chapter three. And literature about the operation of The Tool is processed in chapter four.

**2.1.2 Interviews & Observation**

To be able to decide what components of the brief are interesting to have office user input on, experts are interviewed. The information obtained in these interviews is also integrated in the chapters where the relevant subject is being discussed.

The following experts are informed in semi-structured interviews (Transcripts are in Appendix P):

- **Pieter Jan Stappers** Professor at Industrial Design faculty TUDelft
Pieter Jan Stappers and Brian Tidball were the first persons interviewed. After the interview we decided that they would be my 2nd and 3rd mentor. However, the interview itself was mainly focused on the user participation techniques that are adopted in product design so far and the possible link to architecture; it served more or less to discuss the relevance of this research.

André van der Zalm was interviewed in the phase where the exact scope, mainly of the possible output of the digital tool, still had to be defined. He is an experienced project and concept developer at TCN (previously at OVG) and indicated what aspects of a building are interesting to have user input on.

Thijs Taminiau is the director of Offices For You (OFY). That is a full service office concept where people can rent office space per year and meeting space per hour. The interview with him was to obtain information about what aspects he wants to have input on from office users.

Frank van Jeveren is a consultant at the firm YNNO. They are specialized in advising clients about the ‘new way of working’. The interview was to find out how they work with direct users and where a crowd-dataset can add value to their method. Also aspects of the brief that are interesting to get user input on were discussed.

Thomas Zwart is the founder and owner of Kantoorplanner.nl. This is a digital tool where the client (organization that looks for a new building) can find existing buildings that fit to their demand in a large national database and can immediately see the possibilities of layouts in 3D. The interview with Thomas Zwart was to discuss the relevance of my tool and the different options to get people enthusiastic for using The Tool.

The observations of the IKEA tool existed of observing seven people working in the IKEA shop with the kitchenplanner tool. This was to observe how people interact with the ‘digital’ component and to see how much effort it took for them to furnish a given space in 2D and 3D. It was especially helpful for the experiments, since it became clear that it takes for people in general much effort to understand the operation of a digital tool. Six of the seven observed customers were helped by IKEA personnel. The reactions of some persons were valuable for the operation of this research’s tool. For example one person said: “I hate these buttons; that is because I am used to Iphone-like buttons.” This was for me as the researcher and designer of The Tool an indication on what aspects people pay attention and what they think is important. Appendix Q contains some main conclusions from this observation.

The second observation was that of a tool developed by Heijmans; the Woonplanner (Weggeler Almelo, 2012). This was not an extensive observation, but main features in usability were studied; those are used in the finishing of The Tool.

Figure 2.1: Observation of customers working with the IKEA Kitchenplanner.
2.1.3 The experiments

Three experiments are performed for answering the sub research questions. The first experiment consists of a model of an empty layout of an existing office space. The participants are asked to place objects in the space and create their optimal work environment with that.

The second experiment existed of a computer model (in Adobe Illustrator) of an existing office space. The participants got the same task as in the first experiment. The main difference is that experiment one was a physical model and experiment two was a computer model.

The goal of The Tools in both experiments is to obtain information from the participants without directly asking for it. The fact that you do not give them a choice in predefined options or asking them questions in a survey creates the opportunity for surprising outcomes in the results.

The experiments are the most intensive research part of this research. 22 participants are tested in total; ten per experiment. Referring back to the research questions, the experiments have a threefold goal:

- **Sub 1**: Informing the user what they want and can establish
- **Sub 2**: How The Tool must operate for obtaining the desired results
- **Sub 3**: How The Tool must operate for making it usable and desirable

Explanation for Sub 1: To this part I will pay special attention to what components the participants think are important. This can be done by observing what objects are placed first, asking why they want to place objects and by listening to what they think aloud.

Explanation for Sub 2 and 3: The goal of doing the experiments here is to obtain information about how the participants interact with the features in The Tool, with the computer (Human Computer Interaction) and what input is necessary to gain the desired output. Special attention is on what aspects the participant enjoys to do and what tasks are hard or not fun to perform. After every participant, The Tool and/or task will be continuously changed for making the ‘fun factor’ as optimal as possible. In short: to design a desirable, usable and useful tool.

These experiments are done according to the Protocol Analysis method; close observation of the participants will help to make the right choices about the operation of The Tool. Protocol analysis is an often used method and applicable in several forms and in several sectors. Below is described how the method is applied in this specific research.

Protocol Analysis

Protocol Analysis is an empirical research tool that has become well established in the field of design research. The generic protocol analysis is focused on the issues of verbalization, i.e. the validity and completeness of verbal reports and effects caused by verbal reporting. However, as Jiang and Yen (2009) also state in their article of protocol analysis in the design field; design activities involve many visual and spatial elements that are hard to capture with only words.

There are two different kinds of protocols: the conversational protocols and the think-aloud protocols (Jiang & Yen, 2009), that can be characterized as protocols for groups and protocols for individuals (Waldron and Waldron, 1996). Further distinction is made between process and content-oriented protocols. With process oriented protocols the attention is paid on the problem solving actions and design strategies. Content-oriented protocols focus on what designers look for, see, do, and possibly think.
Based upon these different protocols described in the article of Jiang and Yen (1996), choices are made for this research:

- Normally the on-design-focused protocol analysis is aimed at designers or design students; in this research the design activities of users, who are not, or minimal skilled in designing, is observed.
- This research will use the techniques of the think-aloud protocol for individuals.
- This research is content-oriented; in this case not what the designers look for, see, do, and possibly think, but what the user looks for, sees, does, and possibly thinks.
- There is a maximum of two hours per test, because of the concentration- levels of the participant and the researcher.

2.1.4 Expert Meeting

An expert meeting with practitioners is held to ensure research quality and to verify the result obtained. That is why the meeting was performed after all research results were collected and preliminary conclusions were drawn. The following experts with different backgrounds were present in the meeting:

<table>
<thead>
<tr>
<th>Name</th>
<th>Position/Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ton van Oosten</td>
<td>Partner &amp; Developer at COD</td>
</tr>
<tr>
<td>Gert-Wim Bos</td>
<td>Developer at COD</td>
</tr>
<tr>
<td>Paul Weenink</td>
<td>Director DOC-work</td>
</tr>
<tr>
<td>Annelies Wisse</td>
<td>Interaction Designer at NorthernLight</td>
</tr>
<tr>
<td>Thomas Zwart</td>
<td>Founder of kantoorplanner.nl</td>
</tr>
<tr>
<td>Derick Mekking</td>
<td>Senior Associate at Favela Fabric</td>
</tr>
<tr>
<td>Margot Hoogendoorn</td>
<td>Founder of Jade Jackets</td>
</tr>
</tbody>
</table>

In the expert meeting the research results and the preliminary conclusions were presented. The different backgrounds accounted for different points of view and that resulted in interesting discussions. Based on these discussions, the preliminary conclusions were confirmed, adapted or rejected. The meeting and the discussions are extensively discussed in paragraph 4.3 (tool operation specific) and 5.4 (Output specific conclusions).

2.2 The Research Steps

Figure 2.2 shows how the research steps are taken in time and to what product(s) they are linked. Literature provides a basis to start the development of The Tool with. At the same time the possible output of The Tool, thus the information that forms The Dataset, is defined with help of literature about the brief and its’ components. Information gained from interviews (Appendix P) form at the same time the basis for pilot tool one, but also for the possible output of The Tool. With pilot tool experiment one is performed, which after close observation and drawing conclusions (protocol analysis) forms the input for pilot tool two and for The Dataset (what part do users want to and can have influence on). This same process takes place with the second generation tool that results in pilot tool three. This tool and the output established so far is subject of discussion and validation in the expert meeting. After the expert meeting the last adaptations to The Tool are made and final conclusions can be drawn; those are both processed in the final method.
2.3 Reader’s Guide

Below is an overview of the research steps, the products and the chapters or paragraphs where those are described in this thesis.
COMPONENTS OF THE BRIEF
3. **Components of The Brief**

This chapter answers sub-question 1A: *On what aspects are office user preferences expected to be valuable for the brief?*

Answering this question is possible by looking at all the components of the brief and judging those by estimating how valuable the preferences of users would be when writing the brief. Secondly brief-experts are asked to give their experienced view on this matter.

The current process of briefing, described by developer Ton van Oosten (COD), is simplified being carried out as follows:

The client determines that he needs a new building for his organization. He hires a consultant to write a brief. This consultant questions the client to establish his goals; what he wants in the new office. The establishment of goals is hard; the client often needs help from the direct users of the building (his employees) and from the consultant. The consultant brings his own experience into the new project and writes a brief that is based on his previous experiences with similar projects or based on reference projects. Only sometimes the users (the clients’ employees) of the future building are being involved and (luckily) this happens more often (www.4Building.nl).

In theory several methods for writing a brief are known, however for this research the Problem Seeking Method of Peña and Parshall (2001) is adopted to form a basis and a guideline for the research. Five steps are distinguished in the Problem Seeking Method:

F. Establish **GOALS**
G. Collect and analyze **FACTS**
H. Uncover and test **CONCEPTS**
I. Determine **NEEDS**
J. State the **PROBLEM**

Briefly, the five steps pose these questions:

**GOALS** – What does the client want to achieve, and Why?
**FACTS** – What do we know? What is given?
**CONCEPTS** – How does the client want to achieve the goals?
**NEEDS** – How much money and space? What level of quality?
**PROBLEM** – What are the significant conditions affecting the design of the building? What are the general directions the design should take?

Cited from Peña and Parshall, 2001

Only the PROBLEM-step has a defined order; it will always be the last step. The other steps usually have no clear sequence; however in theory the above mentioned order of taking the steps is most logical.

These current practices defined by COD and 4Building, combined with the Problem Seeking Method of Peña and Parshall (2001) form the workflow scheme below. This is the basis on which this research will continue.
Explanation Workflow-scheme
The persons involved in the briefing process are the client, the brief advisor and the direct users. The client is understood as the organization that demands a new building, mostly the management. The brief advisor is someone that has experience in briefing and consults clients with their knowledge. The direct users are referred to the employees of the organization. In strokes (white and green) are the steps of the Problem Seeking Method illustrated;

A. GOALS
The Client formats his goals (with or without the direct users) first (1). Those goals are checked by the brief advisor on their relevance (2) and he helps the client with formulating the goals (3).

B. FACTS
Facts are collected by the brief advisor. He knows what information about the organization is relevant as input for the concepts (C). The facts serve as input for establishing the goals at the same time.

C. CONCEPTS
Ideally the brief advisor, client and direct users work together to uncover and test concepts; this is based on the method of 4Building. With GOALS and FACTS input, these concepts are uncovered. A continuous alignment takes place with the established goals. When uncovered, they get tested by the ‘team’; this can happen one time, two times, three times or even more, until is defined what abstract ideas (concepts) contribute to the established goals. The concepts that are uncovered are mainly based on the experience of the brief advisor and on reference projects.

D. NEEDS
The concepts of the previous step form a range of possibilities to achieve the established goals. These are still abstract ideas and form they input for
more detailed requirements in the step of determining the NEEDS. It is in effect an economic feasibility test, because in this step the needs are distinguished from the wants. In this phase, feedback takes place to the establishment of goals, because it can happen that because of a limited budget, some goals need to be adapted.

E. PROBLEM
Finally the constraints can be extracted from the uncovered CONCEPTS and the requirements from the determined NEEDS; those together can state the PROBLEMS for the new building. This is called the brief. The task of the architect is to solve these problems in the form of a design.

Alignment with step A is needed in order to check if the goals are stated in terms of constraints and requirements in the brief.

This research will specifically connect to one ‘motherhood’ GOAL that, according to the experience of employees from COD, reoccurs in every office building project. That is to make the office users as productive as possible in the new building by creating an optimal work environment for them.

\[ 'Motherhood' \text{ GOAL} \text{ of client where this research connects to: to create an optimal work environment for the office users of the new building.} \]

Achieving this ‘motherhood’ goal depends on many factors, e.g. organizational culture, sector, function, age, gender etc. Those are the FACTS in a briefing project. When the facts are collected, they can serve as input to Uncover and test CONCEPTS.

And that is where I expect my dataset becomes helpful; when entering facts (e.g. women between 25-35 yrs old in an administration function) possible concepts come out as a result (e.g. 70% in this target group wants to work alone in an office). The specific question that rises here is: on what specific concepts do we want the input of office users? For that, we take a look at the different concepts that Peña and Parshall (2001) describe in their Problem Seeking Method. They defined 24 concepts that seem to occur in nearly every project. All these concepts are based on goals concerning a specific subject. As formulated above, the subject of the client that is central in this research is creating an optimal work environment for the office users of the new building.

3.1 Uncover and test CONCEPTS

Choosing the concepts that are receptive for office user input is done with taking into account three matters:

First the concepts must be based on the clients’ goal of an optimal work environment.

Second the envisioned digital tool that will collect these concepts has to be considered; when office users create concepts with help of The Tool, useful constraints of the spaces must be possible to extract from these concepts.

Third, the offices users must be willing to decide upon these concepts.

The following Concepts (Peña & Parshall, 2001) are adopted for this research. Office users are expected to have useful influence on these by indicating their preferences;
### A. Density (4 of 24)

The user can determine the density of his/her work environment; the number of persons working in the same space.

![Density Diagram](image)

### B. Service Grouping (5 of 24)

Users can for example create separate space for the storage, or integrate storage in the work space.

![Service Grouping Diagram](image)

### C. Activity Grouping (6 of 24)

The user can indicate if there takes more than one activity place in a space or just one per space.

![Activity Grouping Diagram](image)

### D. Relationships (9 of 24)

When designing a work environment, the user places certain spaces next to each other or on a specific location on the floor plan with a relational reason.

![Relationships Diagram](image)

### E. Neighbors (11 of 24)

When having multiple tenants on one floor (like the DOC-work case) it is interesting to see if users want to share spaces or not.

![Neighbors Diagram](image)

### F. Flexibility (17 of 24)

On versatility level users can indicate if spaces are multifunctional or not. Also on convertibility level it is interesting how users reflect upon interior changes.

