DALI KOLOR

Touching music

Product report - MSc04 Industrial Design - AAU - MAY 2017
Andreas Sig Pedersen & Stefan Troels Larsen

DALI

IN ADMIRATION OF MUSIC

Title page

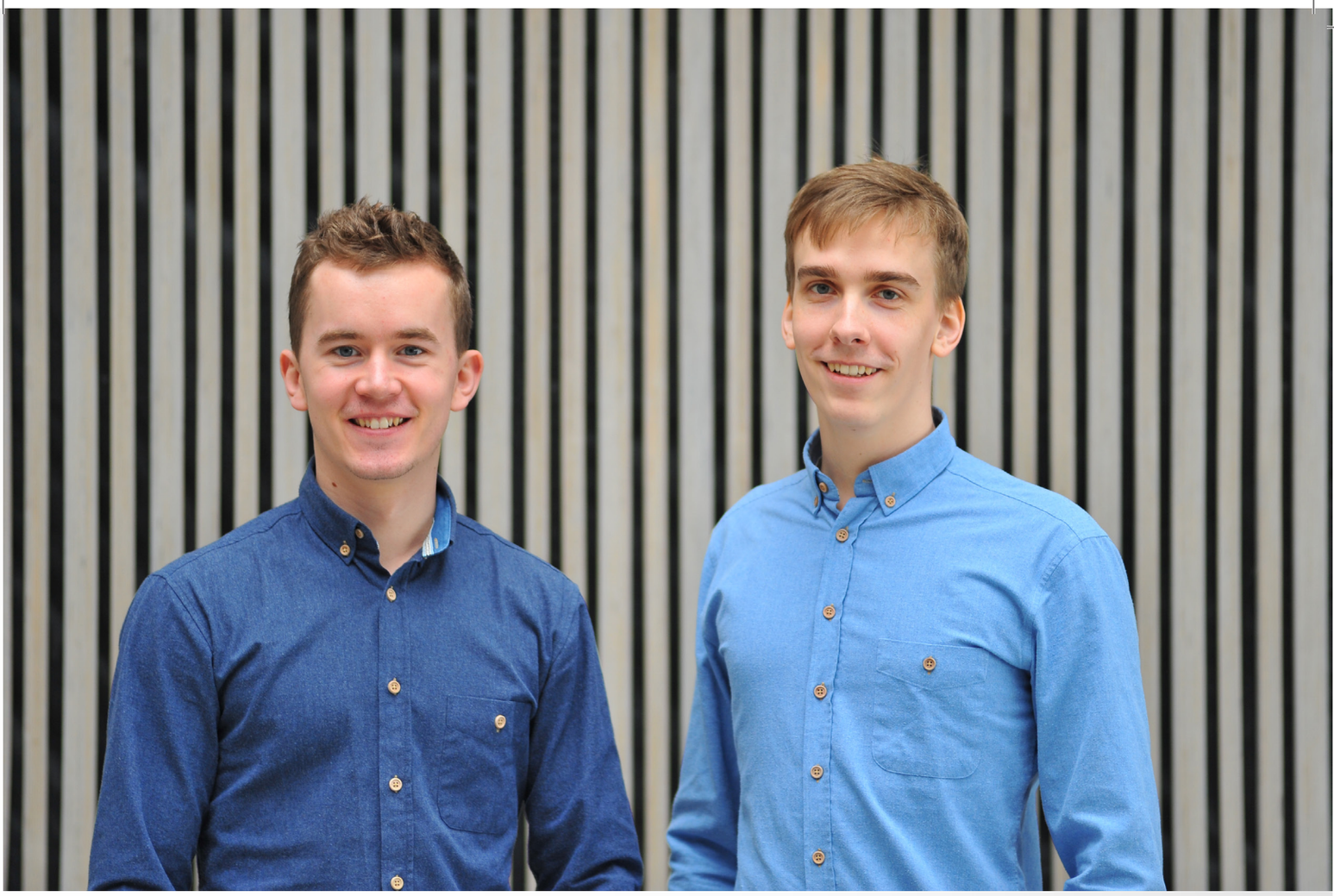
Title:	DALI KOLOR Touching music	
Theme:	Active Loudspeakers	
Project period:	01.02.2017 - 18.05.2017	
Examination:	16.06.2017	
Field of study:	Industrial Design	
Project team:	MSc04-ID7 BK Design	
Team members:	Andreas Sig Pedersen Stefan Troels Larsen	
Supervisor:	Schou, F. Eriksen, K. Jaeger, T. A.	01.02 -> 24.02 24.02 -> 06.03 06.03 -> 23.06
Secondary supervisor:	Nielsen, K. B.	
Product report page count:	24 pages	

Abstract

This project is the master thesis devised by two Industrial Design students in the spring of 2017 on Aalborg University.

The master thesis has been a product development project with take-off in a case formulated between collaboration company DALI A/S and the master thesis group. The focus in the project has been to find the strategic approach best suited for DALI to enter a new market segment. And then develop an active loudspeaker that conveys the DALI brand values and satisfies the target audience's needs and wishes.

A new approach to interacting with speakers has been designed based on market research, user interviews and an extensive registration of physical interfaces with seductive design qualities. The result is a new portable speaker that fits the digital streaming culture of today without the need of smart devices to control your musical experiences.



Andreas Sig Pedersen

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BK DESIGN

We are Andreas and Stefan and together we are BK Design. BK Design have been our common identity in all projects, and competitions we have created together. This master thesis is the pinnacle in the history of BK Design before we move beyond the educational system.

DALI KOLOR

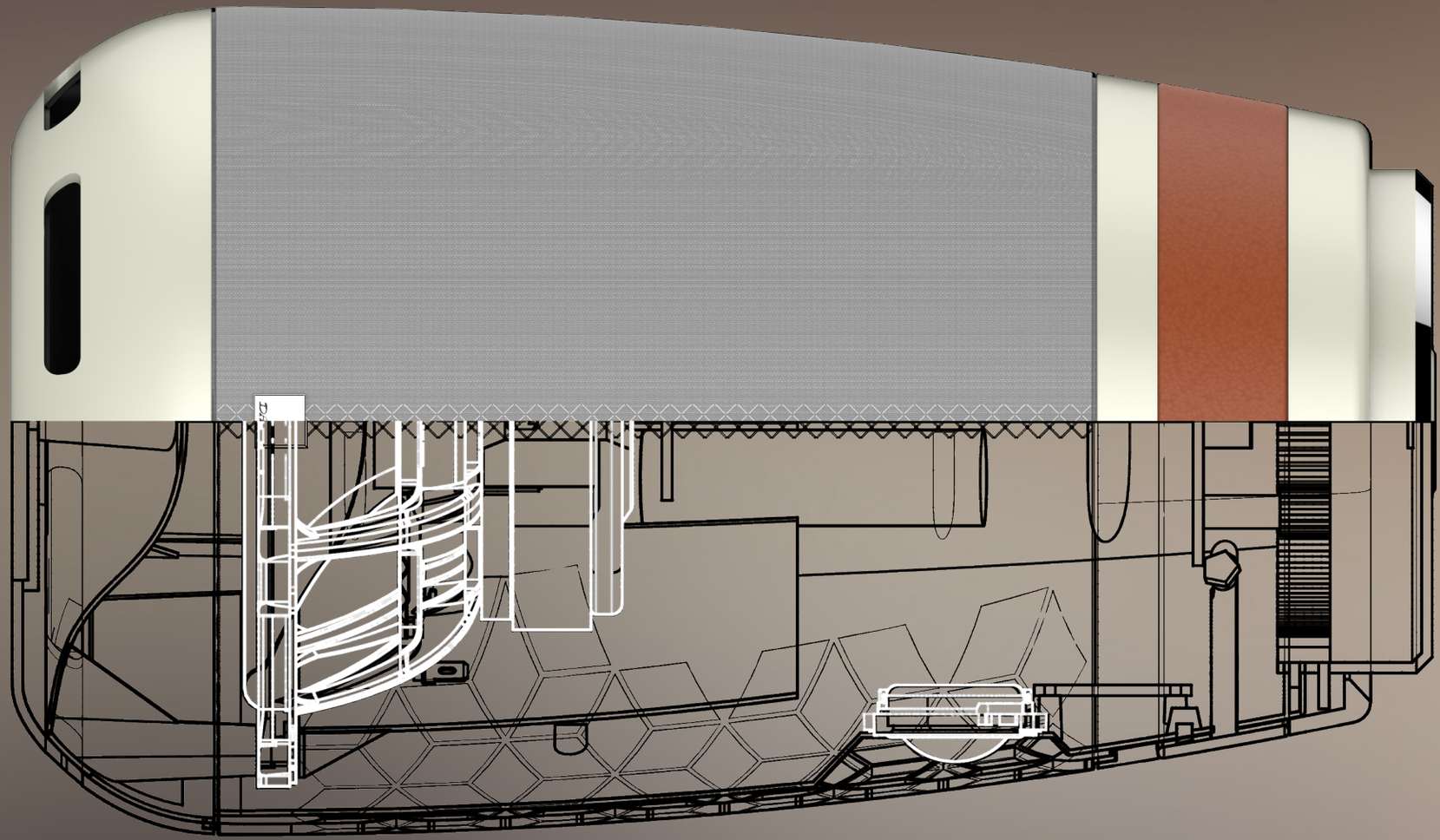
The KOLOR is the newest breed of portable active loudspeakers by DALI that will make your digital streamed music more tangible. It is addressing the complications introduced by the smart digital age and aims to reconnect the users with their music. It doesn't matter where your phone is, if it is able to connect or which playlist will fit your current mood. The DALI KOLOR is always ready to fill your home with music that fits your mood.

The KOLOR is a battery powered Wi-Fi speaker designed by BK Design in collaboration with DALI A/S. Delivering DALI's unmistakable admiration of music to a new audience through the joys of physical interaction. The big knob on top of the KOLOR provides a great feeling of control when changing playlists through the color wheel or turning the volume. The combination of size, resistance and material of the knob will make you keep coming back to change the volume.

At BK Design we believe that the best connection is one established through a psychical interaction with products.

Key insights

- Users turns to more accessible products, sacrificing audio fidelity, when faced with technological constraints that isn't intuitive.
- Physical interaction can lead to better connection between human and machine.
- A seductive design can lead to an emotional attachment to products and thereby make the interaction with products desireable for users.
- Users primarily listenings to playlists, either curated or personal



Specifications

DIMENSIONS:
271 x 158 [mm]

WEIGHT:
≤ 3.5 Kg

COLORS:
Kale, Lapis Blue, Pale Dogwood,
Midnight Black, Pure White

DESIGNER:
BK Design

CONNECTIVITY:
Wi-Fi 802.11b/g/n/ac (2.4GHZ & 5GHZ)
Line-In 3.5 mm mini-jack
USB-C (charging)

STEAMING FEATURES:
Spotify
Chromecast (built-in)

DRIVER UNITS:
2 x 21 mm Soft Textile Dome Tweeter
1 x 5” Wood Fiber Woofer

POWER AMPLIFIERS:
3 x 30W Class D

CABINET PRINCIPLE:
Vented - bass reflex port

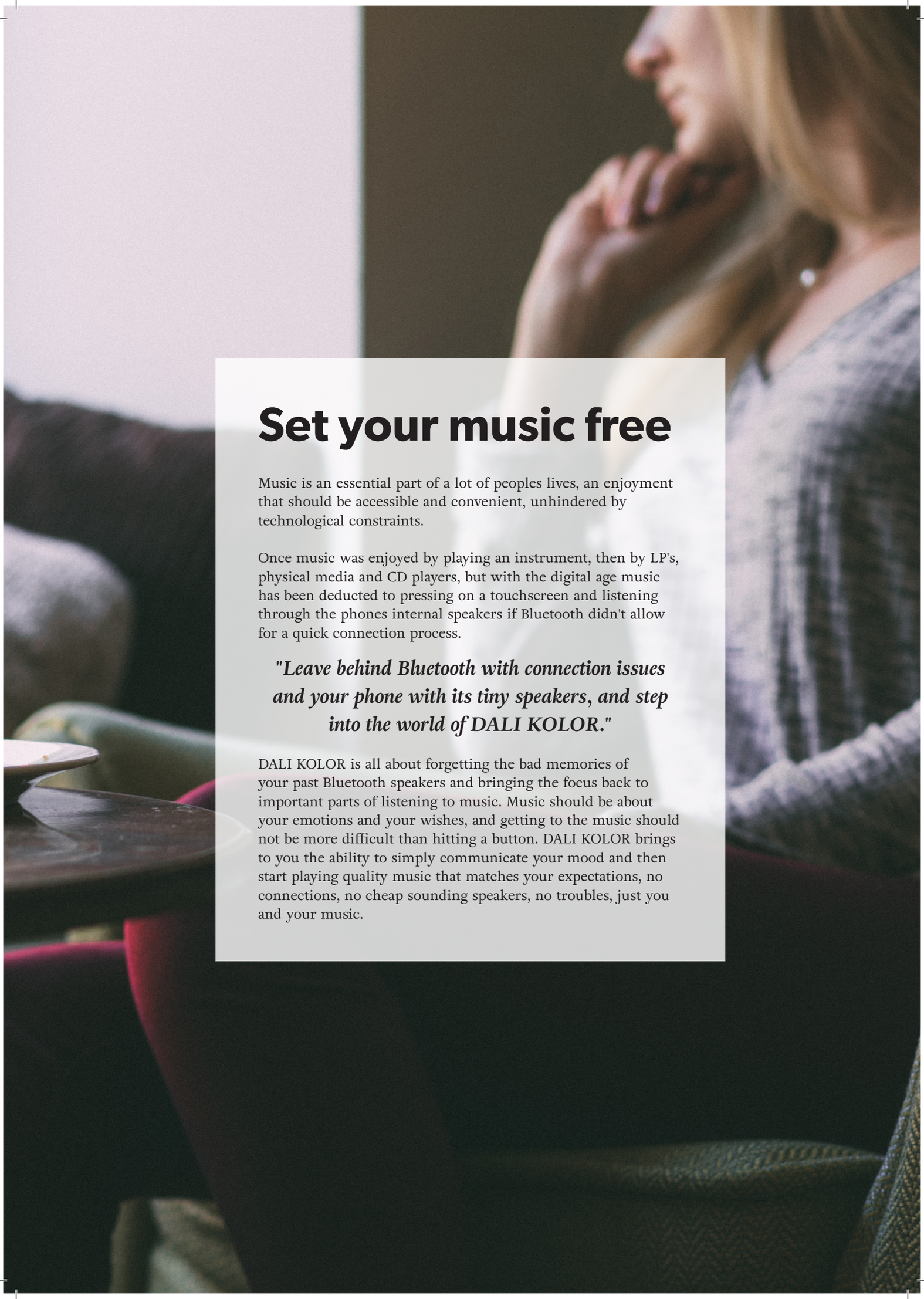
MATERIALS:
Aluminum
Fabric
Leather

BATTERY:
5200mAh rechargeable Li-Ion

SPECIAL FEATURES:
Playlists selector by mood / color

MULTI-ROOM CAPABILITY:
Google Cast

COMPANION APP:
DALI KOLOR companion app
Compatible with Android and iOS



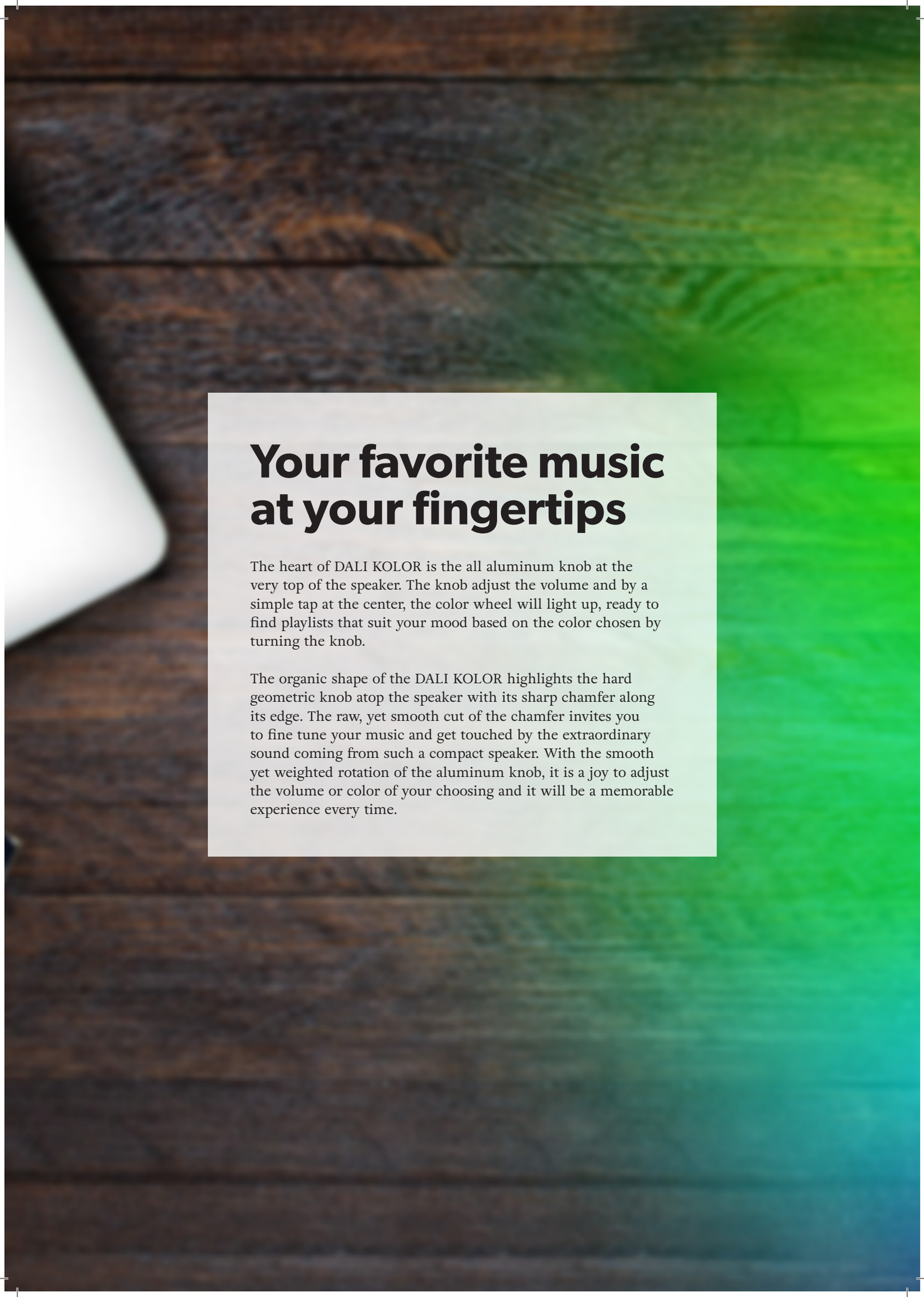
Set your music free

Music is an essential part of a lot of peoples lives, an enjoyment that should be accessible and convenient, unhindered by technological constraints.

Once music was enjoyed by playing an instrument, then by LP's, physical media and CD players, but with the digital age music has been deducted to pressing on a touchscreen and listening through the phones internal speakers if Bluetooth didn't allow for a quick connection process.

"Leave behind Bluetooth with connection issues and your phone with its tiny speakers, and step into the world of DALI KOLOR."

