School of Engineering

Department of Mechanical and Industrial Engineering

ENHANCING TEAM PERFORMANCE THROUGH DIVERSE STANDING AND AGILE THINKING IN AN OFFICE ENVIRONMENT

MEESKONNA VÕIMEKUSE PARENDAMINE SEISUTÖÖKOHTADEGA AGIILSES KONTORIS

MASTER THESIS

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AUTHOR'S DECLARATION

Hereby I declare, that I have written this thesis independently.
No academic degree has been applied for based on this material. All works, major viewpoints and data of the other authors used in this thesis have been referenced.

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Thesis is in accordance with terms and requirements

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THESIS TASK

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Enhancing team performance through diverse standing and agile thinking in an office environment

Meeskonna võimekuse parendamine seisutöökohtadega agiilses kontoris

Thesis main objectives:

1. To investigate how sitting and standing affect teamwork in an office.
2. To propose a valuable solution against sitting in the frame of agile working.
3. To promote team effort in team space.

Thesis tasks and time schedule:

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ABSTRACT

The increasing trend of faster innovation cycles pushe the knowledge worker into a more active and engaged behaviour, especially in teamwork. Agile and focused teams are set to respond and adapt to these challenges. Physically static behaviour mainly sedentarism is one element that does not support a high achieving and engaged teamwork. How can these teams have an active setting that supports focused work and physically healthier behaviour?

This thesis aims to research the effect of sedentarism on the knowledge worker with the frame of agile teams. Through learnings acquired from different offices and knowledge from agile teams themselves, a solution is proposed to enhance the teamwork and engagement of a knowledge worker through focused adaptable space and through physically active behaviour.

CONTENTS

PREFACE

This thesis has been written in the aim to improve teamwork in developmental organizations through more active behaviour. The result is an active team space supported by the Office Shell.

Hereby, I express my gratitude to the interviewees Heldin Rikk, Marek Arru and Pavel Jolkin for finding the time and supporting me with their experience and knowledge. Furthermore, I would like to thank the companies for giving me access and knowledge from their office ways of working.

I would also like to take this chance to thank my supervisor, Martin Pärn for his guidance from the start until the end of this thesis and generally for the fascinating Design and Technology Futures program which has changed my life in many ways.

Most importantly I would like to thank my family for supporting me with the research and for extracting me the time from precious family time to concentrate on my studies. Thank You, Kristi and Lauren.

INTRODUCTION

The adaptation through millions of years in nature has molded human biology to a physically active system. Since the start of the Digital Age, this active behaviour started to decrease, mainly due to cultural changes triggered by technological advance. These changes have negative side-effects, that influence the individual health and leave unwanted footprints to the economic and social systems. The inactive behaviour emerges mainly from sedentarism, whereas the most common places to sit are at home and in the office. The office is the place where sitting is prolonged, thus being a vital area for interventions. The improvements of the sedentary lifestyle have to target not only the individual but also the group. Especially in an era where companies need to innovate rapidly, thus complex work goes from an expert level to a more agile way of working and team-centered effort.

The author, being formerly active in team sports for over 15 years, now has a sedentary office job, which feels frustrating and unnatural. This frustration is being combined with the experience of teamwork and the interest in design, thus generating this thesis. The aim of this thesis is to find an alternative to the sedentary working method, which would support agile teams and have a positive impact on knowledge workers physical behaviour.

Hypothesis and objectives

The following hypothesis is established: Sitting suppresses teamwork while standing enhances teamwork. This hypothesis is guiding the research provided by the thesis and will support the creation of a novel concept that reflects the ongoing changes in an agile office in order to tackle sedentarism and enhances team performance. Two research questions are established:

1. How can the knowledge workers workplace be improved to promote healthier behavior and increase team-centric engagement?
2. How does standing affect agile teamwork?

Methods

The main body of the thesis is empirical research which is analyzed qualitatively and structured to five main parts: literature overview, field study, interviews and survey, market analysis and concept development.

The literature overview gives highly researched insights on how sitting is affecting the individual in the context of the knowledge worker that is working in the office. At the end of the literature

review, the emphasis will go from an individual level to more teamwork and agile working perspective.

Field study is done in three agile offices and one office that was not using agility. Two of the offices were software development offices, one hardware developing office and a service provider office. The research focused on observings about the open office and activity-based settings, ergonomics and physical activity, and agile teamwork and collaboration.

Interviews were conducted with three people who are working with agile teams. An agile coach, a product owner and a scrum master. The aim was to get insight into how agile teams work and how standing affects the teams. To acquire more information a survey was conducted in a technology company with two different teams, a software developing team and a hardware developing team both working in agile ways. The main aim was to evaluate and confirm the information acquired from previous research.

A market analysis was conducted to understand how the current market is supporting agile teams with furniture and office equipment. The aim was to analyze products that offer flexible and active working for the teams and for the knowledge worker.

To generate a valuable idea from the research insights and synthesis, a concept was developed. The final solution was generated after the ideation and prototyping phases in the concept development part. In the end, a business canvas is formulated based on the values that the final concept offers.

1 LITERATURE REVIEW

The literature review aims to find out how sitting and standing influence the knowledge worker through different office trends. In the end, the focus will carry on towards a teamwork perspective which will be the theme for this thesis.

1.1 Sedentary Lifestyle and the knowledge worker

1.1.1 Physical inactivity and Sedentary Lifestyle

Sitting is the new smoking and a very big part of general physical inactive behaviour. We are sitting as much as possible and everywhere we can whether it is in the car, at school, at work, at home, and so on. Even worse is that companies create designs for sitting as comfortable to sit as long as possible. If your body part will be sour from sitting, then it's an indication of a bad design rather than the bodies sign to hint that it is time to move or change the position. Physical inactivity is defined as achieving less than 30 minutes of moderate intensity physical activity per week [1]. The definition is rooted in energy expenditure. Sedentary lifestyle, on the other hand, is defined by too much sitting or lying, by screen time and as well as energy expenditure [1].

The difference between physical inactivity and sedentary lifestyle is still discussed but overall it seems they could be differentiated. Sedentary lifestyle seems like a subset from physical inactivity. For example, too much sitting and too much standing can have different outcomes. They both could be defined through energy expenditure, but the physiological implications can vary. The sedentary lifestyle has its own unique effects like specific posture and neck problems, bad back, tight hips, poor blood circulation, fatigue and foggy brain that are more distinct to sitting than standing. Physical Inactivity is more rooted in not moving enough and the results are generated through time. For example, the daily routine of sitting, laying and standing time with a small amount of light activity could be described as physical inactivity while the Sedentary Lifestyle is limited to sitting or lying slowly. A sedentary person can sit large amounts at work yet be very active which means that they can still be physical inactive since the amount of sitting time is too much and in time the problematic effects still emerge. The clear message is that to be physically active is not enough, but one also needs to avoid too much time spent in sedentary behaviours. [2]

For sure, the inactive and highly sedentary segment of people are at greatest risk. One study concluded that not moving is bad for people but how they stay still probably doesn't matter [3]. In terms of energy expenditure and the effect it has on the human body one can safely say that this statement is true but nevertheless, sitting and standing have quite different physiological effects as stated before. The definitions have not yet fully agreed, but one thing is clear that energy expenditure is just one element of their definitions. To really intervene physical inactivity nowadays one increasingly must decrease Sedentary Lifestyle. With the fitness trend, we are already focusing on more physical activity behaviour in term of exercise but the daily routine of sitting in the office or at home is still there. As said before it is not enough to go training after a full time sitting working day and sitting at home after, there must be an effective intervention at home and in the office.

1.1.2 Sitting in the office

Many people in the Western World are employed in low activity office work. According to one study, sedentary time accounted for 81.8% of work hours, which was significantly greater than the sedentary time during non-work time. Office workers experienced significantly more sustained sedentary time usually more than 30 min and limited brief duration, fewer than 10 minutes, of light intensity activity while working hours compared to leisure time. Furthermore, office workers had less pauses while sitting during work hours compared to non-work time. In conclusion, this study stated that office work is characterized by sustained sedentary time and contributes significantly to overall sedentary behaviour of office workers. [4]

Another study from the United Kingdom concluded that office-based workers showed high levels of sitting time during the working week and weekend. Interventions that focused on the working day and the after working time to intervene sedentarism with a more active behaviour may give the most positive results for reducing levels of sitting time and increasing physical activity, in the office. Office work is a large contributor to overall sedentary behaviour. Thus, the workplace is a crucial setting in which to implement ways to reduce sitting time and to improve health. [5]

In a study conducted on university workers at the University of Sydney, educational and ergonomic interventions were trialed in the office workplace environment to increase incidental physical activity and reduce sedentary behaviour. Educational interventions are defined behaviour strategies such as goal setting, self-monitoring, reducing the use of telephone and email in favor of face to face interaction, going to bathroom further away from the desk, and having standing or walking meetings can increase physical activity at work. In the same study, several ergonomic interventions have also been investigated as a means of reducing unhealthy sitting behaviour or

increasing energy expenditure in office. These include walking workstations, portal pedal machines, and the use of adjustable sit-stand workstations. The results where clear the best benefit offered a sit-stand desk with a combination of educational interventions. [6]

1.1.3 Sitting and standing at the desk

One of the main interventions and most commonly used in office environments against sitting is a sit-stand desk. The ability to adjust the working position height gives extra flexibility to decrease inactive time. Although, sitting and standing both are types of inactivity changing the positions is still better than just dwelling in one posture. There is evidence that these desks are quite effective.

According to one study from Australia, 42 people were given a sit and stand workstation for two months. The results where that sitting time declined participants significantly reduced time spent sitting at work by 73 min per workday and increased standing time at work by 65 min. The option to change posture generates positive outcomes against sitting. [7]

A second study also in Australia was made to analyze the sit-stand workstation effect on sitting behaviour. They measured not only sitting and standing time but also stepping time and compared the results with a comparison group that did not have a sit-stand workstation. Sitting time was reduced by 143 minutes daily at the workplace and the effects were sustained after 3 months. Stepping time did not have any significant changes in the two groups. [8]

A third more recent study that analyzed sitting and standing concluded that prolonged standing has its own health risks, but the best combination would be to have variations of postures during the occupational time. As mentioned before the key is to have minimum prolonged static behaviour and the positive side effect is increased energy expenditure. [3]

A fourth study made on engagement and performance of standing versus sitting concluded that standing will not impair performance on reading comprehension or creativity tasks and furthermore standing generates interest, enthusiasm, and alertness during task completion [9]. Standing is improving engagement and attention and enhanced work engagement has been linked to well-being and performance [9]. If used, sit-stand work station is a good solution to have results against extensive sitting in the office and boost engagement as well as well-being.

1.2 Knowledge worker and office trends

1.2.1 Office settings

There are two types of needs for humans, survival needs and well-being needs. If the survival needs are covered then the well-being needs in the office context are as following: the opportunity to engage in spontaneous social encounters, freedom to move between one social phase and another, opportunity to engage in a full range of typical behaviours (creativity, self-expression, cooperation, exploration), regular exercise, noise levels like that in nature, sensory variability, an interesting visual environment. [10]

The well-being needs are tackled in different ways. A sit-stand desk is a good example of this, but one other of the well-known approaches nowadays is changing from open office to a more activity-based office. Which means modern offices have different settings, so people would have diverse places where to work and collaborate depending on the need and the characteristics of the work being done. It gives more diversity and flexibility for workers to be more productive. The most known settings next to the dedicated workplace is a meeting room, concentration area, collaboration area, learning/studying area, socializing area and exercise/play area. These settings are usually very different and have their own functionality and equipment.

The research of diverse activity settings came in 2008 from a study made by Gensler an architecture design company, it was stated four main activity based spaces: focus, collaborate, socialize and learn [11]. Focus work being work involving concentration and attention to a particular task or project, collaboration is working with another person or group to achieve a goal, learn being working to acquire new knowledge of a subject or skill through education or experience and socializing are interactions that create common bonds and values, collective identity and relationships [11]. These activity spaces should support the knowledge worker to be more efficient and engaged, thus more productive.

Another study that focused on worker the had a very concentrated office work concluded that in the office space, they largely value communication with other workers. So, there is a need for space for the individual and for collaborative work. Furthermore, it was stated that the concentrated worker needs an adaptive environment with a range of diverse settings to match the office environment with the work style. [12]

An additional modern trend is an increasing understanding that to be effective office were well-being and productivity can thrive the space should be more “green” or more natural. The logic comes from our deep roots in nature. A natural setting and natural stimuli are more likely to be beneficial for health and well-being than a room which lacks these elements [10]. The key features in a more naturalistic office space include daylight, views to the outdoor, green plants indoor, sensory variability in ambient conditions across time and space, horizontal visual sight, tree-like forms and so on [10]. The natural design can be implemented in other settings to have maximum effectiveness. This also influences the office workers physical behaviour in a more active and aware state of mind.

Another study stated that urban environments are influencing people’s physical activity patterns. Humans are more active when space is interesting, diverse, green, aesthetic and foremost it must be safe [13]. These activity and natural settings are quite useful in the frame of physical activity. Having the options to work in many different and diverse areas will generate more walking time and the sitting types in different areas are most likely diverse as well, which gives extra flexibility against sedentarism. The big question is how much of these activity spaces and settings are used by knowledge workers?

1.2.2 The mobility of knowledge worker

The activity settings depend on the roles that people are performing in the company. Not all workers have the same type of work nor the same type of activities. This is especially visible on a study about knowledge worker and their usage of space made in 2011. In that study, it was proposed four different types of knowledge worker based on the mobility they had throughout the working time and space – the Anchor, the Connector, the Gatherer and the Navigator as shown in figure 1. [14]

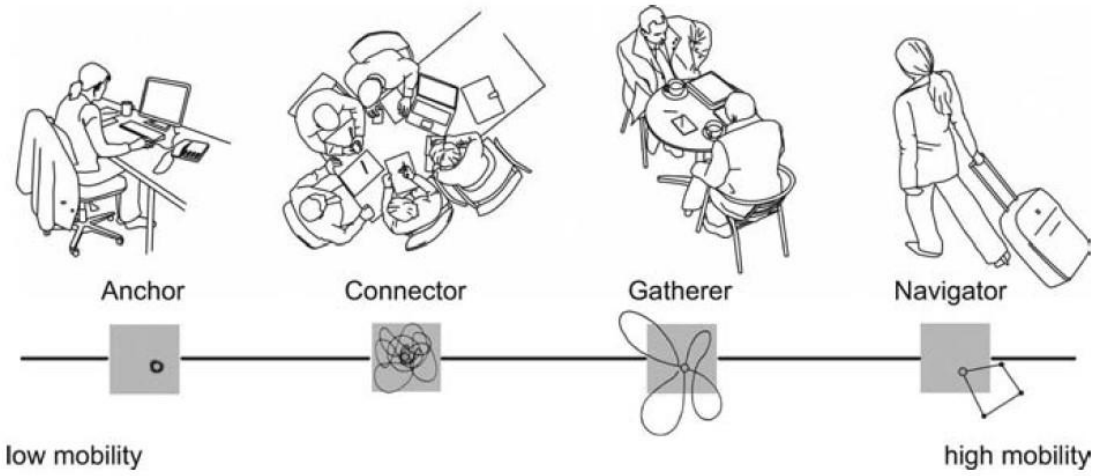

Figure 1. The different knowledge worker types. [14]

The Anchor is the most focused on desk-based tasks and very limited in terms of movements inside the office building [14]. People tend to go to the Anchor rather than the opposite. The Connector is a much more active person that interacts between different parts of the company inside the office [14]. Connector tends to be a communicator that benefits more from visual tools like sticky notes and whiteboards rather than a laptop [14]. The Gatherer benefits from relationship outside the building, bringing important information in from outside [14]. The Gatherer relies heavily on mobile phone and WIFI [14]. They are usually product owners or project leaders. The Navigator rarely visits the office [14]. They are usually the salesmen, freelancer or consultants [14]. In a physical activity point of view, the Anchor seems most likely to be inactive and the navigator the most active but this is most likely not the case since all of these types are probably very sedentary they just use different space and locations to be sedentary. As stated before, these mobility types use technology differently thus need different flexibility from the companies and from the office.

1.2.3 The flexibility of knowledge worker

The office is a part of technological development, it has pushed humans into sedentary behaviour through the interaction between the computer and the user, yet at the same time, this development could reverse this issue. With digitalization, cloud technologies and electronic miniaturization, the phone and laptop generate working flexibility that has changed the office game. It is said that the physical office will be replaced by the virtual office. A good example of this is the knowledge worker types Gatherer and Navigator who slowly are dependent on the miniaturization of our electronic tools as well the digital power coming from the Cloud to work

effectively from distance and to be mobile. Additional benefits from working from distance are the cost of commuting, sustainability and environmental issues [15]. It requires much less energy to work at home.

