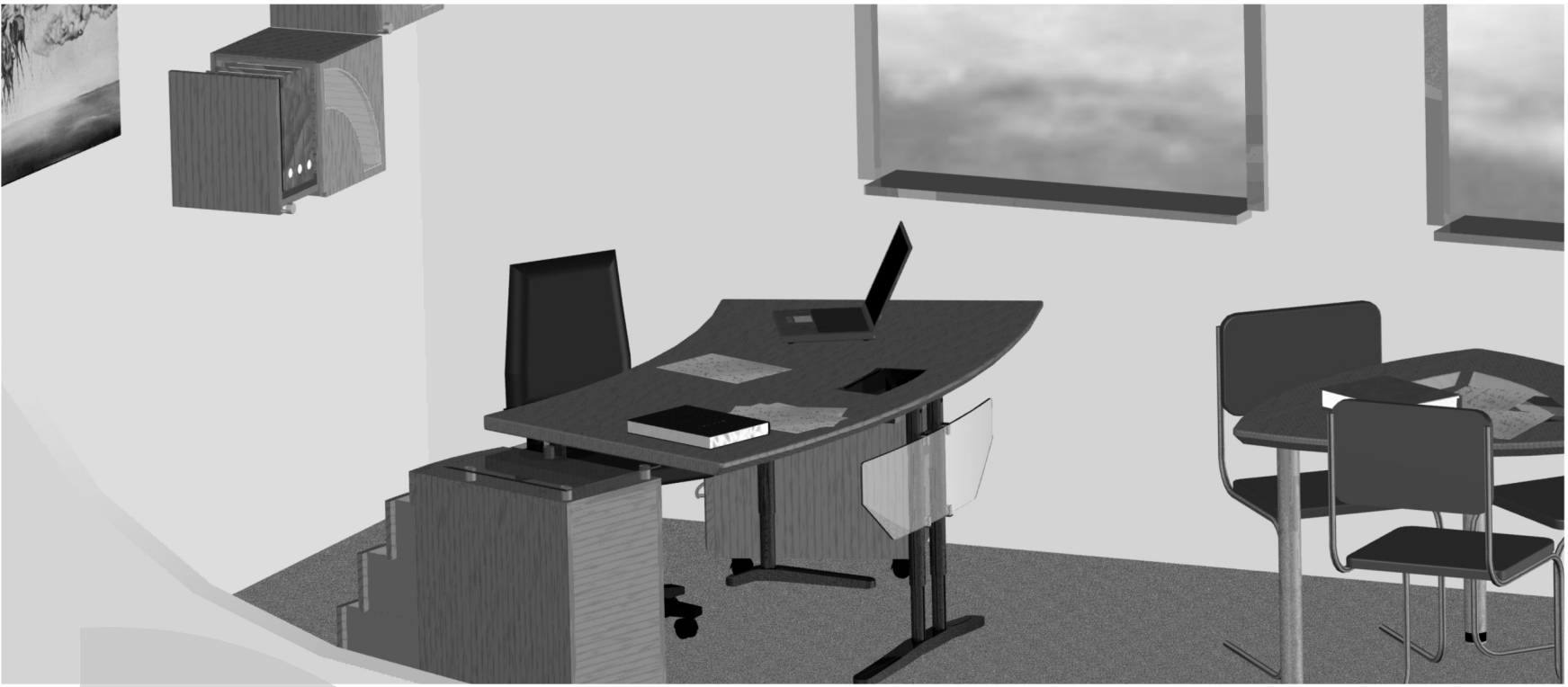
Central Office



Bachelor thesis assignment
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NYUGAT-MAGYARORSZÁGI EGYETEM

Central Office

Design of an office furniture family

Bachelor thesis assignment

Addressed to

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Date of publication: 18th December, 2006
Printed in 6 copies Number of pages: 59 Number of Appendices: 11

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Introduction

The market of consumer products is changing. Besides the functionality of the products, the customer's relation to the product is becoming more and more important. The modern customer wants products which reflect his identity, products which he can identify himself with. A good example for this tendency is the development of the mobile phones during the last decade. Changeable fronts for the phones to give the phone an identity, the identity of the user. Another example is the possibility offered by banks in the Netherlands to create your own bank card. The need for customizable products is a fact.
A similar tendency is visible on the office furniture market. The customers want office furniture that fits their needs, reflects their identity and can be organized the way they like it. This brings us to the goal of this assignment, the design of an office furniture family, built up from elements to satisfy individual needs.
The assignment was worked out on the University of West Hungary (Nyugat Magyarországi Egyetem) in Sopron, Hungary. The base of the assignment is Samas Hungária, former Falco Sopron, one of Hungary's leading office furniture manufacturers.
The development of the result of this assignment, the Center Office, can be found in this report. I wish you a pleasant time reading it!

Preface

I would like to thank the following people for their help and advice during the assignment:

University of West Hungary
Dr. Zsolt Kovács
Dr. József Hegedűs
Prof. Tibor Szentpéteri
Balázs Horváth
Péter György Horváth
Oxána Pankáló
Tibor Papp

University Twente
Ir. Marten Toxopeus

Samas Hungária
Mihály Rados
Tamás Varga
Balázs Lőrincze

Showrooms
András Bóber, Danubiana Design, Budapest
Zsuzsanna Farkas, Goldbüro, Budapest
Csabáné Főző, Allianz Hungária, Sopron
László Herendi, Febrill Bútor kft, Budapest

And finally, Dr. Zoltán Vekerdy and Christel van Dijk for their advice and help with writing this report.

Summary

To understand office furniture, it is important to know the history of it, how it developed into what it is now. This is presented in the first part of the Analyses section. In the next part, the actor, Samas Hungária, the target group and the market with its actors, different pieces of furniture and tendencies are examined. An important conclusion influencing the whole design process was the identification of the target group's diversity.
Knowing the demands of the user group, the actor, the law and the tendencies of the national and international market, a list of demands is presented in the second section, the *Aspects of design*. Further important aspects of design, like anthropologic demands and a short examination on modernity and stylishness are also discussed.
The list of demands leads to the formulation of the *Concepts*, created by brainstorming and morphologic schemes. At the end of this section the concepts are tested in the light of the demands as formulated in the previous section and maybe even more importantly, against the taste of the target group, as described in the *Evaluation* subsection. This leads to the fall of many concepts, but also the birth of the final concept, the Center Office furniture family.
The members of this family are introduced in the *Final concept* section together with details of production and the cost calculation.
The *Testing and reviews* section describes the loading test on the desk of the Center Office, as required by the list of demands.
Finally, some recommendations are made for further development in the last section, the *Conclusion*, based on the results of the tests and reviews.

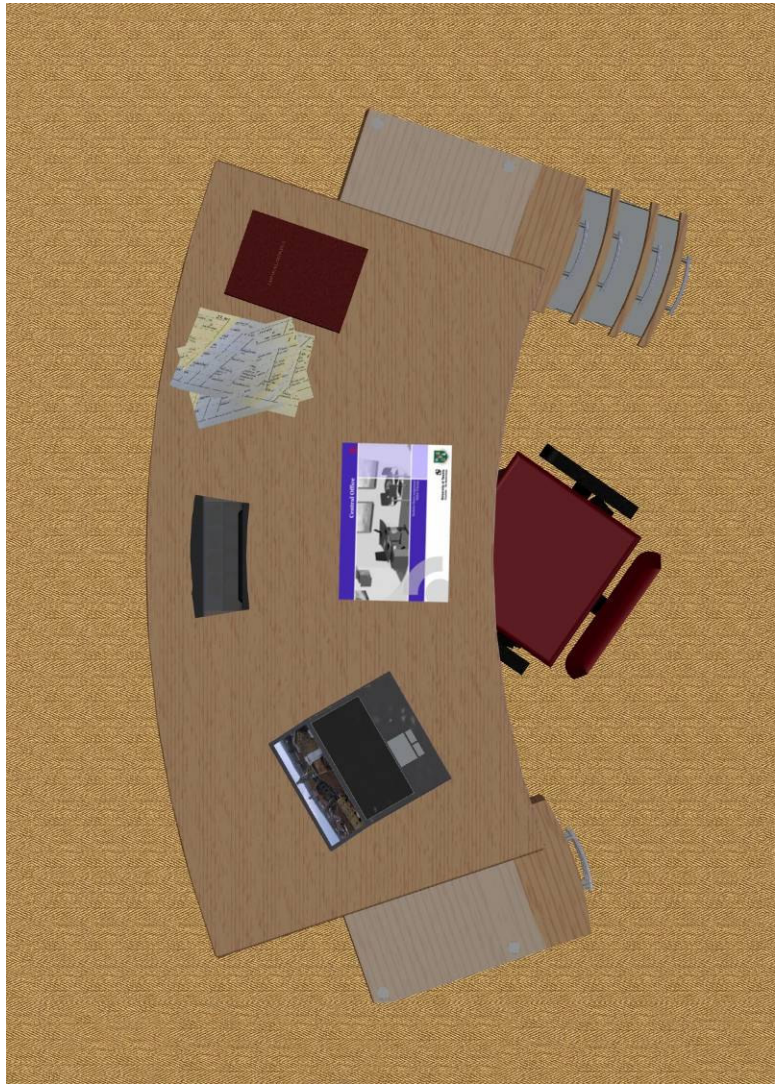

Figure 1 - Top view of the desk of the Center Office

Analyses

History of office furniture

To fully understand office furniture, it is necessary to know its history, how it developed throughout the centuries and how it fitted in the everyday life in the last centuries?

Activities and places in the old times, which correspond to the current offices for business were the market and the rooms in the citizen's homes for trade; for intellectual work were the codex multiplying halls of monasteries; for administration and governance were the royal and nobel residencies and the town halls. These activities were hardly changed till the 19th century. Inventions during the Industrial Revolution brought changes in office activities, mainly with the development of faster communication devices. More about this will be explained later, first let's take a brief look at the offices and the furniture styles from the Middle Ages to the Industrial Revolution.

Office furniture developed slowly in the Middle Ages, simply because the need was not there for it, due to the high degree of analphabetism. Even most of the aristocracy could not read. The only layer in the society who could read was the clergy. For this reason, the education lied for a big part in their hands as well. The first piece of furniture made for writing was also 'invented' by them, namely the codex multipliers desk, see Figure 2.

Figure 2 - Monk working at a codex multipliers desk

During the Renaissance, the 'offices' where located in the homes of citizens. This is the reason why the furniture had the same style as other furniture in the house. These first offices, or working rooms, were separate rooms in the house, often called library or meditating rooms. In these rooms, a fully decorated writing desk could be found, with architectural elements as decoration, see Figure 3. At the beginning of the 17th century, the Renaissance has made place for the Baroque, with its round and more organic shapes. In this period, the veneering and intarsia has been developed on a greater scale and used for decoration. The Rococo followed the Baroque, hiding the architectural elements in furniture and creating the illusion that the furniture was molded in one piece, sometimes not even leaving the opening of the furniture visible. The Rococo also combined the writing desk and the cabinet. The Classicism, around 1770, combined the structure of the furniture with ancient shapes. The shuttered writing desk comes from this period. The Biedermeier has to be mentioned finally, where the comfort of use was emphasized over decorative elements. In these furniture the basic shapes of current furniture can be recognized, see Figure 4.


Figure 3 - Renaissance desk

The Industrial Revolution brought a change in the offices and in office work. The construction of railway and postal networks created a need for separate offices. For the first time in history, office work was considered as occupation. The fast growth of administrative divisions created a need for separate buildings and separate furniture. The writing cupboards were replaced by the more simplistic writing desks. This


Figure 4 - Biedermeier desk

time the mass production of office furniture started. The following three inventions were important for this development:

- The invention of the telegraph of Morse in 1844, creating a new and faster way for transmitting information.
- The invention of the typewriter in 1866, rapidly increasing the use of paper, which also led to the standardizing of the dimensions of paper and with this the standardizing of the dimensions of furniture.
- The invention of the telephone in 1876, creating a new way of communication on distance and making the office the center of communication.

Due to this rapid development, the office needed new furniture for effective work. The shuttered writing desks where used for this, enabling a high degree of privacy for the user.

During the Taylorism administration became more complex, so office work was subdivided into smaller activities, creating departments for each division of work. The writing desk was simplified to a tabletop with a chest of drawers. With this, supervision became easier, but the privacy of the employees was gone. This led to negative psychological symptoms. These same negative symptoms caused by a similar tendency were visible elsewhere in Europe and Russia, where standing offices with dozens of employees were created.

Figure 5 – An office with a telegraph at the beginning of the 20th century

The industrial manufacturing of office furniture in Hungary began at the end of the 19th century as the need for furnishing the railway network of the monarchy emerged.

At the end of the 19th century and the beginning of the 20th century the metal legs for tables and chairs have been introduced for office furniture. This made the production of cheap furniture possible. This type of furniture was first used in the United States. The first metal office furniture was created by Frank Lloyd Wright. During this period, the decorations of office furniture decreased as well.

From the 1920's, big,multi-stored office buildings were built, where relatively big open rooms could be found. Mostly, a big number of people were employed in these offices. Office furniture changed to satisfy the needs of these offices: light, variable and simplistic furniture was needed, which satisfied multiple demands.

The age of Bauhaus arrived. The strict shapes of the Bauhaus did not want to create pleasing furniture, but wanted to revolutionize the art with the use of new shapes, materials and the introduction of the principles of functions. An interesting furniture created in this period is the L-shaped desk from 1927, which can be seen as the ancestor of the modern computer desks.

The development of office furniture was accelerating after the Second World War, due to the automation of the mass production. The construction of big office buildings also got a new impulse. In these office buildings big open office halls could be found, where dozens of people worked behind desks. The so-called system-furniture was developed for these new offices. The system-furniture consisted of components, so they had a high degree of expandability and variability. A German management company, Quickborner Team, introduced the idea of these open offices, where everybody worked in one open room. With these open offices, they wanted to create a democratic, orderly and equal atmosphere. But the effect was different, due to the lack of privacy the employee had. So, the system-furniture got expanded with separators, to separate the individual working areas from each other.

Figure 6 - The Haller system

Figure 7 - The Action Office 2

During the 60's, a further reduction of office furniture was the tendency. A good example for this is the Swiss Haller-system, consisting of separators from which cells could be created, see Figure 6. All components of the furniture were modular and could be built up from the same elements. The top of modularity was reached in 1968 by Robert Propst with his Action Office 2, see Figure 7. The desk was reduced to a horizontal tabletop, which was hung on a separator. The chests and shelves were also hung on the separator. The concept of system-furniture developed rapidly from the 1970's till today. The system furniture makes it possible to create a mass-produced product that can fulfill a big variety of functions and demands.

The fast development of communication at the end of the 20th century changed the society and the way of working in the offices. Some new tendencies are teleworking, multiple shifts of employees working at the same desk and the use of Internet, see Figure 8. With these the demands office furniture has to answer changed as well. Anthropology, ergonomics and research on optimal working conditions became more and more important in the design of furniture, to optimize the welfare of the employee in order to optimize his productivity this way. These principles and research results leave to the furniture of the 21st century.

Figure 8 - Modern desk system

Actor analysis

Brief history of Samas Hungária

Samas Hungária (from now Samas), former Falco Sopron, was founded in 1956. From 1974 till 1994 Falco Sopron was member of the Falco Fakombinát, seated in Szombnathely. In 1994, it was bought by the German Schaerf Joint-Stock company, the biggest German office furniture manufacturing group. Schaerf invested over 4 million DM in Falco Sopron. In December 1994, the Dutch Samas Group became the majority share-holder of the Schaerf AG.
The Samas Group had at that time branches in Belgium, France, the Netherlands and the United Kingdom. Beyond the German speaking countries the Schaerf AG was strategically dominant in the East-European and Middle-Asian markets. With the fusion of the two groups a strong Pan-European conglomerate was created, with a leading role in the office furniture market in Europe. The Samas Group has an annual turnover of just over 360 million euro and employs around 2,300 men and women on permanent contracts. The countries where Samas is represented are: Belgium, the Czech Republic, France, Germany, Hungary, the Netherlands, Poland, Romania, Slovakia, Switzerland, United Kingdom and Uzbekistan.
In January 2006, Falco Sopron officially changed its name to Samas. It has been a leading company in the Hungarian office furniture market since its foundation in 1956. Between 1996 and 2002 its sales duplicated. Currently, one third of the Hungarian office furniture production is represented by Samas. 10% of the production is exported to mainly the Austrian, Slovakian and Romanian markets.

Organization structure

The manufacturing and design differs from country to country within the branches of the Samas group: in different countries, different models are designed and manufactured. However, some furniture components like metal legs are distributed centrally, but used in the different countries in their own models.
The head office of Samas is in Houten, the Netherlands. The department in Sopron is the head office for Hungary. The design of new furniture for the Hungarian market is done here, just as the marketing, production and preassembly.

Production line

The production line of Samas is completely located in Sopron. Here, the materials are worked to create montage-ready components.
The production line is focused on elements made of particle board and MDF plates. These base materials are delivered by the plate producing branch of Falco and an independent company, Forest Hungary kft[1]. For further information on these materials, see *Materials analysis* on page 14.
All the other components like metal legs and metal drawers are bought from other companies like Hettich International[2]. The particle boards and MDF plates come in variable dimensions, but in most of the cases this is around 2750 x 2710 mm. These plates are already laminated. The thicknesses used are 19 and 25 mm, but sometimes a thickness of 8 mm is used as well.
The first major machine in the production line is a big cutting machine, which cuts the plates to the desired dimensions. These plates are then put in a gluing machine, which glues the sides to them. This machine can also dimension the plates a bit, but not as well as the first machine.
ABS coatings are used for the sides. The thickness of this ABS is 1 mm for the edges of closets and 2 mm for the edges of desks. Different types of glues are used, depending on the color of the coating of the plate: for a darker coating, darker glue is used, to keep gluing as invisible as possible.
After this, wholes are drilled in the plates by a machine, plugs are glued and placed where needed. The plates are then sorted and packed with the other components for transport.
Besides these machines, the company also possesses a number of smaller, manually operated machines for corrections or smaller operations. The big machines are all CNC operated.
The only other thing done in the factory is the painting of the components: mostly the metal components and chamfered edges of desks. A separate painting section is available for this. The average time for the production of a desk is 68 minutes and it involves 20 people on average.
The company does not have a storehouse, the manufacturing is based on orders. This enlarges the possibilities for customization of the products for the customer.

[1] Forest Hungary Kft, www.foresth.hu
[2] Hettich International, www.hettich.de

Target group analysis

The furniture office market

The office furniture market can be divided into three segments: the lower, the middle and the upper segments. The main difference between these segments is the quality of the products, in various ways, such as material, construction, life span, design, production and of course, as a result of this all, price. This market can be represented as a pyramid, see Figure 9. The broader lower side of this pyramid represents the size of the market.
In the top half of the upper segment, which is the most exclusive part, mainly hand made furniture can be found, mostly specially designed for the customer. The best material available is used for this, such as hard wood. In the lower half of the upper segment mass-production furniture can be found, from the best quality materials and design. This furniture is mostly not made of wood, but from laminated MDF or particle boards.
Going lower in this pyramid, the quality of the materials lessens, and the price also gets cheaper.

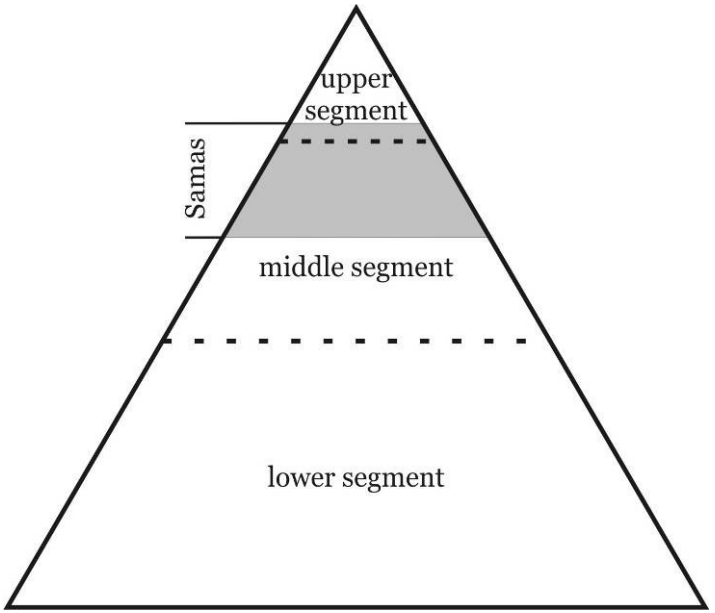

Figure 9 - The pyramid of the office furniture market

Samas Hungária

Samas has her furniture lines in the upper part of the middle segment. Beside this, there are Samas furniture lines also in the lower upper segment, but these lines are not designed and manufactured by Samas Hungária. Of course, Samas Hungária offers these lines to the Hungarian customers, but they import them from other Samas branches from abroad.
With the Central Office, Samas aims to reach the boarder of the middle and the upper segment of the market. This means a mass-produced product, from the best quality materials Samas uses.

Executive lines and operative lines

In office furniture, another important segmentation exists: the distinction between the executive line and the operative line. Since secretaries and managers have different status in a company, their furniture has to have different charisma too, expressing different needs and different expectations. The manager will need a place where he can receive people, while the workspace of a secretary is more based on bureaucratic and scheduling tasks for the boss.
The executive desks are usually bigger and more elegant then the operative desks. Besides this, operative desks are mostly built up to be able to connect multiple desks of the same model creating islands of them. This way they can be put in big offices, while executive desks are designed for stand-alone use in an office.
Companies are willing to spend more money on a representative executive office than on operative furniture. Adding this model to the pyramid model described above tells us that most executive lines can be found in the upper two segments. Of course, operative lines can be found in the upper segment as well, but the percentage of executive lines in the upper segment is higher than the percentage of executive lines in the middle or lower segment.

User group

Samas aims to reach the border of the middle segment and the upper segment with the Center Office line. Big companies can be found here which have more branches all over the country, need a representative look, but because of the big amount of furniture needed, they will not buy from the top of the upper segment. Banks and insurance companies fit this description for example. So, the primary user group is defined as executive managers of branches of big companies as described above. The purchase of furniture for these managers is usually arranged centrally, but there are also companies where the managers may choose to buy their furniture themselves.
To understand the everyday life of the user group, a collage has been made, see Figure 10 on page 11. The collage is split up into four group; 'precision' what characterizes mobility and dynamics; 'home' stands for family, warmness, feeling at home; 'business' stands for consultations, success, profit and finally 'office' what stands for charisma, design, status and at last but not least; work. These phrases make the everyday office work of the user group.

Stakeholders

During the lifecycle of the product, the user group as defined above is not the only group who comes into contact with the product. In fact, there is a whole group of stakeholders with specific interests. These stakeholders and their interests are mapped in Table 1.
In this mapping, the lifecycle of the product is split up into four phases, indicated in the first column of the table. These phases are:

- Development D
- Distribution T
- Usage U
- Disposal S

	Stakeholder	*Interest*
D	designer	sales/profit, create something lasting, image, satisfy a wide market
D	manufacturer	sales/profit, image, capacity utilization, continuity, market share, satisfy a wide market
T	packaging	sales/profit, capacity utilization
T	distribution	sales/profit, effectivity
U	sales	sales/profit, image, market share, service, continuity, satisfy a wide market
U	*Primary user* as described above	wants an ideal working environment, image, wants to identify himself with product, safe in use
U	*Secondary user* • business relation • service, assembly • person controlling furniture purchase • cleaning lady secretary family of primary user	• easy handling, quality • image, quality • easy handling, safe in use
S	recycler	sales/profit, capacity utilization

Table 1 – Stakeholders

Figure 10 - Collage of primary user group

Competitor analysis

A brief analysis of the market has been carried out to review the activities and products of other companies, mainly in the same segments as Samas. The main objectives of this analysis were to monitor the solutions of other companies for individualization of their products and to map the different components they use in their office furniture families, see Appendix A. Only a small selection of the available companies is included in this listing, but this is sufficient to get a good insight into the market.

The first thing noticed as a difference between the products of the Hungarian companies and companies from abroad is the difference in the main function of the wall closet. In many Hungarian designs, these closets still exist as a robust system with shelves and doors, with the main function of storing things. Meanwhile, in the systems from abroad these wall closets much more have an importance from a design point of view, in many cases with a much bigger role as decorator of the office. Smaller cupboards for storing things however are present both in Hungarian furniture and in furniture from abroad.
Then let's have a look at the tables and the possibilities of customizing them. Customization exists as a big variety of tabletops and extensions offered by the manufacturer, from which the customer can choose. However, this possibility only exists when purchasing the furniture: after purchase the only possible customization is the adjustment of the height of the desk.
The chest of drawers is also customizable at purchase. The possible variations are the height, number of drawers, size of drawers and number of shelves.
The other two furniture pieces that almost all the manufacturers have are the coffee table and the small cupboard. This latter one functions as an extension for the table in some cases, which is a simple but practical idea.
No manufacturer offers a back wall to be placed above the desk. This back wall is a common thing at operative desks, where it fulfills the function of dividing space between two desks and also offers the possibility of adding storage space for the desk, for example for paperwork. Other things as monitor shelves, waste bins, coat hangers etcetera are not included in an office furniture family, although, some manufacturers offer them as accessories.

Another important aspect in individualization of the product for the customer is the possibility of determining the color of the furniture. This possibility is offered by each manufacturer.

Interviews

Interviews were held with selected representatives of the user group and retailers (showrooms in Budapest), to determine the market and to get to know the needs of the customer. A short summary of these interviews is presented below; the complete interviews are attached in Appendix B.

Interviews with user group

Interviews have been held with branch managers of insurance companies in Sopron. Unfortunately, only two interviews were possible, due to the busy schedule of the branch managers.
The executive desk was in both offices the 'heart' of the office, the central place. Both offices had a conversation desk, one was separated from the main desk and the other was connected to the main desk. This second combination was not preferred due to the lack of privacy at the main desk.
The transfer of wall closets to the secretary was perceived as pleasant. By far the majority of the things to be stored in an office is paperwork. This could be seen in both offices: big stocks of paper were stalled everywhere. Books could hardly be found in the office. The cupboards and closets were big enough; but need for more drawers was observable in one of the offices.
The most frequently used equipments, the computer and the printer, were both present in the offices. Beside these, normal stationary such as pens, perforator, stapler etcetera were used.
Both managers had the same opinion about ideal office furniture: it should be light, airy, modern, stylish and practical. A darker consultation tabletop is seen as elegant and stylish. Real wood is preferred above other materials.
The origin of office furniture, whether it is produced in Hungary or abroad, is not seen as an important aspect at the purchase. The keywords at purchase could be indicated as design and ergonomics.

Interviews with the retailers

Hungarian furniture is seen compatible with furniture from abroad on the Hungarian market, because of the good price quality relation and the good service the Hungarian manufacturers offer. Yet, on other issues as design, ergonomics and up-to-date technology, furniture from Italy and Germany is superior.
The lifespan of office furniture in the private sector is 8 years on average. This means that a company purchases new furniture in every 8 years, although, in the governmental sector, this period can be longer because of a limited budget.
The major differences between the office of today and 10-15 years ago are the disappearance of bigger storage units from the office and the movements of the consultation place from the desk of the executive to a separate place. The space created by moving the storage units are now replaced by smaller consultation corners.
Another development is the possibility to customize the office furniture. The customer can chose between tabletops of different shape, material and color. Additionally, the height of the desks is adjustable in the more expensive furniture lines.
The chest of drawers has become a separate unit, the so called container, and has become customizable as well.
Executives like to represent authority and respect. For this reason, they like massive, thick tabletops, although, the support of the tables in an executive office is mostly made of metal, which looks not as heavy and robust as the wooden legs.
Pure wooden tabletops are rare, veneered or in most cases laminated tabletops are used more frequently.
The assortment of manufacturers is mostly restricted to tables, extensions to these tables, containers and smaller cupboards. Other products as waste bins, coat racks are usually delivered by an external company.

Material analysis

Although in the actor analysis the materials used by Samas are already mentioned, it is useful to take a closer look at these materials, as well as the other most commonly used materials in the furniture industry.
In serial-produced office furniture, hard wood can hardly be found. This material is used in the upper half of the top segment, in the custom-made furniture or in a few, quite expensive special serial-produced office furniture, as it was already mentioned above. Instead of hard wood, other materials like MDF plates are used in the office furniture of the here discussed segment.
First, the materials from which the plates are made are reviewed in this section. After this, reviews of the coating materials and other materials used in office furniture can be found.
Costs of the materials are not mentioned in absolute terms, only in relative terms, compared to each other. This approach is used, because prices can depend strongly on manufacturer, dimensions, color and can change every day.

Coated materials

Plywood

Plywood is a plate consisting of veneer plates, which have been glued and pressed together, see Figure 11. A big advantage of these plates is the ability to distribute forces in all directions well, while in 'normal' wood the distribution of forces is only in good in the direction of the fibers. Plywood plates also have a wide range of elasticity. These plates became popular in furniture manufacturing in the 19th century. In the fifties of the 20th century its place in the furniture market has been taken over by the much cheaper fiberboard and particle board.

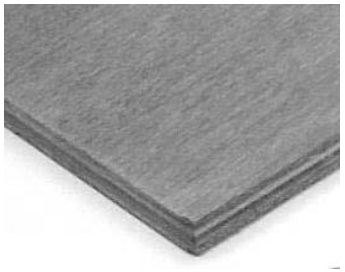

Figure 11 - Plywood

Production
The veneer plates, which build up the plywood are produced using the concentric pealing technique (see Veneering, Production on page 16). Each layer of veneer plates is rotated 90° compared to the layer under it. The minimum amount of layers is 3.
There are different ways for pressing the plates, using hot or cold presses. Each pressing method gives the plates different characteristics. Beside this, the specifications also depend on the type of the glue, the amount of glue, the type of the wood, the thickness of the veneer plates, the number of layers used for the plywood, the pressure in the press and the time of pressing.
The plates are divided in three categories on the basis of their specifications; the plates with low rigidity, plates with middle rigidity and plates with high rigidity.
Nowadays plywood plates are only used in furniture in situations where the high rigidity of it is needed.
The most commonly used dimensions of plywood are 2000 x 1250 mm and 2050 x 900 mm. The most commonly available thicknesses are: 3, 5, 8 and 10 mm (Molnár, 2000).