![Flexibility Diagram](image)
The other concepts are too specialized or on such an overall level where you need professional knowledge when deciding about these concepts, thus not enclosed in the list.

To recap, it is expected that users produce a range of CONCEPTS that are possible answers to the GOAL of an optimal work environment for office users, depending on the collected FACTS.

| GOAL: | Established by the client |
| FACTS: | Who are the users? Sector, Function, Age, Gender will form a category. |
| CONCEPTS: | Ideas given by office users in that category. |

### 3.2 Determine NEEDS

The next step in the Problem Seeking Method is determining the NEEDS (Peña and Parshall, 2001). This is a component where users are expected to have a valuable contribution as well. Recap: during the whole briefing process the aim is to search for and find the whole PROBLEM (step 5). To accomplish this, the problem must be identified in terms of Function, Form, Economy and Time; thus in all steps (GOALS, FACTS, CONCEPTS, NEEDS, PROBLEM) these subjects need to be considered continuously.

Considering the NEEDS, these subjects have the following meanings: for Function the space requirements, for Form the quality of construction, for Economy the money budget and for Time the planning (Peña and Parshall, 2001). The space requirements, thus the needs concerning the function, are interesting for office user's input. These space requirements go a step further than the space constraints given in the CONCEPTS-step; those are focused on the exact measurements of the spaces and area requirements for each activity. For example stating how many square meters are necessary for a one person workplace. Currently these requirements are stated in the Building Decree 2012. The minimum requirements for a newly built office space are 5m², with a
minimum width of 1.8m and a minimum height of 2.6m. In the Building Decree of 2003 this was 10m². It is interesting whether the results of the in the digital tool created spaces by office users deviate from these requirements.

![Figure 3.2: Minimum requirements for newly built office space, Dutch Building Decree 2012.](image)

It is doubted if a layman can decide about exact measurements and area requirements in a digital tool. Despite the doubt, this determining of requirements is included in the experiments; it will leave the possibilities for unexpected outcomes open.

From practice advisor Frank van Jeveren (YNNO) and concept-developer André van der Zalm (TCN) were not particular interested in user input on the exact requirements of the brief. They were mostly interested in ‘surprising’ results concerning the functions of a work environment and how those are worked out. However, they agreed on that the ‘working out’ of those functions can also contain detailed requirements that possibly make the outcomes interesting (Jeveren, 2012 and Zalm, 2012). Their doubt was how realistic office users can decide about these matters as well. Consequently this is tested in the experiments.

### 3.3 Valuable input office users

Now the answer on sub question 1A can be given.

*On what aspects are office user preferences expected to be valuable for the brief?*

As discussed above, these are eight out of 24 concepts of the Problem Seeking method (Peña and Parshall, 2001); density, service grouping, activity grouping, relationships, neighbors, flexibility and tolerance. And second the space requirements (exact measurements and area requirements of activities) that fall under the NEEDS step of the Problem Seeking Method.

The step in the Problem Seeking Method that is called CONCEPTS is used to extract CONSTRAINTS from. And in the NEEDS step, REQUIREMENTS are obtained. Therefore, in the sequel of this report, we speak of CONSTRAINTS and REQUIREMENTS.

Below are the five steps repeated of Peña and Parshall (2001) and who the decision makers per step are. Underlined are the main decision makers per step. Green is where information from the crowd plays a role. Note that the brief advisor will help the client (and vice versa) and not make decisions without informing the client.

<table>
<thead>
<tr>
<th>GOALS</th>
<th>Established by the brief advisor and direct office users</th>
</tr>
</thead>
<tbody>
<tr>
<td>FACTS</td>
<td>Collected by the brief advisor and direct office users</td>
</tr>
<tr>
<td>CONCEPTS</td>
<td>Uncovered and tested by the brief advisor and the crowd,</td>
</tr>
<tr>
<td></td>
<td>7 out of 24 concepts with help of the crowd.</td>
</tr>
<tr>
<td>NEEDS</td>
<td>Determined by the brief advisor and the crowd,</td>
</tr>
<tr>
<td></td>
<td>measurements and area requirements with help of the crowd</td>
</tr>
</tbody>
</table>
Figure 3.3 clarifies the steps of the Problem Seeking Method and where the office users are expected to deliver valuable input. In this scheme it is stipulated how the subjects Function, Form, Economy and Time are continuously taken into account in every step. In the NEEDS step these are zoomed in for enabling to highlight the Function subject for this research.

In this chapter the workflow of writing a brief is now explained and the components where the user-dataset is expected to have influence on its’ content. With this information, the first pilot tool can be created and tested in the experiments. This is described in the following chapter (four).
DEVELOPMENT OF THE TOOL
4. Development of The Tool

As the previous chapter has described, the digital tool to be developed has specific goals concerning the expected output. The Tool must be able to recognize the preferences of the office users on the CONCEPTS and NEEDS levels that are described in chapter three. The output needs to be in the form of the stated CONSTRAINTS and REQUIREMENTS. Through Experiments and the knowledge of experts the operation of The Tool will be determined by testing different input from the office users and different features of The Tool. The second sub question will not be answered in this chapter; this will be done in chapter 5 where is reconsidered what constraints and requirements of the brief can realistically be created by the office user. In this chapter sub-question 1B will be answered by means of the experiments:

1B. What aspects of the brief do office users want to have influence on?

Also sub-question three is answered in this chapter;

3. How must the operation and appearance of The Tool be for making it usable and desirable?

For answering this question, the attention in the experiments lies on the Human Computer Interaction; how the participants interact with The Tool; what they like to do, what they do not like to do, what they understand and what is hard for them to get a grip on. The goal here is that The Tool must be usable, thus understandable. The participant must not spend more than a minute to understand the operation of The Tool; it should be obvious. Secondly, it must be desirable, thus wanted. The participant must enjoy performing the tasks that are given by The Tool. These aspects are tested in experiments (§4.2) and discussed with experts (§4.3) and in paragraph 4.4 the final flowchart for The Tool is presented to achieve these goals.

But first, the development of The Tool starts with copying the successful factors of previous researches and literature about user participation and user-centered Tools, combined with my own experience about the process of designing buildings. The formation of Pilot-Tool 1 is extensively described in paragraph 4.1. With this first generation tool an experiment was set up with ten experimental subjects. Close observation and analysis formed the second generation tool; Pilot-Tool 2. Also with this tool there was an experiment with ten experimental subjects and observation and analysis led to the third generation tool: Pilot-Tool 3. These transformations are explicated in paragraph 4.2. The third generation tool was subject of discussion in an Expert Meeting and one individual meeting with an expert. Based on these recommendations and conclusions from the discussion a fourth generation tool was created. This formation is outlined in paragraph 4.3.

4.1 Towards a Tool through Theory

Some first decisions about Pilot-Tool one were based on the resources that were available within the scope of this research and my personal reach. The first idea was to let office-users design their optimal work environments by giving them some carefully selected objects and a layout in which they could shuffle the objects. What the output had to be was not completely clear at this stage, because the outcomes of the experiments would contribute to the answer about what output was needed and possible to get out of The Tool. Yet, one aspect
was certain; the fact that the output had to be receptive for input from the crowd. Considering these not yet fully formulated constraints at the beginning of developing this tool created many possibilities and directions to start with. Pilot-tool one was therefore created by discovering these possibilities step by step and finding supporting literature or examples for these decisions.

**Physical Scale Model**

From the beginning, the fact that this tool had to be digital, was established. Existing programs for a digital Pilot-tool one were explored, including the IKEA kitchen planner, PCon-planner and Maya. However, none of these programs could offer what was needed in the first generation tool. I wanted to start with a tool that was easy to use by the experimental subjects, without too much explanation about the use of The Tool/program. IKEA kitchen planner fulfilled to this demand, but there are no possibilities with office furniture. PCon-planner may have fulfilled to this demand, but the queue for ordering online furniture was at least three weeks per furniture set; it did not fulfill to the time scope. Last, it was not possible to meet the demand of ‘easy to use’ with Maya; operations within this program were in all probability too hard for unskilled participants.

Thus, after some investigation in the possibilities and considering the pro’s and cons, the choice for a non-digital tool was made. The layout of a floor plan is developed on a white foam board with the walls realized in black foam board. Places of windows or doors are left open. Figure 4.1 shows a picture of the Pilot-tool 1, where these and other features are visible.

The other features are: defined objects that are desks, chairs, sofa’s, coffee machines and meeting tables, undefined objects that are small square formed and long formed rectangles in several sizes, post-its and scissors, a role description, a legend, and very important, but not visible: human steering by the researcher; me.
After the decision for a physical scale model was made, previous researches and literature were consulted to specify the details and the operation of the model. For the context of The Tool/building a test-case of a full service office company will be used; an existing building in Breda from DOC-work. An important author is Liz Sanders, who is specialized in User Participation – Projective and Generative Techniques, where the latent needs of users can be discovered with help of these techniques. A second important author is Eric von Hippel, who wrote two articles about Toolkits that can be used to involve users in design processes of manufactured products. Liz Sanders has made some first steps in applying co-creation techniques in the field of architecture. Eric von Hippel is a professor in Technological Innovation at MIT Sloan school of management and two of his articles focus on letting users state their own needs by means of a toolkit and after that let the expert do the ‘design work’. My goal was to translate these techniques that mostly come from product design into techniques that can be used in The Tool. Further, for deciding which objects to be used in The Tool, the PhD work of Juriaan van Meel will be used and my personal expertise about office design. In figure 4.2 is an overview of all the sources that deliver input to the formation of Pilot-tool 1.

I will first explain about the theories and techniques given by Liz Sanders and what I used and did not use in Pilot-tool 1. Second, I will give a summary of The Tool-characteristics that Eric von Hippel gives in his articles and how I translated these into Pilot-tool 1. After that the decision about the chosen office objects will be exemplified and finally a short explanation about the test-case of DOC-work will follow.

![Figure 4.2: Overview of all sources that delivered input for Pilot-Tool one](image-url)
Projective Techniques

In one of her works, Liz Sanders explains about the different levels of need that can be established from a user of any product (Sanders, 1992). In order to be able to discover all these need-levels, she makes a comparison with healthcare where neuroscientists rely on a mix of technologies, where each technology adds a different piece of the neural puzzle (e.g. MRI, PET, SQUID etc.). Combining different existing techniques from product design should make it possible to combine all parts of the ‘need-puzzle’. In figure 4.3 below is an overview of these levels; the left triangle shows Maslow’s hierarchy of needs that distinguishes seven levels, ascending from the basic biological needs at birth to more complex psychological motives that become important only after the more basic needs have been satisfied. The right triangle contains the levels of needs that can be obtainable from product-users (Sanders, 1992) however different techniques must be used for the different levels.

“The concept of need is a very complex psychological phenomenon. Any theory of need addresses many different levels of need.” (Sanders, 1992)

![Figure 1: Maslow's Hierarchy of Needs](image)

![Figure 2: Levels of Need Expression](image)

Figure 4.3: The Maslow triangle of needs and the needs-triangle of Sanders (1992)

At this stage it was not yet possible to state on which need-level the final tool of this research would contribute. However, the ambition was to aim for the highest level possible; the latent needs. And as can be seen in the right triangle at the bottom; **Latent needs are subconscious, possibly dormant needs that participants are unable to express in words**.

Liz Sanders found the use of ‘projective techniques’ promising for uncovering these latent needs. Some characteristics of projective techniques are:
- The use of visual stimuli
- Constructing collages from pre-selected photographs, images, colors, words and phrases.
- Describing the reasons why participants do what they do
- Giving the possibility of self creating forms & objects
- Comparison between current situation and ideal situation
In this comparison are the tacit and latent needs hidden that can be exposed by the reasoning of the participant behind the choice of something different than the current situation.

**TOOL**

Thus, letting participants express their preferences not only by words, but with help from visual aspects, built-in in The Tool, giving them possibilities to create objects themselves and steering them the right way, can contribute to the discovery of latent needs.

These characteristics will be translated into elements of The Tool. However, a very important aspect that is not built-in is the part of constructing collages from pre-selected photographs, images, colors, words and phrases. When applied, this gives the participant the opportunity to create atmosphere impressions and to express their style. For The Tool this part is deliberately omitted, mainly because output on this level will not be receptive for crowd-input. It is expected that personal styles, expressed in such a diverse manner, are hard to process when trying to obtain these results from the crowd. Besides that, when excluding all ‘quality-aspects’, the task for the participant will be less complicated and the focus lies only on the functional aspects of the work environment.

**THEORY**

**Generative Techniques**

A later article of Liz Sanders describes ‘Generative Tools for CoDesigning’ (Sanders, 2000). These generative tools are a continuation on the Projective Techniques that are described above. She describes a new language that has been revealed by the landscape of generative tools, defined as follows:

“We put a large number of components together into ‘toolkits’. People select from the components in order to create ‘artifacts’ that express their thoughts, feelings and/or ideas. The resulting artifacts may be in the form of collages, maps, stories, plans, and/or memories. The stuff that dreams are made of is often difficult to express in words but may be imaginable as pictures in your head.”

**TOOL**

**Conflicts between Pilot-tool 1 and Generative techniques**

- Generative techniques are based on collaboration
- Pilot-tool one is still based on the presence of a person that steers the participant, but has the final aim to drop this personal steering and transform it into digital steering. Generative techniques, developed so far, always need personal steering.
- The output of this research’s tool will in the end be focused on the ‘crowd’ and must therefore become generic in a way (explanation follows in chapter five). Generative techniques do never have generic outcomes, since it expresses the very personal dreams, thoughts, feelings and ideas of people.

**Affinities between Pilot-tool 1 and Generative techniques**

- Generative techniques are predominantly visual; Pilot-tool one as well.
- Generative techniques use a large number of components that can, but do not have to be used; Pilot-Tool one as well. These components cover a range of representational types: from literal to abstract.
- A generative toolkit usually contains a background on which to work; Pilot-tool one as well. However, a generative toolkit often contains a more abstract background defined by boundary such as a circle, a line or a square. Pilot-tool 1 works with a more in details defined layout of a floor plan of an existing building.