A study on coworking spaces and freelancing suggest that 33% of the US working people are nowadays independent or freelance, and this is projected to increase to be 40% by 2020 [16]. It is theorized that the physical workplace will disappear with working from home and cafes replacing it. This generates problems as people working from home are working alone which affects their social network, human interactions and work support. The whole knowledge transfer that humans benefit from being physically at work is lost [16]. A new trend and advances arise from these issues called coworking spaces [16]. A customizable, modular and flexible space where a community of freelancers meet, work and execute diverse tasks [16]. According to the study as work gets more complex more teamwork is involved in coworking spaces [16].

The advances of technology generate new flexibility of working and new spaces which should decrease overall sedentary time, of course, it does not matter whether the person is sitting at home or in coworking space. A small laptop supports sitting in diverse places and probably does not decrease sedentary time. The question emerges, why most knowledge workers still work in the office if tech allows working anywhere? The reasons are interactions with people including all types of collaboration, social networks and knowledge sharing and transfer between people [14]. People perform better if they are physically in the same place because they understand better the situation and the people. Friendships with colleagues increase engagement and working success [14]. With technological advances and complexity increasing it is very important to keep the social networks up and active amongst knowledge workers.

1.3 Knowledge worker and teamwork

The social networks are especially important in cooperating and in teamwork. In the context of this thesis, a difference must be made between teamwork and group work. While teamwork is more interdependent and group workers are more independent. Both need their own setting to be more successful [14]. Teamwork is a very common part of any organization and it is largely influenced by engagement, motivation and well-being. These elements are depending on a lot of a person's role in the system, the spaces that they can work in and activity levels.

Teamwork is also a huge part of the social network that is created in an office environment. Not all knowledge workers are a part of focused teamwork, but the majority of them need to be highly collaborative. Although technology offers us many solutions to have flexible teamwork it is not enough in term of effective teamwork especially when there are complex and urgent problems [14].

Face to face contact is important and will increase productivity. This is especially true in an open plan environment where a team has high awareness where coordination, planning and information sharing can take place [14]. However, there are many issues regarding open plan environment. The key problems are privacy, loss of confidentiality, distractions, interruptions, noise and visual pollution [14]. Nevertheless, accidental interactions help to spark and sustain a collaborative atmosphere just the question is with whom? If it is a team member than it makes sense, but when it is someone else that seeks interaction at the workplace, then the benefit is questionable.

Research suggests that brief interactions like gossip are deeply rooted in human behaviour which makes the understanding of other people much more profound thus increasing trust and collaboration capabilities [14]. There is no doubt that all kind of interactions inside the group or a team is beneficial. One research made by Teasly with software engineers suggest that moving a team in to a meeting room to work increases the productivity, there were no distractions and the project cycle was less time consuming [14].

The research concluded that face to face communication plays a very important role in maintaining high level of team collaboration and productivity. Open office plan does encourage interaction and collaboration, which enables people to feel more socially involved. However, if their job is related to teamwork, a team space is much more effective [14]. A team that needs to maximize productivity and minimize interruptions needs to move away from open space to a team space. The focus must be in team space to increase social interactions, productivity and engagement.

1.3.1 Active learning and agility

Collaboration increases engagement and vice-versa, but it is also highly linked to active learning which is an important part of group dynamics. The main elements of active learning are positive interdependence, which means the members of the group understand that they depend on each other [17]. Individual accountability, which is the emphasis that everyone has a role to do [17]. Promotive interaction, which is the encouragement of each other efforts [17]. Interpersonal skills which consist of elements like communication, leadership, trust, decision making and conflict

resolution [17]. And group processing, where the team reflects on how they are doing as a team and how could they do even better [17].

These statements are closely built to the agile mindset in software development. Born from lean manufacturing Agility has the heritage on delivering value, respect for people, minimizing waste, adapting to change, continuously improving and acquiring feedback [18]. But how these values are achieved comes in many instances from active learning and high collaboration. Both agility and active learning are very team centered methodologies. For example, the most used agile methodology in software development is the Scrum framework. Scrum is a framework to develop and deliver the product incrementally to the customer which is done in focused small teams usually 5-10 members [18]. It has many events like sprint planning, daily scrum, sprint review and sprint retrospective. Sprint at its core is a time-box of delivering value usually less than 1 month. Every sprint starts with sprint planning where the team plans the goals and tasks and creates visual accountability that the team members commit to [18].

In Scrum, it is beneficial that the team is co-located or has a separate team room [18]. The daily Scrum is a short meeting to follow-up the commitments in a daily manner, so the goals would be achieved at the end of the sprint [18]. Sprint review and retrospective are reflections of the sprint what was achieved and what was not and how to improve as in group processing in active learning. In agile methodology, it is emphasized that all these meetings should be facilitated with trust, collaboration and leadership similarly to active learning [18]. One important thing about daily scrums meetings is that it is usually done standing. The reason for this is that people are more focused and efficient while standing. Through the elements that Agility promotes it is clear that the methodology is about more active and engaged behaviour.

1.3.2 Sitting vs standing in group dynamics

There is no literature on the effects of physical activity on teamwork in the office. This goes already to a team sports area but there are studies made on sitting and standing in group dynamics. One study focused on meeting outcome in sitting versus standing. The research concluded that sitting meetings took 34 % more time, yet the quality of the decisions was very similar [19]. They also stated that the team synergy stayed balanced while the commitment to group decision was the same. Although, the participants that were sitting were more satisfied with the meeting [19]. To sum up the study, stand-up meetings are more efficient but generate more discomfort when having longer meetings.

Another study focused on sitting vs standing in creative group work. They concluded when standing group performance on knowledge work tasks increasing arousal and decrease territoriality [30]. Physiological arousal increases information elaboration and in social situations, joint experiences of arousal generate partnership and group thinking, both of which are important for successful group action [20]. Territoriality is the need to be possessive in space over an object [20]. None-sedentary space could decrease a more individual mindset, thus generate a more open mindset about other people ideas and presence [20]. This study clearly states that collaborative knowledge work would be more effective when there is no chairs nor desks just clear space [20]. Standing could benefit not only at the individual level but also in group dynamics. As stated in the last study „Nothing Creative has ever done while sitting ". [20]

1.4 Literature research conclusion and insights

Physically active behaviour is a key to increase the individual and teamwork engagement, this can be achieved through a sit-stand desk, activity based office or with an agile mindset through team-based stand-up meetings.

To conclude the literature overview the main insight should be summed up so these would be synthesized to design drivers for the concept development phase.

The main Insights:

- Prolonged static behaviour is unhealthy;
- Standing generates more engagement and alertness individually and in teamwork than sitting;
- A sit-stand desk is one of the best interventions against office sitting, mainly because of the more dynamic behaviour of changing postures;
- Technological advances offer the possibility to work away from the office, but offices are still needed because face to face interaction is the best way to get work done;
- Team space is more effective than an open office for a team focused work;
- Successful collaboration and teamwork have its roots in active learning which is a big part in an agile mindset;
- Standing is promoted in stand-up meetings which are performed in agile methodology;

- The knowledge worker needs an adaptive environment where collaboration and concentration can be done by different roles.

Further research is conducted on sitting and standing possibilities in the office with an emphasis on different activity setting and agile teamwork elements.

2 FIELD STUDY

Four offices were chosen to investigate the teamwork conditions and to observe knowledge workers activities in different settings. Three of the offices are different branches of an international technology development company. These offices all have agile teams. The three branches are a hardware development office, software development office and a second software development office. In this thesis, they will be named Office A, Office B, Office C. To counterbalance the big company and to compare the results, a smaller company was chosen, that is not working with agile methodology. This company is a telecommunication provider and will be called Office D. There were many similarities but each of them had unique elements that stood out. The analysis was done in three categories: open office and activity-based settings, agile teamwork and collaboration, ergonomics and physical activity. The aim was to observe and understand how the space and the equipment are designed to influence the teams and how agility is supported with the equipment and space. For the purpose of anonymity, the pictures nor names of Offices A, B and C shall not be used in this thesis.

2.1 Open office and activity based settings

The Offices A, B and C where full open offices with diverse settings and Office D was more of an activity-based office. In terms of design and setup, Offices A, B and C were more formal and team-based while Office D was more flexibility centric, natural and homey (figure 2).

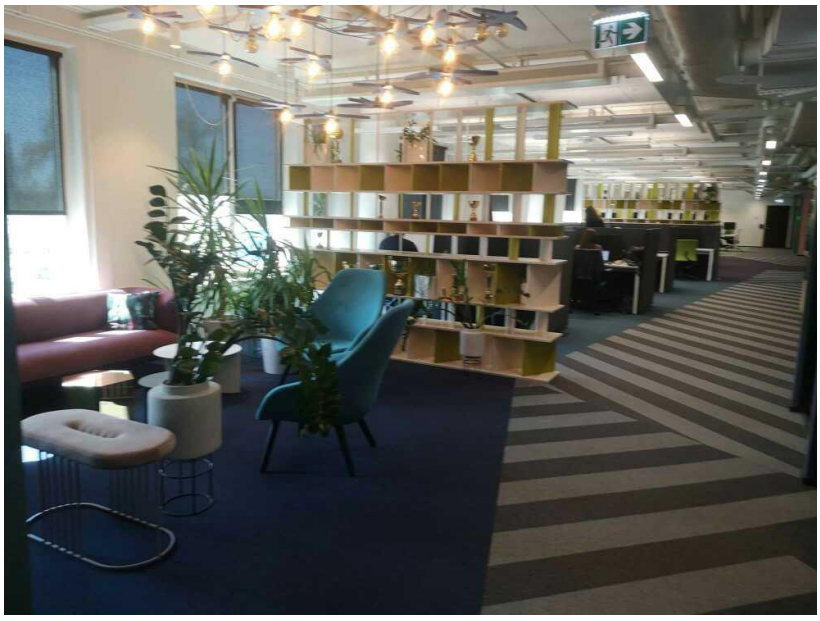

Figure 2. Office D activity-based office. The different activity areas were divided with bookshelves.

In Office D, the employees did not have dedicated desks, but in all three other offices everyone had a dedicated desk, which were team and program located. Depending on the type of work done or the type of knowledge workers at present, the noise tended to be an issue especially in Office C where there are mostly developers (Anchors) who have a very concentrated work. In that office they tried to decrease the noise with big curtains between team areas. According to the employees, the curtain implementation was not effective to reduce the noise. The noise was a problem in Office B as well, but they had very strict rules that working silently had to be provided by all people in the office. In Office D noise was not an issue since there were no dedicated desks nor dedicated team areas and people had the choice to go to a more silent or privet corner/area or meeting room if they needed to. All the offices had different settings for concentration some examples shown in figure 3. In Office D the concentration areas had a monitor to give more flexibility in working there. Office A had one-person telco rooms that were used as concentration rooms or as phone booths.

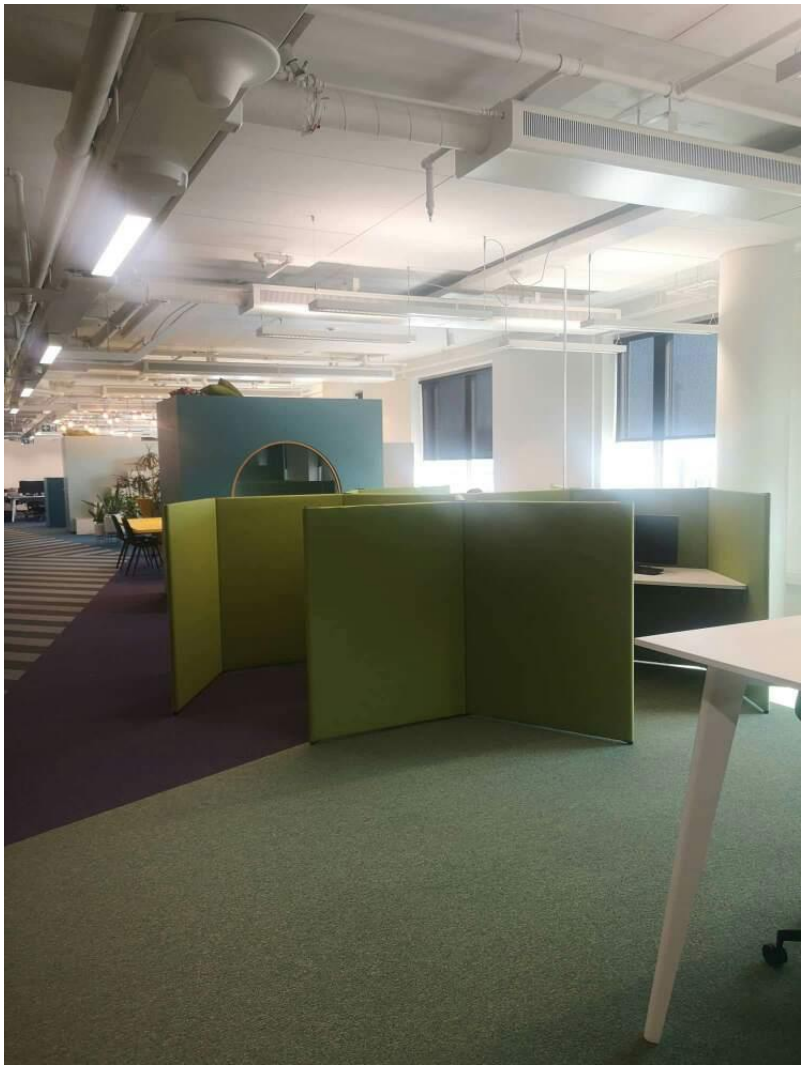

Figure 3. Office D concentration setting and a closed booth in the back.

The main socializing areas where near the kitchen or coffee machine in all offices. In Office D it was a more relaxed environment and it felt that socializing could be done almost everywhere. All offices except Office A had open areas where one could just sit and work or chat with a co-worker having a break from work.

Office A and office D had a library area the idea of these was to come reading or learning and to be totally out from noisy open office setup.

2.2 Agile teamwork and collaboration

One key difference between Office D and Offices A, B and C are that in most areas the agile offices had teams co-located which is one way to facilitate agile behaviour, while in Office D everyone sat where they wanted and this is mainly due to having a hot-desking system. Offices A and C were team-based and had a couple of areas for different stand-up team meetings. The team spaces in Office C were divided with a wall system. Although these walls were not fixed to the ground, to change the team area size can be a hassle. Furthermore, when such changes do emerge most of the team members must adjust with the new area with moving the tables and workstations as well. In Office A similar walls were used that were fixed to the ground. These did not divide the teams but programs and departments which made the area much bigger, more crowded and noisy.

All the offices had meeting rooms and collaboration areas and people used them very differently. In Office, A meeting rooms where scares and that's mainly because the teams were co-located but did not have their own area to collaborate in, which meant that they had to book a meeting room for that. In Office C all meeting rooms where empty and that is because all collaboration was done in the team areas where they had a whiteboard. In Office B the teams used only meetings rooms for collaborations and meetings which was not a problem for them since there was two teams in the office and one large meeting room for 14 people and one medium size for 8 people. In Office D, people who needed to work together booked a room or did so in an open area. In all observed offices, there were many whiteboards in almost all settings to increase collaboration. An interesting example of this was Office C were whiteboards surrounded the office area. Office D had walls which could be drawn at. The whole Office D was surrounded with it so triggering visual collaboration would be very flexible in all areas and settings.

Office A, B and C all used agile methodology so meeting daily in a stand-up meeting is a very common practice. These events were usually done in front of one of the whiteboards in a team area or in a meeting room.

One interesting concept emerged from Office B where they had a room for pair programming which means having a room for two, with monitors so they could work together privately to achieve better results. Same room concepts were used in office D.

Dashboards were heavily used in Office C and some in Office D. Dashboards aim is to have a live overview and feedback on the progress of the team or overview of some sort of business results.

2.3 Ergonomics and physical activity

Office A, B and Office C had all sit-stand desks. It was very visible especially in Office C that almost half of the people there were using standing position. A lot of variety of seatings were in all offices, for example, bean bag laying, working chair, standing and working, stools, couches, lounge/concentration chair and so on. In most settings except for meeting rooms and dedicated desks, there were at least three types of different seatings as shown in figure 2. This all gives a variety of postures thus physically more dynamic behaviours. Office D had the most diverse way to sit and stand a good example of this is shown in figure 4. where a stand-up table with an adjustable mobile stool is used, although the monitors hights are not adjustable enough to have a perfect ergonomic setup. A stand-up table with a mobile stool is a good combination for more active behaviour.