Fiberboard

The development of fiberboard began at the beginning of the 20th century in America. Fiberboard is made of waste material of wood processing, like sawdust. Due to the fineness of the basis material (sawdust) and the production method, fiberboard can be found somewhere between cardboard and particle board, see Figure 12.
Fiberboards exist in three categories, Low Density Fiberboard (LDF), Middle Density Fiberboard (MDF) and High Density Fiberboard (HDF). The first, LDF is most often used as an isolation material in construction work, MDF is used for furniture and HDF is used in construction work or for packaging.

Figure 12 - MDF

The difference in LDF, MDF and HDF lies in the density and strength of the material. These materials also have different thickness; LDF is 20-40 mm thick, MDF 8-38 mm and HDF 3-8 mm.

Since only MDF is used for furniture manufacturing, LDF and HDF are left out of consideration here.

Production
Fiberboard consists of crushed or milled wood like sawdust, gluing materials and other materials like conservation materials. These materials are added to the wood and the mixture is pressed under heat. After this, it is cooled down and cut to the desired dimension.
There are two ways to produce fiberboard, the 'wet' method and the 'dry' method. The details of these methods are beyond the scope of this study. The first method is older and has a higher environmental impact than the 'dry' method.
The advantage of fiberboard is the homogeneity of the material, unlike wood. Furthermore, MDF is relatively cheap compared to plywood and wood.
Another good property of MDF is the possibility of shaping. Due to the homogeneity of the material, round edges with a smooth surface can be created easily.
The most commonly used dimensions of MDF plates are (Molnár, 2000):

2750 x 2710 mm
2750 x 1600 mm
1830 x 2140 mm
1830 x 1600 mm
2800 x 2070 mm

The most often used thickness by Samas is 25 mm, the maximum thickness available on the market is 38 mm.

Particle board

Particle board, also known as chipboard, looks a lot like fiberboard, it is also made of waste created at wood processing, see Figure 13. The difference between the two lies in the material used and the production technique: for particle board much rawer material is used.
As with fiberboard, the characteristics of particle board are mainly defined by the type of wood and glue used.

Production
At the production of particle board, there are two processes running simultaneously. On the one hand, the filling is made, on the other hand the coating. For the filling the wood shreds are dried, burned a bit and after this mixed with the glue and other added materials. From this a layer is made. For the coating, the wood shreds are dried, sieved, burned a bit and glued. From this also, a layer is made.

Figure 13 - Particle board

These layers are placed on each other, in case of a three layered plate, two coatings and a filling layer. Before the hot press, the layers are pre-pressed. After the hot-press, the plated is cooled and sanded.
The most commonly used dimensions of particle boards are (Molnár, 2000):

1850 x 2650 mm
1850 x 3500 mm
2070 x 2650 mm
2070 x 3500 mm
2070 x 5305 mm
2150 x 2650 mm
2150 x 5305 mm

The most often used thickness by Samas is 19 mm, but particle board is available in thicknesses between 8 mm and 38 mm.

Coatings

Lamination

Laminate is a synthetic material produced from cellulose and resin. It is a product with a little environmental impact, during the whole product lifecycle.

Structure
Laminate is built up from 5 layers, see Figure 14, namely: overlay (1), decoration (2), underlay (3), core(4) and the counter layer (6). In this figure, the core is built up from 3 layers, layers (4) and (5). The overlay is a layer of paper, saturated in melamine-resin. As a result of this, it becomes a very hard layer with a high grade of resistance.

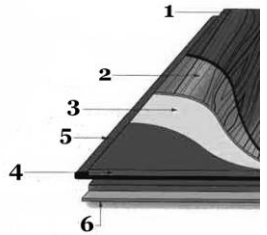

Figure 14 - Lamination

By pressing it becomes transparent. Melamine-resin is the resin with the highest grade of stiffness. Beneath this layer, the decoration layer can be found. This consists of printed cellulose strips. These strips can be painted and also a tread can be given to them, creating an endless variety of possible structures. The underlay is made of alpha-cellulose and has the only purpose to protect the decoration layer from the, mostly dark core, so that the colors of the decoration layer are kept at their best. The core consists of layers in phenol-resin drained heavy paper. The core gives the laminate the needed stiffness. Finally, beneath the core, the counter layer can be found, with the main objective of giving the laminate a good attachment with the glue.

Production
The layers are pressed against each other under a pressure of 100 bar, at a temperature of approximately 150 degrees Celsius. The structure of the surface of the laminate can be created by giving the surface of the press a structure. Using recent technology, even photographs can be painted on the decoration layer in the laminate. The plates are fixed to the coated material by gluing.
Some advantages of lamination:

- no surface treatment needed afterwards
- anti static
- resistant to a lot of chemicals
- water resistant
- relatively cheap

Veneering

Veneer is a thin layer of wood, which can be glued to the surface of another material, creating a decorative layer, see Figure 15. The thickness of this layer can be from 0.1 mm up to a few millimeters. 0.1 Millimeter is called micro veneer. Normally, this thickness lies between 0.5 and 1 millimeter.

Production
Veneer can be produced using two production methods, splitting and peeling. The main difference between these production techniques lies in the way the veneer is cut from the stump of the wood. At splitting, the wood is cut in the direction of the fibers (the way a cheese slicer slices cheese), while at peeling, the wood is cut sheer to the nerves (the way lavatory paper comes off the holder). Micro veneers are always cut sheer to the nerves. The direction the veneer is cut determinates the pattern on the veneer.
A little footnote for the pealing technique: there are two ways for this, the concentric pealing and the eccentric pealing. The difference between these two techniques lies in the way the stump is fixed, in the middle of the stump (concentric) of on one side (eccentric).

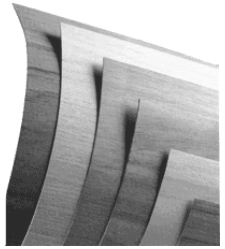

Figure 15 - Veneers

The process of veneering is as following: first, the stump is cut into partitions, horizontally and vertically. This process is called prismeering, because the side look of the stump has the form of a prism. After this, the prism is weakened in steam. The steamed stump is cut hereafter. Finally, the only thing to do is to dry the veneer.
As explained above, the direction of cutting determines the pattern of the veneer. Beside this, also the wood used for the veneer is important for the pattern. Each wood has another structure and creates another pattern.
The following types of wood are used for veneering in Hungary: oak, beach, ashen, elm, maple, sycamore, lime, Spanish chestnut, cherry, walnut, black walnut, wild pear, crab, and wild service tree. Beside this, also the following exotic wood types are imported for veneering: mahogany, okumé, makoré, avodiere, khaya, palisander, mutenye, afrormosia, koto.
The plates are fixed to the coated material by gluing. The specifications of veneer differ with the different wood types.

Edges

The edges of the plates are in most cases covered with a different material than the coating. To get the same structure and pattern on the plates and the edges, these edge coatings are usually made by the same manufacturer as the plate coatings. Here, the most often used edge coverings are summed.

Painting
The easiest way of covering an edge is painting. A big advantage of this technique is the possibility of creating bent surfaces. Not all materials are suitable for this technique, since it requires a smooth surface.

Furthermore, there is no possibility of creating a pattern. This technique is often used for veneered MDF plates.

Edge band
Edge band is a thin coating on paper basis, which is glued to the edge of the plate. It is the cheapest solution for edge coating. Disadvantage of edge band is that it loosens more easily than other edge coatings. An example of edge bands can be seen in Figure 16.

Figure 16 - Edge band

ABS
The most common used material is ABS. This is a thin synthetic material, with a thickness between 0.4 and 2 mm. It is also attached to the edge of the plate with glue, like edge band. Although it is a bit more expensive than edge band, its holding is much stronger and therefore it is more often used than edge band. An example of ABS edge can be seen in Figure 17.

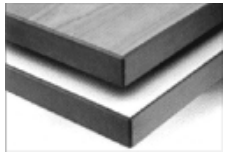

Figure 17 - ABS edge

Figure 19 - Edge veneer

Edge veneering
The edge can be veneered, the same way as the plates. This method it mostly used when the plates are veneered as well. The use of the same material gives a more elegant charisma. See Figure 19 for an example of edge veneers.

T-edge
This method is most often used at particle board plates. After the plates are cut in the right dimensions, a groove is cut in the edges. In this groove, a wooden, mostly T-shaped plate is placed. This can be done before and after veneering the plate. The form of the groove is variable, see Figure 18.

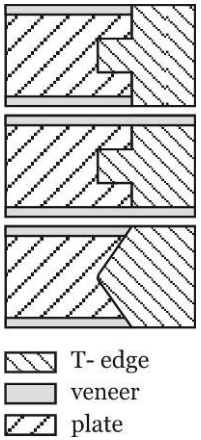

Figure 18 - Different types of T-edges

Post-forming
Post-forming is used when the plate is laminated. At this technique, not only the top of the plate is laminated, but the edges as well, using the same lamination, see Figure 20.
An advantage of this technique is the possibility of creating bent edges when the plate is made of a 'rough' material, such as particle board.

Figure 20 - Postforming

Metal

Metal in office furniture is used for the legs, handles and connections. For the legs, mostly (stainless) steel or aluminum is used. Some other metals, which are often used in furniture are cupper, iron, messing and zinc.

Glass

Glass can be found in a lot of furniture, in all kind of forms. Here, some frequently used glass working methods are summed.

Acidization
With the use of chemicals, the upper layer of glass is affected, creating a milk-like fogginess. Forms can be created by taping some parts of the glass, so the chemicals are not able to reach these parts.

Sandblast
The glass is worked with a sandblast, creating a matt surface. Similar to etching, figures and forms can be created by taping.

Engraving
With a hard-tipped tool, figures are cut in the glass. Often tools with diamond coated heads are used for this operation.

Fusion
On a ground layer of glass, another glass plate is placed, with a different shape and different color. These plates are melt together, creating one plate with a pattern of a different colors in it.

Fixation

There are a lot of different techniques for fixing wood, depending on the type of wood, the type of construction and the purpose of the fixation. The most frequently used fixation techniques are reviewed below. Not all these fixing methods can be used for the different types of manufactured boards.

Gluing
Probably the most often used technique is gluing. There are a lot of different glues available, depending on the surfaces which need to be glued, the force they must withstand etcetera, and a lot of different techniques like warm gluing and cold gluing, also depending on the demands it has to answer. Gluing can withstand high forces, in some cases it is even more likely that the material breaks easier than the gluing. The strengths and costs of gluing depend on the type of gluing. A disadvantage of gluing is that it is quite difficult to disassemble. Depending on the type of the applied glue, chemicals or heat can be used for disassembly.

Plugging
A plug is a wooden cylinder that is used to connect two plates. Holes are drilled in both plates, in these holes the plug is placed, as can be seen in Figure 21. The plug can be glued in the holes, but can also be hit in the plate to jam it in.
By using plugs, the connection can be hidden from outside: a big advantage when fixing areas those are in sight. A disadvantage can be in some cases that it is difficult to disassemble, especially when the plugs are glued in the plates.

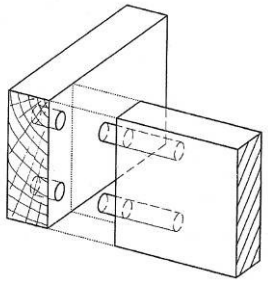

Figure 21 - Plugging

Screws
Applying screws is one of the most frequently used methods for fixing wood. A great advantage is the big diversity of size and structure of screws available, enabling screws to be used on a lot of places. Screws can also be used in a lot of different materials. Additionally to the screws, plugs can be adopted in some types of wood to grant a solid fixation.
Connections with screws are easy to disassemble, though in some cases assembly after disassembly is less effective, because of loss of strength of the material. Another disadvantage is that screws are well visible on the surface, so this method should be avoided when the connection is in sight of the user.

Some other connection types
When working with natural wood serration of different types is applied. Examples of wood serration can be seen in Figure 22. These serrations create bigger connection surfaces and can dissolve strength in the material better. Often gluing is used in combination with serration.
Instead of a plug, a thin wooden plate can be used to connect two plates. This plate is placed sheer on the plates in a cut in both plates. The fixation of this plate is also often done by gluing.
Metal connectors are sometimes applied the way wooden plugs are applied, but are seldom glued in the material. A nice ability with metal connectors is the possibility to pull the two parts tight with a special construction.
Finally, one of the most commonly used technique is nailing. This is cheap and easy but not that good looking and often difficult to disassemble.

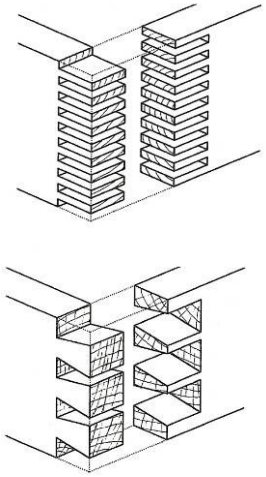

Figure 22 - Serration types

List of components

In the following, the variety of components available on the current market is listed. Furthermore, the possible variations of component are also presented, to give an as complete picture as possible.
This list is partly extracted from the competitor analysis and will be used to determine the list of components for the new design.

Tables

Tabletop
Manufacturers offer a wide variety of tabletops in different shapes; angular, rounded etc from which the customer can choose.
Tabletops can be found in different materials, veneered, laminated and even glass. In Figure 23, a fragment of the choice of tabletops of Báthori can be seen.

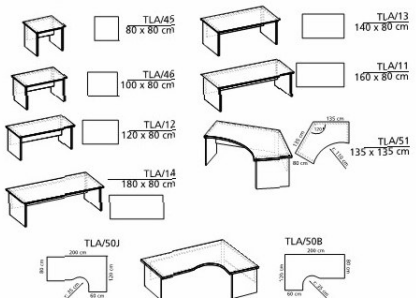

Figure 23 - Tabletops

Table legs

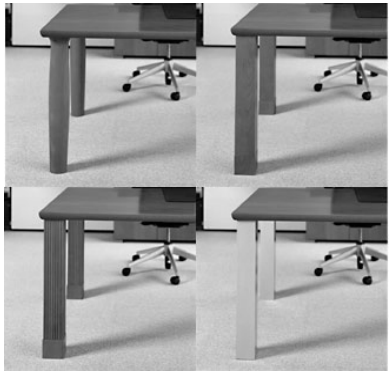

Figure 24 - Table legs

There are two different types of legs used,: wooden and metal ones. Wooden legs usually create a closed side of the table, as visible in Figure 23 of Báthori furniture. Wooden legs are cheaper then metal legs: about half price. The material of wooden legs is usually the same as the material of the tabletop.
Metal legs come in different materials, in most cases aluminum or steal. Metal gives the designer more freedom, since this material is more loadable and easier to form than wood.
In Figure 24, different legs for a desk can be seen from the Bene MK line.

Table extensions
Table extensions are used to connect two tables or to provide an extra area on the edge of the table. The material of the extension is usually the same as the material used in the tabletop. When not connecting two tables, the extension has (usually) a metal leg for support. In Figure 25, a fragment of the choice of table extensions of Báthori can be seen.

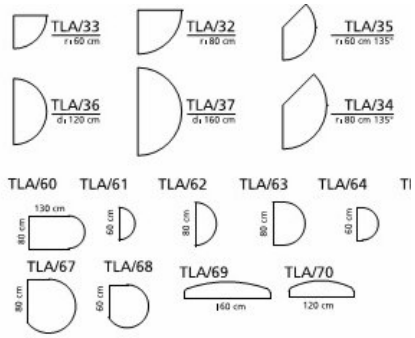

Figure 25 - Table extensions

Coffee tables
Coffee tables are a sort of lowered tables, in most cases with metal legs. They are rarely angular shaped, are meant for negotiations with more important business partners in a relaxing position.
For harmony with the other office furniture, it usually has the same material as the desk.
In Figure 26, a coffe table of Las Mobili can be seen.

Figure 26 - Coffee table

Computer tables
Computer tables are used as an extension for the desk, yet they are a separate desk. On this separate desk, the computer is placed and all the computer work is done here. This way, space can be saved on the main desk.
In Figure 27, a computer table of the Bene AL line can be seen.

Figure 27 - Computer table

Conference tables
Conference tables are used usually in separate conference rooms. They provide space for a (bigger) group of people for negotiation. Conference tables are usually less luxurious then executive desks. In Figure 28, a conference table of Estel can be seen.

Figure 28 - Conference table

Storage

Chest of drawers
The chest of drawers became a separate component, as already mentioned, named container. Because of this, almost every manufacturer puts wheels underneath the containers. Lot of manufacturers offer the possibility of different arrangements, as visible at the variations offered by Báthori in Figure 29.
The materials used in these containers are usually the same as the materials of the desk.

Figure 29 - Containers

Cupboard
The cupboard, such as the computer desk, can be used as an extension of the table. In these cases the cupboard is made of the same material as the desk. The compartments are customizable in most cases, similar to the chest of drawers. The cupboard is also often put on wheels. In Figure 30, a cupboard of Bene from the AL line can be seen.

Figure 30 - Cupboard

Wall closet
Wall closets can be divided into two major groups, the storage and the decorative group. The first, the storage group, is only found at Hungarian manufacturers. The second group has much more a decorative function, where the division of space is also an important aspect. In Figure 31 both are visible, from Báthori, above, and Bene, below.

Figure 31 - Wall closets

Aspects for design

To come to the design of a product which meets the goal of this assignment, the design of an office furniture family, built up from a set of component parts to satisfy individual needs, guidelines have to be set up. These guidelines and demands are based on the results of the analyzing phase. These guidelines are discussed in this chapter.

List of demands

The product must satisfy various demands, stated by the stakeholders, has to comply with the regulations and should be in harmony with possible other products, which will be used in combination with it. To be able to formulate clear technical demands, functions are defined from which these demands can be derived from. The full *List of demands* is presented in Appendix C on page 74. A summarized version it can be found below, in Table 2, containing the most important demands. In the last column a reference can be found to the paragraph of the full *List of demands*.

Functions	Demands	Ref. to App.C
Create work surface	Product must create a surface of at least 1540 x 800 mm on which the user can perform his or her daily tasks, such as computer and paperwork	1.1
Make consultation possible	Consultation place for 3 people	1.2
Make storage of things possible	Product must offer at least 1 m^3 of storage place for storing things safely	1.3
Storage places must be accessible	Storage places have to be placed between 280 mm and 1680 mm high (standing) Storage places may not be deeper than 600 mm for the heights 840 – 1400 mm Storage spaces may not be deeper than 500 mm for the heights 280 – 840 mm Storage places must be accessible all time	1.3.3
Be individual	The primary user must be able to identify himself with the product	1.4
Adjustable to the human body	For Hungarians between P05 and P95 and aged between 25 and 60 years	1.4.1
Customizable in appearance	Available in different colors Choice between different components at purchase Choice between different compositions of components at purchase	1.4.2
Safe in use	The product must satisfy to the laws describing safety	1.5
Support electronic devices	The product must support 2 electronic devices and 1 phone with electricity, wiring, communication and space	1.8
Cheap in production	Use of existing production techniques of Samas Maximum use of material	3.1

Table 2 - Summarized version of the list of demands

Ergonomics

The furniture will be used by both males and females. There are no specific body characteristics of the user group, for this reason the dimensions are determined using the P05 and P95 of the user group.
The product is not perfectly dimensioned for everybody of the user group this way, but as industrialized standards require, for example the Hungarian standard MSZ EN 527-1:2000 which states that office furniture should fit the P05-P95 of the users.
This new product is designed for the Hungarian market, but not only Hungarians will use it most probably. For this, the values of P05 and P95 are the values for European grownups, ageing 25-65 years.

Table

The dimensions of the tabletop are determined according to the standards of ISO 9241-5:1998, see Figure 32. Because people with different body dimensions will use the desk, it has to be adjustable in height. To determine the minimum and maximum height of the desk, two important aspects were taken into consideration. First of all, the ideal working position, which is shown in Figure 32. The smallest people determine the minimum height (Figure 33, 1). This height is the addition sum of the underside of the elbow height and the seat height. In this case is the smallest the P05 of the woman, which is 549 mm. Also, there has to be enough space for the legs (Figure 33, 2). This height is the addition sum of the tight depth and the seat height. This criterion is 455 mm (plus some additional space to move!). For the maximum height the P95 of men is taken into consideration, giving the values 805 mm (Figure 33, 3) and 678 mm (plus additional space to move!) (Figure 33, 4).
The Hungarian regulations describe a minimum height for working desks, which is 620 mm. For the space for the legs, 100 mm is needed in addition of the values defined above. If both values are subtracted form each other, different values are found. This means, that the tabletop thickness may not be thicker than the smallest value found this way. So, the values are determined as following:

Tabletop height:	620 – 805 mm
Space needed for legs:	455 – 678 mm
Tabletop thickness:	max. 127 mm
Eye level:	1103 – 1361 mm

Beside the height, also the size of the tabletop is important. The minimal values for this are determined by the reach radius of grownups, see Figure 34. For this, average values of European grownups are used. Because of the desk will be an executive desk, the tabletop will be most probably bigger, but this value is a good indicator for a minimum size. These values will be also taken into consideration when designing the sectoring of the desk.
According to the Hungarian standard MSZ EN 527-1:2000, the minimum size of a desk used in an office environment with a monitor should be at least 1200 x 800 mm. Combining these two values gives us the minimum tabletop size:

Minimum tabletop size:	1540 x 800 mm

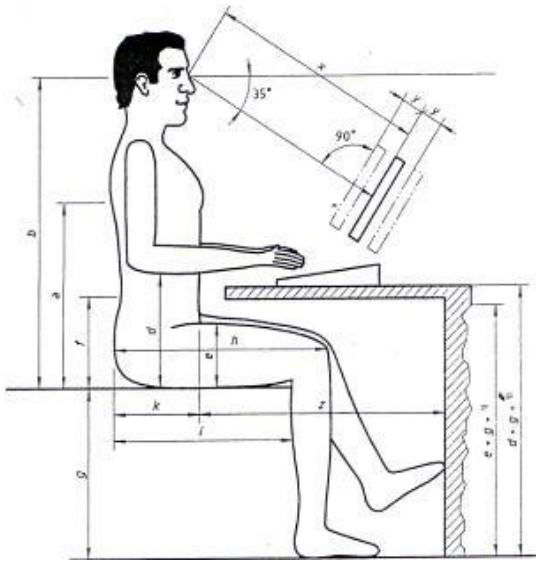

Figure 32 - Dimensioning with ISO

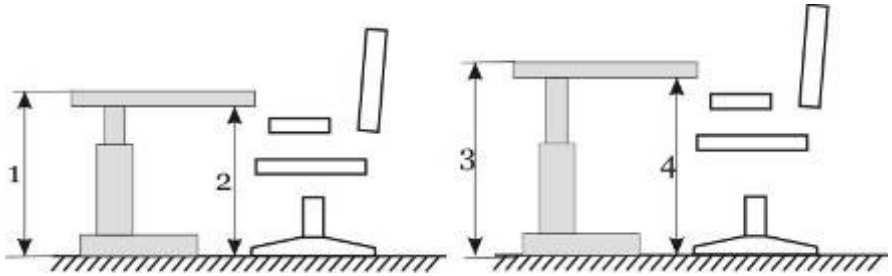

Figure 33 - Tabletop height

Storage

To determine the height of the storage places, two sources were consulted. First, the P05 for reach height of women, which is 1600 mm (Adultdata, 1998). Further the graph for ideal placement of shelves, with average values, see Figure 35. On this graph, the upper limit of the comfortably reachable area is set on 1680 mm. Since the difference between these values is minimal, 1680 mm is chosen as maximum height.

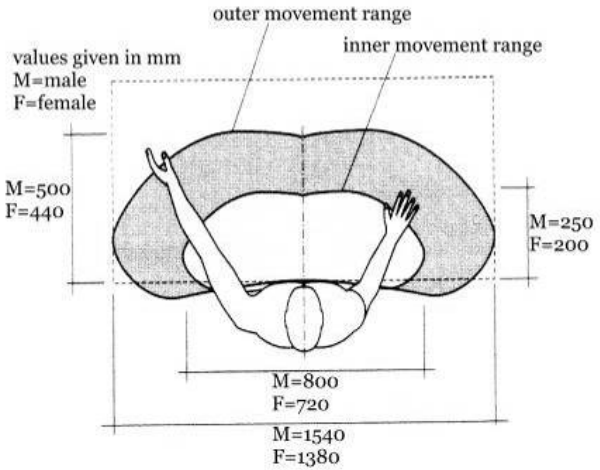

Figure 34 - Reach radius

As minimum height, 280 mm is chosen, keeping the space beneath the cupboard minimal and yet not placing the lowest shelf too uncomfortably low.

Beside the height, the depth of the shelves is also of importance. The shelves are not accessible at all heights. Because of this, different maximum depths are determined at different heights. For this, the values of Figure 35 are used:

Maximum height:	1680 mm
Minimum height:	280mm
Maximum depth (840 – 1400 mm):	600 mm
Maximum depth (280 – 840 mm):	500 mm

These values are for the accessibility of storage places while standing. For seated situations, for a container for example, no values are calculated. Lower areas can be reached much more easily while seated. The maximum depth of 500 mm should be taken into consideration in case no drawers are used. This value is estimated from Figure 35.

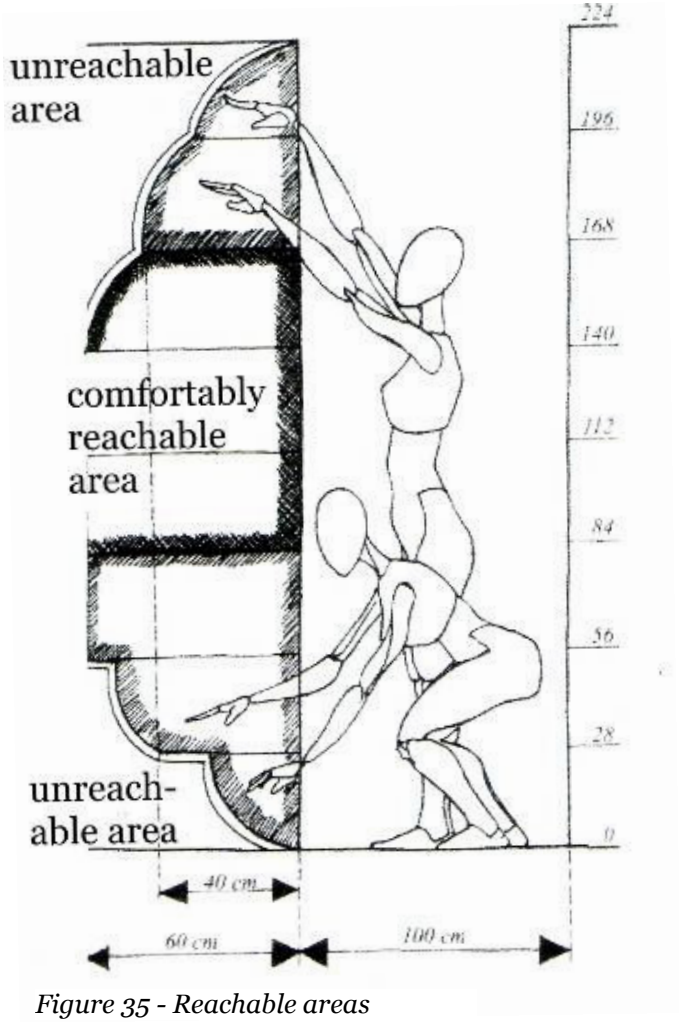

Figure 35 - Reachable areas

Esthetics

The target group consists of different individuals and the majority of these people have different taste. Therefore, it is difficult to create something that everybody likes. There are two solutions for this problem: first, the product has to be individualisable and second, a kind of compromise has to be made. The results of the interviews with the user group are used as a guideline, although, it has to be kept in mind, that the basis of these results is small, so the results can not be considered fully as representative for the user group.
Samas gave the advice after the interviews, continue with these results, since the market on office furniture was quite hard to get a grip on in terms of taste, due to the big variety of people in this segment.
According to the results of the interviews, office furniture has to be:

- modern
- stylish
- airy
- light
- ergonomic

These phrases have a broad meaning, which can differ with every person. Especially the first two phrases, 'modern' and 'stylish' can be quite confusing. To define these phrases more precisely, a test has been set up, where people had to evaluate pictures on modernity and stylishness. This test can be found in Appendix D. It is more difficult to misunderstand the phrases 'airy' and 'light', for this reason, these phrases have not been tested. Nevertheless, a collage has been made on these phrases as well, to illustrate them, see Figure 36. The feeling evoked by the collage has been verified by the target group (defined below) with success.

Figure 36 - Airy & light

Target group

Eight people were asked to evaluate the pictures, using the test shown in Appendix D. These people were not part of the user group, executive managers of branches of big companies. Instead, lecturers and PhD students of the University of West Hungary were asked. There are two reasons for this; first, making an appointment with the user group is quite difficult, since these people are mostly in a lack of time. Second, this way a bigger group was available, with a variety of different people, younger and older, but with a high degree of education, just as the user group has.
As already mentioned earlier, the segment of office furniture market consists of a big variety of people, each with a different taste. Considering this, the choice for another group than the primary user group to test the collages, but with the same degree of education, is acceptable.

Modern and stylish

During the test, the pictures shown were valued on modernity and stylishness. The results shed light on the realtionship between modernity and stylishness: the user group rejected anything that was modern but not stylish. So, one collage on modernity and stylishness is seen as sufficient. This collage is shown in Figure 37.
As visible in the collage, the usage of chrome or aluminum combined with straight clean lines are considerd modern. The combination of a warmer material, such as wood or leather with metal is considerd stylish.
This collage has been varified as well by the test group, with success.