**THEORY**

One of the generative techniques that Liz Sanders calls Participatory Modeling (Stappers, 2010) consists of a layout of a typical patient room in a hospital and little scale cut-outs of all amenities typically found in a hospital.
“We were amazed at how well it worked, that people could not only make the future room, but also imagine future scenarios within it.” (Stappers, 2010)

This can be seen as a more specific example for Pilot-tool one. In further development of this toolkit, also three-dimensional toolkits were developed to test with nurses. In these toolkits, some important elements were stated by Liz Sanders in the symposium about user experience in 2010 (Stappers, 2010);
- The pieces need to be abstract
- There must be enough space for potential ambiguity in The Toolkit

These characteristics together form the possibility for the participant to create their own objects, of which they think are important in the space. The given objects in Pilot-tool one have abstract forms and are not shaped ‘perfectly’. This makes the participant feel more comfortable and earlier invited to cut in and write on the existing objects in order to express their selves more clearly (Stappers & Tidball, 2011).

The above described techniques are translated into specific elements for Pilot-tool one, with the following characteristics and reasons:

| Defined objects | The defined objects that are given to the participant are scale (1:30) cut-outs of furniture that is typically found in an office environment. These objects contain very small inequalities, to invite the participant to cut in and write on these existing objects. |
| Undefined objects | For stimulating creative thinking and giving the participant freedom. However these objects already have a pre-created form that can give the participants a direction to think in. |
| Post-its and scissors | For giving the participant freedom in the design of his ideal work environment. This stimulates creativity as well, but without giving them any direction to think in. |
| Human Steering | Asking for reasons why they do what they do |

Explaining the participant that they can consider their ideal work environment from the positive and the negative aspects of their current situation (comparison current & ideal)

Encourage the participant to think beyond the given objects and indicating that the existing objects may be changed by writing other functions on it.
The following characteristics are not translated into elements for Pilot-tool one, with the accompanying reasons:

| Pre-selected pictures, images, colors, words & phrases | These elements are not processed in The Tool, because it is expected that the output on this level will not be receptive for crowd-input and possible to make the output generic. Second, the focus of the task must be on the functional aspects of the work-environment. |

The fact that this last important aspect of generative techniques will be ignored indicates at this stage that The Tool will not be a Generative Tool. However, important generative aspects are being processed and the ambition to reach the latent need level is still high, but with the possible outcome that this is not feasible without using the ‘collage-aspect’.

**User-centered Tools**

The second major source where characteristics for Pilot-tool one are originated from is Professor Eric von Hippel. He is specialized in research related to the nature and economics of distributed and open innovation. He also develops and teaches about practical methods that individuals, open user communities, and firms can apply to improve their product and service development processes (Eric von Hippel’s Homepage, 2012)

Two articles of him describe how user toolkits can contribute to innovation as a means of transferring need-related aspects of product and service development to users of those. (Hippel, 2001 and Hippel & Katz, 2002)

His research area is so far focused on custom industrial products and services, but he proposes as well that user-centered tools will eventually be valuable product development methods for all product types characterized by heterogeneous user demand (Hippel & Katz, 2002). And that is why this source is chosen to be a valuable contribution for the development of The Tool that is expected to transfer need-related aspects of the brief for an office work environment to the office user. The characteristics of The Tool itself can be transferred, even if the product is different; it has the same major attribute; it is heterogeneous.

Von Hippel states that an effective toolkit for user innovation will enable five important objectives (Hippel, 2001);
- Make needed information available for the user to carry out their tasks effectively.
- Offer a solution space to the user.
- Enable users to carry out complete cycles of trial-and-error-learning.
- The Tool must be user-friendly in the sense that users do not need to engage much additional training to use them competently.
- It will contain libraries of commonly used modules that the user can incorporate into his or her custom design – thus allowing the user to focus his or her design efforts on the truly unique elements of that design.
These characteristics translated into Pilot-tool one, result in the following features:

<table>
<thead>
<tr>
<th>1. Information</th>
<th>The participant first hears an introduction about the building and the floor-plan. General components like the entrance, the emergency exit, the location of the toilets and the windows are explained. The grid may or may not be used; that is up to the user.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Building properties,</strong>&lt;br&gt;<strong>Use of the grid</strong></td>
<td></td>
</tr>
<tr>
<td><strong>2. Solution Space</strong></td>
<td>The solution space for this task and within this tool lies within placing the available objects. These are desks, larger desks, square desks, conference tables, sofa’s, seats, coffee machines, beamer screens, whiteboards and some undefined objects. The user is also able to create his or her self-designed objects with the post-its and the scissors. A pencil is handed out to mark or write down anything the user wants, on the floor-plan itself or on the objects / post-its. Things that the user can not have any influence on are the position of the entrance, emergency exit, windows and walls. These aspects form the solution space where in the participant is free to create any solution he wants.</td>
</tr>
<tr>
<td><strong>Placing objects,</strong>&lt;br&gt;<strong>Creating objects,</strong>&lt;br&gt;<strong>Fixed layout,</strong></td>
<td></td>
</tr>
<tr>
<td><strong>3. Trial-and-error-learning</strong></td>
<td>This attribute in The Tool is partly fulfilled by time-tags and partly by personal steering in words. When the floor-plan is filled with objects and the user seems satisfied, the user will be asked to indicate how much time he or she is working in every space/at every object by placing ‘time tags’ in the model. The goal of this task is to let the user rethink his or her activities during the day and possibly make last changes to the floor-plan.</td>
</tr>
<tr>
<td><strong>Time-tags,</strong>&lt;br&gt;<strong>Human steering</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4. “User-friendly”</strong></td>
<td>With colors, a legend, human steering and a grid consisting of a dotted line, the “user-friendliness” is tried to increase. The use of a physical model for performing the tasks makes it easy to understand and the user does not need additional training in how to use The Toolkit itself. Computer design-programs are not used in this first experiment for enhancing the easiness of use.</td>
</tr>
<tr>
<td><strong>Legend, grid &amp; colors, human steering</strong></td>
<td></td>
</tr>
<tr>
<td><strong>5. Modules</strong></td>
<td>The objects are a collection of commonly used objects in offices. The user is asked to indicate where the objects must be positioned for an optimal work environment, but he or she will not be asked to design the quality of the desk or the sofa. This creates the opportunity for the user to focus on the position and functionalty of the objects, instead of on the objects itself. However, if the user thinks this is of such an importance for his or her work environment that the objects have to be changed, this is possible by using the scissors, post-its or pencil. In this way the user can indicate what is most important for him or her in the work environment</td>
</tr>
<tr>
<td><strong>Desks, larger desks, square desks, conference tables, sofa’s, seats, coffee-machines, beamer screens, whiteboards</strong></td>
<td></td>
</tr>
</tbody>
</table>
and focus on the unique elements of it.

Tool context – test-case

For creating an underground where the participants can work on, an existing building from a Full Service Office Concept Company is used. This company is called DOC-work and so far they are settled in Breda and Den Haag. The director Paul Weenink gave me the opportunity to contact users of the building in Breda and let them participate in my experiments.

The building of DOC-work Breda lies in the centre of the city, near the central station. The second floor was renovated in the end of 2011 and has typical small rooms as private offices (Appendix B). However for The Tool, the second floor will be shown in an empty layout, there is no division in rooms and there are no walls within the space itself. The facades lie on one ‘busy’ side; that is where much pedestrian and bicycle traffic is. And one ‘quiet’ side; that is an alley-like street where almost no traffic is.

The users of DOC-work in Breda are mainly self-employed or employees of a small firm (up to 4 employees). That is where the role description is based on. The choice for Office Manager as the role of the participant comes from a small oral survey in my environment where I asked people what function they can easily imagine in. I wanted one function in order to be able to compare results. That is why the role of Office Manager was chosen.

Tool objects - Office Design

Now decisions about the context and the usability are made, thus decisions about what objects will be pre-selected are made. In order to make an informed decision, a concise overview of typically used office furniture is needed. Three sources are of influence for this; the dissertation of Juriaan van Meel (2000), an interview with the owner of Offices For You (Taminiau, 2012: Appendix P) and my own experience in small scale offices an my background in office design. The following table shows what items come from what source:

<p>| The possibility for connecting a second smaller desk right-angled to the standard desk. | The dissertation of Juriaan van Meel (2000); The European Office, where he extensively investigates the relationship between office design and the national context. He describes a lot of examples where I got my inspiration for the scale office furniture objects for Pilot-tool 1 from. |
| The size of the green ‘undefined objects’ that are so dimensioned that they can serve as a chest of drawers under the desk or as regular cabinets. | The use of frequently used office furniture by OFY (Offices For You), which is just like DOC-work |
| The standard desks with measurements of 0,8x1,60m. | |
| The square desks with | |</p>
<table>
<thead>
<tr>
<th>measurements 1,4x1,4m.</th>
<th>another concept for a full service office (Taminiau, 2012).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference table with six chairs and possibility for putting two more chairs at the table.</td>
<td>My own experience in small scale offices. The choice for the role description of an office with four employees asks for certain meeting capabilities, of which conference tables. The measurements for these tables are reasoned from my own experience of working in an office with 4 and 6 employees.</td>
</tr>
<tr>
<td>Square meeting table with four chairs and possibility for putting extra chairs at the corners of the table.</td>
<td></td>
</tr>
<tr>
<td>A whiteboard</td>
<td></td>
</tr>
<tr>
<td>A beamer screen</td>
<td></td>
</tr>
<tr>
<td>Sofa’s &amp; Chairs</td>
<td></td>
</tr>
<tr>
<td>Coffee Machine</td>
<td></td>
</tr>
</tbody>
</table>

To conclude this paragraph it can be said that this first generation tool can be seen as a Generative Tool, mainly because the needed presence of human steering.

4.2 The Tool vs. The Experiments

In this paragraph, the observations of the experiments are discussed, followed by the adaptations in The Tool that are made, based upon these observations. Note that this paragraph will not discuss the results concerning the potential output of The Tool (§ 5.2 does), but only that of the usability and desirability of The Tool.

4.2.1 Experiment One

In experiment one, ten participants were tested on Pilot-tool 1. These people had very diverse professions, though all have had experience in the use of office environments in their past. Some changes were made after every test, but globally the tests were as follows:

*The participant is asked to read the role description. After reading he/she gets a spoken introduction by me about the characteristics of the floor plan and the building. It is very clearly told that questions are welcome during the whole test and that thinking aloud is desirable. After this introduction, the participant is asked to start with creating his or her ideal layout for a work environment. During the moves that the participant makes, I ask why certain decisions are made and sometimes if other possibilities (I show examples) are an option as well.*

For investigating the usability (understandable) and the desirability (wanted), close observation of the participant with The Tool and the human steering was required. An overview of the observations with all the results can be found in Appendix C. These observations were analyzed and made decisions upon about deleting, keeping and adding features / items to The Tool. These decisions are summarized in table 4.1 below.
<table>
<thead>
<tr>
<th>Deleted features / items</th>
<th>Kept (strong) features / items</th>
<th>Added features / items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-tags</td>
<td>All defined items</td>
<td>Pictures of the context</td>
</tr>
<tr>
<td>Hierarchy in the grid</td>
<td>The presence of undefined items</td>
<td>Walls placing (three options)</td>
</tr>
<tr>
<td>Role description of Office Manager</td>
<td></td>
<td>Interaction with computer</td>
</tr>
</tbody>
</table>

**Table 4.1: Adaptations to pilot-tool 1 into pilot-tool 2**

**Time tags (deleted) vs. Simulation of situations (added)**

The intention of the time tags was to let people rethink about their choices. However, only one participant (1.5) changed the layout after the time tags task, so it did not have the effect I was hoping for. It was also a little confusing in what detail the time tags had to be placed, see for example the quote of participant 1.2 below:

> “I see the smallest timetag is ½ hour; but that is not what I spend on the toilet. How shall I solve this? I guess it is included in the time that I spend at the coffee machine.” (Participant 1.2 – Film2: 07:45)

That is why this task of time tagging was deleted, but a simulation of a situation at the end was added to reach the desired effect. The image on the right shows how this is realized in The Tool. A top view person is added to the layout. When the participant thinks he / she is finished, I drag the small person over the layout and through the created spaces. The participant will see a simulation of the use of the space. In experiment one this was verbally performed. See quotation below:

> Me: “So when people enter the floor here, what happens then?” Participant: “People will immediately feel comfortable and they walk into the space where the coffee machine and the break area are; it is very informal.” (Participant 1.7 – Film1: 16:36)

**Hierarchy in the grid (deleted)**

7/10 participants had problems with using the hierarchal grid that was dotted on the plan. It was hard for them to decide whether to hold on to the grid or ignore it. Only 3/10 indicated that it was easy and pleasant to use. That is why also this feature is deleted and a non-hierarchal grid is added.

> Participant: “It seems to me that this is going to be the hallway…” Me: “The brown or the black gridline?” Participant: “Euhm, I don’t really know, the black one is too narrow I guess.” (Participant 1.7 – Film1: 09:52)
Role description (deleted)
During the tests it was remarkable that the participants found it hard to imagine themselves in the role of an Office Manager. The background of the participant was always visible in the choices he or she made. For example participant 1.2, who has five real estate brokerage offices, made a remarkable layout. He was thinking from a real estate broker perspective; he continuously repeated that efficiency and rental income was very important. That is why he made four separated office-rooms. This and same type of choices from the participants, for example the quotation of participant 1.1 below, made me conclude that the role description only worked disturbing instead of supporting. People can make easier and more reliable choices based on their own background and function.

"That depends on what kind of firm you have; in some firms you are much working outside the building and in others you stay inside all day." (Participant 1.1 – Film2: 07:30)

Kept items and added items
Logically all defined items were used by most participants; what they get is what they use. However, two items were several times asked for by participants. A self-made kitchenette was placed five out of ten times and I suggested a fridge to some participants but it was not always placed. It seemed interesting to see if people would actually place it if a predefined fridge would be added to the items, or if they would still choose not to use it. That is why a kitchenette and a fridge are added to the items-collection. The use of undefined items proved to be successful, because all participants used them in different ways. Also the option of post-its and scissors proved its success; six out of ten participants used it to create items that were not in the standard or undefined items collection.