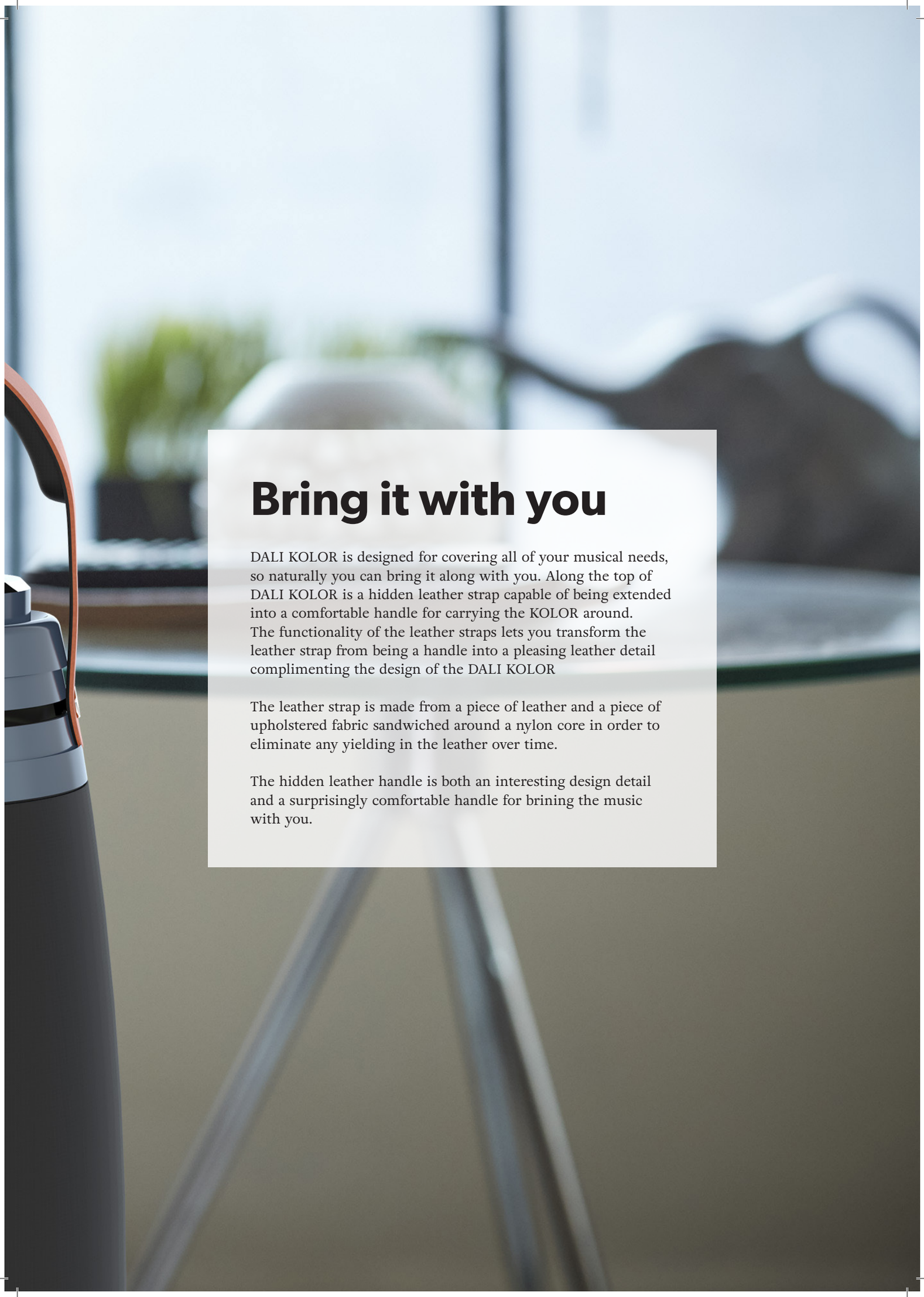
DALI KOLOR is all about forgetting the bad memories of your past Bluetooth speakers and bringing the focus back to important parts of listening to music. Music should be about your emotions and your wishes, and getting to the music should not be more difficult than hitting a button. DALI KOLOR brings to you the ability to simply communicate your mood and then start playing quality music that matches your expectations, no connections, no cheap sounding speakers, no troubles, just you and your music.



Your favorite music at your fingertips

The heart of DALI KOLOR is the all aluminum knob at the very top of the speaker. The knob adjust the volume and by a simple tap at the center, the color wheel will light up, ready to find playlists that suit your mood based on the color chosen by turning the knob.

The organic shape of the DALI KOLOR highlights the hard geometric knob atop the speaker with its sharp chamfer along its edge. The raw, yet smooth cut of the chamfer invites you to fine tune your music and get touched by the extraordinary sound coming from such a compact speaker. With the smooth yet weighted rotation of the aluminum knob, it is a joy to adjust the volume or color of your choosing and it will be a memorable experience every time.



Bring it with you

DALI KOLOR is designed for covering all of your musical needs, so naturally you can bring it along with you. Along the top of DALI KOLOR is a hidden leather strap capable of being extended into a comfortable handle for carrying the KOLOR around. The functionality of the leather straps lets you transform the leather strap from being a handle into a pleasing leather detail complimenting the design of the DALI KOLOR

The leather strap is made from a piece of leather and a piece of upholstered fabric sandwiched around a nylon core in order to eliminate any yielding in the leather over time.

The hidden leather handle is both an interesting design detail and a surprisingly comfortable handle for brining the music with you.

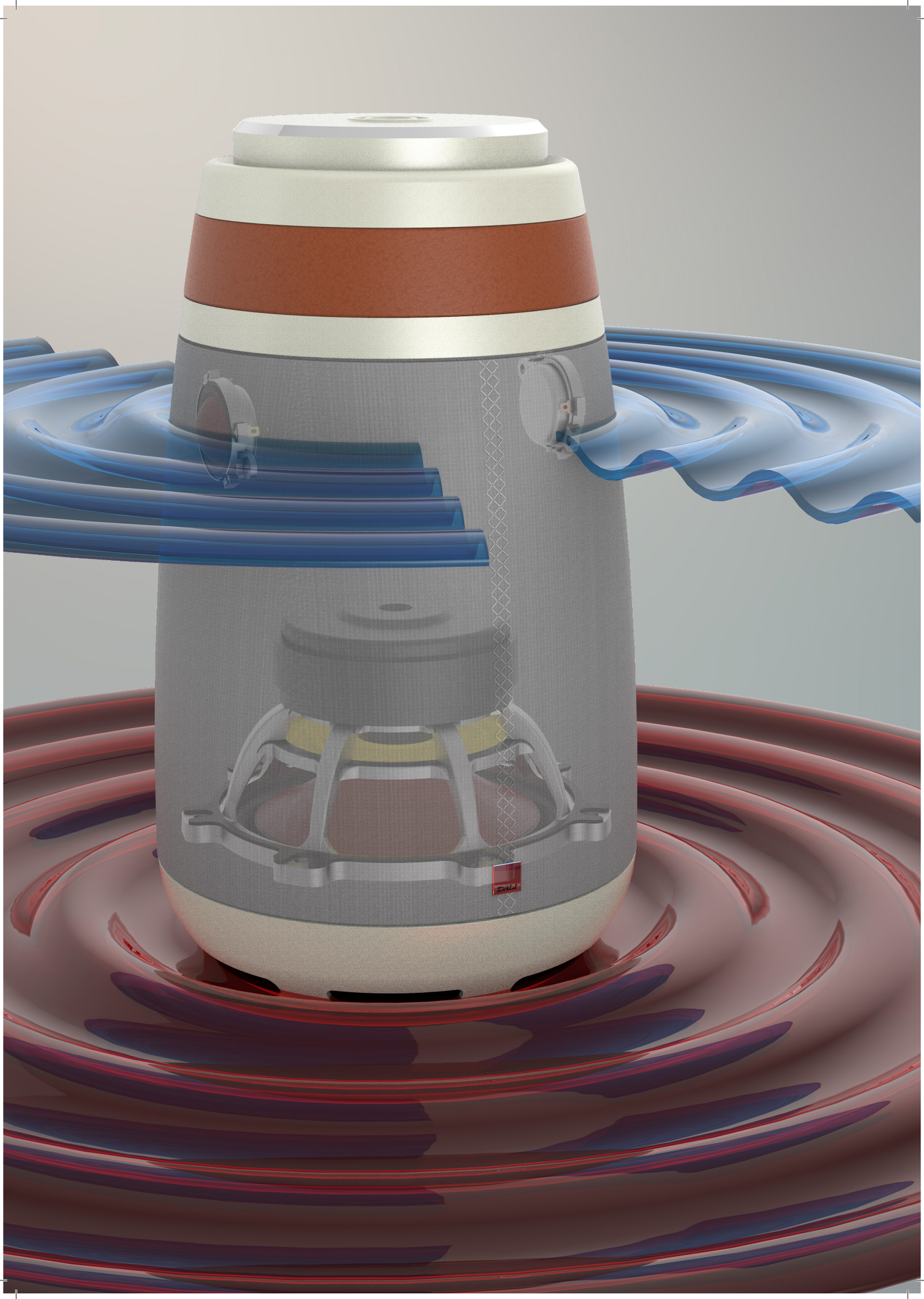
Full room coverage

The DALI KOLOR has been designed to deliver great sound no matter where you place it. The combination of the form, two tweeters and the downward facing woofer creates an even 360* sound dispersion. Enabling a room filling quality sound no matter where you place it.

The two 21mm light weight soft dome tweeters delivers the mid to high-tones and with DALI's wide dispersion technology it is able to eliminate any off angles, ensuring the best possible experience no matter the situation.

The big 5" woofer accompanied with the bass reflex port and internal volume creates a deep punching bass that you haven't experience before in a portable device of this size. The acoustic lens in front of the woofer enables the KOLOR to fill the room with deep base with only one driver, maximizing the efficiency.

Never seen before in a portable speaker is the added bass reflex port surrounding the woofer. Extending the bass capabilities even deeper.



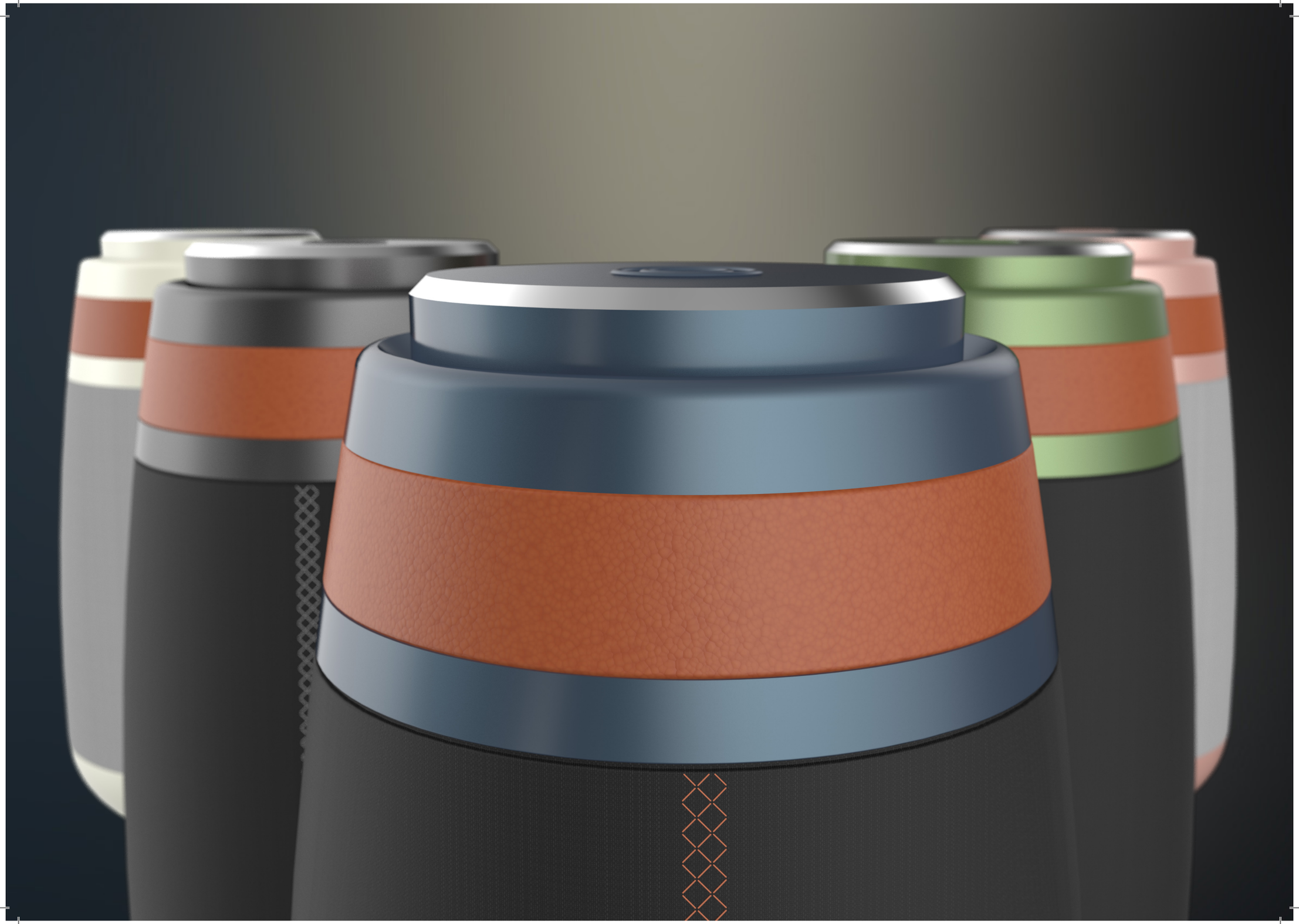
Personalize the experience

Enabling the KOLOR's key promise of a no nonsense daily music experience is the companion app, that guides the user through an easy and quick setup of the KOLOR. Out of the box the KOLOR only needs to find and connect to the home Wi-Fi network in order to start playing.

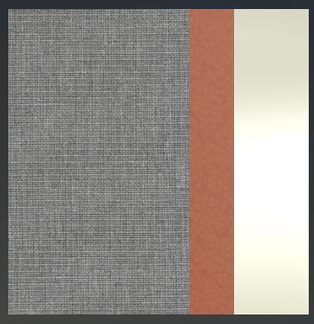
Simply open the app and it will find the DALI KOLOR that is searching for a network to connect to, then share the home's Wi-Fi credentials, choose the streaming service of choice and log-in to start streaming music without having to ever connect again.

Should the music associated with a color not fit the user it can easily be customized in the app to sort out unwanted genres or playlists. It is also possible to rearrange the color/genre association and add personal playlists to specific color areas.


CONFIRM

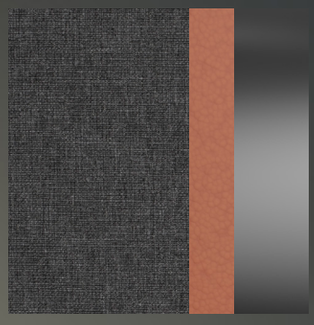


Fabric
Xpress 60003



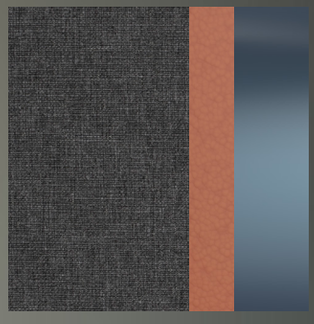
Powder coated aluminum
RAL 9003

Fabric
Xpress 60004



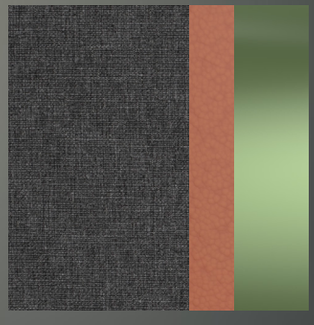
Powder coated aluminum
RAL 9005

Fabric
Xpress 60004



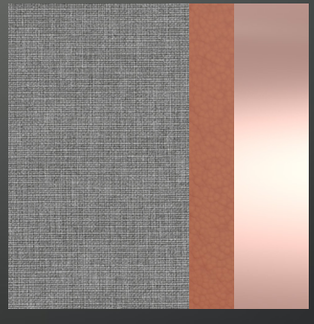
Powder coated aluminum
RAL 5010

Fabric
Xpress 60004



Powder coated aluminum
RAL 6011

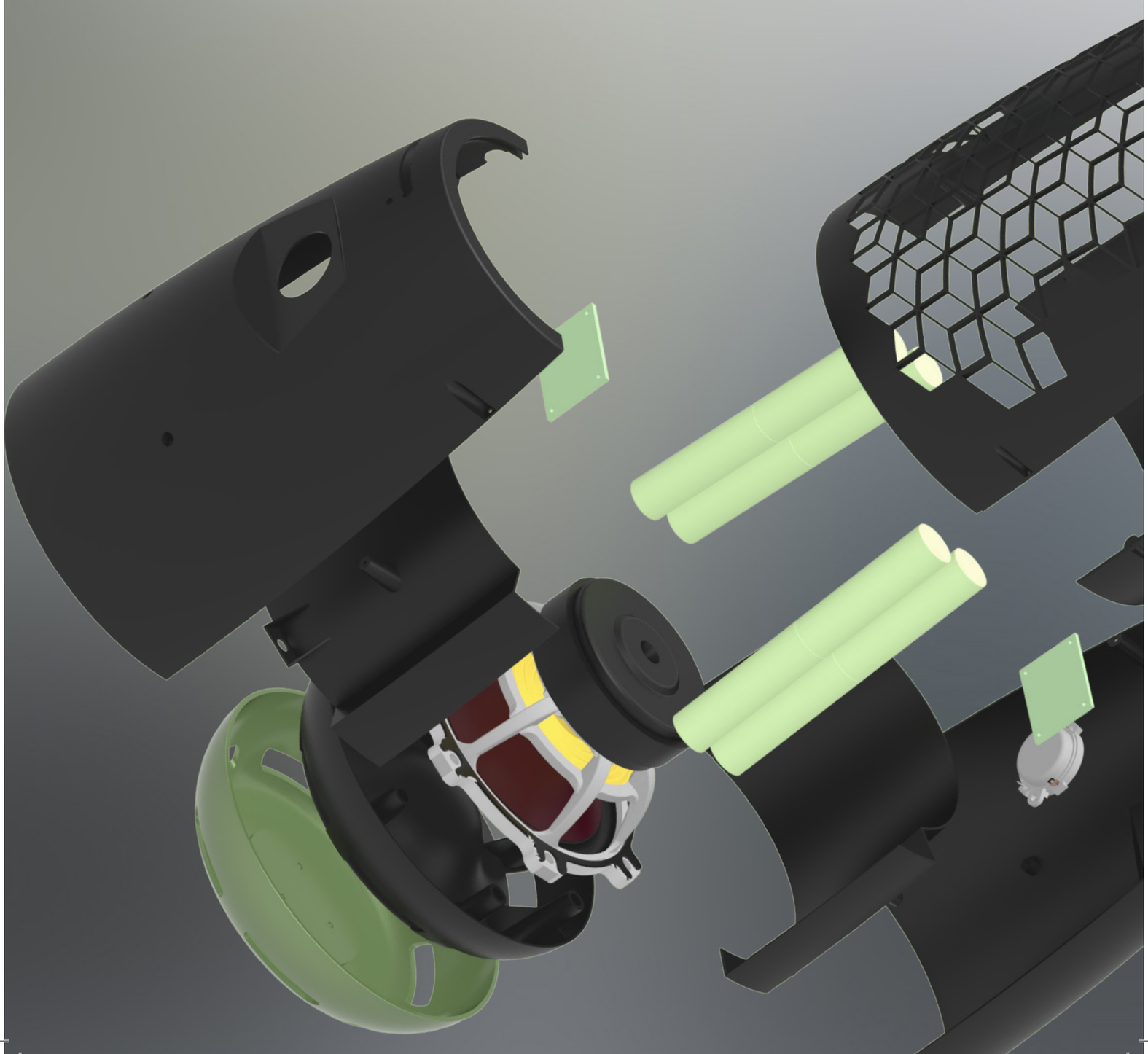
Fabric
Xpress 60003

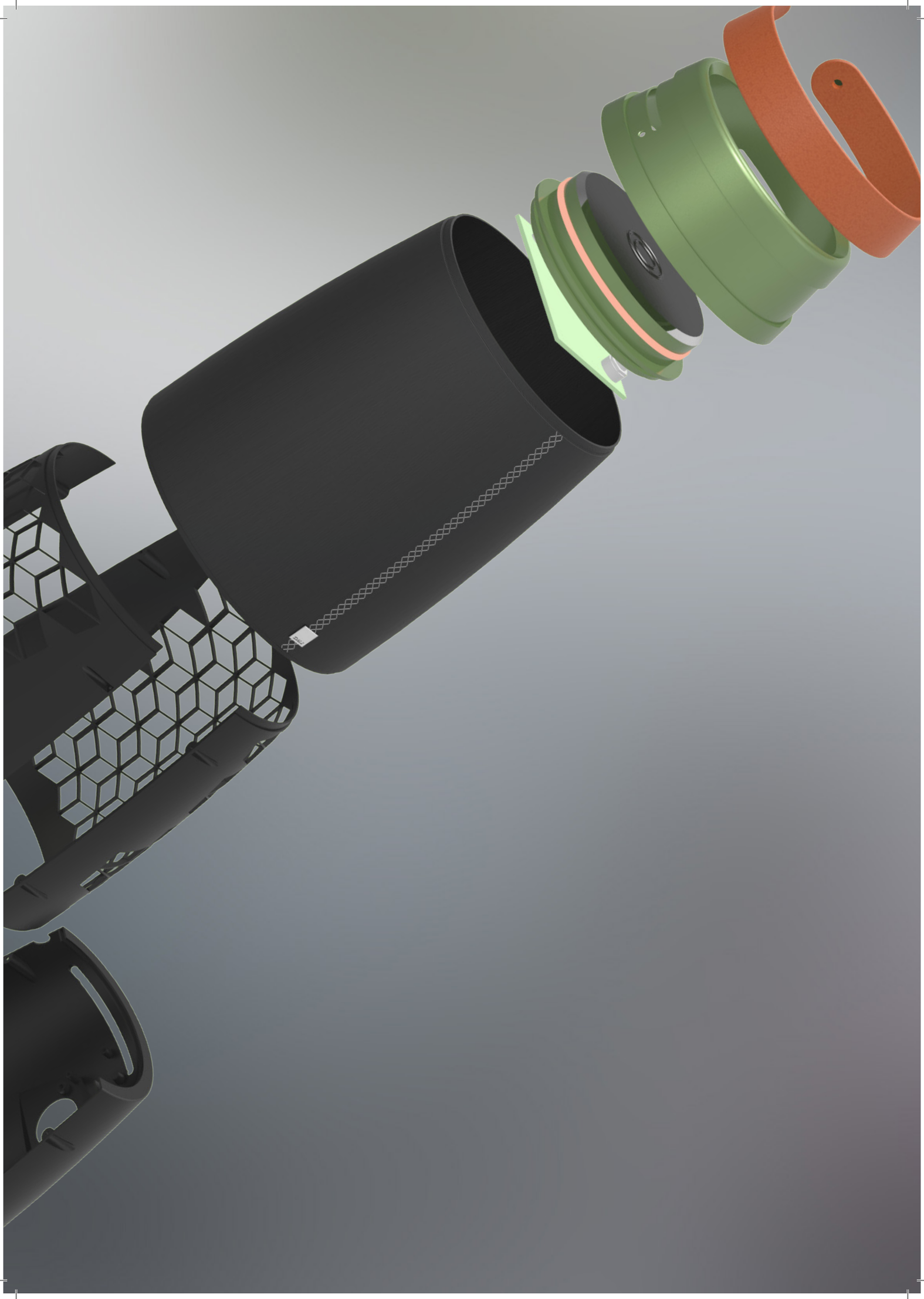


Powder coated aluminum
RAL 3015

Construction

DALI KOLOR is made from a number of plastic molded parts, cleverly assembled and capped off with the aluminum top and bottom, leaving no visible points of assembly.