Figure 37 – Modern & stylish

Design considerations

After setting up the list of demands and before working out the concepts, decisions have been made concerning the product, such as the number of components from which the new product consists of, the way it is customizable and some other aspects, as described in the following subsections. It is important to define these aspects, since the design concepts are all built up around these decisions and ideas.

Components

Given the list of demands and taking the user analysis, the competitor analysis and the list of possible components into account, the components of the new product can be defined.
The central place in the office is the desk. Looking at the type of work performed at the desk, it is desirable the desk supports both paperwork and computer work.
Another important aspect is the storage space. In nowadays office, mostly containers are used for this purpose. This solution fulfills all needs of the customer; it is customizable and can be placed in the neighborhood of the desk.
For extra storage space, a cupboard is a good solution. Though, bigger cupboards (or wall closets), are hardly used by international companies and given the tendencies of the market, it is likely that the need for them will decrease in the future. So, a smaller cupboard and a container should offer enough storage space.
The desk combined with a consultation table is considered as disturbing. For this reason, a separate conversation table will be created. Therefore, the components used in the new product will be: a main desk, a container, a cupboard and a conversation table.

Individualization

When creating a product for a wide range of users, it is essential to make sure that the product is adoptable to the taste and wishes of the individual user. There are two stages of achieving this adoptability: at purchase and during use.
First, let us take a look at the possibilities of individualization of the product at purchase. The possibilities are:

- offering the product in different colors,
- offering the product in different materials,
- offering the possibility of choosing the individual (complete) components from a wide range offered by the product family,
- offering different parts to the same components:
    - offering different shapes of tabletops to choose from,
    - offering different types of legs for the desks,
    - offering storage units that can be partitioned to the wishes of the user (with shelves, different types of drawers),
- offering the possibility to choose extra services like built in sockets, (electronic) height adjustment of the desks, locks for the storage units.

The possibilities of individualization after purchase are:

- offering height adjustment for desks,
- offering height adjustment for storage spaces,
- offering adjustable storage components (with removable shelves, drawers),
- offering extendable desks with different possible extensions,
- reorganizing the components, creating new compositions this way.

Most of these ways of individualization are possible, yet there are a few, which are proved not to be realistic in the previous sections, considering the user group, such as offering adjustable storage components and offering extensions for desks. It is unlikely for a branch manager to store extra elements just for the case he might need it, for example.
Considering this, the conclusion can be made that the new product should offer a wide range of possibilities for individualization at purchase. After purchase, it should offer easy adjustment to the human body.

Environmental guidelines

Since the 70's the protection of the environment plays a role in the modern society. Until the 90's, it mostly played a role at use of the products, but in the 90's it also became an important aspect to be considered after the life-time of the product, in example in its recycling. During this period, these considerations also begun to play a role in the development of the product, So, as one of the first steps of the design, a number of guidelines related to the production, distribution, structure and recycling are mapped which are kept in mind during the process of designing with the goal of creating a product with a minimal impact on nature.
These guidelines can be found in Appendix E.

Other considerations

A number of further aspects were also kept in mind during the design process, which are reviewed here briefly.

First, as already mentioned, the desk fulfills a central place in the office. For this, the concepts are all built up around the desk. This means, that the components follow the style, lines and basic ideas of the desk.
The use of laptops is taken as a standard, for this, the sockets for electricity and internet are placed on the surface of the desks. The space created for the laptop should also be enough for an external keyboard. The choice for the use of the laptop is described in the *List of demands*.
The basic shape of the conversation table is in all concepts a triangle. With this shape openness is created. The partners sitting at the conversation table can not sit directly facing each other but has to sit sideways to each other; this sitting situation is friendlier, less hostile than sitting directly facing each other, see the sketch in Figure 38.
Finally, the surface of both offices visited for the interviews were around 20 m^2. This was considered a characteristic office size. In the *List of demands* a minimum value of 16 m^2 is mentioned for this, to be sure the product family fits smaller offices as well. The concept drawings are placed in an office of 20 m^2. Yet it is still clear that the concepts would fit a smaller area as well.

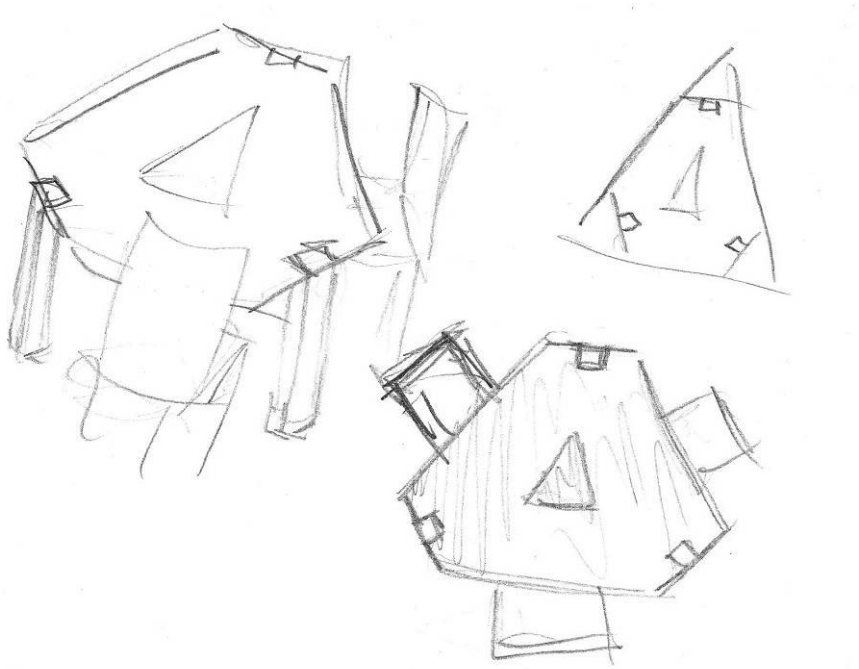

Figure 38 - Sketches for the conversation table

Concepts

With the guidelines outlined above, ideas were gathered for the product in the forms of sketches, as shown in Appendix F. Design instruments as morphologic schemes were used for finding solutions for (mostly) technological problems, see Appendix G. Finally, four product families are created. These families are reviewed in the following subsections.

Cubic

The drawings of the Cubic product family are shown on pages 29-31, in Figure 39 - Figure 41. The general idea behind this product family was to create an office furniture family built up from cubic and angular elements. The design created this way has a minimalistic and modern appearance.
The main desk is L-shaped and has a height difference, partitioning the workspace into different functional areas. Nevertheless, it rests on 'normal' four legs. The top of the legs are visible on the surface of the desk, this creates a playful impression. The height difference is separated by two metal elements, with identical planar dimensions as the legs of the desk. In the height difference sockets can be placed, this way they are always reachable for the user. The wiring can be placed inside the legs.
The container is also angular, in as many details as possible, such as the handles. The drawers can be replaced by simple shelves, leaving the precise decision of the division of space to the user.
The shelves, or cubes, have to be mounted to the wall of the office. They open sideways. This way, they remain lockable and can hide quite big amounts of paperwork.
The conversation table has a glass triangle in the middle, which gives a light and elegant impression. The legs are placed on the chopped sides of the triangle. As with the main desk, the top of these legs are also visible on the main surface.

Float

The drawings of the Float product family are on pages 32-33: Figure 42 - Figure 43. The main idea behind this concept was to build up an office furniture family from mainly horizontal elements. The desk of the Float is partitioned into three parts, which are placed on three different levels. The two side partitions can be used to store things and create space for devices, while the partition in the middle can be used for work. Sockets are placed on the two side partition, to support electronic devices. The wires are led away through the legs.
All the edges are round and organic shaped, creating the illusion of floating islands. The legs are made of metallic tubes and are adjustable in height.
The container has a glass plate on top, on a height of a few centimeters from the top drawer. This gives a floating, light impression. The front side is bent slightly. The drawers can be substituted by shelves at purchase.
The cupboard is also built up from three levels, just like the desk. These levels are connected in the middle part, where they all have the same shape. The upper and lower shelves are the mirrored versions of the shelf in the middle.
The middle part is enclosed by glass, creating a lockable area. On the corners of this area, metal tubes can be found, which hold the construction.
The conversation table has a glass triangle in the middle. This triangle is slightly elevated out from the plane of the table, creating the same floating effect as the other components have. The corners of this table are rounded softly.
The legs of the cupboard, the desk and the conversation table are the same round metal tubes.

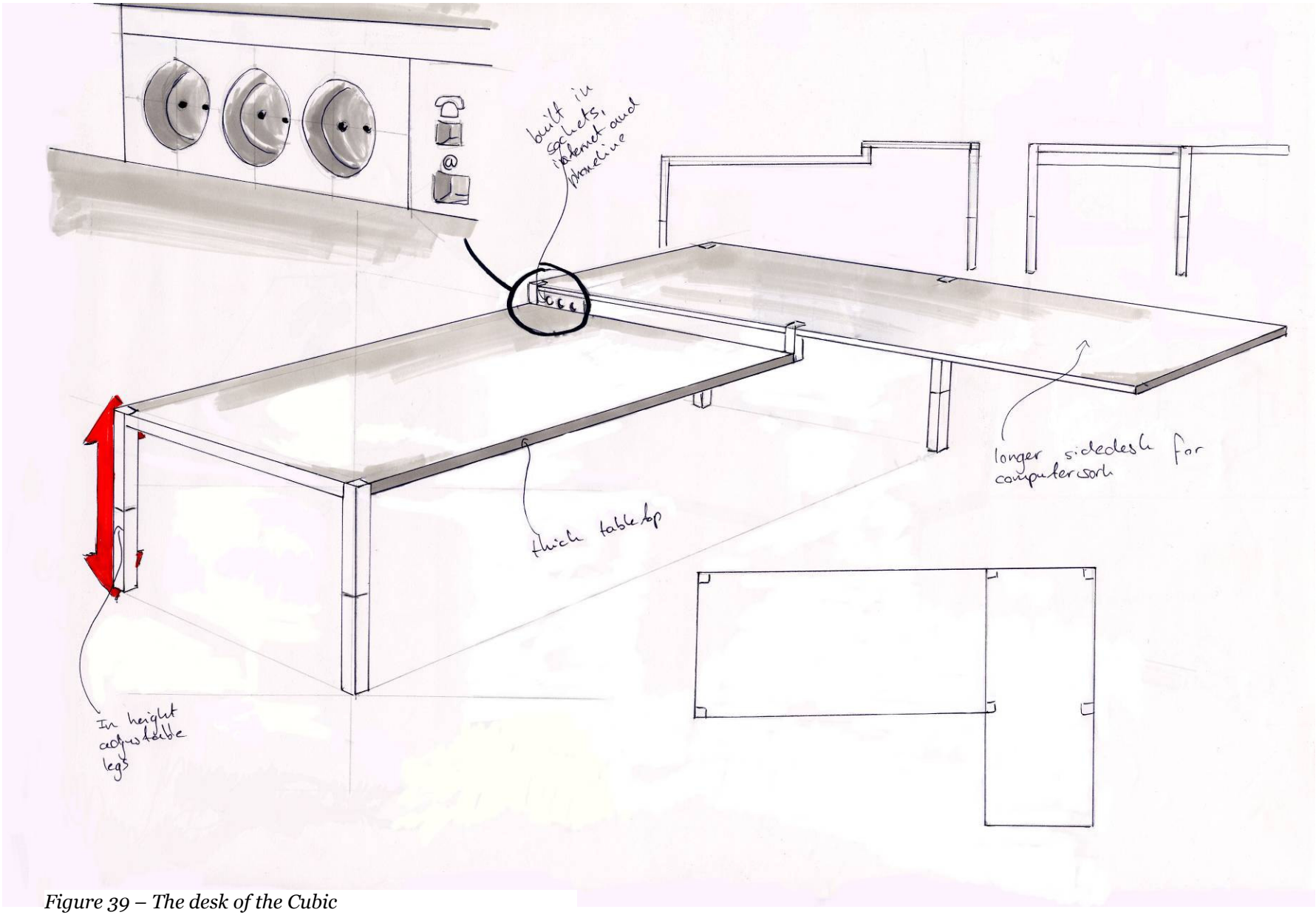

Figure 39 – The desk of the Cubic

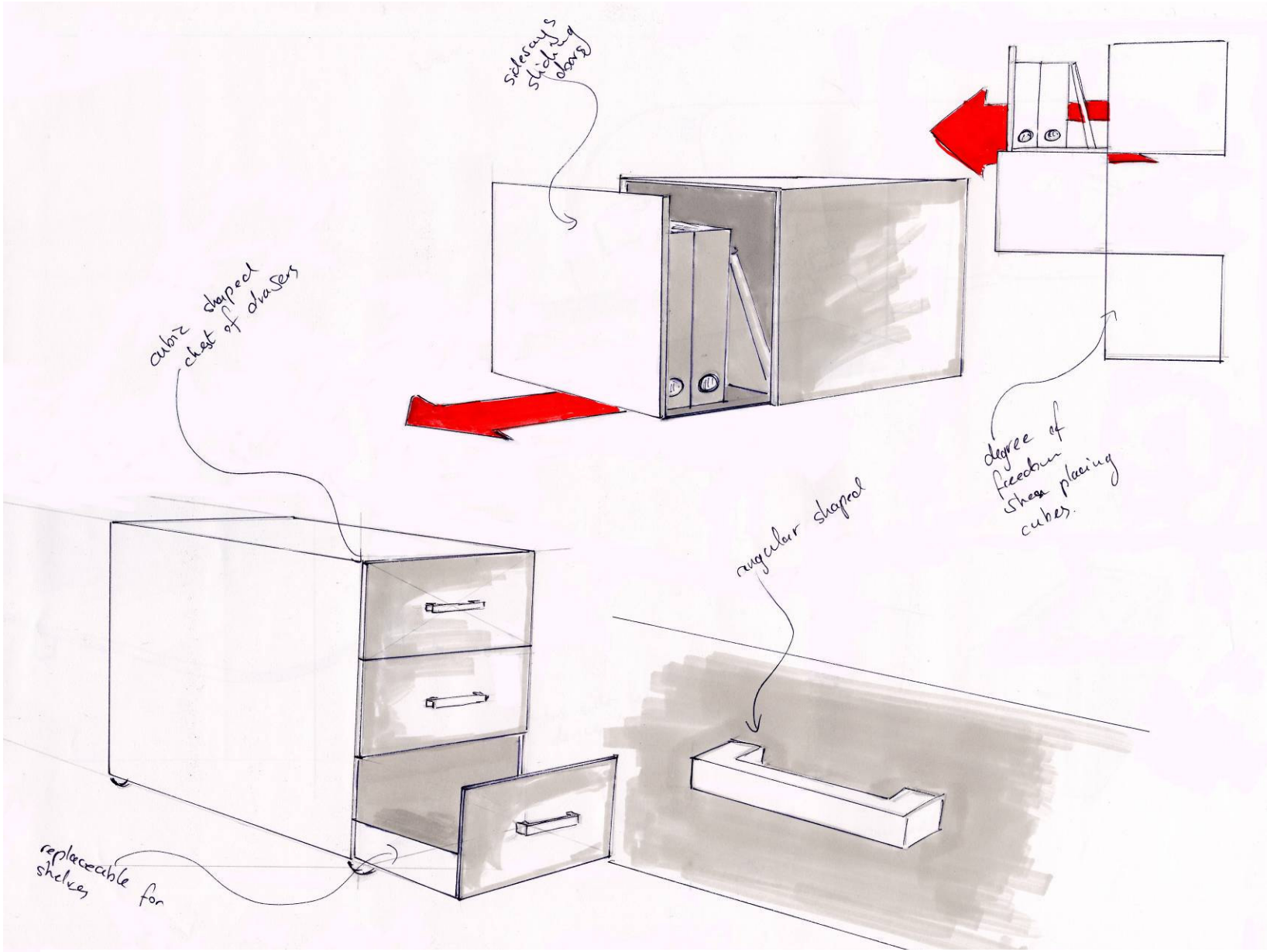

Figure 40 – The storage spaces of the Cubic

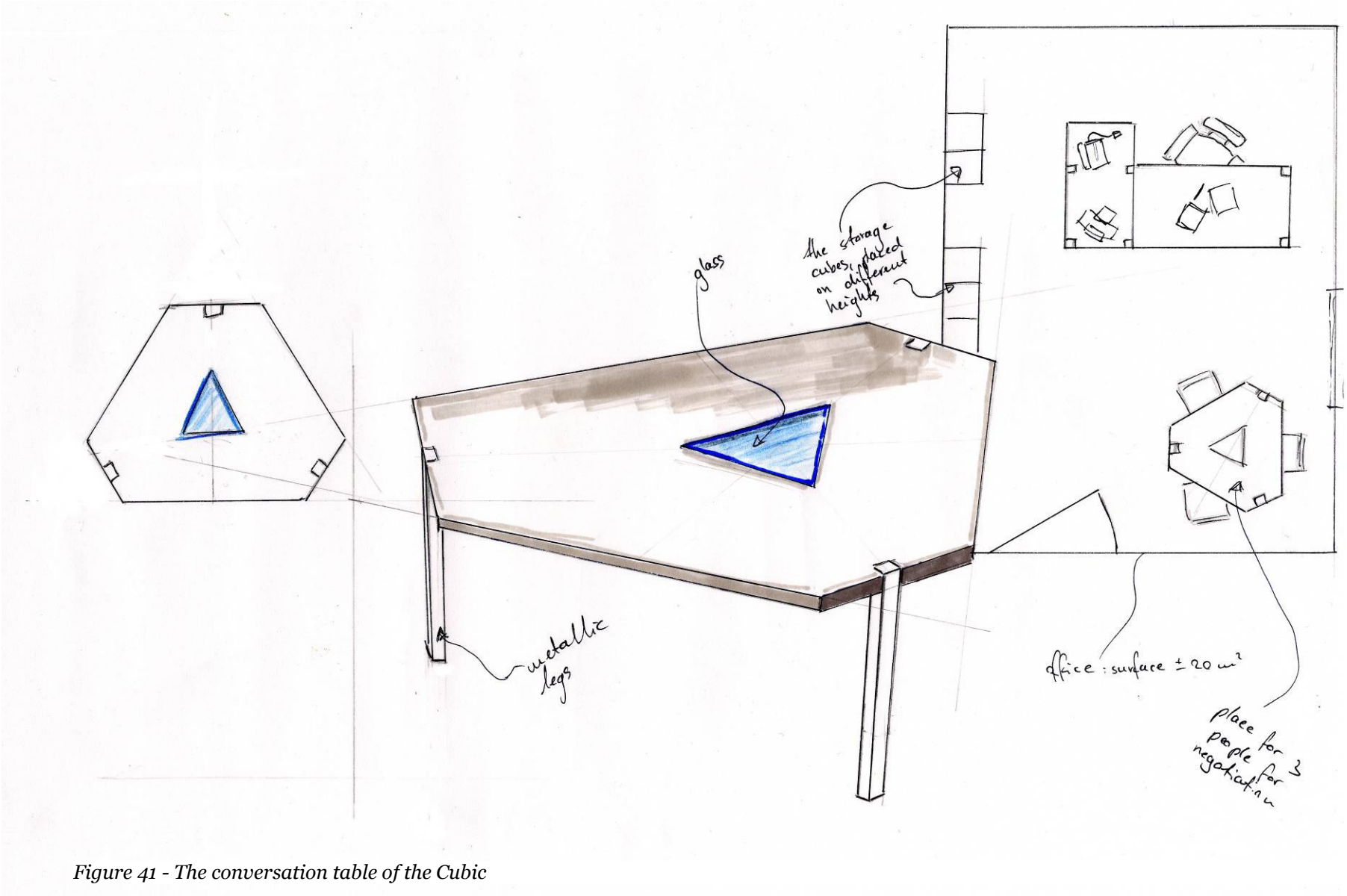

Figure 41 - The conversation table of the Cubic

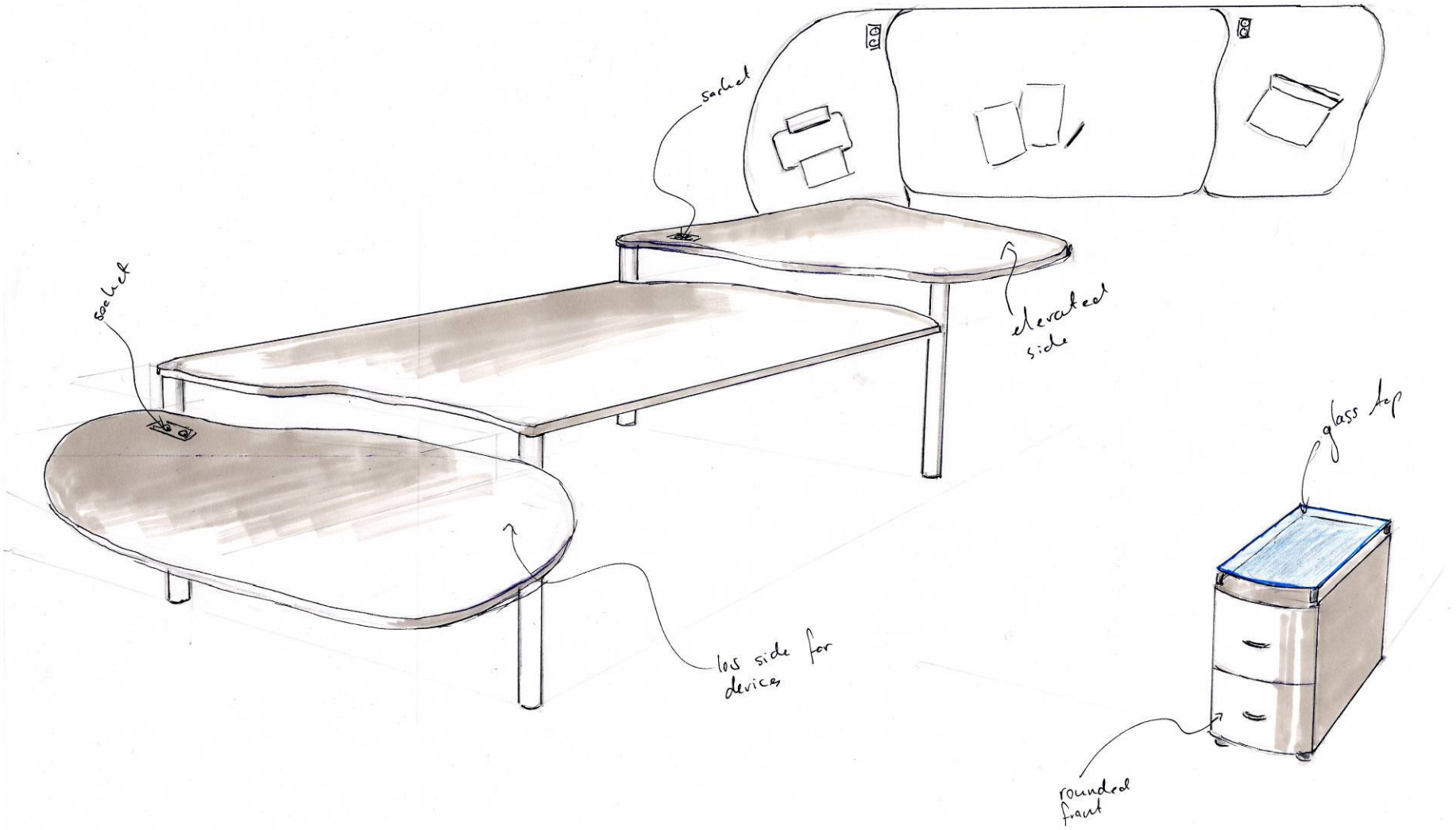

Figure 42 - The desk and container of the Float

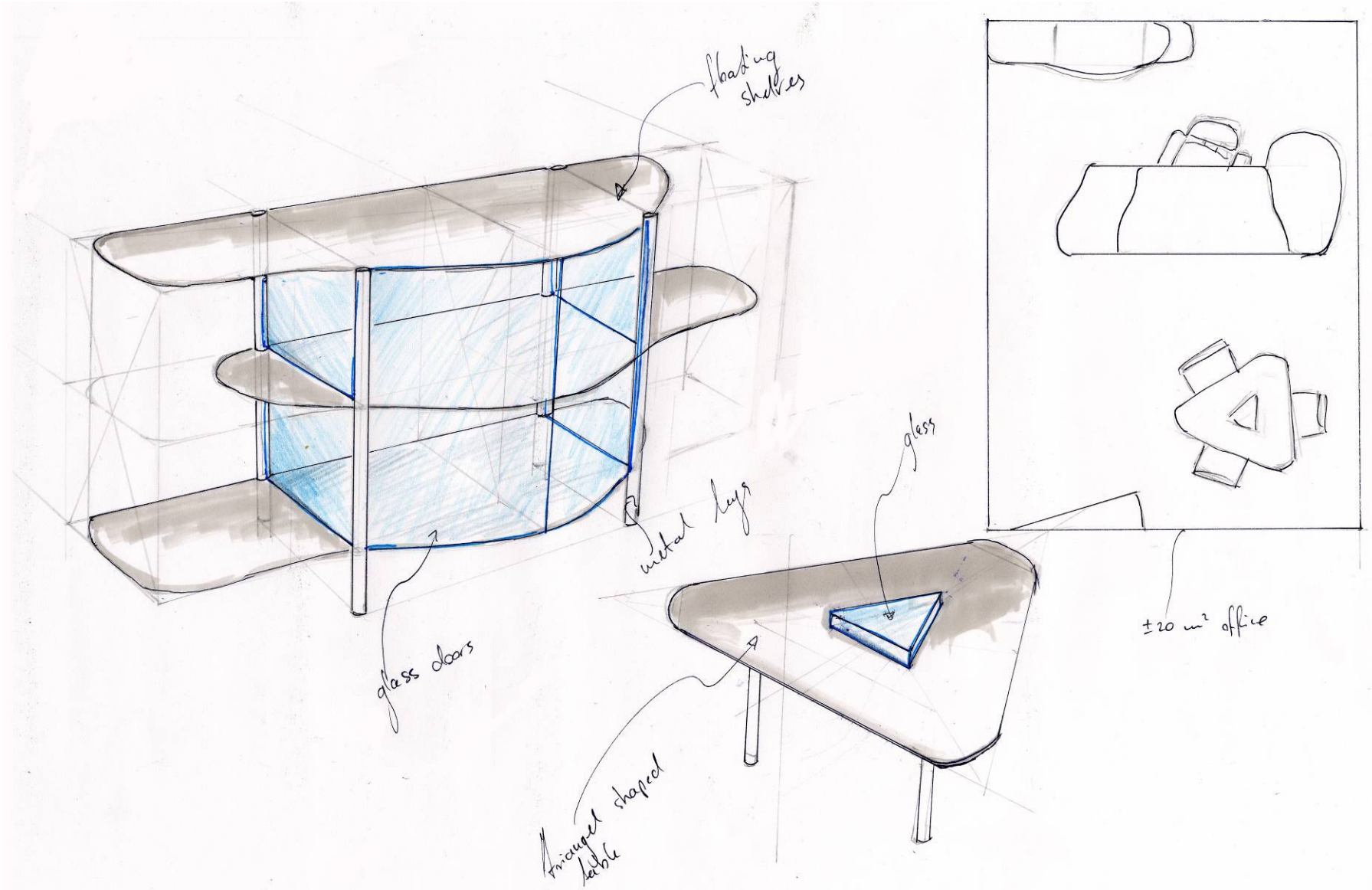

Figure 43 - The cupboard and the conversation table of the Float

Float II

The drawings of Float II family are shown on pages 35-36: Figure 44 - Figure 45. The idea of working with horizontal elements is continued in Float II, where the main idea was to avoid as many vertical elements as possible. For this reason, the desk has no legs, it is hung on the ceiling on one side. The other side is mounted on the wall. The height of the desk could be adjusted by changing the length of the cable and by creating a rail-system on the wall. The desk is a bit wider on the side where the cable is attached to it, creating an ergonomic extension on this side.
The drawers are not placed in a separate component, as with the other concepts, but are hung under the desk. The drawers hang on thin metal bars. On these bars, guides are placed, which hold the drawers and function as side walls for the drawer. The drawers consist of only a plate with a front, so when opening the drawer, only the bottom and front come out.
The cupboard also hangs half on the ceiling. One side of the cupboard is built up like a showcase, the sides of it are fixed with thin bars and have legs. The other side is hung up to the ceiling. This way, a lockable area is created avoiding as many visual vertical elements, as possible.
The triangle shape of the conversation table is extended on one corner, so it can be attached to the wall. This is needed to be able to hang it up and create a solid table. The table is hung up with a cable, the same way as the desk. The triangle shape of the conversation table is maintained, so place is granted for 3 people to sit down.

Central

The drawings of the Central family are shown on pages 37-38: Figure 46 - Figure 47. In this concept, the furniture family is built up around the user, like a town is built up around its center, highlighting the central role of the user in the office.
To maintain this feeling, the desk is bent slightly, placing the user in the center. The legs of the desk are metal tubes. On the side of the user, these tubes are placed on both sides, while on the front, they are placed in the middle of the desk. The legs are adjustable in height. The front legs rest on a kind of foot, to give stability to the desk. On these two front-legs, a dark bent glass is placed, hiding the legs of the user, creating a bit of privacy.
The sockets are placed in the middle in the front of the desk. This way they are reachable and the wiring can be hidden in the legs easily. The sockets can be lowered slightly, to hide the plugs.
The container has shelves on one side. These shelves follow the shape of the desk, when the container is put beneath the desk it will not stick out. The drawers of the container can be replaced by shelves, as with the Cubic and the Float concepts.
The cupboard looks a bit like an ordinary cupboard, but it is bent a little. So, when placed beside the desk, it strengthens the centrality of the user. The storage space in the cupboard consisting of a row of drawers and two doors with shelves, is lockable.
The conversation table has bent sides, so it becomes something between a circle and a triangle. In the center of it, a glass plate is placed, giving a light and airy feeling to it. The legs of the conversation table are made of the same material as the legs of the main desk.

