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Development of an extendable outdoor cutlery set and matching eating kit

Master's thesis in Industrial Design Engineering

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Cover: CAD rendering of final concept solution

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Abstract

In a time when good, real food is becoming increasingly popular it is no wonder the same is happening within the outdoor market. Historically outdoor practitioners have often resorted to pre-packaged or freeze-dried meals but an increasing number of people are choosing to carry real food with them in order to enjoy freshly cooked meals out on the trails. These people do however need good equipment to cook and eat with.

This report details the process of developing a cutlery set and a complete eating kit intended for outdoor practitioners who wants to eat real food while out hiking, camping fishing or hunting. The work was done together with the company Wildo with the goal to develop a finished cutlery set that can be extended for eating or stirring with and connectable together for storage. In addition a redesign of Wildo's Camp-A-Box kit was done on a conceptual level.

The project started with a thorough pre-study where the market were analyzed and users were observed and interviewed regarding their habits and use of tools while cooking and eating outdoors. Based on the findings several tests were done regarding ergonomics and technical aspects before several concepts of solutions was developed. The concepts were then evaluated and one concept of the cutlery set and one of the Camp-A-Box kit were selected and further developed in terms of functionality, producibility, surface treatments, weight and sustainability.

The project resulted in a finished cutlery set that can both be extended and connected together for storage without any extra parts to get lost or small parts to break of. A concept of a new version of Wildo's Camp-A-Box was also developed that is both more functional, more sustainable and more user friendly.

Keywords: Outdoor, nature, cutlery, eating, dinner, food. Cutleries, hiking, industrial design, technical design, industrial design engineering,

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1 Introduction

Eating during outdoor activities is often a less prioritized activity and candy and quick energy often trumps cocked food. Especially hikers, who are out for several days, have often resorted to freeze-dried meals to save weight, avoid food going bad and to simplify cooking. There has however been those who choose to carry a bit extra to be able to eat cocked food. This group of people has also been increasing in numbers as outdoor activities have risen in popularity and as more people have chosen to carry a little bit extra to be able to eat good and this is where Wildo and this project comes into play.

1.1 Background

Wildo was started in 1979 with the idea to create simple, thoughtful and durable products for hikers, hunters and campers. The products should be easy to stack together and the weight should be low to make it as easy as possible for users to pack and head out. Injection or blow molded plastic is used exclusively and the production is done locally in Borås. The product line is quite small and comprises different outdoor eating equipment.

Wildo's most famous product is the Fold-a-cup (Figure 1), a cup that can be folded together when not in use to make it possible to fit in a pocket. The cup is available in two sizes that fit into each other. Other products are for example a spork (combined knife, spoon and fork), different "Kåsor" (rigid cups) and a spice jar.

Figure 1 Wildo Fold-A-Cup

The Camp-A-Box (Figure 2) is Wildo's main product. It is a combined box and plate and is sold as a set together with their two folding cups, spork, spice jar and a cutting plate that also functions as a strainer.

Figure 2 Wildo Camp-A-Box

Many of the products are quite old and Wildo have been starting to update the line with smaller changes that still allow them to use the same molding tools to save costs. The plan is however to make a larger update of the entire line with more substantial changes. Wildo has therefore initiated this project to start the work through redesigning their main product, the entire Camp-A-Box set.

In addition, a cutlery set shall be developed as an alternative to Wildo's only eating tool, the spork. While the spork is great when a single tool is all that is needed, such as when eating from freeze-dried pouches, it is lacking when real food is cooked. Wildo is also pushing the idea in their marketing that it should be possible to eat good, real food in the outdoors and not just freeze-dried meals or soups. Cutting a steak or de-boning a freshly caught and cooked fish is simply not possible to do with a single spork. This makes the need for a set of cutlery more urgent.

1.2 Project goal

The goal of this project is to analyze the market and usage to create a new version of the Camp-A-Box set on a conceptual level. As the need for a good cutlery set to go along with it is more urgent for Wildo the cutlery should be developed on a more detailed level and include detailed construction to create a finished product.

The cutlery set shall consist of a spoon, fork and knife and fit inside the Camp-A-Box. In addition, it should be possible to connect all the pieces together to simplify storage and transportation. It should also be possible to extend it by connecting two of the pieces to make it easier to eat from deep pouches or pots.

1.3 Limitations

The limitations of this project were:

- While the materials should be considered, no detailed material study or development should be done
- The complete Camp-A-Box set should only be developed at a conceptual level but still consider for example production limitations

2 Method

The project broadly followed a process based on Nigel Cross's *Four Stage Design Model* (2008*)* but as it became clearer what needed to be done during the project the plan was gradually modified and in the end the general process can be described as in Figure 3.

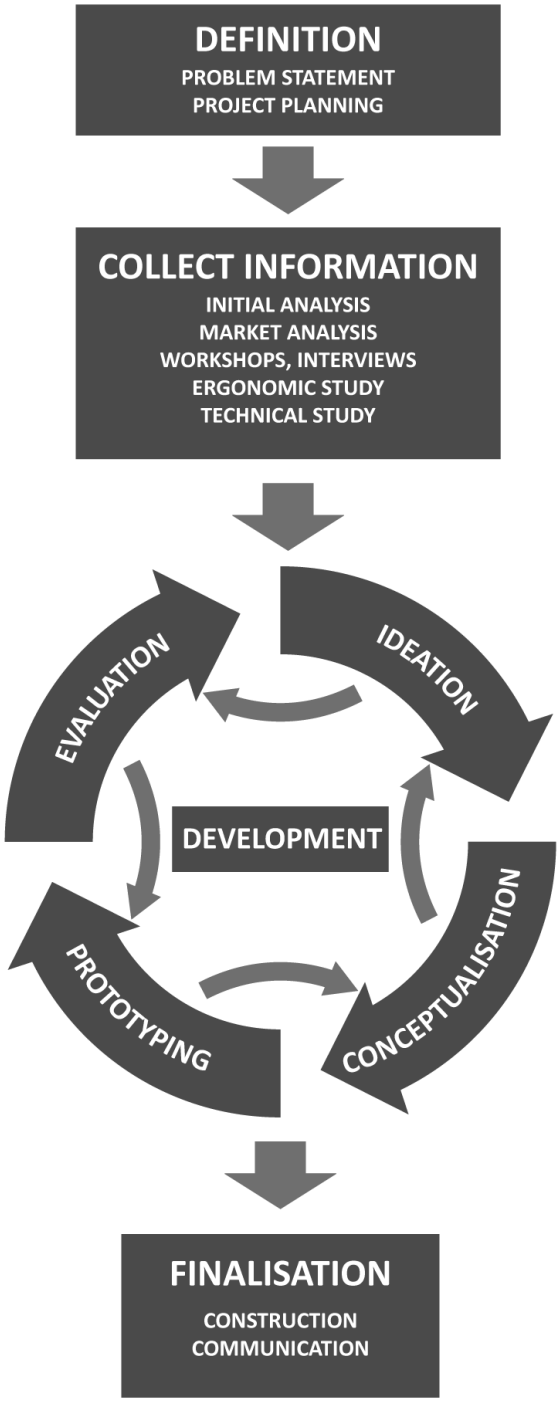


Figure 3 Design process overview

2.1 Stage 1 Definition

In the first stage the goal and the purpose of the project were defined from the initial briefing and problem description from Wildo. A project plan was written where all the fundamental activities that should be done in the project were mapped out and a time plan was created to get a schedule to follow and make sure that the project was on track.

2.2 Stage 2 Collect information

In the second phase of the project a thorough pre-study was conducted to collect as much information as possible that would be of help when developing the new products.

2.2.1 Analysis of Wildo

As a first step Wildo as a company and brand were analyzed to find how and where the project should focus. Initially this was done through a SWOT-analysis (Agndal & Axelsson, 2012). Here different things or characteristics that may affect the company is listed per the four categories. This served as an entrance to get a better overview of where Wildo stands today.

From the SWOT the analysis progressed to studying Wildo's brand and marketing activities. This part of the analysis was done through semi-structured interviews with company representatives and through web searches and reviews of Wildo's products.

2.2.2 Market analysis

The second step was to analyze where the market was heading and to analyze a few competitors product. Here other products that either were commonly available or seen as very high performing were listed. Some of these products were then selected and analyzed in depths regarding their functions, performance, smart solutions or other features that could be beneficial for the project.

Another area that was explored here was to map out where the outdoor market in general was heading and what trends could be found. This was done through looking at older products and see how they have evolved over time and through reading trend analyses in the form of blogposts, magazine articles or news articles.

2.2.3 Workshop

A very important step in the pre-study was the workshops conducted with the intended users of the products. The main activity was a combined workshop and focus group where a group of three people at the time could test Wildo's current products and examples of the competitors' products.

In total, 12 participants with different backgrounds, ages, experience and gender took part in the workshops. An initial workshop was conducted to evaluate the procedure before the bulk of them took place.

The workshop was conducted in two steps. First, the participants were asked to cook a meal together on an outdoor stove and over open fire and then eat it. The meal itself was changed according to the participants religious and ethical views but was designed to not be too simple to cook or eat to challenge the eating tools that were to be evaluated. The meals basically consisted of fresh vegetable, a barbequed steak, boiled pasta and fried pancakes. Preparing and eating this meal required the participants to use a wide array of cooking equipment including the spice jar, cutting plate (and its bonus function the strainer) and to use the cutlery in the intended environment. During this step the participants were encouraged to try all the different equipment and to voice their opinion regarding its function.

Because this step was a bit unstructured the second part of the workshop was a calmer, more structured discussion regarding all the different equipment they used. Here, one piece was discussed at a time regarding its function, aesthetic, use, problems, the users' needs or any other points the users brought up. This part of the workshop was semi-structured with some key questions prepared in advance through brainstorming, but because of the participant's direct use of the products and the fact that the first part served as a very good team building exercise the users were very vocal and outspoken about they experience and opinions.

The workshops were audio recorded for later processing and photos were taken when the participants voiced problems or good points.

2.2.4 Interviews

During the pre-study, several interviews were conducted with different persons. Some were users who did not have the time to participate in the workshops, these users were typically experienced outdoors persons whose opinions and experience was seen as important to the project. These interviews were structured around their experience and activities when they were out in nature s their respective sports.

People from Wildo were interviewed regarding the company and were they wanted to head in the future, sales staff in outdoor shops were interviewed about their sales experience with different products and what their customer saw as important and a few engineers were interviewed regarding technical questions. The bulk of these interviews were performed in a semi-structured way with some questions and areas of interest planned and audio or notes were taken for analysis at a later stage.

2.2.5 KJ-Analysis of the workshop and interview material

After the workshop and interviews had taken place, the recordings were analyzed according to the KJ-method. Due to the length of the recordings only the parts were important quotes were made were transcribed and printed. In addition, notes were taken about smaller issues or overall feelings among the participants. These quotes and notes were then grouped together according to their respective area to give a better overview about the problems and needs. The areas concerned both specific products but also general use, behavior and technical points.

These quotes and notes were then grouped together in a hierarchal style according to shared factors in a logical manner. Splitting the data into these smaller group created a library of information that was analyzed and used during the development of the new products.

2.2.6 Personas and user scenarios

Based partly on the interviews done with different users regarding their habits, activities and situations two different personas and use scenarios were created to give two different perspectives to use during

the development stage. Using these two slightly narrower perspectives rather than trying to evaluate against all the possible user scenarios made evaluation and reflection faster, easier and more reliable when comparing different ideas to each other as the base for the evaluation was the same every time.

2.2.7 Surface finish tests

During the workshops and interviews several problems and areas of interest were found. To tackle some of these before the development stage started a few shorter technical tests were done. The first was to look at how the two different surface finishes Wildo currently use in the Camp-A-Box kit behaves during use.

The first test performed simulated how hard it is to clean the plastic. To get a "worst-case" kind of scenario, animal grease was used as it hardens when it cools down. Six different samples were coated with warm bacon grease, three on the shiny and three on the matte surface. The grease was left in place for several hours to cool down.

Figure 4 Washing up test

The samples were cleaned in three different ways; with toilet paper, with cold water and detergent and with warm water and detergent. The samples were then left to dry and once dry, all the samples were compared and evaluated, both visually and tactilely on how much grease remained.

The second test done to compare the surface finishes was a scratch test. During use the plates in particular get many small scratches and cuts. These impact the visual look of the products but may also leave food remnants that could cause bacteria to grow.

To see how the two different surfaces reacted a scratch test was performed were one shiny and one dull surface were subjected to a large number of cuts and scrapes. Half the surface from a metal knife and half the surface from a plastic knife. The result was compared and evaluated visually.

2.2.8 Ergonomics: Shape and size testing

The last step during the pre-study was to create a set of guidelines for the shape and size for the cutleries from an ergonimcs perspective. This was done in three steps. First data was collected during the workshops regarding the users preferences for the tested cutlery regarding their size and shape. After this a large number of cutleries for both outdoor and home use were measured to give a large set of data. This data was then used to create two sets of tools for user testing. One set of tools compromised of different sizes of spoons and forks and one set compromised a spoon and knife where different angles could be changed. These two sets were then presented to users that tried them and stated their preferred sizes, shapes and angles.

Figure 5 Ergonomics testing tools

The data from this test was then recorded and presented in a diagram were each user's preferences could be distinguished separately to see if any connections between the different measurements could be made.

2.2.9 Sustainability assessment

In order to reduce the cutleries harmful effect on the environment a Life Cycle Assessment(LCA) was done on Wildo's current Camp-A-Box (White, 2013). In an LCA the total effect from a product is studied, from raw material to its end of life including its use. This was conducted with the help of the online tool Product Ecology Designer. In the tool, each step in the product's production, transportation and end of life was listed ("Product Ecology", 2016). In addition the total emissions from transportation to and back from outdoor activities was calculated and added. These emissions were based one of the personas created earlier in the process and an estimation of the total life length of the product itself.

The result from the LCA was used to form a set of design guidelines that was used throughout the project. The basis for these guidelines were the ECO Strategy Wheel were suggestions for sustainable design are given from ten different angles (Brezet and Hemel, 1997).

2.2.10 Requirement list

All the needs and wishes identified during the pre-study were studied and those deemed important, viable and not hazardous for the users or the environment were compelled into a list of requirements. The individual points were labeled as either a requirement or a wish depending on its impact for a successful finished product versus how hard it would be to implement without affecting the product negatively.

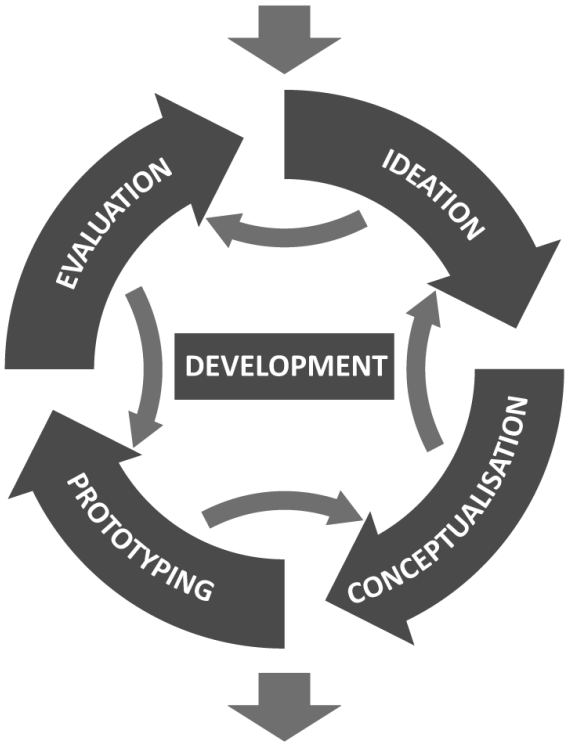


Figure 6 The Development phase

2.3 Stage 3 Development

The main phase of the project was the development stage were the new products were developed. The process was characterized by an alternating evolutionary and iterative style were new ideas were developed, tested and evaluated and then either passed on or rejected. This cycle was repeated several times both on a smaller scale to target smaller problems or individual products and on a larger scale to, for example create concepts for the whole new Camp-A-Box set.

2.3.1 Ideation

The first step in the development cycle was to ideate a lot of different ideas to the problem studied. In order to accomplish this several different techniques were used, the two main techniques were first free mind-mapping, mainly regarding the separate products different functions but also to explore different themes that potential concepts could use. The second technique was sketching, both by hand and in computer programs as well as quick and simple CAD models when more technical problems were studied.

The main CAD programs used throughout the project were Dassault Systems CATIA V5 and quicker renderings in Keyshot 5 due to its simplicity and fast workflow. Other computer programs used to sketch and make illustrations were Adobe Illustrator and Photoshop.

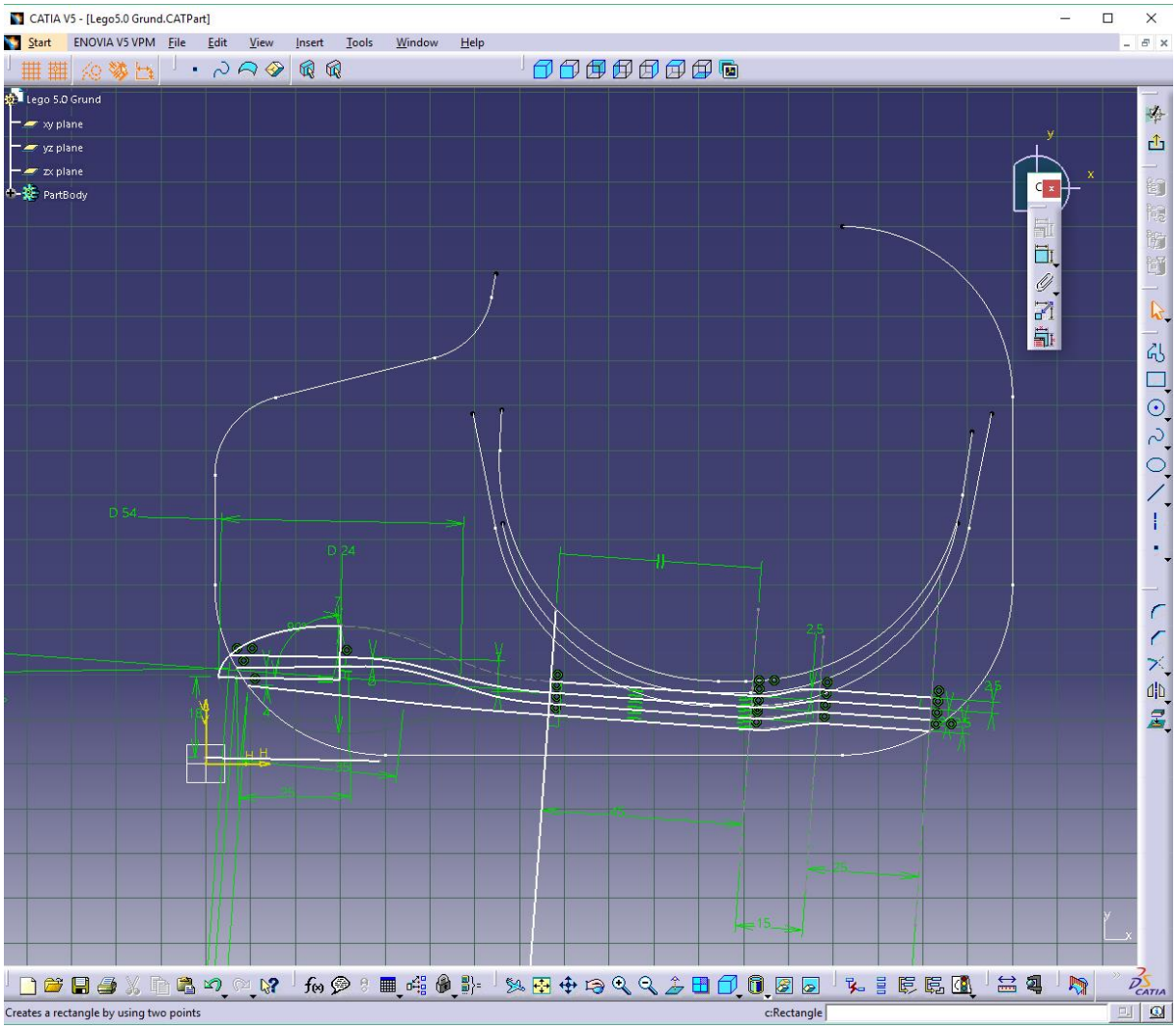


Figure 7 CAD done in CATIA V5. The layout for the cutlery set is done from the available space in the Camp-A-Box

2.3.2 Conceptualization

The ideas from the first stage of the development process were sorted and grouped after their respective function, problem or product. They were then combined to create complete products or solutions, often with the help of morphological matrices. In these matrices solutions or ideas are listed according to the function or problem they solve. This gives an overview of the available solutions. One or several solutions for each function are then combined in a logical manner to create several concepts of new products.