Pictures of the context (added)
Already after participant 1.1 I decided to add an oral description about the surroundings of the building. And after that I observed that many participants made choices based upon this valuable information; activities were deliberately placed at the ‘quiet’ or the ‘busy’ side of the building. Participants also asked for the view, so adding pictures of the context was a logical decision for pilot-tool 2.

Participant: “Now I know what kind of streets are on both side of the building, but what is the view from the windows?” (Participant 1.3 – Film1: 03:38)
Walls placing (added)
The undefined objects were mainly used to indicate some sort of separation between spaces. My conclusion to that was to add the option of placing walls in pilot-tool 2 as well, with the choice between transparent, semi-transparent and closed walls. Afterwards, this was not a good decision, but that will be explained in the following paragraph (4.2.2).

Tags: Shared-Space & Private-Space & Colleagues (added)
During the tests with the participant I asked them to indicate if the spaces they created were shared with other tenants or private and only for their own use. To take away some human steering, this can be done in pilot-tool 2 by placing tags in the spaces with “SS” (Shared Space) and “PS” (Private Space). A second tag-task is to place colleague-tags that are working in the same space or separate from the participants’ place. Think about an example of the director and the secretary; often they are placed separate from each other, but an assumption can also be that placing them together in one space is more effective.

“As the office manager I want the same desk as the others and to sit mingled with the others, especially when it is with my boss.” (Participant 1.9 – Film1: 13:37)

Thus, tags of colleagues are added to pilot-tool 2 as well; “SP” (Same Position), “PE” (Project Employee), “Admin” (Administration), “HP” (Higher Position) and “ME” (Myself).

Interaction with the computer (added)
A general conclusion of experiment one, was that participants feel comfortable with a physical model and items; it makes it easy to imagine themselves in certain situations. That is why I decided it is all the more important to observe the interaction with a computer. People are so much more used to work on a screen then five or ten or fifteen years ago; this made it hard for me to estimate the difficulty of working on and from a screen. That is why I decided to use the program Adobe Illustrator for Pilot-tool two. With the options of locking layers and the fact that I could help the participant any time with the operation of the program made it a workable solution for experiment two.

Figure 4.5 shows the start-screen of Pilot-tool two:
Other observations / findings

Seven out of ten participants had a hard time in making the first step of the task; it took them more than three minutes. This made clear that people do need some time for making themselves comfortable with the task. This is not something to hurry or speed up; it helps them to get a grip on the task. However, the possibility for questions at me created sometimes more details than necessary for the task. Look at the example of participant 1.10; he keeps asking things, and this is just a fragment.

“So I only have to make the layout for myself, including the seats and sofa’s etc? Not for the other tenants right? .... And what is North? So this is east? Uhm... what is this? Alright so now I can craft something...” (Participant 1.10 – Film1: 05:09-06:10)

In the first experiment I was tended to answer all questions, but for experiment two this level of detail when participants keep asking is taken into account.

The potential of input from office users

An interesting observation in experiment one was that the results from all these participants are very different than the current situation in the DOC-work building in Breda. None of the participants made private personal office spaces,
which contradicts very much with the current situation (Appendix B). After feedback of this data to the director Paul Weenink from DOC-work, his feelings were mixed. On one side he was glad to finally know what office users actually want; on the other hand he was not happy, because he just did a large renovation and transformed the floor into separate one desk-office spaces; a solution that none of experiment one’s participants has created.

4.2.2 Experiment Two

In experiment two, again ten participants were tested, but now on the second generation tool. Four of these people were direct users of the current floor plan that was used as the context in pilot-tool one; clients of DOC-work. For me and the director of DOC-work it was interesting to see how these users would make a layout for a building that they were not using and if the outcomes would be comparable with the current situation of DOC-work in Breda (experiment one proved the opposite). The other six participants were people with different backgrounds and all have at least some experience in office environments.

The tests of experiment two looked as follows:

The participant is asked to read a task description on the computer screen (Appendix E). After reading he/she gets a spoken introduction by me about the characteristics of the floor plan and the building. Also the main operations of the computer program (Adobe Illustrator) are explained. It is very clearly told that questions are welcome during the test and thinking aloud is desirable. After this introduction, the participant is asked to start with creating his or her ideal layout for a work environment in the computer program. During the moves that the participant makes, I ask why certain decisions are made and if other possibilities (I name examples) are an option as well.

So the human steering was still present in order to clarify what steering should be transformed into computer steering and again the focus of observing was on the features in The Tool that would make it usable and desirable. A change in human steering was that not all questions were answered anymore; the level of context knowledge should not be too detailed because this is risky for keeping an overview of the overall task. An overview of the observations with all the results can be found in Appendix D. These observations are analyzed and made decisions upon about deleting, keeping and adding features or items for pilot-tool three. These decisions are summarized in table 4.2.

<table>
<thead>
<tr>
<th>Deleted features / items</th>
<th>Kept (strong) features / items</th>
<th>Added features / items</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Undefined items</td>
<td>The option to drag created spaces as a whole over the floor-plan (replacement of human steering)</td>
</tr>
<tr>
<td>Defined items</td>
<td></td>
<td>The option to indicate what function one created space has and if that particular space has a second and possibly a third function (replacement of human steering)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A clear Roadmap that indicates certain steps that can be taken (replacement of human steering)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rotating, Moving and Transforming the objects is now possible with only using the mouse (not the keyboard). (replacement of human steering)</td>
</tr>
</tbody>
</table>

*Table 4.2: Adaptations to pilot-tool two for processing in pilot-tool three*
None deleted items
Deliberately I chose not to delete any features or items, because I wanted the experts in the expert meeting to respond on the items that could possibly be removed. Those were the option to place walls and the colleague tags. The option of placing walls made participants ask for more (doors, what is ‘semi-transparent’? etc.). Read the following example:

ME: “So this is a completely open space?” Participant: “Oh no no, this should be closed here (pointing) and there should be a door.” (Participant 2.3 – Film1: 23:41)

The colleague tags were not effective, because of two reasons. A company of only four persons does not have that many differences in functions of colleagues and most participants did not really think it was important to give colleagues a fixed desk. As a matter of fact, no participant placed these tags in experiment two. Yet these two items will be discussed in the expert meeting (§4.3).

Drag spaces as a whole (added)
Remarkable during this experiment was that participants had a hard time in selecting all furniture of one space to move it to another space on the floor plan; it seemed too much of a hassle.

“Can I select everything at the same time? Because I want to move it just a little to the right.” (Participant 2.7 – Film1: 17:30)

That is why this option is added; it must be possible to drag one space/function with its’ belonging furniture over the floor plan. When this is more accessible and easy for the participant it will probably deliver more well thought and thus reliable results.

Indicate functions (added)
To know what activities will take place in different spaces, I asked for the function of the spaces during the tests in experiment two. Trying to take all human steering away, in pilot tool three it is now possible to formulate the function and when applicable second and third functions (e.g. when the meeting room will also be used to have lunch).

Roadmap (added)
Participants found it hard to start the task of making the layout for their ideal work environment. Some did not know where to start and indicated that some kind of map would help in making this decision. That is why at the bottom of the screen of pilot-tool three, the steps are marked by using an icon. Previous made decisions are always reversible by going back to the previous step by clicking on the icon.

Improved objects transformation options (added)
Participants often asked me to transform the objects that they used. The interface for transforming, dragging or deleting the object was not very ‘friendly’ in the program Adobe Illustrator. Thus in the third generation tool, this will be made easier by using icons, copied from www.wenswonen.nl, where people can digitally furnish their future homes (figure 4.6).

Figure 4.6: A screenshot of the digital tool from Heijmans: wenswonen.nl
Figure 4.7 shows the start-screen of Pilot-tool three, but there is a complete flowchart of The Tool that can be found in Appendix F; it contains a ‘screen-shot’ of all the steps that can be passed through. This flowchart is also presented to the experts.

4.2.3 Experiment Three

The last important aspect that was missing for developing a tool that could be spread through the internet to the crowd was the independence of human steering. The previous experiments were both performed with intensive steering from the researcher. For testing its independent capability, the human steering should be removed to see if The Tool can be individually used by participants. Since there were no resources for actually developing The Tool as a working software program, some human steering was still needed in the last experiment. The last experiment looked as follows:

The first screenshot of The Tool is opened on the computer screen. The participant is asked to read and to say what steps he/she would take if The Tool would be a working software program. The only action that the researcher fulfills is showing the following screenshot and copy-pasting the created lay-outs from one screenshot in the following screenshot. The participant is asked to think aloud, so possible misunderstandings or ambiguities are observed by the researcher.

In this way, the flaws in the usability of The Tool can be discovered and improved. Because only the usability is tested, two test persons were sufficient to see the main flaws. Mostly extra explanation about the task to fulfill per step
was needed and some aspects needed clarification. For example the meaning of the ‘employee chairs’ that had to be placed were not clear.

“The employee chairs are more comfortable chairs for the employee and the other chairs are just simple chairs at a table right?” (Participant 3.1 - Film 3: 13:11)

This is what the first participant thought, but in fact there is no quality difference between the chairs indicated by The Tool. That is why explanation is added at this step of The Tool. The final flowchart of The Tool, where all steps are explained by means of pretended screenshots can be found in Appendix L.

4.3 The Tool vs. The Experts

The final step in developing The Tool is the set-up of an expert meeting. Two main items are discussed in the meeting (output & The Tool), but in this paragraph the focus lies on the last; development of The Tool. For obtaining useful results, a broad compilation of experts is put together.

4.3.1 The Expert Meeting – 10.04.2012

The following experts were present in the meeting:

- **Ton van Oosten**  
  Partner & Developer at COD
- **Gert-Wim Bos**  
  Developer at COD
- **Paul Weenink**  
  Director DOC-work
- **Annelies Wisse**  
  Interaction Designer at NorthernLight
- **Thomas Zwart**  
  Founder of kantoorplanner.nl
- **Derick Mekking**  
  Senior Associate at Favela Fabric
- **Margot Hoogendoorn**  
  Founder of Jade Jackets

The only expert that had planned to be there, but could not make it, was Quiel Beekman, she is a User Participation Designer at 4Building. Especially for the appearance and operation of The Tool, her expertise is valuable. That is why a separate meeting with her has taken place (see §4.3.2). The other experts were prepared with help of a briefing (Appendix G) that they got one week in advance, containing a short personal description about what focus point they were expected to have from their expertise.

The meeting took one and a half hour in total; I gave a short presentation about Pilot-tool three and after that discussed the operation and the output of The Tool. In this paragraph only the operation of The Tool and the expert’s contributions are discussed. These are arranged in the following topics:

**Context**
All experts stipulated that the surroundings of the building were of highest importance. However, for The Tool it is possible to generalize these characteristics, thus in stead of showing the participant a real-life picture, it could be described (e.g. Wide view and Busy street).

**Walls**
Experts confirmed my doubt about letting participants placing walls; this should be removed. The value of office users, who are not professionals in designing, is not in playing the architect and placing walls in a justified manner.
Colleague tags
Also removing the colleague tags was being confirmed by the experts; currently it is not that valuable to know who works where. Only when a firm has a defined hierarchy it can be interesting to know. However, the ‘ME’ tag is important to see what desk/place is preferred above others and considered from their specific function. On the other hand it is hard to judge whether participants place the ‘ME’-tag because it belongs to one of the tasks, or whether they place it because they truly prefer one desk above another. This stays a point of discussion for more decisions that participants make and so far it is not possible to filter these decisions 100%.

The Why
Annelies Wisse (interaction designer) emphasized that she finds it more important why people make the decisions that they make. That can be solved by using ‘pop-ups’ that ask the participant why they place the object where they place it.

Roadmap
The sequence of choosing what to do first must not have a clear sequence; this must be the ‘free’ choice of the participant. In that way, it is easier to observe what the participant thinks is most important and thus places first in the layout.

The changes that must be made to pilot-tool three into the fourth (and last) generation tool are summed up in the table in paragraph 4.3.2.

4.3.2 Separate meeting with Quiel Beekman – 18.04.2012

Quiel Beekman
User Participation Designer at 4Building.

Unfortunately she was not able to come to the Expert Meeting, so a private appointment was scheduled with her at the office of 4Building. She is a User Participation Designer and experienced in the development of ‘hands-on’ tools that help to inform the latent needs of users in building projects.

In the session that we had, I showed her the flowchart of Pilot-Tool three and we discussed its usability and effectiveness. Since she is experienced in uncovering the latent needs of participants, this was an important focus point during the conversation. There were a couple of remarkable outcomes in this meeting:
- Quiel directly pointed out that the specific relations between spaces are easier to find out when asking it to the participants in a different, rougher, form and leaving the drawing of a floor-plan omitted in first instance. She showed an example of circles, where every circle had its own activity, and where the participant was asked to place these circles in the correct relation to each other. Because of the schematic appearance, participants feel immediately more comfortable with the layout and the understanding of circles is easier than the drawing of a floor-plan.
- Another tip that she gave was about the profile of the participants. She thinks that only giving the sector, function, age and gender is not enough for understanding the latent needs. However, for The Tool, this is not the direct goal. The information why they do the things that they do is interesting and certainly important when designing the brief, but that falls under the task of direct user participation. After discussing for a while, Quiel agreed that this kind of information is hard to capture by a digital Tool and it must be excluded in the goal of this research.
- The regular way of working when letting users participate in a building project at 4Building is first to uncover their latent needs, desires and
activities and after that trying to determine the design requirements for the building. As I emphasized earlier, also Quiel stated that the task of user participation is not in the field of actually designing solutions, that is still the task of the architect. To repeat Peña and Parshall (2001); Programming is Problem Seeking, designing is Problem Solving. User Participation, what 4Building does and User contribution, what I do, both fall under the denominator of Problem Seeking.