Strategic innovation

The DALI KOLOR is the next step in DALI's entry into the URBAN market of active speakers. Accompanying the KATCH in providing this market segment with DALI's signature sound quality and attention to detail, the KOLOR focuses on the home use. With a new approach to delevering a great musical experience in a time where all music is streaming through smartphones or computers, the KOLOR places DALI at the front-line of innovation in the portable active speaker market.


DES
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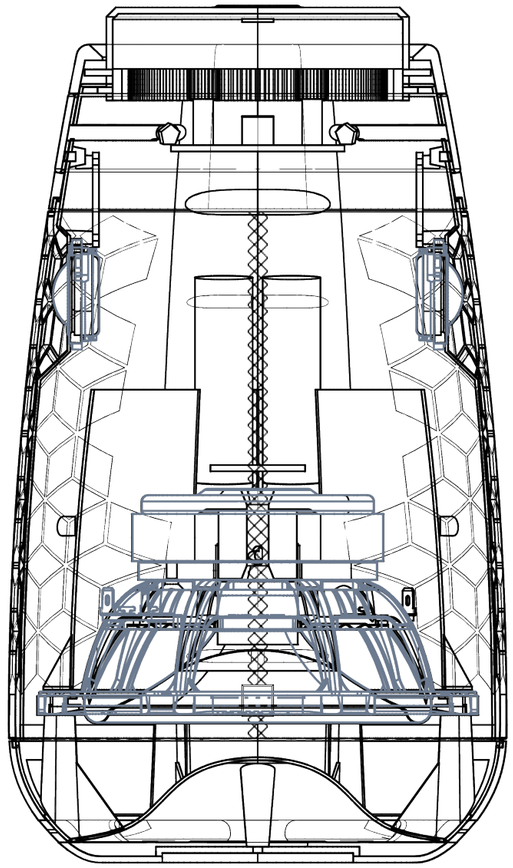
DALI KOLOR

Touching music



Process report - MSc04 Industrial Design - AAU - MAY 2017
Andreas Sig Pedersen & Stefan Troels Larsen

IN ADMIRATION OF MUSIC

Andreas Sig Pedersen

Stefan Troels Larsen

Identity

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Supervisor:	Schou, F. 01.02 -> 24.02 Eriksen, K. 24.02 -> 06.03 Jaeger, T. A. 06.03 -> 23.06
Secondary supervisor:	Nielsen, K. B.
Collaboration Company:	DALI A/S
Contact:	Mads Ullits
Process report page count:	115 pages
Worksheets:	42

Abstract

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A new approach to interacting with speakers has been designed based on market research, user interviews and an extensive registration of physical interfaces with seductive design qualities. The result is a new portable speaker that fits the digital streaming culture of today without the need of smart devices to control your musical experiences.

Reading guide

This is the process report documenting the process behind the product presented in the product report. The process is split into four major phases, Phase 0 - Planning, Phase 1 - Research, Phase 2 and 2½- Concept Development, Phase 3 - Detailing, Phase 4 - Eiplogue.

The insights found during each phase is summarized in the end of each phase through logic strings and listings of requirements. Insights will be marked as either **!** or **?** depending on the amount of further research needed.

All references are noted according to the Harvard method in the text as (Surname, year of publication) and refers to the alphabetic bibliography in the back of the report.

Accompanying the reports is a folder containing technical drawings and an appendix containing worksheets that has been used to document the process during the project.

An Audio Dictionary is found in the back of this report (See "Audio Dictionary" on page 107). It is provided as a guide to the reader when discussing loudspeaker specific terms and represents our understanding of the terms.

Acknowledgments

A special thanks to Thomas Arvid Jaeger, Karl Brian Nielsen, Kaare Eriksen, and Finn Schou for supervision throughout the project and valuable feedback.

Thanks to DALI for making this colaboration possible and a special thanks to Mads Engel Ullits for facilitating the communication between us and DALI and continues feedback througout the project period.

A thanks to all the people who have helped us with interviews, input, test ect.

Contents

0

The goal of this phase is to establish the first design brief, that will help align expectations and communicate with the collaborating company, DALI. With DALI's objective of reaching new markets, this phase will cover a strategic analysis of DALI's position, preliminary user input and a market analysis looking at competitors, retailers and market trends.

The output is an initial design brief which points at different interesting search areas and opportunities that will be explored and specified in the following phase.

This first phase 0 has been approached with methods and theories from Peter L. Phillips' "Creating the Perfect Design Brief" (Phillips, 2012), the second stage of the Delft Innovation Model the Strategy Formulation (Buijs, 2012) and Chapter Three, Opportunity Identification, from Product Design and Development (Ulrich and Eppinger, 2012)

Intro

This master thesis is a product development project that aims to provide DALI with a new product based on a strategic approach. DALI acts as both the case to develop for and a collaborator in the project development. DALI is looking for new markets to expand its value proposition and this project will give them one example of how a product could be designed for a chosen market.

DALI is a Danish manufacturer of passive loudspeakers who produces both cabinets and drivers at their headquarter in Nørager. To stay competitive and establish better contact with sub-suppliers they have opened a factory in Ningbo, China.

Passive loudspeakers isn't a growing market. In a strategic move to innovate and explore new revenue streams DALI has started producing active speakers and hiring skilled staff to a new electronics department. Their latest product released in this direction is the DALI KATCH portable Bluetooth speaker that aims at the, internally dubbed, "URBAN" lifestyle segment. A segment this project will explore further (Fig. no. 4 on page 8).

DALI

IN ADMIRATION OF MUSIC

Fig. no. 1 DALI logo and payoff

Fig. no. 2 DALI Zensor series

Objective for DALI

Prior to the start of the project DALI had an extensive end-user study report made by SynCrowd to get a profound understanding of the lifestyle segments for active loudspeakers across the world. The report presents 14 different lifestyle segments with insights about purchase drivers, sound usage and price frame etc.

At the initial meeting with DALI four different lifestyle segments fitting the "URBAN" market was decided to focus on; the urbanist, the interiorist, the conveniest, and the acceptor (Fig. no. 5 on page 9)

Common for the four targets is that they are outside of DALI's core group of loudspeaker enthusiastic customers, but instead are more passive towards the technical aspects of their speakers. Common for the top three lifestyles (urbanist, interiorist, conveniest) is that they all are very conscious about their choices of products especially the attributes of the product that contribute to their public image and lifestyle.

* The report is confidential and all displayed information is an interpretation made by BK Design.

Observation

Two out of four of the targeted lifestyle segments are depicted as women, but end-user study provided by DALI is primarily based on male answers. With the rising buying power of women (See "The WAF" on page 19) expanding the knowledge of the female customer segments would be beneficial.

?

- Explore the needs of the users but direct the focus mainly on females(See "Preliminary user input" on page 14)

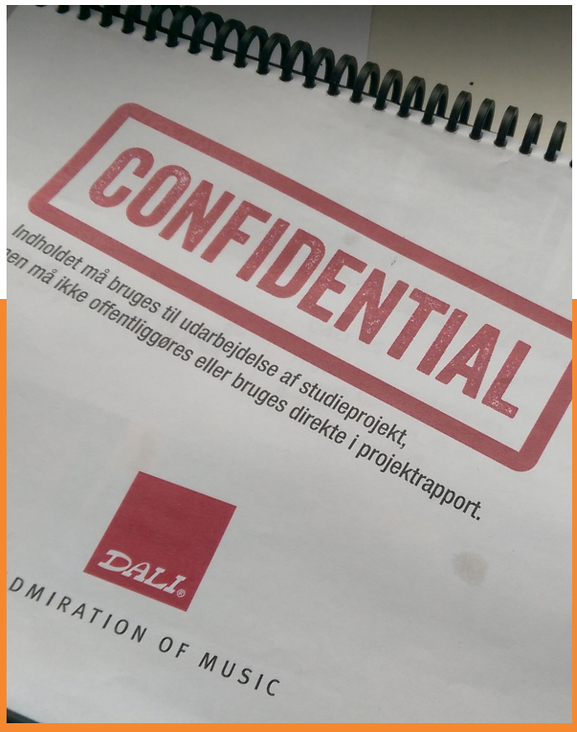


Fig. no. 3 Confidential end-user study

Fig. no. 4 DALI KATCH

Fig. no. 5 URBAN lifestyle segment

DALI A/S

It is important to have a common direction within a company in order to design meaningful innovation (Verganti, 2017). As a design consultant for a company it is crucial to first understand the company, before pointing at strategic direction to innovate. To gain insight of DALI, an analysis of the brand, company structure, business model and history has been made and is presented through a Business Model Canvas (Osterwalder and Pigneur, 2013), System Map and Golden Circle (Sinek, 2016). The following sections is based on several company visits, desktop research, and handed over information from DALI.

History

Going all the way back to 1915 where the Dane Peter L. Jensen and his partner Edwin Pridham invented the first loudspeaker, DALI and Denmark in general has a had a big influence on the loudspeaker development and history. What started out as a Nordic sales company for the American loudspeaker brand Peerless, became the main supplier of speaker units in Scandinavia because of tariff barriers on imported speakers during the Great Depression in America. Peerless is just one of several big brand that grow or started in Denmark. Scan-Speak, Vifa, JAMO and others are all world recognized as some of the largest and among the best speaker unit manufacturers through the ages, but due to high competition on prize and higher wages in Denmark, most of them have shut down, sold the business, or operate in China today.

Parallel to Denmark's rise in loudspeaker production was the rise of Danish designers such as Børge Mogensen, Finn Juhl, Hans Wegner who became acknowledged word wide for their furniture design. These influenced the loudspeaker business too. Woodworking companies such as "Tistrup Møbelsnedkeri" and "Hornslet Møbelfabrik" became world famous for their loudspeaker cabinets production and delivered to high end brands such as Bowers & Wilkins and also DALI.

The combination of world leading speaker manufactures and exceptionally skilled cabinet makers lay the foundation for Denmark to be one of the world leading loudspeaker manufactures. Bang & Olufsen, DALI and Dynaudio are recognized world wide for their design and high-end sound reproduction. (Danish Loudspeakers - 100 years, 2017)

Danish Audiophile Loudspeaker Industries

DALI, short for Danish Audiophile Loudspeaker Industries grew out of the Scandinavian hi-fi retail chain Hi-Fi Klubben in 1985, because of high demand for loudspeakers to go along with the NAD or Denon amplifiers sold in Hi-Fi Klubben. They started in 1983 by making NAD branded speakers for the Danish market but after two years became an independent company producing loudspeaker under the DALI brand. They gained immediate success on delivering high quality compact loudspeaker for unseen low prices at the time.

In a time where many choses to move production to China for cost savings, DALI chose to build all critical parts by themselves. They have previously designed everything but had them produced by other loudspeaker manufactures. The move to in-house production enables DALI to fine tune every detail with their engineers in close proximity to the production line. The move also sparked new technology developments for DALI, placing them on the cutting edge of technology developments in the loudspeaker industry. In 2007 opened DALI's first factory in China, this allowed them to produce certain components cheaper and get in closer contact with their Chinese sub-suppliers. (Danish Loudspeakers - 100 years, 2017).

DALI has in recent years expanded into the active speaker market with KUBIK ONE and KUBIK FREE and last year also the portable Bluetooth speaker KATCH. With this expansion they have added a new electronically engineer division to their company in order to keep designing and developing every detail in-house. The KUBIK ONE and FREE was the result of the first R&D into making active speakers in-house.

The KATCH is their first speaker in pursuit of the portable speaker market, where BeoPlay, Libratone, Ultimate Ears and Bose among others has seen huge success in recent years. The KATCH is designed in collaboration with Munich based design consultancy Designit and DALI. It is produced at a Chinese supplier.

Company Review

Based on the topics in the Business Model Canvas such as, Value Proposition, Channels, Key Activities etc. a quick analysis of DALI's company structure has been made. The company review is based on DALI's core market, the passive loudspeaker.

Value Proposition

The primary value proposed by DALI is in the authentic reproduction of sound used to increase the realism of home entertainment experience. DALI takes pride in delivering "best in class" loudspeakers through state of the art technology ("Worksheet no.: 4 Value proposition").

Customers Segments

The core customer segment is Hi-Fi enthusiasts that have a passion for authentic sound and enjoys the complex system and comprehensive setup of a traditional stereo/surround setup. Often called an Audiophile the gearhead of the Hi-Fi market ("Worksheet no.: 4 Value proposition").

Channels

Hi-Fi Klubben is the exclusive sales channel of DALI products in Scandinavia. DALI otherwise sell their products to other distributors all over the world.

Key Activities

DALI primary activity is designing and development of every single part of a loudspeaker. They develop technologies for their high-end product and apply vertical leveraging through process optimization to integrate them in mid- and low-end product. (Lehnerd and Meyer, 2014)

Key Resources

The key resource of DALI is in the know how and expertise of their highly skilled engineers. Their partnership with Hi-Fi Klubben and their close connection with sub-suppliers.

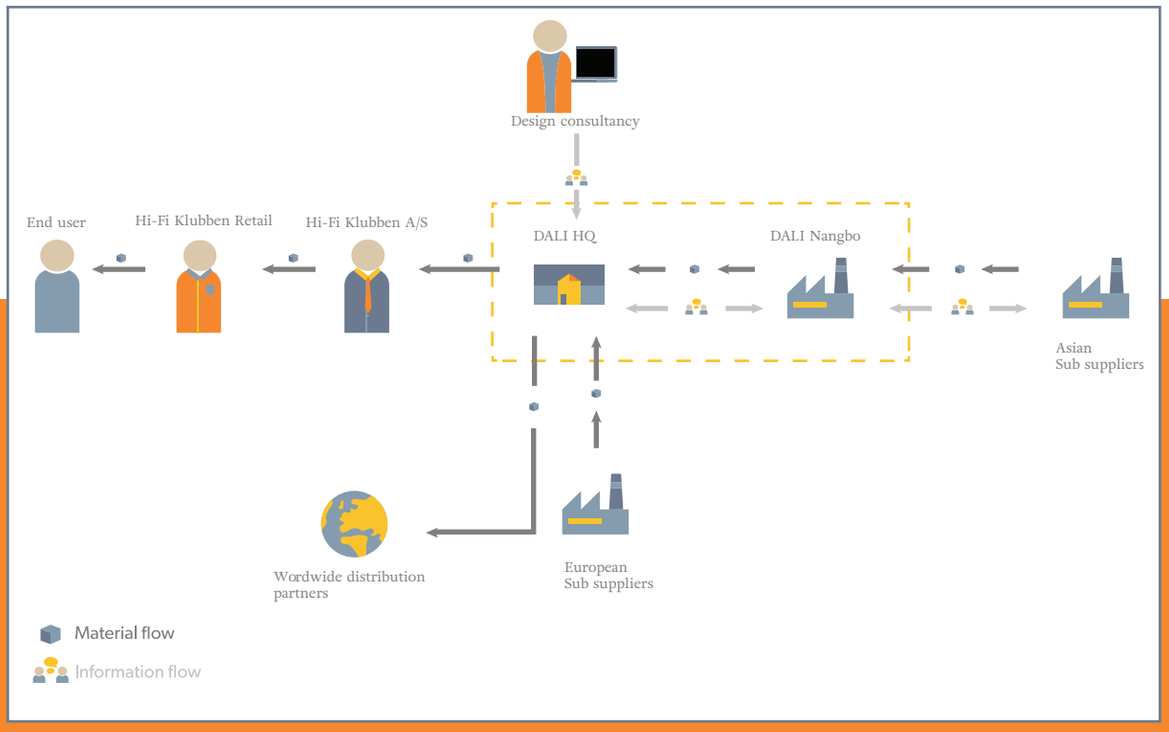


Fig. no. 6 System map (Morelli, 2007)

Brand values

"In Admiration of Music" is the payoff often accompanying the DALI logo. While DALI is in admiration of music and pursues the perfect reproduction of sound they have no ambition of moving into the very high end of loudspeakers. They always strives to become better yet they don't see the challenge in a "cost-no-object" loudspeaker. DALI has always had a focus on the value of money aspect and objective of creating the best loudspeaker for a domestic environment. (Danish Loudspeakers - 100 years, 2017)

DALI has a set of values which they use to define their brand:

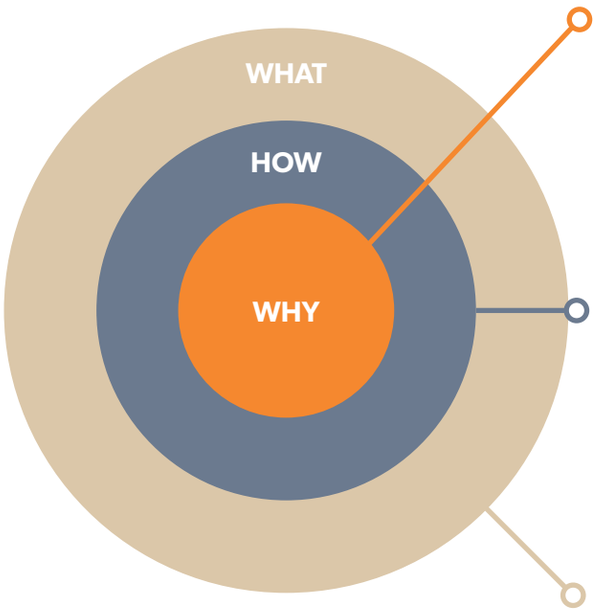
- **Made in Denmark**
- **State of the art technology**
- **In-house Driver production**
- **High quality components from world leading suppliers**
- **Innovative design**
- **Value for money**
- **Best in class**
- **Authentic sound reproduction**

Using the Golden Circle (Sinek, 2016) to classify and overview the DALI brand shows what their core values is and WHY they do what they do. It is evident when visiting the DALI headquarters in Nørager that they are very enthusiastic in what they do all the way from management to the assembly line. Where each employee signs the finished assembled loudspeaker themselves, as a sign of quality. The HOW is from their state of the art technology, in-house driver production and established partnership with suppliers. DALI is able to deliver their WHAT, which is best in class, value for money loudspeakers from a Danish brand. (Fig. no. 9 on page 13)

The portable Bluetooth speaker market is somewhat contradicting to the DALI brand values. The pursuit for authentic sound reproduction is challenging in a market where portability, size and battery life are some of the main selling points. The KATCH doesn't utilize any of DALI's in-house production because of price competitiveness, which put it at the edge of what the DALI brand consists of.

Fig. no. 7 DALI production

Fig. no. 8 DALI production



- Authentic sound reproduction

- In house driver production
- State of the art technology
- High quality components from world leading suppliers

- Best in class loudspeakers
- Made in DK
- Value for money
- Innovative design

Fig. no. 9 DALI Golden circle (Sinek, 2016)

Sum up

DALI wants everybody to experience their sound consumption as an authentic reproduction of the sound intended by the creators of the music. They deliver that by using state of the art technology and keeping high standards for their production. This results in DALI making speakers that each are the best in their class' regarding authentic sound reproduction, all packed in a innovative design and made in Denmark.

DALI has a legacy for designing everything themselves and with the expansion to active speakers have established a electronically engineer division in order to keep doing that.

The portable Bluetooth speaker market is drawing on the same expertise that the DALI engineers use when developing high-end loudspeakers. But it is quite far away from the values of the high-end passive loudspeakers, that the DALI brand is know for.