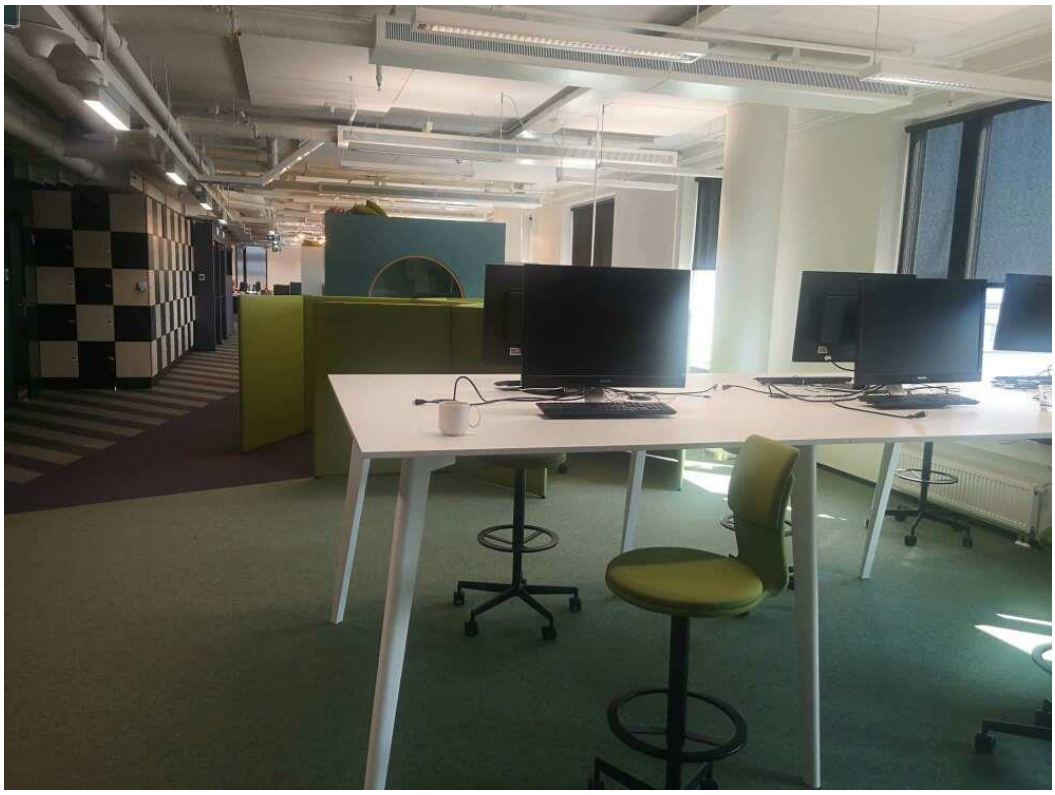

Figure 4. Stand-up desk and adjustable mobile stool in Office D.

Some office workers had a personal leg rest. While standing or sitting there is the need to not only changes the upper body posture but the lower body as well, thus a leg rest is used in many cases as shown in figure 5.

Figure 5. Leg rest while sitting and leg rest under a stand-up table.

Office A and Office B are quite large facilities and walking from one setting to another is long and could be beneficial for office people to increase their physical activity, however, it could be also demotivating for workers to go from one side of the building to another. In Office A there was a

stretching area in-between the walk from the office to the canteen, there was no exercising equipment but there were stretching instructions, at the same time, in Office C there was a Wellness Wall and in Office D there was a Swedish ladder as shown in figure 6. All of these are for to promote exercise and more active behaviour. In the Wellness Wall with the pull-up ladder, there was also a skipping rope, stretching bar and a yoga strap. Instructions were on the well to give an idea of how to use the stretching bar. Upon asking the office people in Office C whether these items are used they mostly said that the stretching bars are used for light stretching and sometimes people even take these to their desk, but you can't see many people at the Wellness Wall skipping or doing pull-ups.

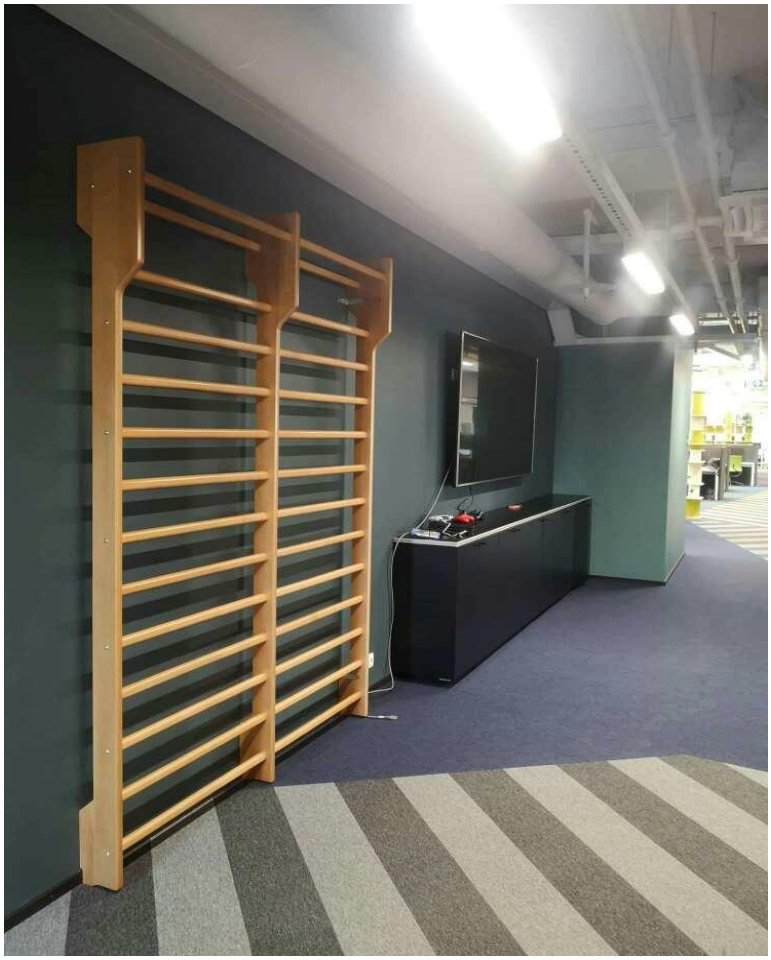

Figure 6. The Swedish ladder in Office D.

Office B, C and D had all a table tennis area to give additional variety for physical activity and social engagement. In Office A, people had a couple of times a week a coach coming to have an exercise pause. According to the people, usually around 10-15 people participate in the movement pause with light exercise and mild stretching to exit the constant physically static behaviour.

2.4 Conclusion and insights from field study

To sum up, the studied offices have diverse ways to intervene sitting, trigger standing and collaboration. While Office A, B and C had agile teams they were still very different. Office C was to most focused on agile teams efficiency with the teams in more closed areas and stand-up meetings and whiteboard meetings done in that area compared to Office D which focused on hot desking and diverse activity settings. The most active setting in Office D was the area where people had the chance to work on a stand-up desk with a mobile and adjustable stool. According to the research made the main insights from field study:

- Companies that work with agile methodology have small teams that are co-located. Some teams try to have a more private and noise free area.
- In different activity settings, there are diverse sitting possibilities.
- There are three places where working and standing can be done: At the sit-stand desk, stand-up meeting area or in the case of Office D an activity setting for standing.
- Agile teams should have the possibility to conduct meetings in the team area to avoid meeting room overbooking
- All of the offices had many whiteboards to trigger collaboration and visualization
- Offices A, B and C had a sit-stand desk, which according to the literature research is an effective method to intervene sitting
- Exercise bar is an easy way to stretch and to counter static behaviour

To understand more deeply the behaviour of the people using different settings, how active they are in these settings and how agility influences these settings a more deeper investigation in the form of interviews were done.

3 INTERVIEWS AND SURVEY

Based on the field study, agility is an important element in teamwork and it has a physically active focus through stand-up meetings. There were three interviews conducted with knowledge workers, who were using agile methodology and were implementing it on a daily basis. All the questions where aimed to find out more about different settings, physical activity behaviour and teamwork elements in an agile office.

3.1 Agile Choach: Heldin Rikk

Agile coach is a role that implements and develops agile elements throughout the company. The role is very much making companies more efficient and productive with a high focus on team development.

3.1.1 Office Settings

Although it is very trendy to have diverse settings, in an agile perspective, the main work is done at the desk and in the team space, whether it is a meeting room or a co-located area for the team. The aim should be focused more to get the team together rather than letting everyone go in a different setting. It depends on the company as well, but whenever there are very complex developments which have a high business pressure a strong and focused team is needed. Which means that the most important setting is the team setting. Work is done mostly with the team or at the desk, everything else is great to have but does not add much value. Regarding the dedicated desk, the agile coach was very sure that dedicated desk is needed when the team is co-located.

3.1.2 Sitting and Physical Activity

While asking how much is the interviewee using a sit-stand desk it was said that not at all since the work is done often in meeting rooms with the teams. About 70-80% of the time the dedicated desk is empty. But nevertheless, it was stated that many companies have a sit-stand desk and there is a practical reason for it. The active behaviours are mainly drinking more water and having walks with someone else. The interviewee has also used a yoga ball because too much sitting affects the legs in an unhealthy way.

3.1.3 Teamwork and Space

A group of people that have one goal is a team and they have to be co-located and ideally have their own space so there would be a maximum focus. Emphasis on team interior relationships as well as exterior elements like one space for a team are all important to maximize the team's performance. The main challenges for teamwork are that people do not know what it is. They know what group work is but not teamwork. In difficult markets or complex development strong focused cross-functional teams are needed to be successful. The interviewee has experimented with the team in working two months from the meeting room. The team cohesion and communication increased drastically. It was stated that working with the team in one space is a must. Also what the agile coach tried with one team was to go work with the customer office for one month, this generated much bigger collaboration with the customer. Regarding the effect of standing on teamwork it was mentioned that all daily meetings are done standing, so that the team would be more focused and efficient on what they are saying in that meeting. Another thing that influences greatly teamwork are constant changes in team setup and team location. Every quarter teams will move their location to optimize space and the moving itself is demotivating for the people and for the teams.

3.2 Agile product owner in software and hardware development: Marek Arru

Marek is a strong driven and focused former project manager, who takes new challenges with a software team as a product owner. The product owner is responsible for the developed software backlog.

3.2.1 Office settings

Has a dedicated desk but does not need it since all of the necessary information is in the laptop. Works from home and from everywhere else via phone but prefers to be in the office because of face to face contact and direct information sharing. Main work is done inside the office at the desk and in the meeting room, sometimes goes to a telco room for one person to have concentration work. The office does not have many settings, there is a silent room/library but has never used it. Does not need natural items in the office, although thinks that these are good to have.

3.2.2 Teamwork and Space

His team works in agile ways. Marek thinks that in a separate team space the team would be more open-minded and would achieve faster a closer relationship. In an open space, people tend to use earphones to reduce noise and by doing so they are closing themselves down from indirect information. The team should be in one location and ideally in a separate space. The team can be more productive with strong vision/goals and efficient task break-down with task estimations. All team collaboration is mainly done in the meeting rooms. Likes stand-up meetings because they are short and focused. Standing generates more active behaviour while sitting forces people to a more inactive state of mind. It is easier to start any action when a person is standing.

3.2.3 Sitting and Physical Activity

Marek has a sit-stand desk and is always standing when working at the desk. He stands because there are many meetings during the day and in these meetings, people always sit so the aim is to counterbalance the sitting time with standing at the desk.

3.3 Scrum master in software development: Pavel Jolkin

Pavel is an experienced scrum master. Scrum master is a role that facilitates the team in becoming more agile through the Scrum framework. The end goal is to maximize the value that the team can offer.

3.3.1 Office Settings

An office is a place where one should feel comfortable whether it is an open office or a team space. The interviewee is working in an open office with shared spaces. Has a dedicated desk and needs it. Sits away from the team because has a lot of visitors which often are bothering the team when arriving. Can work from home, but as a scrum master working away from the team is not effective working and prefers to be in the office to maximize face to face interactions with the team. In the office, there are meeting rooms, open collaboration areas and kitchen. Concentration is either done at the desk or in a small meeting room. Natural settings are extremely important for the interviewee.

3.3.2 Teamwork and Space

Pavel has two teams and both are working with agile methods – an adapted version of Scrum. The team sits close - they are co-located. He thinks that the teams definitely need to be sitting in the same area but he is not confident whether the teams need a separate closed space. States that it depends on the project and the maturity of the team. Newly formed teams benefit from co-location much more than older teams.

3.3.3 Sitting and Physical Activity

Uses sit-stand desk usually twice a day at least. Some people use stairs in the building instead of the elevator to be physically more active. Has stand-up meetings daily with the team and thinks that standing is vital to keep the meetings short but does not think that standing affects overall team productivity.

3.4 Two team surveys

To broaden the analysis and evaluate the information raised from the interviews, a survey was done. The aim of the survey was to have a wider overview of agile team members understandings and behaviours. The survey was focused on two different teams. One was sent out for software developers and the other was focused on the hardware development team. All teams worked according to agile methodology and were very team-centric. The surveys were conducted via an online survey system [21]. The survey was built up with 8 questions, with identical questions for both teams. The aim was to understand more deeply about their thoughts on open office, sit-stand desk, and changes happening in the team. 25 developers were sent the survey in which 10 replied. 30 hardware developers team members were sent the survey in which 16 replied.

3.4.1 Analysis

As confirmed before and concluded from the survey, people come to the office to conduct face to face work. No big difference did arise between the teams. It does not matter how good are the communication technologies, face to face interaction gives much more information for people and it is particularly important for teamwork, thus the conclusion is that face to face working is more effective then any other method offered by technology. What it also means is that offices or physical places where people conduct work do not disappear.

Overall, both teams gave similar data but the biggest contrast was the second question. Both teams were asked, which of the given statements describe open-office the best for them. While software developers think that open office is a more unfocused and dysfunctional than noisy and loud, the Hardware team members chose a more noisy and loud option. Hardware teams also thought that open office is collaborative and some of them even though that open office is fun. This confirms the data that there are no clear and one-way understandings whether the open office is a positive or negative place to work at, it depends on the roles who daily work at the office.

The third question was about team space. Both teams were asked, that do they need to have a separate team space to maximize the efficiency of the team. The results were very clear. These people, who belong to teams value a separate space for the team and think that the best way to work in a team is within a separate team space.

From the interviews, it turned out, that people mainly use two work settings- desk and meeting rooms. Everything else is less important or not valued that much by them. There was a need to evaluate this with the emphasis on value, rather than the location. The survey results confirmed the statement, that the most valuable work is done at the desk. What was surprising, is that the meeting room was not considered a place where value is created. Some developers even though they could create more value at home.

Sit-stand desk was considered useful and developers even thought that it is affecting productivity in a positive way. The research supports this statement as well. Most hardware team members thought that a sit-stand desk is beneficial but does not affect productivity. One reason for these results could be, that the hardware team is overall more mobile in working at the office, while software developers tend to be really focused on desk-based work.

With the notion, that people and teams are changing the setup and location in the office rather often, this was further investigated. With hardware teams, it was clear that quarterly seating place changes are too often. The developers change office positions yearly, thus this frequency of the change is rather more acceptable.

The survey also concentrated on information sharing via whiteboards. The value of the whiteboard was primarily about visualizing complicated concepts and explaining this to others. The hardware team also visualizes tasks on whiteboards. The author finds task visualizing as a very important teamwork method.

The last question was about the natural setting, how important and how valuable it is for the teams. Most of the hardware members thought that natural setting increase productivity. Surprisingly, half of the developers were thinking that natural work settings do not affect productivity and the other half thought that it does.

All of the questions and data are shown at the end of the thesis, in appendix 1.

3.5 Conclusion of interviews and survey

The main insights from the interviews and survey are following:

- Main work is done at the desk, in meeting rooms or teams space. Different settings are not valued that much in an agile perspective
- The team needs to be co-located and ideally in a separate space to get maximum performance
- Strong focused teams are needed to tackle complex developmental activities in a high-pressure business environment.
- Team setup changes and location change are too often for many teams
- Noise is a problem in the open office especially for developers who tend to think that the open environment is dysfunctional
- The natural setting is commonly thought to be beneficial and sometimes even thought to increase productivity
- People come to work mainly because of face to face interaction
- A sit-stand desk is largely considered beneficial and useful

4 MARKET ANALYSIS

From the perspective of team-work and agile working methods, the equipment and the space should support it. A market analysis was conducted to understand what kind of flexible and ergonomic solutions does the market offer for offices to promote an agile team space and the possibilities to be more focused as a team, yet more active individually. It is very important to understand, how working space could be created for these high achieving teams? Four top online companies that were developing, manufacturing and selling office equipment were investigated: humanscale.com, steelcase.com, ergotron.com, and abstracta.se. Additionally, two local online office furniture sellers were researched, isku.ee and ergonomik.ee. Based on the above, four different, but important to agile team-work, products were chosen for the market analysis. The products, which were chosen were: mobile acoustic room dividers, to create an agile space, mobile and adjustable desks and stools for a more active behaviour and finally, stand-up tables to support stand-up meetings. All of the examined furniture would be useful in an agile team setup and would support physically more active behaviour. The research thus far has shown that agile teams have a need to be more focused, flexible and active.