Adaptations in Pilot-Tool 4
The points above will be processed, or with a specific reason not be processed, in Pilot-Tool four:

- The Tool will start with activity-circles that can be placed in one large circle. See figure 4.8 for an example. When adding this task as first step, activities within the work-environment need to be established. These activities will be established by the participants themselves. This helps to ensure their commitment and the completeness of the final result.
- Adding characteristics of the building can help the participants to make decisions. Characteristics are ‘Wide Water View’, ‘City View’, ‘Busy traffic side’, ‘Quiet street’. These are based on the observations of the considerations of participants in the experiments and on my background knowledge from my study.

Table 4.3 below shows the deleted features / items and the kept (strong) features / items and the added features / items for the fourth and last generation tool.

<table>
<thead>
<tr>
<th>Deleted features / items</th>
<th>Kept (strong) features / items</th>
<th>Added features / items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walls</td>
<td>Undefined items</td>
<td>Start with activity circles</td>
</tr>
<tr>
<td>Colleague tags</td>
<td>Defined items</td>
<td>Description of context instead of pictures</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Some pop-ups after several actions; to find out the ‘WHY’</td>
</tr>
</tbody>
</table>

Table 4.3: The deleted, kept and added features / items for the final tool

4.4 The Final Tool

In Appendix L is the flowchart of the final tool illustrated. In this paragraph are the different steps described with attention to the specific tasks within every step. It is a summary of the results that are discussed in the previous paragraphs.

Step 1: Activity circles
In this step the people get an overview of what activities actually come along with their job and for what activities they should create a layout
after this step. There are some predefined activities and some empty circles that can be defined by the participants themselves. It is up to the participant what circles he / she will use in the large circle with the characteristics ‘Wide Water View’, ‘City View’, ‘Busy traffic side’ and ‘Quiet street’ along the sides.

**Step 2: Information**
The task is explained, information about the building is given and characteristics of the participants are asked in this step. Information is given about the size of the space; not exact measurements, but the indication that it is large and that the participant should zoom in on the location he/she wants to be located. It is on the third floor, so noise from outside can be ignored; taking away this constraint makes it easier for the participant to decide. Besides, aspects like these need to be decided upon by experts. The columns in the drawing are explained not to be neglected and at last the presence of other tenants is announced. Participants do not have to create spaces for them, but the option of sharing spaces is given. Participants must create an optimal layout for four persons.
The number of four colleagues is large enough to obtain information about the amount of people working together in one space and small enough to keep it clear for the participant. In chapter five this number of four is explained more extensively.

**Step 3: Furniture**
In this step the participant is asked to place furniture in the given layout of the building. While placing the furniture he / she can parallel think about the activities that were defined in the first step.
This *furniture* step is closely linked to the *Spaces* step (4); when participants place furniture, The Tool spaces from combinations of furniture (See figure 4.9). With the + button (red circled) the participant can in- or exclude a piece of furniture in the created space.

**Step 4: Spaces**
The established spaces in the previous step get a name in this step. The spaces need to be defined by the participants by naming them after different functions. There are five functions predefined (extracted from the experiments) and the participant can fill in other functions as well. The spaces can have three functions at the same time.

When the participant creates the *workspace* the question of working at home will pop-up. The
participant has the choice between most of the day, only a little, 50/50 or not at all. This question is useful for the final output that The Tool needs to deliver; explained in chapter five.

Also in this step, the spaces that are created with the furniture in the previous step can be dragged over the floor plan as a whole. With this step the participant refers back to the very first step wherein he/she had to establish activities. It can be considered again whether placing one space next to the busy traffic side or yet the quiet side. A pop-up asks why functions are specifically placed on the chosen location. Another pop-up asks if the created space is Open, Closed or Semi-closed. Semi-closed can be understood as storage closets for example.

**Step 5: Tags**
In this step the participant must place tags in the created spaces with SS or PS. This indicates whether a space is solely for the organization of the participant (PS: Private Space) or shared with other tenants (SS: Shared Space). The participant can decide that a shared space saves money. This is not a reminder that is literally given in The Tool, because participants will than focus on the money-issue, which is not the aim of The Tool. Also the ME-tag must be placed; this is to indicate where the participant’s place is.

**Step 6: Simulation**
The simulation of a visiting client was successful during the experiments. That is why the simulation definitely should be included. The other simulations are more reminders about activities that can take place. The Light incidence simulation (figure 4.10) is to make people aware of the effects of large and small windows and the corresponding light incidence. More simulations can be added.

![Figure 4.10: An example of how the simulation of light incidence can be illustrated.](image)

The final tool forms a complete whole where office users are expected to easily interact with. The close observation in the experiments has step by step led to this last generation tool. Participants had fun to use it and the interaction with the digital tool (Human Computer Interaction) reached a level where the majority of participants can use The Tool without spending much time on the operation of The Tool itself.
The output of The Tool can also deliver useful input for the brief; how this output has been achieved is described in the following chapter five.
5. Output of The Tool

In the previous chapters we have seen the final flowchart for The Tool. In this chapter will be discussed what The Tool does and how it functions. This will be done by reflecting upon the steps of Peña and Parshall (2001), earlier mentioned in Chapter three: Uncovering and testing CONCEPTS and determining the NEEDS. From the created CONCEPTS, the useful constraints can be deduced and from the stated NEEDS, the useful requirements can be deduced. In this chapter is repeated what output levels were intended to obtain, what levels have been obtained in the experiments and what levels are to be obtained by means of the final tool. And not of least importance how these levels are obtained and that at the same time forms the answer to sub-question two:

2. How can you recognize these preferences by means of a Digital Tool?

To recap: the CONSTRAINTS and the REQUIREMENTS are the two areas where users are expected to have valuable input on. The constraints stand for Density, Service Grouping, Activity Grouping, Relationships, Neighbors, Flexibility, Tolerance and Home Base of the created spaces. The requirements stand for detailed information about those spaces; exact measurements of spaces and area requirements for each activity.

During the experiments the participants are tested on their ability and their willingness of contributing to these constraints and requirements. The Tool was especially designed for this output, so the fact that these constraints and requirements were produced is not surprising. However, the question is if the outcomes are usable (do users have the ability to realistically form this output?). This will be discussed in §5.2. Further a byproduct arose on the GOALS-level of the Problem Seeking Method (Peña and Parshall, 2001). Users stated WHAT they wanted and WHY they wanted it. The reason for this is that The Tool is based on theories about generative techniques (discussed in §4.1). This output-level will be discussed below in §5.1.

Finally, the output levels that are obtained are discussed in an expert meeting and judged whether the output is realistic and feasible. Realistic stands for the extent to which users can give a reasonable contribution to the components of the brief. The requirements seemed on the measurement-level not realistic, thus deleted as a potential output level of The Tool. On the objects-level, the requirements were realistic to let a user judge upon, thus included. Feasible stands for the extent to which The Tool itself is capable to deliver the requested output. The Goals/Generative Output turned out to be not feasible within the scope of the final Tool, thus deleted. The constraints of spaces are realistic and feasible, however not all eight constraints that are stated in chapter three receptive for office user input (Density, Service Grouping, Activity Grouping, Relationships, Neighbors, Flexibility, tolerance and Home base). Extended explanation can be found in §5.3. As a recap and to summarize, the final potential of The Tool is described in §5.4.
5.1 Goals / Generative output-level

The first level of output, of which the background theory is explained in § 4.1, is in fact a byproduct of this research; it is valuable information when it can be obtained in a building project, thus not to be neglected. It connects to the generative techniques that are partially applied for designing the digital tool. While doing the experiments, I continuously asked the participants why they made the choices for certain moves. This has delivered interesting results for the WHY-question: It contributed to the GOALS-step of the Problem Seeking Method (Peña and Parshall, 2001). For example that the participant places his desk facing the window, not because of the nice view, but because he will not be distracted by the other employees that work in the same space by not facing them. Those considerations are important for an architect to know, because he does not have to fill in the ‘missing information’ himself anymore. He can design a long wall where the office users all face the wall instead of each other; this gives a complete different image and more possibilities than trying to face every workplace with a view outside a window. The GOAL here can for example be formulated as: office users need little distraction from other users.

The reasoning behind the choices of users is the key obtainable knowledge when using generative techniques.

During the experiments it was an unintended benefit to find out that The Tool could deliver this sort of information. This is actually direct user information and not the original aim to gather, but it was highly interesting and potentially useful as well. However, when finding out that the main attribute providing this kind of information was the human steering during the experiments, the expectation of obtaining this knowledge with a digital tool dashed. The human steering is ‘taken away’ in the final flow-chart of The Tool; the level of generative output has disappeared more and more during the development of The Tool, because the human steering is tried to be replaced by computer steering. For some steering this has succeeded (see §5.2), but not enough to obtain the complete GOALS / generative output level. Establishing GOALS (=generative information) turned out to be intensive on the field of human to human interaction. That is one of the features that The Tool does not have anymore after the experiments, because it needs to be dispersible through the internet.

To conclude this paragraph: The experiments have shown that Pilot-tool one and two (those were tested by participants) can be used as generative tools, provided that human steering is present.
5.2 Constraints output-level

In the experiments there was a double focus; on the one hand to observe how The Tool was being used and what decisions had to be made for the appearance and for operating The Tool as optimal as possible (Subject of chapter four). On the other hand to observe what output-levels users can produce and on what aspects they want to exert influence on (Subject of chapter five). Paragraph 5.1 already described the goals / generative output level. This proves to be a valuable byproduct. Another output-level, intended this time, was that of the space constraints. To recap: chapter three has described the following constraints that users are expected to have reliable influence on:

A. Density
B. Service Grouping
C. Activity Grouping
D. Relationships
E. Neighbors
F. Flexibility
G. Tolerance
H. Home Base

Those will be discussed one by one, involving the user input that was delivered during the experiments. Per constraint it is indicated whether those are being captured by The Tool or not. We use this sign for ‘captured’ and for ‘not captured’.

If captured, the method how this information is captured is described behind the HOW – sign.

| A. Density (4 of 24) | During the experiments it was not hard to find out the density of a space; participants thought out loud and if this was not clear yet, I asked them for more information. Often the question “Are you all together working in one room, or does a wall or object separate you from each other?” resulted in ‘rethinking’ of the participant and sometimes changes in the plan. This means that in The Tool they must get an option that makes them extra aware of the fact that their colleagues are in the same space, or separated from them. Combining this with the output that needs to be processed to gain usable results; different objects are designed for in The Tool. The density for a space will be determined as follows: Per space the chairs are counted that are placed for the employees. Desks will not be used for this because those can have a double function. Double functions of chairs are discarded by separate chairs for visitors or other use. This is visible in the figure on the left. There is a maximum of four ‘employee chairs’, thus there can not be a misunderstanding of placing too many ‘employee chairs’. |
| B. Service Grouping (5 of 24) | To know if a service is integrated in another space or separately placed in a space, can only be known if a separate space is created and indicated as a 2nd and possible 3rd function. However, this function must than be formulated as |
a service. Within the design of this tool, services that are given are storage and coffee machines. Participants have the possibility to add self-designed services, but it is hard to captivate whether those are grouped in one space or not. The experiments indicated that not many participants have put a strong focus on these supporting spaces. Most of them took for granted that the basic supporting services were available anyway. For example only two out of 22 participants placed a copy machine.

C. Activity Grouping (6 of 24)

The techniques that Sanders used in the architecture sector so far began most of the times with defining activities (Stappers, 2010). Also the techniques that Quiel Beekman uses at 4Building (see §4.3.2) begin with defining activities. However, during the experiments the first step began immediately with the floor plan of a building. Experiment one contained a list of activities for the office manager, so participants could look back to these activities and make decisions about the practical influences. Experiment two was argued from their own experience, function and sector; they had to define their activities themselves. This was just verbally performed, not processed in The Tool yet.

The final Tool does ask for the users’ work activities. This is one of the steps. In experiment one it was the first step to think about the activities, only the difference was that those were already formulated in the role description. The activities do play a role in the final output; although is it foremost helps the participant to create a complete plan. What I have seen during the experiments is that participants than began to think about the spaces in the grouping of activities. However, it seems too hard to capture this grouping of activities with only The Tool (without human steering). That is why this specific grouping does not form output of The Tool.

D. Relationships (9 of 24)

The 22 participants of the experiments all made a certain layout for their ideal work environment. In the results (Appendices C&D), it is visible that some results have the same characteristics concerning the relation with the surroundings. For instance participants 1.1 to 1.5 and 1.8 all placed their workspaces on the ‘quiet side’ of the building. Five out of six clarified this was a conscious choice for the purpose of concentration during work-activities. The fact that the participants placed the workspaces here and that they did it with a reason is possible to capture with The Tool;

It can be captured by means of a pop-up (see figure on the side). The main reasons / characteristics of the building are placed in a row that can be indicated by checking the box. When the participant has another reason for placing it there, he / she can type that out. When certain reasons occur more often, those can also be adopted in the row with checker boxes. For now these options are chosen, because those reasons for deliberately placing the space somewhere occurred most in the experiments.
These are constraints concerning the relationship with the building context. There are also mutual relationships between the spaces. After doing the experiments, these relations were visualized in relation diagrams (Appendix H). An example of such a relation diagram is in figure 5.1; the relations between spaces that participant 1.4 indicated.

These diagrams were used for discovering relations between spaces that occurred at more than one participant; and that happened a lot. For example the relation between workspace and meeting space was present in seven out of ten results from experiment one. And in six out of ten results the workspace was not connected to the break area; we can expect this is related to concentrated activities (workspace) and recreation activities (break area). All the same, it suggested that users want to have influence on these aspects as well.

The results will not be processed into a diagram like in the example, but as a CONSTRAINT of the space.

* The figure (5.2) below this table shows how relations with the buildings’ attributes and with the spaces mutually are processed in an output-sheet. The sheet is filled in with the results of Participant 1.4.