?

- Uncover and decide on a strategic direction for DALI in perusing this new market (See "DALI strategic options" on page 29)
- DALI isn't used to design lifestyle products that people are interacting directly with.

!

- Stay true to values while expanding into new markets.
- Utilize that DALI has assembly and production in house (Drivers, cabinets, etc.)
- Sold through Hi-Fi Klubben
- Utilize the new electronic engineering division

Preliminary user input

In order to refine the understanding of the 'URBAN' market a more qualitative and first hand experience with the target audience is needed. The objective is to gain insights in the users pains and gains from both the traditional loudspeaker and from whatever speaker solution they use in their life. The input is aquired thorugh shadowing and interviews.

Interviews and observations

Going into selecting users fit for interviewing fitting the 'URBAN' market it were important that the users were not 'audiophile' resulting in interview persons that resembles the traditional DALI customer more than this new market. Additionally the confidential end-user study from DALI were made from a gender distribution of twice as many male compared to female respondents. This uneven distribution clashes with the target groups which were, in two out of four, represented as women.

These factors led to a stronger focus towards the female part of the target audience and the selected 9 interview persons were split between 2 males and 7 females. The amount of interview persons is based on the notion that 9 persons in individual interviews would uncover above 80 percent of the user need (Griffin & Hauser, 1993).

User statements

Common for all the users were a disconnect with the traditional DALI offering of black square loudspeakers. The users acknowledged that the sound quality of loudspeakers generally were better but they disconnected with all the challenges surrounding the traditional loudspeakers such as the aesthetic and technical knowhow required to setup and operate a loudspeaker.

The interview persons chooses smaller more convenient speaker solutions such as small portable speakers. Most users experience a big challenge in connecting their playing devices with their portable speakers and some interview persons even got anxious when asked to connect the speakers. This leads to some admitting defeat and settling for a lesser but even easier solution like phone speakers.

Although its not the only use of speakers a majority of respondents primarily used their speakers for playing background music when during other tasks such as cooking, cleaning, and taking a shower. This background music use results in the use of sound in almost every room of the residence.

Most of the respondents uttered a wish for expanding their speaker setup when moving to a larger home and/or when they have a sizable income. In most cases this was a wish for multi-room speaker setups.

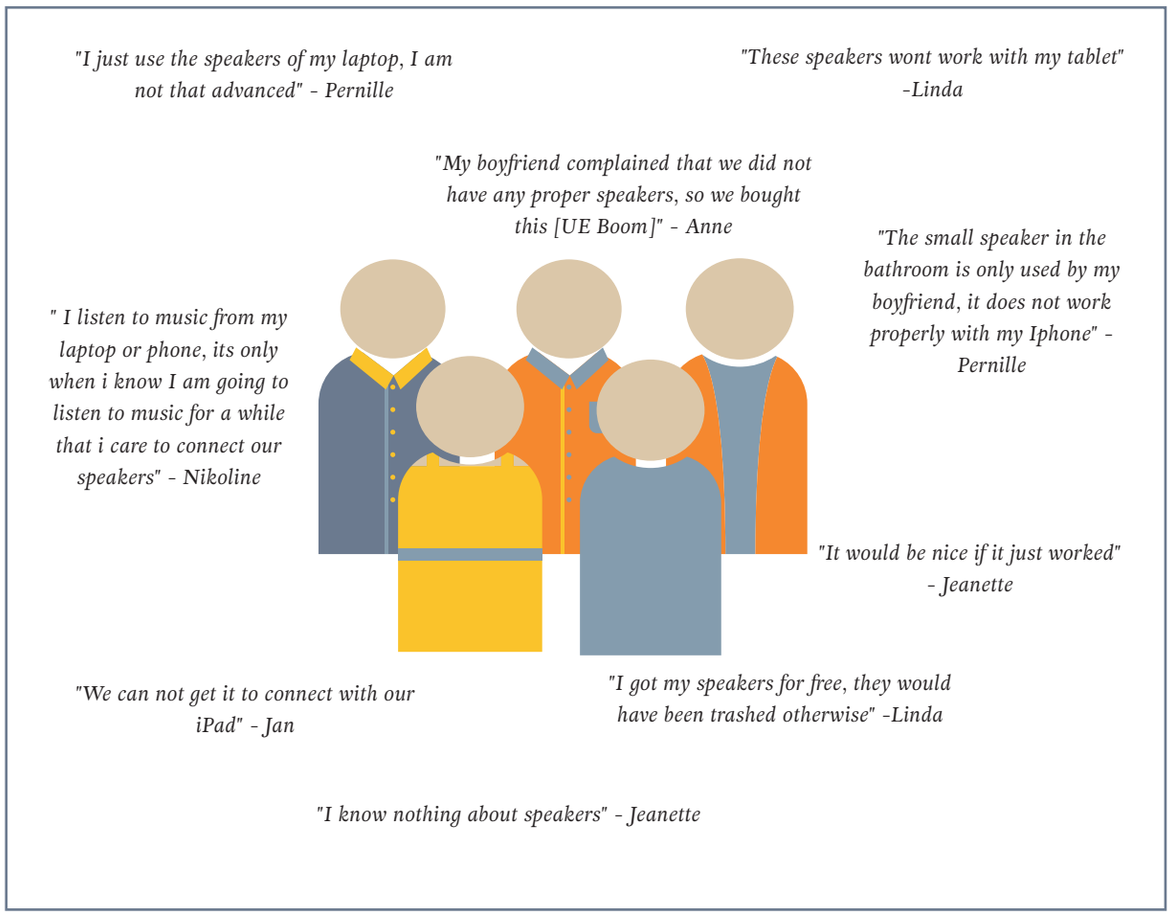


Fig. no. 10 *User input*

Sum up

The interview persons can be described as a group of customers that does not focus on hard technical specifications of their electronic products and does not have wishes regarding top performance. Instead the customer segment cares about how the products fit into their life and homes, that they are easy to use and that they can rely on their products to deliver the same comfortable experience every time. The customer segment especially do not want products that makes them feel inadequate. The customers experience a disconnect to the traditional loudspeaker setup as they simply do not feel they know enough to operate them and they dislike the aesthetic of multiple black boxes connected with a series of wires.

- Make the user feel adequate when operating the product solution
- Create an easy and reliable way to start playing music
- Make a product solution that deviates from the aesthetic of a traditional loudspeaker setup

Market analysis

In order to confidently hit the market with a future product, the market needs to be assessed in regards to competitors, moving or upcoming trends, and the market in general. The assessment is done through desktop research to get the view of market experts together with field research in retail stores (Appendix no.: 1).

Market as is

Going into the analysis of the market a mapping of many of the current product were made in order to compare the different speakers on the parameters they sell themselves on. Specifically a big spreadsheet were made listing the different speakers next to each other. These specifications were acquired by searching through specifications sheets provided online.

Speaker types

Loudspeakers

This is the traditional speaker setup which is DALIs core offering. The loudspeakers are setup as a series of speakers arranged around the television and carefully placed around a sofa so that the user experiences a correct sound image (left sounds from the left and so on). The loudspeakers requires an amplifier which is a physical box that translate and amplify the signal from the television and sends it to the speakers through the connected wires.

Soundbars

Soundbars or soundbases are speakers which main purpose is to enhance the sound of the television without taking up the same space and requiring additional amplifiers like the loudspeakers. The soundbars therefor uses drivers bigger than the televisions but smaller than the loudspeakers, and have an internal amplifier.

Fig. no. 11 DALI loudspeaker setup

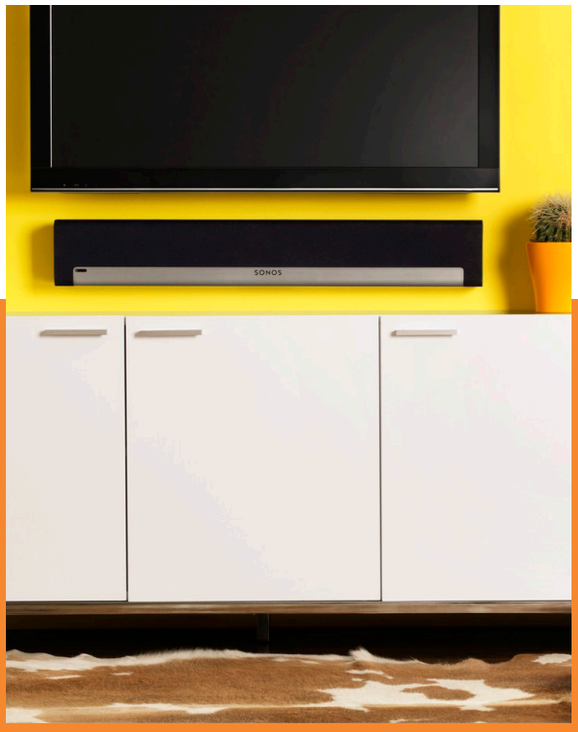


Fig. no. 12 Sonos soundbar

Portable Bluetooth speakers

The portable speakers are the smallest of the types and addresses the need for bringing music around and in many cases focuses on outdoor use. The speakers requires a phone or tablet to operate the speaker and the connection between the two is the Bluetooth technology which requires a close proximity between the speaker and the phone.

Fig. no. 13 *DALI KATCH portable speaker*

Wi-Fi speakers

The Wi-Fi speakers are speakers focusing on sound in the home but usually away from the television. The Wi-Fi speakers are connected with the wireless Internet of the residence which allows for control through a phone or tablet without any limits of distance, within the wireless network. The wireless speakers are placed in a fixed spot in the home as it is mains powered.

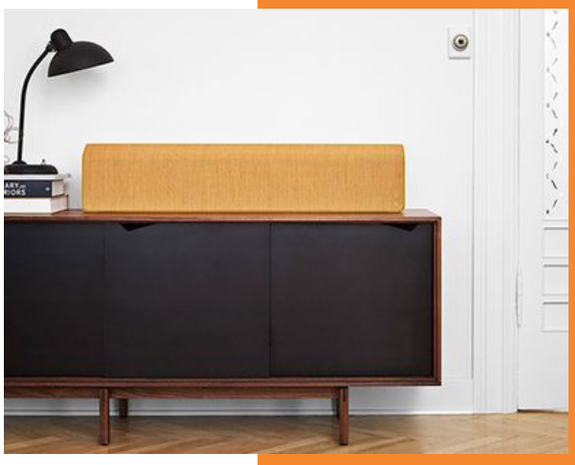


Fig. no. 14 *Vifa Stockholm Wi-Fi speaker*

The multi-room system

The multi-room system is a system of soundbars and Wi-Fi speakers that work in unity. This system is connected to the wireless Internet and is controlled by a phone or tablet. This system of speakers is then meant to be placed around the house allowing the user to play music in every room of the residence and all controlled from a phone or tablet.

Fig. no. 15 *Sonos multi-room*

Market trends

Through desktop research the movements within the consumer electronics market is uncovered. The objective of the search in market trends is to gain knowledge in the wishes and patterns of the general electronics consumer so that a broader perspective of the market is maintained through the product development.

Regarding trends specifically in the speaker market there is a tendency of rugged portable speakers eating away the market share of other portable speakers. But also a drastic growth of Wi-Fi speakers compared to Bluetooth speakers. David Yang, spokesman for Jam Audio points to this specific trend and states that this might be because that feature set is becoming a basic feature that is expected in every speaker (Wilson, 2017).

Consumer electronics trends

Looking at the trends in the consumer electronics it is assessed that there are three major tendencies that shows promise in influencing the product solution.

Smart speaker / Smart home

The smart home or home automation trend is still going strong as The major topic for the last couple of years doing CES and throughout the industry. Still more products are getting IoT (Internet of Things) integration and that is expected to continue (Wilson, 2017). Ranking as the number one trend in the smart home direction on several news outlets is "Voice control". The trend and innovation research company J. Walter Thompson Intelligence even went as far as to call 2017 "The year of voice" (Christian, 2017).

Amazon restarted the voice control market with the introduction of Amazon Echo, a smart speaker that lets the user interact with the intelligent personal assistant(IPA) service Alexa through voice commands. Google entered the smart speaker market with the release of the Google Home in late 2016, powered by Googles own IPA, Google Assistant. Other big players in the IPA market, such as Microsoft with Cortana and Apple with Siri is expected to enter the smart speaker market soon.

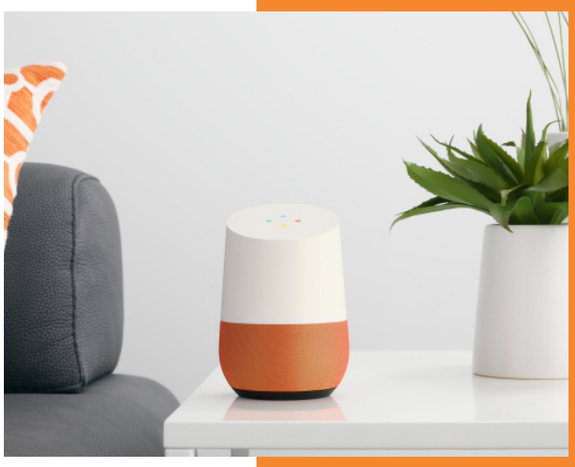


Fig. no. 16 *Google Home*

Fig. no. 17 *The light phone*

Fig. no. 18 *SACKit MOVEit*

Digital detox

Amidst all the home automation, smartphones and IoT enabled products, another consumer trend has arisen, digital detox. The "always on" lifestyle has sparked a disconnect / digital detox movement to increase mindfulness, reduce stress and reconnect with what matters in life. It is about being present, with nearly every device being IoT integrated and screens calling out for attention, people have found the need for disconnecting and just being present.

It is an abstract trend, but looking at it from a business perspective, there is opportunities to be found. It could be seen as a cry for products that requires less technological knowhow to operate and in general requires less of the user. The Light Phone is an example of a product exploiting this trend. The Light Phone is a back to basis phone that is only able to call and last for weeks on one charge.

The WAF

The Wife Acceptance Factor or WAF is a known term in the consumer electronics industry and even more so in the Hi-Fi segment. Researchers from both the Scandinavian trend institute, pej gruppen, and the Danish design consultancy, design-people, expects the influence of this effect to increase in the future. Calling this trend womenomics which is rooted in the expanding influence of women in the household, business and society through increased access to education and better jobs.

“By 2028 women will control nearly three quarters (72%) of consumer spending worldwide.” - Boston Consulting Group

One of the research main goal is to locate gender preferences in relation to technology products and found that product design with a female benchmark also tends to be attractive to men (Design-people, 2017).

Field research at local retailers

In order to get a more hands on aspect on the market a visit at the local retailers of Aalborg were conducted. The visit were conducted at four different locations: Hi-Fi Klubben, Salling, Elgiganten, and Kalejdoskop.

Salling

Salling is a three story department store located in the center of Aalborg. Salling were chosen as a member of the group had previously seen a speaker product in the interior department of Salling.

At Salling the interior department did not house any speaker products. At a conversation with one of the sales representatives he cleared out the reasons why. Previously Salling had offered Beoplay and Libratone products in their interior department but discontinued due to low sales. "*It just didn't sell*" - sales representative.

Kalejdoskop

Kalejdoskop is and interior design store in Aalborg that sells a single speaker, the MOVEit bluetooth wifi speaker from SACKit. The speaker is displayed nicely in a display case (See "Fig. no. 18 SACKit MOVEit" on page 18).

At an conversation with an employee it were uncovered that the sales of the MOVEit speaker were good and Kelejdoskop had received positive feedback from their customers as Kalejdoskop sometimes hosted presentations of the speakers for customers, in order to display the speakers capabilities. The employee assessed that the buyers of the MOVEit speaker in their store, did not arrive with the intentions of buying a speaker. This results in the customers at Kelejdoskop impulsively investing DKK 1700,- in a speaker.

Elgiganten

Elgiganten is an electronics store housing a big range of speaker products. The speakers were arranged in groups according to brand.

In a talk with a sales representative he stated that the costumers of their speakers could roughly be split into two groups: The ones on a very tight budget, going for the cheapest speakers. And the group of customers which values their needs above the price of the speaker, resulting in the customer buying what he wants regardless of price.
In addition he states that the Bose brand sells well with the older customers meanwhile JBL and UE speakers appeal to the younger customers with their colorful exterior and low budget and higher durability for outdoor use.

Hi-Fi Klubben

Being the retailer of DALI products, Hi-Fi Klubben is chosen for a visit. At Hi-Fi Klubben the selection of speakers were arranged according to speaker types so that the portable speakers were all gathered in one place (See "Fig. no. 20 Hi-Fi Klubben selection" on page 20).

The employee at Hi-Fi Klubben expressed his gratitude of the DALI Katch speaker as customers had requested beautifully designed products. He mentions that in a Hi-Fi Klubben store another place in Aalborg, the store battles a nearby Humac store for customers. A lot of the customers are drawn to the aesthetics of the light and open Humac store. After visiting the Humac store customers visit Hi-Fi Klubben in which they acknowledge the audio fidelity of Hi-Fi Klubbens offerings, DALI KATCH especially.

Focusing on the sales situation at this particular store, the employee requested neutral colors for the speakers as he experience some customers reconsider buying the KATCH based on the non-neutral color selection. Likewise he also points to the equalizer button on the DALI KATCH. When a couple enters the store to buy a speaker, the equalizer button can be a selling point to the male while the aesthetics appeal to the female.

Sum up

Regarding the speaker market there is a set of categories which most products fall into. In each of these categories there is a range of products that all do roughly the same and tell the same story resulting in few to none real features that differentiate the speakers from each other. The market trends is hardly visible in the local stores, except for the WAF which is a present factor in the minds of retailers. The market trends covered in this chapter covers the existing movements in the consumer electronics market, an area of focus could be trends outside the consumer electronics market.

?

- Locate trends outside the consumer electronics. Look into general consumer behavior (See "Consumer trends" on page 30)

Fig. no. 19 *Selection from Elgiganten*

Fig. no. 20 *Hi-Fi Klubben selection*

	HELPFUL	HARMFUL
INTERNAL	Highly skilled acoustic engineers, with a high passion for delivering the best sounding product in each class. Close contact with sub-suppliers. Expanding with a factory in Ningbo, China, for cost effecting and build a closer relation to suppliers from that region. Exclusive retail agreement with Hi-Fi Klubben is both a Strength and a Weakness, as it is limiting the consumer reach in the Scandinavian market.	Most of DALI main differentiating technologies is developed for the very high-end and then through process optimization leveraged vertically for lower tier product lines. This however doesn't give them the edge against competitors in the URBANE lifestyle segment. DALI are experts in designing and producing high quality passive loudspeakers that are connected to other manufacturers power-amplifiers. Which means they have little to no experience with designing products that users directly interact with, and let alone feel connected to and create meaningful experiences. Something that the competitors are highly focused on.
EXTERNAL	The portable speaker market is dominated by Bluetooth speakers, that doesn't deliver the experience that the consumers expect. The Bluetooth technology doesn't deliver and only a few manufacturers are pursuing other technologies for connecting to the devices.	Passive loudspeakers are reliant on power-amplifiers from other manufactures. Perception of DALI will be influenced by whatever could be problematic with the power-amplifier. Similar the portable speaker market is reliant on the phone and connection technology for a pleasant experience.

Fig. no. 21 *SWOT analysis*

SWOT analysis

The strategic aspect of entering a new market is very important factor. By looking both internally and externally of DALI and the loudspeaker market a SWOT analysis to highlight possible Opportunities to pursue based on the Strength and Weaknesses of DALI, while avoiding the threats of the market.

DALI's competitive edge lies in their close relationship with suppliers, their Danish legacy and highly skilled acoustic engineers. A new product will have to build upon these Strengths.

End of Phase 0

The objective for Phase 0 was to get a better understanding of DALI and their brand values as well as an overview of what moves in the audio market and what the users are experiencing.

- Stay true to values while expanding into new markets.
- Utilize that DALI has assembly and production in house (Drivers, cabinets, etc.)
- Sold through Hi-Fi Klubben
- Utilize the new electronic engineering division
- Make the user feel adequate when operating the product solution
- Create an easy and reliable way to start playing music
- Make a product solution that deviates from the aesthetic of a traditional loudspeaker setup

Initial insights were gained and new questions emerged. A sum up and interpretation of these findings as well as initial problem statements for both DALI and the users are presented in the illustration (Fig. no. 22 on page 23). These findings was presented in a Design Brief to both supervisor and DALI as a base of discussion (Appendix no.: 2).
The following chapter suggest possible product solutions that could fit the "opportunities" field between DALI and users.

- Uncover and decide on a strategic direction for DALI in perusing this new market (See "DALI strategic options" on page 29)
- Locate trends outside the consumer electronics. Look into general consumer behavior (See "Consumer trends" on page 30)
- DALI isn't used to design lifestyle products that people are interacting directly with.