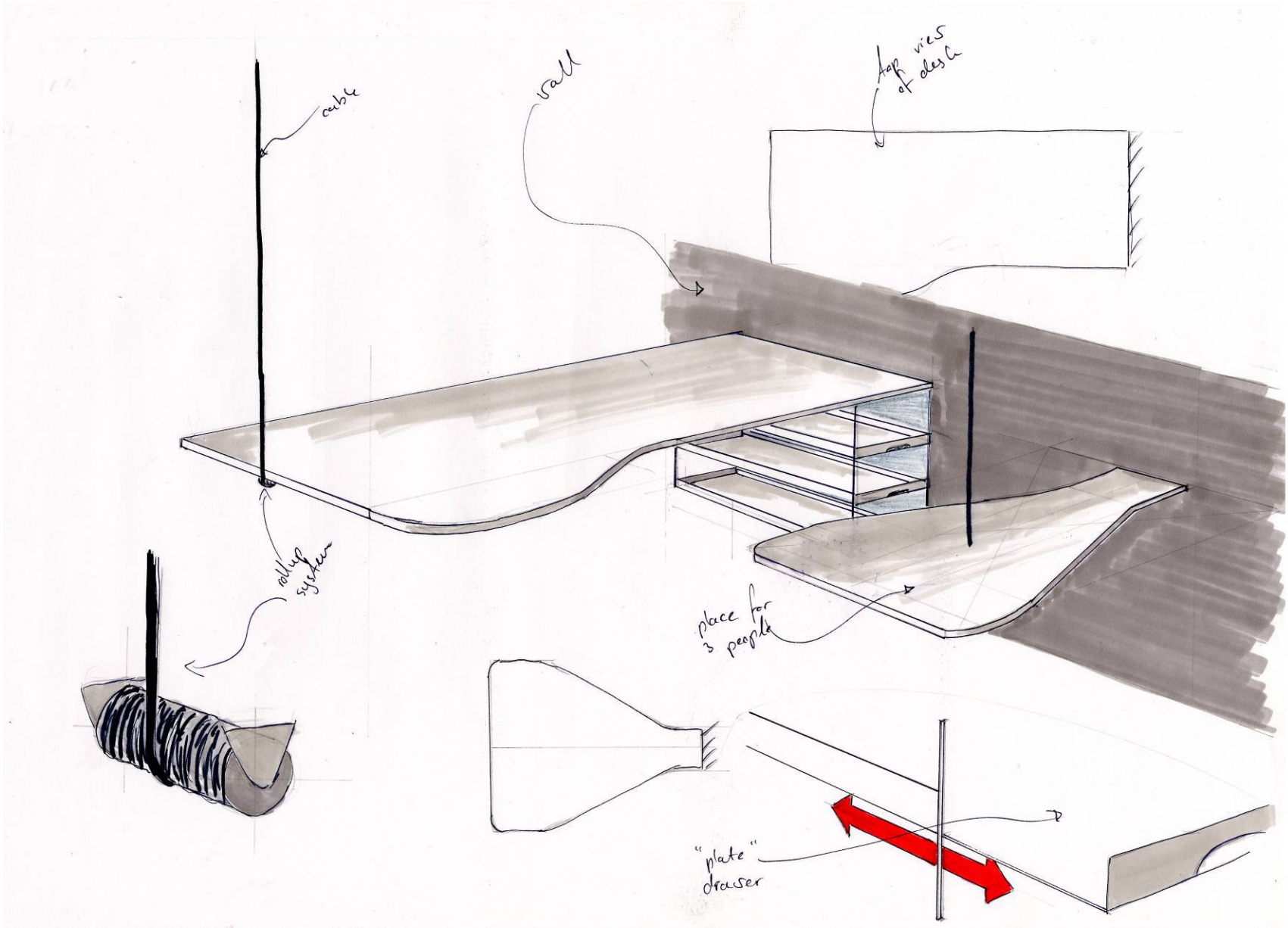

Figure 44 - The desk and conversation table of the Float II

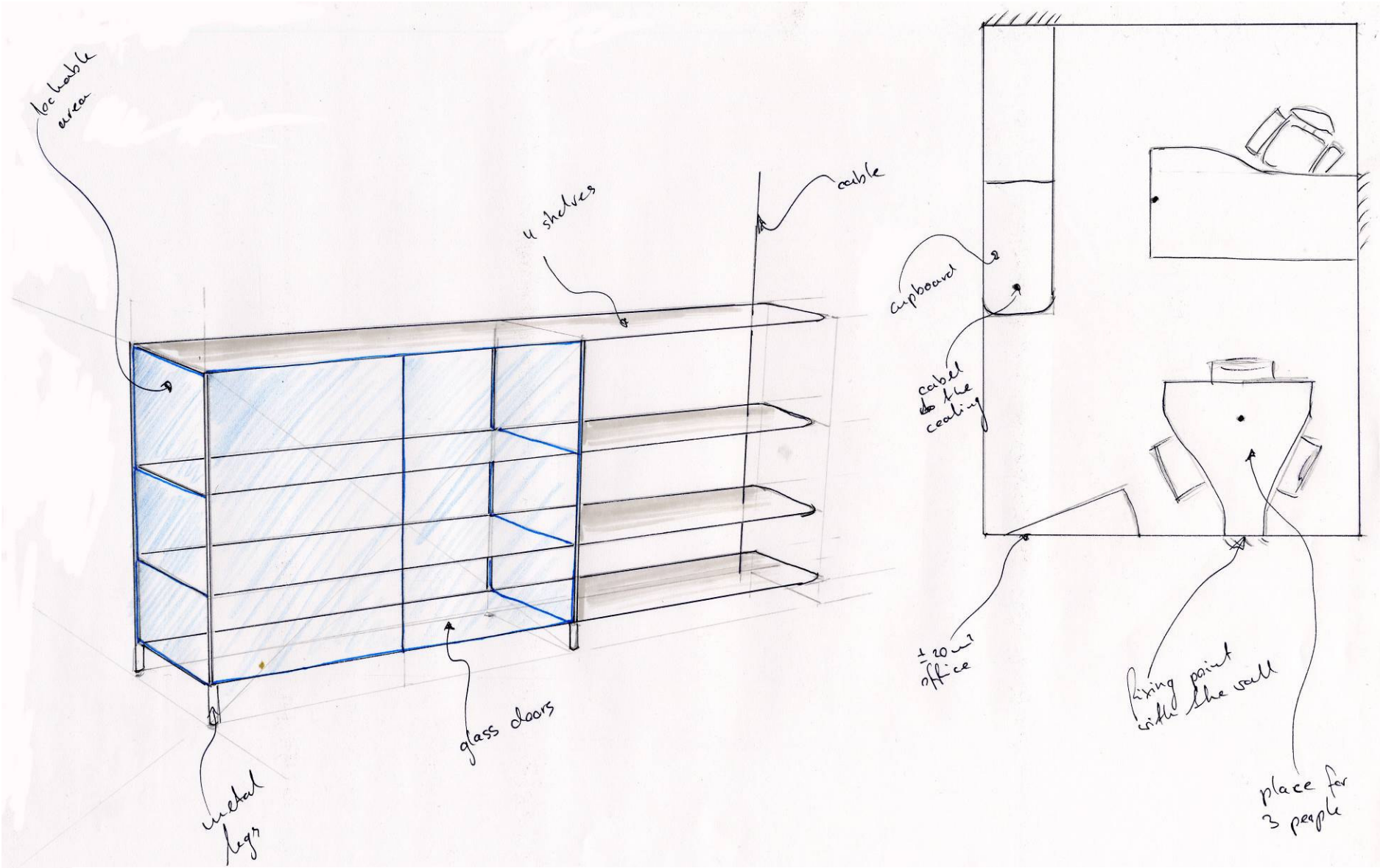

Figure 45 - The cupboard of the Float II

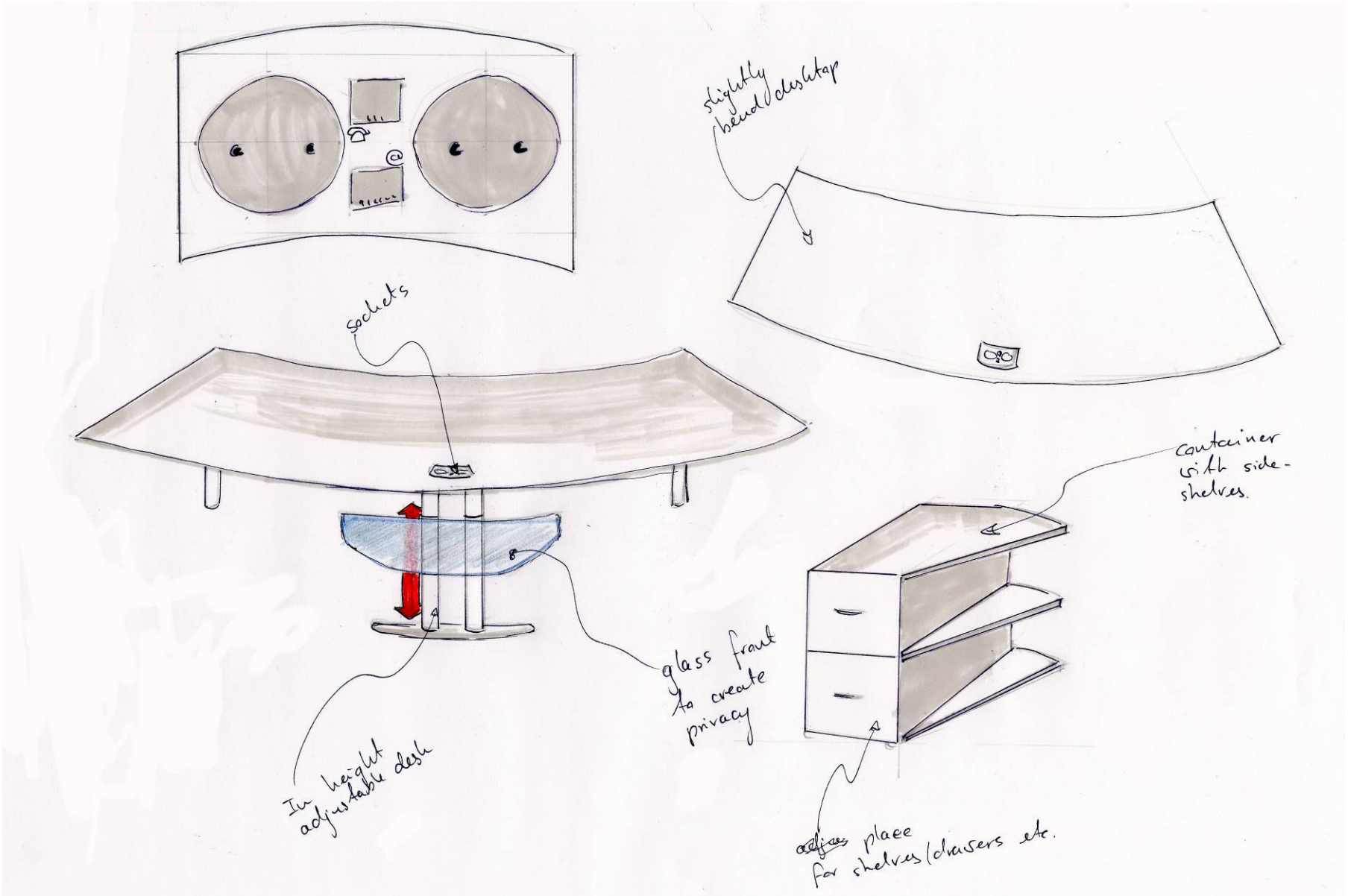

Figure 46 - The desk and container of the Central

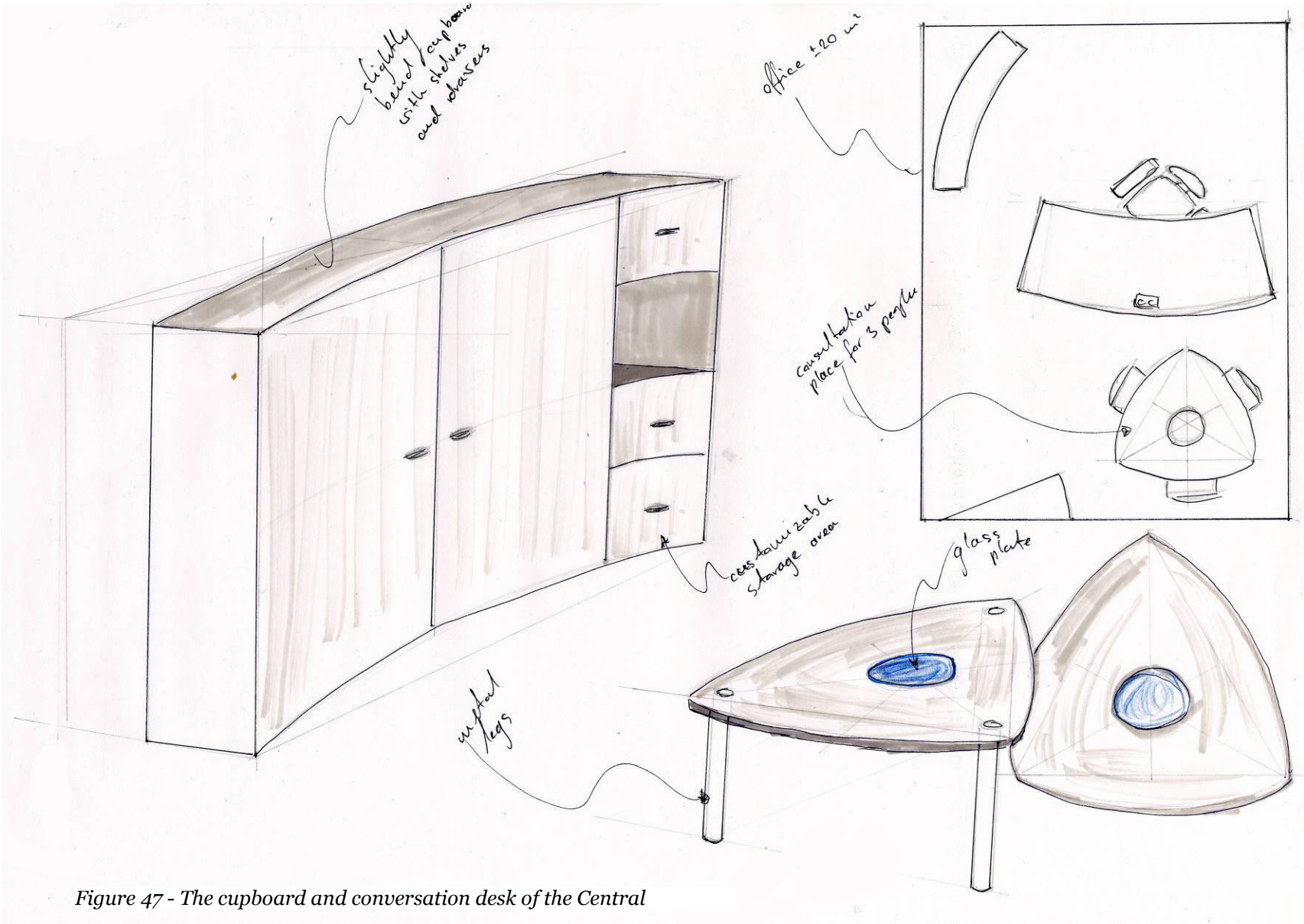

Figure 47 - The cupboard and conversation desk of the Central

Evaluation

From the concepts above, one has to be chosen to be worked out. It is of high importance that the chosen concept fits the requirements as listed in the *List of demands*.
The points on which the concepts are evaluated are the main points derived from the chapter *Aspects of design*: customizability & adjustability, ergonomics, appeal to the primary user, business economical functions and environmental considerations. These five points are considered as the most important ones for reaching the goal of the assignment. Below the choice for these points is explained:

- customizability & adjustability

For a product, which has to satisfy individual needs, it is of high importance that it is customizable. This point also refers to paragraph 1.4 of the *List of demands* on page 74 and section *Individualization* on page 26.

- ergonomics

Ergonomics is seen as a point of attention as well, as indicated in the target group analysis. This point refers to paragraphs 1.1.2, 1.4.1 and 1.6 of the *List of demands* on pages 74-75 and to section *Ergonomics* on page 21.

- appeal to the primary user

The product is designed to reach the line between the middle and upper segment on the furniture market, so it is of high importance that it appeals to the primary user group, as mentioned in paragraph 2.2 of the *List of demands* on page 75 and section *Esthetics* on page 24.

- business economical functions

From the point of Samas it is also important that profit can be made and that the product represents the company, as stated in paragraph 3 of the *List of demands* on page 75.

- environmental considerations

Besides all this, the environmental part of the design is also important, see chapter *Environmental guidelines* on page 82.

In order to choose a concept appealing to the primary user best, the concepts are evaluated by a group of people. During this evaluation it became clear, that the questioned people almost without exception preferred a combination of components from concepts instead of one concept product family. Based on this, the evaluation of the concepts is done componentwise and conceptwise, to be able to choose a concept fitting the user group best and to be able to choose the best components for this concept.
These points, as described above, except the point 'Appeal to the primary user', are divided into sub-points and these sub-points are valued by marks between the 1 (low) and 5 (high). The sub-points give the values for the main points. The sub-points and the full table with evaluation can be found in Appendix H on page 87. The explanation of the valuing of the point 'Appeal to the primary user' can also be found there.
The weight of the five main points for the final value differ, some points are considered more important then others:

- Since the product has a high esthetical value, this point is considered most important with a value of 30%.
- The product must also grant a high level of customizability and the production of the product must also be implementable, so these two points are considered second important with a percentage of 20 % both.
- From the five main points, ergonomics and the environmental considerations are seen as the least important compared to the other points with both a percentage of 15%.

A compact version of the evaluation table can be found in Table 3, to give an impression of the valuing process.

	Cubic	Main desk	Conversation desk	Container	Cupboard	**Float**	Main desk	Conversation desk	Container	Cupboard	**Float II**	Main desk	Conversation desk	Container	Cupboard	**Central**	Main desk	Conversation desk	Container	Cupboard	**Weight**
Customizability	3.4	3.5	3	3	4.3	3.1	3	3.5	3	2.8	2.1	2.5	2	1.3	2.8	3.3	3.5	3.5	3	3.3	20%
Ergonomics	3.5	3.3	3.5	3.5	3.5	2.8	4	2	2.5	2.5	3	3.7	3	3	2.5	3.3	4	3.5	3	2.5	15%
Appeal to primary user	3.7	1	1	1	3	4.3	1	2	5	1	4	1	1	1	1	4.4	4	4	1	1	30%
Business Economical	3.5	3.5	3	3.5	4	3	3	3.3	3.3	2.5	2.6	2.3	3	2.3	3	3.4	3.8	3.3	3.3	3.3	20%
Ecologically considered	4.5	4.4	4.1	4.4	4.9	4.2	4.4	4.1	4.1	4.3	4.3	3.9	5	3.9	4.3	4.5	4.1	4.1	5	4.7	15%
Total	3.73	2.9	2.72	2.86	3.82	3.59	2.88	2.83	3.76	2.45	3.38	2.53	2.65	2.22	2.52	3.85	3.91	3.73	2.84	2.72	

Table 3 - The compact version of the evaluation

Evaluation results

Looking at the results of the evaluation at concept level, the Central concept has the highest score. Although, the difference between the results is minimal, this choice can be made for two reasons: looking at the point Appeal to the primary user, where it is valued with the highest score on all points except one. Additionally, the personal opinion of the designer is that this concept fits the user group best.

Not all the components of the Central product family are seen as the best design at the component level. In the groups of the main desks and conversation tables the Central has the highest score, but among the cupboards the Cubic scored the highest, whilst from the containers the Float was proved to be the best. These components are chosen as the starting points of the final design. The difference between these results is big enough to make the choice based on these values.

Final concept

The components of the final concept come from different concepts. To unite them, some of these components have to be modified a little in order to fit the chosen concept, the Central.
Below, the components are worked out and described, starting with the main desk, since this is the 'heart' of the furniture family. For this assignment, only the main desk is worked out thoroughly, the other components are modeled, but no technical drawings or production information are given: although, a few suggestions for use of materials or external components are mentioned.
It is quite confusing sometimes, which side of the components should be called front, back etcetera. To clarify this, the sides are identified in a figure at the beginning of each section.
The final concept is named Center Office, referring to the central position of the user. The whole Center Office line is introduced in a rendering on page 51.
The technical drawings of the product can be found in the separate booklet named *Technical Drawings*.

Figure 49 - The main desk

Main desk

The main desk is slightly bent looking from above, putting the user in the focus. Furthermore, this form is ergonomic, since it follows the shape of the reaching area of humans.
In this concept, the tabletop is not partitioned explicitly. With explicitly partitioning the workspace, the user's freedom to organize the desk the way he likes would be lost.

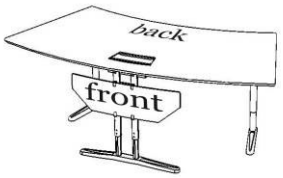

Figure 48 - Desk orientation

Tabletop

The Tabletop is made of 38 mm thick laminated MDF plate. Normally Samas uses 25 mm thick tabletops, yet there are two reasons for choosing

for this thickness. First of all, from the interviews it appeared that people associate a thick tabletop with power, respect and authority. This fits the user group, the executive managers. Secondly, a thick tabletop hides the sockets better.
The manufacturer Samas usually buys the laminated plates from, Falco Rt, but unfortunately they do not offer this thickness, so the laminated MDF plate offered by Fritz Egger GmbH & Co[3] are used: 38 x 2800 x 2070 mm.
The choice for MDF is based on the properties of this material. The sides of the desk are rounded or chamfered, as explained further in this text, from particle board these roundings would not be possible. Plywood boards are not thick enough and more expensive.
The choice for lamination over veneering is also based on economical issues. With veneering, the product would be much too expensive for the user group. Furthermore, Samas does not have the equipment for the production or processing of veneered plates.

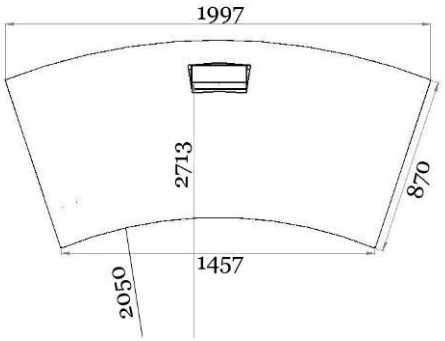

Figure 50 - Dimensions of the tabletop

The sides of the tabletop are covered with ABS-sides. T-edges and edge veneering are mostly used with veneered plates. Looking at edge band and ABS, ABS edges are longer lasting, look better and do not cost that much more, around 270 Ft against 150 Ft per meter.
On the front side of the tabletop the lower edge is chamfered to the half, so the front side does not look that aggressive and flat. The other edges and the corners are rounded, for safety and esthetical reasons. The dimensions of the tabletop are presented in Figure 50. Note that the thickness of the ABS edges is not calculated here, this means an extra 2 mms on all sides.
The front and backside of the tabletop are concentric arcs. The radius of the back side is 2050 mm.

[3]http://hu.egger.com/ost-eng/egger-osteuropa-holzwerkstoffe-mdf-platten_12792.htm

The middle of the socket is placed at a distance of 2713 mm from the center point of the arcs, meaning 663 mm from the back side. The average grip length of a female is 625 mm and of a male 675 mm (Adultdata, 1998). Although the distance of the middle of the socket is more than the average grip distance of a female, this deviation is still acceptable.

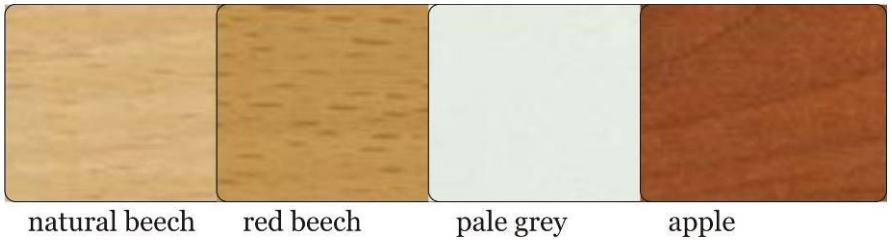

Figure 51 - Colors for lamination

For lamination, the existing colors Samas uses are used, namely natural beech, red beech, pale grey and apple, see Figure 51, to emphasize the relationship with other Samas products. The user can choose from these colors at purchase. In this document, the rendered models are covered with a red beech layer.

Socket

Sockets are placed in the tabletop to support electricity and computer connections for the user. These sockets are placed in a special part, the socket holder, which is sunk into the tabletop. It is built up from four elements. In Figure 52, an exploded view illustrates these main parts: a glass cover (number 1 in the figure), a part where the sockets are fixed in, the socket base (number 2 in the figure), a tube for fixing the bottom (number 3 in the figure) and a cover for the bottom (number 4 in the

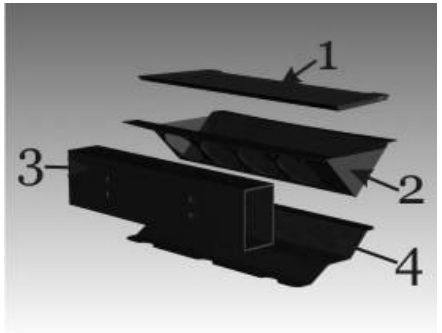

Figure 52 - Exploded view of the socket holder

figure).

The main element is the part where the sockets are placed in, which is a bent metal plate. This plate is made of a 1 mm thick bent stainless steel plate. The choice for bending a plate instead of molding is made considering the limited estimated number of desks that will be produced. Estimated, molding would be financially attractive if the production exceeds the X thousand pieces, which is not expected.

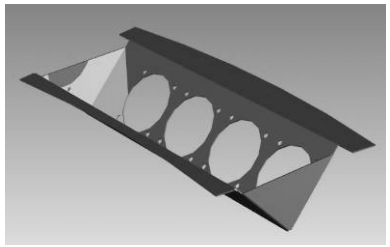

Figure 53 - The socket base

This plate is in the direct sight of the user, so the surface is sandblasted for a more exclusive look. This technique gives a slightly rough, mat surface.

The two longer sides of the socket base are slightly bent, following the bending of the tabletop. The sockets are placed facing the user in the isosceles triangle which is embedded in the desk, see Figure 54. The sockets are drawn in this figure for illustration. Some extra space is created on the left side of the leftmost socket for bigger plugs, as shown in the figure.

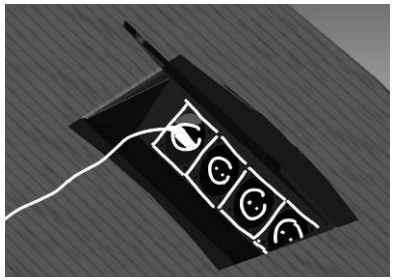

Figure 54 - Socket holder with sockets

The sockets have to be ordered from an external company, other than the ones Samas already has contacts with, since neither Hettich nor Forest Hungária sell sockets. A suggestion is Berker[4], a German company which focuses on electric accessories. During design, the spaces needed for the sockets are calculated based on the dimensions of the Berker products. These sockets have a universal fitting, which can host a big diversity of components: electricity, telephone or internet sockets. This way, the sockets are customizable. the B Mobil socket line of Berker is chosen for the present design.

[4] www. berker.de

The wiring of the sockets is led away in the front leg via an extension lead. All metal pieces should be connected with the earth in the wiring, to prevent accidents. Additionally, the wiring has to be wrapped well, to ensure that the metal wiring does not come into contact with the socket holder.

The top of the socket holder is covered with a glass plate, see Figure 55. This glass is made of 5 mm thick, on demand colored glass. The two, in Figure 55, horizontal edges are cut down in an angle of 45°, this way it fits the socket holder perfectly. On the side facing the user, room has been created for the wiring coming out of the socket. The user can open the socket holder via this by flipping the glass plate out with his or her fingers via this opening.

Figure 55 - The glass

The bottom side of the socket unit has two functions: covering the bottom of the sockets and hiding the wiring. This plate is also made of bent 1 mm thick stainless steel. The fixation to the tabletop is done by three M3x16 woodscrews on the side where it contacts the tabletop and by four M2x5 screws on the side where it connects to the tube which holds the front legs (number 3 in Figure 52). Screw threads are cut in the holes for these screws in the fixing tube. By fixing this plate with screws, this part can be removed and the back side of the sockets remains accessible.

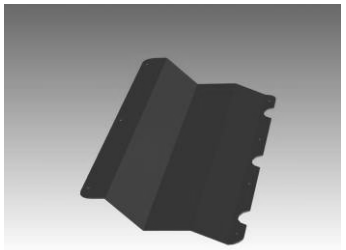

Figure 56 - Socket holder, bottom

On the side of the tube, three half circle cuts can be found, so the screws holding the tube to the table remain accessible.

All elements of the socket holder can not be produced by Samas itself, they have to be ordered from an external company.

The space needed for the socket holder is cut into the tabletop. This cut is a quite complicated one, with places that go through the plate and places

which are only cut a few mms deep, as illustrated in Figure 57. In this cut, the socket base (number 2) and the glass (number 3) are sunk in the upper surface of the tabletop (number 1); the socket holder bottom (number 4) covers the bottom. There is also space created for the tube for fixing the front leg (number 5) and the front leg (number 6). On the upper side, it is of high importance that the socket holder base is in line with the surface. With this, the glass plate should be in line with the surface as well.
The cut is cut bigger on some places, to avoid angular corners, so it can be cut with a machine.