Table 1 Morphological matrix example

Functions needed in a product	**Different solutions to the functions**			
Function 1	Solution 1	Solution 2	Solution 3	Solution4
Function 2	Solution 1	Solution 2	Solution 3	Solution4
Function 3	Solution 1	Solution 2	Solution 3	Solution4

	Concept 1		Concept 2

After the different concepts had been created a number of questions was raised regarding their function and suitability. In order to address these questions the concepts were refined and developed further. This included basic construction of mechanical functions, size and ergonomic considerations.

The concept created were then put together in sketches, CAD-models or descriptive text and refined to create representations that could be used for evaluation and comparison against each other.

2.3.3 Prototyping

In some cases, the visual representations or text were not enough to thoroughly evaluate the concepts and physical prototypes were created. These could either be quick and simple models designed to test a specific function or more refined models meant for a deeper evaluation of shape, form, function, ergonomics or some other aspect.

Depending on the exact product and function that were to be evaluated the prototypes were created in different materials. Initially clay models were tried to create the shape for the cutlery due to its moldability, however, because of the cutleries long thin shape the clay used deformed too easily. Instead 3D-printed models were used to a large extent due to their relative accuracy ease of creation. Other materials used were folded paper, cardboard and rebuilt similar products.

2.3.4 Evaluation

Once all the questions raised could be answered the concepts were evaluated against each other and the best of the concepts were selected for further processing. This evaluation was done through both listing the different hard data available as well as presenting the concept to users and to Wildo to get their opinion.

For the evaluations, a PUGH selection matrix was often used. In this method, each concept is given a score according to a number of criteria, the concept with the highest total score is seen as the best. However, as not all criteria are as important for the finished product the different criteria are given a unique ranking. The score for each criteria's is then multiplied with the ranking before the total score is summed up. The more important criteria are then contributing more to the final score and a more accurate final score is given.

The concept with the highest score is then selected and processed further.

2.4 Stage 4 Finalization

Once the development stage was finished and the final concepts for the cutlery and Camp-A-Box set were selected, the final stage, Finalization, commenced. In this stage the final construction was done to the cutlery concepts to create a finished product and a final refinement to the Camp-A-Box concept. In addition, renderings and other communicative were created of the final products.

The final CAD models were mainly done in Dassault Systems CATIA V5 and renderings in Autodesk VRED were more control could be had compared to the quicker Keyshot renderings that were used earlier in the process.

3 Result

The result of the project is divided into separate parts according to the different phases of the project.

3.1 Pre-study

Before the development of the new products started a thorough pre-study took place. This study started by looking at Wildo's current products and were they want to head as a company and brand, their competitors product and where the outdoor market is heading. In the next phase of the pre-study, users were interviewed and studied to find their needs and wishes. This was done through interviews and workshops. Finally, some technical aspects such as different surface finishes, ergonomics and sizes were analyzed to serve as a foundation for the finalization of the new products later on.

3.1.1 Wildo – Analysis

Understanding the company, its brand and its product is important to create commercially successful products through drawing on a company's strength and brand. Failure to doing this will create products that do not seem to belong to the company, will be harder to sell and/or hard to manufacture with the competence and connections the company currently have.

3.1.1.1 SWOT Analysis

As an introduction to analyzing Wildo's current products and brand, a SWOT analysis (Table 2) was done to get an overview of the current situation.

Table 2 SWOT Analysis

Strength's • Small company • Potential for short time to market • Established contacts with manufacturers and resellers • Local manufacturing • Low manufacturing costs • Simple products	*Weaknesses* • Old product line • Low cost of individual products • High tooling cost in comparison to product price • " Missing" products in line • Weak brand and unknown name • No in-house construction or little product development expertise
Opportunities • Time for a large overhaul of products • The outdoor market is expanding • New markets internationally • New segments in other outdoor areas/sports	*Threats* • Many low-price competitors • Cost of overhauling all the products at once

Being a small company with established local manufacturing Wildo is quick to bring updates and new products to the market. Many of the products are also of a very simple nature and belong to the same category which facilitates logistics and communication with resellers.

As most of the products are injection molded with plastics the manufacturing costs for each product is very low. This however is offset by the fact that tooling costs are high and the price for each sold product is relatively low. New products must therefore sell at a high number or drive other sales to create a return of investment.

Seen at a larger scale the outdoor market in general is expanding, both in Sweden and globally. Outdoor activities are also diversifying with many outdoor sports such as mountainbiking, trail running or climbing skyrocketing in popularity brining more people into the market. At the same time is the traditional outdoor activities still alive and well. Fishing, hunting, hiking and camping are also

gaining in popularity and Wildo have been experiencing both increased sales and result in the last couple of years.

However, Wildo is not alone on the market and many competitors exist, both with similar products but also some with straight of copies of some of Wildo's products. Since Wildo previously have not used a specific company or brand name and instead only used the name of the specific products, the brand is still relatively weak and unknown. When asked, many of the users recognized the more iconic products like the Fold-A-Cup or Camp-A-Box but not the brand name.

3.1.1.2 Brand and marketing

While Wildo have existed for nearly 40 years the company name has only been in use since 2010. This means that when asked, many of the users recognize the products but do not connect them to the company itself. As a brand, Wildo wants to be associated with genuineness, quality, solidness and that it should be easy and simply to cock in the outdoors. One should not need to have the most high tech equipment or be a professional in order to enjoy eating real food outdoors.

Figure 8 Wildo marketing example (Wildo, 2016)

The marketing content Wildo produce revolves much around eating real, fresh food outdoors and not just snacks and freeze-dried meals. Many of the pictures used on the website or in brochures feature social gatherings with fresh food and a feeling of rawness. Boiled coffee, mushrooms and fires are often used to create the romantic feeling many connect with being outdoors. The muted colors help Wildo's colorful products stand out and create an association with the colorful food.

> *"The pictures should have a solid feeling… Swedish, preferably a bit rough and gloomy weather […] It should be nice, no hard work and preferably social."* (Andersson, 2016)

When other products are used in the pictures it is often other Swedish brands with a long heritage and were quality rather than quantity is associated with the brand. Doing this helps building the brand around the cornerstones of quality and solidness.

3.1.1.3 *Wildo design guidelines*

Wildo's design aesthetics have changed a lot over time, from a very simple function driven style to the current, more modern style that combine functionality with an increased focus on form and aesthetics.

Wildo's largest cup (Figure 9) is a good example of the new design style, it has been designed from the start with the new aesthetics in mind. Here, different surfaces finishes have been used to break up the inside and create a more refined look. The handle has also evolved from the older style as can be seen Figure 10. The new handle has moved away from the symmetric, flat and simple shape of the older handle to a new version with a more dynamic look with the diagonal end. Construction wise the new handle is also a lot stiffer because of the ribs on the underside.

Figure 9 Kåsa XL

The company logo is also placed in a central position, a much needed step to promote the brand. The use of a clear surface finishes with a very shallow engraving of the logo gives it a refined and subtle look. When handled, it will become obvious thanks to the light reflecting differently but when the cup sits still it is more subdued and does not scream out it message in an overdone way.

This all becomes obvious when the two generations of the cup are compared to each other as can be seen in Figure 10.

Figure 10 Comparison of Wildo's old and new cup

3.1.2 Market analysis

Although the main focus of this project has not been the market and business aspect it is still important to take some of these factors into consideration when creating new products to ensure that they will not only look and function great but also fit into the current market and will be competitive when compared to other companies' products.

3.1.2.1 Trends in the outdoor market

Like most consumer markets today the outdoor market is expanding and changing at a faster pace than ever before. Cheap manufacturing in developing countries and big jumps in production techniques have opened up for radically more complex products than have ever been available.

Social media have also created an increased appetite among consumers for more extreme adventures and with rapid sharing of information it has also been possible for even average users with limited skills and knowledge to perform advanced adventures that professionals would have struggled with a few years ago. All this has led to a very different market than that 20 years ago. A few of the larger trends that can be seen on the market is:

- **Selling the experience, not the product**

Although not limited to the outdoor market many companies have used social media and other marketing channels to highlight the use of their products rather than the product itself. For outdoor products, this has proven extremely successful, much thanks to the fact that they are products that does allow users to fulfill their dreams or to truly get away from their everyday life.

- **Diversification and system-think**

Many outdoor companies have successfully diversified their product portfolio over the last couple of decades and this trend is continuing at a higher and higher pace. This has happened both horizontal (same customers, new product areas) and concentric (same technology, new product areas). An example of the horizontal diversification is Primus, an old Swedish pot and stove manufacturer that nowadays is also selling eating accessories similar to Wildo's. Embracing this allows companies to further take charge of a complete activity (such as the whole cooking and eating) and to design a complete system meant to work together rather than individual pieces that must rely on other company's products.

Examples of concentric diversification are the myriad of *Lifestyle products* offered. Many outdoor clothing companies such as Fjällräven have successfully launched everyday clothes but with an outdoor feeling or form language. In some cases these lines have made the companies lose some of its brand value among hardcore practitioners (Chenault, 2016). However, in many other cases it has led to companies being able to attract new customers or use the higher margins of these lines to fund the development of more specialized gear.

- **Minimalism and flat design**

Many of the same fashion trends seen in consumer electronics, digital content and other consumer markets can be seen in outdoor equipment as well. One example of such a trend is the minimalistic design used by companies such as Apple, in flat design illustrations or by architects worldwide ("Design Minimalism: What, Why & How.", 2014). This trend can be seen in many companies in the outdoor industry such as Kleen Kanteen with their simple looking water bottles or by Arc'terryx with their seamlesss looking clothes.

- **Design driven product development vs engineering driven product development**

The majority of outdoor companies have historically been started by practitioners whose main driving force has been to develop products for themselves that have not been available on the market. These products have very often had focus on functionality and performance for elite practitioners. Usability and form have often suffered as a result. As companies have grown and matured the focus have often shifted towards products designed to also sell and create revenue (Chouinard, 2005). This Chouinard explains, has lead to a wider focus during the development process to also accommodate beginners

and amateurs and to design products that look more refined and friendlier. An example of this is Charlet Moser's ice tools were the modern versions are both more ergonomically refined, feature more double curved surfaces and offer a more dynamic look (Figure 11).

Figure 11 Comparison of old(left) and new(right) ice tools (Drytooling.com, 2016) (Petzl, 2016)

3.1.2.2 Competitor product analyze

With the products being relatively simple it is no wonder that Wildo suffer from a lot of competition from other companies, both locally in Sweden and internationally. A rough split can be made between those products that is meant to simply complement a basic pot and stove combination and those that, like Wildo, are going for a complete set.

Some of the main competitors' products can be seen in Figure 12.

Figure 12 Competitors, (Light my Fire, 2016), (MSR, 2016), GSI Outdoors, 2016), (Sea To Summit, 2016), (Primus, 2016), (Biltema, 2016)

In Sweden, the number one competitor is Light My Fire, another small Swedish company situated in Malmö. On a global scale, it is harder to pinpoint the main competitor because many companies still operate on a local marker or is at least largest on their local market. Therefore, the competition can vary a lot from company to company, depending on local actors and local use patterns.

Two different competitors products were chosen for a deeper evaluation: Light my Fire and Sistema Salad

3.1.2.2.1 Light my Fire - Meal Kit 2.0

The meal kit from Light my Fire is probably Wildo's largest competitor. It comes from another Swedish company and targets the same needs as Wildo's Camp-A-Box. When asked about it, several users stated that they were attracted by its aesthetics and intriguing triangular shape. However, in use the shape has proven awkward and hard to pack into a backpack and to store at home due to its deviant shape and thickness. The sticky TPE band also makes it harder to slide down the side of a packed backpack.

Figure 13 Light My Fire - Meal kit

The soft TPE in the bottom of the cup makes it easy to fold but also easy to rollover. The lid is therefore a definitive must. This together with the longer shape and small exposed liquid surface makes it good at keeping for example coffee warm.

The included waterproof boxes allow users to store some leftover food or prepare food in advance. Although the cup is meant to go inside one of these two boxes it can be stored outside if both boxes are to be used.

3.1.2.2.2 Sistema – Salad To Go

While the Sistema Salad kit is targeting a different audience and use area it still features some interesting parts. The kit is waterproof and feature separated spaces for different food and dedicated storage space for its different content. This allow the user to store the kit and fill it with food without risking losing or forgetting some parts.

Figure 14 Sistema Salad kit

The extendable cutleries allow the user to store everything inside the box but at the same time have full length cutlery to eat with. One negative points with the box is that messy food will contaminate the cutlery. In addition, if used as an outdoor kit, the snaps on the lid may risk breaking of.

3.1.3 Product analysis

The main product in this project is the Camp-A-Box and the included accessories. It is available in three different versions depending on how many of the accessories that are included with the smallest, *Basic* (Figure 15), only including the box and a small cup and the largest, *Complete*, including everything that could be needed to eat outdoors.

Figure 15 Camp-A-Box

The complete set costs about 175 SEK and includes the following:

• **Box**	125 grams	PP	*Serves double duty as plates*
• **Small Fold-A-Cup**	25 grams	TPE	
• **Large Fold-A-Cup**	45 grams	TPE	
• **Spork**	10 grams	PP	
• **Cutting board**	52 grams	PP	*Serves double duty as a strainer*
• **Spice jar**	17 grams	PP	*Space for 3 different spices*

One important point brought up during the user evaluation was that the whole kit includes two Fold-A-Cup and two halves of the box, several users stated that it felt unnecesary to carry that much extra and that they would usually not share a kit between two people anyway.

3.1.3.1 Camp-A-Box

The Camp-A-Box is one of Wildo's original products and serves as the basis for the Camp-A-Box set. The square shape gives the box a static feel and the flat surfaces without any span or strengthening ridges make the box flexing. Because of this the locking tabs does not work perfectly. The bottom of the box eatures a handle with tabs on top that match the tabs also found on the Fold-A-cup, connecting the two products together. The size is slightly too small to fit a full sized meal and having the possibility to fit some extra accessories inside would be a useful feature.

Originally the square shape was chosen to make the set pack down small and to fit into the side-pockets on the classic Scandinavian outdoor pants made popular by Lundhags, Fjällräven and other manufacturers.

From the original version, the box has been updated with a new etched graphic of the company name on the lid instead of the original sticker. It also features a new locking mechanism with locking tabs to keep the box together. The original version featured a mechanism that could lock the two pieces together at two heights to allow extra items to be stored inside. This mechanism was however hard to use and not reliable in the field which lead to Wildo removing it.

Figure 16 Camp-A-Box packed

While the set is designed to pack together in a semi logical way, there is a lot of unused space inside because the products do not fully match each other's shape.

User comments

When asked about it, several users stated that the form felt slightly dated and too simple. The sleek square shape was however considered as very good since it made it easy to slide it down in a backpack, or it could be stored in a logical way at home together with other boxes that often also are rectangular.

> *I really like the high straight sides, it makes it so much easier to eat from than my other plates with an angled or lower side.* ("Workshop", 2016)

Two other good points brought up during the workshop and interviews were the steep sides that meant it was hard to spill food and the handle that allows the box to be gripped without getting food on one's hand. However, some users felt that the lid was a bit unnecessary and served no real purpose when eating and that the closing mechanism felt to vague and did not give enough feedback that it was closed.

3.1.3.2 Fold-A-Cup

Wildo's most famous product is probably the Fold-A-Cup. This is also one of the original products designed in the 70's and with a larger version added later. It features similar ridges as those found on the Camp-A-Box handle and some reinforcement ridges along the perimeter and the fold.

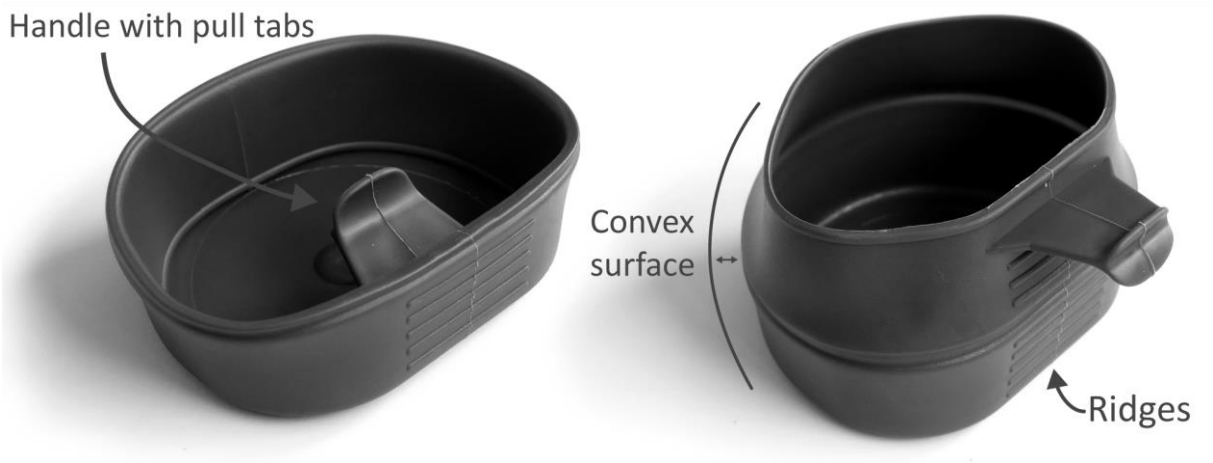


Figure 17 Fold-A-Cup

The cup is made of polypropylene based TPE which makes it flexible enough to fold down into itself yet rigid enough to keep its shape and drink from, even with warm liquid inside. The cup suffers from some production "remnants", clearly visible parting lines on the outside and a very visible flow port on the bottom.