LOGIC STRINGS

PROBLEM	INSIGHT	SOLUTION PRINCIPLE	VALUE
DALI does not have passion for the small portable speaker market.	DALI values heavily favors their loudspeaker passion KATCH speaker is not produced or aestethically designed by DALI	Move production of the product solution to Nørager	DALI embrace the portable active speakers as a part of their identity
DALI core values is not an obvious fit with the URBAN market	URBAN market is not Hi-Fi enthusiast	Unknown	Unknown
Users can not connect to their BT speakers	Users uses other devices for playing music because they experience difficulties with their BT speakers	Unknown	Users confidently and successfully use their speakers for playing music every time.
Users are emotionally disconnected with their speakers	Users feels inadequate and get anxious when asked to operate their speaker	Unknown	Makes the user feel comfortable and happy to operate their speaker

Fig. no. 22 *DALI and user insights*

Opportunities

Based on the insight from the preliminary research a session of opportunity generation was conducted, for where DALI could innovate within this market. The opportunities could be vague concepts or direction ideas for where the project could go ().

The opportunities will act as a catalyst for a creative discussion with DALI on which direction they find interesting, and align expectations for the project.

The problem and mission statements from previous chapters, worked as the idea catalyst for the opportunity generation.

All of the ideas has been combined into four different directions and presented through the Horizon matrix by Terwiesch and Ulrich (2009). The map is used to map each opportunity in regards to knowledge of need/ market and knowledge of solution.

1

Ultra Portable

USP; Waterproof, rugged, smaller and cheaper than KATCH.

Scenarios: Road trips, beach, BBQ get-togethers, social, outdoor, extreme sport.

The DALI Brand values isn't an obvious fit and will require changes, doesn't utilize DALI Strengths.

2

No-Nonsense Portable

USP; Minimal interface, analog connection (cable), bigger than KATCH,

Scenarios: BBQ gatherings, home, living room, kitchen, social outdoor gatherings.

Could be produced in Nørager, strong story on the Digital Detox and could fit the DALI Brand.

3

1,2,3 System

USP; Scalable system of small/portable speaker (1), larger mains powered speaker (2) and a Center/ soundbar speaker with build in AMP for passive loudspeakers(3).

Scenarios: Home multi-room system with portable flexibility. TV / surround sound.

The (1) speaker is assembled in Nangbo, China, the 2 is produced and assembled in Nangbo, China, and the 3 is produced in Nørager.

4

Modular

USP; Seamless integration between portable speaker and home Hi-Fi, shared interface

Scenarios: Home and on the go. Carry around "multi-room" speaker.

Smaller is produced in China, and the dock/home is produced in Nørager.

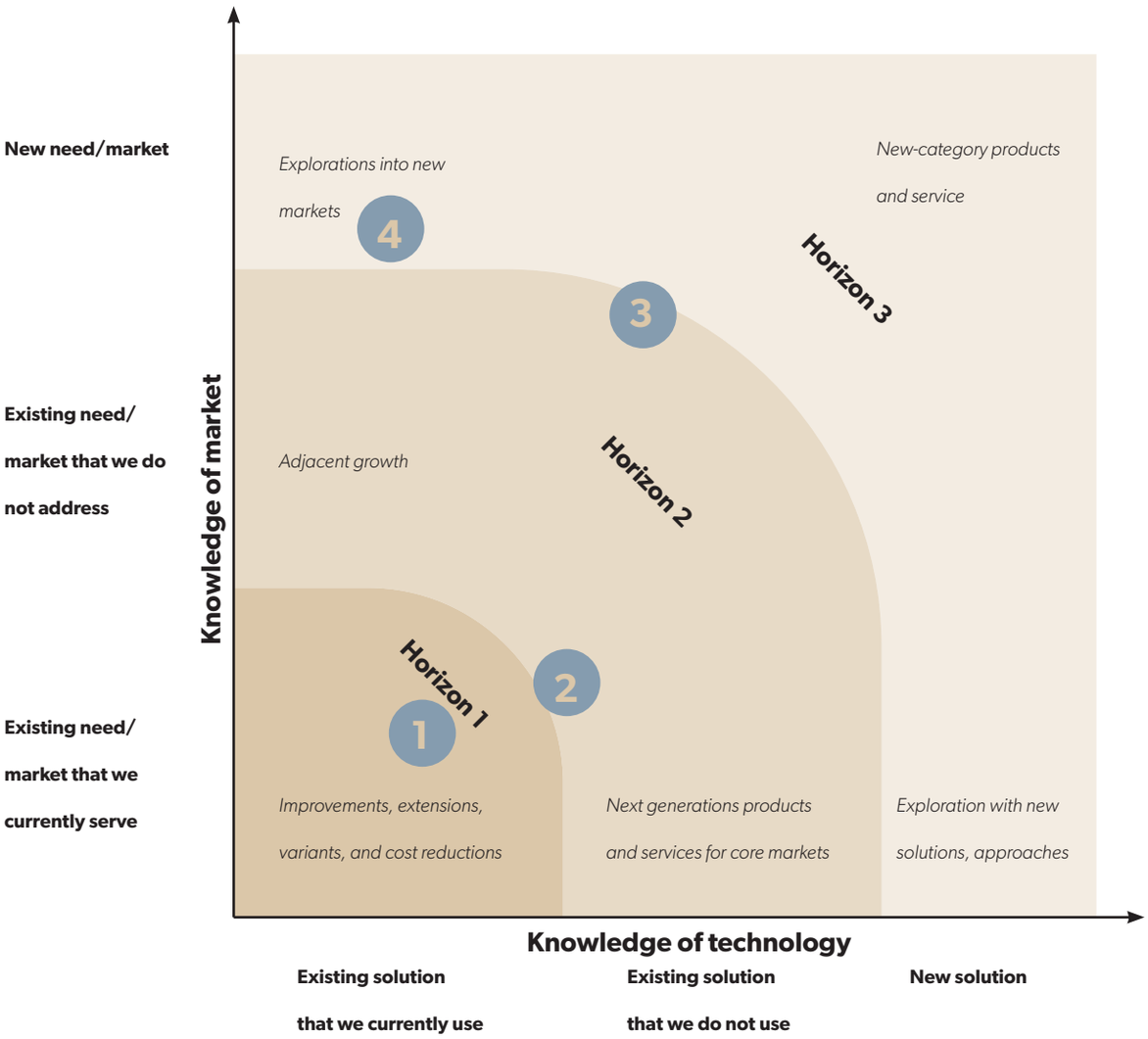


Fig. no. 23 *Horizon matrix (Terwiesch and Ulrich, 2009)*

1

Following the first design brief and opportunities, further research into the problem is needed and specify which parameters is crucial for a product solution that targets both the values of the consumers and DALI.

In this phase the goal is to specify upon the first design brief and clarify the problem and outline the subproblems and possible requirements for a solution.

This phase is approached with the Five-Step Concept Generation Method in mind (Ulrich and Eppinger, 2012) and presented through a persona, value proposition and a requirement matrix.

Case study of competitors

DALI is searching for greener pastures though DALI's main market of passive loudspeaker, might not yet be in trouble. But the market isn't growing, Euromonitor reports a fall of 21% in retail volume sale of the Hi-Fi home audio setup in 2015. While MarketsAndMarkets reports a CAGR increase of 6.4% towards 2022 led by soundbars and the convenience of streaming and wireless speakers. (Marketsandmarkets.com, 2016) (What Hi-Fi?, 2012)

To better understand DALI's move into a new market a case study of two similar cases were made.

Bang & Olufsen went through a somewhat similar processes of having a big brand heritage that experienced troubles in their main market and in pursuit of new markets had to compromise on some of their core brand values.

Libratone the Danish company that came out of nowhere and gained huge traction because of their innovative offerings in the portable speaker market. Looking at what they did might provide some useful insight to how to innovate in this market.

Bang & Olufsen

B&O experienced falling revenues in the aftermath of the financial crisis in 2008. They had trouble attracting new customers and their loyal costumer base was slowly dieing or content with the long lasting products B&O sells. The move away from analog and physical media in the audio industry and the consumers embrace of streaming and digital devices further troubled B&O's foothold in the audio market, since their offerings was CD focused.

In 2012 they launched their new brand, BeoPlay, targeting the younger target audience, with a higher emphasis on music listening on the go. Offering them a peek at the B&O experience through cheaper BeoPlay products and influence them to buy B&O products when they settle with house and family.

The BeoPlay brand is a downward brand extension that relies on the parent brand but to a younger audience at a lower price point. It was a risky move for Bang & Olufsen that could end up harming the brand equity of the parent brand. B&O did end up dropping on international ranking lists, but that could be influenced by other factors. (L. Hansen and M. Bjerregaard, 2013) (Hougaard, Rysgaard and H. Møller, 2014)

Libratone

Libratone started as a response to docking stations having a low market performance in 2009 and was intended as a technology platform around their "FullRoom" technology. Which is one speaker unit that sends sound in all directions. But they eventually chose to go to market themselves with High-end docking stations. In order to do differentiate from the already crowded market of docking stations they looked to break the established convention of the high-end audio market. Break away from the piano black or PC speaker reference and make products that look and fit into the homes and lifestyles of the users, a unisex Scandinavian-home speaker that provides soundtrack to other activities. For connection they dropped the docking station idea and went with AirPlay instead of the already popular Bluetooth technology. They entered the market as one of the first AirPlay supported speakers and was sold in Apple Stores. Libratone did something that few others in the market did at the time by focusing on aesthetics, technology, the use scenario, and interaction. (Møller, 2015)

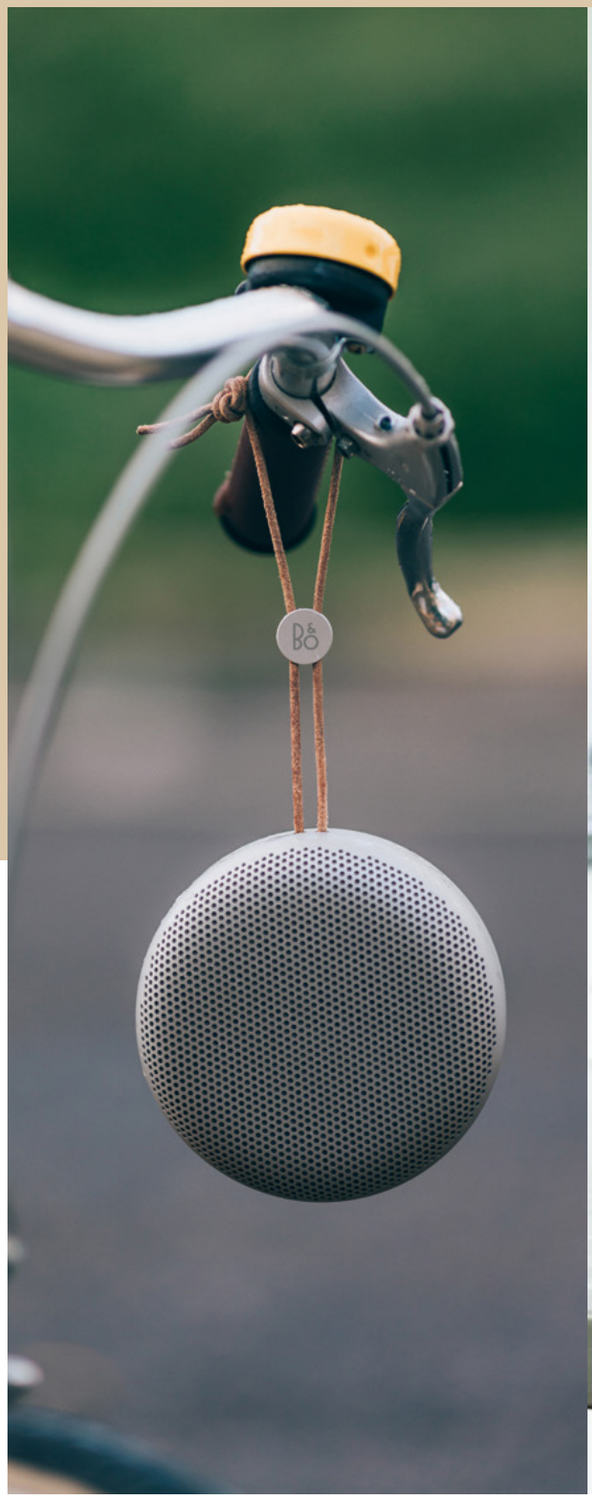


Fig. no. 24 *BeoPlay A1*

Fig. no. 25 *Libratone Live*

DALI strategic options

From attained knowledge about DALI and their values (See "DALI A/S" on page 10) and the knowledge about other speaker companies in similar situations it is assessed that DALI will have to follow one of the following strategic directions in pursuit of addressing the 'URBAN' market.

Brand extension

In order not to compromise the existing DALI values (Fig. no. 9 on page 13), a brand extension is made similar to the situation with B&O and their Beoplay. A brand extension of this sort would require a new set of values to be determined on the behalf of DALI.

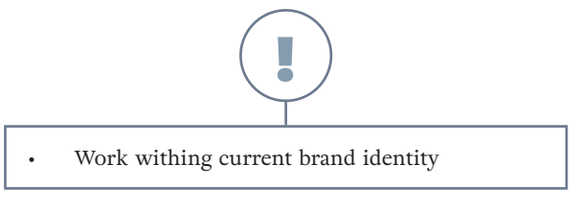
Identity stretch

If DALI wants a coherent brand identity while addressing the 'URBAN' market, an adjustment of the DALI values have to be made. The adjustment should serve the purpose of housing both the traditional loudspeakers sold by DALI together with the new active and portable speakers like KATCH, targeted at the new market.

Apply current brand identity

This solution implies that DALI from the future on and out stick to their values and only create products that fit within these values. This should result in every product fitting with the original DALI values which might make it harder to expand to other target groups but will insure that DALI does not become a 'follower' but makes their own unique place in the market.

In choosing among the three different strategic direction the group have assessed that the 'Apply current brand identity' is the most fitting for the project. This is based on the assumption that the two other directions involves a lot of branding and marketing processes which falls outside the desired focus of the project, likewise the reasoning behind a collaboration with DALI entitles that the group can anchor the project in some of the DALI values. In case of a major identity adjustment, the project looses its anchor in DALI and might as well be targeted at any other speaker manufacturer.



Consumer trends

From the trends in consumer electronics it was clear that a search of trends in general consumer behavior might prove useful. The objective of this research is to uncover trends in consumer behavior that could be exploited in the product development.
The research is conducted through desktop research and focused on two categories. The behavior of the female consumer as the WAF trend and response from the retailer points towards women being a interesting actor in the future market of speakers. Likewise the younger generations are in focus as the product solution is targeted at a 25-35 year old consumer. In order to meet the wishes of the future consumer the younger generations are put into focus.

Movements

From the research the following categories were assessed to be the most prominent factors that could be exploited in a future speaker.

Flexibility

Flexibility is required of the products of tomorrow. This flexibility relates to the physical flexibility. The life of the consumer is in constant change and the products surrounding the user needs the ability to adapt to these changes (Forbes.com, 2014).

Engaging

In a world filled with buzz and surface interaction caused by the "always-on" lifestyle expected of modern people, there is a crave for getting away from the internet, public, and the many decisions. This manifests itself in a need for a simpler, sensorial, and more engaging experience with products with more time for self-development and mindful interaction (Meredith Corporation, 2014).

Educating

The new female generations are more receptive to learning than previous generations and desire products that aid them in understanding and in intuitive ways teaches them about the products. They want to learn what is best and if you teach them they will gladly spend more on their products (Meredith Corporation, 2014).

Traditional values

Though the new generations are raised in a mobile and "always-on" lifestyle which they embrace and rely on, they still share some of the traditional values of their parents. The new generations mirrors themselves in the older generations and values some of the same things but still depend heavily on the modern mobile lifestyle. In conclusion the future products should convey traditional values but not loose its relevance in a modern lifestyle (Patel, 2016).

Sum up

The consumer trends points towards a solution that is both flexible and addresses multiple situations and needs, while remaining meaningful in its use. In addition the spotted consumer trends doesn't necessarily points towards everything becoming simpler and all interactions stripped to its minimum, as the trends points towards traditional values and the users urge to learn from their products.

- The solution should be flexible and support multiple use cases
- The solution should strive to support mindfulness in its use

Fig. no. 26 *Consumer trend, curious and meaningfull learning*

Users in detail

The objective of this analysis is to uncover in detail the users daily use of sound, the pains and gains they experience when dealing with their sound habits. The approach of the task were to map out the users day with sound and their pains and gains related to each individual use of sound. The method is primarily based on the theories from Value Proposition Design. (Osterwalder et al., 2015).

Data collection

The data is collected through interviews with the users in their homes. Each interview was audio recorded and later transcribed. During the interviews the everyday use of sound were uncovered together with their motivations by continuously making the interview person think about the reasoning behind their actions.

Following pages includes a sum up of each individual interview session and in afterwards the user insights is gathered into an overview of the users in a user profile.

Fig. no. 27 *User insights arranged in a time line*

Anne & Jan

Age: Anne: 25 Jan: 32
Occupation: Anne: University student
Jan: Highschool teacher
Primary speakers: Ultimate Ears UE Boom 2

Use cases

Anne uses her speaker when during tasks like cleaning and cooking, she then carries the speaker with her into the rooms she is entering.

They have a radio in the kitchen and one in the bathroom which is used in the morning and when showering. They have no speakers connected to the TV.

Problems

"We tried three different android phones and none of them could connect to the speaker[UE Boom]" -Jan

Future dreams

"When we move into a house I would like one of those systems with one speaker in each room" -Jan

Other

"In the morning it is just easier to flick the switch on the radio instead of connecting to the UE Boom" -Anne

Fig. no. 28 *Interview at Anne & Jan*

Helene

Age: 26
Occupation: Designer at Melvin
Primary speakers: Colors LED Sound Jar

Use cases

Helene consume most of her sound through her headphones connected to her computer. She have no speakers connected to the television.

Helene owns a small Bluetooth speaker that is mainly active during other tasks such as doing the dishes or showering. Have used it in parks and on beaches with friends.

Problems

"Spotify is actually somewhat a pain, what playlist is this and where is the playlist I listened to last time. I am so sick of those top 40 lists"

Future dreams

"I am imagining a soundbar or similar. Small and compact, something you cant immediately recognize"

Other

When asked to play some music with her speaker, Helene got anxious and for good reason as she struggled with connection and had to switch from her phone to her computer in order to play music.

Fig. no. 29 *Interview at Helene*

Jeanette

Age: 27
Occupation: Unemployed
Primary speakers: Hi-fi setup

Use cases
Jeanette uses sound to enhance or regulate her mood by playing evocative music, and this happens when she is alone.

The big Hi-Fi setup in the living room is responsible for both music and television sound, and a small radio in the bathroom is used when spending time in there.

Problems
"Our system is cumbersome, i think. The thing about selecting channels". [Settings on Hi-Fi setup]

Future dreams
"I can live with any speaker, that is not something I want to fight about.....Maybe some that could blend in, in some way"

Other
"I do not know which speakers are aesthetically pleasing, I know nothing about speakers"

Nikoline

Age: 25
Occupation: Development coordinator
Primary speakers: Hi-Fi setup & WOOFit by SACKit

Use cases
Nikoline and her boyfriend owns a Hi-Fi setup which is not always connected to the television or other. Nikoline often uses her phone or computer for listening to music, as these options is the fastest way to get music.

The MOVEit speaker is used primarily in the bathroom.

Problems
"If it takes more than 10 seconds to connect, then I abandon it" [WOOFit]

"It is not difficult, you just have to turn a knob. But apparently it is cumbersome enough for us not to use it" [Hi-Fi setup]

Future dreams
"The systems should be almost automatic"

Other
Nikoline and her boyfriend bought their two MOVEit speakers when they were shopping for beds. They ended up buying one each, in different colors.