4.1 Mobile walls and acoustic room dividers

Sound absorbing is the key in open office, so when a room is divided the walls should be acoustic. This is very important when some of the work consist of calling or communicating with external partners, as shown in the office D field study. Ideally, the walls should have the possibility to have a whiteboard as well, to give the people the option to collaborate, an example shown in figure 7. Office D used installed acoustic walls and added painted whiteboard walls where necessary. Furthermore, the acoustic walls should be highly mobile to create different spaces with ease in different areas at the office, but these do not work well with the knowledge worker need of having a more personal space whenever more concentrated work is needed to be done. Also, depending on the nature of the work, it should be taken into account that the information on the whiteboard, or whiteboard wall, could be confidential, so more individual whiteboards could also benefit the company to protect the information.

Figure 7. Mobile acoustic wall with whitheboard [22].

A good example of a flexible and collaborative team space is represented in the Abstracta commercial picture shown in figure 8. On one hand, this space is very flexible to adjust to changes, yet it remains very collaborative. On the other hand, the area is not suitable for concentrated work.

Figure 8. A mobile and flexible team space [23].

4.2 Ergonomic workstations

The main focus of a sit-stand desk is to have more variety of postures but in many cases, the users need even more adjustability. For example, standing workers need the screens at eye level yet the keyboard in elbow level. A good solution for leveling these needs is shown in figure 9.

Figure 9. Adjustable desktop to have different sitting and standing postures [24].

A table is considered as a normal part of an office workstation yet its usage is increasingly put under question. The reason is that most of the elements that are required for a knowledge worker are digitalized. The space that a table takes is usually 1600x800, which could be unnecessary room cost for companies. The focus of this part of the market analyses were smaller and more mobile desks, where the worker could use more standing and sitting positions (figure 10).

Figure 10. Smaller, more mobile and adjustable desk [25]

The mobility gives the option to choose a working place while the adjustability gives the option to choose the posture, or at least it would not be limited by the height of the person. Based on the field study, none of the offices used these mobile and adjustable tables. From the negative perspective, using the table, shown in figure 10, in an open office could be too open for the user and visible for third parties.

Regarding the team table, then there was a good and flexible option in ergonomik.ee as shown in figure 11. From the positive side, the table is foldable and mobile which gives options for changing the space in an easy way. But from a workers perspective, a stand-up table should have the possibility to rest legs in diverse ways to support the posture.

Figure 11. Hight adjustable team desk [26].

4.3 Adjustable stools

Stools are considered better than chairs, since stools promote more standing, while chairs tend to promote sustained sitting. The emphasis in the work environment should be on active behaviour stools which make much easier to get up and be active. The stools should be adjustable, mobile and light as shown in figure 12. Some stools have a leg rest as well, which could give extra options for having diverse postures.

Figure 12. Mobile stools with adjustable hight [27][28]

4.4 Conclusion of the market analysis

Based on the market analyses, there are elements that could support agile offices in the market, but there is no cohesive system for it. A system that supports agile teams being co-located and having fewer interruptions from outside the team area and at the same time would emphasize the knowledge workers value creation at the workstation. This should be a separate area, that promotes standing, rather than sitting and is flexible to move whenever necessary and whenever it is needed. Agility as a practice is used in the offices, but a supporting system that truly focuses on the productivity of the teams is missing from the market.

5 RESEARCH CONCLUSION AND INSIGHT SYNTHESIS

The aim of the insight synthesis is to evaluate all of the insights and combine them to a logical and sensible design brief.

While technology trends give the possibility to work from anywhere the workers still need to meet face to face. Furthermore, the complexity of creating new products and the constant innovation pressure that businesses have forced people to work more with agile methodology and more in small units as focused teams. Thus, emphasis to maximize team efforts and performance should be aimed by companies that are dealing with such challenges. Thus, organizations are becoming more flexible and responsive which means that the focused teams need a more flexible and responsive team space that adapts to different needs and team setup changes throughout the company.

The focus should always be well-being rather than comfort, even if office workers exercise after work they still tend to be sedentary, sustained sitting in the office is one of the most problematic elements to the long-term individual health which does affect organizational performance. Based on the research the best way to intervene sedentary behaviour in office is to have diverse options for different postures and a more dynamic office setup. While activity based offices have very diverse seatings they are not used that much by agile teams. The key is bringing the activity settings more to the team space. Agile teams use often standing to increase focus and alertness but standing can also increase engagement and creativity in teamwork as the research suggests. But standing itself is a static behaviour so it generates problems on its own. The key is how to stand while having the possibility to be mildly active or how to stand diversly. There is no direct evidence that sitting suppresses teamwork yet there is evidence that standing enhances teamwork. This is what an agile team should be taking advantage of.

Another key element emerged from the research is that while agile teams are very focused, open office is not a good setting for these highly focused teams with having too much noise and visual interruptions.

To maximize the team performance the activity settings should merge with the team space to increase collaboration, visualization and physically active behaviour inside the team area. The aim should go from open office to a more teamwork centered office especially companies that use agile methodology. Thus, a team centered furniture and equipment that is suitable for team engagement as well for concentrated work with the aim of maximizing the effort of an agile team is needed. This system is missing from the market.

Considering all of the data and research a brief is formed: How to create team space options in an open office which could adapt to diverse changes in the team setup and promote more physically dynamic behaviour? A space that is designed considering agile elements so that the team would have an active and focused area of execution and achievement.

There is a need for an agile space which is responsive to changes yet promotes teamwork, concentrated work, and more engaged behaviour.

The three cornerstones of the design brief are: **Diverse standing, flexible team area, focus on team performance through agile thinking and concentrated work**

6 CONCEPT DEVELOPMENT

The concept development aims to reach a final solution based on the cornerstones of the synthesis. The process will go through ideation and prototyping to a valuable concept creation. After that, the business value of the idea is being analyzed with the business canvas tool.

6.1 Ideation

The cornerstones of the research synthesis were flexible team area, diverse standing and performance space for agile teams. These elements were giving the core for ideation.

Team effectiveness will increase when it works in one area and in one space having no interruptions from outside the team. To separate teams in a flexible way mobile room dividers are needed as shown in the market analysis. The problem with these is adding them with a table of 1600x800mm which is a typical size of an office work table and a chair takes too much space and the tables are usually not mobile enough. Furthermore, considering the technological developments of digitalization, cloud and electronic miniaturization 1600x800 size of tables are unnecessary, thus, a synthesis of room dividers and workstation is created to a more compact solution for an agile office. The proposed concept is a workstation without a desk. The initial concept of a work station wall is shown in figure 13. While creating a space the workstation has an adjustable hight touchscreen and an adjustable height laptop docking so the user has many options to work either standing or sitting.

Figure 13. Initial sketch of a work wall to create a team space. Has a touchscreen monitor and a docking system for laptop. The hight of the dock and monitor can be adjusted for the user preference.

An agile team is usually 5-10 members, each of the members would have their own work wall which together they form a team space. An agile space for an agile team.

Healthier behaviour is promoted when there are more options to stand rather than sit. To promote standing the work wall has a structural element at top of the product which could be used as a stretching bar and it increases the rigidity of the product as shown in figure 13. Furthermore, with the addition to the stretching bar, the team space should have mobile stand-up team table to carry out agile meetings in that space and mobile stand-up chairs (stools) to promote more standing and active behaviour. Both of these products are currently in the market as shown in the market analysis. With the space created by the work wall, the stand-up desk and stools the result is a performance space for an agile, highly active and productive teams, an example of this system is shown in figure 14. The created space will be supported by different activity areas, so if the team member needs a change, they can always go to another setting to work more independently or to socialize with people outside of the team.

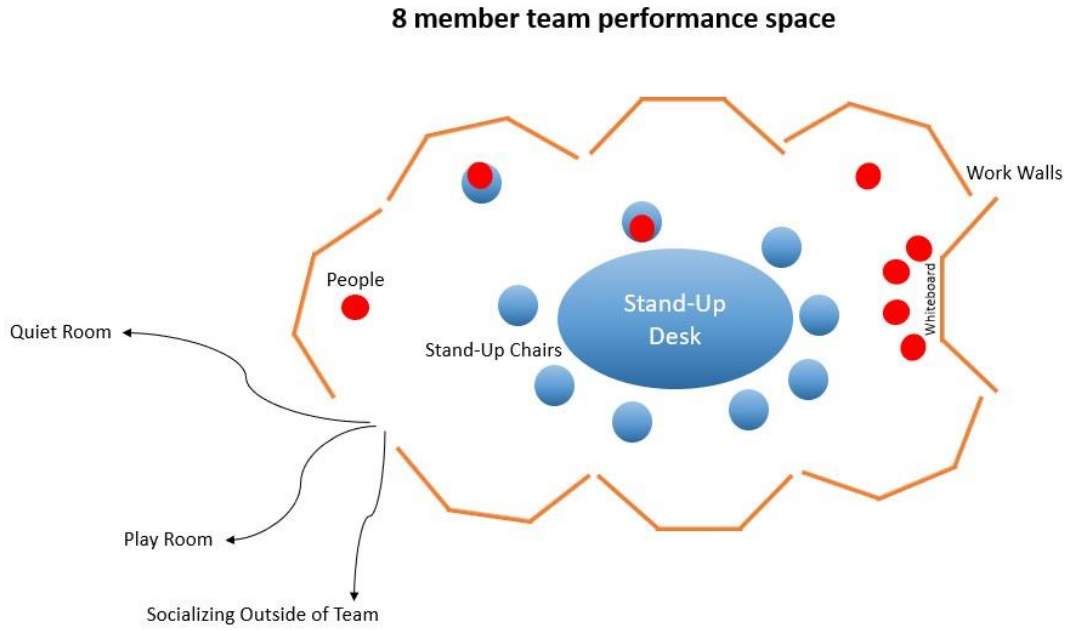

Figure 14. An 8 member team setup with the work wall, stand-up tables and stools, so-called agile team performance space.

6.2 Prototyping

A prototype was made to test the initial sketch and to understand the size and usability of the product. The prototype was built out of three 2200x600mm honeycomb boards and connected with two hinges (figure 15). A 1600mm metal pipe was added to promote healthier behaviour. Cuts were made on different locations on the side walls to generate diverse standing options. A small table was installed to hold the laptop. Monitors positions were rethought from the initial sketch and added smaller ones to the sides to make the product more ergonomic. Simple plastic wheels with brakes were installed to understand how would it be to move the product around the room.

Figure 15. A prototype of the initial sketch.

Different postures were tested as shown in figure 16. The aim was to give more options for the user to stand as well as the possibility to stretch or even exercise with the bar.

Figure 16. Variety of postures that the exercise bar allows the user to take when attached to the work wall.

6.2.1 The outcome of the prototype phase

One honeycomb board should have been 800x2200 instead of 600x2200 to give more space and bigger options to have larger screens, thus the base area of the work station will be increased as well. Sound reflection is a problem, the walls must be acoustic. Light can be an issue, it depends on the lighting in the office but an additional lighting option on the wall should be implemented. The stretching bar was rethought to an open exercise bar to give more diversity with stretching, exercising and when attached to the wall to support different standing postures. Cut-outs on the wall were created to have different options to rest a leg, this gave additional options for diverse postures. The mobility of the wall was light and easy, yet the real product would be much heavier and more rigid because of the acoustic material which needs a stronger and heavier construct for support. Bigger wheels should be implemented to deal with offices that have carpets. According to the research, teams use whiteboards a lot, thus a whiteboard will be added on the back side of the work wall. The product should be more inspired by nature and less formal as the research suggests.

6.3 Final concept: The Office Shell

The final concept is a shell inspired workstation that is designed to promote team engagement and physically active behaviour with protection against external interruptions outside the team. The product is visualized in figure 17.

Figure 17. The Office Shell

6.3.1 Description and features

The look is made green to give it more of a natural shell protective feeling. The shape is round with emphasis on concentrated work, yet there is openness for team communication and collaboration. The exercise bar and the holes at the back side are there to support diverse body postures while working.

The wall itself is structured with a plastic frame which is supporting a soft natural woolen sound absorbing material inside an acoustically transparent green cotton layer. The whole plastic frame is

connected to the lower metal base. The base keeps the weight of the Shell near the ground so it would have a better balance and it would be easier to move it whenever there is a need. Six wheels with stoppers are connected to the metal base. Inside the wall beneath the screen system, there is an electric battery to give additional flexibility in moving the Office Shell while working. (figure 18)

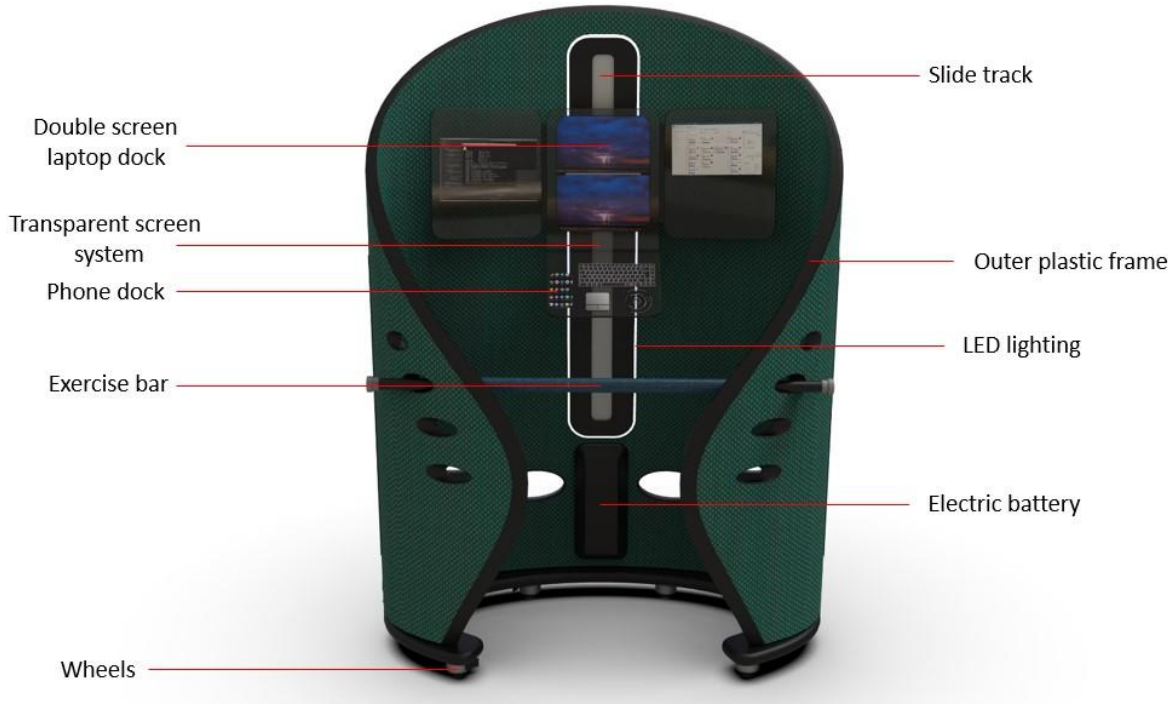

Figure 18. The Office Shell front side and features.

The product has two magnetic ribs on the sides to connect two or three workstations together. The electricity slots are in the lower part in the back and sides as well as in the upper part. The sides have a plug-in cable and a nest so there would not be wires hanging throughout the floor. The whiteboard is on the back side of the product, so if needed the wall is turned around for collaboration and visualization. At the lower side in the back are leg rest holes so that if standing the user can have diverse ways to do it. (figure 19)

Figure 19. The Office Shells back side with features.

6.3.2 Individual usability

The size of the Office Shell is 2286x1602x803mm as shown in figure 20. It takes the same area as a classical office desk(1600x800mm) but the user can be inside the Shell while the normal desk is used outside of the table area.

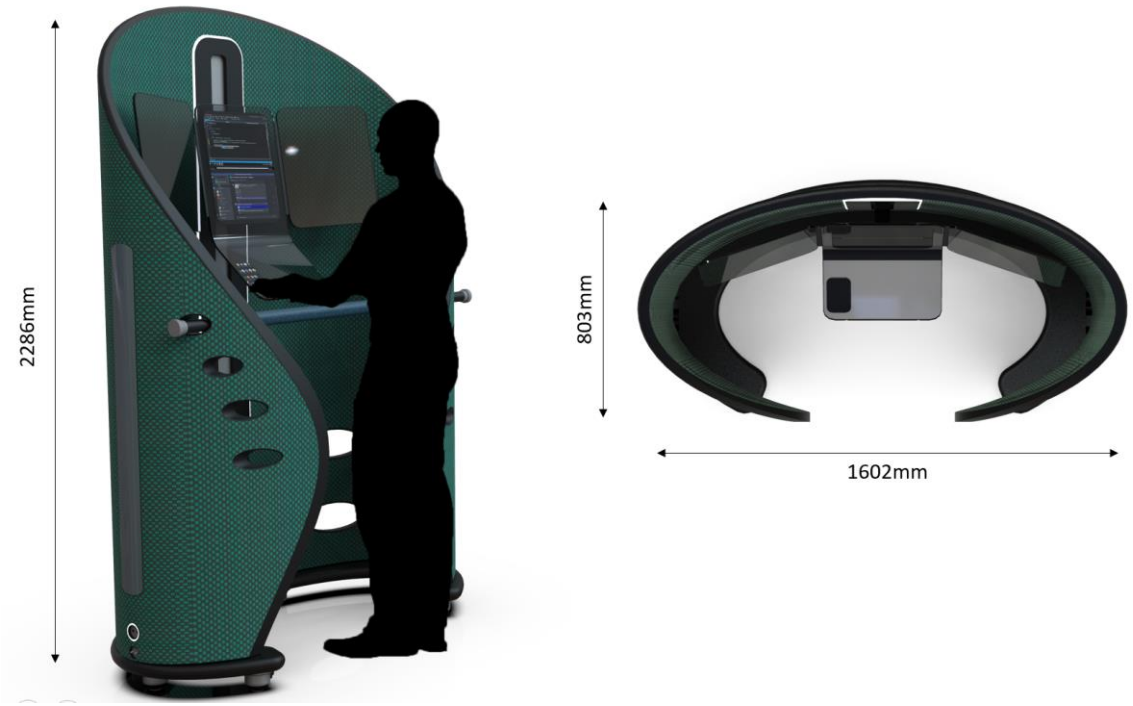

Figure 20. Hight, length and width of the Office Shell.