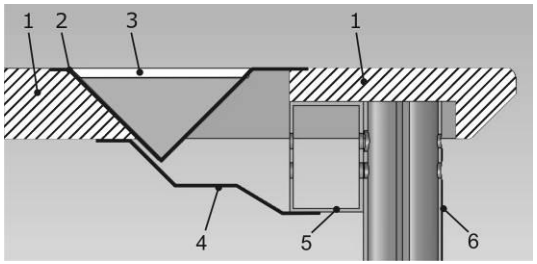

Figure 57 – Cut for the socket holder section view

Legs

During design of the desk, the aim was to use existing desk legs of Samas as much as possible, reducing the costs this way. Unfortunately this was not completely realizable, because with the standard legs the desk would capsize, see section *Testing* on page 55. For the fixation of the front glass on the desk, the legs had to be modified as well. Yet, the majority of the elements used for the legs are existing components.
The back legs are built up from four elements, see Figure 58. These elements are: a fixing dish, an upper tube, a lower tube and a foot. The fixing dish, the upper tube and the lower tube are new elements designed by Samas, but they are already tested and approved for production. The foot is newly designed for the Center Office. All elements are made of stainless steel.
The fixing dish is 200 mm is diameter and is fixed to the desk with 8 5x20 wood screws. Since these screws are strong enough to withstand the forces, see *Appendix I - Testing* on page 91, no plug for embedding is used in the tabletop for extra fixation. This counts for all screws in the Center Office.
The upper tube is 45 mm in diameter, the lower is 41 mm. Both have a material thickness of 2 mm. In the upper part of the upper tube and in the lower part of the lower tube a metal plate is placed with a thickness of 5 mm, on a distance of 10 mm from the edge. On this plate, a 5 mm thick M8 screw top is weld. The fixing dish and the foot are fixed to the tubes via this construction with one screw each. The screws are not visualized in Figure 58.
In the lower tube, holes with screw threads are drilled with 20 mm spacing, starting 30 mm from the foot. In the upper tube one hole is drilled. The tubes are fixed to each other via these holes with one screw. The holes also make the leg variable in height, from 586 to 816 mm.
The dimensions of the foot are 407 x 52 x 50 mm. It is triangle shaped from the side, leaning on its front and back, providing stability.

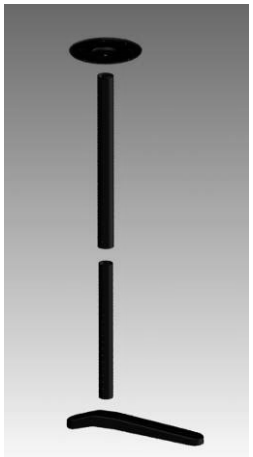
Figure 58 - Exploded view of back leg

The front leg is built up from five different elements, see Figure 59. Similarly to the back leg, only the foot of the leg is newly designed, the other elements are already in use at Samas. The leg comes from the High Office series, it can be found under the name HA53JY.
This leg consists of four tubes, a 45 mm diameter tube and a 41 mm tube, each with a thickness of 2 mm. The lower and smaller tube has a trapezium shaped groove on its side, running from the bottom to the top with its smaller side facing outwards. A trapezium shaped metal piece is placed in this groove with a screw threaded hole in it. In the upper groove there are two holes. Via this hole, screws connect the both tubes. The tubes can be fixed on the desired height via the trapezium in the inner tube.
The upper tubes are modified in order to hold the glass plate. On four places on the front a metal plate is weld to it. Under the upper two and

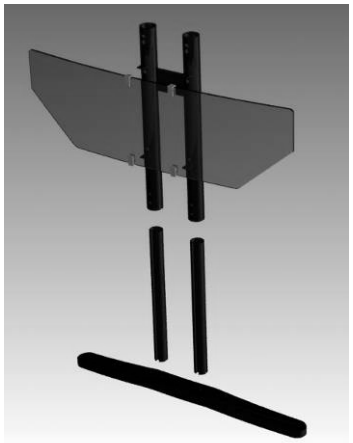
Figure 59 - Exploded view of the front leg

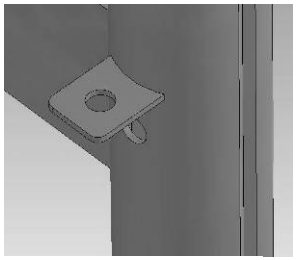

Figure 60 - The glass holder holders

above the lower two holders holes are drilled into the tube, see Figure 60. The purpose of these holes is explained at the *Front glass* section on the next page. Two holes are drilled in the upper part of both upper tubes and two in the lower part of the upper tubes. The lower holes are for fixing the upper tubes to the lower tubes, the upper holes are for fixing the legs to the fixing tube, see Figure 61. Three M8x16 screws are used for this, the remaining hole is used for leading the wiring of the sockets away.

The foot of the front leg has the same bending as the tabletop, seen from above. This foot is a bit triangle shaped from front, as the feet of the back legs, but it is 10 mm higher. The reason for this is the greater length of the front foot. All elements are made of stainless steel, as the back legs.
The distance between the center points of the front legs is 130 mm. The metal plate between the two upper tubes is part of the original design.

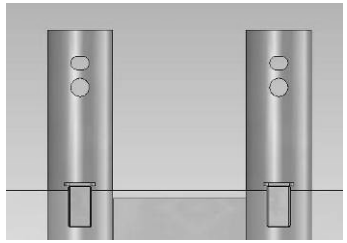

Figure 61 - Holes in the upper tube

The front leg is attached to the tabletop via an angular tube, see Figure 62. This tube is 272 mm wide, the same with as the socket holder. The bottom part of the socket holder is fixed to it, as visible in the exploded view of Figure 62.

Figure 62 - Fixation of the front leg

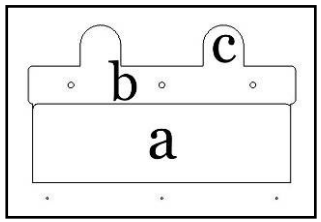

Figure 63 - The cut in the bottom of the tabletop

This fixing tube is 60 mm high. With this height it would stick out on the bottom of the tabletop. To hide it, it is embedded 20 mm in the tabletop and with it, the front legs as well. This embedding is connected with the hole of the socket holder, see Figure 63. In this picture, (a) is the cut of the socket-holder, (b) the cut for the fixing tube with the holes for the screws and (c) the cut for the legs. These last two are 20 mm deep as already mentioned while (a) goes threw the plate. The wiring of the socket holder is led away threw the front legs. It passes threw the fixing tube before going into the legs via one of the four holes in the upper tubes. The fixing tube is fixed to the tabletop with three 5x20 woodscrews.

The legs can be purchased in three different colors, these are the colors Samas already uses for the legs. These colors are black, granite and platinic metal, see Figure 64.

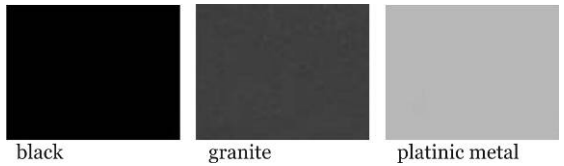

Figure 64 - The colors of the legs

Front glass

The front glass has a bent surface. Also this bending follows the shape of the tabletop. The front glass is 800 mm wide, 240 mm high and has a thickness of 6 mm. This glass thickness should be strong enough not to break when it is accidentally punched, during cleaning for example.

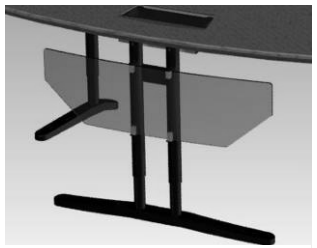

Figure 65 - The front glass on the desk

Figure 66 - Glass-holder

The glass is trapezium shaped, with its wider part above, see Figure 65. Airiness is emphasized this way. The corners are rounded for safety reasons.
For the fixation of the glass to the leg, the upper part of the leg is modified, as described above in the 'leg' section. On this modifications glass holders are placed. The glass holders used in the design are made by Schachermayer[5], see Figure 66. This glass holder can be delivered made from steel or from

[5] Schachermayer Catalog 2006, 1st edition, Section MBT, page 370 www.schachermayer.at

aluminum. For this design, the steel glass holder is used, because all other parts are made of steel as well.
The glass holders are fixed to the front legs with screws. No information could be obtained from Schachermayer on the dimensions of these screws, the final model might has to be modified when information is available. The holes in the front legs at the glass holders are made there to make the screw on the back side of this glass holder accessible. It is possible that these screws are not accessible when the front leg is installed in a low position, due to the lower tube getting in the way.

Ergonomics

The user should reach some parts of the desk easily. This ergonomic aspect is tested by drawing the contour of the main desk on a table and letting two persons reaching to the important areas.

Figure 68 – Desk with different objects

To simulate an office environment, different objects used in the everyday life in an office are put on the testing area, see Figure 68. The space in the area was found sufficient for the objects.

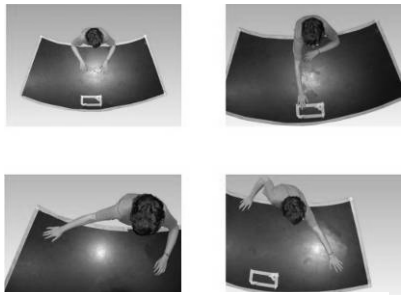

Figure 69 - Candidate A

As already mentioned above, two candidates were selected to test the reachability of different parts of the desk. Candidate A is female and 155 cm tall, Candidate B is male and 198 cm tall. The P05 for women is 151 cm, the P95 for men in Central-East Europe is 186.2 cm (Adultdata, 1998). With the female participant close to this value and the male participant over this value, the results of this test can be assumed useful. The candidates were asked to sit at the desk and to reach to different areas. During this, they were photographed from above. The size of the testing desk was 1450 mm on the 'short side', the side of the user, and 2000 mm on the 'long side'.
The shape of the drawn desk differs from the testing table. This means, that the candidates could not take place directly at the 'desk'. To solve this problem, the photos taken from the candidates are modified in an image editing program, by placing them directly to the edge, see Figure 69-66. Special care was taken to keep the original size and proportions of the test persons and the desk.

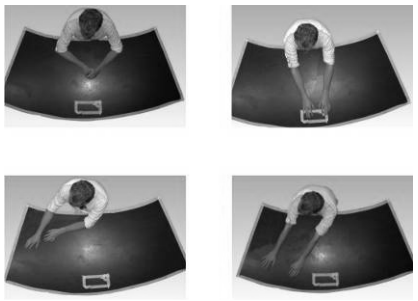

Figure 67 - Candidate B

The candidates were asked to reach to 3 areas, the corners on the side where they were sitting, the corners on the front side and the socket. The 'short corners', on the side of the user, and the sockets are considered important, these areas must lie in the reach radius of the user as described in the section *Adjustment to the human body*.
Candidate A could not entirely reach the 'short corner', she missed 4-5 centimeters. This is assumed acceptable; this deviation could be caused by photo editing or the testing circumstances. The other important areas were reachable for both candidates.

Container

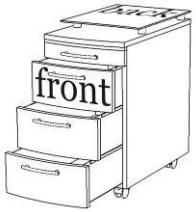

Figure 71 - Container orientation

The container used in the final concept comes from the Float product family concept. It has a slightly bent front and a glass plate on the top. In search for a solution to make the container fitting in the furniture family, several versions were worked out for the bending of the front and the shape of the glass plate on the top, see Figure 72. The main aspect was to find a shape that is in harmony with the rounding of the main desk.

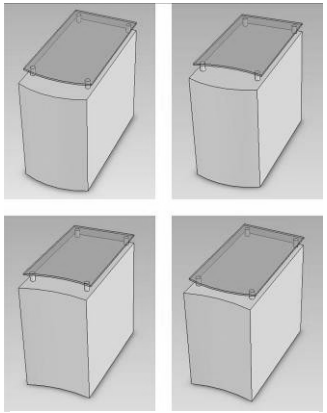

Figure 72 - Different shapes for the container

The basic shape of the container remained the same as was in the Float concept, to ensure maximal functionality. Eventually, the possibility of combining the round shape with the sides was searched, but the result of this was far too crowded and rejected for this reason.

Finally, a glass plate which follows the round edge of the main desk is chosen. The front of the container is bent the other way around, as in the Float concept, creating an oval shaped place on top, see Figure 73. With this, the container gets a playful character. The space between the glass plate and the top should be around 30 mm, to make cleaning possible.

Figure 73 - Top view

The suggested material for the container is 19 mm thick MDF or particle board, laminated with the same color and structure lamination as the desk.

The drawers are made of metal in three different vertical sizes, offering the customer freedom to organize the container the way it fits him or her the best. The drawers come from Hettich, as in other products of Samas. There is also a

Figure 70 - The container

possibility to choose from at least two different container heights. The main reason for this is, when the desk is lowered very much, a higher container might not fit under it. Some possible combinations can be seen in Figure 74. The same way the height can be varied, there is also a possibility of choosing between two different depths. This way, the customizability is kept as high as possible. This is feasible, since Samas works with production on demand.

Figure 74 - Different combination containers

The front of the drawers is made of bent and laminated plates. This means, that in case the drawers are cubic shaped, some space will be lost between the front of the drawers and the drawer itself. A solution for this would be to cut the front of the drawers the same shape as the front itself or use open fronted drawers and extend the bottom with a round shaped front. This way, the rounding of the front of the drawers would be no problem. The container should be lockable, above the drawers a lock can be placed.

Figure 75 - Handle

The handles on the drawers come from Hettich as well. A simple, not decorated aluminum or chrome style handle should be used, such as Furniture Handle 14163, see Figure 75.

The container has wheels to enable easy displacement. These wheels are also from Hettich. Plastic wheels should be enough to carry the container, like model number 02992, with a maximum load of 45 kg per wheel, see Figure 76.

Figure 76 - Wheel

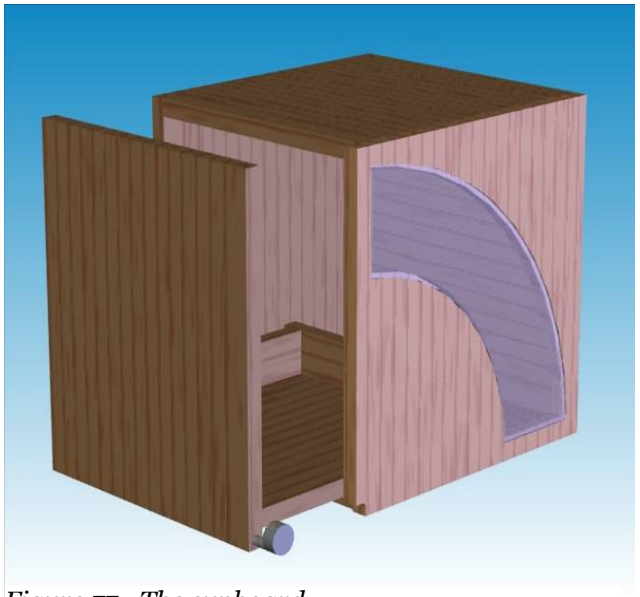

Figure 77 - The cupboard

Cupboard

The cupboard comes from the Cubic concept, which is not in line with the round shapes of the central. Furthermore, the functionality of this cupboard is based on its shape, creating a large number of possibilities for combinations when placing multiple units. Changing the basic shape only leads to losing functionality, so another solution was searched. Since the front side of the cupboard has a big 'empty' surface, decorating this surface is a good option to combine the round shapes with the angularity of the box. Different patterns were created for this, looking at continuity of the pattern when placing multiple boxes above or diagonally above each other, see Figure 79.

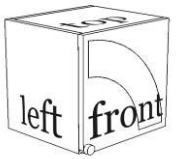

Figure 78 – Cupboard orientation

Finally, a quarter of a circle is chosen, with a midpoint in the lower left corner. This symbolizes the idea behind the Central, a midpoint where everything is built around.
Continuing on this idea, this midpoint is used to be the handle to open the cupboard. The circle is chosen to be made of glass, creating unity with the other components, and also creating a playful effect of making the content of the cupboard vaguely visible, see Figure 80.

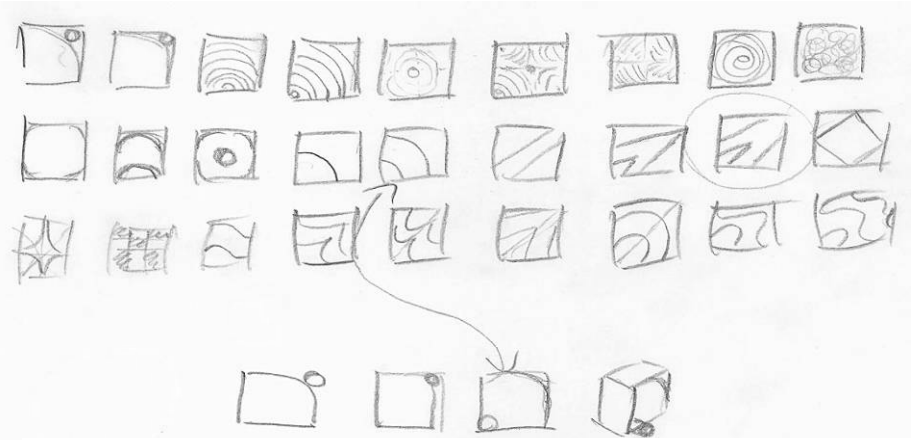

Figure 79 - Different sketches for decoration

Suggestion for the material of the cupboard is 19 mm thick laminated MDF or particle board. The dimensions should be so, that ring binders and files fit in easily. The front side of the cupboard is a square, so the height of the cupboard determines the width of it. The color and structure of the lamination is the same as the main desk.
The same material is suggested for the drawer. This drawer consists of a 'front' side (left side of the cupboard), a bottom, a smaller side wall for stability and a smaller back wall. This back wall is needed so that nothing can fall under the bottom of the drawer. The rails for the drawer, two pieces in total, are placed beneath the bottom of the drawer and behind this smaller side wall. Hettich rails can be used for this.
The box itself consists of a front wall with glass, a back wall, a sidewall, a top and a bottom. It is chosen to use a separate bottom for the box, so the box remains intact when the drawer is pulled out. Another option was to use the bottom of the drawer as bottom of the box, but this way the rail system could not be hidden and the cupboard would not be that stable. For these reasons the choice of a separate drawer is made.

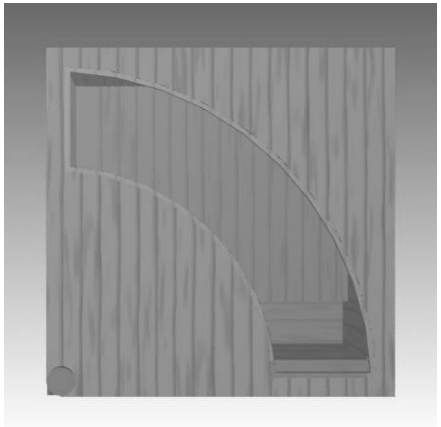

Figure 80 - Front side of cupboard

The metal 'midpoint' is fixed to the door of the cupboard. Since 19 mm thick material is used for the door, a 10 mm tube can be placed in it from the side easily. At the front surface, this metal tube is broader and not centrally placed (see Figure 81), so the midpoint can be positioned in the lower left corner on the front so, that it is clearly visible yet it does not hang off the front surface on the sides, see Figure 80
The cupboard should be lockable, the lock can be placed in this handle, with the keyhole on the front side, in the 'midpoint'.
The cupboard is fixed to the wall with fixing points on the back wall of the cupboard. These fixing points can be holes through the back side of the cupboard, or built in fixing points in the back side.

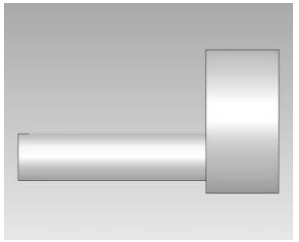

Figure 81 – Side view of handle

Conversation table

The conversation table is triangle shaped, as already explained in the section *Design considerations*, on page 27. The thickness of the tabletop is 38 mm and is also made of laminated MDF. The reason for choosing for this thickness of the material is the elegance, the solidity and authority it reflects. The choice for MDF over particle board is the stability of the material at rounding on the edges.
Reviewing the different concepts, the shape of the glass in the middle of the tables did not match the Central Office concept, so other shapes, other possibilities were searched, see Figure 83.

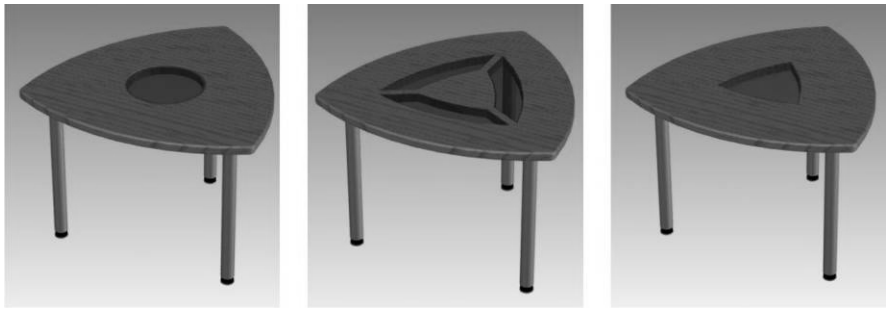

Figure 83 - Variations on the glass

From these concepts, the middle one is chosen. This variation breaks the surface of the table. The shape of the glass pieces is comparable to the glass used in the cupboard, so this shape enlarges the unity of the furniture family.
The lower edges of the tabletop are chamfered the same way as the front edge of the main desk. The upper edge is rounded softly. The legs used for the table are existing legs of Samas, the N54y legs from the Inter office line. These are 720 mm long, not adjustable legs.

Figure 82 - The conversation table

Figure 84 - A 16 m² office, furnished with the Center Office line. In the lower left corner a top view of the office can be found.

Production

Only the production of the main desk of the Center Office is explained in this chapter, since only this component is worked out in detail in the present document.

Tabletop

The tabletop is cut from a 2800 x 2070 mm, 38 mm thick MDF plate. The tabletop is dimensioned so, that two tabletops can be cut from one plate, see Figure 85. These plates are already laminated. The direction of this lamination is indicated in this figure by arrows.
This cut can be done by the machines Samas uses to cut the other plates.
After this, the front edge chamfered and the ABS edges are glued to it. On the chamfered area nothing is glued, this area is painted in the workshop the same color as the lamination at the end of the process.
The socket holder is cut out with a CNC programmed machine. This machine can not cut angular inner edges, so the cut on the surface has to be finished manually. The inner part is over dimensioned a bit, with round corners, so the socket holder fits in easily.
When the cut is done, the holes are drilled in the plate.

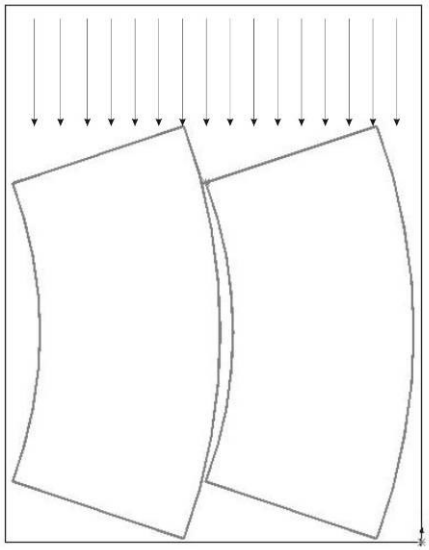

Figure 85 - MDF plate with two tabletops

Legs

The legs are made by an external company, so the modifications on the front legs have to be done there as well. This means the drilling of four extra holes in the upper tubes and the welding of the four glass holder elements on the tubes.
The feet of the legs are new components, so molds have to be made for them. For the calculations 3 mm thick steel is used for these legs, but they are not calculated on molding and wall thickness yet.
The legs are painted with the desired color at Samas.

Socket holder

The socket holder has to be manufactured by an external company. This means, that it only has to be painted and mounted in the tabletop at the factory. The top part of the socket holder is glued to the tabletop after painting. After this, the sockets can be installed. The bottom part of the socket holder is only mounted with the legs, most probably on the location of the customer. They are only packed at Samas for transportation.

Cost calculation

A calculation is made for the production costs of the main desk in Hungarian forints, Ft (1 € is approximately 275 Ft). This is an approximation, not all the prizes could be given exactly.
For the prizes of elements that have to be ordered from external companies a quotation based on 100 pieces in asked. Only one company is approached for each piece, no cheaper solution was searched.

Material costs

#	Element	Price / unit	Quantity	Total
1	38 mm coated MDF	18330 Ft/plate	½	9165
2	ABS edge	270 Ft/m	5.25 m	1417.5
3	Front leg upper part	2500 Ft/piece	1	2500
4	Front leg lower part	961 Ft/piece	2	1922
5	Front leg fixing part	400 Ft/piece	1	400
6	Front leg wedge	25 Ft/piece	4	100
7	Front leg foot	1750 Ft/piece	1	1750
8	Back leg dish	650 Ft/piece	2	1300
9	Back leg upper part	1000 Ft/piece	2	2000
10	Back leg lower part	961 Ft/piece	2	1922
11	Back leg foot	1500 Ft/piece	2	3000
12	Paw	88 Ft/piece	6	528
13	Socket holder top	1817 Ft/piece	1	1817
14	Socket holder bottom	949 Ft/piece	1	949
15	Sockets	5434 Ft/piece	1	5434
16	Sockets wiring	2118 Ft/5m	1	2118
17	Sockets glass	3000 Ft/piece	1	3000
18	Front glass	17000 Ft/piece	1	17000
19	Front glass holder	139 Ft/piece	4	556
20	Screws		app. 45	387
			Total	57265.5 Ft

Table 4 - Material costs

Production costs

To approximate the costs for the painting of the elements, Samas advised to calculate 30% of the price of the elements-.

Painting of elements 3, 4, 5, 7, 8, 9, 10, 11, 13 and 14:
17560 Ft x 0.3 = 5268 Ft.

The total production costs including material, overhead costs, loan, construction costs etcetera can be approximated by multiplying the material costs including paining with 4. Samas did not want to publish the exact multiplying key for this calculation, but these costs can be approximated well with this multiplying factor.

This gives the total cost of the main desk:

Material costs	57265.5 Ft
Painting costs	5268 Ft
Total	62533.5 Ft
Production multiplier	4
Total	**250134 Ft**

Summary

The cost of a desk from the High Office series of Samas is around the 190000 Ft. This means that the desk of the Central Office is approximately 25% more expensive, which is still acceptable, since the Central aims at a higher target group. This high price is mainly due to the more expensive MDF plate. A 25 mm MDF plate costs around the 2200 Ft/m², around the 1000 Ft/m² less than the 38 mm plate.

Remarks on Material costs

1 This price is based on a quotation by Egger, € 11.50 per m² .
3 This is the price of the upper part of the legs, weld together.
3 The price of an unmodified element is 2035 Ft. Since it has to be modified a price of 2500 Ft per piece is estimated.
7 No extra price for the development of a mold is calculated. The price for a mold is also calculated in the other metal elements.

9 This price is estimated, since this element is also new for Samas, they had no indication for the price of it.

11 No extra price for the development of a mold is calculated. The price for a mold is also calculated in the other metal elements. The price between this foot and the front foot does not differ that much, since the price is more determined by the work of the metal than by the amount of material used.

13 This price is based on a quotation by Zolforg Bt, a metalworking company.

14 This price is based on a quotation by Zolforg Bt, a metalworking company.

15 This price is depending on the choice of components in the sockets. The electricity sockets cost 979 Ft (€ 3.56) per piece, the covers 759 Ft (€ 2.76) per two. The internet and telephone sockets are more expensive, the socket costs 602 Ft (€ 2.19) and the internet connecting socket 4114 Ft (€ 14.96) per piece. The calculation is done with four electricity sockets.

16 5 Meter supply cable, Conrad Electronics[6], 2118 Ft (€ 7.70). In case of an internet connection in the socket, an extra cable is needed.

17 Price based on a quotation by Pápai Rt[7].

18 Price based on a quotation by Pápai Rt.

19 Price based on Schaermayer catalogue, € 10.10 per 20 pieces.

[6] Conrad Electrincs BV, www.conrad.nl

[7] Pápai Üvegipari Vállakozás, www.papai.hu

Testing and reviews

Finally, the desk is tested and reviewed on the main points from the *List of demands* and the *Environmental guidelines*. Only the desk is reviewed and tested at these points, since only this component has been worked out.

Testing

The design has to meet several standards constraining stability, solidity and sustainability, as mentioned in *the List of demands* in Appendix C, on page 74. Some of these standards, such as stability and solidity are critical to satisfy, since, for example, the product may not capsize. The product has to be tested before finalization therefore.
The testing of the product on stability and solidity can be found in Appendix I – *Testing* on page 91. The stability testing is done by computer simulation, by applying a load of 750 N on the spot on the desk where the chance of capsizing is the biggest. Solidity testing is done by creating a Final element analysis of the desk under multiple load cases.
The results of this testing show, that the product can withstand the forces prescribed by the standards.

Review according to the Environmental guidelines

The points mentioned in the section *Environmental guidelines* on page 82 are reviewed here shortly, to determine to what extent the main desk meets these guidelines. It is not easy to give a concrete answer to every point, so a summary is given for each category with the points of attention during design.

For production

There are two categories of 'raw' materials used in the design, moulds and materials delivered in a particular dimension. When working with material with a particular dimension, the tabletop for example, the aim was to use the material as effective as possible.

For distribution

No packaging is designed for the product. When designing packaging in the future, the point summed in the section *Environmental guidelines* should be kept in mind.

Structural

The amount of material used during design has some points of discussion. The tabletop is made of a 38 mm solid MDF plate. By applying a thinner plate, for example 19 mm MDF and creating extra thickness on places needed, like the edges to give the impression of a thick plate and around the socket holder, the amount of material could be reduced while creating the same esthetical experience.
Also the legs have different length. The reason for this was the choice for using existing elements in de design. The legs can be cut the same length, but this means an extra modifying step in an existing element. Yet, the result gives a neater impression.
The assembly and disassembly of the desk is kept easy, ensuring easy replacement and reuse of elements.

For recycling

The main aspect for recycling is the possibility to reuse elements of the desk. The different materials are easy to disassemble and separate, making them easier to recycle. Furthermore, the components of the product family can be used separately.

Review according to the List of demands

The Central Office is verified on the requirements listed in the *List of demands*. In Appendix J on page 94 this list is reviewed point by point. Below, a summary of the main aspects is given. From the results of this verification recommendations are made for further development of the product.