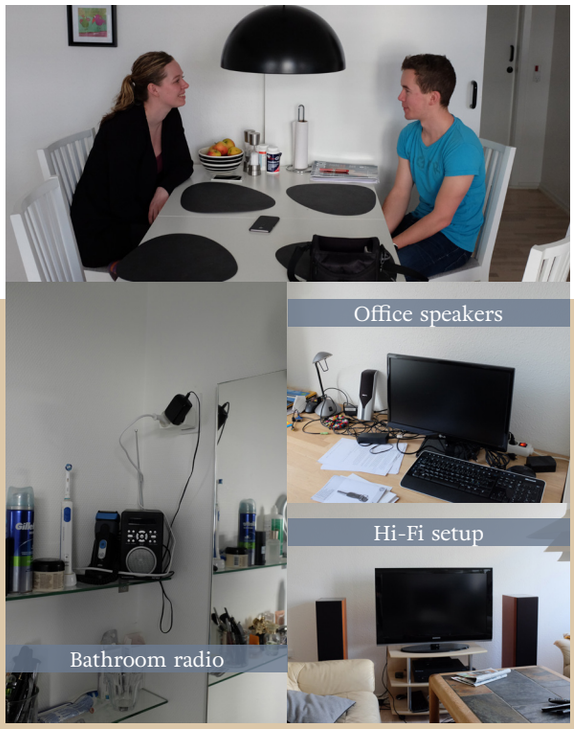


Fig. no. 30 *Interview at Jeanette*

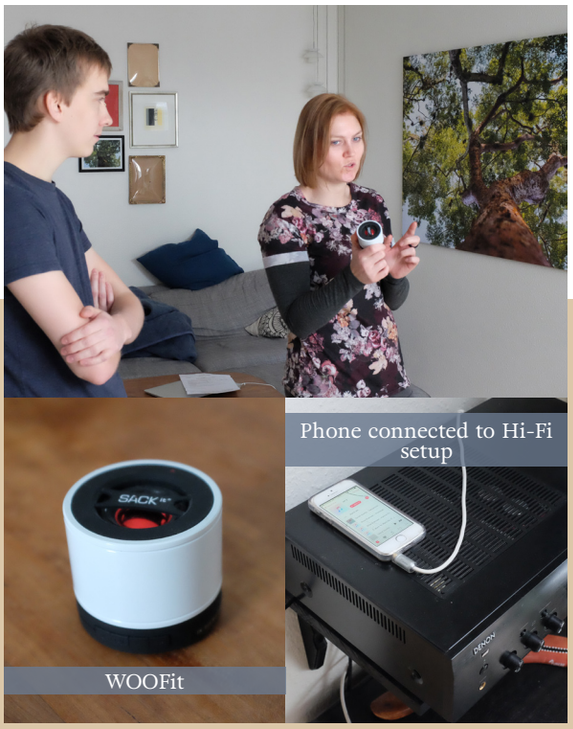


Fig. no. 31 *Interview at Nikoline*

Marthe

Age: 25
Occupation: Student
Primary speakers: Harman Kardon Soundstick II

Use cases

Marthe have a rigid morning routine which involves her starting Spotify on her phone when she steps out of bed, and then carries it around with her in the morning. She listen primarily to playlist she have made herself or recommended by Spotify.

When at home she uses her Harman Kardon speakers by plugging her iPad to the speakers, and then controlling it through her phone.

Problems

"The worst thing is when I am showering and a bad rap song comes on. Then I either have to change song with my soaked fingers thus splashing all over, or just listen to an annoying song"

Future dreams

Marthe wants some multi room solution that is wireless. Likewise it is important for her that it is as simple as her Harman Kardon which only have three buttons.

Christian

Age: 24
Occupation: Student
Primary speakers: BeoPlay A2

Use cases

Christian uses his Bluetooth speaker in many different situations; In his morning routines, when working at a grocery store in the morning, when studying with his group at the university, when watching television, and when he just sits at his laptop. Christian uses it as a background music in most of the situations to improve his mood and get him through otherwise tedious tasks.

Problems

Christian have multiple sources connected to his speaker ei. his laptop, his phone, and his tablet. When the speaker is within range of multiple of the sources the speaker have difficulties prioritizing which source to play.

"When the computer makes a notification sound, then the music stops from the tablet and then I can not figure out why the music will not start when I press play"

Future dreams

Christian dreams of SONOS system as he use sound in every room.

Fig. no. 32 *Interview at Marthe*

Fig. no. 33 *Interview at Christian*

Pernille

Age: 25
Occupation: KBU doctor
Primary speakers: Small Surround setup

Use cases

Despite many speakers, Pernille uses her laptop for playing music and she brings it around her apartment when during other tasks like cleaning and cooking.

She has a surround sound setup that is connected to the television. She also has a small speaker in the bathroom but this is only used by her boyfriend.

Problems

Pernille experiences connection issues with all of their current and previous speakers which has led her to settle for her laptop speakers.

"I just use the laptop speakers, I am not that advanced"

Future dreams

"I would like to get SONOS.....They are aesthetically pleasing and I have heard that they function properly"

Other

Pernille wants a soundbar for her television because one speaker are more aesthetically pleasing than five.

Linda

Age: 27
Occupation: Student
Primary speakers: Nordklang BT600

Use cases

Linda owns a small speaker setup placed next to her TV with the small satellites placed under the TV and behind picture frames. She uses music in her daily life when preparing food and studying.

In addition, Linda own a small Bluetooth speaker which were intended for Linda to bring in the bathroom, but is hidden in a drawer as she prefers to bring her iPad to the bathroom.

Problems

"I prefer to bring my iPad, so i can change between tracks, but then I have to turn the volume all the way up, which is not optimal. Its only if I'm spending a lot of time in the bathroom that I bring my Bluetooth speaker"

Future dreams

Linda misses the surround sound from her parents home while still hating all the wires and the black box aesthetics of that kind of speaker setup.

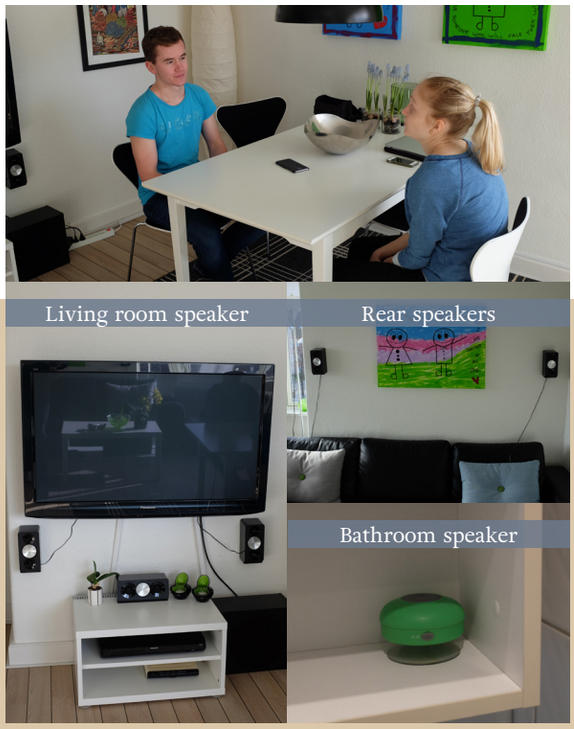


Fig. no. 34 *Interview at Pernille*

Fig. no. 35 *Interview at Linda*

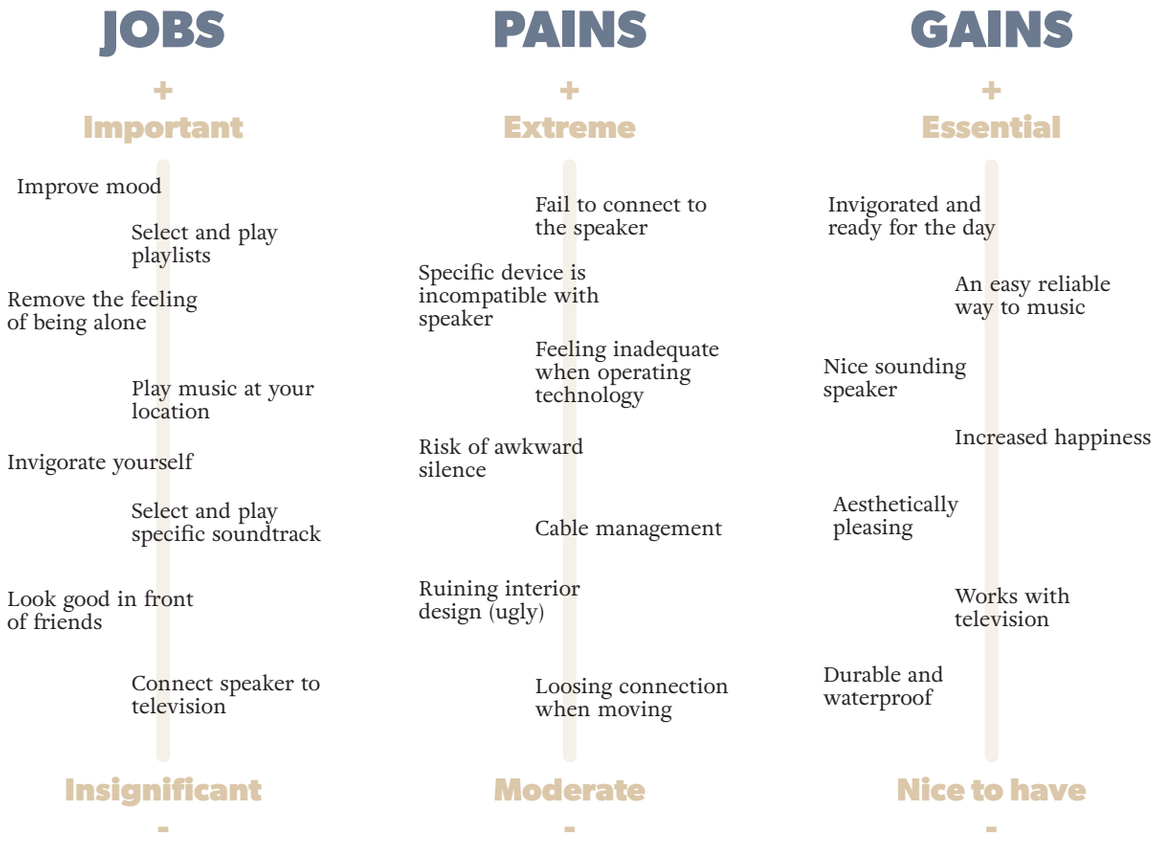


Fig. no. 36 *Ranking of user jobs, pains and gains*

User profile

The insights were analyzed and combined into a user profile describing the jobs, pains, and gains of the users in relation to speakers and music in general (Osterwalder et al., 2015)(Fig. no. 35 on page 36 37).

Its clear that music is an emotional part of the users life and music is used in many situations in their every day routines. The users want to effortlessly start some music and have it follow them around the house when doing other tasks such as eating, cleaning etc.

The pains the users experience is two fold. They dislike the traditional loudspeaker setup and the wires and big black boxes, and high complexity those kind of solution often involves. The second is caused by the users responding to their dislike of the traditional setup by buying smaller Bluetooth speakers. With Bluetooth speakers the users experiences a lot of pains related to the transition from no music to getting their speaker to play, this involves Bluetooth that doesn't work every time or with every device.

Coping strategies

From the user insights theres are two major needs that the users do not have satisfactorily covered by any speaker solution and have therefor developed different coping strategies to handle these needs.

Both coping strategies are presented on the following page.

Easy and reliable music.

The users want to confidently, easily, and quickly put on some music without worrying about anything, the goal is just to get some music to play while the users does something else.

The users experiences that the traditional speakers takes to long to setup and their Bluetooth speakers are often to much of a hassle to get connected and starts playing music.

The coping strategy to reliably and confidently get some music to their life is to stick to devices they are comfortable with, and this evident in two different variations.

In many cases the users let the speakers be and use their phone, tablet, or laptop to play music from, by doing this they remove the hassle related to connection and they are much more confident in using these other devices. By using this coping strategy the users sadly sacrifices a lot of the sound quality as devices such as phone, tablets, and laptops are not focused at sound quality the same way as speakers are.

The second variation is using radios as the users tunes in to a specific channel once and from there on music is just a flick of a switch away. In addition to being the fastest way to music, it also removes the need for making decisions about what to hear, which is preferred in many situations.

Fig. no. 37 *Radio placement*

Music at your location

The users wants music with them no matter where they are as music is an addition to other tasks, this requires the sound to be audible in every room of the users home.

The first strategy to obtain music in multiple locations is to turn the volume way up on a speaker, but this is exclusively used by users when they are alone but still doesn't deliver, as the music doesn't reach all parts of the users home or is way to loud when the users are close to the speaker.

The second solution is to place speakers in the rooms where the users needs music. The speakers used in this solution is often radios as these also fulfills the wishes described in previous coping strategy.

The last one is also linked to a previous coping strategy. The last solution observed is bringing along a small device like a phone, tablet, or laptop around with them so that the music is always audible at the users location.

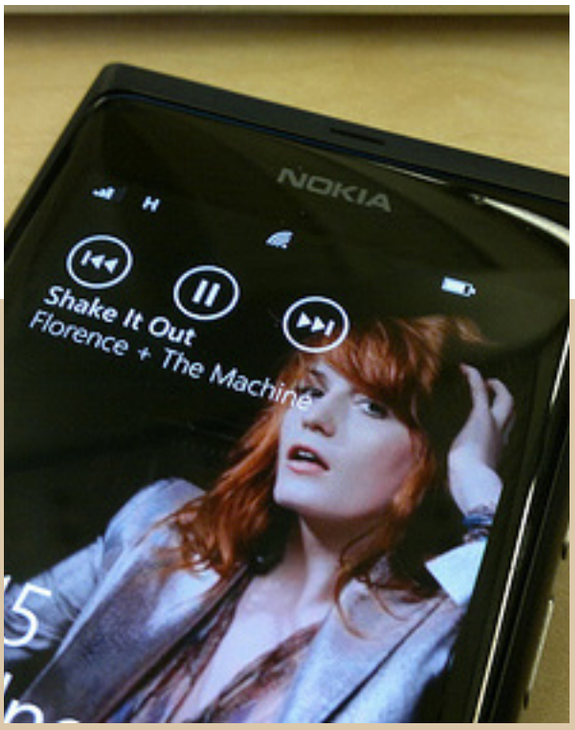


Fig. no. 38 *Phone as primary speaker*

Sum up

From analysis of the interviews it is clear that the users are preconceived to not understand "speakers", but they do appreciate quality sound and are aware of their own need for speakers better than just using their phone or laptop. When the users then tries to buy products to cover their needs, they are tackled by all the problems following a Bluetooth speaker, connections troubles being the most severe, and then often settles for solutions such as phones, tablets and radios. Sacrificing either audio fidelity or control.

LOGIC STRINGS

PROBLEM	INSIGHT	SOLUTION PRINCIPLE	VALUE
DALI does not have passion for the small portable speaker market.	DALI values heavily favors the Hi-Fi market KATCH speaker is not produced or designed by DALI	Move production of the product solution to Nørager	DALI embrace the portable active speakers as a part of their identity
DALI core values is not an obvious fit with the URBAN market	URBAN market is not Hi-Fi enthusiast	Create a speaker that act on the the URBAN market search of meaningfulness and general sense of quality	Enable DALI to make use of their competencies but framed differently to match the URBAN market
Users can not connect to their BT speakers	Users uses other devices for playing music because they experience difficulties with their Bluetooth speakers	Replace BT with Wi-FI and remove the phone from the use scenario, thus removing daily connection actions	Users confidently and successfully use their speakers for playing music every time.
Users are emotionally disconnected with their speakers	Users feels inadequate and get anxious when asked to operate their speaker	Unknown	Makes the user feel comfortable and happy to operate their speaker
Users wants a fast, easy, and reliable way to music	Users settle for radios, phones and lesser sound experiences because they work as needed	Unknown	Enable users to effortlessly start listening to music
Users needs music in many different rooms	Users places radios in many rooms or carry around their phone or similar	Unknown	Achieve the flexibility of the phone without sacrificing the sound quality

Bluetooth

Based on the users experience and coping strategies in the previous chapter a look at the Bluetooth technology was needed. Through observation and time tracking of the users interacting with their own Bluetooth devices, simple tests of Bluetooth devices and a dive into the technology and its history, a better understanding of the problem might prove itself.

Research

Bluetooth was developed to remove the cable between headsets and other devices with a low bandwidth requirement, printers, keyboards etc. Bluetooth operates with a "source" and a "sink" device, the source is often a smartphone or computer, the controlling unit. And the sink could be the headset, speaker or printer that needs an input.

The Bluetooth module in the source device receives the digital audio signal and compresses and encodes the signal to the Bluetooth patented SBC codec. The sink devices then receives this signal wirelessly and decodes the signal and converts it to a analogue signal that the power amplifier can amplify and output through the speaker drivers. Less compressed audio streams can be achieved if both devices support it, for a higher audio quality. It will not be enough to have a "high" quality Bluetooth module in one of the two devices. (A2DP - Advanced Audio Distribution Profile, 2012) (Worksheet no.: 18).

Pairing

When connecting two devices the sink device should be in discoverable mode and the source in inquiring mode in order to find each other and establish a connection. Together this is the pairing mode/process. Most sinks doesn't enter discoverable just by being powered on, but looks for previously paired sources, if none is found enters standby for further input from the user.

Range

A quality Bluetooth experience is determined on a lot of factors that the creators of Bluetooth speakers cannot control. The source device is often smartphones or laptops that all introduces a wide variety of possible problems making troubleshooting very complex. Then there is external factors, such as interference from other electronic devices that can interfere with the 2.4GHz band and physical obstacles limiting the range and audio quality.

Fig. no. 39 *Nikoline Bluetooth test*

Fig. no. 40 *Helene Bluetooth test*

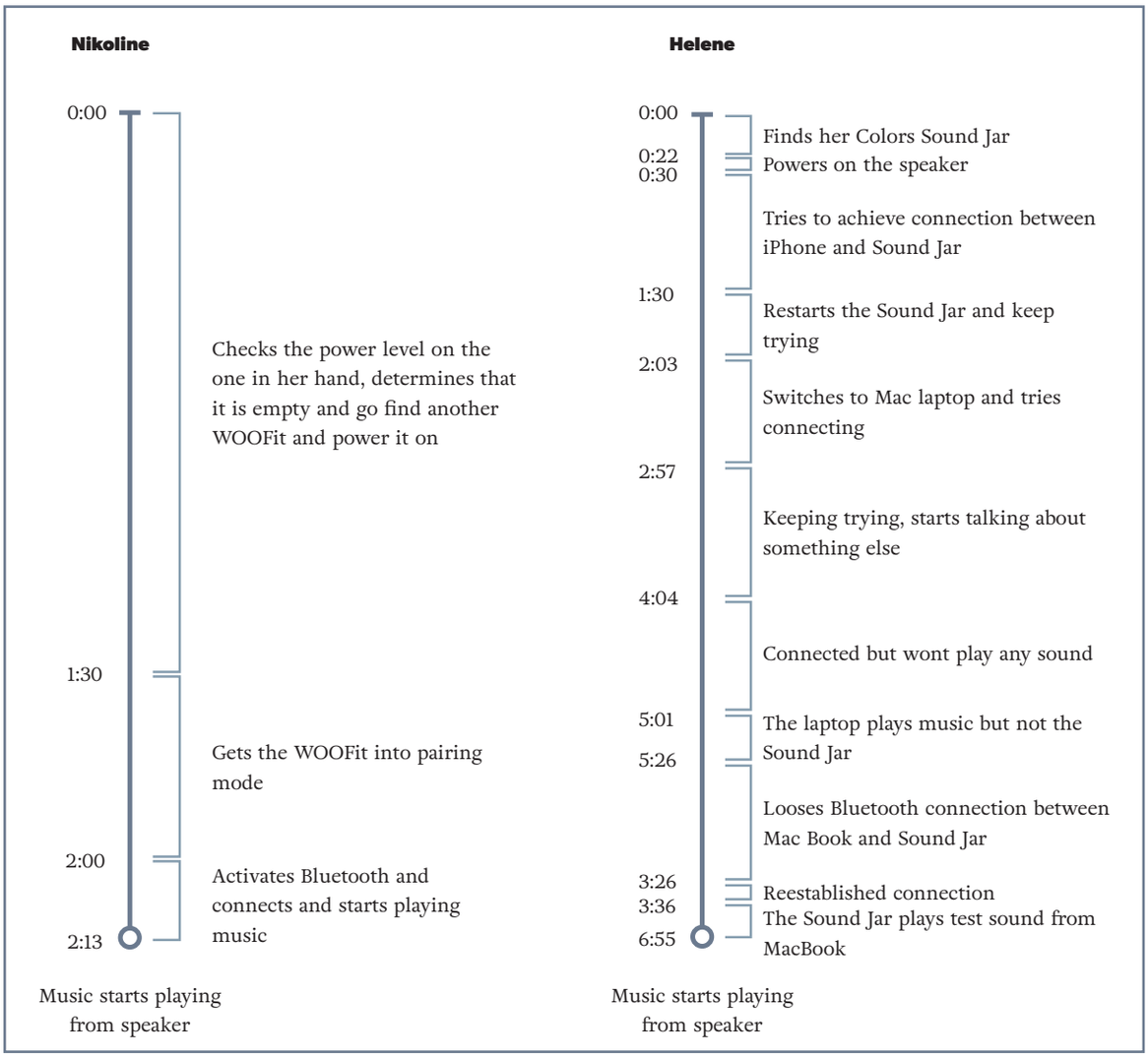


Fig. no. 41 *Bluetooth test timeline*

Time tracking

The time it takes from silence to start enjoying music is crucial for speaker products. If it takes to much effort, in time or number of steps, to get music playing the users settle for other easier though inferior sounding products.

Two test have been highlighted, one almost ideal scenario with Nikoline and a almost worst case scenario with Helene.

The observed users doesn't find the interface of Bluetooth speakers intuitive. The pairing process of putting source device in "inquiring" mode and the sink device in "discoverable" mode isn't communicated clearly on the devices that the users tried. And this is devices that they have bought and have at their home.