Two noteworthy good points are:

- A handle with pull tabs helps to fold it open
- The convex outer surface help keep the liquid from spilling out

User comments

The Fold-A-Cup was the product that generally was the most well received among the users. The fact that it folds down very small yet is not weak or fragile when folded up was welcomed.

One point brought up during the tests was however that the smallest size felt too small and the largest size too big. Several users expressed a feeling that the small cup was more akin to the older small coffee cups and not the modern larger mugs. On the other hand, the larger cup felt slightly too big and almost like a deep plate. One user explained that he would normally only carry the larger cup and use

it as both cup and plate. One size consideration that was raised in particular was that a cup of "Varma Koppen", a very common Swedish brand of warm drinks, does not fit inside.

> *My function-fetish loves it, but looking at it from a purely aesthetic point of view it is ugly* ("Workshop", 2016)
>
> *I appreciate items that feels soft, they feel durable and that they won't break when packed* ("Workshop", 2016)

Aesthetically wise several users stated that the cup lacked a form intention and the cup was seen as quite boring when unfolded. In particular the handle and the opening that gets slightly deformed because of the folding received some criticism. The users did however like the fact that it folds down as this allowed them to store the cup separate from the box and keep it easy accessible.

3.1.3.3 Spork

The spork is Wildo's newest product and marks a shift in both form language and surface complexity. The older products are characterized by simple surfaces and detailing. Many of the features are also symmetric and with a static impression. The spork on the other hand has taken use of modern construction techniques like advanced CAD, different surface finishes and more dynamic shapes.

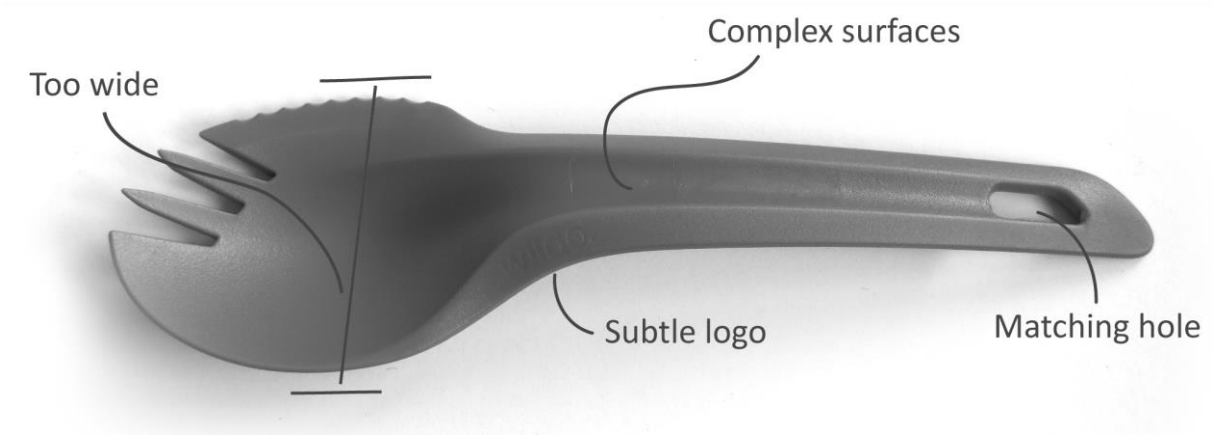


Figure 18 Spork detailing

The handle is built from three different surfaces, giving both extra strength and rigidity to the construction. The lines and surfaces have a 3D-span/double curvature making them more interesting and appealing compared to the flat surfaces of the older products. The hole for the keeper cord also differs from the older products. Here, it follows the shape of the surfaces rather than simply being round.

The surface finish also differs between the surfaces. Overall the spork features a matt surface that both hides scratches and makes it easier to extract from the molding tool. Since the logo does not stick out and instead only features a shiny surface it has a very subtle and minimalistic appearance.

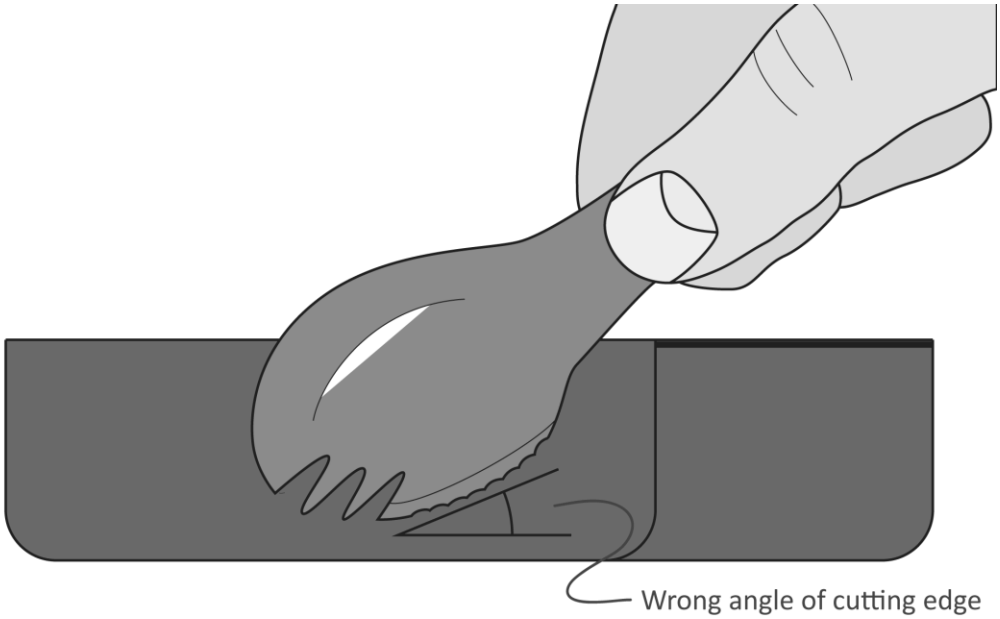


Figure 19 Wrong angle of cutting edge on spork

However, in the user tests the spork has proven to be too wide for people with small mouths. Some users even expressed concerns using it because they were afraid that the cutting edge on the side might hurt them. Another problem with the cutting surface is the angle of it. When used inside the Camp-A-Box it must be angled in such a way that the edge isn't pointed down because of the deep sides.

3.1.3.4 Shaker

The spice jar included in the set have space for three different spices but with a much larger compartment for one. The semi-see-through plastic used in the body allows the users to see which spice is in which compartment.

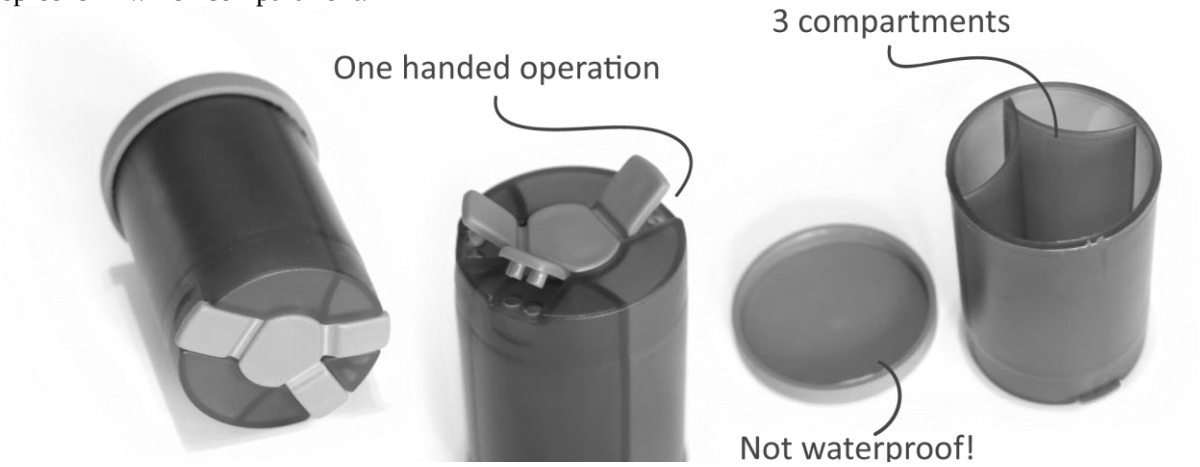


Figure 20 Wildo Shaker

A large lid that can be completely taken of in one end is supposed to aid filling off the jar but in real use it is still very hard to get the spices into the right compartment without the help of a funnel. The smaller openings in the other end meant for distributing the spices during cooking is also quite problematic in the sense that the holes are too small for herbs or flakes. It can however be opened one handed, a good feature for users eating outdoors who might be holding the plate in one hand.

> *"For normal spices like salt and pepper it worked fine, but it was really difficult to fill it with larger flakes or when filling from a can with a big opening"* ("Workshop", 2016)
>
> *"Different sized compartments are good, but they don't need be have this big difference".* ("Workshop", 2016)

The box is not waterproof, an issue brought up by many users during the workshop and interviews. If it is used during rain or stored together with wet gear many users voiced concerns that it would ruin their spices and render the item useless.

A majority of the users also requested more compartments so more spices could be used; one larger compartment for salt and then several smaller for other spices such as pepper, chili, herbs and/or cinnamon. The volume was also seen as too large, smaller compartments would mean that a similar overall sized box could be obtained but with the added functionality of more spice options.

3.1.3.5 Cutting board

The cutting board included in the Camp-A-Box set is a sturdy, quite heavy piece of plastic that also serves double duty as a strainer for pasta or other things that need rinsing. It is very simple and is designed to be stored in the lid on top of everything else when the box is packed together.

Figure 21 Wildo cutting board

As a cutting plate, it works well except that due to its dark color scratches and cuts are very visible compared to white cutting boards. Some users also stated that it felt unnecessary to have a separate cutting board as one of the boxes could be used instead.

Figure 22 Cutting board strainer test

During the workshop tests several users stated that they felt it was easy to lose the grip and spill out all contents of the pot when the plate is used as a strainer, the angle that was obtained due to the position of the holes was not considered as optimal or ergonomically correct.

3.1.4 Usability tests of cutlery

During the workshops performed several different outdoor eating cutlery sets were tested and evaluated. During this evaluation 11 different competitor outdoor cutlery sets were tested and compared to one normal cutlery set and Wildo's current spork (Figure 23).

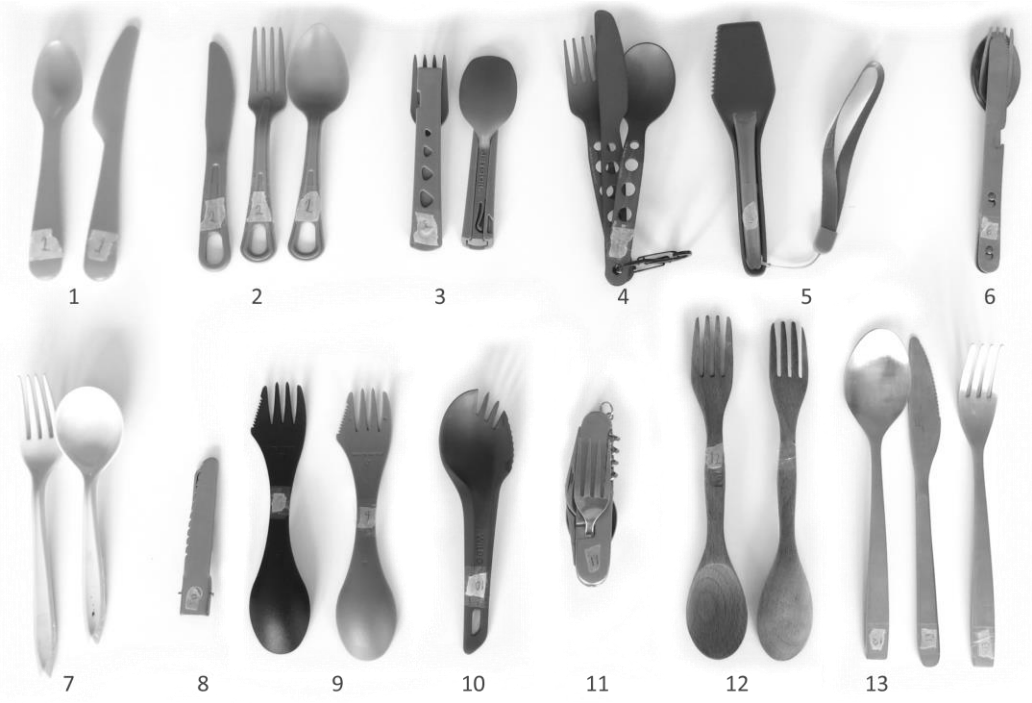


Figure 23 Cutlery usability test items

Several of the tools tested differed from the traditional fork, knife and spoon setup that has become the standard in the western world for normal eating. Instead, many of the tools tried to target the outdoor need for a simpler setup were graciousness and manner is less desirable and simplicity, packability and a "all-in-one tool" are more needed.

In some cases, the manufacturers have succeeded, for example in the set from Four Season (Nr 5 in Figure 23) where a spatula have been included. This was very welcomed by many users when they were cooking the food. However, as soon as they started to eat the spatula was of little use and the included spoon was considered as too small. Another approach, taken by Light My Fire (Nr 9) and Wildo (Nr 10) is to include all three functions into one tool, a spork. This leads to some compromise in the functionality and performance of each function and in the Light My Fires case also that the handle is compromised strength wise. The upside is a significantly lighter eating tool and that the user has all function available without having to use both hands, a very welcome function when the user has to hold the plate as well.

Some of the tools also included a mechanism or extra part that allowed them to be shortened or folded to make them pack down smaller. This was seen as a welcome extra functionality during the evaluation but several users also expressed concerns with weak constructions breaking in the field or if extra loose parts (such as carabiners) getting lost. Strong construction with a minimum of loose or moving parts were clearly expressed as a favorable approach by users.

Another point that differed among the tested tools were the knife edge. Many of the tested tools lacked a sharp edge altogether even if they through their looks implied they had one. Although metal tools clearly can be sharpened and keep their edge longer than plastic several of the plastic tools performed

better than their metal counter parts. When examined why, serrated sharp edges were found to be the shared reason.

For a short review of each set see Appendix 6.1.

3.1.5 Surface finish tests

In order to determine the best suitable surface finish for the products two tests were done on different surfaces finishes, the shiny blank surface currently used by Wildo on the inside of their products and the textured finish currently used on the outside.

3.1.5.1 Wash test

This test was done primarily to see which of the two surface finishes that is easiest to clean from grease while in the outdoors. When asked, most the users responded that they normally only wipe their cookware clean with some grass, sand or simply just rinse them clean. Some users even expressed that they would only buy products with blank surfaces because they were easier to wipe clean.

These methods are not very effective and against grease in particular. Selecting the best surface would therefore make it easier for the users to clean their equipment.

The test was done with bacon grease as this represents a worst-case kind of scenario because the grease is not water soluble and hardens when it cools down. As warm water and soap are not always used in the outdoors to wash up dishes three different ways of cleaning the plates were applied. Warm water and soap, cold water and soap, and wiping them clean with toilet paper.

Figure 24 Wash test

The result from the test shows clearly that the textured surface was better, less grease was left and the perceived cleanliness of the surface was much higher since the grease was not as visible in reflections from lights. The only case where the shiny surface was just as good was when it was wiped clean with toilet paper.

3.1.5.2 Scratch test

Both the shiny and the matte surface were subjected to a scratch test with both a plastic and a metal knife. This was done to see how the surface finishes stand up to wear from using.

As can be seen in Figure 25 the result from the test shows a similar result for both surfaces. With the metal knife both surfaces suffered damage much beyond the surface finish itself and yielded a similar result. With the plastic cutting tool the shiny surface got matter and the textured surface finish was flattened out, although hard to deduct from the pictures the shiny surface showed slightly less visible wear but this was highly dependent on the reflections from the light on the surface.

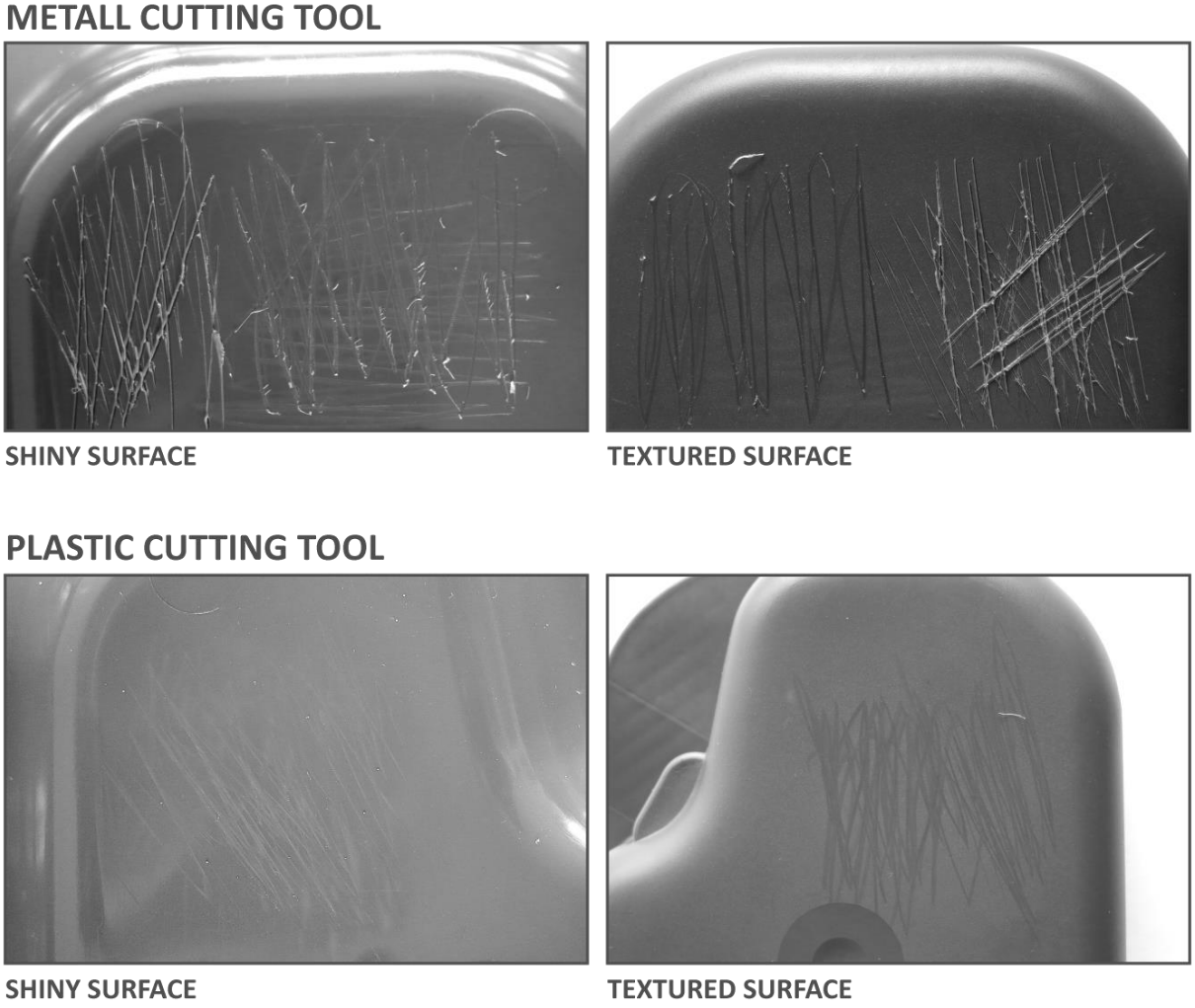


Figure 25 Scratch test

3.1.5.3 Conclusion of surface finish tests

The result from the tests showed that both the surfaces finishes have strengths and weaknesses and no clear winner could be found.