1 Main functions

The design offers enough space, both for work and for conversations. The workspace is not partitioned, because that would mean loss of freedom for the user. The privacy of the user is maintained by a separate conversation desk and the glass front on the main desk.
The storage space offered by the Central Office is not sufficient. The product family will have to be extended with another, bigger storage component. The concept offers enough flexibility to answer the ergonomic demands and the customizability.
The desk is successfully tested on stability and solidity. Other aspects of the demands, such as resistance, were not tested.
The main desk supports electronic devices sufficiently, both by space and by connecting possibilities. The wiring is well hidden, on the furniture.

2 Emotional user functions

The main desk can be moved by two men, although it is 9 kg too heavy to be moved constantly without aid pieces such as belts.
The endurance of the desk is not tested, but it is assumed to fulfill the demand of 8 years.
The furniture family fits in a room of 16 m^2.

3 Business economical functions

The desk can be produced with existing production techniques at Samas, or can be ordered from external companies. Maximal usage of materials was strived for in the design. There are two exceptions found, the thickness of the tabletop and the length of the legs, as already mentioned.
Existing components are used as many as possible, such as the legs, screws and drawers. Construction is kept simple, the desk can be assembled with a screwdriver and a spanner.
The Samas look is kept by offering the same coating colors and structures as in other Samas products. No packaging is designed for the product, this still has to be done in the future.

4 Social functions

This point matches the summary of the section *Review according to the Environmental guidelines* on page 55.

5 Other functions

The product family is not tested on appealing to the secondary user group, this could be done in the future, if need emerges.

Conclusion

Looking at the results of the reviews above, it can be stated that the main objective to design an office furniture family, built up from elements to satisfy individual needs is fulfilled. The final design consists of a main desk, a conversation table, a container and a cupboard and can be customized to meet the demands of the customer. Yet, recommendations for further development have to be made to improve the product. These recommendations are presented below.

Recommendations

After analyzing the final concept, a few recommendations can be made for further development of the product family.

- The tabletop is expensive, due to the high price of the 38 mm MDF plates. Furthermore, this material is not provided by the usual suppliers of Samas, so a new supplier has to be found. A solution could be using a 19 mm MDF plate with an extra layer glued to it on places where needed, as already mentioned. It can be assumed that this would also solve the weight problem. The strength of the desk should be tested in this case and the desk should be reinforced when needed.
- The moldings for the feat have not been worked out. For these feats, the material thickness has to be determined, molds have to be made and the costs have to be recalculated.
- The front legs do not have the same length as the back legs. This means use of superfluous material. It has to be investigated what it would cost to modify the legs.
- The wiring is led away via the front legs. This could be an esthetical problem, since this leg is most probably not near a wall. In this case, a solution has to be found for leading the wiring away via one of the back legs.
- The socket-holder is currently made of bent metal plates. The choice for this is made on an estimation of the costs. A quotation for molding these parts from plastic or metal has to be made to see whether the current solution is the cheapest.
- No information was available on the exact dimensions of the Schachermayer glass holder and the screws used to fix it. The model and screws will have to be changed when information is available on this product.
- During the cost calculation of each component, quotation has been asked from only one supplier. To ensure the cheapest solution, more quotations from more suppliers have to be asked.
- During the *Review according to the List of demands* it became clear, that the storage components do not offer sufficient storage space. If the need emerges for more storage space, the furniture family has to be extended with another, bigger storage component.
- Only the main desk has been worked out within in assignment, for the other components only suggestions have been made. These components have to be worked out as well.
- No packaging is designed for the product family, this has to be done as well.

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Images

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All images from the internet are last accessed in December 2006.

Appendix A - Competitor analysis

Ahrend and Techo
www.ahrend.com
www.techo.com

Ahrend is one of the Dutch leading office furniture companies. The main aspect of their furniture is efficiency and design. They received prizes for their 'Dutch design' line. Ahrend is active worldwide and well represented on furniture fares like the Milan furniture fare. The products of Ahrend belong to the top segment of the market.
One of the most representative lines for executives is the Mehes line, see Figure 86. It consists of an aluminum or metal framing with a 12 mm thick tabletop. Besides top-of-the-art fabrication techniques, the everyday usage is top-of-the-art as well, with electric height adjustment for example. The Mehes does not come with a standard storage line, but Ahrend offers a big variety of 'stand alone' storage possibilities.
Since 2005, Techo is part of the Ahrend group. This originally Czech company is operative on the British, Czech, Hungarian, Slovakian and Romanian markets. Their top segment line is the Horizont, see Figure 87, consisting of a table, drawer compartment and a small cupboard.

Ahrend - Mehes		Techo – Horizont	
Table	yes	Table	yes
Table extension	no	Table extension	no
Custom tabletops	yes	Custom tabletops	yes
Backwall on table	no	Backwall on table	no
Shelf for monitor	no	Shelf for monitor	no
Drawer compartment	yes	Drawer compartment	yes
Customizable container	yes	Customizable container	yes
Coffee table	no	Coffee table	no
Small cupboard	no	Small cupboard	yes
Wall closet	no	Wall closet	no
Available in multiple colors	yes	Available in multiple colors	yes

Figure 86 - Ahrend Mehes

Figure 87 - Techo Horizont

Báthori
www.bathori.hu

This Hungarian furniture company is active in the middle segment, focusing on the esthetics and practical use of their furniture. They have two mainstream lines, the Standard and the Trendline, see Figure 88, the latter one is a little more exclusive.
For both lines, there is a big variety of tables, extensions, drawers and cupboards available. Almost all their furniture has a closed look; they use a lot of closed sides.

Báthori - Trendline	
Table	yes
Table extension	yes
Custom tabletops	yes
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable conatiner	yes
Coffee table	yes
Small cupboard	yes
Wall closet	yes
Available in multiple colors	yes

Figure 88 - Báthori Trendline

Bene
www.bene.com

Bene is one of Austrians leading furniture companies, represented on almost the whole European market, the Arab Emirates, Russia and even Japan.
Bene has three lines for executives, the AL line, see Figure 90, the OL line and the MK line, see Figure 89. The AL line has a solid, angular design with a solid aluminum or metal frame. The MK line has a more natural impact, with wooden legs and a more 'conventional' design. The OL line is perhaps the most playful design, with an airy charisma.
Since these lines have (almost) the same possibility of components, both are reviewed in one table.

Bene – AL, MK and OL	
Table	yes
Table extension	no
Custom tabletops	yes
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable container	yes
Coffee table	yes
Small cupboard	yes
Wall closet	yes
Available in multiple colors	yes

Figure 89 - Bene MK

Figure 90 - Bene AL

Estel
www.estel.com

Estel is an Italian furniture manufacturer, founded in 1937. They export 40% of their production to all over the world. The emphases of their products are ergonomics, special requirements and design.
Estel has a number of furniture lines for the executive office, two are shortly highlighted here; the Direzionali and the Asterisco Direzionali. Both designs are kept really simple, basic shapes and a solid, simple design.
These models are available with different material tabletops, such as glass or laminated plates.
These two lines are quite exclusive, designed for the upper segment.

Estel – Direzionali	
Table	yes
Table extension	no
Custom tabletops	yes
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable container	yes
Coffee table	yes
Small cupboard	yes
Wall closet	yes
Available in multiple colors	yes

Figure 91 - Estel Direzionali

Figure 92 – Estel Asterisco Direzionali

Fafém Bútor
www.fafem.hu

Fafém Bútor, established in 1950, is a Hungarian furniture company, which produces furniture for the Hungarian and the West-European market. About 50% of the production is being exported. At the moment, they have two furniture families in the middle segment, the Prizma line, see Figure 93 and the Franko line, see Figure 94.
The desk of the Franko line has closed legs and a closed back. The cupboard has the same height as the desk, so it can be used as an extension of the table. The customer also has the possibility of choosing between drawer compartments of different height.
The wall closet has different compartments, bookshelves, showcases and a bigger compartment for suits.
The Prizma line has a more open character, the desk has only a semi closed backside. It also comes with a customizable drawer compartment and a wall closet. The whole setting, the compartments are much more spacey, which gives a more luxurious touch.

Figure 93 - Fafém Prizma

Fafém Bútor – Franko	
Table	yes
Table extension	yes
Custom tabletops	no
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable container	yes
Coffee table	no
Small cupboard	yes
Wall closet	yes
Available in multiple colors	yes

Fafém Bútor – Prizma	
Table	yes
Table extension	yes
Custom tabletops	no
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable container	yes
Coffee table	no
Small cupboard	no
Wall closet	yes
Available in multiple colors	yes

Figure 94 - Fafém Franko

Kid Bútor
www.kidbutor.hu

Kid Bútor is a Hungarian manufacturer, from the middle segment. They offer furniture with low prizing, mostly with wooden legs.
For the executive office, they have the Sziluett line, see Figure 95, and the Solo line, see Figure 96.
The remarkable aspect of the Sziluett line is the bent legs, which follow the bent lines of the furniture.
The Solo line focuses on metal, bent legs. A nice detail is the container which is built in the leg, giving a light impression.

Kidbútor – Sziluett and Solo	
Table	yes
Table extension	yes
Custom tabletops	yes
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable container	yes
Coffee table	yes
Small cupboard	yes
Wall closet	no
Available in multiple colors	yes

Figure 95 - Kidbútor Sziluett

Figure 96 - Kidbútor Solo

Las Mobili
www.las.it

Las Mobili is one of the biggest Italian manufacturers specialized in office furniture. Las produces office furniture since 1976 and are represented all over the world.
Las Mobili has three lines for executives, the Efex, the Fill and the Kiklos lines. The Efex has round shapes, the office line looks a lot like a group of islands, see Figure 97. As a contrast, the Kiklos line has more angular lines, see Figure 98. The Fill line is a bit of both other ones with rounded corners and straight lines. All of these three lines have wooden, closed legs and come with almost the same group of components.

Las Mobili – Efex, Fill and Kiklos	
Table	yes
Table extension	yes
Custom tabletops	?
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable container	?
Coffee table	yes
Small cupboard	yes
Wall closet	no
Available in multiple colors	yes

Figure 97 - Las Mobili Efex

Figure 98 - Las Mobili Kiklos

Samas Hungária
www.samas.hu

Samas offers four lines for execurtives, from which two are designed for the higher segments: the Inter Office, see Figure 99 and the High Office, see Figure 100,. Both lines have a big variety of possible tabletops and extensions.
Samas does not have separate containers and cupboards for the different lines, but works with a 'central' line from which the customer can choose. These storage elements are available in the colors of the desks, of course.

Samas – Inter & High Office	
Table	yes
Table extension	yes
Custom tabletops	yes
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable conatiner	yes
Coffee table	yes
Small cupboard	yes
Wall closet	yes
Available in multiple colors	yes

Figure 99 - Samas Inter Office

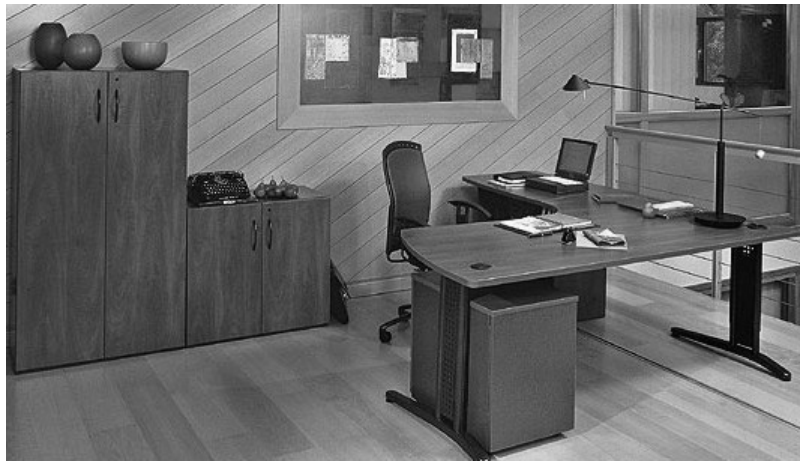


Figure 100 - Samas High Office

West
www.westquality.hu

This company targets the middle segment of the market, producing elegant and not too expensive office furniture. West does not have special executive furniture, but offers the possibility to create a more exclusive composition for an executive office. They can do so by offering a big variety of possible variations on a model like wooden and metal legs.
The most exclusive line of components is the Premium line, with a wide variety of components, as described above.
Besides production, West also imports and distributes furniture from abroad.

West – Premium	
Table	yes
Table extension	yes
Custom tabletops	yes
Backwall on table	no
Shelf for monitor	no
Drawer compartment	yes
Customizable container	yes
Coffee table	yes
Small cupboard	yes
Wall closet	yes
Available in multiple colors	yes

Figure 101 - West Premium

Figure 102 - West Premium

Appendix B - Interviews

Retailers

Danubiana Design

1015 Budapest
Hattyú u 10/c
www.danubianadesign.hu

About the company

Danubiana Design is a company not only specialized in selling furniture, but also in interior design and furnishing services. They offer a wide range of furniture from Hunagrian and foreign manufacturers as well, both for the office and private homes.

András Bóber, manager

In office furniture, there are components that can be found in almost every office, such as a desk, chair, chest of drawers etc. Are there components which are needed or ordered less by the customers, if we compare the current market with, let us say, 10-15 years ago?

No, I haven't noticed changes.

Is there a visible shift in the dimensioning of furniture?

Yes, the market gets more and more customizable. This means, that the furniture more and more has to fit the customer. The legs of the table are adjustable in height for example and the customer gets a larger choice of tabletops with different depths.

On the Hungarian office furniture market, you can get furniture from abroad and furniture of Hungarian manufacturers. Do you think the Hungarian furniture is competitive with the foreign furniture? (Furniture from Germany, Italy or any other East-European country)

The Hungarian furniture is not competitive at all, from my point of view. It is not competitive due to the technical implementation, the design and the esthetics of the furniture. I even think that the Hungarian furniture stands beneath the level of other East-European furniture.

Can you name one or two Hungarian manufacturers which stand out from the others?

I would say Falco and Garzon, if they still exist.

Furniture is representative for the design of a period, like cars. In which direction does the current furniture design develop?

There are two major directions that can be distinguished. First, there is the futuristic direction, which creates floating, high furniture. They look at the natural, ergonomic posture of humans and design their furniture on basis of that. You get furniture here where you don't have to sit down for example, but knee down to work on it.
The other direction is the more conventional, robust furniture.
One development, which can be seen, is the return of veneered furniture. This is used more and more, but with great technological development, the valuable, wooden surface gets thinner and thinner.

Febrill bútor kft

1124 Budapest
Törpe u. 8
www.febrill.hu

About the company

Febrill bútor kft is active since 1991 on the Hungarian market. They offer furnishing of offices and private homes both, although this latter one is a new service of them. Just as Danubiana Design, they offer furniture from Hungarian and foreign manufacturers.

László Herendi, company manager
László Herendi is active since 2004 on the furniture market.

In office furniture, there are components that can be found in almost every office, such as a desk, chair, chest of drawers etc. Are there

components which are needed or ordered less by the customers, if we compare the current market with, let us say, 10-15 years ago?

Of course, there are changes. Maybe the most significant change is the decrease of the storage space in the office. More and more storage space is placed over to the secretary. Beside this, a change is visible in the conference and negotiating space. Earlier, the desk had a part where negotiations were held, now a separate negotiation corner is created in the office, mostly were earlier the storage places were, or even a separate negotiation room is created.

Is there a visible shift in the dimensioning of furniture?

I think that the vision of the customer has changed. This separate table for negotiation can be named as a change.

On the Hungarian office furniture market you can get furniture from abroad and furniture of Hungarian manufacturers. Do you think the Hungarian furniture is competitive with the foreign furniture? (Furniture from Germany, Italy or any other East-European country)

Hungarian furniture is absolutely competitive, due to it's price: it is in most cases cheaper than the foreign furniture and the quality is good.

Are there aspects of Hungarian furniture that are better then that of foreign furniture?

I think the price is absolutely the main aspect that is better.

Can you name one or two Hungarian manufacturers whoch stand out from the others?

I think that Falco is the best Hungarian manufacturer. There are a few other very good ones, but they are too small for the 'big' market, they have a too small production.

What do you think, is there a difference between the Hungarian market and the Austrian or Czech market?

Yes, I think that on the Hungarian market it is more the price that counts, while on the Western markets they take ergonomics and design much more into consideration.

Furniture is representative for the design of a period, like cars. In which direction does the current furniture design develop?

This is quite easy to determine on the Hungarian market. Here, everything comes with a delay of 5 years on the market, compared with the Western market. So if we take a look at the Western market of 4-5 years ago, look at the successful (and not very expensive) models, we can state that those models will be on the Hungarian market now.
Beside this, there's a difference between the German and the Italian furniture. The German furniture has a more simplistic design, it is a little bit more minimalistic, but has a very high quality. So the German furniture is still good furniture after 10-15 years. The Italian furniture has a much richer world of design, but it is more vulnerable, it damages more easily.

Goldbüro

1071 Budapest
Dózsa György út 68
www.goldburo.hu

About the company

Goldbüro is founded in 1993 and is specialized in office furniture. They offer a choice from 15-20 different furniture families, from Hungarian and foreign manufacturers. Besides sells, they offer interior design as well.

Zsuzsanna Farkas, sales cooperative

Zsuzsanna Farkas is almost for 30 years active in the office furniture business.

In office furniture, there are components that can be found in almost every office, such as a desk, chair, chest of drawers etc. Are there components which are needed or ordered less by the customers, if we compare the current market with, let us say, 10-15 years ago?

Yes, there are noticeable changes, for example the chest of drawers. Earlier, they used to place the chest of drawers fixed to the side of the desk, they even had models wit a centered drawer under the tabletop. Nowadays the chest of drawers became a separate unit, customizable for the customer. They are called containers.

Furthermore, you have a whole market specialized in accessories, like monitor shelves and many other things. It is even so, that when a manufacturer needs something for a model, they order it from these companies, because that's cheaper than manufacturing it themselves.
Another thing that has changed is the disappearance of big wall closets from the office. Now, the big closets can be found at the secretary, and only a smaller model of cupboard is still in the office. Of course there are exceptions: we once had a customer, a professor, who had a small library of his own, which he wanted to have in his office, of course locked. So it is also important to be able to lock the cupboards, closets everything.

Is there a visible shift in the dimensioning of furniture?

Yes, maybe the most concrete example for this is the pc table, which is pushed more and more to the background. In the past, the most executive desks where placed in a L-form, creating a working part and a negotiating part. Nowadays, they prefer to have a separate negotiating place, only the shorter consultations take place at the desk. Beside this, the coffee table, which was a fashion in the eighties, starts to disappear from the executive office.

On the Hungarian office furniture market you can get furniture from abroad and furniture of Hungarian manufacturers. Do you think the Hungarian furniture is competitive with the foreign furniture? (Furniture from Germany, Italy or any other East-European country)

On the Hungarian market, it is fully competitive. Most of the customers don't pay attention to where it is manufactured, the design and the price is important. And in the executive office, the thickness of the tabletop is important. The executives like a thick tabletop, which exudes authority.

Are there aspects of Hungarian furniture that are better then that of foreign furniture?

Yes, usually the related services are better. If something might go wrong, the manufacturer guarantees a repair in 48 hours, while with manufacturers from abroad, often it is not that simple.
Nevertheless, furniture from abroad, for example Italian furniture, often has more design.

Can you name one or two Hungarian manufacturers that stand out from the others?

Without doubt the manufacturer that stands out the most is Falco Sopron. Additionally the ones, which deserve mentioning are Fafém, Garzon, West and Mezőkövesdi Asztalosipari, although this last one is a little company, but manufactures really nice furniture. And Sandra bútor, but this one is also so small that it is hardly represented on the market.

What do you think, is there a difference between the Hungarian market and the Austrian or Czech market?

Sorry, I'm not at familiar with the situations on the markets abroad.

Furniture is representative for the design of a period, like cars. In which direction does the current furniture design develop?

Technology is very much present in the direction taken. Nowadays the laminated surfaces, ABS borders are fashionable, on a metal support. Wooden legs are still available though, mostly for half price of a metal one.
Another interesting technology is postfoarming, where from a plate of glued wood the tabletop is cut out. This technology also provides the possibility of rounded tabletops.
Moreover, an important aspect when looking to office furniture is the lifespan of it. Usually, a company changes their furniture in 8 years. At governmental offices, this period can be longer, due to less financial possibilities.

User group

Allianz Sopron
Csabáné Főző Branch manager

The following furniture is found in her office, see also Figure 103:

- main desk (1)
- consultation desk (2)
- table extension (3)
- chests of drawers (4)
- office chair (5)
- smaller chairs (6)
- wall closets, one with two doors and a higher one with glass doors (7)

The tables have a grey color, the chairs are blue. These are the colors of the company. The executive desk has wooden legs. The wall closets are made of the same material as the tables. The office was furnished in 1997. The office has a surface of approximately 24 m².

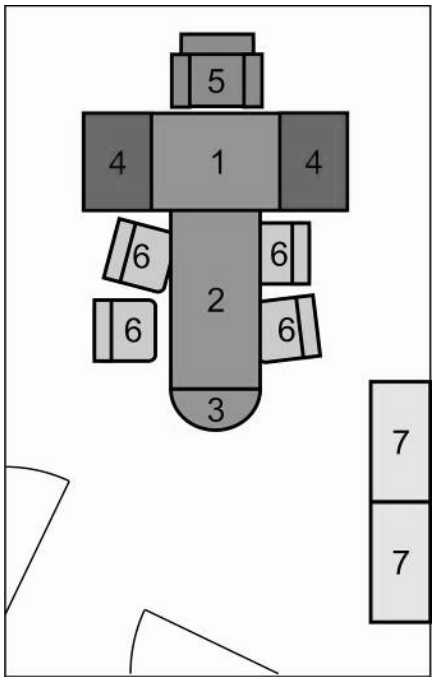


Figure 103 - Office of Csabáné Főző

Did you choose the current furniture of your office? How does this work at your company?

No, this is arranged centrally in Budapest. All the branches of Allianz have the same colors, they must be uniform. Although, the regional headquarters are usually a little bit better furnished, they are a little bit more exclusive. The consultation desks have a darker color there, which gives an elegant and serious impression. For the branch offices, the executives have a little say in the furnishing of their office, but that's really minimal.

Do you like the design of your current furniture?

Yes, I like them, but I don't think that I would buy them for my own house.

Are you satisfied with your current furniture in use? What would you like to change, if you had the possibility of doing that?

I am satisfied, but not with everything. The extension of the consultation desk for example, is really not practical. If we have a meeting, nobody can sit there, because it is impossible to write there, there's not enough room for that.

What office devices can be found in your office?

A desk computer and a printer.

It seems to be a trend that, more and more wall closets are transferred from the office to the secretary. Is that so in your office as well?

I can't say that for sure. Yes, a lot of paperwork can be found at the secretary, but there is still enough for the office.

Are you satisfied with the storage place in your office?

Yes.

Do you receive people in your office? And if you do, where?

Yes, quite often. I receive them here in my office. The disadvantage of this is the little privacy I have: I would prefer a separate consultation room.

How does the ideal office furniture look, according to you?

I should be light in structure, light in color, airy and modern.

Which aspects do you think are important when purchasing office furniture?

I think ergonomics and design are the two most important aspects. Office furniture should be elegant and practical in use.

Do you think it is important where the furniture is designed and produced?

In the first case not, but if I could choose form two furniture families, both the same quality, I would choose the Hungarian.

An insurance company, Sopron[8]
Branch manager

The following furniture can be found in the office, see Figure 104:

- main desk (1)
- cupboard (2)
- consultation desk (3)
- smaller chairs (4)
- office chair (5)
- chest of drawers (6)
- corner cupboard (7)

The tables have a light brown, wood look-a-like color, the chairs are purple. The office chair is dark blue. The executive desk has elegant, black metal legs. The wall closet and the corner cupboard are made of the same material as the tables. The office was furnished in 2002. The office has a surface of approximately 18 m².

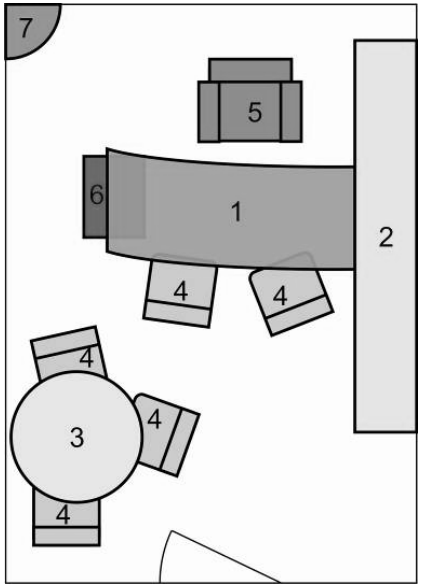


Figure 104 - Office 2

Did you choose the current furniture of your office? How does this work at your company?
Yes, although I inherited some things, such as these extremely ugly purple chairs. I got a budget I could spend on furnishing my office.

What brand is this furniture?
I don't know.

Do you like the design of your current furniture?
Yes, I like it, it is nice.

Are you satisfied with your current furniture in use? What would you like to change, if you had the possibility of doing that?
Yes, although I would prefer if I had more drawers.

It seems to be a trend that more and more wall closets are transferred from the office to the secretary. Is that so in your office as well?
Yes, that can be seen. I also would not mind if I could move more to the secretary. But of course that is not always possible. I would really like if I could get rid of all these papers.

Do you have furniture in your office which causes irritation during use?
No. The cupboards are a bit too low, when you have to grab something from the bottom of it, that's not comfortable, but you have to make a compromise. If I had a million forint to furnish my room, it would be different, that's for sure.

What office devices can be found in your office?
I have a laptop, a printer and a paper shredder.

What other office products do you like to keep in range during work?
Only the usual office stuff, pens, a perforator etc,

Are you satisfied with the storage place in your office?
Yes, except the drawers...

Do you receive people in your office? And if you do, where?
Yes, quite often. I always receive my guests at this table, where we're sitting now.

How does the ideal office furniture look, according to you?
It should be airy and light. And I also prefer wood. Although I know, they don't produce that these days.

Do you think it is important where the furniture is designed and produced?
No.

[8] This company explicitly asked not to publish their name

Appendix C - List of Demands

Functions		Demands
Main functions		
1. Support office work		Product must support the everyday office work of the primary user group.
1.1	**Create work surface**	Product must create a surface on which the user can perform his or her daily tasks
1.1.1	Define workspace	Desk must have at least 1540 x 800 mm of workspace
1.1.2	Partition workspace	Desk must support computer work Desk must support paper work
1.1.3	Create privacy	Desk must create room for private objects of the user Product must create a feeling of privacy
1.2	**Make consultation possible**	Consultation place for 3 people
1.2.1	Create work surface	A work surface of 750,000 mm^2 must be available for consultation
1.2.2	Create room for a group of people	Consultation place for 3 people
1.3	**Make storage of things possible**	Product offer room for storing things safely
1.3.1	Create room for storage	Product must offer at least 1 m^3 of storage place
1.3.2	Safe storage space	50% of storage place must be lockable
1.3.3	Be accessible	Storage places have to be placed between 280 mm and 1680 mm high (standing) Storage places may not be deeper than 600 mm for the heights 840 – 1400 mm Storage spaces may not be deeper than 500 mm for the heights 280 – 840 mm Storage places must be accessible all time
1.4	**Be individual**	Product must be so, that the primary user can identify himself with it
1.4.1	Adjustable to the human body	For Hungarians between P05 and P95 and aged between 25 and 60 years.
1.4.2	Customizable in appearance	Available in different colors Choice between different components at purchase Choice between different compositions of components at purchase
1.5	**Safe in use**	The product must satisfy to the laws describing safety.
1.5.1	Must not harm its environment	May not have sharp edges, that can harm people or animals
1.5.2	Be solid	Desks must have class A (average) solidity Desks must have class N (normal) stability Desks must have class N (normal) endurance Storage components must have

		class A (average) solidity Storage components must have class N (normal) stability Storage components must have class A (average) endurance
1.6	**Easy to clean**	The product must be easy to clean in everyday use
1.6.1	Be accessible	Product may not have unreachable surfaces Product may not have unreachable grooves or holes
1.6.2	Support cleaning	No use of material that hangs on to dust or attracts dust Use of easy to clean material
1.7	**Not easy to damage**	The product must satisfy to the laws describing durability.
1.7.1	Be scratch resistant	Desks must have class A (average) mechanical resistance Storage components must have class A (average) mechanical resistance
1.7.2	Be heat resistant	Desks must have class N (normal) heat resistance Storage components must have class N (normal) heat resistance
1.7.3	Be water resistant	Desks must have class A (average) fluid and chemicals resistance Storage components must have class A (average) fluid and chemicals resistance
1.7.4	Be climate resistant	Desks must have class A (average) climatical resistance Storage components must have class A (average) climatical resistance
1.8	**Support electronic devices**	The product must support 2 electronic devices and 1 phone
1.8.1	Hide wiring	Product must hide wiring
1.8.2	Support electricity	Product must support the supply of electricity for at least 2 electric devices
1.8.3	Create room	Product must create room for a laptop, a printer and a telephone
1.8.4	Support communication	Product must support a socket for internet and a socket for a telephone line (wish).
Emotional user functions		
2.1	User friendly	Product must be easy in handling Product must be movable by two men (components must be lighter than 50 kg)
2.2	Appeal to primary user	Product must have a design which appeals to the primary user
2.3	Be durable	Product must last 8 years at least, under normal service conditions
2.4	Fit the office	The product family must fit in an office of 16 m^2
Business economical functions		
3.1	Cheap in production	Use of existing production techniques of Samas Maximum use of material
3.2	Easy in construction	Usage of universal components Product must be constructible using existing tools
3.3	Easy and cheap in repair	Usage of universal components Product must be repairable using existing tools
3.4	Cheap distribution	Maximum use of space when

	packed
3.5 Samas line	Product must fit in the product lines of Samas
Social functions	
4.1 Environmentally considered	Product must fit the points of the Environmental guidelines on page 82 Product must be 60% recyclable (demand) Product must be 80% recyclable (wish)
Other functions	
5.1 Appeal to secondary users	Product must appeal to the secondary user (wish)

Remarks on the list of demands

1.1.1 Define workspace

See page 22 for origin of values.