Note that the deeper value of these mutual space relations is not captured by The Tool. Only when a large number of users have participated and delivered their input to The Dataset, conclusions can be drawn about the mutual relations. To compare with the building context relations: the relations with the context of the building are caught by asking the participant WHY they create the specific relation. This reason can then be included in the brief as a constraint of the space, and the architect can solve the problem with his own expertise and creativity. In contrast, when the participants create mutual relations between spaces, the importance (‘WHY’) of these relations is not captured by The Tool. Maybe it does not matter for the participant if the break-area is next to the workspace or not, but he places it there ‘by coincidence’. However, when 10.000 participants place the break-area next to the workspace, and 500 do not make this relation, it indicates that this relation is certainly important for this category user. The missing information is the WHY question here and that in fact reduces the solution space of the architect. With this information, the architect can not solve ‘the problem’ differently than creating a physical relation between these spaces, while the stated problem can possibly be solved by creating an open view between the spaces or by means of technology (intercoms or similar). That emphasizes again that input from the direct user is still important as addition to this user data.

The relations with the building’s attributes (POSITION (ON FLOOR)) are indicated by means of colors;

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange</td>
<td>Observed placement</td>
</tr>
</tbody>
</table>

The context-
characteristic is not particular the reason for placing this function here.

Blue: Choice of participant = Indicated as the reason for placing this function here on the floor.

Below the buildings’ attributes are the mutual space relations (CONNECTION OF SPACES), where the mutual relations between spaces will be indicated with two colors:

Orange: Closed connection = Connected by means of a door
Yellow: Open connection = Open space; no walls between the functions

After capturing this information in the output sheet, it can be summarized as constraints in the form of relations of every space with other spaces and with the context. One Example for the workspace of participant 1.4 (see relation diagram on the left) gives the following constraints concerning the relations with the building and the other spaces:

| Workspace: | Open connected with | Entrance
| Pantry Area | Attached to |
| Quiet side | City-view |

E. Neighbors (11 of 24)

The Tool, designed for the experiments, was based on the idea of multiple tenants; the concept of DOC-work. Especially for small companies this has many benefits, because certain spaces can be shared with other small companies or individuals.

That was one of the tasks of the participants during the experiments; to indicate whether spaces were shared with other tenants (more efficient, saves rent) or to keep spaces solely for their company (privacy and maybe more representative for clients).

In The Tool this can be done by placing tags in the spaces.

F. Flexibility (17 of 24)

As explained in Chapter three, the constraint of flexibility has two kinds: convertibility and versatility. On versatility level the participants can, and during the experiments wanted, to indicate if one space is being used for more than one function (work, meeting, break etc.).

For the convertibility the option to indicate one of the undefined objects as a flexible wall is implemented. During the experiments participants 1.2, 1.5, 1.6, 2.4, 2.6, 2.7 and 2.10 indicated they would use a flexible wall for creating more flexibility in the floor plan.

For this constraint of flexibility, two characteristics of the specific space are captivated; a possible 2nd or 3rd function and if there are flexible walls present in the space. The value of knowing if there is a flexible wall or not can be indicated...
as the level of flexibility that the participant suggests. The question WHY would be more interesting to know, but not possible to captivate with The Tool. Besides, the WHY-level of constraints can be obtained after the step of uncovering concepts (Peña and Parshall, 2001). Thus one of the constraints of a space is called ‘versatile yes/no’. In a ‘yes’ case the space has more than one function. In the case of a ‘no’ the space has just one function. The other flexibility constraint is called ‘convertible yes/no’. In case of a ‘yes’, the space contains a flexible wall. In case of a ‘no’, there is no flexible wall.

G. Tolerance (18 of 24)

The constraint of tolerance explains if one space is capable to accommodate future change of the use of space. Peña and Parshall (2001) also call it a ‘loose fit’. Expected was that the users could have an influence on this, but it appeared that only in a few cases of the experiments, the participants were able to reason about future changes. First, this is not possible to captivate with The Tool because the participants that mentioned it, did it by reasoning verbally. Second, it has been found out that the participants did not think about the future use of the spaces.

H. Home Base (8 of 24)

In the experiments there was no single participant that mentioned the subject of ‘working at home’. This shows a big contrast with the current trend of Het Nieuwe Werken (The New Way of Working) where people are sometimes feel imposed to work at home a part of the time. The sample of 22 participants is too small for drawing significant conclusions on this level, but it does indicate a potential gap between employer and employee; when employees work at home half of the time, this is cheaper for the employer. Because of this potential gap it is interesting to know, not in what form people want to work at home, but if they want to work at home at all.

In The Tool this is processed by a pop-up that appears when participants indicate that a certain space is defined as a ‘workspace’. They have four options; none of those are specified in terms of exact time / percentage, because that is hard to tell for participants (this is proven in experiment one when placing the time-tags).
### LEVEL 1

**Relations with the building and between spaces**

<table>
<thead>
<tr>
<th>POSITION (ON FLOOR)</th>
<th>Observed</th>
<th>Indicated as the placement reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Near busy street</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>Near quiet street</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>Not attached to façade</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>City view</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>Wide view</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>In a corner (with windows)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>In a corner without windows</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>Near small windows</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>Near large windows</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
<tr>
<td>Fixed to the entrance</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
</tr>
</tbody>
</table>

### CONNECTION OF SPACES

<table>
<thead>
<tr>
<th>Entrance</th>
<th>Workspace (Pu)</th>
<th>Workspace (Pr)</th>
<th>Meeting Space (Pu)</th>
<th>Meeting Space (Pr)</th>
<th>Break Area (Pu)</th>
<th>Break Area (Pr)</th>
<th>Pantry Area (Pu)</th>
<th>Pantry Area (Pr)</th>
<th>Waiting Area (Pu)</th>
<th>Waiting Area (Pr)</th>
<th>Other (Pu)</th>
<th>Other (Pr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workspace (Public)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Workspace (Private)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Meeting Space (Public)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Meeting Space (Private)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Break Area (Public)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Break Area (Private)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Pantry Area (Public)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Pantry Area (Private)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Mailbox Area (Public)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
<tr>
<td>Mailbox Area (Private)</td>
<td>Workspace (Pu)</td>
<td>Workspace (Pr)</td>
<td>Meeting Space (Pu)</td>
<td>Meeting Space (Pr)</td>
<td>Break Area (Pu)</td>
<td>Break Area (Pr)</td>
<td>Pantry Area (Pu)</td>
<td>Pantry Area (Pr)</td>
<td>Waiting Area (Pu)</td>
<td>Waiting Area (Pr)</td>
<td>Other (Pu)</td>
<td>Other (Pr)</td>
</tr>
</tbody>
</table>

Figure 5.2: Relations Output sheet (mutual and with building features)
The relations with the building that are indicated in the output sheet have the following exact meanings;

**Near busy street:** When the space is on the busy street-side of the building. It means that the view from the windows is directly on this busy side, there is no space in between the function and the window. It can be noisy from the traffic. Busy is understood as a street where much traffic is (pedestrian, bicycle and cars).

**Near quiet street:** When the space is on the quiet street-side of the building. It means that the view from the windows is directly on this quiet side, there is no space in between the function and the window. It is not noisy; there is not much traffic on this side.

Quiet is understood as a street where (almost) no traffic is.

**City-view:** The view from the window looks out on an urban surrounding. This means that there are medium to high buildings that enclose the office building and creates a so called city-view.

**Wide view:** The view from the window looks out over water, grassland or another landscape that creates a wide view.

**In a corner (with windows):** The space is placed in the corner of the floor plan where there are windows on both sides.

**In a corner without windows:** The space is placed in the corner of the floor plan where there are no windows.

**Near small windows:** The space is directly connected to small windows. Small windows are in this tool understood as 0.7m wide.

**Near large windows:** The space is directly connected to large windows. Large windows are in this tool understood as 1.5m wide.

**Fixed to entrance:** If you enter the space directly when you come through the entrance-door of the floor. (In case of connection by a second door, this will be indicated in the connection-matrix)
5.3 Requirements Output level

In this paragraph we will elaborate on the space requirements. The expectation was that users could say, without explicitly asking for it, how much space they would need for certain activities. Thus letting them design their work environments and afterwards extracting the m² from the results. However, this was harder than it looked like. For the participants it was doable to think about the objects they would need, where and how they placed those, but the mutual distances were very hard to estimate in a scale model (in all three experiments). Also efficient use of a space was hard to estimate; useless spaces have appeared often. Below are some examples of results from participants who had troubles with measurement estimations:

Participant 1.5 created this break area. There is not enough space to take a seat on the chairs: the table is in the way. Also the storage closets behind the left chair are hard to access. It actually surprised me, because this person was an advisor for interior layouts. This indicates that even for an ‘expert’ it stays hard to estimate realistic measurements in a 2D layout.

Participant 1.6 was a light artist and she made the layout on the right. This is a good example of a non-efficient grouping of objects. She knew what objects she wanted to use, she even created extra objects with the post-its and scissors. However, the grouping of the objects is not efficient at all. There is much ‘left-over’ space.

This result shows a good example of the over-dimensioning of spaces. The participant (2.1) was a self-employed lawyer and used to work in a separate office. He indicated that most of the time he receives his customers in his own office. Nevertheless he says he needs a meeting room (which is still understandable), but the meeting room has large dimensions; 36 m². Also his break area is large; 56 m². Even after a couple of times mentioning that he was working with above average dimensions, and asking if this is his intention did not change his floor plan.

These examples reappeared with more participants in all three experiments. The conclusion can be made that letting the user decide upon exact requirements does not deliver reliable information for the brief.

However the information given by participants can give an indication about the exact requirements. And that is where former research from Center for People and Buildings can contribute to this research.
Space Typologies
This research contains pre-defined office space typologies and is from the Center for People and Buildings in Delft (van Meel et al. 2010).

Figure 5.3: Examples of office typologies (van Meel et al., 2010)

In this report eight possible constraints of an office space are discussed so far. The typologies above also possess constraints that altogether result in one or another office space typology. In the book of van Meel et al. (2010) the typologies are extensively described with picture examples and descriptions of the spaces. A tool from CfPB (Center for People and Buildings) called the PACT-tool, can link square meters and other quantifiable data to these typologies. How this tool works and how the data from this research can be linked to the PACT-tool is described below.

The PACT-Tool
Appendix I contains a promo poster (in Dutch) that shows the main features of The Tool. This Tool is in essence a calculation model that establishes the amount of needed workspaces per workspace typology. Using activities and office spaces as input, the output is the number of office spaces per typology and the square meters per space type. PACT is foremost an awareness tool for comparing different alternatives; it is not only a calculation model that establishes the amount of workspaces and its m².

Figure 5.4: The input and output for the PACT-tool

The idea behind the PACT model is that activities need to be formulated prior to establishing what spaces are needed in the building. The work process is then translated into activity-profiles with percentages of space use. The CfPB has generated basic activity-profiles from their own database. One of the two input aspects that the PACT-tool needs for generating the result can be established by using The Tool of this research (crowdcontribution); the establishment of workspace typologies.

When connecting the output data from The Tool to the typologies from Van Meel et al. (2010), and using that as the input for the PACT-tool it is possible to obtain exact requirements (Figure 5.3) for the brief. However, these are not direct established by the users of The Tool, but the users have given the input for what typologies are needed.

Figure 5.5 shows that the first step is to translate the output of The Tool into the Typologies of van Meel et al. (2010). For this translation, three aspects need to be defined.
The number of people working in one space, the fact that the space is open, enclosed or semi-enclosed, and the kind of activities (short-term, concentration, interaction etc.) that take place in the spaces are the three constraints that determine the type of space. Three sorts of spaces are distinguished:
- Workspaces (in yellow)
- Meeting spaces (in blue)
- Support spaces (in red)

Consultancy office YNNO (Jeveren, 2012) has worked with this PACT-tool and established square meters per type of space and an explanation per typology (figure 5.6). See Appendix J for the requirements of all three kinds of spaces that YNNO established. That is how for example the outcome of this tool could be linked to these requirements and on that basis quantifiable requirements can be obtained for the brief.

**Selection of Typologies**
For this research a selection of usable typologies is made, because office users do not have the ability to make decisions about spaces like ‘Circulation space’
and a ‘Mail area’ is not applicable when creating an office space for only four employees. More spaces like these are deleted; Appendix K contains the space typologies that are selected for connection with The Tool-output and some adaptations on the descriptions per space to fit them better with the task of The Tool.

**Connecting the data**

The question now is how the data of The Tool can technically be categorized into the typologies of Van Meel et al. (2010). The three aspects that define the typology must be obtained from the solutions that participants create with The Tool. These aspects are:

1. The number of people working in one space (Work and Meeting spaces)
2. The barrier of the space: is it open, enclosed or semi-enclosed? (Work, Meeting and Support-spaces)
3. The activities that take place in the space (Work, Break, Meeting etc AND Other)

**Operation in The Tool**

The aspects are operated in The Tool as follows:

1. The number of people will be obtained by the number of chairs that are placed in the space. There is a distinction between ‘employee-chairs’ (max 4) and ‘visitor-chairs’. In that way it can indicate if people work in one space alone, with two or with more people together.
2. In the spaces step, the participant can indicate if the created spaces are enclosed or not. Also the option of semi-enclosed is there. This is for example by storage closets or a half-wall.
3. Also in the spaces step, the participant must indicate what kind of space it is. There are five standard options that occurred most during the two experiments, but the participant can also type it when clicking the other box if the wished space is not in the five options. When more spaces occur more often this can be added to or replace one of the other five options in the future development of The Tool.

**5.5 Output vs. The Experts**

The output-levels, except the GOALS level, were presented in the expert meeting on the 10th of April 2012. The experts that were present are stated in §4.3.1. For preparing the discussion between the experts a presentation was given with three output-levels; slightly different than the levels described above. However, the content is the same. The experts were asked to respond from their expertise and discuss about the value of information on these output-levels for the brief.
Three levels of information were presented; from abstract (level 1) to detailed (level 3) information. Be careful not mixing up these levels with the CONSTRAINTS and REQUIREMENTS levels given in paragraph 5.2 and 5.3.