As told before the exercise bar with leg rest holes supports diverse standing postures for the user. Additionally, the exercise bar could be used for stretching and exercising in many different ways, some of these in figure 21.

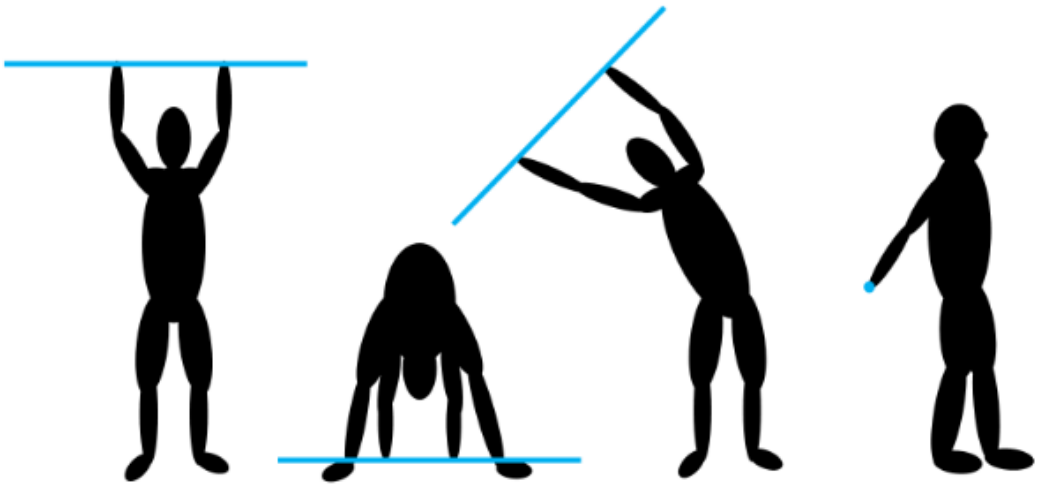

Figure 21. Stretching methods that can be done with the exercise bar.

The monitors are linked to an adjustable system which the user can set the hight that is needed through a slide track behind the screens (figure 20). The screens were created in thinking on concepts that LG was promoting, mainly transparent screens and double screened laptops [27]. The aim was to think through how could the shell be used after 2-3 years. In the Office Shell, there are three transparent screens which could be folded. The middle screen is longer to have a more suitable and ergonomic form for a human body to work with. Additionally, the middle screen has two docking slots, one for a phone and the other for a laptop. The laptop is docked to the middle screen and acts as a double screen itself in the Shell monitor system. (figure 22)

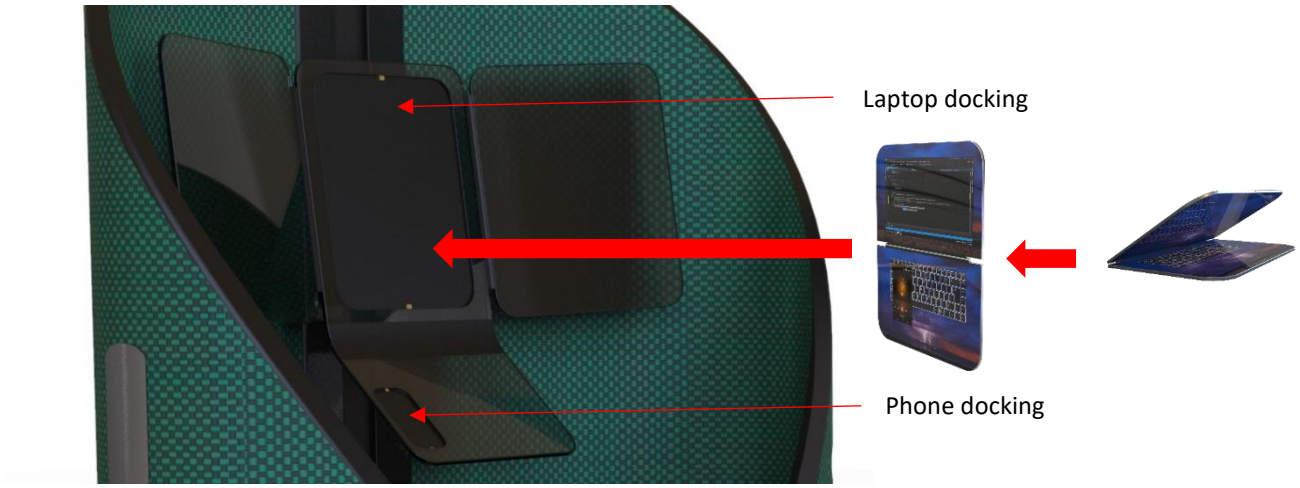

Figure 22. Docking the phone and the laptop.

6.3.3 Team usability

Considering that an effective agile team has 5 to 10 members the best usage of the Shell is in the system with stand-up table and office stools. (figure 23)

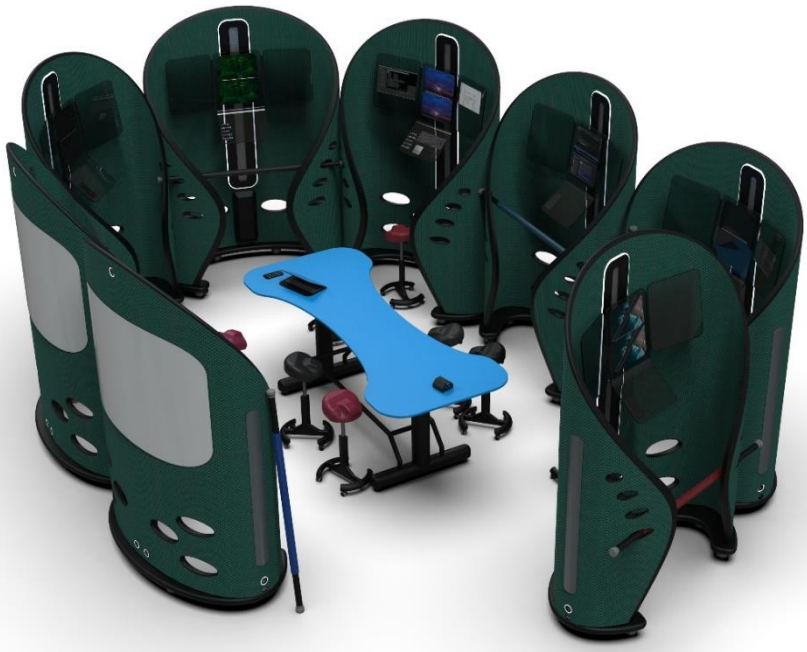

Figure 23. Eight-member teamwork space with Office Shells, stand-up table and stools.

The best way to interact with the team is to have stand-up meetings at the area in front of the stand-up desk. Furthermore, The Shell can be turned around to have a whiteboard meeting or there could be a portable projector which could be used for presentations. The dashboard could be added to the stand-up table to have a live overview of the progress that the team is making. All of this so that the team could work together in a more focused and effective way.

With the flexibility that the item offers the space can be created in diverse ways. If needed it can be closed area but it can be open on many sides. For example, windows can be on one side of the team area and exit on the other side of the space. It all depends on the team size, but the Shell supports flexibility to form diverse areas. Furthermore, the Shell could be used in individual work as well, throughout the office. (figure 24)

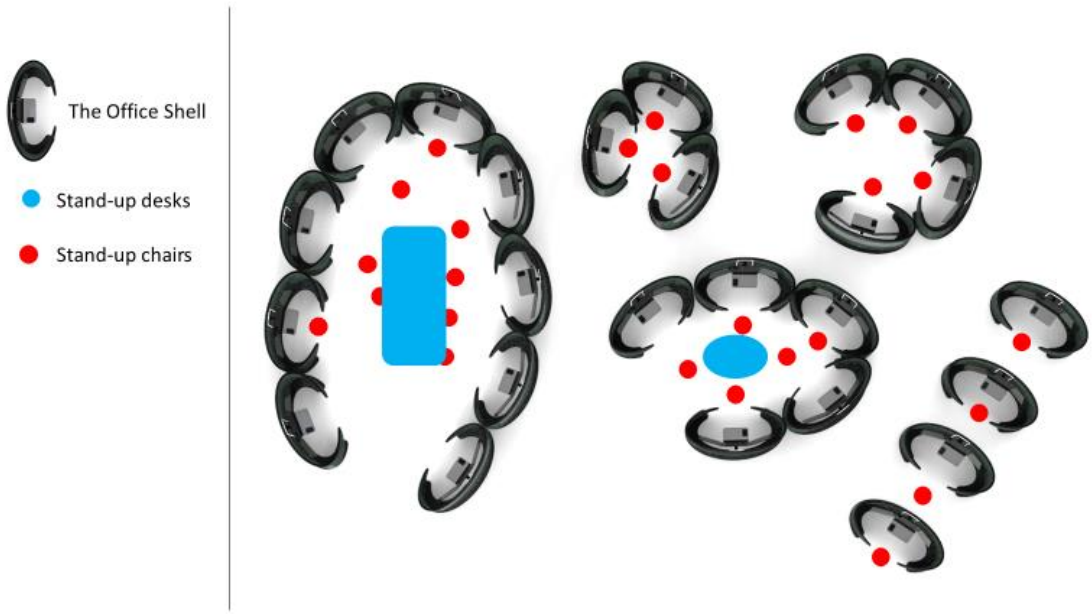

Figure 24. Different team setups and individual setup.

6.3.4 Conclusion

The main direct advantages of the Office Shell is that it gives the organization more options to respond to changes in the office. The teams can form a space to achieve their goals in a more focused manner and the whole team set up in that space generates more physically active behaviour through diverse standing options. With all of the team meetings done in team space, there will be no need for stand-up areas outside from the team area and there could be potentially be less meeting rooms needed.

6.3.5 Further Developments

Additional work has to be done on making the Office Shell a more flexible product in terms of storing an unused Shell and a second prototype has to be built to test the system in a real office environment and acquire feedback from the users.

6.4 Business canvas

To understand the business value of the proposed concept a business canvas is created. The value lies deep in companies that need the ability to adapt to complex problems through strong and focused teams. The teams need space in open areas to be more engaged and efficient in tackling the challenges at hand. The Office Shell will provide such a space for these teams. The key partners are companies that offer displays and acoustic walls. The first activities should be developing a final concept with testing it with the users and from there out-sourcing all of the parts and focusing on assembly, marketing and sales. The users are developers, team leaders and all focused team members and the customers are IT companies and companies which focus on teamwork. The main sales are done through the product web page. The product cost is estimated to 1200 Euro while the sales price is 50% profit margin. All of the data is shown in fig 25.

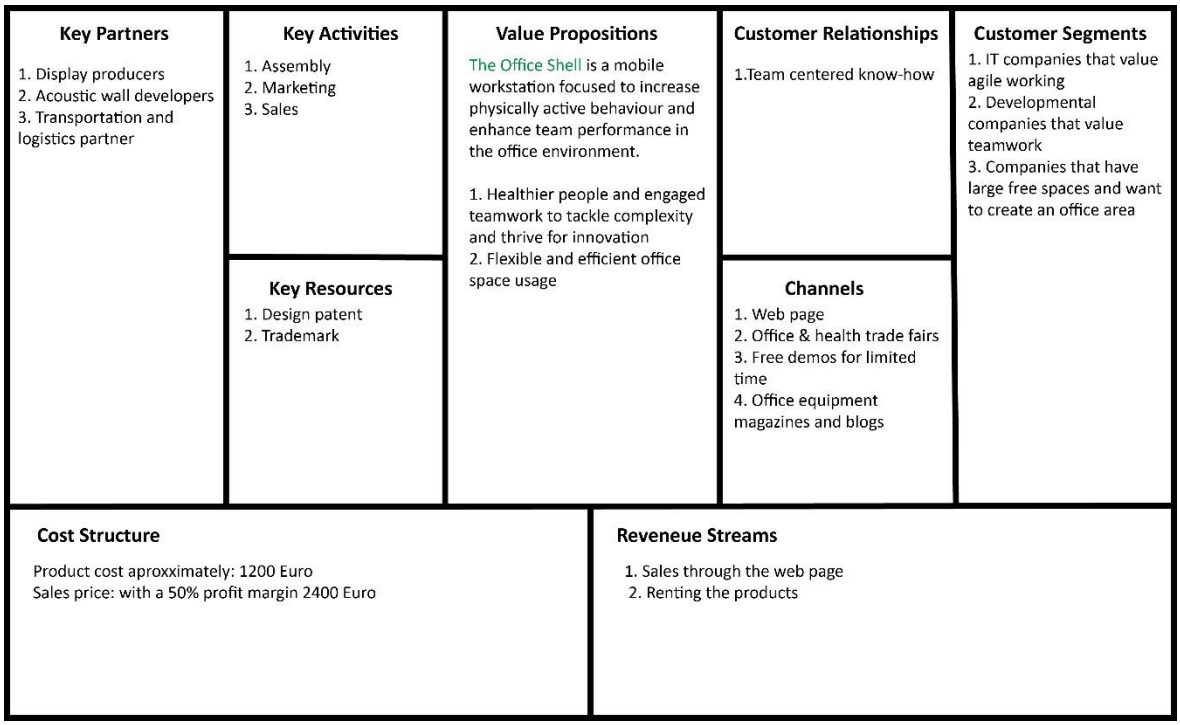

Figure 25. The Office Shell business canvas

7 SUMMARY

The thesis aim was to research sitting and standing in the office environment with an emphasis on teamwork. The investigation went from an individual perspective through the knowledge worker trends, one of these being agile teamwork. This gave a frame to the thesis which connected to standing through focused engaged behaviour and stand-up meetings. The field study gave insight into how office work happens through different settings and an agile mindset. The main principle that was noticeable throughout the thesis was that the high achieving teams need a focused work area that would be flexible to changes. Nevertheless, the knowledge worker needs privacy to be productive as well. Through the market analysis, it was clear that a system that would support agile team space yet would engage the knowledge worker physically while supporting concentrated work is missing. The synthesis combined all the research results into four design cornerstones: Diverse standing, focus on team performance, flexible team area and concentrated work. These elements gave fruitful soil for design interventions thus the Office Shell was created.

The Office Shell is a workstation that is a part of an agile teamwork system. With a stand-up table and stools, the wall forms a physically and mentally active and engaged workspace. It offers flexibility to adjust to changes happening inside the team set up yet protecting the people from external visual and auditory interruptions. The aim was to decrease sitting time and increase the standing time which does happen through an active, engaged agile team and with the support of the Office Shell system. The concept is a new way of thinking about how offices can enhance teamwork, so companies would be more effective in innovating or solving complex challenges.

Future developments should be done in creating a concept and testing it with an agile team while more thinking should be done making the Shell more flexible to store an unused workstation in the office.

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9 LIST OF FIGURES

APENDIX 1

The interview questions:

1) Introduction

- What is the industry you are working in?
- What is your role in the company?
- How many projects/products are you working in?

2) Office Work

- What defines office work for you?
- How long have you been an office worker?
- What type of office do you have?
- Do you have a dedicated desk? Do you need a dedicated desk?

3) Mobility & Flexibility

- Can you work from home?
- Have you worked from other places than the office?
- How many places can you work inside the office?
- Why is working in the office better than from home/any other place?

4) Exercise & Physical Activity

- How do you stay active? How do you stay physical inactivity?
- What kind of ergonomic interventions you have in your office to engage people with physical activity?
- What kind of educational interventions you have in your office to engage people with physical activity?

5) Teamwork & Collaboration

- Are you a part of a team? Describe your teams' ways of working?
- What kind of space does your team have? Do you need a separate space for the team?
- What are the main challenges in teamwork?
- What kind of tools do the teams use in your company?
- Are the teams using a whiteboard?
- How do ensure the team is productive?
- How does physical activity influence teamwork?

6) Office setting

- How many settings does your office have? Do you use them? Why?
- How much natural settings does your office have? Biophilic office design
- Do you have space for play/exercise?