While the blank finish did not handle the grease so well the mechanical damage was less visible unless the light shined in a particular way but the difference for the mechanical wear was less than that of the grease test and therefore the textured finish can be said to be the better finish. However, this must also be weighted against the opinions of the customers in order to create products that not only function great but also sell. As several users expressed that they would specifically look for poroducts with blank surfaces to aid in cleaning this gives a strong preference for using the current configuration that Wildo uses with a blank inner and a textured outer. One options would however be to market the textured surfaceas easier to clean in the field and through that create a selling point for the new products.

3.1.6 Personas and use scenarios

In order to gather the different users perspective found during the pre-study two different personas were created complete with a use scenario highlighting some of the problems that the suers expressed they had experienced during their outings. These personas were later used to evaluate the ideas and products to make sure that they would be equally compared on the same foundation.

3.1.6.1 The Andersson-family

Anna, 36. Police

Per, 35. Nurse

Alma, 4. *Wilhelm*, 6. *Ted*, 7.

Figure 26 Persona: The Andersson family

Before Anna and Per got children, they traveled all over the world to hike long-distance hiking trails, but with children along this has gotten harder to do. Instead they try to get out every other weekend to hike around Gothenburg together with their three children. But as both Anna and Per works shifts they have a hard time to find the time together. Therefore, every minute counts when it comes to preparation and cleaning after a trip. With three kids around that needs attention this gets even harder. To help with this they have a dedicated book shelf with all the hiking equipment in their basement where they organize everything they need for a weekend out with the kids.

In addition to their own stuff, they also have to carry most of the children's items, this means that pack weight and size of their equipment is very important to them. Things that fit together or have sleek shapes get an immediate plus in their book.

Use scenario

It is Easter and the family plans to hike on Bohusleden for a few days, they have managed to get the entire long weekend of and plan to take the train up to Munkedal and start there as soon as Anna gets of work on Thursday night. As Per got the whole day of he is in charge of packing. In the morning, he goes out to buy food. The two oldest kids refuse to eat freeze-dried meals so he buys food from the grocery store. Freeze-dried meals are too expensive as well he thinks for all five of them.

At twelve the kindergarten closes and he picks up the children and then goes home to pack everything. As he is packing he has to both manage the kids and make sure that everything they need get packed.

Once out on the trail they try to also get the kids involved in the camp chores, this makes it a bit messier to cock and the kids tend to run away with things. After they have eaten one of the parents heats a little bit of water and cleans all the dishes before packing everything up again and trying to squeeze it in into their already full backpacks.

3.1.6.2 Peter, 47. Fly-fisher

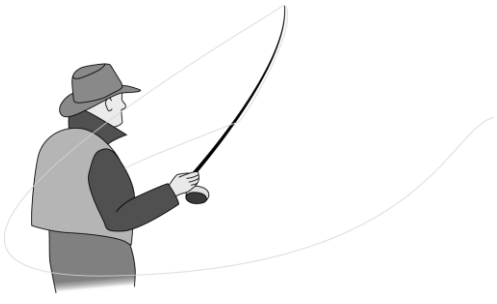


Figure 27 Persona: Peter

Peter grew up in Vilhelmina in northern Sweden and spent a lot of time in his youth fishing and hunting in the forests and mountains around is home village. Now, he lives just outside Göteborg and commutes to town every day.

He works as a technician at a company that manufacturers security cameras and travels all over Europe to service and install their products. While he has to wear work cloth when he is at work he exclusively used outdoor lifestyle clothes from

Fjällräven and Lundhags on his spare time. For him, this is a way to connect to his fishing interest but also to not lose an identity. Erik spends a lot of time online, looking at new gear and reading reviews. While he likes new and better gear, preferably that with a little bit of “gadget” status to them he still thinks a lot of the new gear is over-engineered and made too cheaply.

Every summer he travels up to northern Sweden at least two times to go fishing in the mountains. In addition, he spends several weekends at small forest lakes and streams closer to home. Having fished his whole life, he has tried several different fishing techniques but now primarily uses a fly-fishing rod since he has grown a bit tired of the more tech-heavy normal spinning rods.

Use scenario

At the end of July Peter takes the night train from Gothenburg up to Umeå, here he transfers to a bus that will take him up to Hemavan, a small mountain village close to the Norwegian border. From here he will have to hike for two days to get to the small valley where he will spend the next two weeks.

As he will set up camp and remain there for 10 days Peter has decided to carry a bit of extra gear this time to make camp life a bit more comfortable. A larger tent, a collapsible chair, a better stove, some whiskey and fresh food. He plans to eat a lot of the fish he catches but still buys some smoked reindeer meat in Hemavan to compliment his diet.

On the train, Peter buys some dinner and brings it back to his compartment. Unfortunately, he breaks the cheap single-use knife that came with it. He briefly considers digging out his Mora knife to eat with as his spork does not have a very good cutting edge, but since the other passengers does not look very outdoorsy he hesitates and goes back to the restaurant wagon to get a new one.

Once in the valley he sets up his tent and arranges a camp with a small fire next to a creek. He manages to catch quite a bit of fish that be barbeques. But as it is raining quite a bit he is forced to prepare the fish in the rain a couple of times. This is quite problematic for him as the breadcrumbs and flour he has brought with him gets wet and soggy.

His dishes also get quite greasy from the fat fish, normally he has been able to clean his pots and pans with just some sand or moss but this time he decides to use some toilet paper instead to wipe them clean from the grease.

3.1.7 Sustainability

An important part of the pre-study was to investigate possibilities for improving the sustainability of the product. However, as the materials used was not a part of this project this represented a real challenge. The first part of the sustainability work was to analyze the current Camp-A-Box set and how it affects the environment today. This was done through a Life Cycle Assessment where each step in a product’s life is listed and its emissions and effect calculated (White, St. Pierre and Belletire, 2013). This step was done through the online tool Life Cycle Designer from Product Ecology and the result can be found in Figure 28 ("Product Ecology", 2016).

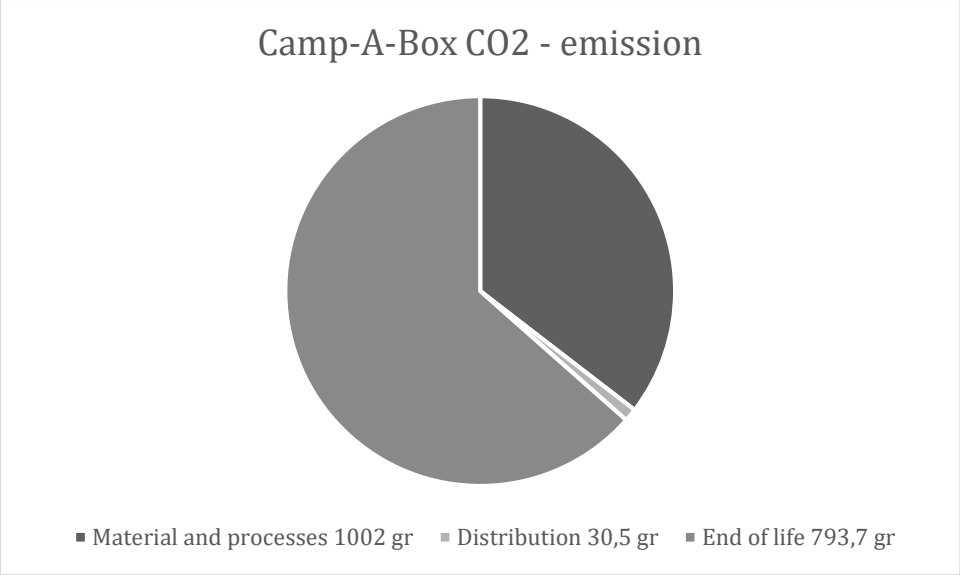


Figure 28 CO_2-emission for Camp-A-Box

As the Camp-A-Box and its content do not use any fuel or other consumables themselves during use it would be easy to categorize them as passive products and assume that their total effect on the environment is limited to raw material, production and its end of life. However, in reality the situation is far more complex. When it is used the user first takes the kit in a car, by train or plane out in nature, then the user carries the product with him, washes it and finally takes it back home. If this also is included in the LCA the situation is very different.

To calculate the extra emissions from the travel, the second persona (see 3.1.6.2) was used. If he keeps the set for 5 years and during that time go on average 10 trips every year the result will instead be according to Figure 29.

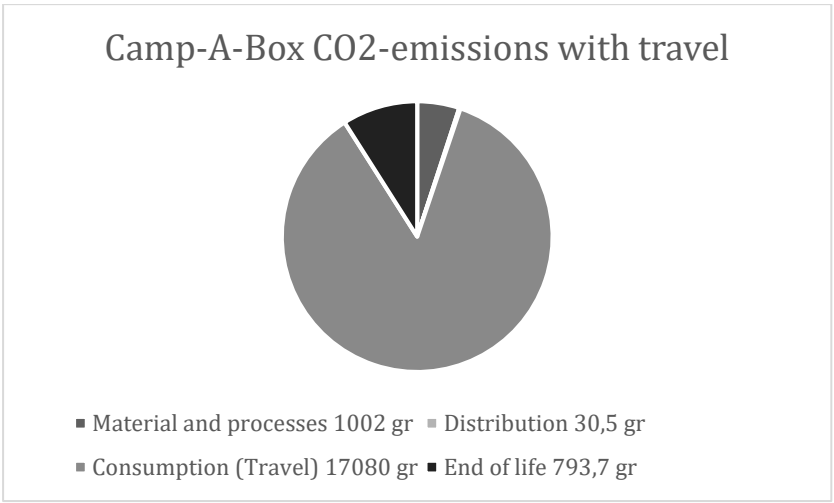


Figure 29 CO_2-emissions for Camp-A-Box with travel included

As can then be seen, the emissions from travels during use greatly overcast those from production. These emissions come from the energy needed to accelerate and lift the transportation vehicle used with the Camp-A-Box inside since the product does not effect the aerodynamics of the transportation vehicle. This means that reducing the weight of the Camp-A-Box will directly translate to a reduction in those emissions.

The second step in the initial sustainability analysis was to develop a set of guidelines for the development process. To create these guidelines, the findings from the LCA together with the ECO Strategy Wheel were used as inspiration. In the ECO Strategy Wheel 10 different approaches with

several suggestions for each approach are given to help develop more sustainable and environmentally friendly products. While several of these concern the material selection and production process which falls outside of the scope of this project they were still used as an inspiration for the guidelines in order to make sure that no harmful side effects would be introduced.

The guide lines created were:

- Reduce the weight through stiff and strong construction – this will affect both the amount of raw material needed and the associated production emissions but also the emissions from travels during use.
- Change material where possible to other materials that Wildo currently use and that is better for the environment.
- Use designs that will promote less waste of food or other consumables during use.
- Minimize the number of different materials used in the same product to make the product easier to recycle.
- Create products that will work well both together as a set but that can also be used on their own to lessen the need for the users to buy similar products for different scenarios and through that make sure that the products are used for their full life time before they are replaced by newer and better products.

3.1.8 Ergonomics: Shape and size

During the initial evaluation of the different competitors' products several users commented that some of the tools felt unnatural or had the wrong shape or size. In order to get a better understanding of what shape and sizes that were most appreciated two different sets of tools were created.

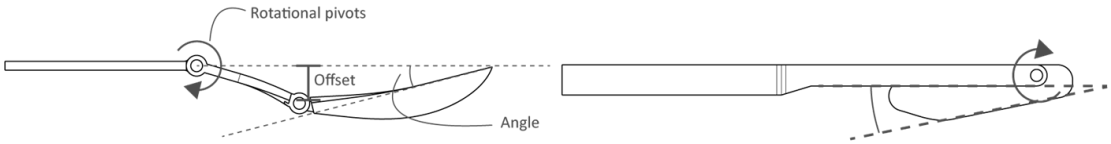


Figure 30 Angle testing tools

The first was a spoon with an adjustable handle that was used to investigate how different angles and offsets of the scoop versus the handles translated into real world feel and use. The second was a knife with an adjustable angle of the cutting blade to was used to find a correct angle of the cutting blade for use inside the rather deep Camp-A-Box.

Figure 31 Size and ergonomics tools

In addition, three sizes of different widths were created for each of the spoon and fork. These prototypes were then used in a short user tests where the participants tried the prototypes and decided on their favorites.

The result of that test can be found in where each color represents one of the user's preferences.

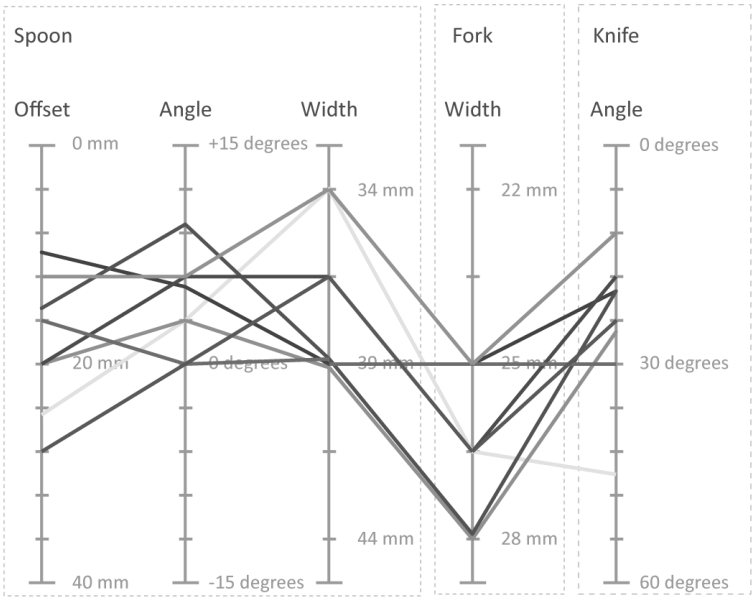


Figure 32 Result of size and ergonomics tests

As can be seen in the results, there is a correlation between the different measurements for the users as well as the result for each single measurements. But the variation for each measurement was still large enough that a single size could not be determined from the test. Instead, the result was used as a foundation for the construction and prototyping work for the final product.

3.2 Development

After the pre-study was done the project moved to the next phase, the development phase where the cutlery set and the Camp-A-Box was developed based on the findings from the pre-study.

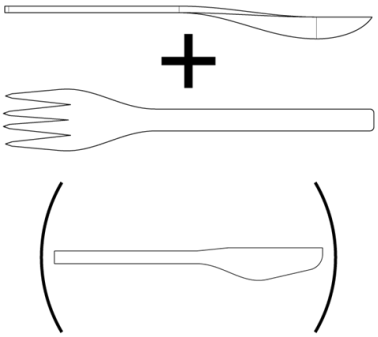
3.2.1 Cutlery set

In the initial project request from Wildo two different functions for the cutlery set were stated; that they should be connectable for storage and be extendable for stirring or eating. This required some kind of mechanism for the cutlery set which to a large extent would define it. In addition several other needs and wishes were found during the pre-study. The most important ones can be found in Figure 33 and Figure 34 and the complete list in Table 3.

Figure 33 Requirements

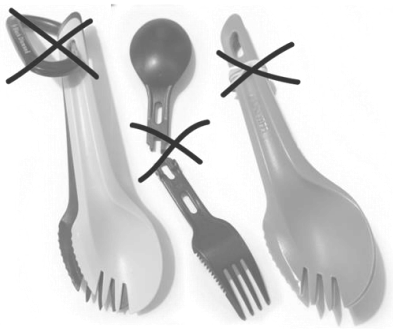
Connectable/extendable

It should be possible to connect the cutleries together to form a longer tool to make it easier to eat from deep freeze-dried pouches.



Fork + Spoon

Preferable it should be possible to connect any of the cutleries together but two of them are acceptable.



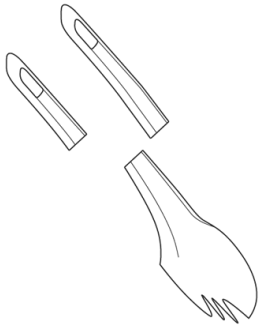
Joinable with no small or loose parts

The cutlery set will be used in the rough outdoors. Small parts or loose extra items will break or get lost.

Figure 34 Requirements 2

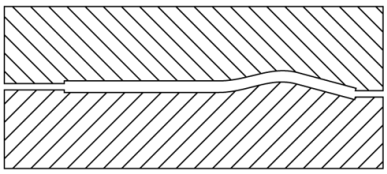
Fit inside the current Camp-A-box

The set should fit inside the current Camp-A-Box for ease of storage.



Longer version

It should be possible to manufacture a longer version through switching out a part of the mold.



Two piece mold

Preferable it should be possible to manufacture the cutlery in a two-piece mold to keep production costs down.

Table 3 Cutlery set requirement list

	Cutlery set			
No.	**Wish/Requirement**	**Requirement**	**Target**	**Comment**
3.1	Req.	Size and shape should match the users preferences		Shape and size according to the ergonomic test
3.2	Req.	Extendable through insert in mold		To create a longer set sold separately
3.3	Wish.	Extendable through connecting together	Any pieces	
3.4	Req.	Extendable through connecting together	Fork + Spoon	
3.5	Req.	Possibility to connect for storage without extra parts		
3.6	Req.	Fit inside old Camp-A-Box		
3.7	Req.	Fit inside new Camp-A-Box		
3.8	Req.	Match Wildo's new design style		
	Req.	No small parts that can snap off		
	Req.	Manufactured through injection molding	2-piece mold preferred	

3.2.1.1 Attachment method

One of the main functions for the cutlery set is that it should be possible to both connect the set together to make storage and transportation easier and more secure but also to connect at least the spoon and fork together to create a longer eating tool. The connecting mechanism needs to be able to handle forces and bending moments in several directions. The main forces is visualized in Figure 35.