**Level 1:** Relations with the building / surroundings and mutual space relations.

**Level 2:** The typologies of office spaces. This level contains information about the space itself. (Is it shared with others? Is it open / closed? Is it multifunctional? Etc.)

**Level 3:** The office space details. This level contains information about the furniture IN the space. (Where is the desk? Are the desks placed in pairs or alone? Etc.)

A first reaction pointed out that level one seemed most important for the experts in a brief. After reminding them that the question was about the part where they wanted user preferences and not only ‘the most important part of the brief’, the discussion started. They concluded that level one is a very important part of the brief, but that this level is more like a puzzle and needs many skills to come to a reliable result. Besides, they thought that there will not be very surprising results on this level from the users, because ‘every programmer knows that a workspace needs more daylight than a meeting space’ and ‘that a pantry area should be separated by at least a wall from the workspace’. Therefore the conclusion about level one in the Expert meeting was:
The user should be involved in creating level one, to be able to perform the tasks for the other levels, but the input of the user here is not most valuable for the brief. That is because experience and subject specific knowledge is necessary to be able to decide about the relations of spaces mutually and with the building and surrounding.

More discussion pointed out that level two was most valuable for the experts to have categorized user data about. Especially in the current market situation where ‘the new way of working’ and ‘flex working’ are rising phenomena, but not all people prefer this way of working. Therefore the experts indicated that it would be interesting to know what categories users do like new or innovative ways of working and what categories do not. And especially if there are new ways, that programmers are not aware of yet (The same interests as Frank van Jeveren (YNNO) and André van der Zalm (TCN) indicated in the interviews (Appendix P); described in chapter three). Information about this could be captured by the typologies of spaces; what functions spaces have; if spaces are used for more than one purpose; if the spaces are closed or openly connected with other spaces. Therefore the conclusion about level two in the Expert meeting was:

Level two is the level where information about preferences of user categories is of most value. It is expected that when the user has unlimited design freedom, surprising results will come out. Those are valuable in these fast changing times and will help to appreciate or depreciate trends in the work environment.

The ‘trends’ aspect that is indicated at level two has also to do with the more specific requirements of the spaces. However, detailed requirements are less important for the brief according to the experts, because those are easier to change when the building is already finished. Also on measurement level, the experts agreed on the issue that the value of users is not in finding m² for their activities. Yet, other requirements can be established by the user; the use of objects in the space. The position of the desks (grouped in pairs or not) and the creation of self-designed items can be interesting, but the experts did not reach a joint conformity about this. They foremost decided that this was in the solution domain of a building, not in the formulation of requirements (the brief). Translated to the task in The Tool that can produce this data; the furnishing of spaces, is probably the most fun part of the task for the participant. Therefore the conclusion about level three in the Expert meeting was:

The level three-output contains too much ‘solution focused’ information about the design. That is not the goal of the brief (that is: formulate the problem, not the solution), therefore this output level is not suitable as input for the brief.

5.6 Conclusions: Potential of The Tool

Now all the output levels are discussed. First the GOALS, CONSTRAINTS and REQUIREMENTS levels concerning the ability of the participants during the experiments and the operation of The Tool. And second the experienced opinion of the experts on the value of three output levels. These sources together form final output boundaries for the final tool and the brief. Those are extensively described in the previous paragraphs; in this paragraph is an overview of the output aspects given.

Figure 5.7 shows the figure that is also given in Chapter three, but now adapted to the conclusions of the research. The difference is in the number of concepts that The Dataset will contain (five instead of eight). This is mainly caused by the
reach of The Tool. The other difference is in the definition of exact requirements. This is mainly caused by the capability of the participants during the experiments that could not satisfy realistic and reliable results. However, the expectation is that when connecting The Tool’s output with the PACT-tool of Center for People and Buildings, these exact requirements can be established.

The PACT-tool is still dotted in this diagram, because one of the limitations of this research was that the PACT-tool could not be afforded. The proposed connection is based on an extensive conversation and discussion with Anca Gosselink from CFPB. She explained how the PACT-tool operates and what it needs as input. Part of that input can be delivered by means of The Tool of this research, the other part with the activity profiles must be provided by CFPB.

The Goals / Generative output-level has been dropped, because The Tool will not be able to capture this kind of data; it is too time- and labor intensive to process in a digital tool. There are five levels of CONSTRAINTS that will be captured by The Tool:
- Density
- Relationships
- Neighbors
- Flexibility
- Home Base

These constraints are captured by means of different items built-in in The Tool. The Tool will also capture information about the typologies of spaces (density, closed yes/no, functions) which has potential to result in REQUIREMENTS output by linking to the PACT-tool of Center for People and Buildings. The table below shows an overview of the operations in The Tool that are linked to these specific output levels. In red the operations on REQUIREMENT-level that serve as an input for establishing what office space typology it is (see the list in Appendix K).
For a final clarification of what output will exactly be delivered by The Tool, below is an example given of the constraints for a workspace.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Media &amp; Publishing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td>Poster designer</td>
</tr>
<tr>
<td>Age</td>
<td>38</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
</tr>
</tbody>
</table>

**Workspace**

<table>
<thead>
<tr>
<th>Density</th>
<th>2 persons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationships</td>
<td></td>
</tr>
<tr>
<td>Open connected with</td>
<td>Entrance</td>
</tr>
<tr>
<td>Closed connected with</td>
<td>Pantry Area</td>
</tr>
<tr>
<td>Attached to</td>
<td>Quiet side</td>
</tr>
<tr>
<td></td>
<td>City-view</td>
</tr>
<tr>
<td>Neighbors</td>
<td>Private space</td>
</tr>
<tr>
<td>Flexibility</td>
<td>No</td>
</tr>
<tr>
<td>Flexible walls</td>
<td>Lunch area</td>
</tr>
<tr>
<td>2\textsuperscript{nd} function</td>
<td>Meeting room</td>
</tr>
<tr>
<td>3\textsuperscript{rd} function</td>
<td></td>
</tr>
<tr>
<td>Home Base</td>
<td>Only a little</td>
</tr>
<tr>
<td>Open / Closed</td>
<td>Semi-enclosed</td>
</tr>
</tbody>
</table>

Figure 5.9: Example of possible output of The Tool

So far, in chapter three, four and five the sub questions of this research are separately answered. The Tool and its outcome are created so The Dataset can be developed that is useful for writing the brief and the content of the brief. The following chapter will give an answer to the main research question and discuss the influence of The Dataset on the briefing process and the brief itself.
BRIEFING WITH THE CROWD
6. Briefing with the Crowd

This chapter describes the influences of The Dataset for writing the brief and for the brief itself: the process and the product. Together with the previous chapters it answers the main research question of this research:

In what form can online crowd-contribution deliver generic data about the preferences of the office user in the brief of an office project?

6.1 Briefing with categorized office-user information - process

The process of briefing is considered from a theoretical perspective and from a view adopted from practice.

Theory
The process of briefing has different phases. As we have seen in chapter three, the PSM (Problem Seeking Method) defines five steps to create a complete brief before the design process starts. According to literature there are basically two different approaches of the briefing process (Bogers et al. 2008). One approach is based on the idea that the brief is completely finished before the design process starts. This is how Peña and Parshall (2001) describe the process in the PSM as well.

![Figure 6.1: The complete brief is finished before](image1)

The other approach is based on a continuous process between brief and design. For example the SBR 258 method (SBR 258, 3de herziene druk 1996) describes five phases:
- Abstract brief
- Basic brief as a fundament for the structural design
- Brief for the preliminary design
- Brief for the definitive design
- Definitive brief, as a fundament for the specifications and conditions

![Figure 6.2: The continuous process between brief and design](image2)
One pitfall of the first approach (complete brief) is that clients often are not able to formulate all their requirements beforehand (Bogers et al., 2008). One pitfall of the second approach (the continuous process) is that an ongoing briefing process can result in new requirements and many changes along the way (Bogers et al., 2008).

In both approaches The Dataset of this research can help avoiding the pitfalls. In approach one it can help the brief advisor and the client formulate well supported requirements for the brief, so all aspects are covered. In approach two it is expected to save time; the client has early in the process a complete, up-to-date and clear set of preferences of users in the category of his employees. This will in all probability avoid adaptations in the rest of the process.

Practice
From a perspective coming from practice, contributions on two sources that the brief advisor currently informs can be achieved. The first source is that of reference projects and the second source is that of direct users.

The abstract brief that is described as phase one in the SBR 258 contains at least a description of principles, objectives, an abstract overview of functions and activities and an estimation of the required floor area. Often reference projects are used for standards and key figures (Voordt & Wegen, 2000). Also Ton van Oosten (COD) confirms that in practice, the briefs are mostly copied when projects have some similar characteristics. The drawback of this method is that specific characteristics of projects are not taken into account when the start of a brief is being made. When this abstract brief at the start of a project is based on transparent, certain and up-to-date data about preferences of office users (The Dataset), this drawback can be prevented or at least reduced. Look at the following example:

John has a law firm with 200 employees. The current office building is outdated and is becoming too small for the company. He wants a new building and hires an advisor for creating a brief for this new building.

When briefing in the ‘old’ style: Client & advisor formulate main principles and objectives together. Then the advisor collects facts about the organization and the new location. With these facts he tries to think of reference projects and looks at the functions and activities that take place there, maybe presents and discusses this with the client, and then establishes the first standards and key figures for the abstract brief. The figure below illustrates this process and at the same time what can go wrong. When the advisor thinks of reference projects, none of those projects will exactly fit to the Goals and Facts of the current organization. The Concepts that are based on these references will thus be hard to perfectly fit the goals of the client. Either the goals need to be adjusted or it takes more time to think of concepts that do fit the initial goals of the client.

Figure 6.3: The old style of briefing
**When briefing in the ‘new’ style,** thus with help of The Dataset; client & advisor formulate main principles and objectives together. Then the advisor collects facts about the organization and the new location. The facts about the organization are input for The Dataset. For example 70% is male; the senior lawyers have an age between 45-60 yrs; the junior lawyers have an age between 30-45 yrs; starter lawyers have an age between 20-30 yrs. The Dataset delivers output about the preferences of these categories users. Based upon these preferences, the functions and activities can be established and discussed with the client. As a possible follow-up this can be connected to the PACT-tool of Center for People and Buildings, than the exact measurements can be established for the abstract brief. Figure 6.4 shows how the Facts are input in The Dataset that establishes part of the Concepts. The other part of the Concepts is based upon the Goals. Together these form the required Concepts.

![Figure 6.4: Briefing with The Dataset](image)

In the ‘old style’ briefing process, the standards and key figures are based on reference projects. This can give an overall view to make these aspects tangible. However, the largest characteristic of real estate is its’ heterogeneity. No building can be the same as another building and one building has different users than the other building. Therefore copying requirements can never completely fulfill to the unique characteristics of a building, its location and its occupying organization. These problems are confirmed by several parties in practice. It is not transparent and certain where the requirements of the reference project come from and therefore not usable for the brief of a new building. The Dataset on the other hand does deliver transparent and certain data about categories office users.

A second addition to the process of the brief refers to the direct and / or indirect office users. Within the GOALS, CONCEPTS and NEEDS steps, the direct users of the future building can be involved. The two methods that are currently applied for involving direct and indirect users are also described in chapter one.

To recap:

At the company Twynstra & Gudde this happens through target groups. Target groups of for example secretaries get some options presented of how they want to work and then they can choose between those options. The creativity of the individual is not stimulated in this way and it is a time intensive and costly method.

Another consultancy company goes one step further in exploring user needs; 4Building does this by means of interviews, observation and creative sessions. This is mostly useful to obtain the latent needs of direct users. Also this method is highly time intensive.

The information that this last consultancy office obtains from the users will not be replaced by The Dataset. However the information from The Dataset can for
example be used as a start for the user participation sessions that 4Building does.

In The Tool the relationships with the context of the building are obtained including the reason why (Quiet side, busy side, large windows, City view & Other:...). This is useful information for in the brief, because the architect can create solutions within different contexts of future buildings. Yet the mutual relationships of spaces do not contain this why-question, only the fact that some relations between spaces are important can be caught. This is already in the domain of the architect: offering solutions (how) for certain problems (why). Since The Tool, and thus the data, does not cover the why-question, this could still be determined. And that is where direct user information can still play a role.

The advisor could show the client and the direct users the data from The Dataset and can discuss the importance of it for them. With the known user participation techniques (e.g. Contextmapping) the real needs can then be discovered.

<table>
<thead>
<tr>
<th>The information from The Dataset acts as a basis to start upon. This information contains preferences of, and trends within categories of office users. (This data can still be refined by the advisor with the client and the direct users by means of existing user participation methods.)</th>
</tr>
</thead>
</table>

One domain, mentioned earlier as well, where The Dataset can be directly used without feedback of the direct users, is the Full Service Offices market. In this sector, the direct users are not known yet, but a market research can identify the potential users of a certain category. When this target group is identified, The Dataset can give general information that is relevant for most of the users in that category. The director of full service office company DOC-work Paul Weenink indicated that this sort of information is significant for developing a new office. And it does still not exist.
Below is the workflow-scheme of Chapter three repeated; the expected influence on the process of briefing was stated here. Now all the experiments are done, the final conclusion on how the process will change with the crowd information can be illustrated. The diagram is therefore supplemented. It requires one step more to take (informing The Dataset), but the fact that this information is ready to use saves time in the whole process.

![Diagram of workflow scheme](image)

**Figure 6.5:** The final briefing process with The Dataset (crowd data) input.

Another benefit of The Dataset and collection method (The Tool) is the anonymity for the participant. Some would say this is also the pitfall of the method, but it is expected that people who not want to contribute by using The Tool, will not even make use of The Tool (Zalm, 2012: Appendix P). The anonymous character avoids political issues of the organizations itself. Managers, directors or bosses can not intervene or manipulate the data or use it as a source of power. In the 1970's user participation in design was used as a source of power instead of an activity that added value to the outcome of the design (Granath, 2001). Again difficulties like these are avoided with this method.