7) Productivity

- How do you stay productive?
- How do you increase your performance at work?
- What stops you at being productive?
- What would you need to be productive?

APENDIX 2

The survey conducted with hardware developing team and software developing team

1. Why is working from office beneficial?

    a. Face to face interaction

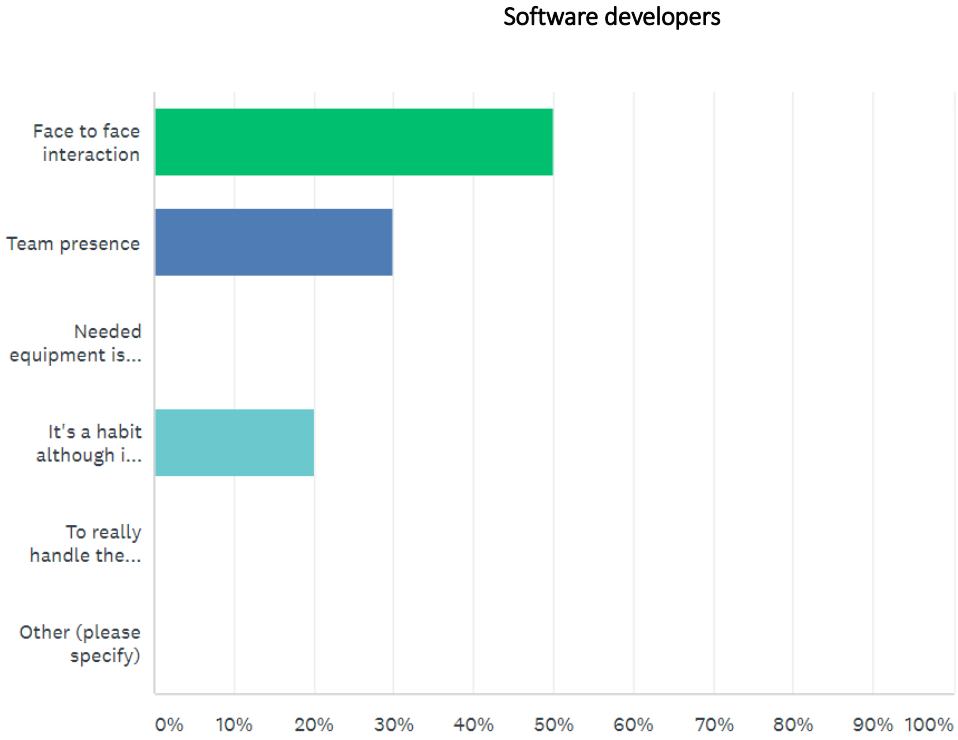
    b. Team presence

    c. Needed equipment is in the office

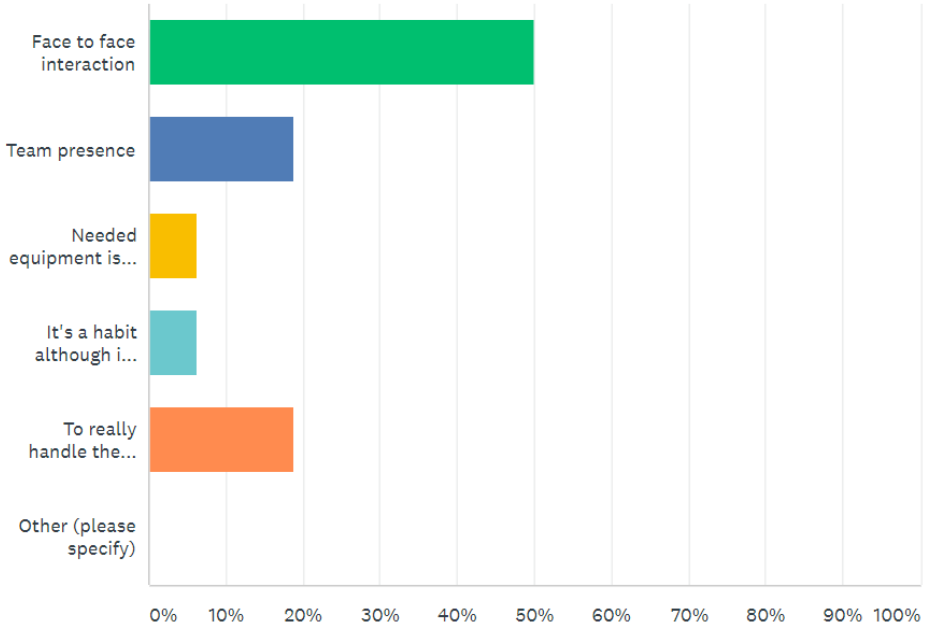
    d. It's a habit although I could do everything at home

    e. To really handle the situation you have to be physically in the situation

    f. Other



Hardware team



2. Which of the following statements describe open-office the best for you?

a. Noisy and loud

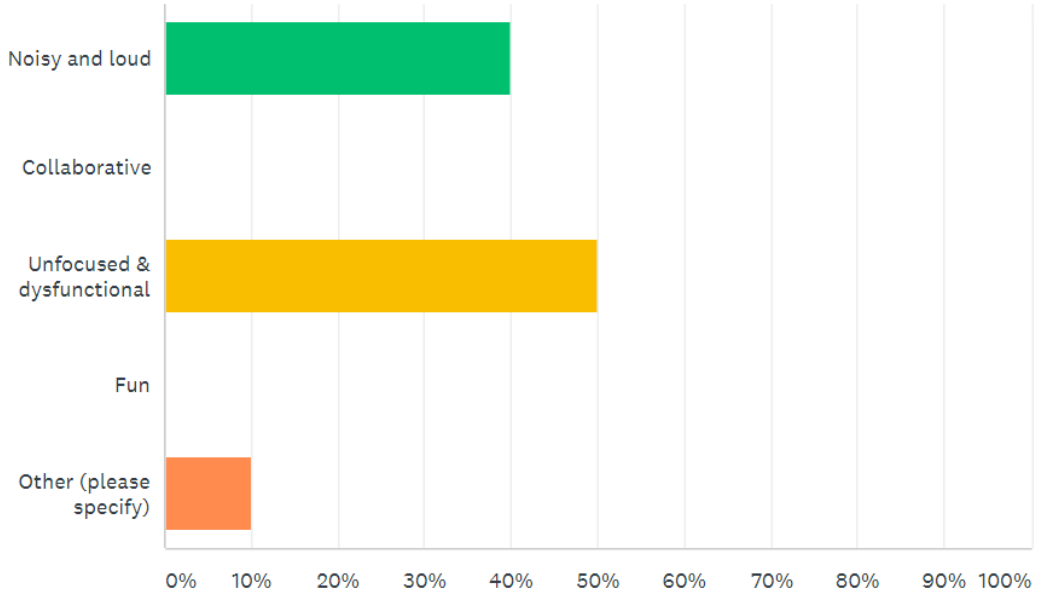
b. Collaborative

c. Unfocused & dysfunctional

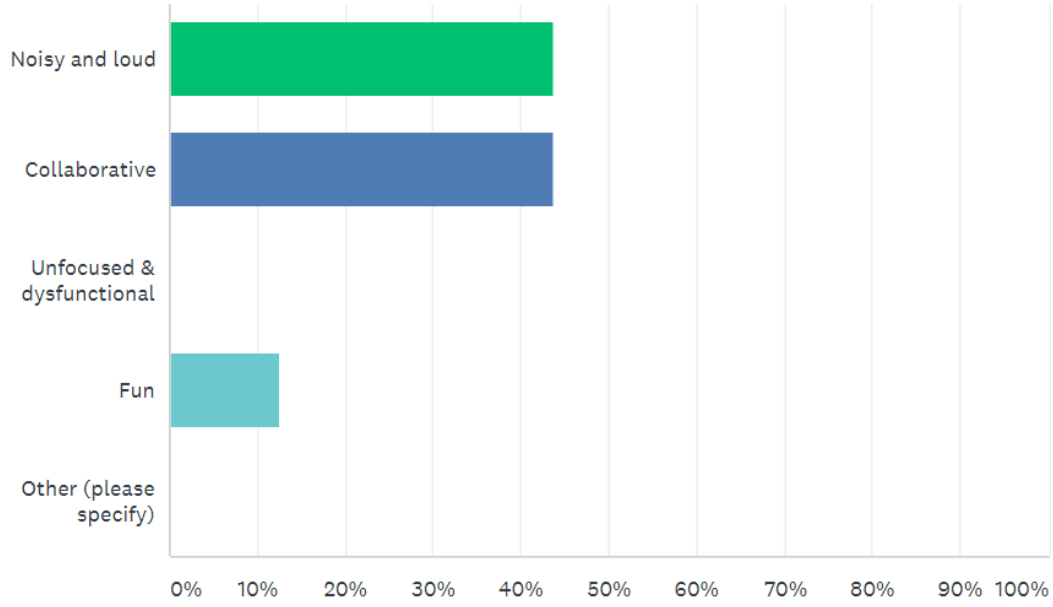
d. Fun

e. Other

Software developers



Hardware team



3. To maximize the efficiency of the team they need to have a separate team space?

a. For sure

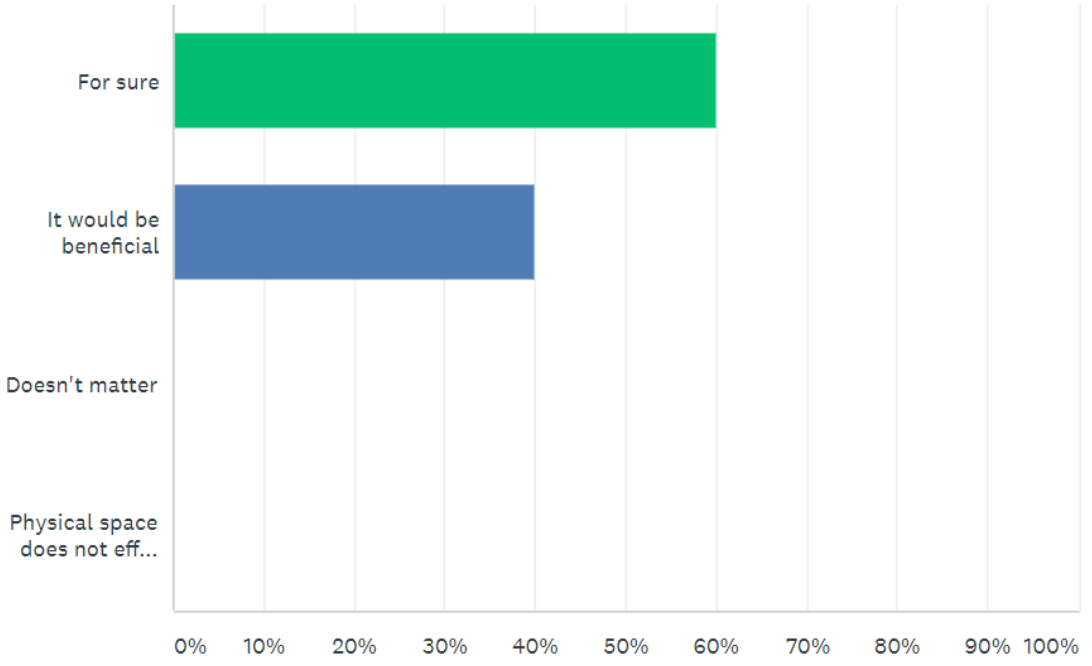
b. It would be beneficial

c. Doesn't matter

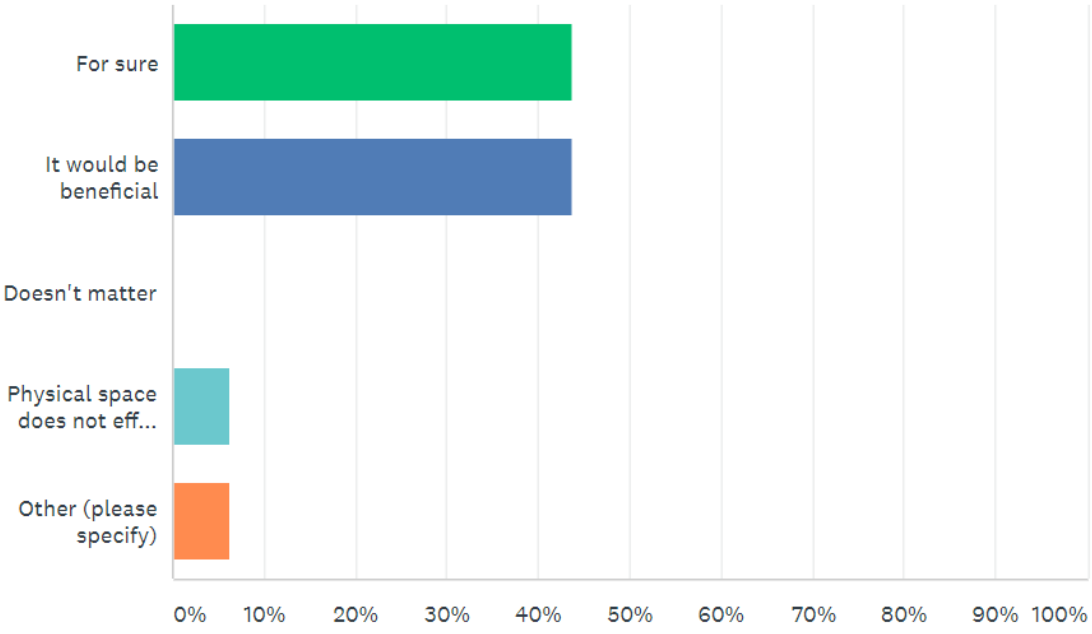
d. Physical space does not effect teamwork