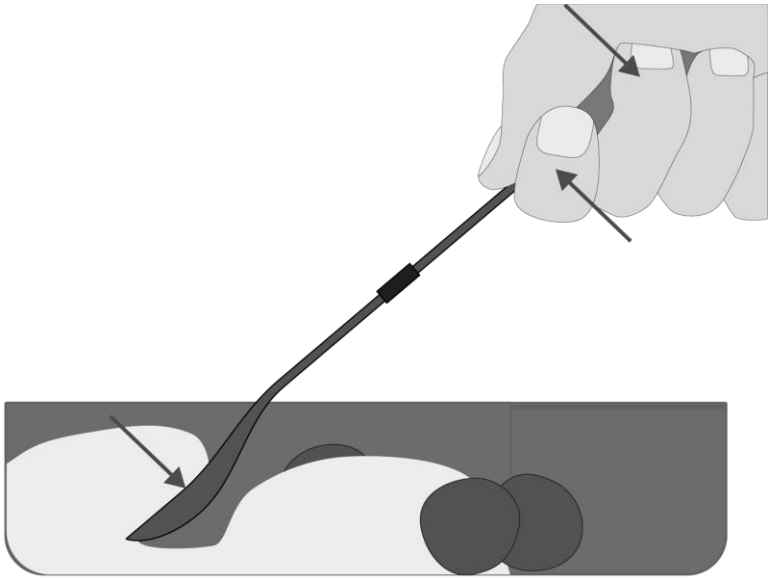


Figure 35 Visualization of the forces involved when eating with the connected cutlery

This will result in two counterforces from the hand that will result in a bending moment that will be quite high where the connecting mechanism is positioned. In addition, the cutlery must handle smaller sideways and longitudal forces. If a knife is connected instead of the spoon or fork a much higher sideways force will be created as a result from the different angle of the knife edge compared to the fork or spoon.

A large number of different connection methods were ideated through brainstorming and through drawing inspiration from other products were similar functions are found. Examples of some of the ideas can be seen in Figure 36.

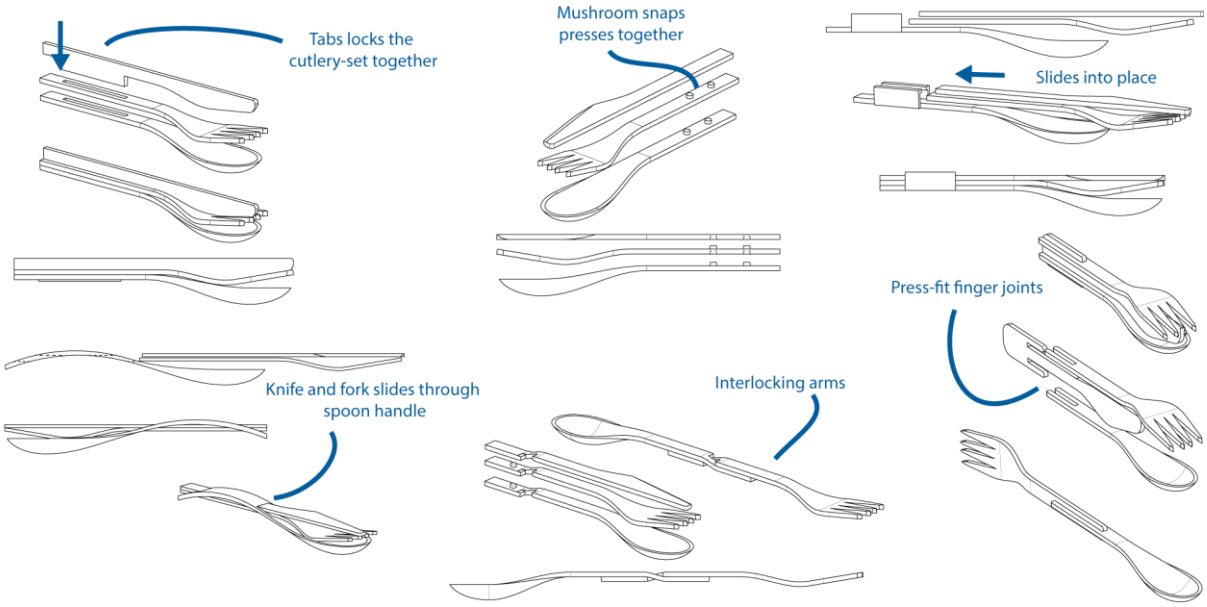


Figure 36 Examples of connecting mechanisms

The ideas were evaluated based on their perceived stability, ease of use and strength. The best ideas were then selected and developed further. Samples were 3D-printed to get a physical product that could be evaluated and the function validated. The physical prototypes then raised a number of questions regarding if they could actually be made to fit into the tight space available in the Camp-A-Box. It was therefore decided that a concept would be created based on the best ideas and that these would be developed on a detailed level to fit inside the Camp-A-Box to be able to evaluate them properly.

3.2.1.2 Conceptualization

The best ideas for the attachment method were selected and developed further into finished concepts.

3.2.1.2.1 Concept 1 – Finger Joints

In the first concept the spoon and fork has long cut outs in the ends that are used to slide them into each other to create a secure and strong lock. To store the kit, the knife features similar cut-outs that are used to keep the whole kit together. The initial concept can be seen in Figure 37.

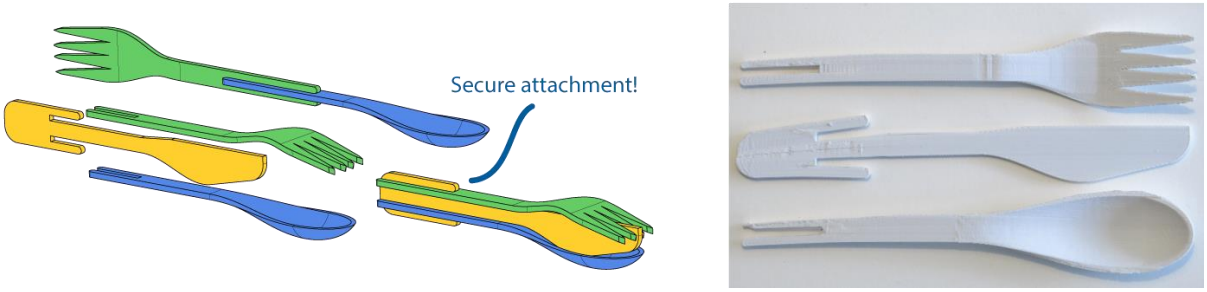


Figure 37 Concept 1 – Finger joint at an early stage

The concept were then developed so that it would fit inside the Camp-A-Box and with a style resembling that of the current spork. The final concept can be seen in Figure 38 and Figure 39.

Figure 38 Concept 1

Figure 39 Concept 1 - Finger Joints

The concept is intuiative and easy to understand for a first time user and can be designed with a size and shape that relatively closely follows the values gained from the ergonomics study except for the fork thas has to be made with a “flat” shape. However, it can only be made very short in order to fit inside the Camp-A-Box because of the limited space available.

Summary in pros and cons:

+Secure and strong extension	-Very short, 137 mm
+Good Ergonomics	- “Flat” fork
+Easy to understand and use	

3.2.1.2.2 Concept 2 – The Lego set

The second solution draws inspiration from Lego bricks press fit and uses button to press lock the pieces together for storage and extension. To increase the strength and stiffness when it is extended it also uses two z-shaped arms that interlocks the two tools together.

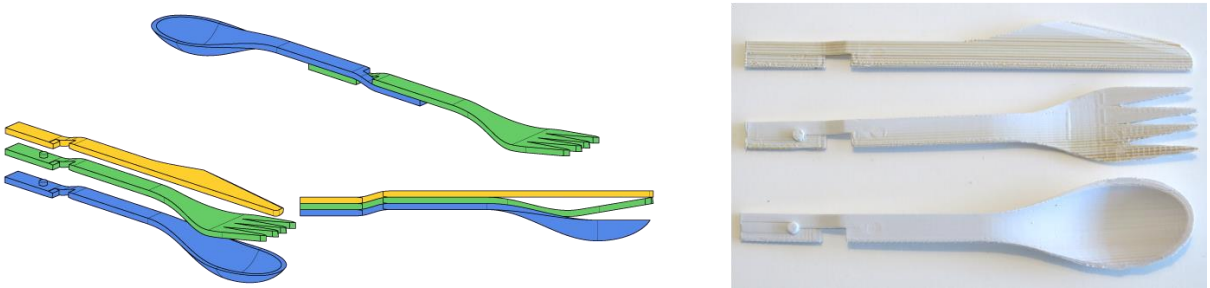


Figure 40 Attachment method 2 "Lego"

From the initial idea the concept was developed in a similar way as the first concept with a style resembling Wildo's current Spork and made to fit inside the Camp-A-Box. The final concept can be seen in Figure 41 and Figure 42.

Figure 41 Concept 2 Lego

The second concept's handle can be made much longer than the first concept and still fit inside the Camp-A-Box which will make it easier to eat with. The shape and size of the fork, spoon and knife end can also be designed with measurements very close to those from the ergonomics study. However, the extension function is both slightly less stiff and is less intuitative to understand and use.

Figure 42 Concept 2

Summary in pros and cons:

+ Good ergonomics	-Slightly less stiff
+ Secure and strong extension	-Slightly harder to understand the extension function
+ Good length, 152 mm	-Storage function might be less secure
+Very easy to use storage function	

3.2.1.2.3 Concept 3 – The hole

In this concept the fork and knife is threaded through two holes in the spoon. To extend the cutlery, the fork is simply inserted the other way around.

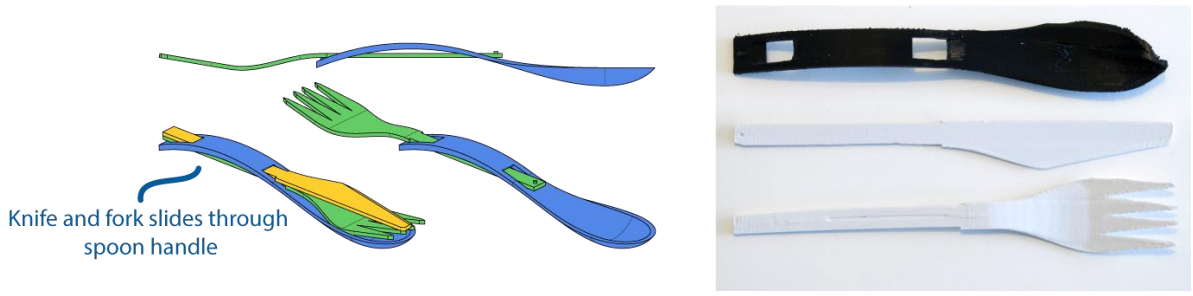


Figure 43 Attachment method 3 "The hole"

The fully developed concept can be seen in Figure 44 and Figure 45. The fork and the knife is given two different widths as is the hole in the spoon. This gives the fork a tight fit when the set is extended.

The concept can be made with a long handle and still fit inside the Camp-A-Box but the fork has to be given a very flat shape as it has to be positioned on top of the knife for the extension mechanism to work.

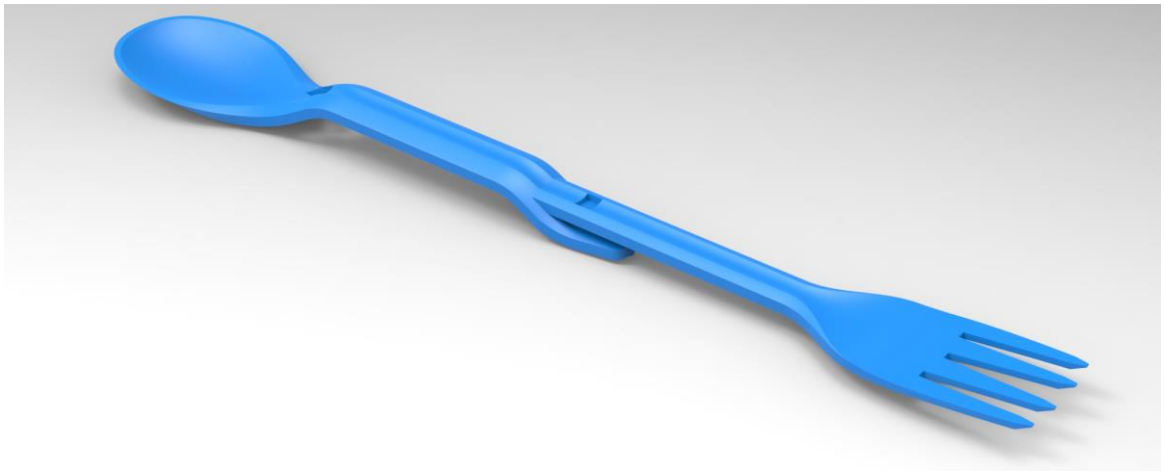


Figure 44 Concept 3

Figure 45 The Hole

Summary in pros and cons:

+ Very good length, 155mm
+ Easy to understand the storage function

-Less secure/stiff connection
-Very flat fork
-Not possible to extend with the knife

3.2.1.2.4 Concept 4 –The Hole 2.0

The last concept is a different version of Concept 3. Again, the fork and knife are threaded through the spoon for storage but here the spoon completely encapsulates the fork's and knife's handles when it is stored. To extend it, the fork or knife can be threaded through the spoon in a slightly tapered hole in the end. This will require a more complicated mold with a moving piece to create that hole. However, as it is very small and the spoon will be quite flexible due to its length it should be possible to pull it out from the mold with relatively little force.

This concept can be made with both a long handle and with shapes and sizes of the eating ends that closely matches the result from the ergonomics study. The function will be relatively easy to understand and use but the manufacturing cost will be higher due to the more complicated mold that is needed to manufacture the concept.

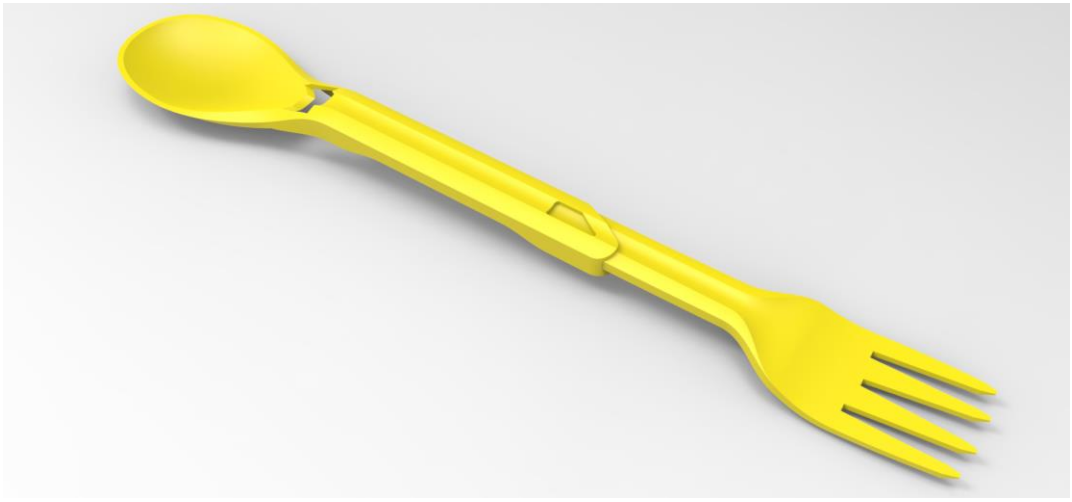


Figure 46 Concept 4

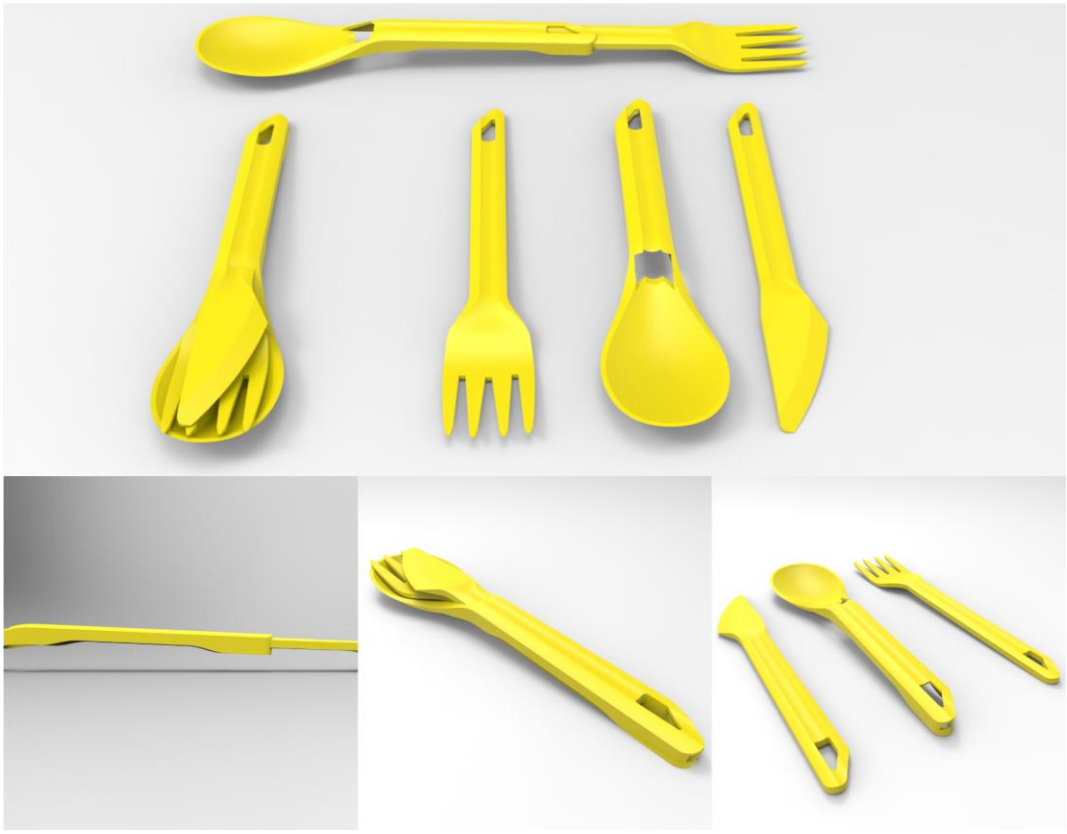


Figure 47 The Hole 2.0

Summary in pros and cons:

+ Very good length, 155mm
+ Easy to understand the storage

-Less secure/stiff connection
-Very flat fork
-More expensive to manufacture thanks to the complicated mold

3.2.1.3 Evaluation

With all cutlery concepts styles completed they were evaluated on their estimated performance. This was done both through presenting the concepts to a group potential users, through evaluation of the concepts mechanical properties and through a presentation to Wildo.