Output

The Bluetooth technology might not be the best option for a good user experience as the user experience is dependent on limitation of the technology and external factors.

?

- Explore other possible connection technologies

Wireless

Bluetooth isn't providing a good enough experience for users but in a time where almost all music consumption is streamed from the Internet a device connected to the Internet is needed. A smartphone or computer is often the source device.

Three distinct technologies

Bluetooth

The figure beside, shows the flow of data and user interface of a typical Bluetooth speaker (Fig. no. 42). The source device is the smartphone/laptop. It streams music from the Internet through either cellular network or WiFi and then streams that data to the speaker through Bluetooth.

AirPlay/AllPlay/Play-Fi

AirPlay is an other popular technology for streaming music to speakers. It is very similar to Bluetooth, but operates over the home WiFi network. The smartphone/laptop is still the source device but isn't connected directly to the AirPlay speaker. Instead the music is streamed to the phone and then from phone to speaker (Fig. no. 43).

Google Cast

Google Cast is a different approach to WiFi connected speakers. The smartphone/laptop is no longer the source device but acts as a remote control. Content is found on the smartphone and then a link is "cast" to the speaker. The speaker then follows this link and streams directly from the Internet and the "remote" could be turned off (Fig. no. 44).

Evaluation

Building upon the Google Cast platform could allow for a standalone streaming speaker that won't require other devices to stream content from the Internet. DALI has already shown goodwill towards Google Cast, by specifically designing the USB power outlet on the DALI KATCH to support the Chromecast Audio dongle. The Google Cast ecosystem will also allow for a multi-room feature.

- The device will be Wi-Fi enabled allowing access to the Internet.
- Build upon Google Cast technology

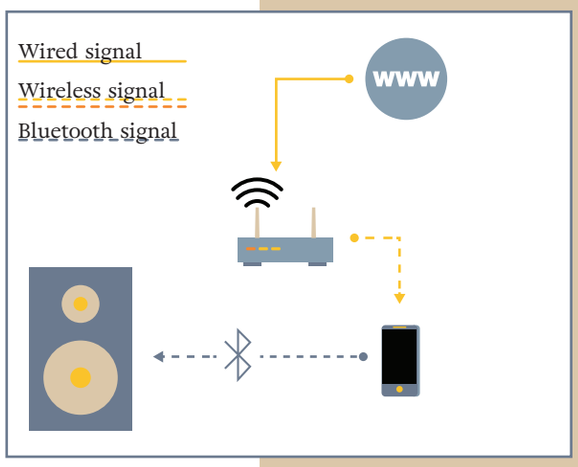


Fig. no. 42 *Bluetooth*

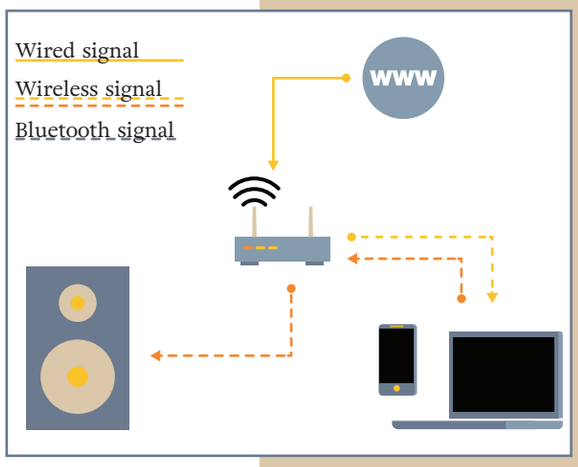


Fig. no. 43 *AirPlay*

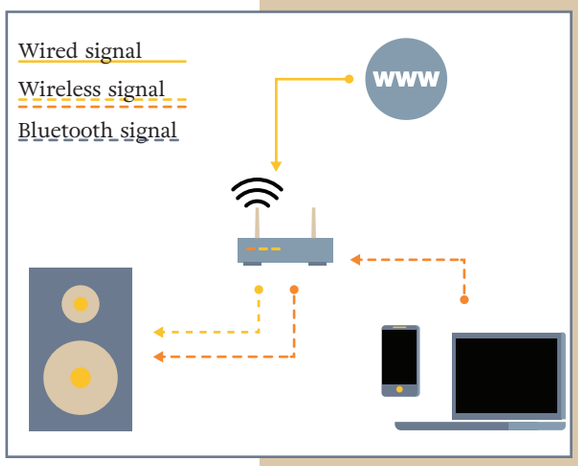


Fig. no. 44 *Google Cast*

Interaction exploration

The interaction between the speaker and the user is important, and the problems related to the connection issues might be related to the interaction with the speaker failing at being successful, so this interaction aspect of the speaker is explored.

Hands off

The traditional loudspeakers have always been a type of product not meant for touching, the controls of the loudspeakers are placed on the connected amplifier and thus you never touch the loudspeakers. In addition to no direct interaction, the traditional loudspeakers are typically a valued, precious, and probably expensive object owned by the users and therefore the owner is typically anxious when people touches his speakers.

The new market of active portable speakers have removed this anxiousness around the speakers by being more rigid and having the controls placed directly on the speakers. The drivers of active portable speakers are well sealed of inside the product compared to traditional loudspeakers which have the drivers exposed for optimal sound quality.

Although the active speakers have eliminated the anxiousness around the handling of the speaker, they have missed out on the opportunity on making the interaction a part of the product experience, and thus the portable speaker market often results in anonymous boxes placed somewhere and controlled by the users phone or similar device.

It seems like a missed opportunity to tighten a closer bond between user and speaker which might benefit the user in regards to trusting their speakers, in addition to this its a shame to use larger amount of money on a nice speaker and no matter which one you chose you are always left with your phone as the main interface (Fig. no. 45 on page 43).

Fig. no. 45 *Vifa, Oslo speaker*

Fig. no. 46 *Urbanears, Steammen speaker*

Interaction registration

Some speaker manufactures are attempting to make interaction a part of their products so a registration of some of these products and their interaction were made.

B&O

A visit at B&O showed some of the atypical interactions B&O have incorporated into their speakers. One of the most striking interactions were the touch interface on the back of the BeoPlay A9 and BeoPlay A6, which were similar. The two speakers had a touch area across their back which allows the user to adjust the volume by sliding their finger along the back, likewise the user can tap the touch area to pause/play and if the tap is in the right or left most area the next/previous song will play.

The other interesting B&O speaker were the Beosound 1 and 2 which had a dial at the top for adjusting volume and a black touch area at the very top (Fig. no. 48 on page 44). The touch interface allows the user to pause/play by tapping once, change input by tapping twice, and change song by swiping right or left.

As an additional feature the "head" of the Beosound 1 acts as a handle when moving the speaker. This way of handling DDK 10.000,- weighing 3,5 kg was very uncomfortable and nerve-raking as you hold it in only the tips of your fingers.

Naim

Visiting Lydspecialisten, a local Hi-Fi store, the most interesting speaker regarding interaction were the Mu-So by Naim. Like the Beosound 1 and 2 the Mu-So is also equipped with a dial and a touch interface, but on the Mu-So speaker the touch interface doubles as a screen. Instead of various swiping and tapping gestures the Mu-So speaker just display the different "buttons" on its screen eliminating the need for the user to remember the different gestures.

Fig. no. 47 *BeoPlay A9*

Fig. no. 48 *Lifting Beosound 1*

Fig. no. 49 *Dial of Mu-So by Naim*

Fig. no. 50 *Mu-So Naim*

Sum up

Theres a clear opportunity for making a speaker solution which features a more tactile interaction with its users, in addition to creating a luxurious feeling to the speaker it might also create a bond between speaker and user making the users more confident in operating their speakers.

During the registration at B&O it is clear that minimalistic interface might not be the way to go, as the minimalism demands the user to remember the gestures required to control the speaker, this probably results in the speakers being controlled by phone in the end.

?

- Test the relations between weight and handle
- Figure out what constitutes a nice interface

!

- Portable speaker should maximum weigh in at 3.5 kg
- The interface should not include a long range of gestures that need remembering
- The solution should incorporate a tactile interface
- The solution is primarily operated without the use of a phone

Persona

To focus the product development all user information are selected and condensed into one persona to whom the product development will be targeted (Cooper, 2015). The persona is based primarily on the interviews and first hand knowledge gained through said interviews, but with respect to the confidential end-user study with its target lifestyle segments.

Anna the architect

Age:	29
Status:	Single
Place:	Valby, Denmark
Occupation:	Architect at Lendager Group

About Anna

Anna is a single woman that cares a lot about her professional life and wants her coworkers to think positively about her work but also of her as a person. Anna is very creative but also a perfectionist in everything she does, and this shines through in both her work life, her radiant personality, and her beautiful home.

Daily life

Anna wakes up in the morning and the first thing she does is to start the music in the kitchen and make breakfast for herself. Anna enjoys the popular tunes to invigorate her in the morning while she focuses on getting ready for the day.

During the day Anna works at Lendager Group where she enjoys the creative and professional atmosphere where quality is key to success. In the breaks Anna enjoys coffee with her coworkers she have befriended while working at Lendager.

When Anna gets home she likes to go for a run down at the park before she starts on preparing her dinner. When making food its is important to Anna that her diet is healthy and delicious, and while preparing food she uses her tablet for playing some of her personalized playlists from Spotify.
In the evening Anna likes to watch some of her favorite shows on the television while snacking on some dried fruits.

In the weekends Anna regularly meet up with her friends at local cafés to catch up on each lifes.

Speaker situation

Anna owns a Vifa Oslo speaker which she bought as she thought she needed some great sound in her living room for when she had guests over plus she thought the idea of taking the music outside to picnics where appealing. The choice of the Oslo model was caused by the design and the salesperson who guided Anna to a model with high quality sound, much better than the rest of the speaker selection in the store.

The reality is that Anna seldom uses her Vifa speaker as she often have a lot of connection problems with the speaker and her phone, so her beautiful speaker have gotten a place in the living room where it acts mostly as a decorative piece. Instead Anna uses her phone for playing music, especially in morning Anna likes to put on an invigorating playlist from spotify accompanying her through her morning routines.

Fig. no. 51 *Vifa, Oslo*
Fig. no. 52 *Persona, Anna*

Strategic position

To overview the insight gathered until now and help define where to innovate the Blue Ocean theory was used. The users current coping strategies of using smartphone or radio is plotted in together with portable Bluetooth speakers and a multi room system like Sonos (Worksheet no.: 17) (Kim and Mauborgne, 2005).

Blue Ocean Canvas

Parameters:

Each parameter is chosen as the most important factors gain through the research up until now.

Multi room functionality - The ability to provide music at several locations in the house.

Portability - The amount of effort needed to move the sound source. Mains-powered / Battery

Audio fidelity - The audio quality, based on personal experience, amount/size of drivers, amplifier etc.

Mental effort - The mental effort require to start listening to music. Connect, choose song/playlist.

Source device dependent - Is the device "standalone" or is it dependent on a smartphone/laptop or similar.

New product development

The black line in the graph represents which parameters the new product development should hit in order to succeed in this market. The solution should be portable enough to be easily carried from room to room and deliver some of the multi-room experience from products like Sonos but at a lower price and with a higher focus on audio fidelity.

It is also crucial for this product solution to be independent from other devices and lower the mental effort needed to start playing music. And delivering the simplicity values of a radio and flexibility of smartphones but with a big increase in audio fidelity.

Create

The last two parameters are two factors that the new product will create in the market. The joy of interacting with products is crucial to make users enjoy and understand complicated products. Furthermore continuity in the interface might help consumer break down the barrier to the Hi-Fi market.

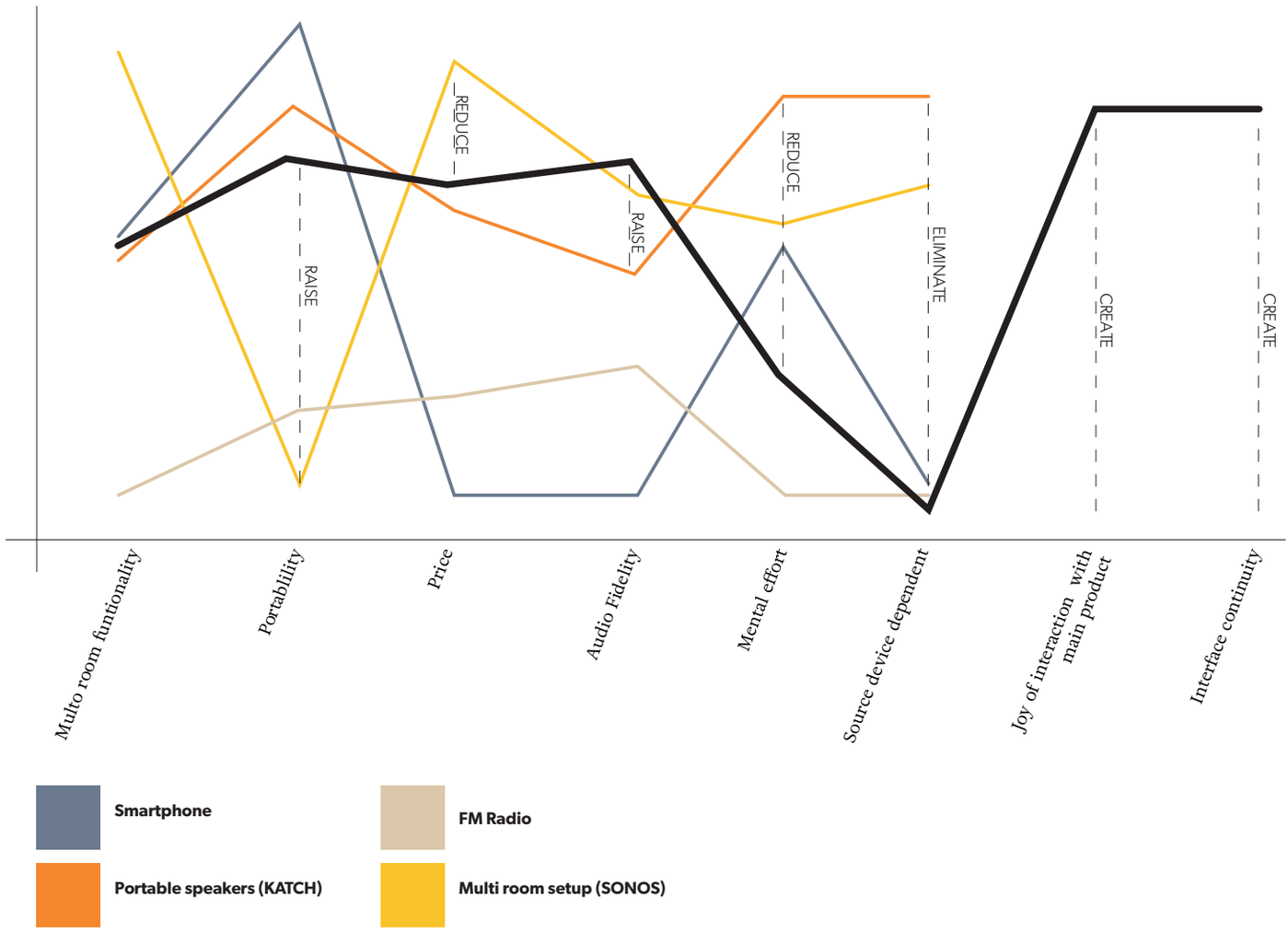


Fig. no. 53 *"As is" Blue Ocean Canvas*

End of phase 1

The objective for phase 1 was to gain insight into users main pains, gains and coping strategies and specify possible solution principles for a solution. While exploring strategic possibilities for DALI to gain a foothold in this market.

The insights about DALI and their options in relation to the 'URBAN' lifestyle segment is assessed together with a evaluation of the product directions described in 'End of phase 0', and their fit with the strategic options of DALI and the needs of the user Persona Anna.

All this was collected in a revised design brief and again used to present and communicate the project progress to DALI and supervisors (Appendix no.: 3).

Project requirements

The insights (!) attained throughout the previous chapters are listed together in two requirements matrices. These two matrices will together with the revised logic strings on the following pages be used to select between the product opportunities presented in phase 0 (See "Opportunities" on page 24).

Problem Statements

"How can DALI apply their core values in a way that targets the URBAN market segment?"

"How can we bring the user and the speaker together using a tactile interface?"

Selection of product directions

In order to push the project forward one of the four product directions described in end of phase 0 (See "Opportunities" on page 24) is chosen as a base for the project moving forward.

The four product direction are evaluated in relation to how well they fit in the strategic direction decided for DALI, their fit with the persona Anna (See "Persona" on page 46), and the groups own assessment of the level of innovation possible in the product direction.

Based on the results of this comparison the product direction named 'Modular' is chosen. The extend and specific layout of the direction will be specified in the following chapters.

Sum up

The solution is a Modular speaker concept that deal with the main problems experienced by the user, the solution is mainly operated without the phone resulting in more physical interaction between speaker and user. The solution should place itself under the existing brand identity of the speaker manufacturer DALI, which causes the product solution to abide the DALI values (See "DALI Golden circle (Sinek, 2016)" on page 13).

	ULTRA PORTABLE	NO-NONSENSE PORTABLE	1,2,3 SYSTEM	MODULAR
STRATEGIC DIRECTION FIT	2	3	4	4
PERSONA ANNA FIT	2	2	5	4
LEVEL OF INNOVATION	1	2	3	4
TOTAL	5	7	12	12

STRATEGIC REQUIREMENTS

	QUALITATIVE	QUANTITATIVE
NEED TO HAVE	• Stay true to values while expanding into new markets.	• Utilize that DALI has assembly and production in house (Drivers, cabinets, etc.) • Utilize the new electronic engineering division
NICE TO HAVE		• Sold through Hi-Fi Klubben • Work withing current brand identity

PRODUCT REQUIREMENTS

	QUALITATIVE	QUANTITATIVE
NEED TO HAVE	• Make the user feel adequate when operating the product solution • Create an easy and reliable way to start playing music • The interface should not include a long range of gestures that need remembering	• Portable speaker should maximum weigh in at 3.5 kg • The solution should incorporate a tactile interface • The device will be Wi-Fi enabled allowing access to the Internet • The solution is primarily operated without the use of a phone
NICE TO HAVE	• Make a product solution that deviates from the aesthetic of a traditional loudspeaker setup • The solution should support multiple use cases • The solution should strive to support mindfulness in its use	• Build upon Google Cast technology • The solution should be flexible and support multiple use cases

LOGIC STRINGS

PROBLEM	INSIGHT	SOLUTION PRINCIPLE	VALUE
DALI does not have passion for the small portable speaker market.	DALI values heavily favors the Hi-Fi market KATCH speaker is not produced or designed by DALI	Move production of the product solution to Nørager	DALI embrace the portable active speakers as a part of their identity
DALI core values is not an obvious fit with the URBAN market	URBAN market is not Hi-Fi enthusiast	Create a speaker that act on the the URBAN market search of meaningfulness and general sense of quality	Enable DALI to make use of their competencies but framed differently to match the URBAN market
Users can not connect to their BT speakers	Users uses other devices for playing music because they experience difficulties with their Bluetooth speakers	Replace BT with Wi-FI and remove the phone from the use scenario, thus removing daily connection actions	Users confidently and successfully use their speakers for playing music every time.
Users are emotionally disconnected with their speakers	Users feels inadequate and get anxious when asked to operate their speaker	Increase the amount and joy of interaction with the speaker	Makes the user feel comfortable and happy to operate their speaker
Users wants a fast, easy, and reliable way to music	Users settle for radios, phones and lesser sound experiences because they work as needed	Make use of the fact that users almost always listens to playlist, and supply users with quick access to playlists	Enable users to effortlessly start listening to music
Users needs music in many different rooms	Users places radios in many rooms or carry around their phone or similar	Unknown	Achieve the flexibility of the phone without sacrificing the sound quality

2

The concept development phase the modular princip will be explored an developed. With basis in the output of the previous phases, BK Design will now have to develop the concept into a solution that fits both DALI and the users needs.

The goal of the phase is to develop the concept into a more specified product while locating target specifications for the solution.

The development process is approached with the broadening and narrowing solution theories of Ole Striim's practical idea development. (Striim, 2000)

Modular principle

A lot of thougths and ideas on how the modular principle could work has run in parrallel with the process until now. With the problem statement in mind a creative process of brainstorming and role-perspective (Striim, 2000) led to several ideas for how the modular speaker principle could bring the most value to users.

Concept Classification Tree

The concept classification tree (Ulrich and Eppinger, 2012) was used to divide the ideas into classes that allowed for quickly comparison and evaluation.

First divided into number of modules and afterwards how many was active speakers and their size. Three ideas stood out and was developed further.

Two Modules

A smaller battery powered speaker that can be brought around the house. And a bigger speaker that functions as the home and charging platform for the smaller one. They share the same user interface, so that the user doesn't have to get acquainted with different products and user interface depending on if it is small and portable or large and powerful sound that they are needing.