1.1.2 Beside the demands of the stakeholders, there is also a Hungarian law to what the office furniture as used in an environment with a computer, has to answer. According to this law (50/1999.(XI.3.)) the following is compulsory (and relevant for the design of office furniture):

- a separate shelf for the monitor or in height adjustable desk
- space of at least 80 mm in front of the keyboard for arm support
- Non-reflecting or moderate reflecting tabletop

1.3.1 Storage space

The demand of at least 1 m^3 of storage space is calculated by looking at the storage space available in the current executive office (approximations):

2 chests of drawers ±0.2 m^3
1 cupboard ±0.8 m^3

1.3.1, 1.4.1 & 1.6.1 Accessibility and adjustment to the human body

See page 22-23 for origin of values.

1.5.1 Be solid

The product is classified according to the Hungarian standards MSZ 8351-87 and MSZ 8350-87.
The values for the given classifications are as following, according to the Hungarian standards MSZ 9050-86, MSZ 9051-86, MSZ 9052-85, MSZ 8898-85, MSZ 8897-85, MSZ EN 14073-3:2004, MSZ EN 1727:2000:
Desks:
Solidity – A load of 1000 N in horizontal and 450 N in vertical direction, the maximum displacement allowed is 8 mm
Stability – A load of 750 N in horizontal direction
Endurance horizontally – 10000 times 150 N under a load of 750 N
Endurance vertically – 5000 times 150 N under a load of 750 N

Storage components:
Solidity – A force of 1000 N horizontally
Stability – A force of 50 N after opening all doors, drawers etcetera
Endurance horizontally – 1000 times 1000 N under a load of 0.65 kg/dm^2
Endurance vertically – 1000 times 1000 N under a load of 0.65 kg/dm^2
The testing of storage components is more sophisticated than testing the desk, because of the different types of components. The values chosen above can differ with each component, here the values for testing of a cupboard, smaller than 1000 mm and not attached to a wall can be found. The way of testing storage components are left out of consideration because of this big variety.

1.7.1, 1.7.2, 1.7.3 & 1.7.4

The product is classified according to the Hungarian standards MSZ 8351-87 and MSZ 8350-87.
The values for the given classifications are as following, according to the Hungarian standards MSZ 9924-86, MSZ 9926-86, MSZ 9928-86 and MSZ 9930-86 (the values are identical for desks and storage components:

Mechanical resistance	Values
surface hardness with the pencil method	4h
fretting with the Taber-Abreser device	max 0.25 g/100 turn

strike resistance with the sphere-dropping method	no damage from a dropping height of 500 mm

Heat resistance	Values
dry heat resistance	75 °C
wet heat resistance	50 °C
steam resistance	-
little change in diffusion allowed	
cigarette resistance	-

Fluid and chemical resistance	Values
water	1h
ultrapor	1h
fet-alcohol-sulfonate	1h
chloric alkyl-cyclo-alkylarylfenol	1h
chlor-amine-T	1h
hypo	1h
citric acid 10%	1h
vinegar-acid 10%	1h
ethyl alcohol 40%	1h
cooking oil	1h
coffee	1h
black-currant syrup	1h
tea	1h
milk	1h
red wine	1h
acetone	-
ammonium-hydroxide	-
gasoline	-
ethyl-acetate butyl-acetate	-
ethyl alcohol 96%	-
iodine	-
natrium-carbonate solution	1h
natrium chloride 15%	1h
natrium chloride 5%	1h

Climature resistance	Value
Stability of color in natural light (blue scale)	4
Stability of color in artificial light (blue scale)	4
Aging in artificial conditions	80%

1.8.3 Create room for a laptop, a printer and a telephone
As already mentioned in the User Analysis, mobility is an important factor in the everyday life of the user group. Laptops are more and more commonly used by businessmen. For this reason, the choice is made for the product to support a laptop and not a personal computer.
The choice to support a printer is based on the results of the interviews with the user group, where an inkjet could be found in both offices.

2.1 User friendly - Product must be movable by two men (components must be lighter than 50 kg)
The limit of 50 kg is a guideline, based on the Dutch Arbo law[9].

2.4 Fit the office
The product must fit an office of at least 16 m^2. The offices visited in the User Analysis were both bigger, to be sure to fit a big percentage of the offices 16 m^2 is taken as a demand.

3.2 Cheap in production
Use of existing production methods of Samas, investment in new production methods for this new line should be avoided.
The current average of production time at Samas is 68 minutes. Because the product aims at the upper category, this time can be exceeded. The product must be producible in 80 minutes.

3.2 & 3.3 Use of universal components
Universal components like screws and other connection elements.

[9] Digitaal informatieplatform voor wetgeving en normalisatie
http://www.euronorm.net/content/template2.php?itemID=7

Appendix D - Styles

To determine the meaning of the words ‘modern’ and stylish’, people were asked to value the following pictures on modernity and stylishness.

Modernity

not modern ○ ○ ○ ○ ○ modern

Stylish

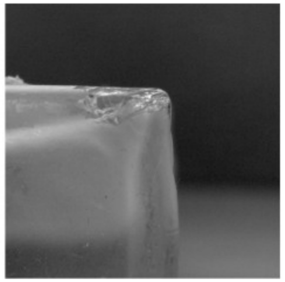
not stylish ○ ○ ○ ○ ○ *stylish*

Modernity

not modern ○ ○ ○ ○ ○ modern

Stylish

not stylish ○ ○ ○ ○ ○ *stylish*



Modernity

not modern ○ ○ ○ ○ ○ modern

Stylish

not stylish ○ ○ ○ ○ ○ *stylish*

Modernity

not modern ○ ○ ○ ○ ○ modern

Stylish

not stylish ○ ○ ○ ○ ○ *stylish*

Modernity

not modern ○ ○ ○ ○ ○ modern

Stylish

not stylish ○ ○ ○ ○ ○ *stylish*

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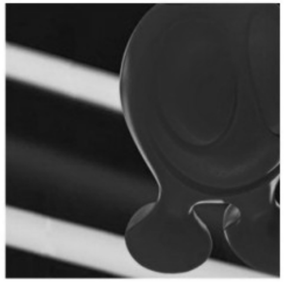
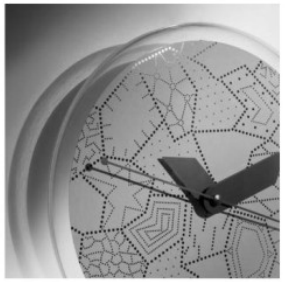


Modernity

not modern ○ ○ ○ ○ ○ modern

Stylish

not stylish ○ ○ ○ ○ ○ *stylish*



Modernity

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Results

1M	1S	2M	2S	3M	3S	4M	4S	5M	5S	6M	6S	7M	7S	8M	8S	Av1	Av2	Av3	Av4	Av5	Av6	Av7	Av8	AvM	AvS	AvAv
4	5	4	3	5	4	3	4	4	3	5	1	4	4	3	4	4.5	3.5	4.5	3.5	3.5	3	4	3.5	4	3.5	3.75
1	1	3	2	3	2	4	3	3	2	4	4	2	3	2	2	1	2.5	2.5	3.5	2.5	4	2.5	2	2.75	2.38	2.56
2	2	3	1	3	1	4	2	2	2	1	3	3	4	3	2	2	2	2	3	2	2	3.5	2.5	2.63	2.13	2.38
4	4	4	3	4	5	5	5	5	4	5	5	4	4	4	4	4	3.5	4.5	5	4.5	5	4	4	4.38	4.25	4.31
1	1	3	1	2	2	4	1	4	2	1	1	3	4	3	1	1	2	2	2.5	3	1	3.5	2	2.63	1.63	2.13
5	5	4	4	4	4	5	5	4	4	5	4	3	4	4	4	5	4	4	5	4	4.5	3.5	4	4.25	4.25	4.25
5	1	5	2	5	2	5	4	5	4	5	4	4	5	5	4	3	3.5	3.5	4.5	4.5	4.5	4.5	4.5	4.88	3.25	4.06
4	4	4	4	5	5	4	4	5	4	4	4	4	3	4	5	4	4	5	4	4.5	4	3.5	4.5	4.25	4.13	4.19
2	2	2	4	2	3	3	5	2	3	2	5	2	4	2	3	2	3	2.5	4	2.5	3.5	3	2.5	2.13	3.63	2.88
3	2	3	3	3	3	3	3	2	5	3	5	4	5	3	4	2.5	3	3	3	3.5	4	4.5	3.5	3	3.75	3.38
5	2	4	3	4	2	5	3	5	3	5	5	5	4	5	3	3.5	3.5	3	4	4	5	4.5	4	4.75	3.13	3.94
4	2	4	4	5	5	5	5	3	3	4	4	4	3	4	3	3	4	5	5	3	4	3.5	3.5	4.13	3.63	3.88
3	4	3	4	2	3	5	5	2	4	5	3	5	5	3	4	3.5	3.5	2.5	5	3	4	5	3.5	3.5	4	3.75
3	5	2	2	4	4	4	5	4	5	5	4	3	3	2	4	4	2	4	4.5	4.5	4.5	3	3	3.38	4	3.69
5	2	5	3	5	3	4	2	5	3	5	5	5	5	5	2	3.5	4	4	3	4	5	5	3.5	4.88	3.13	4
1	3	2	4	2	3	3	3	2	3	4	5	1	4	2	3	2	3	2.5	3	2.5	4.5	2.5	2.5	2.13	3.5	2.81
5	1	5	3	3	2	3	2	5	4	5	3	5	4	5	4	3	4	2.5	2.5	4.5	4	4.5	4.5	4.5	2.88	3.69
5	2	5	4	5	5	4	2	4	2	5	4	5	5	5	2	3.5	4.5	5	3	3	4.5	5	3.5	4.75	3.25	4
3	3	3	3	2	4	3	5	3	5	3	3	3	3	3	3	3	3	3	4	4	3	3	3	2.88	3.63	3.25
1	1	5	3	5	2	4	3	2	1	2	2	4	4	4	2	1	4	3.5	3.5	1.5	2	4	3	3.38	2.25	2.81
5	2	5	4	5	4	4	2	4	2	5	2	5	5	5	5	3.5	4.5	4.5	3	3	3.5	5	5	4.75	3.25	4

The participators were asked to valuate the pictures with marks between the 1 and the 5: 1 for not modern and not stylish and 5 for very modern and very stylish. These results can be found in the first 16 columns
(M = modern, S = stylish, Av = average).
The target group desired a 'modern' and 'stylish' product. So, a product that is modern but not stylish, does not satisfy the needs. For this, average values are calculated. The average of the separate participators can be found in de columns Av1-Av8. Also, averages have been calculated for the categories 'modern' (AvM) and 'stylish' (AvS). Finally, an average (AvAv) has been calculated on the averages of AvM and AvS.

After this, the pictures with a grade of 4 or higher are analyzed on design, use of materials and shape. From these results a collage is made. This collage can be found on page 25.

Appendix E - Environmental guidelines

These guidelines are (Hegedűs, Kő, 2001):

For production:

- Maximum effective use of standard units of 'raw' material, creating a minimal amount of waste,
- Avoiding the use of materials in the product harmful to the environment,
- Avoiding the use of materials harmful to the environment during production,
- Avoiding the use of production methods with a high environmental impact.

For distribution:

- Using minimal packaging,
- Using recyclable packing,
- Avoiding the use of materials damaging the environment for packaging.

Structural:

- Use of a minimal amount of materials,
- Use of a minimal amount of components,
- Use of a minimal amount of different materials,
- Easy and clear construction ensuring easy repair,
- Ensuring a long product life,
- Enabling lifetime extension by adding additional functionality to the product.

For recycling:

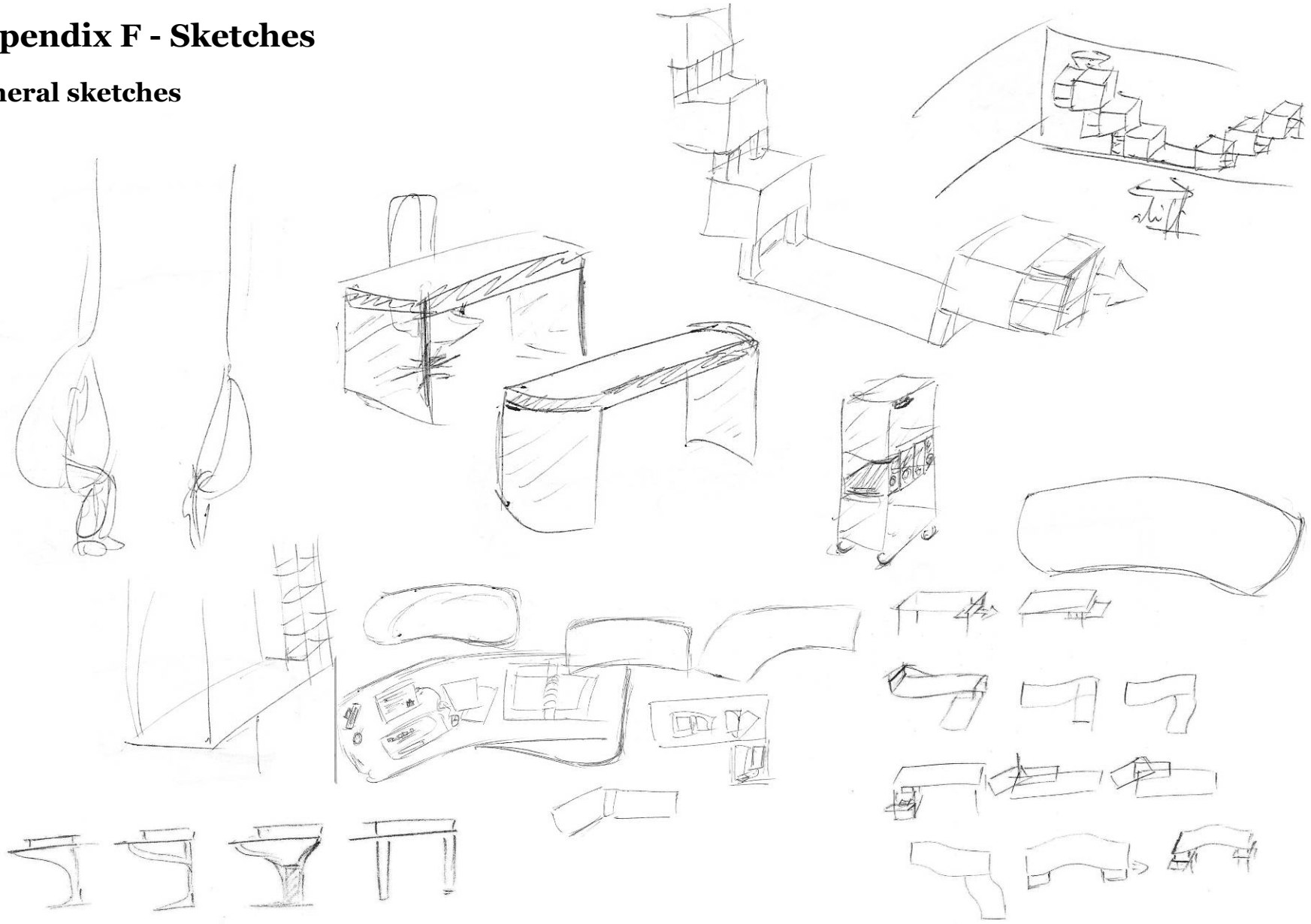
- Ensuring the reuse of components after discard of the product, a 'second life' ,
- Ensuring easy assembly and disassembly of the product,
- Ensuring the reuse of materials,
- Use of materials for which the recycling facilities already exist,
- Avoiding composite materials,
- If possible, include 'wear' indicators, of make it easier to replace parts that are sensitive to wear.

Beside these points, a Life Cycle Inventory will be made for every concept. This consists of an approximation on the environmental impact of the concepts during its life cycle, in terms of low/middle/high, on the following points:

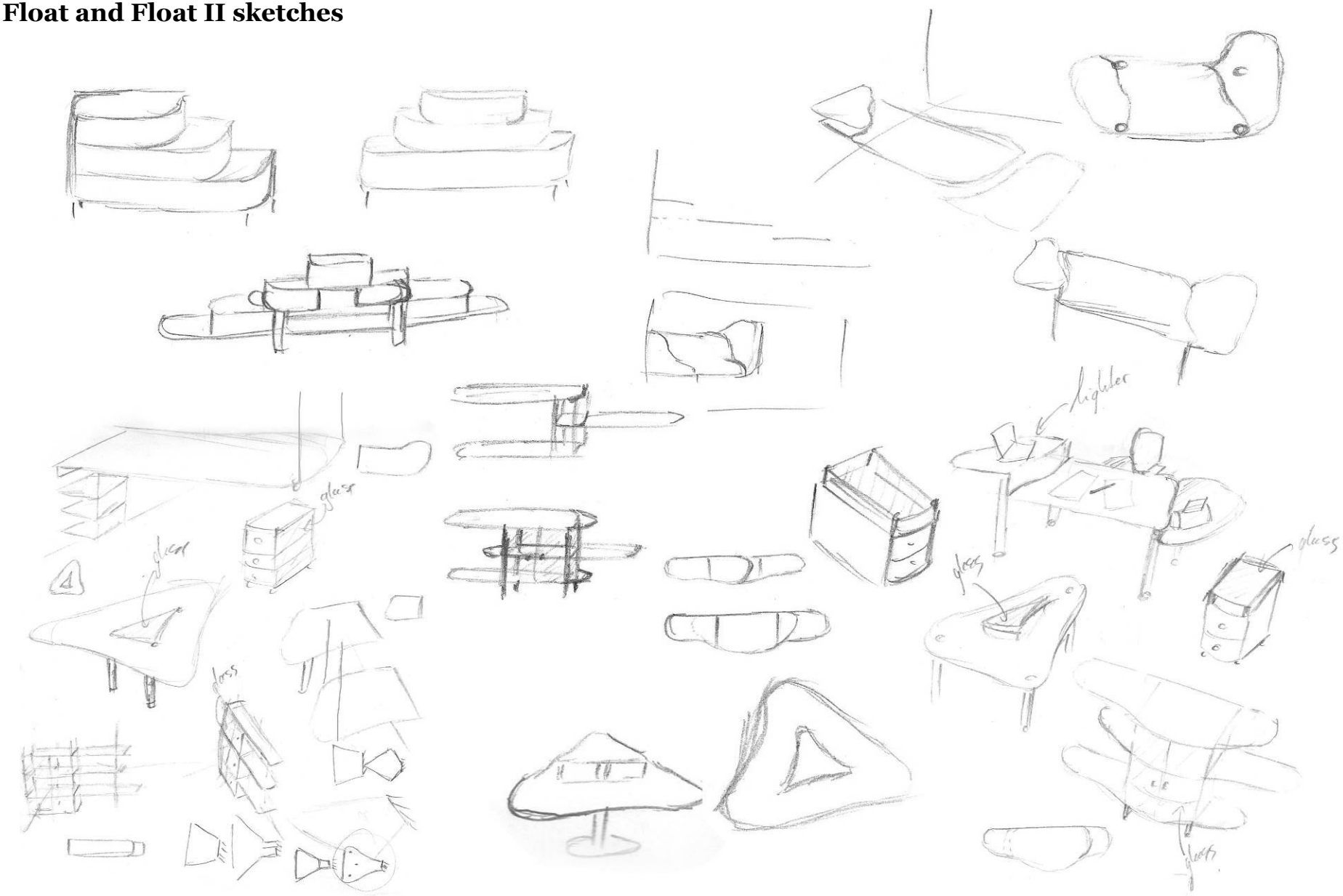
- production and transportation of raw materials
- use of raw material during construction
- production of waste during construction
- complexity of product
- transportation/retail
- use and lifetime
- deconstruction
- recycling
- waste deposition

Appendix F - Sketches

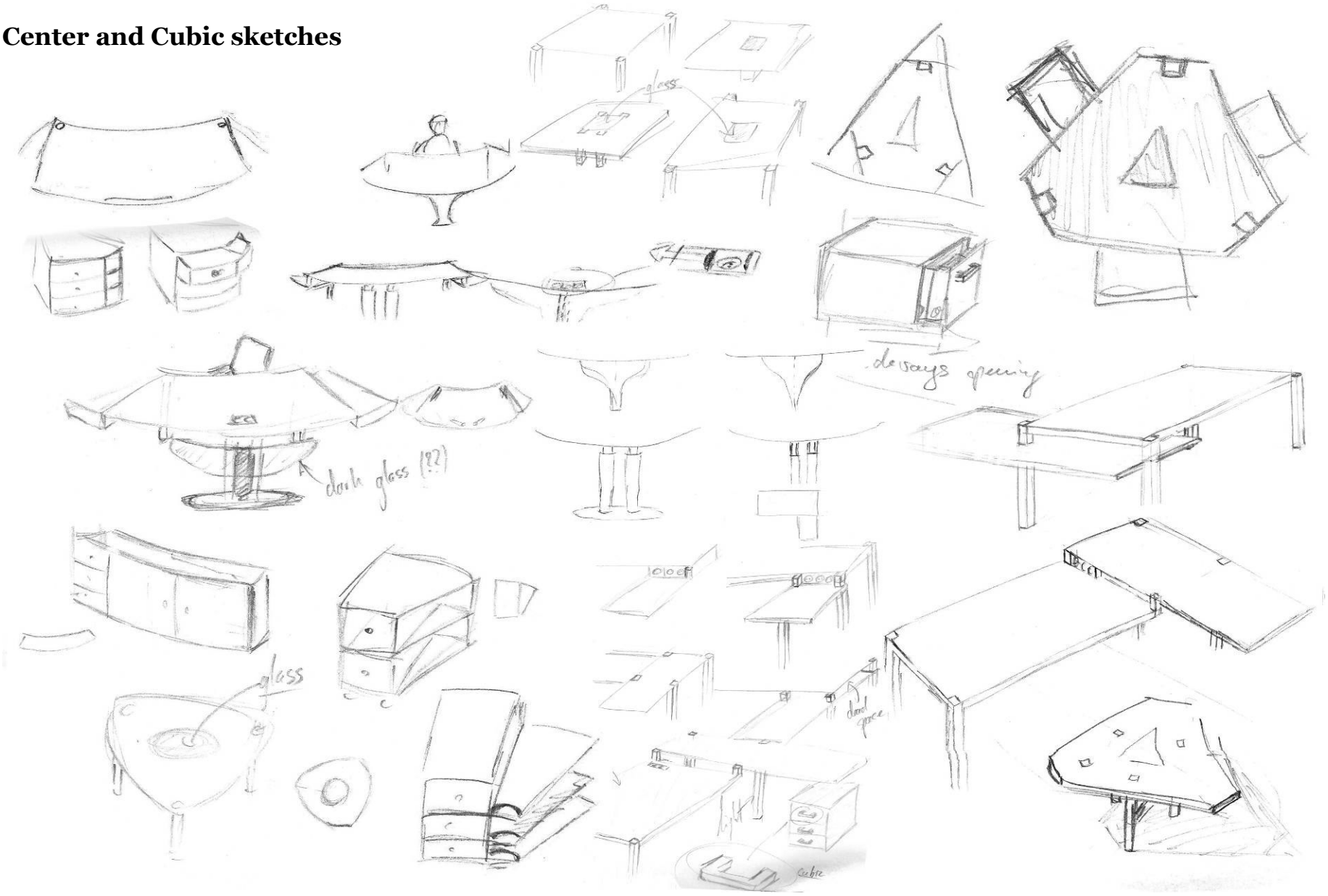
General sketches



Float and Float II sketches

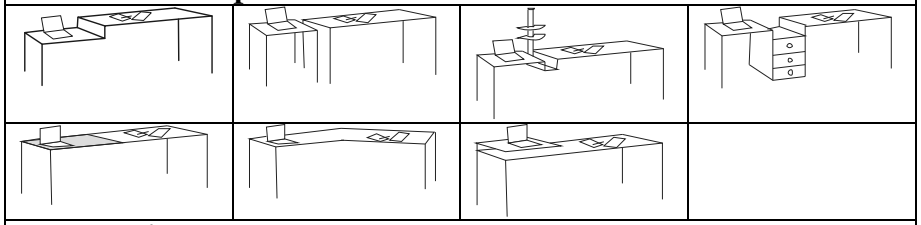


Center and Cubic sketches

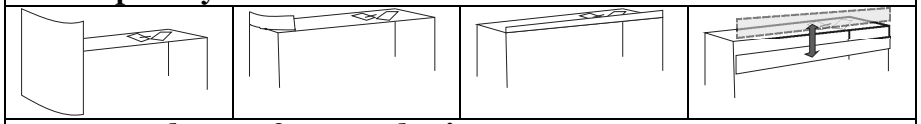


Appendix G - Morphologic schemes

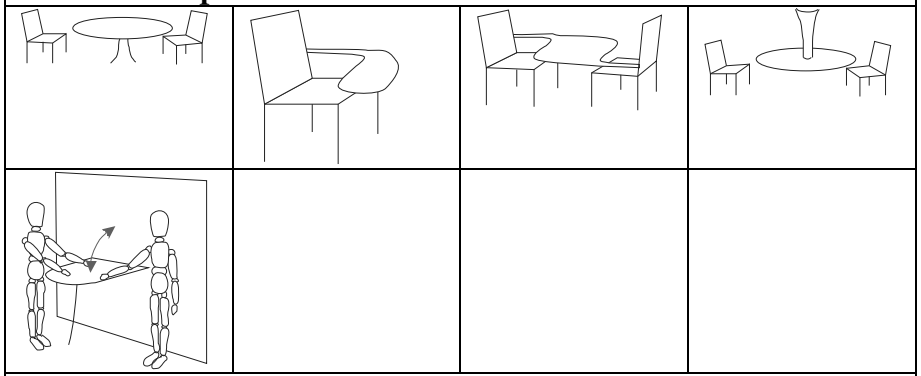
Partition workspace



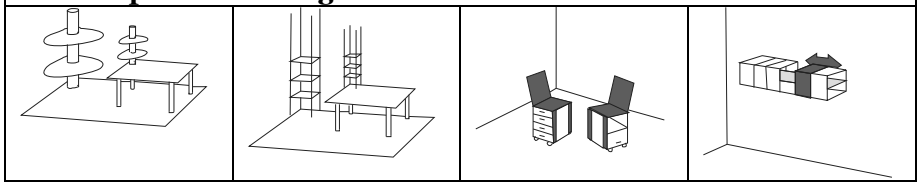
Create privacy

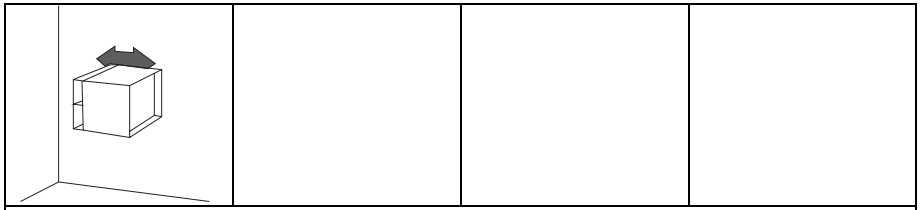


Create workspace for consultation

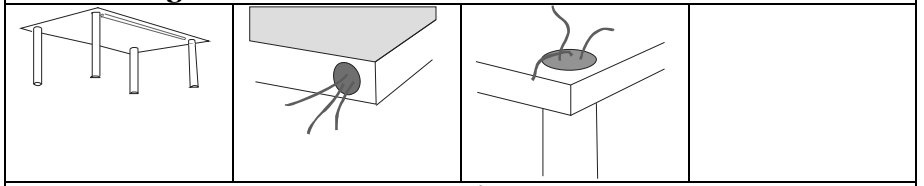


Create space for storage

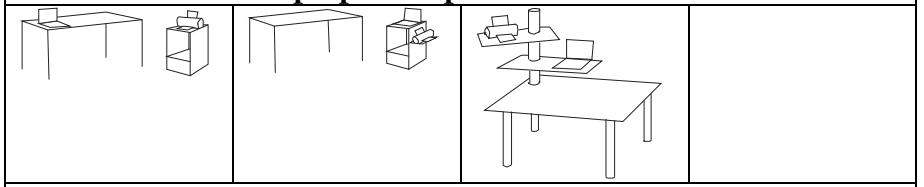




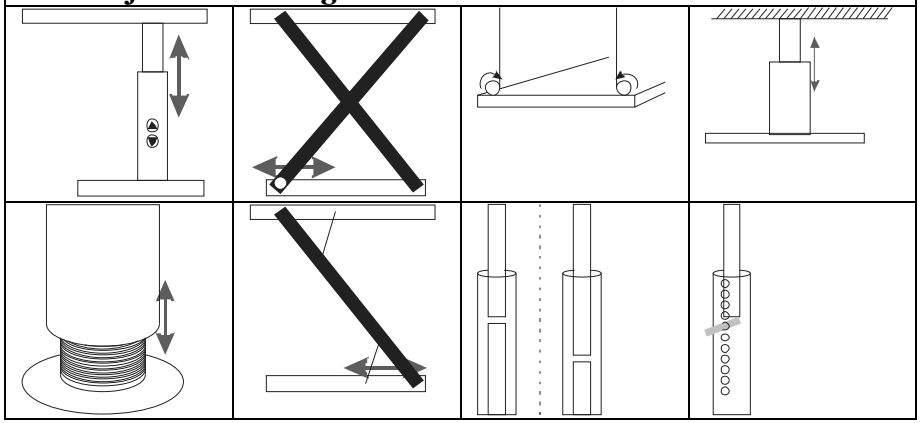
Hide wiring



Create room for a laptop and a printer



Desk adjustable in height



Appendix H - Evoluation

	Cubic	Main desk	Conversation desk	Container	Cupboard	Float	Main desk	Conversation desk	Container	Cupboard	Float II	Main desk	Conversation desk	Container	Cupboard	Central	Main desk	Conversation desk	Container	Cupboard	Weight
Customizability	3.4	3.5	3	3	4.3	3.1	3	3.5	3	2.8	2.1	2.5	2	1.3	2.8	3.3	3.5	3.5	3	3.3	20%
Customizing storage	-	-	-	-	4	-	-	-	-	2	-	-	-	-	2	-	-	-	-	4	-
Enlarging storage	-	-	-	3	5	-	-	-	3	3	-	-	-	1	3	-	-	-	3	3	-
Adjusting to human	-	3	2	2	5	-	3	3	2	2	-	4	3	2	2	-	4	3	2	2	-
Reorganizing	-	4	4	4	3	-	3	4	4	4	-	1	1	1	4	-	3	4	4	4	-
Ergonomics	3.5	3.3	3.5	3.5	3.5	2.8	4	2	2.5	2.5	3	3.7	3	3	2.5	3.3	4	3.5	3	2.5	15%
Accessibility storage	-	-	-	3	4	-	-	-	3	3	-	-	-	4	3	-	-	-	3	2	-
Accessibility desks	-	3	4	-	-	-	4	2	-	-	-	4	3	-	-	-	5	4	-	-	-
Cleaning	-	3	3	4	3	-	3	2	2	2	-	4	3	2	2	-	4	3	3	3	-
Partitioning workspace	-	4	-	-	-	-	5	-	-	-	-	3	-	-	-	-	3	-	-	-	-
Appeal to primary user	3.7	1	1	1	3	4.3	1	2	5	1	4	1	1	1	1	4.4	4	4	1	1	30%
Modernity	4	-	-	-	-	4.4	-	-	-	-	4.4	-	-	-	-	4.9	-	-	-	-	-
Stylishness	3.6	-	-	-	-	4	-	-	-	-	3.6	-	-	-	-	4.3	-	-	-	-	-

	Cubic	Main desk	Conversation desk	Container	Cupboard	**Float**	Main desk	Conversation desk	Container	Cupboard	**Float II**	Main desk	Conversation desk	Container	Cupboard	**Central**	Main desk	Conversation desk	Container	Cupboard	**Weight**
Light & airy	3.4	-	-	-	-	4.6	-	-	-	-	4.4	-	-	-	-	3.9	-	-	-	-	-
Overall impression	3.7	-	-	-	-	4.1	-	-	-	-	3.6	-	-	-	-	4.3	-	-	-	-	-
Business Economical	3.5	3.5	3	3.5	4	3	3	3.3	3.3	2.5	2.6	2.3	3	2.3	3	3.4	3.8	3.3	3.3	3.3	20%
Maximum use material	-	5	4	3	5	-	2	4	3	3	-	4	3	3	4	-	3	3	3	3	-
Difficulty of construction	-	3	3	4	4	-	2	3	3	2	-	1	4	2	2	-	5	3	3	3	-
Ability of manufacturing	-	4	3	3	4	-	4	3	3	2	-	2	3	2	3	-	3	3	4	3	-
Fitting Samas line	-	2	2	4	3	-	4	3	4	3	-	2	2	2	3	-	4	4	3	4	-
Ecologically considered	4.5	4.4	4.1	4.4	4.9	4.2	4.4	4.1	4.1	4.3	4.3	3.9	5	3.9	4.3	4.5	4.1	4.1	5	4.7	15%
LCI	-	4.4	4.1	4.4	4.9	-	4.4	4.1	4.1	4.3	-	3.9	5	3.9	4.3	-	4.1	4.1	5	4.7	-
Total	3.73	2.9	2.72	2.86	3.82	3.59	2.88	2.83	3.76	2.45	3.38	2.53	2.65	2.22	2.52	3.85	3.91	3.73	2.84	2.72	

Table 5 - Evaulation

Explanation on evaluation

In this section the points of evaluation and the calculations are clarified, componentwise.