Figure 48 Comparison of cutlery concepts

During the evaluation with Wildo and the user groups the concepts were presented and discussed from a number of perspectives including but not limited to how easy they would be to use, the aesthetics and how the short length of some of the concepts would affect real world use. In addition a few technical aspects such as the strength of the cutlery set was evaluated with the help of the CAD-models or the production cost based on estimated tooling costs.

To summarize the evaluation a Pugh decision matrix were used where the concepts were graded according different criteria and the concepts scores were calculated. As not all the criteria are of the same importance to the finished product's performance they were also ranked differently. Each concept therefore got two different total scores, the first where each criteria contributes the same to the total score and the second is where the criteria score is multiplied with the ranking before being summed up.

Table 4 Pugh matrix evaluation of cutlery concepts

		Finger Joints	Lego	The Hole	The Hole 2.0
	Ranking	Score			
Strength	4	5	4	3	3
Connection streng	5	4	3	3	5
Ease of use	5	4	3	4	4
Length	4	1	4	5	5
Ergonomics	3	5	5	3	3
Cost	4	4	4	3	1
Aesthetics	4	2	4	3	4
Total Score		**25**	**27**	**24**	**25**
Total Score with ranking		**87**	**93**	**88**	**102**

In both summaries of the evaluation The Hole 2.0 concept got the highest score, much thanks to its high strength and secure attachment method. Therefore it was selected for further development.

3.2.2 Camp-A-Box

The second set developed was the Camp-A-Box kit. During the user study and the product evaluation it was discovered that some of the products were working better and were more liked than others by the users and other stakeholders in the project. For example the Fold-A-Cup was generally seen as a very smart and clever product and others, like the Spice jar received a lot more criticism. Because of this it was decided to focus the development on those products which had the best improvement potential.

3.2.2.1 Requirements and guidelines

The needs and wishes found during the pre-study for the comple set and each product were summorised into a requirement list (Table 5). In addition, a number of general points were found that were used as guidelines for the development work.

- Reduction – The current version of the Camp-A-Box kit contains two Fold-A-Cup's and two halves of the box. This was seen as an excess by many users. Reducing this but keeping the functionality would improve the product
- Storage – Having a logical and well thought out way of storing the contents together will improve the quality feeling and usability of the product
- Better food space – Improving the food space will increase sustainability by letting less food go to waste
- Size – The current Camp-A-Box was seen as slightly too small, both by Wildo and by users. Scaling it up slightly will allow longer cutleries to be used and a full meal to be loaded.

Table 5 Complete set requirement list

1.	**The complete set**			
No.	**Wish/Requirement**	**Requirement**	**Target**	**Comment**
1.1	Req.	Match Wildo's new design style		
1.2	Req.	Pack everything together without any extra parts		
1.3	Wish	Include everything needed for a meal for one person except stove and pot		
1.4	Req.	Wildo logo printed or engraved		
1.5	Req.	Include space for print of customer logo or text		
2.	Camp-A-Box			
No.	**Wish/Req.**	**Requirement**	**Target**	**Comment**
2.1	Requirement	Match Wildo's new design style		
2.2	Requirement	Handle		
2.3	Wish	Stackable bottom		
2.4	Wish	Locking tabs/mechanism without loose parts		
2.5	Wish	Streamlined shape		To facilitate easy sliding down into bags
2.6	Req.	Pack everything together without any extra parts		
2.7	Req.	Include space for print of customer logo or text		
2.8	Req.	Steep edges to keep food inside		
2.9	Wish	Larger space		Too small today

3.	Fold-A-Cup			
No.	**Wish/Req.**	**Requirement**	**Target**	**Comment**
3.1	Wish	Small size fit “Varma koppen”	>2.5 dl	With enough space to avoid spillage
3.2	Requirement	Fit inside new Camp-A-Box		
3.3	Requirement	Feature volume markings	Both dl and oz.	
3.4	Requirement	Match Wildo’s new design style		
3.5	Wish	No deformation marks in the plastic		
3.6	Requirement	Finger support in handle		To get a good grip when folding it up
4.	Cutting board			
No.	**Wish/Req.**	**Requirement**	**Target**	**Comment**
4.1	Requirement	Match Wildo’s new design style		
4.2	Requirement	Draining holes		
4.3	Wish	Solid construction		Easier to cut, but heavier
4.4	Wish	Foldable		
5.	Spice jar			
No.	**Wish/Req.**	**Requirement**	**Target**	**Comment**
5.1	Wish	Waterproof		
5.2	Requirement	Compartments	>4	
5.3	Wish	User customizable number of compartments		
5.4	Requirement	Large opening to fill spices		
5.5	Wish	Different sizes on holes for distribution of spices		To accommodate different sizes of the spices
5.6	Requirement	Match Wildo’s new design style		
5.7	Wish	Smaller compartments	~15 ml	

3.2.2.2 Ideation

The first stage in the devlopment of the Camp-A-Box kit was to ideate a number of solutions to the functions and problems for each of the different products. Examples of ideations sketches can be found in Figure 49 and Figure 50 with shorter descriptive texts below.

Box
The box is the main product in the kit and has the two main functions; to serve as a plate to eat from and to store the contents during transportation. In addition it must have a sleek shape to make it easy to slip into tight spaces when packing a backpack.

The improvement for the box included ergonomic aspects, such as rotating the handle to create a better angle of the box to eat from, exploration of how the shape could be made sleeker to improve the storage or if the box could be made waterproof to enable food transportation aswell.

Fold-A-Cup

The Fold-A-Cup was generally seen as an extremely smart and clever product during the pre-study and several users stated that the folding function absolutely should be kept. As such, the Fold-A-Cup was the product that received the least amount of attention during the development phase

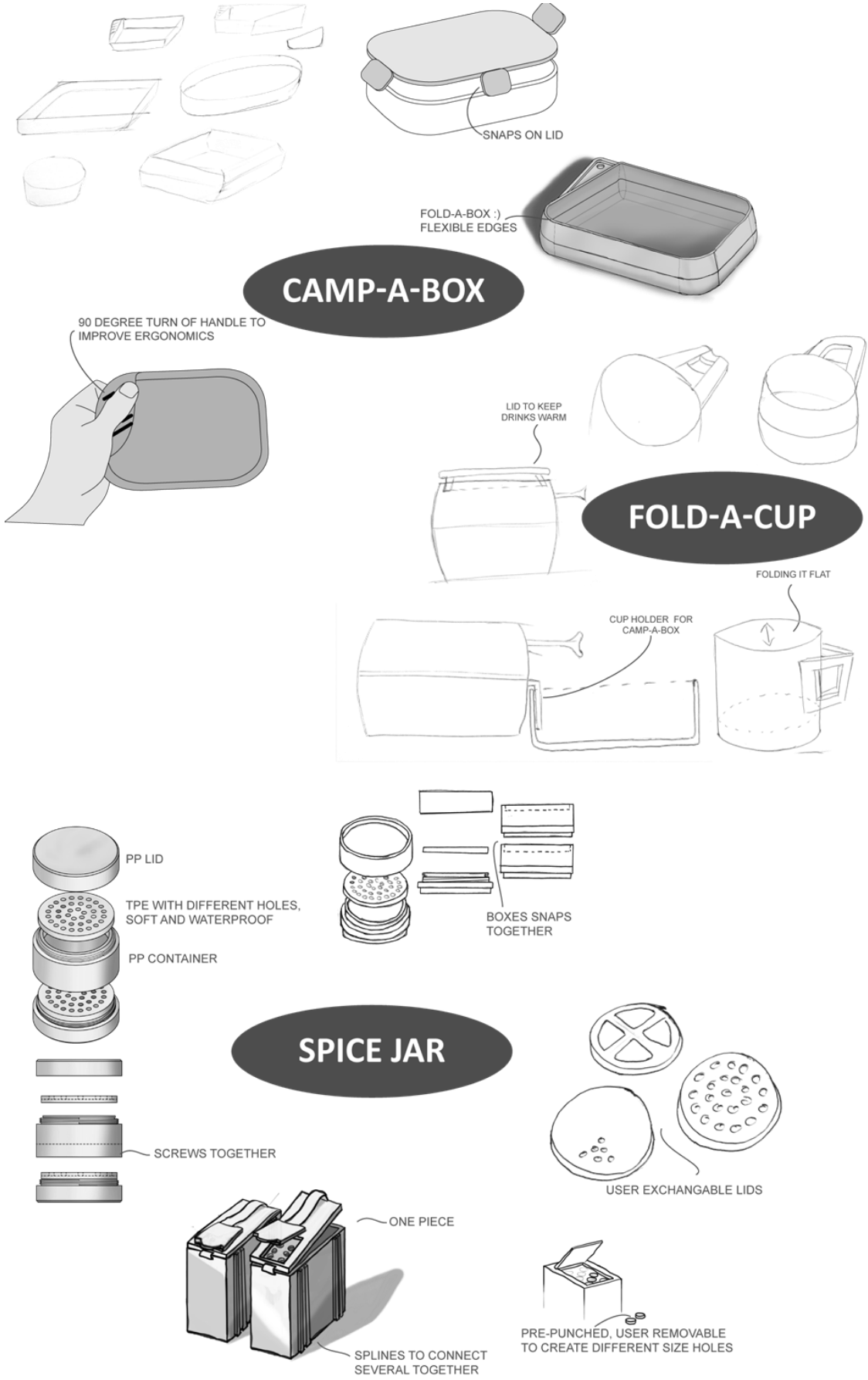


Figure 49 Examples of ideation sketches 1

Cutting board

The extra function of the cutting board as a strainer for pasta was a very welcomed function by several users. However, it was also seen as very heavy when the lid of the Camp-A-Box could be used instead as a cutting board. A few users also expressed fear that they would lose the grip and risk spilling out the pasta. To target these two problems the ideation revolved around how the functionality of the cutting board as a strainer could be improved and how the weight could be reduced.

Shaker

The shaker was the product that received the most criticism both from users, from the technical evaluation and from Wildo. Two areas regarding its function where a lot of the problem were concentrated were that it was tricky to get the spices into the jar when refilling and that the holes for distribution were too small to get flakes or larger herbs out. In addition, several users also requested the possibility to bring more kinds of spices with them and to make it waterproof.

As such, the ideation for the spice jar revolved around making it easier to refill the spices through separating the compartments better, to make it possible to distribute different sizes of spices and ways of making it waterproof.

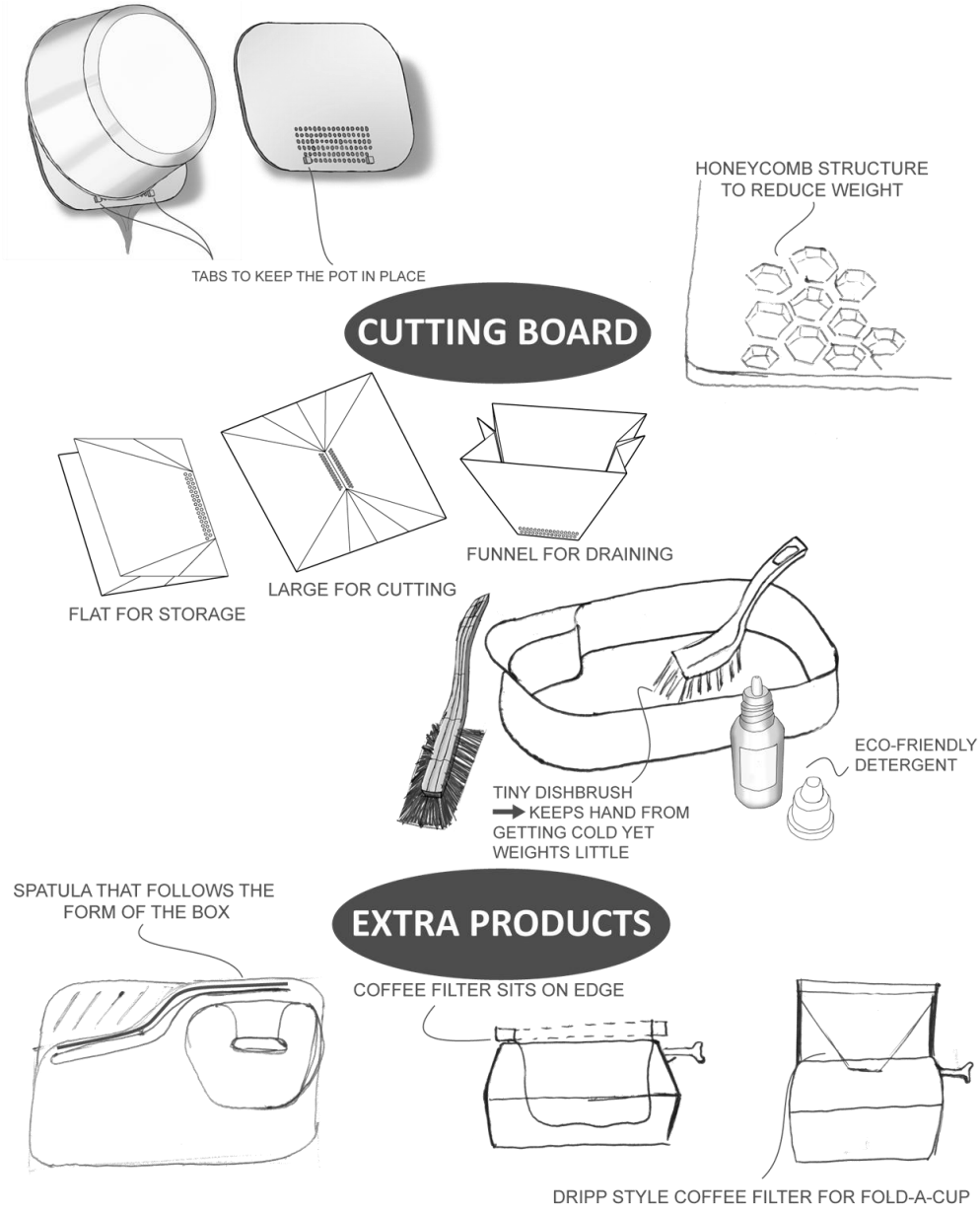


Figure 50 Examples of ideation sketches 2

Extra products

During the pre-study, several users expressed a wish for some new functions or other products that could be a logical part of the complete Camp-A-Box kit and help them when eating outdoors. Some kind of way to brew coffee in a Fold-A-Cup was one of the more common wishes, as was a small bottle to bring oil for frying.

However, many of the suggestions brought up were considered as larger products, complex and worthy of being sold as individual products. Instead, the ideation revolved around finding smaller, simple products that could be a logical addition or supplement to the items already included.

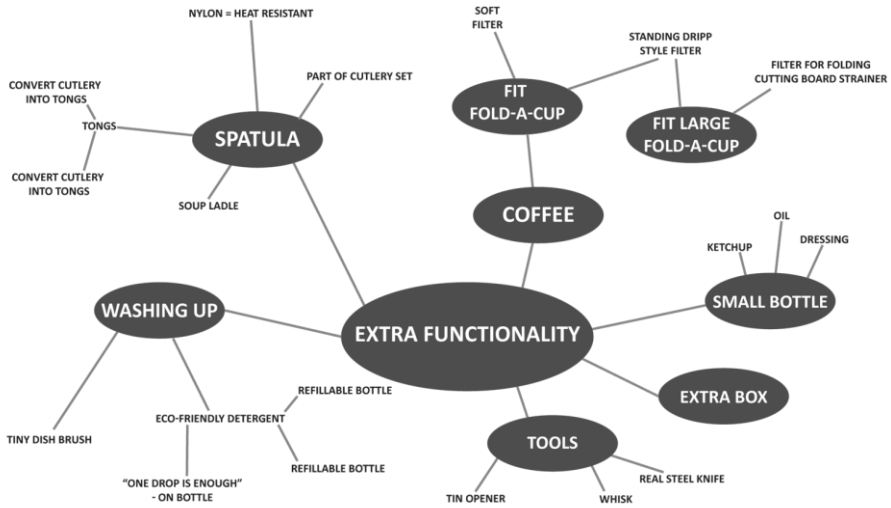


Figure 51 Examples of extra products

The first step was to brainstorm ideas for possible products with the starting point of what kitchen supplies is commonly used at home but lacking in the Camp-A-Box kit. Those ideas seen as most feasible for Wildo and most fitting for the Camp-A-box kit were then further explored.

3.2.2.3 Concept creation

With the ideation stage complete the most promising of the different ideas for the different products were gathered in a morphological matrix to gain a better overview (See Figure 52). From here, three different concepts where created based on those ideas.

Products	**Ideas**								
Spice jar	Separate containers, screws together		Separate compartments lid snaps together		Separate compartments, profile lock on side		Punch out spice openings		
Cutting board	Tabs to lock it against the pot	Foldable board		Board as lid	Three contact points to make it stable		Honeycomb structure to save weight	Folding into standing drainer	
Fold-A-Cup	Fold-It-Flat		Three contact points to make it stable		Medium size		Lid to keep drinks warm		
Camp-A-Box	Folding edges		Move handle to improve ergonomics		Waterproof snap lid		Stackable		
Extra functions	Coffee maker for FAC	Spatula	Dish brush + Detergent bottle	Dish brush with built in detergent bottle	Bottles for liquid	Coffee filter that lays on top of Fold-A-Cup	Box for food	Tongs	Turn cutleries to tongs

Figure 52 Morphological matrix Camp-A-Box

After the concepts were put together they were developed further in CAD to create visualisations that could be compared and evaluated.

3.2.2.3.1 Concept 1 – Green – Waterproof storage

The main idea with this concept was to give the users access to waterproof storage so they can either bring food with them out for shorter outings or to store leftovers while out for longer trips. To do this this concept features a waterproof snap lid, a smaller box, a lid for a single Fold-A-Cup, a set with waterproof spice jars and a spatula to make it easier to cock.