### 6.2 The brief with categorized office-user information - product

The Dataset of this research will also contribute to the quality and completeness of the brief itself, especially concerning the information about the end user. As
described already in the ‘process’ paragraph above, categorized data about the preferences of indirect office users is not available yet. However it makes a brief a better founded document, since assumptions about user preferences do not have to be made up by the client or advisor anymore; those can be looked up in the intended dataset. It is transparent and clear, thus reliable information. This counts for every brief of any office project. A second benefit of this dataset is found with help of the test case that is used for the experiments: It becomes now possible to design a user focused and well founded brief for office concepts like DOC-work (the test case of The Tool) where no direct users are known yet. The work that needs to be done before in the collecting FACTS step of the process is obtaining market information for that specific location. When is known what category users will probably use the office spaces, this can serve as input for The Dataset and have preferences of this category as output. Figure 6.6 below gives an example of how this output looks like and what choices can be made by the advisor (and the client).

![OFFICE TRENDS & PREFERENCES](image)

*Figure 6.6: Example of output that the dataset can deliver with the given input top left*

To fully understand on what parts of the brief The Dataset can have great value; a real brief of a project is taken as an example. This brief was for the new Innovation Centre of Danone in the Utrecht Science Park. COD was one of the participants in the tender (unfortunately did not get the commission), and studied the brief well for making a sketch design- and plan. This complete brief is in Appendix M, but the essential parts for The Dataset are discussed below. The choice for this brief is made upon the appreciation of COD employee Randy van de Broek. He indicated that this brief is, compared to other briefs that he have seen in his career as project developer, more complete than others. Thus, when The Dataset can add value to this ‘high-quality’ brief, it is assumed that it can definitely contribute to other briefs as well. In the elaboration of the example brief below, the parts where the direct users need to be informed are marked and the specific parts where The Dataset adds value. This also explains how it can be used in the briefing process. In the previous paragraph we have seen that The Dataset is mainly valuable at the start of a briefing process. In the example below, this becomes clear again.
First, a summary is given below, that is included in the original brief. The part where The Dataset will add value is circled; The Offices and Conference Centre.

Danone Innovation Centre – Summary

- New Innovation building for Danone Specialized Nutrition in Utrecht Science Park
- The Centre will comprise of
  - Laboratories and pilot plant
  - **Offices and Conference Centre**
  - Restaurant and Meet & Greet area
- The building accommodates for a total of approximately 460 people
- Key words describing the building:
  - Functional, flexible, interaction, international, feeling at home
- Area is about 7500 sqm, footprint of the building plot is approximately 4700 sqm (final dimensions are currently under negotiation with Utrecht Science Park).
- Size of the building: 20.000 sqm (Gross floor space)
- Danone has interest in a compact building, NOT a High-rise building
- Sustainability is of key importance in design and exploitation of the building

The whole building will accommodate 460 people of which 30-50 home bases in the office communities (4 floors of office communities, thus 120-200 home bases in total). The majority will work in the laboratory and the board established that people should use workplaces in a flexible way. The following section of the brief shows the main features for the new way of working and the office communities.

- **New way of working**
  - more flexible office hours, extended opening hours
  - working 1-2 days/week from home if possible
  - flexible use of workplaces
  - laptops and wireless phones for all employees

- **Office Communities**
  - home bases for 30-50 people
  - feeling at home (flexibility without loosing connection)

These features of the new way of working will save expenses for the owner; he saves much space by saving on fixed workstations. Whether this is what the employees prefer is not clear in this brief. However, the information in The Dataset does contain preferences of the office users on these subjects. That is the first thing where the crowd information can add value on this particular brief. In The Dataset is indicated if office users want to work at home or not. If for example 90% in this category user states that he/she does not want to work
at home, the brief (and with that the future building) gets a complete different approach than stated above. If the other way around (90% does want to work at home) the details about working at home (percentages, days etc.) can for example be obtained from the direct users. In this case you can avoid political issues of the company itself.

Below is a fragment of the brief where the ‘Access to building’ is described. Besides the main entrance and the hierarchy of security levels, the areas and facilities on the central floor are described.

Central floor
- Facilities for employees (services, coffee bar, plaza)
- (Welcoming) area for groups of visitors (max. 50 people)
- Conference centre and wardrobe

Also here, The Dataset can be valuable for establishing what sort of facilities the employees want; it gives a transparent overview of what facilities employees would prefer. Again, coordinating this information with the client and the direct users can add extra value. It is then initiated based on a user perspective instead of only the experience of the brief advisor and the client. The requirements for the conference center are stated below.

Conference center

<table>
<thead>
<tr>
<th>Meetings rooms</th>
<th>Size (p)</th>
<th>Number</th>
<th>m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference room</td>
<td>50</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>Formal meeting rooms</td>
<td>15-18</td>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>12-14</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>8-10</td>
<td>2</td>
<td>40</td>
</tr>
<tr>
<td>Creative meeting rooms</td>
<td>10-12</td>
<td>1</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>6-8</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>Small meeting rooms</td>
<td>4-6</td>
<td>6</td>
<td>72</td>
</tr>
</tbody>
</table>

The numerical requirements stated above fall under the NEEDS \( \Rightarrow \) REQUIREMENTS step of Peña and Parshall (2001). As described in chapter five, the exact measurements of spaces are not defined by the office users, but by the typologies that are defined by Van Meel et al. (2010) and the PACT-tool of Center for People and Buildings. However, what typologies are preferred is defined by the office users; again transparently obtained and clear.

The ‘interior and atmosphere’ is typically a requirement that needs to be determined by the direct users and the client; it is organization culture specific and therefore not decidable by the crowd.
This page of the brief shows the interaction between data that can be obtained by the crowd (The Dataset) and data that can be obtained by the direct users and the client of the organization. The presence of the spaces itself; Quiet zone, Team zone and Interactive zone can be determined with help of the crowd information. And for example the Team zone (stated above) can be formulated according to the typologies of Van Meel et al. (2010); Open offices, Team spaces, Work lounges or Team rooms. The Dataset would underpin these statements in a transparent and clear way.

The constraints of the spaces that really go into detail must be defined by the direct users (low cupboards, high tables, lounge tables etc.); the exact requirements. The client or user can also choose to leave this part to the insights and creativity of the brief advisor and the architect. The level of detail in briefs stays an ever ongoing discussion for architects and brief advisors, so this is up to the client (Bogers et al. 2008).

The complete brief of Danone is given in Appendix M.

6.3 Other sectors

The influences of The Dataset are both adding value on the process as well as on the product. For this graduation research the scope was narrowed down on office buildings to make it feasible, but also in other sectors, a dataset like this can be developed.

With help of a similar tool a dataset can also be developed for buildings like schools and/or hospitals. Attention should than be paid to the expertise of the
user; it is assumed that especially in a hospital the knowledge of an expert is essential because of the specialized equipment and processes. However by testing this expertise with help of experiments, performed like in this research, it must be possible to define a realistic and usable scope, even for such a specialized sector.
For a school one of the difficulties will be the fact that children need to deliver input for a similar dataset. This will have consequences for the operation of The Tool.
Thus, when applying this research method in other sectors, different focus points need to get special attention, but the expectation is that a similar dataset can be developed in such specialized sectors as well.
7. Reflection

This chapter gives a reflection on the final product, the process and the planning. Also the limitations and recommendations for further research are described.

Product

The final product of this research is a method that describes how to obtain preferences of office users categorized in a Dataset. The final result is satisfying, although it can always keep being complemented, as in any design process. During the development of The Tool, I have seen some aspects that are excluded, but if they would have been included they would have made The Tool even more complete. First the activity circles in step one. If those activities could be translated by The Tool into real spaces on the floor plan in step two, it would be easier to work with for the participants. However, the idea of the activity circles only came after the expert meeting, thus too late for fully integrating in The Tool. They are processed in The Tool, but more as an awareness step for the participant, than as possible output that can be processed in The Dataset.

Second it was hard to keep in mind that The Tool should not take much time for the participant to use, otherwise it will be a too large assignment with the risk that it will not be used. When time would not be an issue, many more aspects could have been integrated in The Tool, such as quality and looks of furniture, the atmosphere and/or a special focus on the services. Those aspects are deliberately decided not to integrate. However, a new Tool could also be designed with the focus on other aspects of the brief. For this research, the focus was decided based on the PSM (Problem Seeking Method) of Peña and Parshall (2001) and interviews with experienced people in the real estate practice.

Third, because I was not familiar with generative tools I gave the participant sometimes too many detailed information and options in The Tool. I have experienced myself that the more details you give them, the more they ask for, and that makes the task only more confusing. In the final Tool I have tried to find a good balance between detail and surface, but a real expert in generative tools could still improve this aspect of The Tool.

The utility potential of this product now is indicated high by real-estate developer COD, consultancy office 4Building and Full Service office DOC-work. Yet none of these companies will implement the research directly, mainly because there is no earnings model for it as it is now. Also the marketing how to reach the right people through the internet is not completed, but it is in short discussed. In a brainstorm session with Derick Mekking, who was also one of the experts in the meeting, he indicated that there are many marketing tricks that could potentially answer this question. Thus a marketing agency could be hired for this aspect.

Process

The subjects of this thesis are properly diverse and this sometimes caused a split in the research focus. On one hand the development of the input for The Dataset that was backed up by in-depth knowledge from briefing processes; Design & Construction Management. On the other hand the development of The Tool that had a strong focus on Human Computer Interaction. The real challenge was to find a balance between these subjects. The focus on The Tool has been predominant for at least two months in the period where the experiments took
place. It took a lot of effort to simultaneously keep in mind the underlying goal of The Tool, namely to produce useful data for the brief. With the gained knowledge now, it is easy to say this could have been done better in the process, but looking back at the moment itself this was rather hard.

An important phase that was necessary in hindsight, but felt highly frustrating at the moment itself was the switch from one first mentor to another first mentor. The first two and half month the first mentor was someone different than Alexander Koutamanis. At the moment of switching it was as if all research so far could be thrown away. Looking back this phase was extremely important for discovering and scanning the field of research that did finally help to define the final scope. Nevertheless, the choice for another mentor was a good decision.

Planning
Sometimes it was hard to plan everything in a desired order. For example the separate interviews with professionals were planned to be completed before the experiments, but this was not achieved. Afterwards this was not too bad, because some reflection on the experiments discussing with some professionals was fruitful as well.

In hindsight, the expert meeting was too fast after the last experiment. The steering during the meeting was not structured enough; the experts were talking too ‘free’ and were not good enough updated about what I really wanted to know from them. This was mainly caused by the fact that the information gained in the experiments was not clear enough for me yet. The Tool-discussion was sufficient, but specifically on output-level I was not prepared enough. Looking back I needed more time to process the last experiments before presenting the results to the experts.

Limitations and recommendations

The only limitation was that the PACT-tool was not free available for my research; it was only for sale. As explained in the thesis the potential of linking the PACT-tool with this research’s Tool is high. This link is based on an extensive conversation with Anca Gosselink from CFPB, who designed the PACT-tool. She indicated that some output of The Tool could be linked to the PACT-tool, but it still needs some refinement. Further research should point out if the two tools can really be connected to each other. The diasadvantage is that the exact requirements established in the PACT-tool are not created by the users. So the high ambition at the start of this research to let office users decide about the size of their own workspaces is not met. The size will still be established by experts, and this research with its experiments has showed the reason why this is still needed.

Further research could investigate the potential of this method for hospitals and/or schools. The big difference is the target group to aim at. In this research the target group existed of office users. These people are easy to inform, because they are mostly above eighteen years old and in good health. Hospital users or school users fall in a complete different category, thus The Tool should be especially focused on them.

The recording of the last participant of experiment two (2.10) failed, because of a crash while transferring the film from the memory card to the computer. Also the second half of the recording of participant 1.7 is missing, because the memory card was full and this was not perceived in time.
Hoi
hallo
AN
EPILOG
8. An Epilog

The graduation research is the last step of a student’s study. Before starting it is almost scary when thinking about it. During the start my ambition was to improve the whole ‘conservative’ real estate sector with help of innovative thinking. My belief was that it would not be that hard as long as I would be convinced enough about my own story. That is also what I have learned during the design projects of the bachelor of my studies; without a convinced story, your design is half as good. When I defined my scope more and more, I found out that the graduation period is too short for making the changes that I had in mind at the start. However, I do not believe in the saying ‘a drop in the ocean’. I am convinced that every contribution, small or big, changes the world. And that thought satisfied me through the whole process, but did still not allow me to drop my ambition.

My ambition started to learn from other innovative sectors, like the software branch, where Open Source processes are conducted. I wanted to try applying these renewed methods in the real-estate sector. However, this was too ambitious for the ‘old fashioned’ sector and finally I ended in a split between the subjects Human Computer Interaction (The Tool) and Design & Construction Management (The Dataset as input for the brief). My focus shifted continuously from one subject to the other and back. Only in the last couple of weeks I had a precise overview of the scope of my research. And that is something that I would like to pass on to future graduates: Do not panic when you think you do not have the overview anymore, finally it will all fall into place.

In hindsight I can now proudly say that I am satisfied with the result. I can also say that the process made me stronger. Many times I made the mistake of not continuing and following my own path when people or events counteracted my ideas. People in the field who do not feel compassion with innovation or new ideas are impossible to convince about renewed methods, without first showing them results. Luckily there are organizations and people out there who do believe in innovation and renewed methods without first seeing the end result. A leading organization with such an innovative character is definitely COD that offered me a place for conducting my research. Their support, not only on the content, but also in their way of thinking supported me to go on with my creative and ‘outside the box’ thinking. Also my mentors from the TUDelft have encouraged me on this path. It is extremely important to find the right people and organization that will accelerate your research instead of withholding you.

In this last year of my studies I felt almost like the little child that makes her first steps outside; it was a major learning process, and that process is not finished yet.
Bibliography


All pictures in between the Chapters: www.Flickr.com – photographers:

Alex Bryant

Philipp Klinger

Thif Minatti

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