e. Other

Software developers



Hardware team



4. Where do I create value the most?

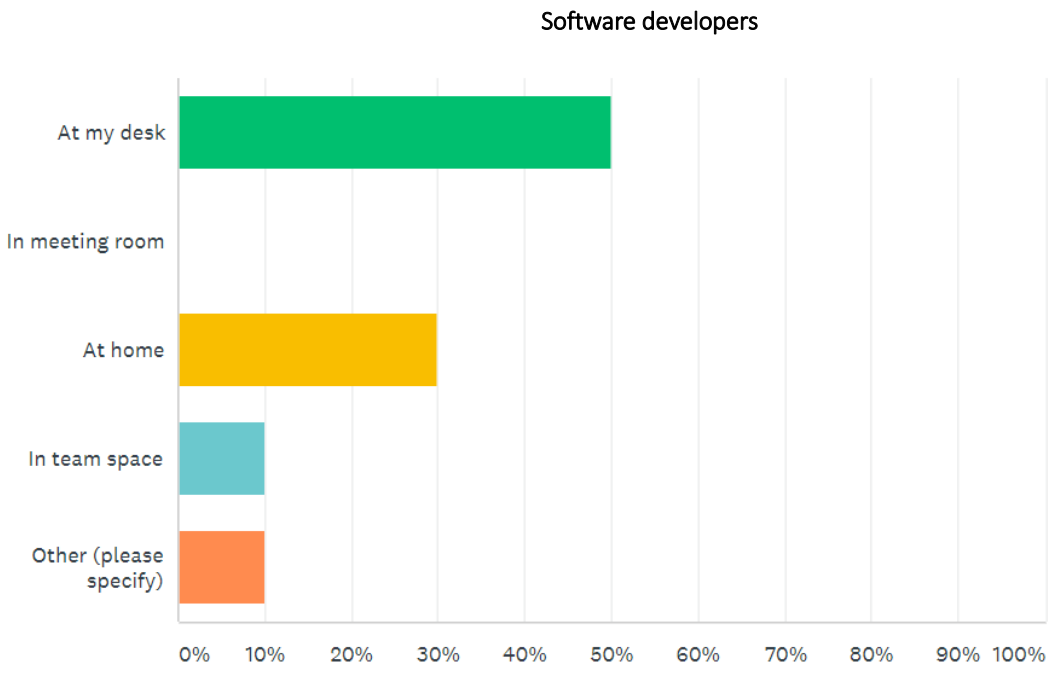
a. At my desk

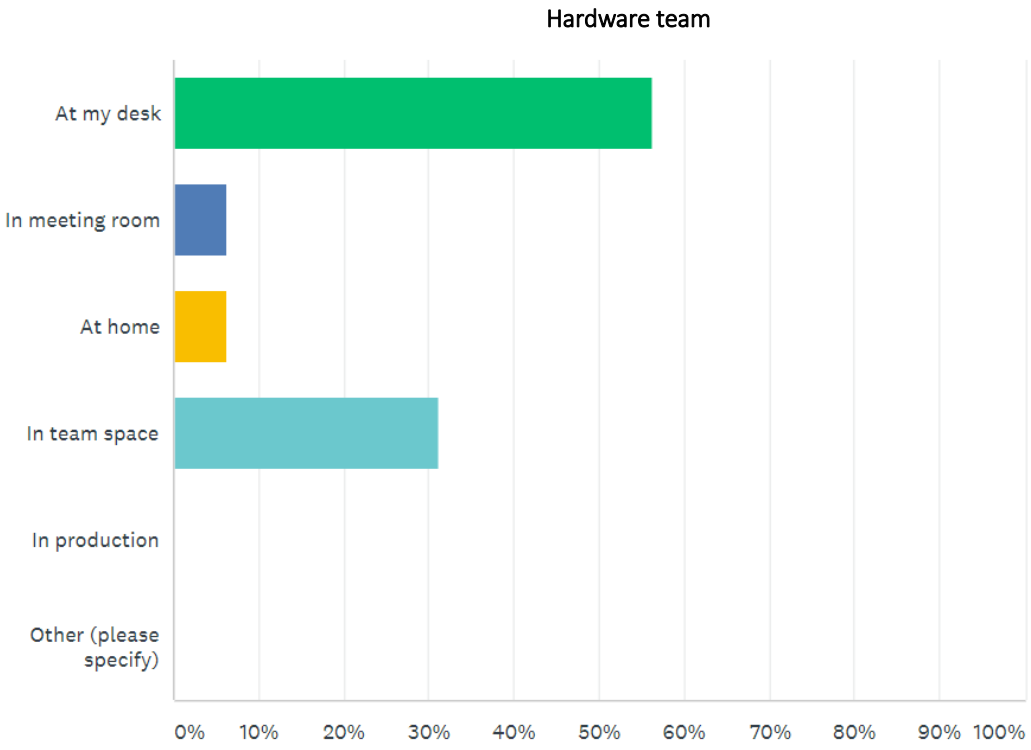
b. In meeting room

c. At home

d. In team space

e. Other





5. Stand & Sit desk is useful and increases engagement and productivity?

a. Totally agree, I use it every day multiple times

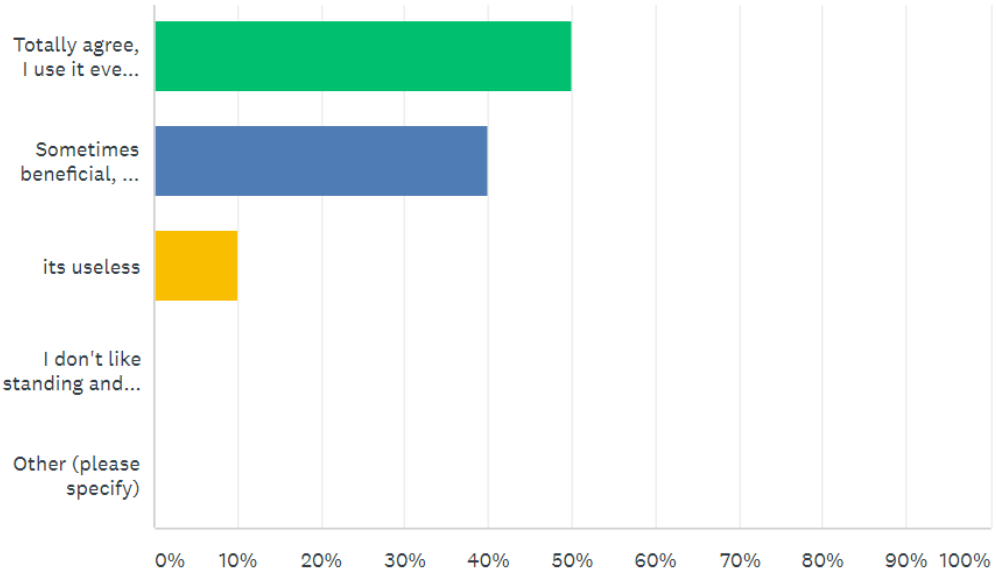
b. Sometimes beneficial, but does not effect my productivity

c. its useless

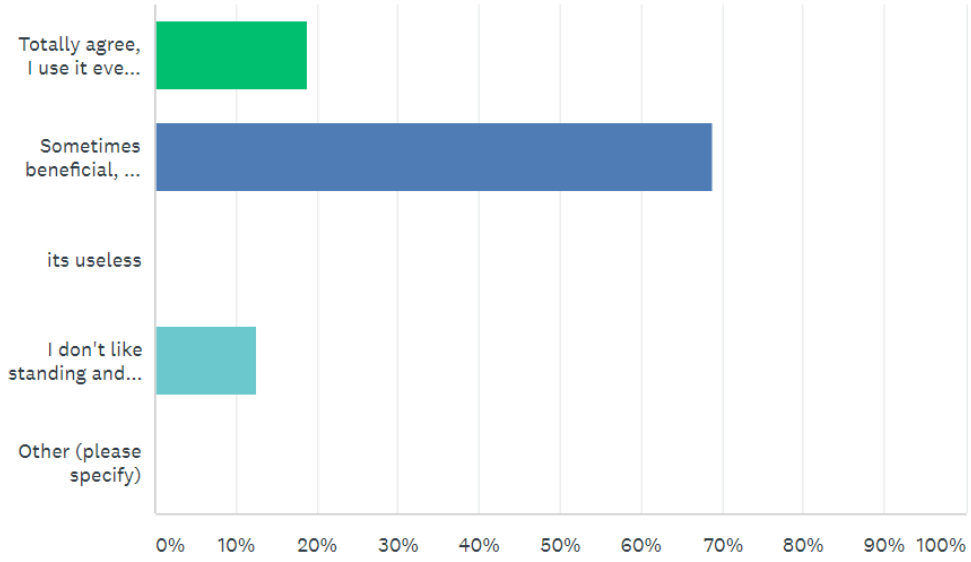
d. I don't like standing and working

e. Other

Software team



Hardware team



6. How often do you change your sitting area or desk?

a. every month

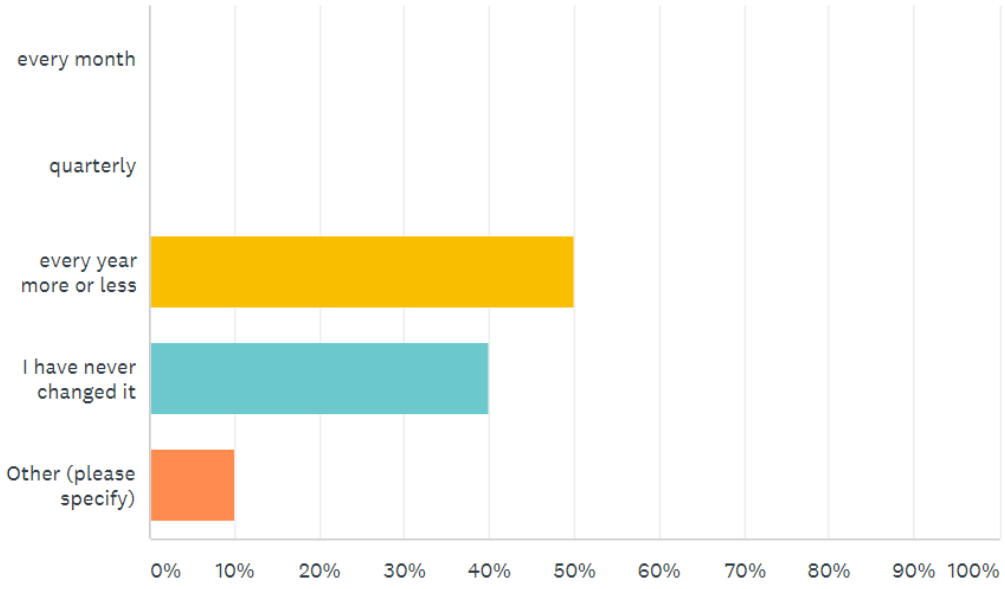
b. quarterly

c. every year more or less

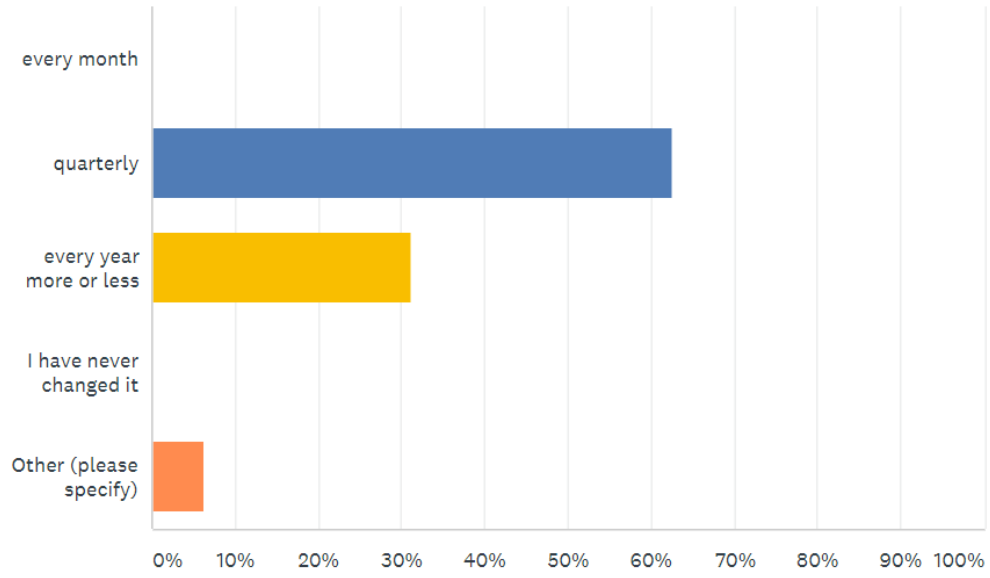
d. I have never changed it

e. Other

Software developers



Hardware team



7. How do you use whiteboard?

a. With team to visualize tasks

b. Explain complicated stuff to others

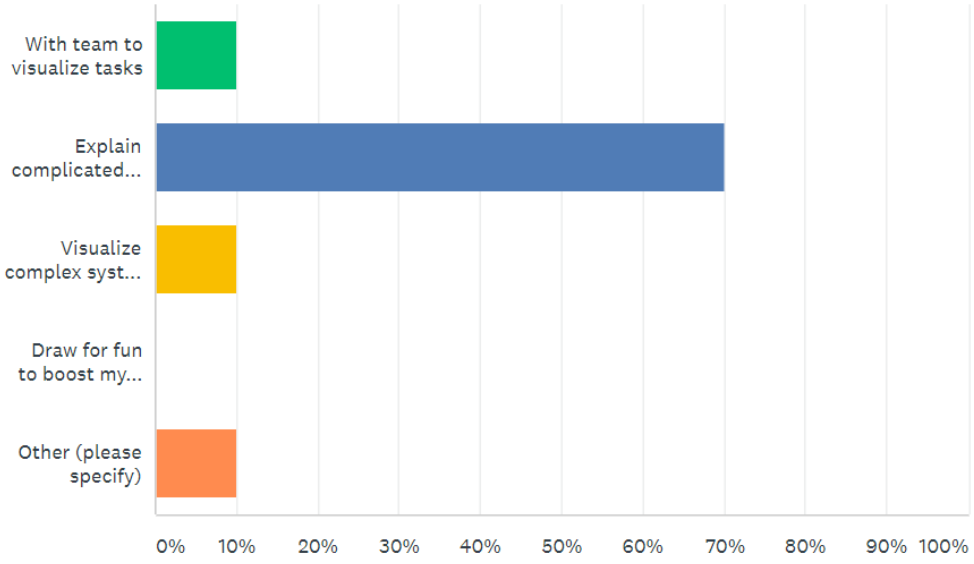
c. Visualize complex systems for myself to understand them better

d. Draw for fun to boost my creativity

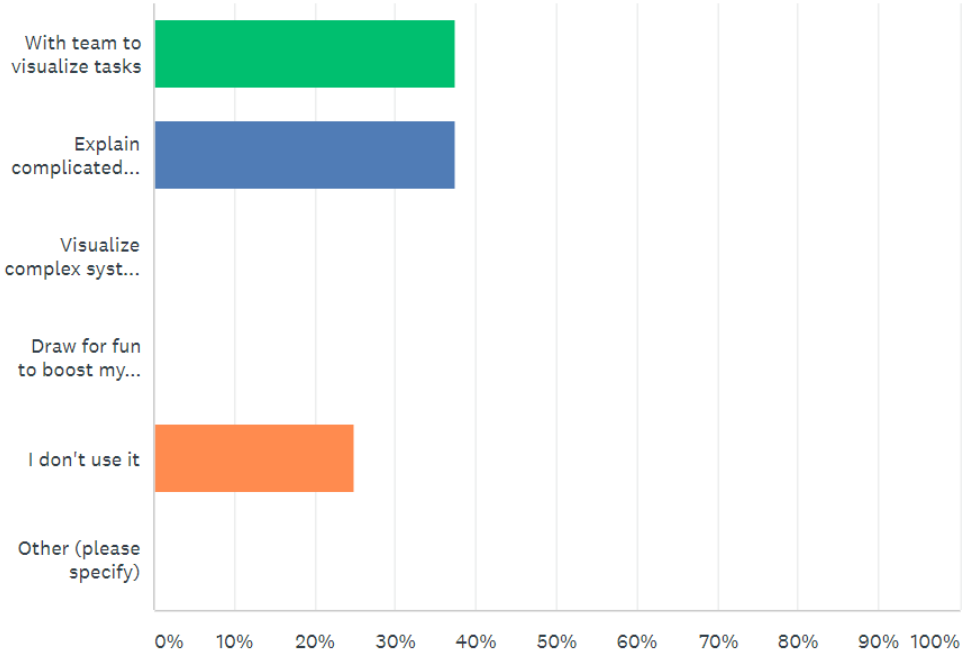
e. I don't use it

f. Other

Software developers



Hardware team



8. Natural setting in office (plants, flowers, green stuff, no echo, etc)?

a. I feel more relaxed and more productive in a natural setting

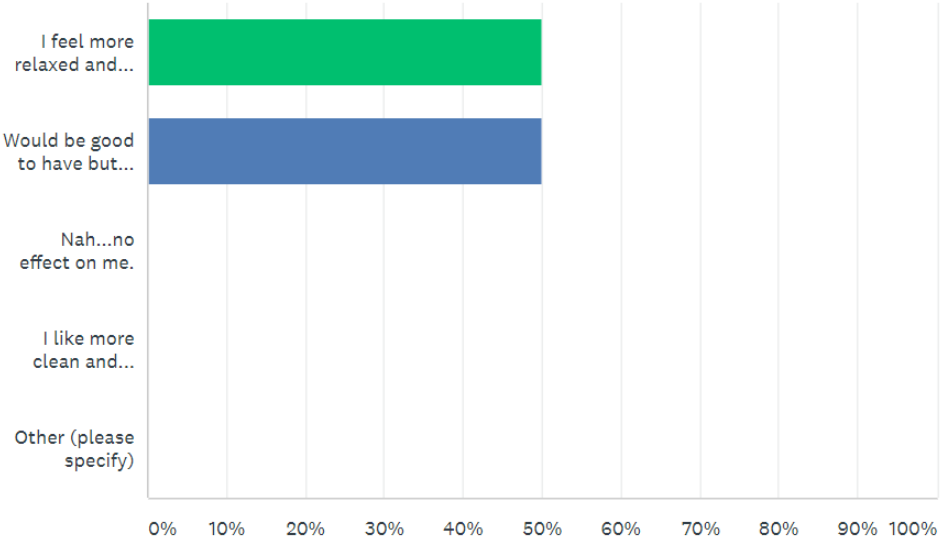
b. Would be good to have but does not influence my work

c. Nah...no effect on me

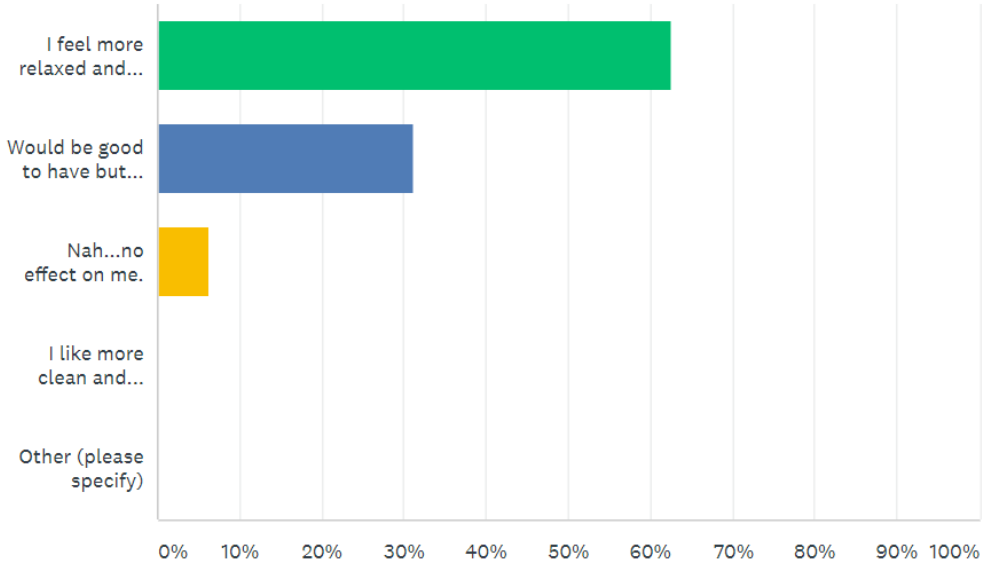
d. I like a more clean and formal setting