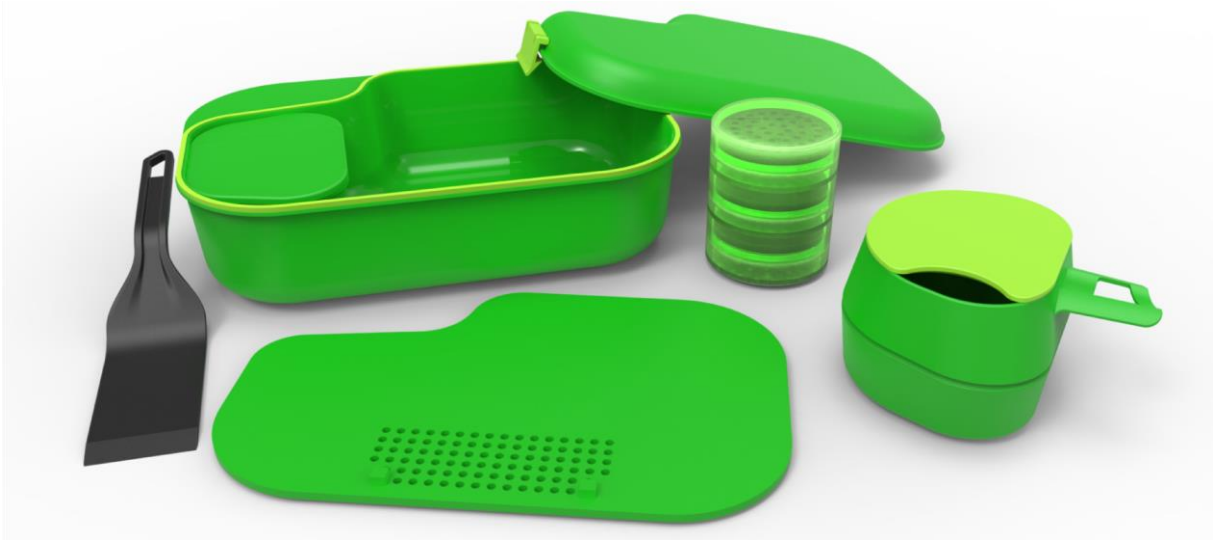


Figure 53 Concept 1: Waterproof box

The incorporation of a waterproof lid and an extra box will increase the production cost, both through higher tooling costs but also in the increased number of parts in the set. The box is also slightly bulkier than the current box but the rounded shape of the corners will still make it possible to slide in a crammed space in a backpack for example.

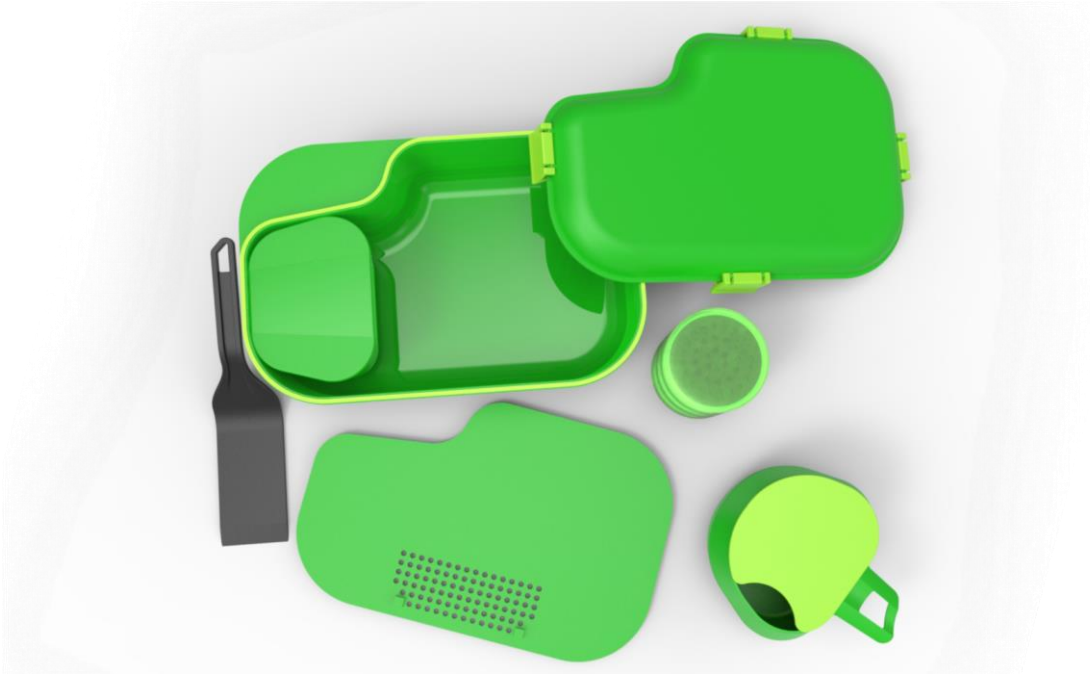


Figure 54 Concept 1: Waterproof Box - Picture 2

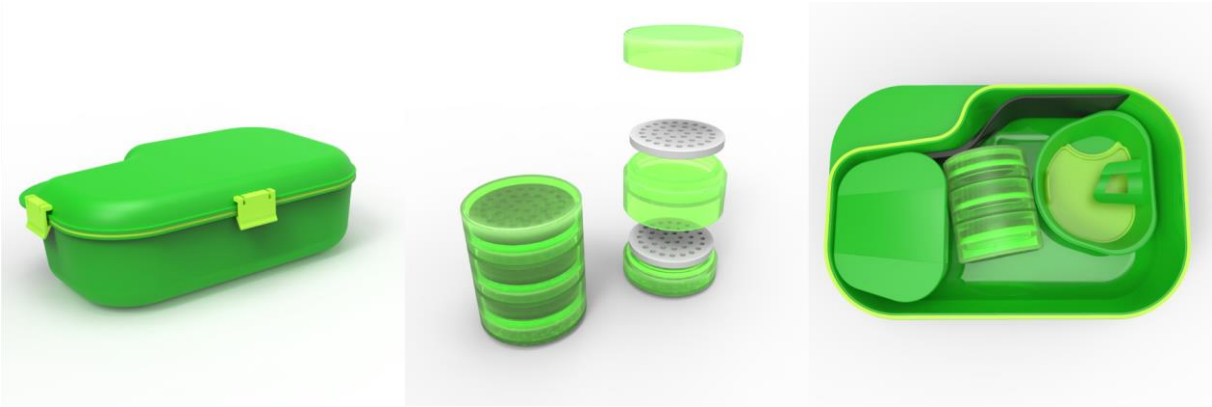


Figure 55 Concept 1: Waterproof box - Picture 3-5

The waterproof lid makes the box more suitable for saving leftovers, bring pre-cocked food or simple to keep matches or other items save from rain.

In this set the spice jar is a series of stackable boxes that screws together. A soft TPE lid that can be detached allows easy refilling of spices, makes the container waterproof when screwed together and allows the user to use different lids depending on the size of the spices.

The spatula is curved to match the lines of the Camp-A_Box to minimize its storage space. The lid for the Fold-A-Cup is stored upside down inside the cup. If it is inserted before the cup is folded down it cannot be lost.

Summary in pros and cons

+ Water proof storage for food
+ Less food waste

-Snap lid can break easily when stored inside pack
-Bulky
-Expensive compared to current kit

3.2.2.3.2 Concept 2: Reduction – Red

The second concept revolves around bringing the pack size down to a minimum through eliminating the lid and instead use the cutting board. In addition the bottom box can be stacked meaning several bottoms can be brought without without making the kit much bulkier. The cutting board will also fold into a pasta drainer and a small TPE accesories for the cutlery set is included that will turn them into a set of tongs that can be used while cocking.

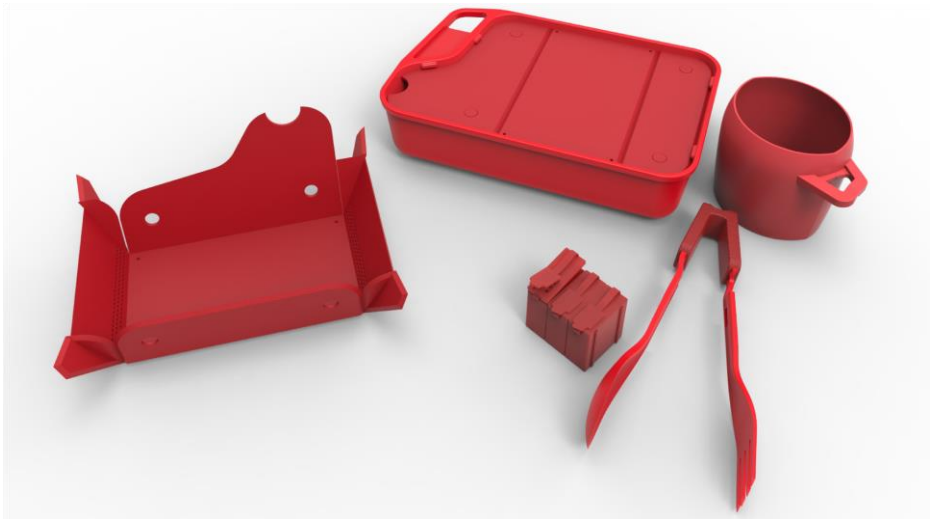


Figure 56 Concept 2 - Picture 1

The cutting board is the main feature of this concept, it can be folded in threee different ways; as a free standing strainer, flat for storage and large for cutting. This is possible thanks to a number of grooves and locking tabs. It makes the cutting board slightly heavier than the current version but the total weight is still lowered because this concept uses the cutting board as a lid.

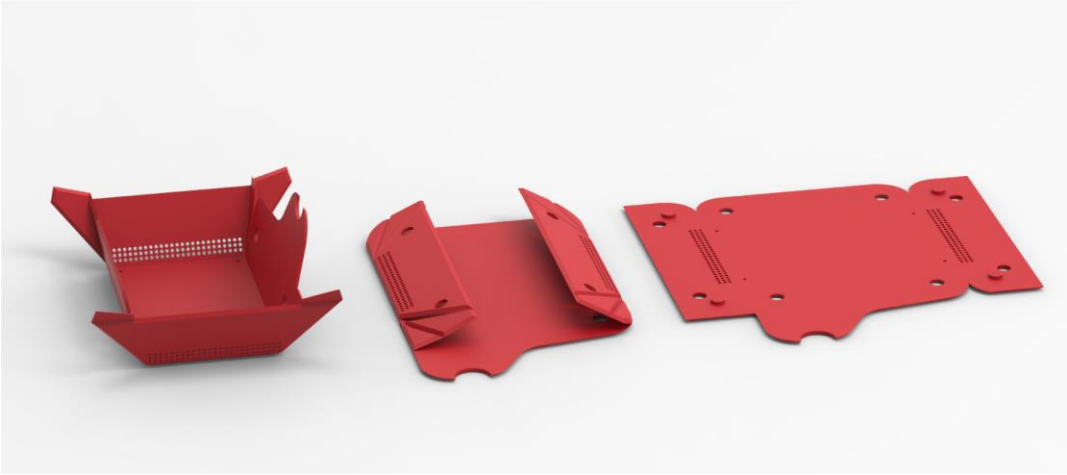


Figure 57 Concept 2: Reduction - Picture 2

Although complex in its function, the cutting board is still molded in a single piece which will keep the production cost down.

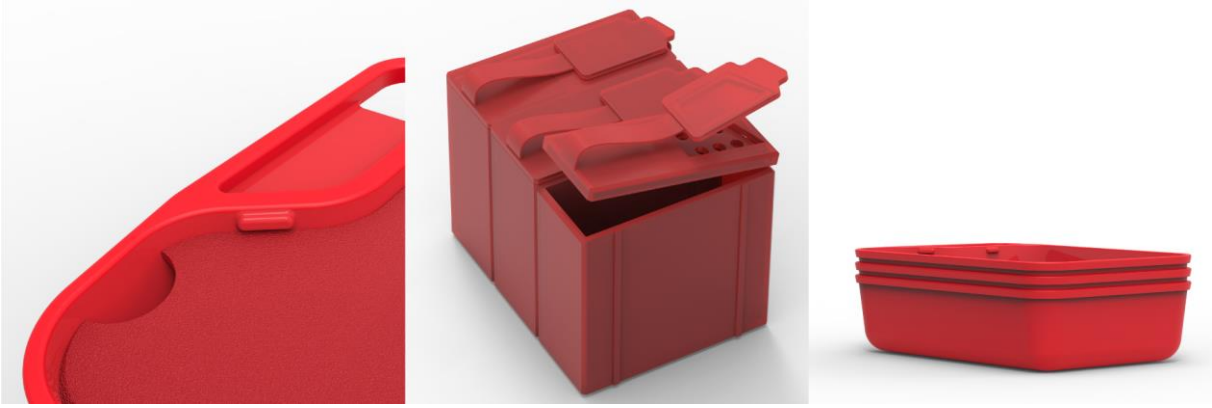


Figure 58 Concept 2: Reduction - Picture 3-5

Small tabs locks the cuttingboard lid in place.	The spice jar included the lid is injection molded in one piece. The individual boxes can be connected together with a set of T-shaped splines on the side.	The boxes can be stacked together to reduce space for transportation and storage and allows the users to bring several boxes.

Summary in pros and cons:

+ Smaller space
+ Easy to bring extra boxes for several people
+ Very easy pasta water draining

-No lid to be used for extra storage while cocking
-Not as good looking

3.2.2.3.3 Concept 3: Fold-A-Box – Blue

The last concept explores Wildo's ideas of folding cups but for the complete box. Here, the box itself folds to create a super packable set. This means that the available storage space inside is very limited and the included equipment must therefore also be super small. To accomplish this only one Fold-A-Cup and a small spice jar set are included in the set.

Figure 59 Concept 3: Fold-A-Box – Picture 1

Figure 60 Concept 3: Fold-A-Box - Picture 2

This concept can

Figure 61 Concept 3: Fold-A-Box – Picture 3-5

Included in this concept is a small dishbrush and detergent bottle. This allows the user to wash up the dishes without getting cold fingers from cold mountain streams.

The spice jar consists of small blow molded bottles that are stacked on top of each other. The lid features an extruded edge that the bottle on top snaps onto. This makes them cheaper to produce than the similar spice jar in Concept 1: Waterproof storage but also less secure.

When packed together, this concept is very small and minimalistic in its appearance.

Summary in pros and cons:

+ Smaller space	-Very little space for the cutlery set
+ Very easy pasta water draining	-Risk for soft feeling of the box

3.2.2.4 Concept evaluation

With the concepts finished their perceived performance were evaluated and compared using a Pugh decision matrix. The criteria used were mainly based on the guidelines used during the development. The evaluation was done in a similar fashion as the evaluation of the cutlery set through presenting and discussing the concepts to potential users with a technical background as well as comparing solid facts like the weight of the concepts from the CAD models.

Figure 62 Camp-A-Box Concept comparison illustration

While the extra products included in the concepts affect their usefulness they also give an unfair advantage between the concepts. Since they should be adaptable to either concept they were not included in the comparison of the concepts.

To summarize the evaluation a Pugh-decision matrix was used.

Table 6 Camp-A-Box Pugh matrix

		Concept 1	Concept 2	Concept 3
Criterias	Ranking	Score		
Slim shape when stored	4	2	4	5
Weight/sustainability	5	2	5	4
Food storage	3	5	2	3
Ease of use	4	4	4	3
Pasta draining security	2	3	5	1
Cost	5	1	4	3
Aesthetics	5	4	3	4
Total Score		**21**	**27**	**23**
Total Score with ranking		**75**	**88**	**83**

As can be seen the second concept where the cutting board is used as a lid got the highest total score and was chosen as the final concept.

3.2.3 Form study and development

In addition to the concepts that were developed for the cutlery set and the Camp-A-Box set, a separate form study and development phase was done in parallel. As one of the concepts for the cutlery set was used to visualize the forms it is presented last although the work was done in conjunction with the development for the cutlery concepts.

Among Wildo's newer products different form languages can clearly be seen, while they share some design cues they differ in expression. Based on these, three different styles were outlined that could be used to create different expressions for the products.

3.2.3.1 Style 1

This is the same style that Wildo have been using for the latest version of Kåsorna and features a vigarous edge that gives this style both a strong and powerful expression and strengthens the construction. This makes the style ideally suited where strength and a good grip are needed.

Figure 63 Style 1 – Matching Kåsa XL

The large edge ridges could however feel harsh to grip and unless the design is hollowed out from the underside it could lead to sink marks due to difference in thickness.

3.2.3.2 Style 2

The second style is matching the visual appearance found on Wildo's Spork. The ridges that is creating the shape stiffen and strengthen the construction but at the same time a sleep and streamlined shape is achieved. It also makes it more suitable for when a lower profile is needed and to make the appearance neater.. In addition the design lends itself well to objects that are to be stacked and will be easy to mold.

Figure 64 Style 2- Matching the Spork

3.2.3.3 Style 3

This style mimics the style found in Wildo's Camper plates. Mimicking this style for the cutlery would help with selling more of the plates through targeting a slightly different audience and usage, namely car campers, barbeques, picnics and similar. While it is still eating outdoors, it is not in the same rough nature conditions as the Camp-A-Box is intended and marketed towards.

Figure 65 Style 3 - Matching the Camper Plate

3.3 Final products

The final part of the development work was to fine tune the chosen cutlery and Camp-A-Box concepts and, in the case of the cutlery set perform the detailed construction neccesary for function and production.

3.3.1 Cutlery set - Finalisation

The chosen concept was 3D-printed in order to have a physical prototype to manimulate and to validate the design with. During testing of the prototypee two points were raised that were addressed during the final development. First, the cutlery set was made slightly longer by curving the handle to allow it to fit around the Fold-A-Cup inside the box during storage.

Secondly, the attachment method was changed to a longer hole inside the spoon so that the extended tool would be locked in all six directions rather then the five that the concept did. This means that a side-action mold will be required to manufacture the spoon, the benefit of the stronger locking mechanism was however seen as more important.

It was also decided to keep the same form style as the Spork as it was seen as the most ergonomically correct for holding with fingers and because its neat appearance.

The final version of the cutlery set was then 3D-printed as a final prototype. CAD renderings and the 3D-print of the concept can be seen below in Figure 66, Figure 67, Figure 68 and Figure 69.

Figure 66 Final cutlery set 1

Figure 67 Final cutlery set 2

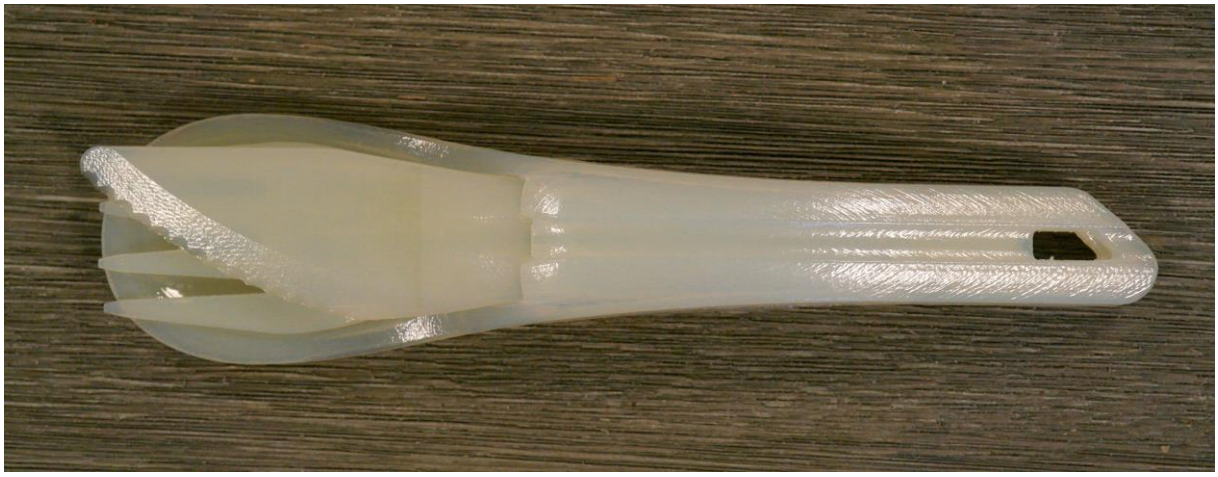


Figure 68 3D-print of the final cutlery concept 1

Figure 69 3D-print of the final cutlery concept 2

With the attachement method changed to a longer hole only the knife could fit inside the end of the spoon during storage. The fork is instead “hanging” on the underside of the spoon. It is however held in place thanks to the pressfit in the front hole and the front tip of the knife pressing down on it and locking it in place.