Calculation

The table of the evaluation, Table 5, is divided into sections. Horizontally, the main categories can be found on which the concepts and/or components are tested. In the grey row, the average value of the components on the category of evaluation can be found.
Vertically, the different concepts with its components can be found. The grey column with the name of the concept highlighted contains the average value of the concept on the valued category, based upon the average values of the concepts on each point of the category.
For example: In the category Customizability, the main desk of the Cubic has an average value of 3.5, based upon the values found below it (a 3 and a 4). The score of the concept Cubic on Customizability is a 3.4, this can be found in the first grey column. This value is the average of the score of its components, as can be found in the 2nd till 5th place of the first row.
The only exception on this is the category Appeal to primary user, where the concepts are valued by the users on the points of the category. These values can be found in the grey columns of the concepts. The score of a concept on this category is the average of the values below it. The values of the components in this category, which can be found in the grey row of Appeal to primary user, are based on how many users indicated they liked that component best. For example: from the main desks, 1 person liked the main desk of the Cubic best, 0 person liked the main desk of the Float best, 1 person liked the main desk of the Float II best and 4 people liked the main desk of the Central best. These values calculated to values between the 1 and the 5 give the values of the components.
To final value, as can be found at the bottom of every column, is the score of a concept or components on every category, times the weight of the category. This weight can be found in the last column. For example for the Cubic: (3.4 x 0.2) + (3.5 x 0.15) + (3.7 x 0.3) + (3.5 x 0.2) + (4.5 x 0.15) = 3.73

Main desk

Adjustability to the human body - Because all the components are adjustable in height, the shape of the components is reviewed at this point. The main aspects were round shapes and accessibility of areas.
Possibility of reorganizing the space – The shape of the components compared to the shape of an average office is important, so that when reorganizing the desk fits different places in the office. Beside this, the movability of the desks was valued.
Accessibility desks – The accessibility of the desks from all the sides and the accessibility of areas were valued at this point.
Cleaning – The difficulty and frequency of cleaning of the materials used in the desks are compared. Also difficult to clean places like corners and grooves are valued.
Partitioning workspace – The desks are compared on the partitioning of the workspaces, done by different height levels, the possibilities of a separated computer space and space for paperwork.
Maximum use of materials – The raw plates are delivered in rectangular shaped plates at Samas. Looking at the shape of the desks the amount of waste created can be estimated, although the exact dimensioning is unknown. The desks are valued on this point.
Difficulty of construction – The number of conncetions and the difficulty of placing these connections is reviewed at this point. Also unusual thing like hanging constructions are considered for valuing.
Fitting Samas-line – The desks are compared with recent Samas products, in order to determine whether they fit the collection.

Conversation table

Adjustability to the human body – The sharp edges of the conversation tables are compared.
Possibility of reorganizing the space – The possibility of moving the tables is looked at.
Accessibility desks – The accessibility of areas of the tables, from all sides is reviewed. At Float and Float II, the glass triangle that sticks out and the cable is considered disturbing.

Cleaning – Just as with the main desks, the cleaning of the materials was one aspect of valuing, corners and edges was the other aspect.
Maximum use of materials – The shape of the tables is reviewed, to approximate the waste created at construction.
Difficulty of construction – The difficulty of fixing the legs and use glass were aspects of valuing.
Fitting Samas-line – The tables are compared with recent Samas products, in order to determine whether they fit the collection.

Container

Enlarging storage space – The possibility of enlarging the storage space, for example by changing the number of components is valued.
Adjustability to the human body – The height of the components is valued.
Possibility of reorganizing the space – The movability of the components is valued.
Accessibility of storage space – The accessibility of storage spaces is similar at the Cubic, the Float and the Central. The storage space of the Float II is higher and more accessible, for example from the sides.
Cleaning – The movability of the components, the materials used and the corners, and difficult to reach areas are valued at this point.
Maximum use of materials – Due to the simplicity and the similarity of the shapes, the same value is given to the concepts.
Difficulty of construction – The number of components used and the difficult to reach areas during construction are valued.
Fitting Samas-line – The containers are compared with recent Samas products, in order to determine whether they fit the collection.

Cupboard

Customizing storage space – The possibility of organizing the storage space with shelves and drawers for example is valued.
Enlarging storage space – The possibility of step-by-step enlarging the storage space, for example by changing the number of components and the extra space created this way is valued.
Adjustability to the human body – The height of the components, and the possibility of changing the height of the components is valued.
Accessibility of storage space – The height of the storage compartments is reviewed, as well as the depth of the compartments.
Cleaning – The following aspects were considered during valuing: difficult to reach corners, material used and unreachable of difficult to reach areas.
Maximum use of materials – The shape of the concepts is reviewed, on the amount of possible waste created during construction.
Difficulty of construction – The valuing on this point is done based on the number of connections needed and the different types of material used.
Fitting Samas-line – The cupboards are compared with recent Samas products, in order to determine whether they fit the collection.

Appendix I - Testing

Stability

According to the standards, the desks have to be tested on stability. For this test, a simulation is made, where a load of 750 N is applied on the desk, at the area where the chance of capsizing is the biggest, 50 mm from the edges. For 'our' desk, this point can be found in the front corners, due to the asymmetric placement of the legs.
The desk capsizes when its center of mass passes the 'capsize-line'. This line is the line between the outside edges of the back foot and front foot of the desk.
Initially, the desk had the tendency to capsize under the load of 750 N, calculated by Solidworks. This was then corrected by increasing the length of the feet of the front leg. Since this was not enough, feet were placed under both back legs. Knowing the position of the back legs, the length of the foot of the front leg can be calculated.
For this calculation, the load, the center of mass of the desk, the capsize-line and some other construction lines are needed, see Figure 105.

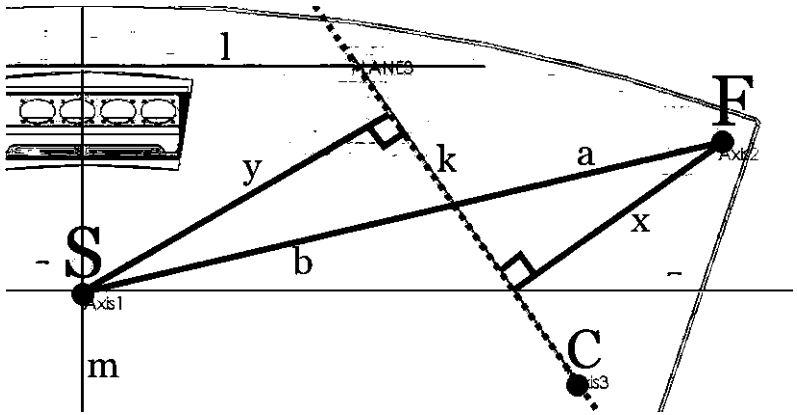


Figure 105 - Calculation on stability

F = load on desk = 750 N
S = center of mass of desk without load = 575.43 N
C = position of edge of back leg
k = capsize-line
l = line of front leg
m = line through center of mass of the desk = midline of desk
a+b = line between center of mass of desk and load = 961.98 mm
x = line through S and at right angles to k
y = line through F and at right angles to k

The force S is the mass of the entire desk multiplied with the gravity. This mass is calculated by Solidworks, knowing the density of the materials used.
The distance between F and S is measured in Solidworks.
We are interested in the length of line a or line b, so line k can be constructed. After this, the distance between the intersection of line m with line l and the intersection of line l with line k gives us the length of the foot of the front leg.
The desk is in balance when:

$F * x = S * y$
$750 * x = 575.43 * y$
$x = 0.7672 * y$

$a+b = 961.98$
$a = 961.98 - b$

The relation between a,b and x,y is as following:

$$\frac{a}{b} = \frac{x}{y}$$

$$\frac{961.98 - b}{b} = \frac{0.7672 * y}{y}$$

From this follows:

$961.98 = 1.7672 * b$
giving $b = 544.35$ mm

With this, line k can be constructed and this gives 370.64 mm length for the foot of the front leg, seen from the midpoint. This means that this foot has to be 741.28 mm for the desk to be stable. To ensure stability, the foot of the front leg is made 750 mm long.
This solution is checked with Solidworks, see Figure 106. As visible on this picture, the center of mass does not cross the capsize-line, varifying the calculation.

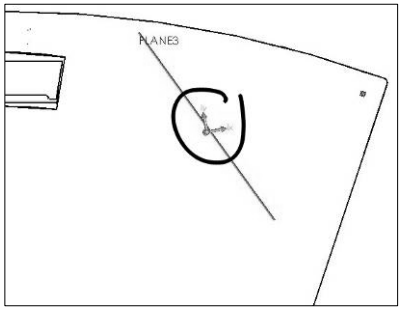


Figure 106 - Center of mass on loaded desk

Solidity

By MSZ 9050-86, desks are tested on solidity by applying vertical loads on the tabletop in 4 different points, as visible in general in Figure 108.
The load applied on these places is 1000 N each.
The exact positions of these points are as following: in the center of the desk, arrow 1 in Figure 108, in the middle of the side facing the user, 50 mm from the edge, arrow 2 in Figure 108; and in two corners diagonal to each other, 50 mm from the edges, arrow 3 and arrow 4 in Figure 108.

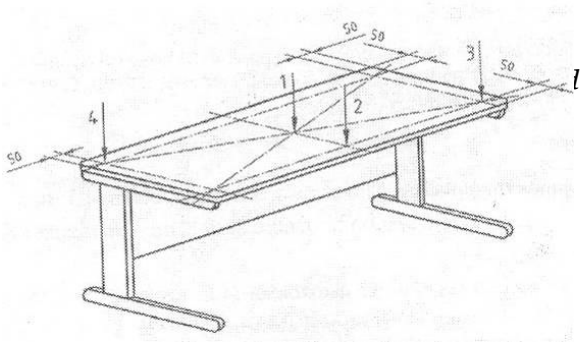


Figure 108 – Positions of loading for stability testing

The solidity is also tested by applying horizontal forces of 450 N each on the desk. The position of these forces on a general desk can be found in Figure 109. As visible in this figure, the forces are applied 50 mm from the corners of the desk, on all sides. During both tests, with the horizontal and with the vertical loads, the legs of the desk have to be fixed to the ground.
A simulation is made to test the solidity of the desk using AutoCAD's Sofiplus extension. For this simulation a simplified model of the desk had to be created using the finite elements method. This means, that the model is subdivided into X number of elements and the forces applied on the desk can be calculated for each of them. This way, the forces in the connecting elements can be determined.

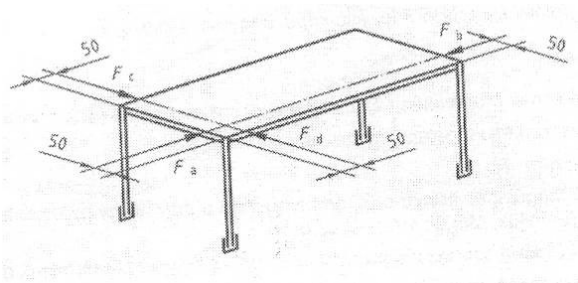


Figure 109 – Positions of loading for solidity testing

Force 1 and force 4 of Figure 108 form the vertical forces and one horizontal force on the left side of the desk and one on the front are simulated on the desk, these forces are expected to give the biggest deformations and loads on the connections. Also, two combined testing cases consisting of one horizontal area load of 1000 N and a horizontal load of 450 N on the left side is applied on the desk, once with all the legs fixed to the floor and once with only one leg fixed to the floor. The results of these simulatione give the deformation of the tabletop and the loads on the connecting elements (screws).
The most fragile point in a connection area is the screw. The maximum force applied to the screw without tearing it out of the material is important. This force can be calculated by the following equation[10]:

$$F_{max} = A * d^{1/2} * (L-d/3)^{5/4} * \rho^2$$

With: A = MDF coefficient = 57.3
d = diameter of the screw in mm

[10] Source: Faipari Kézikönyv II, Dr. Zsolt Kovács et al - Bútoripari termékek, technológiák, Facsavaros kapcsolat – forgácslap, MDF, page 198

L = length of the screw in the material in mm
ρ = density of the material = 0.75 g/cm^3

In all testing cases the biggest force parallel to the axis of the screw was searched in the different test cases, both in the screws of the back leg as the screws of the front leg. The testing cases refer to the following simulations:

Testing case 1 – Combined testing with only one leg fixed
Testing case 2 – Combined testing with all legs fixed
Testing case 3 – Horizontal load applied in the center of the desk
Testing case 4 – Horizontal load applied in the corner of the desk
Testing case 5 – Vertical load applied on the left side of the desk
Testing case 6 – Vertical load applied on the user side of the desk

The results can be found in Table 6, in kN.

	testing case 1	testing case 2	testing case 3	testing case 4	testing case 5	testing case 6
front screws	*0.3*	0.5	0	0.4	0.1	0.2
back screws	*0.8*	0.1	0	0.1	0.1	0.1

Table 6 - Forces in the desk

In this table, only the forces pointing downwards, the tearing forces can be found. The forces pointing upward do not tear the screw out of the desk, so are of no importance.
The simulations are made with a model where four screws connected the fixing tube of the front leg with the tabletop. During the test it became obvious, that the two screws on the side had all the tearing forces, the two screws in middle had forces pointing upwards or minimal forces pointing downwards. Because of this, one of the middle screws is considered redundant and has been removed.
The program calculated the forces in kN, rounding everything to the decimal.
The values of testing case 1 are not taken into consideration, since the setup of it differ a lot from the norm. These values are for illustration only of a case when all the forces applied during the norm testing are concentrated in the left back leg.

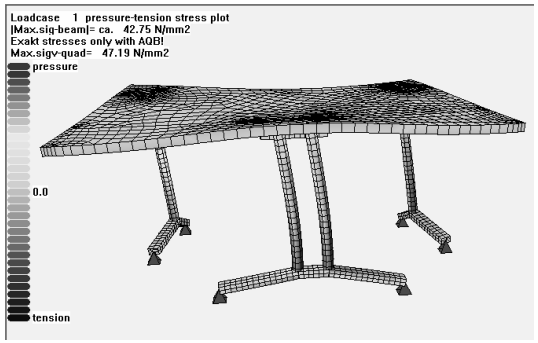


Figure 110 - Testing case 2

When designing furniture, the calculations on strength are not done calculating only according to the norm, but a so called safety calculation is done. This means, that the norm should be around 30% of the load the desk can bear. With this, the chance of accidents lies somewhere between 0.005 and 0.001. According to this the screws must be able to bear approximately 3 times the force found during testing. For the forces in the screws of the back legs this is 0.5 kN and in the screws holding the front leg 1.83 kN. To determine the maximum force in the crews, 0.15 is multiplied with 3 1/3 instead of 0.1 for the back legs and 0.55 instead of 0.5 for the front legs. The reason for this lies in the precision of the results, since these results are rounded to one decimal, so 0.1 can be 0.149 and 0.51 as well.
Samas uses 5x20 woodscrews for the fixation of stand alone legs. These screws can withstand a force of 1020 N, when only screwed in 10 mm in MDF. 10 mm is calculated here, since the thickness of the fixing dish has to be taken into consideration as well.
The fixing tube of the front leg has a material thickness of 2 mm, and also the head of the crew has to be calculated, an extra 2 mm. Using 5x20 woodscrews, the maximal force a screw can bear is 2010 N, so this satisfies as well. This type of screw is used for fixing the front leg and the back legs to the tabletop.
The deformation of the materials can be seen in Figure 110. This deformation in the figure is overdone, the value of the biggest deformation can be found in the front corners, namely a deformation of 1.98 mm in vertical direction under testing case 4. This deformation is acceptable: the maximum acceptable deformation under a load is 8 mm.
The deformations and forces in the legs are not reviewed, these are already existing and certified elements.

Appendix J - Review according to the List of demands

1.1.1 Desk must have at least 1540 x 800 mm of workspace (=1,232,000 mm²)
The Center has a work surface of approximately 1,465,000 mm², the space needed for the sockets not included.

1.1.2 Desk must support computer work.
Desk must support paper work.
On the desk of the Center, there is enough room for a laptop and paper work. These areas are not indicated visually or explicitly and no extra elements are used for this, because that would mean loss of freedom for the user.

1.1.3 Desk must create room for private objects of the user.
No explicit area is created for private objects of the user.
Product must create a feeling of privacy.
To maintain the privacy of the user, a separate conversation table is created. Also a glass plate is placed on the front of the main desk, hiding the legs of the user, for more privacy . Above the surface no wall is placed to prevent loss of openness.

1.2.1 A work surface of 750,000 mm² must be available for consultation.
The conversation table has a surface of approximately 837,000 mm².

1.2.2 Create consultation place for 3 people.
The conversation desk has room for 3 people.

1.3.1 Product must have at least 1 m³ of storage space.
The storage spaces are variable. The smallest container has a volume of approximately 0.09 m³. The cupboard has a volume of 0.03 m³. Taking two containers and one cupboard this gives a total volume of 0.21 m³. This is only one fifth of the demand. But since the cupboards are designed so small to be easily customizable, the user can buy the amount needed. However, a dozen of these cupboards do not look that charming in one office. To satisfy this need, the furniture family has to be extended with a bigger cupboard.

1.3.2 50% of the storage space has to be lockable.
Both the cupboard as the container are lockable.

1.3.3 Storage places have to be placed between 280 mm and 1680 mm high (standing).
The cupboard can be freely placed at any height.
Storage spaces may not be deeper than 600 mm for the heights 840 – 1400 mm.
The cupboard is approximately 300 mm deep.
Storage spaces may not be deeper than 500 mm for the heights 280 – 840 mm.
The cupboard is approximately 300 mm deep.
The container has a drawer.
Storage spaces must be accessible all time.
All storage spaces are accessible all time, as long as nothing is placed in front of them.

1.4.1 Adjustable to the human body for Hungarians between P05 and 95 and aged between 25 and 60 years. In values (only the desk):
Tabletop height: 620 – 805 mm
Monitor height: 1103 – 1361 mm
Both legs are adjustable in height, but the back legs determine the height of the desk, since they are less in height adjustable as the front legs.
Back legs (including tabletop): 614 – 854 mm
Front legs (including tabletop): 588 – 930.5 mm
No height adjustment for the monitor/laptop is included in the furniture family.

1.4.2 Available in different colors.
All components can be purchased in different colors. The user has a choice of 4 different colors in the laminated areas and three different colors for the metal parts.
Choice between different components at purchase.
The components can be purchased separately from each other.
Choice between different compositions of components at purchase.

The container has a variable composition at purchase, it can be delivered in different heights and with shelves and drawers as well.

1.5.1 May not have sharp edges that can harm people or animals.
All edges are rounded or chamfered.

1.5.2 Desks must have class A (average) solidity.
A load of 1000 N in horizontal and 450 N in vertical direction, the maximum displacement allowed is 8 mm.
The maximum deformation of the tabletop of the main desk found is 1.98 mm in vertical direction.
The conversation desk is not tested on solidity.
Desks must have class N (normal) stability.
This means a force of 750 N in horizontal direction.
The desk does not capsize under a load of 750 N.
The conversation desk is not tested on stability.
Desks must have class N (normal) endurance.
Endurance horizontally – 10000 times 150 N under a load of 750 N.
Endurance vertically – 5000 times 150 N under a load of 750 N.
The desk could not be tested on endurance.
The conversation table is not tested on endurance.
Storage components must have class A (average) solidity.
The storage components are not tested on solidity.
Storage components must have class N (normal) stability.
The storage components are not tested on stability.
Storage components must have class A (average) endurance,
The storage components are not tested on endurance.

1.6.1 Product may not have unreachable surfaces.
The most difficult to reach surface is the top of the container, beneath the glass plate. The space between the glass and the surface is approximately 30 mm, this is enough for a hand brush.
Product may not have unreachable grooves or holes.
The use of grooves and holes is avoided as many as possible.

1.6.2 No use of material that hangs on to dust or attracts dust.
Use of easy to clean material.
The materials used are laminated MDF, metal and glass. These materials are easy to clean and do not attract or hang on to dust.

1.7.1 Desk must have class A (average) mechanical resistance.
Storage components must have class A (average) mechanical resistance.
The materials and coatings Samas uses for desks and storage components must already answer these demands. In the product these materials are used, so this point is assumed to be fulfilled.

1.7.2 Desks must have class N (normal) heat resistance.
Storage components must have class N (normal) heat resistance.
The materials and coatings Samas uses for desks and storage components must already answer these demands. In the product these materials are used, so this point is assumed to be fulfilled.

1.7.3 Desks must have class A (average) fluid and chemicals resistance.
Storage components must have class A (average) fluid and chemicals resistance.
The materials and coatings Samas uses for desks and storage components must already answer these demands. In the product these materials are used, so this point is assumed to be fulfilled.

1.7.4 Desks must have class A (average) climatical resistance
Storage components must have class A (average) climatical resistance
The materials and coatings Samas uses for desks and storage components must already answer these demands. These materials are used in the product, so this point is assumed to be fulfilled.

1.8.1 Product must hide wiring.
The wiring is led away via the front leg. From beneath, the socket holder is covered with a part, so no wiring is visible. There is no covering for the wiring on the ground.

1.8.2 Product must support the supply of electricity for at least 2 electric devices.

The sockets in the desk can support electricity for four electric devices, when all four sockets are used for electricity.

1.8.3 Product must create room for a laptop, a printer and a telephone.

There is no space explicitly for these devices. The desk has space enough for a laptop and the phone, the printer could be placed on the top of the container for example.

1.8.4 Product must support a socket for internet and a socket for a telephone line (wish).

The sockets can be organized the way the user wishes, combining electric support, internet and telephone.

2.1 Product must be easy in handling.

The furniture family has no difficult to handle areas, the socket holder can be opened with one hand and the drawers and cupboard have handles to open them.

Product must be movable by two men (components must be lighter than 50 kg).

The heaviest component is the main desk, with a weight of approximately 59 kg. This is a slightly heavier than the maximum allowed to shift by two men, yet acceptable, since it is assumed not to move the desk frequently.

2.2 Product must have a design which appeals to the primary user.

The concept of the Center product family is chosen by the primary user, however it has not been tested afterwards.

2.3 Product must last 8 years at least, under normal service conditions.

The endurance of the product family could not be tested, but assuming the lifespan of the material it is assumable that the furniture lasts 8 years.

2.4 The product family must fit in an office of 16 m².

The product family fits in an office of 16 m², see Figure 84.

3.1 Use of existing production techniques of Samas.

The tabletop is cut from MDF plates the same way other plates are cut. Also the edges are covered the same way. The other components are mold metal or glass which are weld or screwed together. All these techniques can be done at Samas or can be ordered.

Maximum use of material.

The dimensioning of the tabletop allows two tabletops to be cut from one MDF plate, yet the tabletop could be made of thinner material and the legs could be cut the same length saving material this way, as already mentioned in the *Review according to the Environmental guidelines* on page 55.

3.2 Usage of universal components.

Existing legs are used for the desk and the conversation table, and the sockets and glass holders are already existing parts. For fixation, the by Samas most commonly used screws are used.

Product must be constructible using existing tools.

No new connection elements such as not existing screws are made and/or used.

3.3 Usage of universal components.

See 3.2 above.

Product must be repairable using existing tools.

The product can be put together with a screwdriver and aspanner, elements can be replaced easily this way. The bottom of the sockets is accessible with the use of one screwdriver.

3.4 Maximum use of space when packed.

No packaging is designed for the furniture family, so this could not be tested.

3.5 Product must fit in the product lines of Samas.

The same lamination as Samas already uses is applied on the models, existing legs of Samas are used in the product and the components scored relatively well on this point during valuing, so this is assumable, but the product is not tested on this point.

4.1 Product must fit the points of the *Environmental Guidelines* (page 82).

During design, these points were kept in mind. For further details, see page 55.

Product must be 60% recyclable.

Everything is recyclable, except the sockets and the wiring.

5.1 Product must have a design appealing to the secondary user.

The Center is not tested on this point.

Errata

Bachelor thesis assignment – Bálint Vekerdy
26th January 2007

Report

Page	Is written	Should be
Cover	Central Office	Center Office
Footer	Central Office	Center Office
1	Central Office	Center Office
2	Center and Cubic sketches	Central and Cubic sketches
3	…for the phones to give…	…for the phones give…
8	All the other components like metal legs and metal drawers…	All the other components like metal drawers…
9	With the Central Office…	With the Center Office
19	There are two different types of legs used,:	There are two different types of legs used:
20	The first, the storage group, is only found at Hungarian manufacturers.	The first, the storage group, is only found at Hungarian manufacturers during this analysis.
21	Maximum use of material.	Optimal use of material.
24	Samas gave the advice after the interviews, continue…	Samas gave the advice after the interviews to continue…
26	The desk combined with a consultation table…	The desk combined with a conversation table…
41	Normally Samas uses 25 mm thick…	Normally Samas uses 19 and 25 mm thick…
42	…laminated plates from, Falco Rt, but…	…laminated plates from Falco Rt and Forest Hungária Kft, but…
44	The fixing dish is 200 mm is diameter…	The fixing dish is 200 mm in diameter…
46	…directly to the edge, see Figure 69-66.	…directly to the edge, see Figures 67 and 69.
53	…the material costs including paining with 4.	…the material costs including painting with 4.
53	This means that the desk of the Central Office is…	This means that the desk of the Center Office is…
53	…since the Central aims…	…since the Center aims…
55	Final element analysis…	Finite element analysis…
56	The Central Office is verified…	The Center Office is verified…
56	…offered by the Central Office is not sufficient.	…offered by the Center Office is not sufficient.
56	Maximal usage of materials…	Optimal usage of materials…
57	The moldings for the feat have…	The moldings for the feet have…
57	For these feats, the material…	For these feet, the material…
57	…has been worked out within in assignment…	…has been worked out within this assignment…
67	…and the High Office, see Figure 100,.	…and the High Office, see Figure 100.
70	…two Hungarian manufacturers that stand out…	…two Hungarian manufacturers which stand out…
75	Maximum use of material	Optimal use of material
75	Maximum use of space when packed	Optimal use of space when packed
85	Center and Cubic sketches	Central and Cubic sketches
96	Maximum use of material	Optimal use of material
96	Maximum use of space when packed	Optimal use of space when packed

Technical drawings

Page	Is written	Should be
Cover	Central Office	Center Office
D07	?	1