e. Other

Software developers



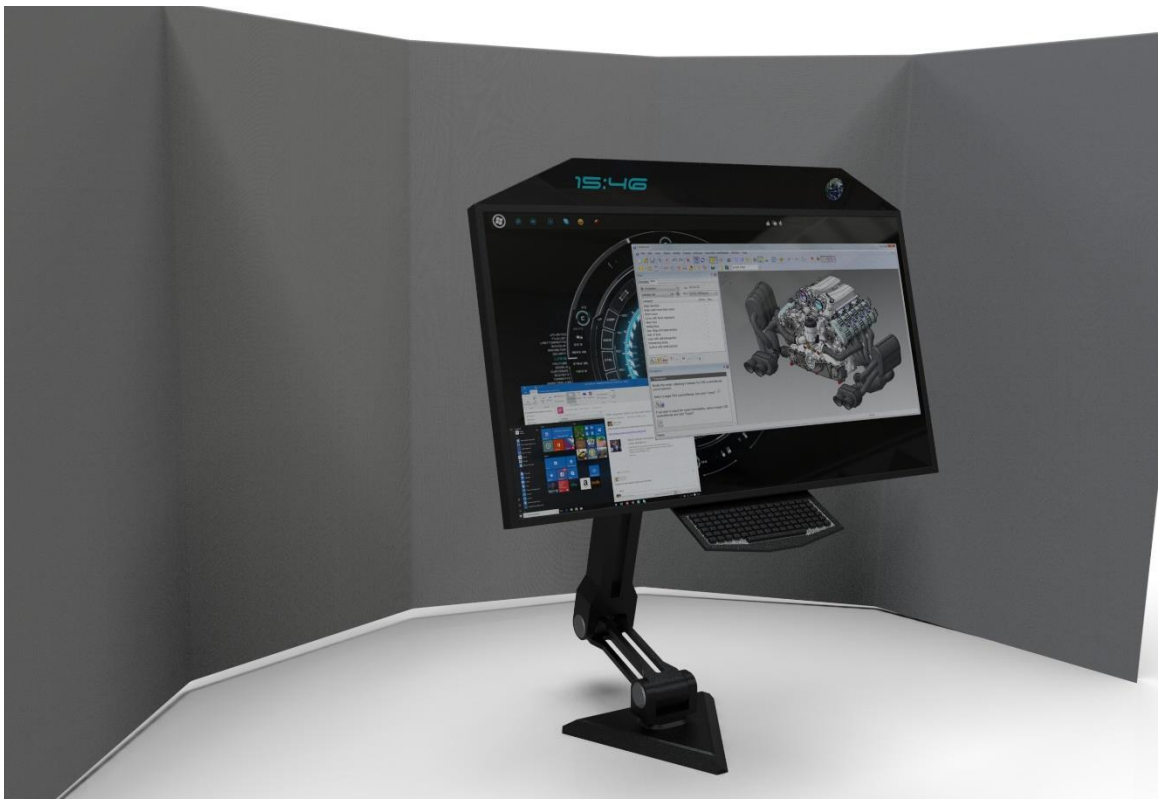
Hardware team



GRAPHICAL MATERIAL

The concept development was done in parallel with the research, so different concept development iterations were generated.

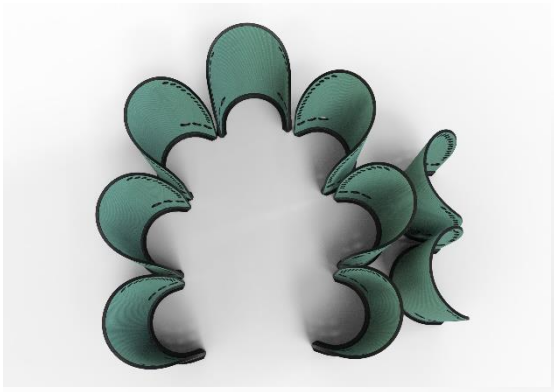
Iteration one

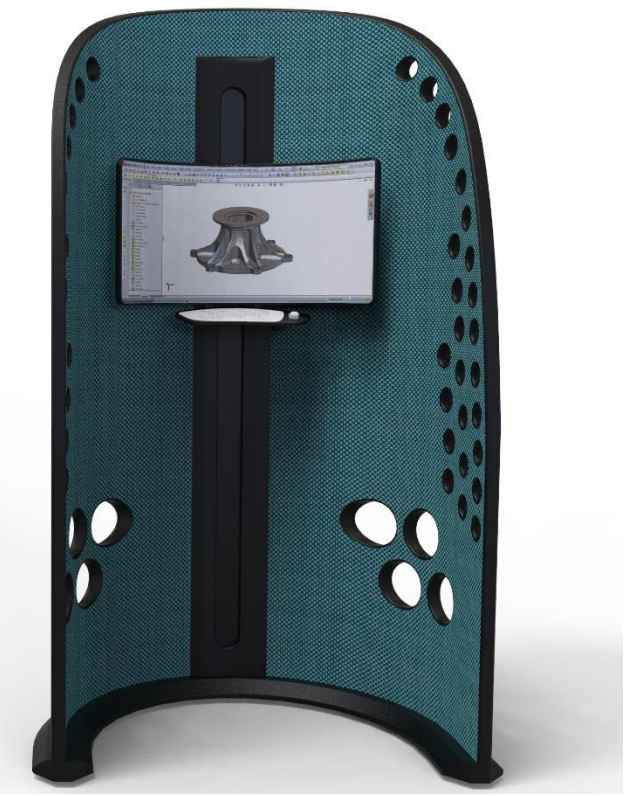


Iteration two: The work wall

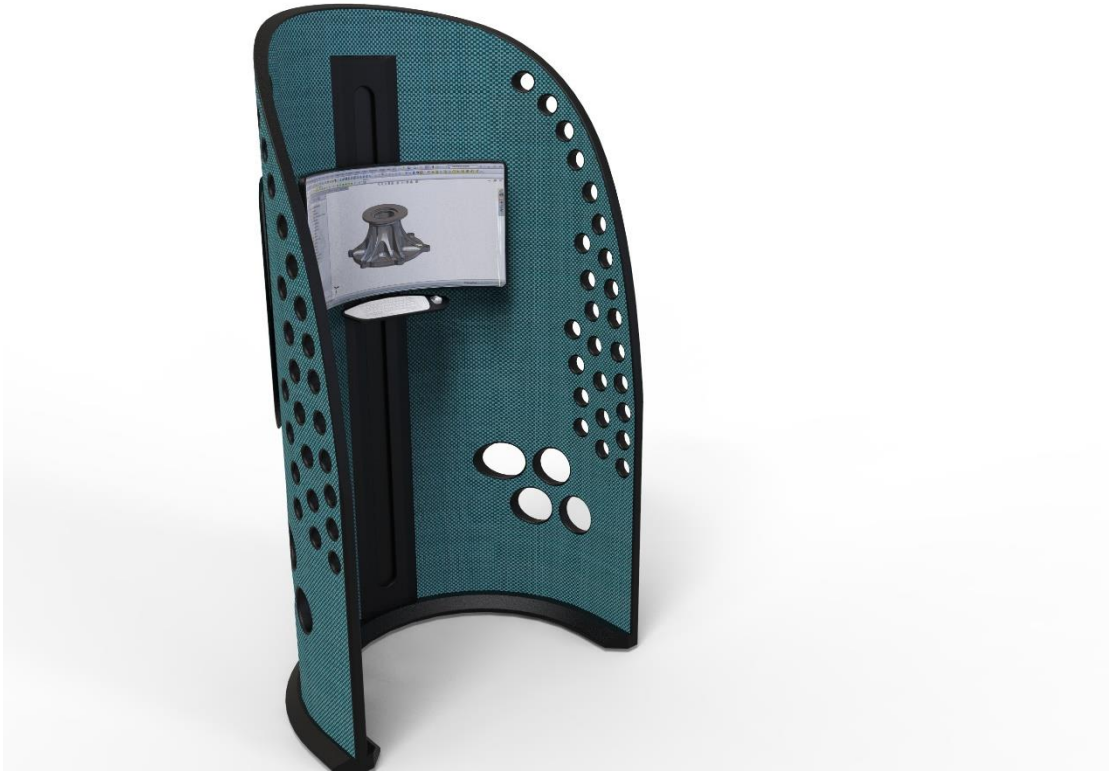
Features

Iteration three

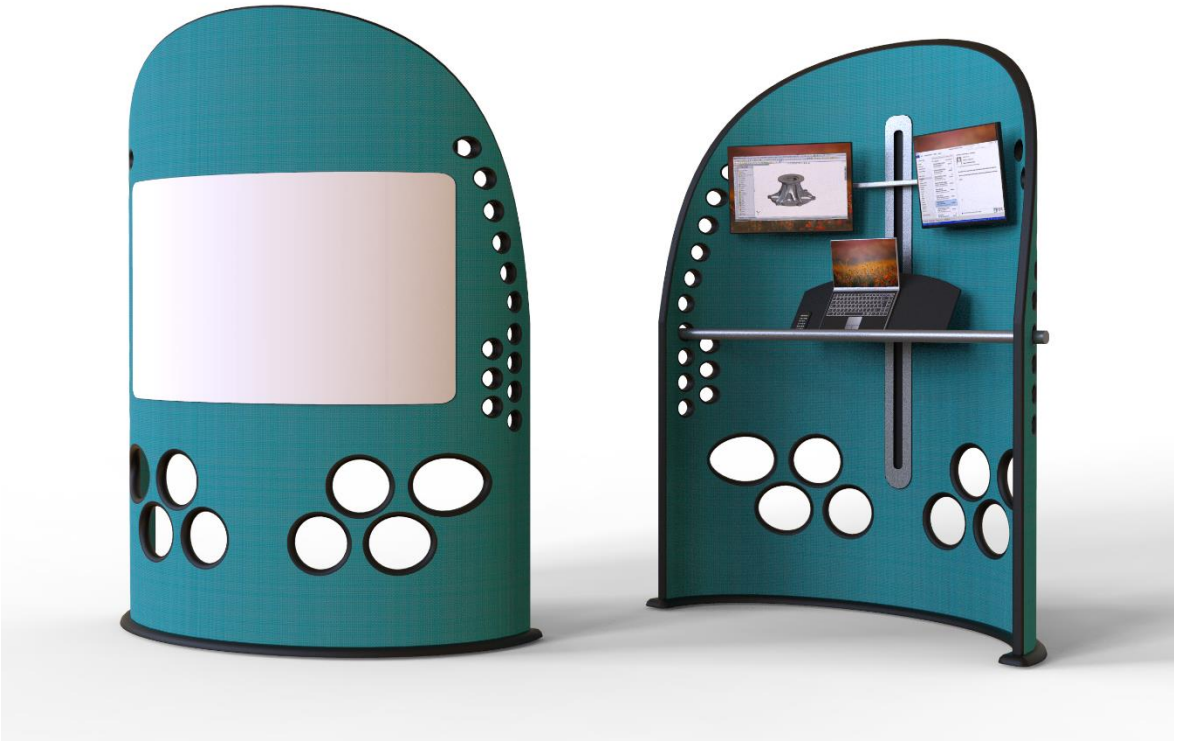




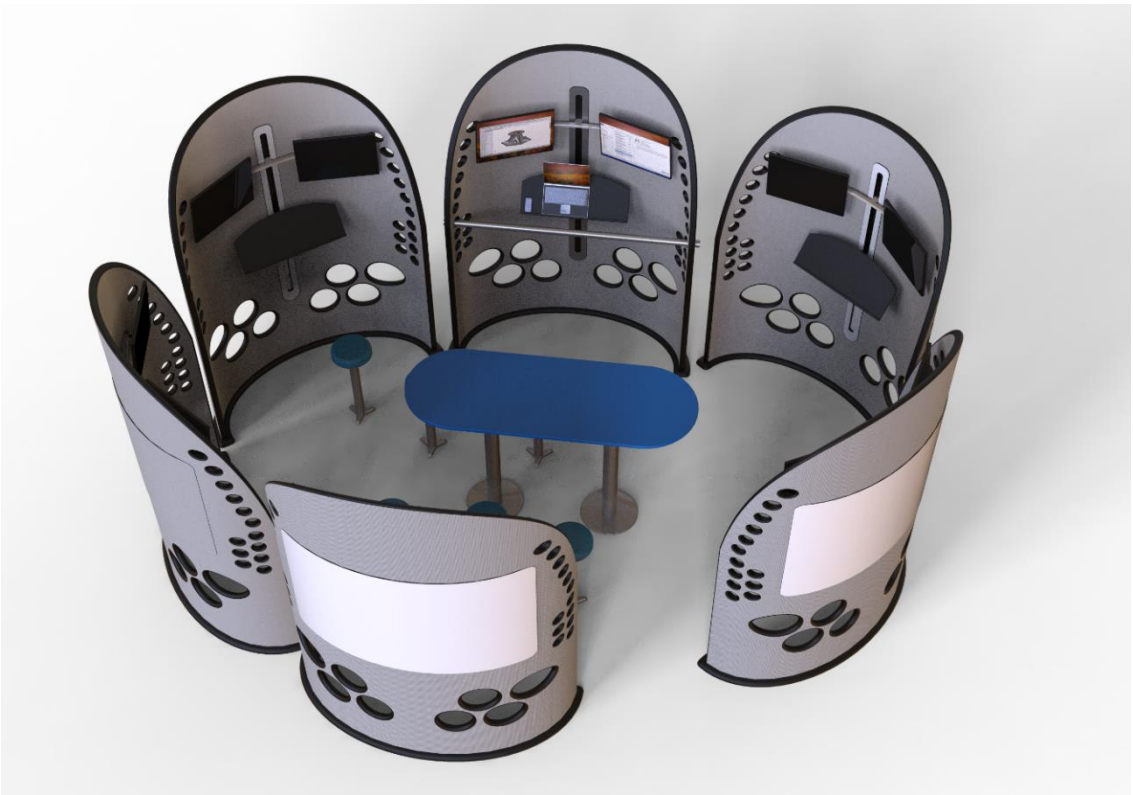
Emphasis on a more natural design and diverse postures



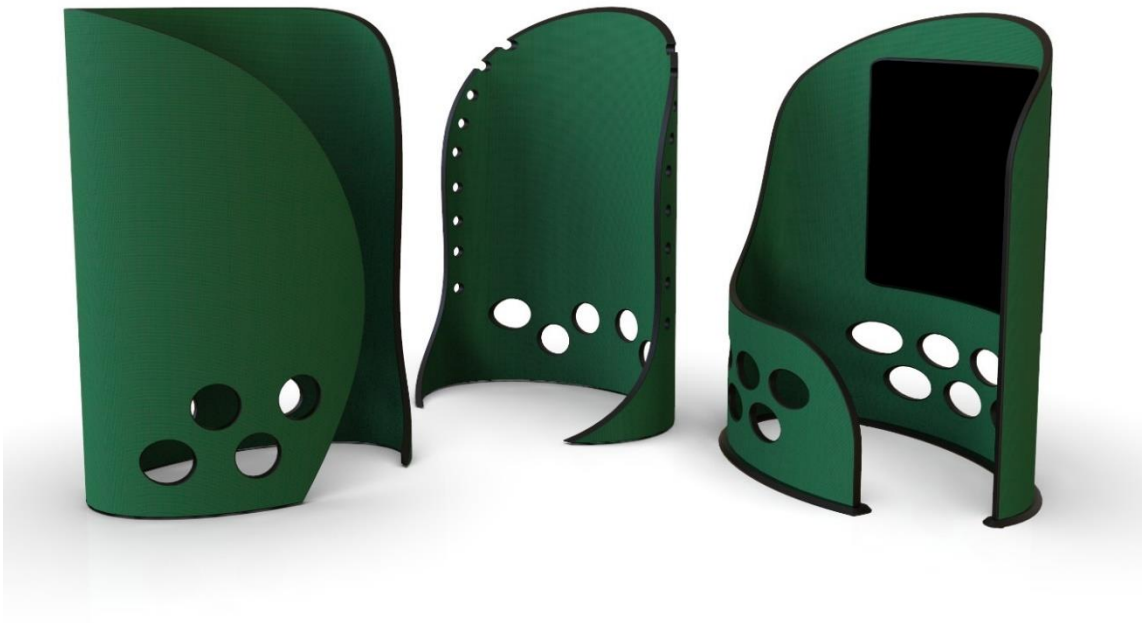
Iteration four



Team space with stand-up table and stools



Iteration five



Playing with shapes

Iteration six

Team area

Iteration seven

Individual and team setups

Iteration eight: The Office Shell

THE OFFICE SHELL

Agile team space