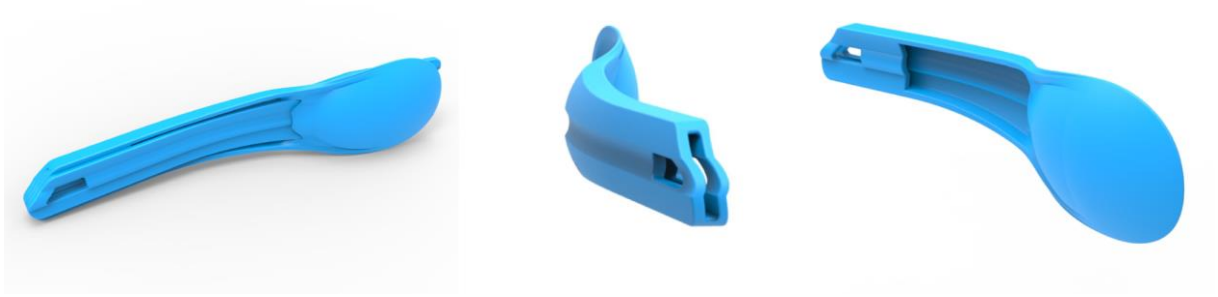


Figure 70 Details on the spoon for the locking mechanism

With the curved handle the length could be made 12 mm longer without affecting the fit inside the Camp-A-Box. A few selected measurements can be seen in Figure 71.

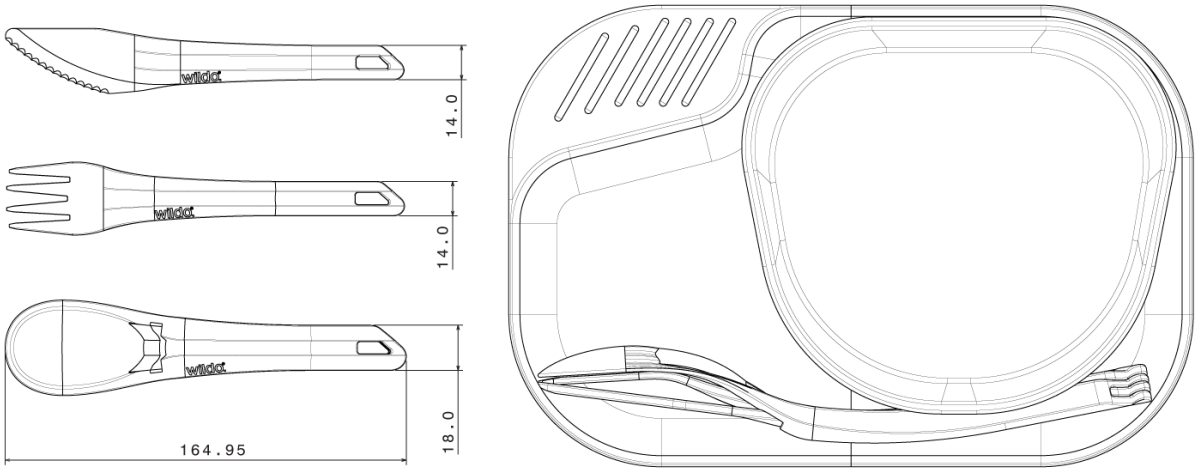


Figure 71 Excerpt from the drawings showing length, width and how the set fits inside the current Camp-A-Box

The pressfit mechanism was constructed with a 0.5^{O} taper in order to be able to extract the side core during the molding. As the knife will have to be inserted from the other end during storage, a similar taper was added to the handle in order to counteract the thinner bottom end of the hole. This will also give a deeper and stronger insertion while the set is in its extended position. For the press fit a H7/p6 tolerance was chosen (Oberg. 2008).

3.3.2 Camp-A-Box – Finalisation

While the second concept, where a folding cutting plate was used as a lid, was chosen during the concept evaluation it received some critisism and low scores. This mainly regarded the choice of a non-waterproof set of spice jars, the flat folding cup and the tong accesory. The best parts from the other two concepts were instead chosen and further developed together with the main idea from the winning concept, the folding cutting board.

This lead to a solution with a single, medium sized Fold-A-Cup, a spatula and a set of waterproof stacking spice boxes.

Figure 72 Final Camp-A-Box Concept

While the internal of the new box space is larger than the former one it is only slightly larger on the outside thanks to it not having a dedicated lid. This makes it easy to pack and with the strong side edges the wall thickness can be brought down without flexing and warping during manufacturing (like the current box does). This gives a box that has a larger functional space, yet takes up the same space and has the same environmental impact over its life time based on the weight based LCA done in the pre-study.

Figure 73 Storage

Internal space is no longer a large concern and the user can chose to store other cooking accessories inside the box. One such is the included spatula that will simplify cooking.

Figure 74 Stacking boxes and Nylon Spatula

The spatula is made of nylon to make it more heat resistant, something that is very much needed when cooking over a propane burner with a thin walled pot. Because it is made of nylon it is also colored black. Nylon can be colored in other, brighter colors but it is easily miscolored by some foods.

The new box can also be stacked on top of each other making it easier for instance for families or school groups to pack the boxes while heading out.

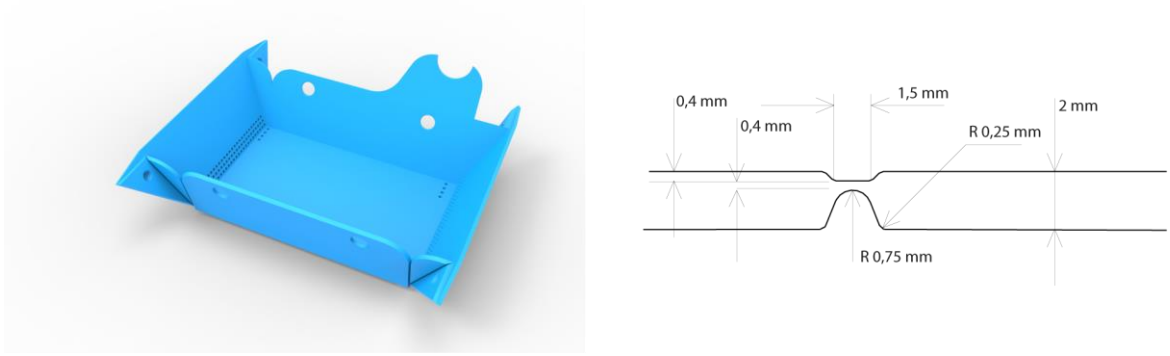


Figure 75 Folding cutting board and detailing of the hinge function

The cutting board can be folded together for storage or into a bowl to act as a pasta strainer. This is possible thanks to a set of living hinges. This is a construction feature where the whole cutting board is molded in one piece with very thin bridges connecting the thicker parts together. Polypropylene that Wildo uses for many of its products is perfect for this type of function because of a phenomenon where the polymers line up across the bridge when it is made at a specific thickness (Beall, 2002) (Erhard, 2006). The cutting board hinges were constructed according to guidelines from Erhard (2006) and the sides were mathematically calculated to give as a high volume as possible from the availabe shape of the cutting board based on the outline of the rectangular Camp-A-Box.

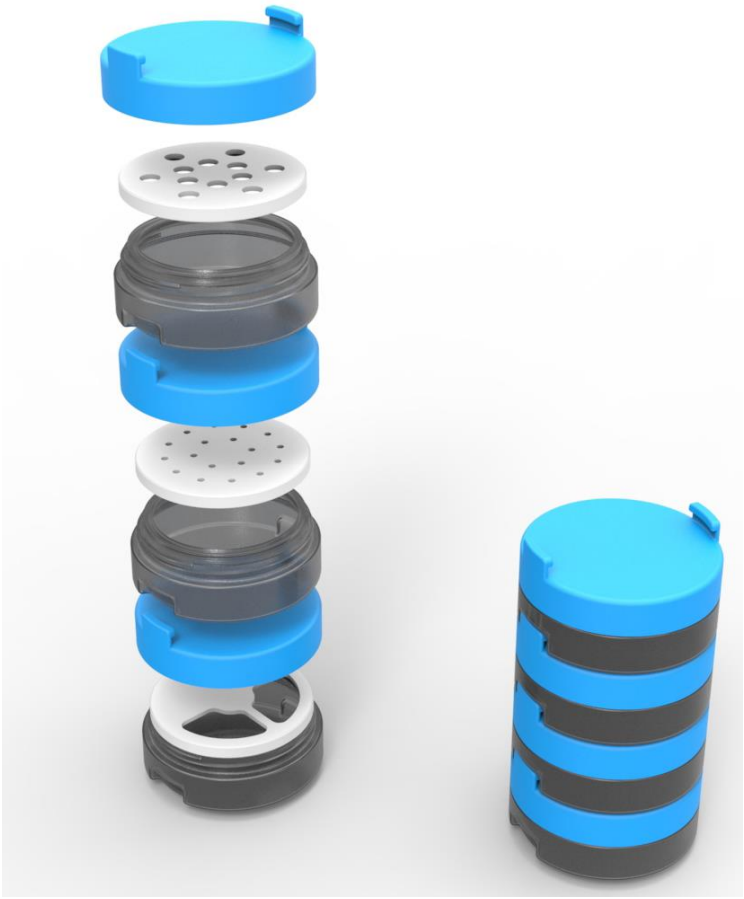


Figure 76 Stacking spice jar set with different variations of inner lids

The newer version of the spice jar features a set of stackable boxes. Each unit features a semi see-through blow molded box made of PP, a TPE lid that is available with different openings for different types of spices and screw on lid that is also used to snap the boxes together. This spice jar solves many of the problems with the current box and the wishes put forward by the users.

It is easy to refill thanks to the large opening (larger than the current), different sizes of spices can be used thanks to the user replaceble inner lids, and the user can chose themselves how many different kinds of spices to bring with them.

Finally it is also waterproof as well as airtight because of the screw top that seals with the TPE lid. This in total improves both the sustainability and the users' satisfaction with the product.

The new products all show Wildo's logos through different surface finishes and while the cutlery set uses the same form style as the spork, the Camp-A-Box uses the same style as that on Wildos Kåsor. This form with the strong side edges signals strength and durability and fits well with the larger handles on the box and the cup. The spatula also feature this form style despite being of similar size to the cutleries. This choice was made to promote the spatula as a cooking tool that can handle some abuse.

Figure 77 Logo

3.3.3 Final renderings

As a final visulaisation of the two concepts a few renderings in a real environment is presented.

Figure 78 Final rendering 1

Figure 79 Final rendering 2

Figure 80 Final rendering 3

4 Discussion

The goal of the project was to develop a set of outdoor cutleries with the two special functions to be connectable for storage and extendable to create a longer tool and to look at how Wildo's complete Camp-A-Box kit could be developed to function better and be made more sustainable. While all these goals were achieved the project was not without its struggles.

During the pre-study it was soon evident that there were many conflicting interests and requirements. For example technical aspect such as the limiting space avaliable for the cutlery versus the need for good ergonomics, but also questions like how to design when a majority of the users' perception of a features performance does not match reality and it is fact the other way around like with different surface finishes.

Some of these questions could be answered through tests and further development work, other were harder like where users were very vocal about wanting to have shiny surfaces because they were easier to clean yet testing showed the opposite. Going with what the tests showed would give a better product at the risk of losing sales. Other considerations that were valued highly in this project was the producability of the products. Draft angles, material thickness and undercuts were a big part of the process even at a conceptual level in order to make sure that the product were possible to produce.

Process

Initially this project set out to follow a very basic and simple design process, what this process did not account for was how to handle the large amount of data involved in the project at a given time. The seven, very different, products that were developed each had its own set of functions, requirements, constraints and problems. Dealing with all this data proved problematic although similarities could be found between the products and their interaction with each other. One way of simplifying this and to help achieve a better cohesive work was to develop two user scenarios to go with the personas. Using these scenarios as walk throughs for each evaluation proved to work well to ensure that each concept was evaluated on the same grounds. Another method that was used, especially for the construction of the cutlery set, was to gather as much hard data as possible such as the size testing and use that to put down hard constraint that the project could not move out of. That eliminated many possibilities at an early stage which helped to focus the work.

Another method that proved very valuable was the workshops done early on in the project. These both provided very useful data for this project but they also worked very well as a learning opportunity of how to design workshops and user studies on their own. Allowing the users to first cook together while testing the equipment served as a perfect teambuilding exercise and made the users very confident in speaking about their opinions and wishes despite in many cases being strangers.

Where the project struggled the most was during the ideation stages, being a single project rpactitioner it was hard to have really productive brainstorming sessions regarding new ways or ideas. Here some kind of workshop with an ideation focus should have been conducted in order to force out more ideas at an earlier stage.

Products

Early on in the project it was decided to focus the available time and energy towards those products in the Camp-A-Box kit where most problems could be found and thereby make the biggest difference. This have meant that the cutting board and the spice jar have received the most amount of energy and this also shows in the final products. The spice jar now features a design that is improved in several ways. It is waterproof, the refilling and distribution are much easier and the user can chose himself how many spices he wants. The downside is presumed higher production cost due to more parts in each sold set and that the spice jar can't be handled with a single hand anymore.

The cuttingboard and the box are improved in similar ways; new functions, larger usable space but at a cost in complexity. While improving these functions the sustainable effect of the products was also taken into account. As was showed during the initial LCA the main factor with these product is the use of energy during transportation to and from outdoor activities. The contributing factor here is mainly

the weight of the products. Therefore the design sought after to minimize the weight through promoting less parts and stiffer construction where possible. Another way the new design will lead to a better environmental effect is the spice jar that will preserve the spices better than the old version thanks to its waterproof design.

The cutlery set is fulfilling all the initial requirement and special functions, in addition it is a large step up in terms of ergonomics over the current Spork. It does not rely on any small snap joints or extra parts for its function that can break or get lost. The cross-section also gives it a stiff and strong construction that will last.

Suggestion for further work

Although the project have fulfilled its goals there are still areas related to the project where work would benefit the products. Some of those areas are:

- Materials – Although materials was not not a part of the project there is some work that could be done in this area. Finding a suitable plastic that is both more heat resistant than the PP currently used but that still can be dyed into Wildo's strong signature colors is a challenge. This would give a much more useful set of cutleries as they wouldn't risk melting during use.
- Construction of the Camp-A-Box kit – While the cutleries have been developed into a final product the Camp-A-Box kit still needs some finalisation mainly regarding tolerancing and material thickness.
- Extra products – Some ideation was done in this project regarding other products that Wildo could include in Camp-A-Box kit. One such product brought up several times during the pre-study was a way to brew coffee directly into a Fold-A-Cup. This was however seen as a too large extra challenge to bring on during this project and it would be worthy both to be sold as its own product and its own development project.

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6 Appendix

6.1 Cutlery tool comparison

Figure 81 Competitor cutlery 1 IKEA children's cutlery

IKEA - Children's cutlery

+ Nice to hold with the large handle

– Very bad edge
– Heavy

Figure 82 Competitor cutlery 2 No brand

No brand - Outdoor cutlery set
Cheap set from various online sources

+ Good shape to eat with
+ Reasonably sharp knife and fork tips
+ Ridges stiffens the tools considerably

– Strange color according to many users
– Feels brittle
– Attaches together with a small carabiner

Figure 83 Competitor cutlery 3 Jetboil

Jetboil - Spoon, fork and spatula kit
Collapsible set of cocking tools, includes a spatula.

+ Stores small yet possible to eat from freeze-dried pouches
+ Fun to fiddle with the mechanism

– Very soft construction, fold easy
– Strange color according to users, but fits Jetboil brand

Figure 84 Competitor cutlery 4 Sea to summit Titanium

Sea To Summit - Titanium set

+ Durable
+ Reasonable good shape to eat with

– Carabiner used to attach them together is easily lost
– Metal = will rattle

Metal will scratch some pots

Figure 85 Competitor cutlery 5 Four seasons

Four Seasons -
The clear favorite among most users, largely thanks to the spatula and sharp knife

+ Great, serrated knife
+ Nesting function is very clever

– Too deep grove in handle to be comfortable
– String is annoying and in the way
– Fork function is too shallow

Figure 86 Competitor cutlery 6, No brand

No brand – steel outdoor cutlery
Older style of outdoor cutlery, very popular 15-20 years ago.

+ Serrated knife but could be better
+ Attachment function works good, no rattling

– Heavy
– Too small to work good
– Feels outdated according to users

Figure 87 Competitor cutlery 7 Sea to Summit plastic

Sea to summit – Plastic set

+ Sharp fork

– The spoon is too deep to be comfortable to eat with
– Feels “plastic”, like single use tools according to several users
– Feels fragile, like it could crack. Especially the deep fork design

Figure 88 Competitor cutlery 8

No brand – Folding titanium cutlery

+ Small storage

– Very unreliable mechanism, loosens too easily
– The knife looks sharp, but the edge is rounded

Figure 89 Competitor cutlery 9 Light my fire

Sea to Summit - Spork
Probably the most well-known outdoor eating tool

+ Clean design
+ "All-in-one" tool
+ Very good shape of the spoon to eat with

– Breaks very easy
– Ergonomics is not very good when holding the spoon

Figure 90 Competitor cutlery 11 No brand "Swiss army knife look alike"

No brand "Swiss army knife look alike"
Cheap swiss knife copy with fork, knife and spoon as part of the tools. Can be split into two pieces.

+ Clever attachment method
+ Good selection of extra tools

– Very heavy
– Hard to clean all nooks and crannies
– Outdated design

Figure 91 Competitor cutlery 12 Naturkompaniet wood spork

Naturkompaniet – Wooden spork
Combination of spoon and fork made of wood

+ Long handle means it is easy to eat from freeze-dried pouches
+ Wood does not scratch pots

– Bacteria's might grow on the surface of left wet long
– Potential strength issues with the long fork?