Three Modules

Two active and a charging station

Two active modules enabled the possibility of a real stereo soundstage and could easily be used in both a home theatre scenario or as portable speakers for different situations.

Three active

Two battery powered "satellite" speakers and a mains-powered bigger speaker. Focused on the home theater scenario this concept could give either a larger soundstage with a Left-Center-Right setup or use the two battery powered satellites as surround speakers and the mains-powered as a center/LCR speaker.

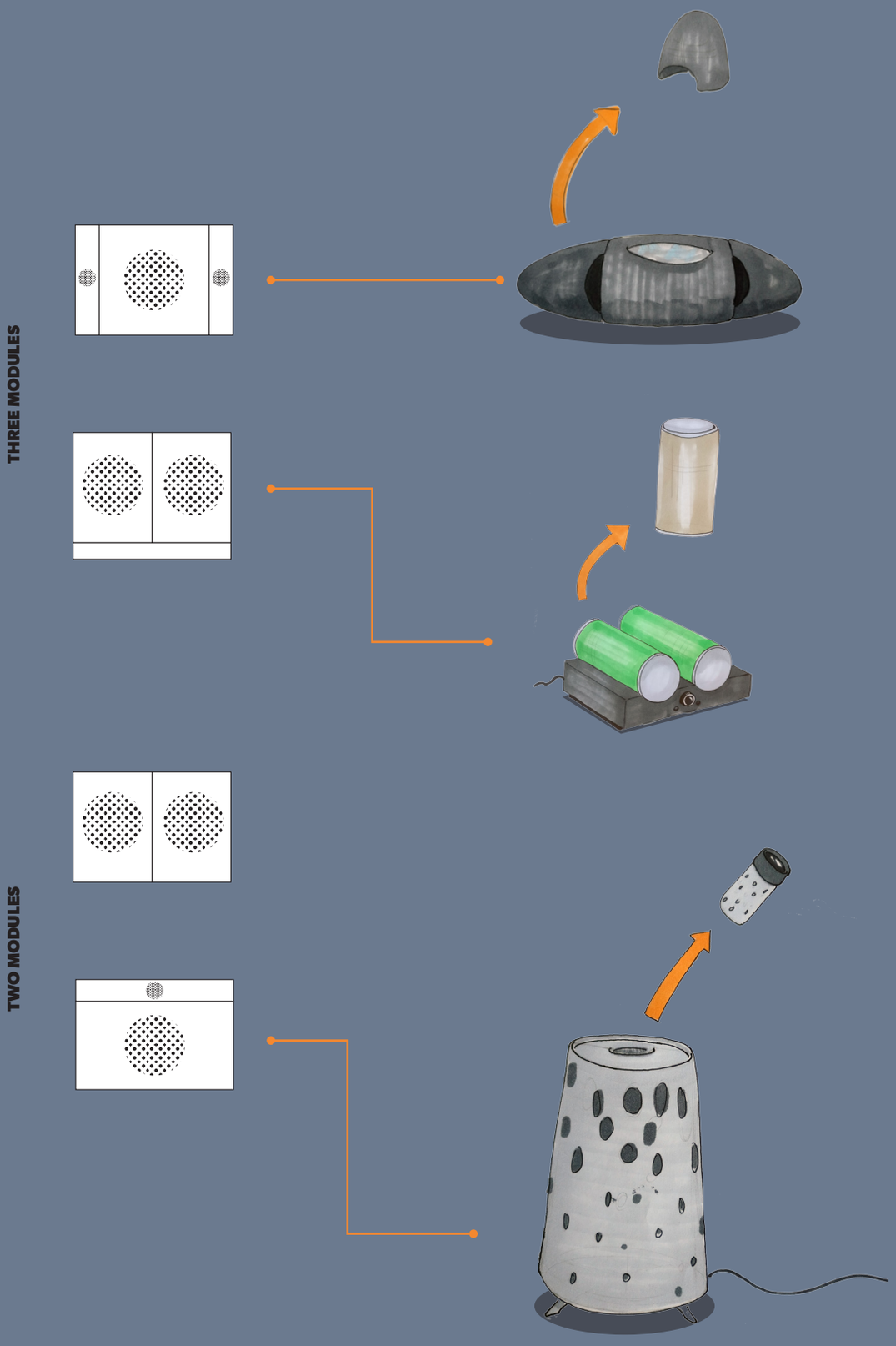


Fig. no. 54 *Clasification tree Modular*

Bodystorming

To test and evaluate the ideas, three quick mock-up models were made in cardboard and foam to give some tangibility to the concepts. The three models would then through an internal bodystorming exercise and later an external session with a lead users be experienced and evaluated on what values and scenarios they empower.

The bodystorming exercise is an "act it out" process somewhat similar to role-perspective, but with 1:1 scale models and in the real context and environment. It gives perspective on how the users might act and use the product in different scenarios, and help highlight the benefits and shortcomings of each concept. (Oulasvirta, Kurvinen and Kankainen, 2003)

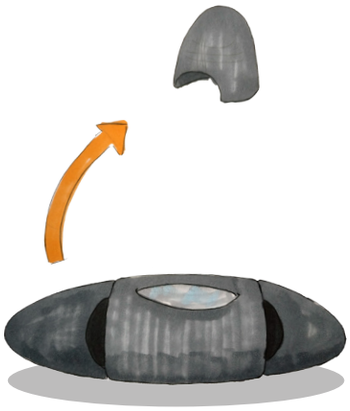
Evaluation

Interviewed user Christian, was drawn upon again to help bodystorm in context of his home. The results of the evaluation is listed as positive and negative feedback on the three concepts (Fig. no. 56 on page 57).

Based on the internal exercise and the inputs form the user act-it-out it was clear that in order to keep it simple more than one portable speaker unit didn't provide enough value to be justified for the user.

- A small portable speaker with controls for both modules.
- A bigger mains-powered speaker, that delivers the Hi-Fi experience.

Fig. no. 55 *Act it out with Christian*

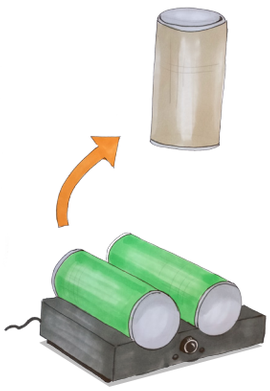


+

- Great possibilities for home theatre experience
- Possible to play music in three rooms

-

- Very few scenarios besides movies that needs both satellites.
- Management of satellites.
- Interface on all devices
- Very similar to Philips Fidelio B5

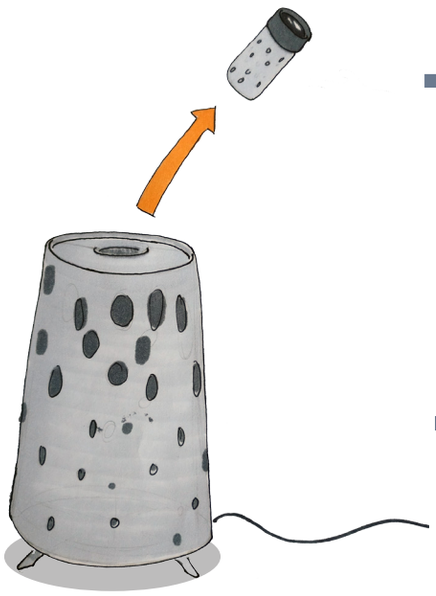


+

- The stereo possibilities.
- Possibility for music in two rooms.

-

- Very few scenarios besides movies that needs both satellites.
- Two identically satellites, needs two interface for separate usage.
- Management of satellites.



+

- Always have a good speaker connected to the tv
- Never worry about battery level or reconnect when coming home with portable speaker
- Same interface for all sound needs.

-

- Control of the main-powered without the small control unit.

Fig. no. 56 *Bodystorming evaluation of concepts*

Interaction exploration

On the assumption that more interaction with a device would assist in making a bond between user and speaker, it is key that the interaction is meaningful to the user. The following chapter consist of an exploration of the solution space related to interaction.

Approach

Going into the exploration of how a user might interact with his speaker is was known that three categories needed attention: Basic controls (Pause/Play ect.), The selection of songs/playlists, and how the user receives feedback as a result of his actions.

The three categories were listed in a classification tree and followed by a series of sketching processes trying to expand upon the categories. Some of the sketching/ideation techniques used were: Association chains and forced role perspectives. (Striim, 2000)
The ideation process resulted in this classification trees explaining the technical solutions to the different categories. (Fig. no. 57)

Combination

The different technical solution was combined into three different concepts. The combination is made with persona Anna in mind together with the notion that the interaction should be meaningful and intuitive to Anna.

The three combined concepts are evaluated with the theories of good behavioral design (Norman, 2005). The concepts are evaluated on three parameters and then ranked based on the groups personal evaluation of how the persona Anna might perceive the concepts (Fig. no. 58 on page 59).

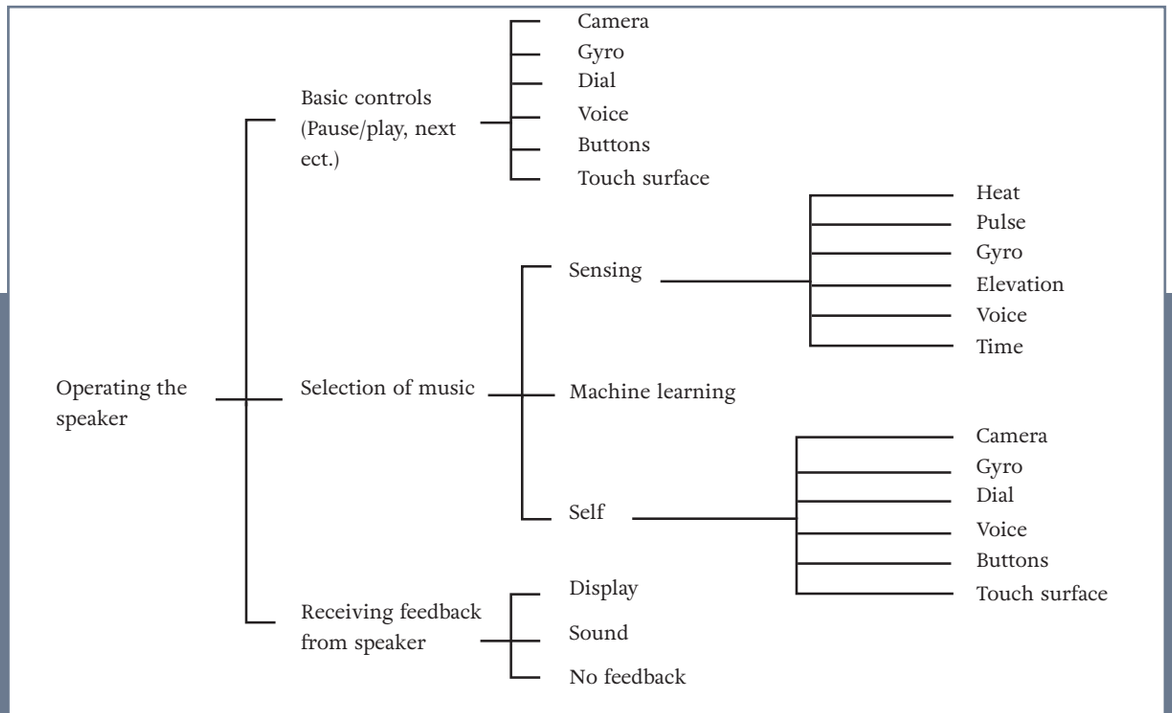


Fig. no. 57 *Clasification tree Input map*

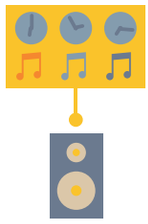
	The voice controlled speaker:	Physical interaction speaker:	The automatic selection:
ILLUSTRATION			
DESCRIPTION	Speaker is controlled exclusively by voice commands.	Speaker with big physical dial with a small touchscreen to chose and display playlists that invite to physical interaction.	Press the start button and the speaker chooses music based on your past patterns. With the help of machine learning and cloud computing.
UNDER-STAND-ABILITY	2	2	1
USABILITY	2	1	2
FEEL OF TOUCH	0	2	1
TOTAL	4	5	4

Fig. no. 58 *Interaction matrix*

Results

The interaction concepts presented focuses on the need of going from no sound to sound in a short moment while exploiting the fact that the Anna often just put on playlist because the particular track is not important as the goal to just get some music started.

The chosen interaction concept is the physical interaction speaker as the feel of touch is a big factor of the design theory by Norman, 2005, and that a physical dial holds a 'back to basics' feel compared to the more automatic concepts although this might require more mental effort to operate, which is why it is important that the interface and controls is limited to the needed functions only.

?

- Figure out which functions is required for daily music consumption.

!

- The speaker should feature a touchscreen display, for playlist selection.
- The speaker should feature a physical dial

Fig. no. 59 *Consumer trend, curious and meaningful learning*

Style boards

To better understand the value proposition and develop the story behind the concept a material and story exercise was initiated. Inspired by the Material Story Lab under the Dialogue Labs research from Aalborg University (Kommunikation.aau.dk, 2014) the workshop focused on meaning making by creating material style boards. (Strand, 2012)

Three distinct stories formed during the exercise. Each story has a different perspective on the value that the modular product solution is offering to the users.

The fireplace & candle

The fireplace and the candle: A story about the atmosphere created when gathering around the fire and enjoying each others company. Likewise the speaker could be center for a time of "hygge" and warmth.

The lighthouse & lantern

The lighthouse and the lantern is based on the monumental shape of the light house that spreads light far and wide. while the lantern basically do the same but in a different scale.

The product in this story should be monumental, a centerpiece of attention.

The waterfall & creek

The waterfall and the creek is more abstract as this isn't based on objects per say but rather on an experience.

The story is about the small calm creek delivering a small relaxing experience, and in contrast we have the big thundering waterfall, that delivers a dramatic yet beautiful experience.

Reflection

The exercise led to the three stories presented above and a handful of different material combinations, that can be used as inspiration when entering the detail phase. More importantly it put word and material to the somewhat fuzzy modular concept. The communicational aspect of the exercise is the primary one and in this case it was materialized in three stories with material and color combinations.

It helped define and seperate what features each of the modules should deliver.

Fig. no. 60 *Styleboard 1*

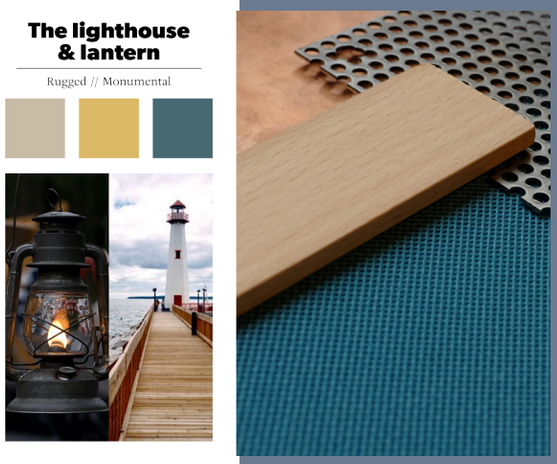


Fig. no. 61 *Styleboard 2*

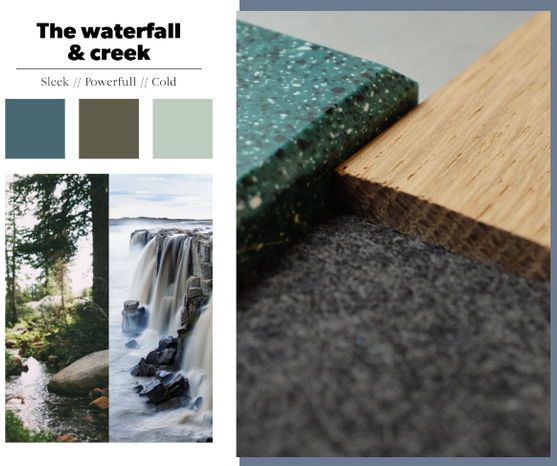


Fig. no. 62 *Styleboard 3*

Defining the concept

Inspired by the styleboards and new insights, the concept is specified according to the logic strings presented in that sum up.

DALI does not have passion for the small portable speaker market.

In order for DALI to gain passion in this new product, the speaker is split into two: a smaller portable speaker that can be produced and assembled at the DALI factory in China (Referred to as "The Brain"). And a big speaker that can be produced in Nørager and utilize some of DALI high end competencies (Referred to as "The Muscle").

DALI core values is not an obvious fit with the URBAN market

The solution utilizes DALI's speaker competencies to target the market general sense of quality.

Users can not connect to their BT speakers

The physical action of establishing a connection between the speaker and the streaming device, phone or similar, is negated by replacing the BT technology with Wi-FI thus allowing the speaker itself to be the music source through the internet. Additionally in the attempt to strengthen the users mental connection with their speaker, the solution features a friendly and inviting user interface.

Users are emotionally disconnected with their speakers

The solution focuses all interaction in a nice tactile interface on the brain. The close and physical interaction with the brain shall create an emotional bond between the solution and the users, making the user confident in using the solution

Users wants a fast, easy, and reliable way to music

To solve this, the solution exploits the fact that users mostly listens to playlists as the track itself is not important but the goal is to "just get some music playing". The speaker offers a "one click" for music option, that with a press on the interface starts playing a random playlist based on the users previous behavior.

Users needs music in many different rooms

The speaker is composed of two speakers, the brain that have all the controls that is brought along around the users home, and then the muscle, which the brain is inserted into, that features bigger speaker drivers which allows the user to get a greater sound experience in the living room and when watching television.

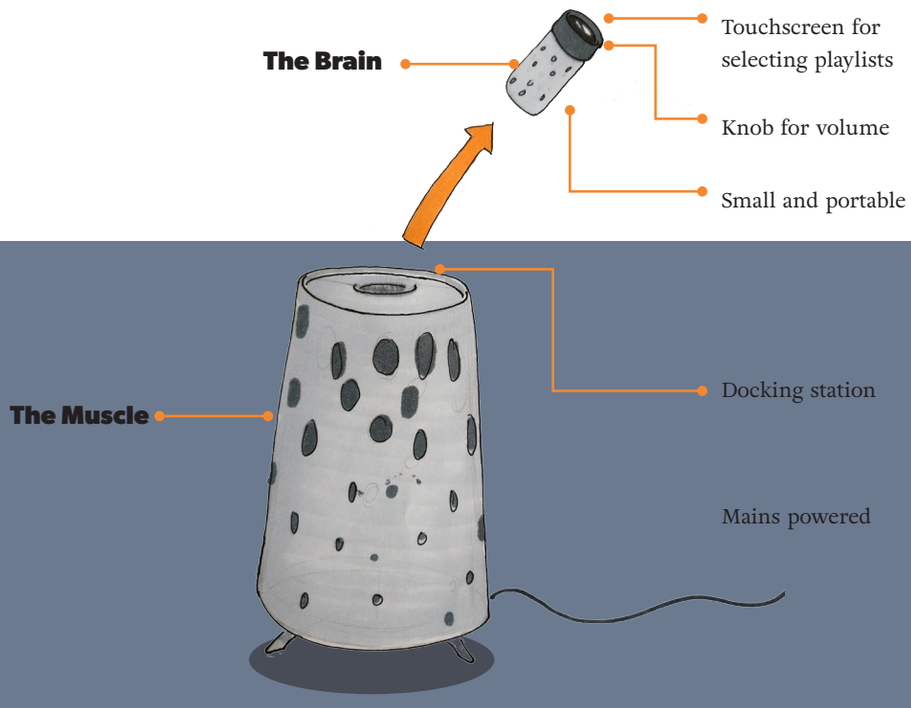


Fig. no. 63 *The modular concept*

LOGIC STRINGS

PROBLEM	INSIGHT	SOLUTION PRINCIPLE	VALUE
DALI does not have passion for the small portable speaker market.	DALI values heavily favors their loudspeaker passion KATCH speaker is not produced or designed by DALI	Move production of the product solution to Nørager	DALI embrace the portable active speakers as a part of their identity
DALI core values is not an obvious fit with the URBAN market	URBAN market is not Hi-Fi enthusiast	Create a speaker that act on the the URBAN market search of meaningfulness and general sense of quality	Enable DALI to make use of their competencies but framed differently to match the URBAN market
Users can not connect to their BT speakers	Users uses other devices for playing music because they experience difficulties with their Bluetooth speakers	Replace BT with Wi-FI and remove the phone from the use scenario, thus removing daily connection actions	Users confidently and successfully use their speakers for playing music every time.
Users are emotionally disconnected with their speakers	Users feels inadequate and get anxious when asked to operate their speaker	Increase the amount and joy of interaction with the speaker	Makes the user feel comfortable and happy to operate their speaker
Users wants a fast, easy, and reliable way to music	Users settle for radios, phones and lesser sound experiences because they work as needed	Make use of the fact that users almost always listens to playlist, and supply users with quick access to playlists	Enable users to effortlessly start listening to music
Users needs music in many different rooms	Users places radios in many rooms or carry around their phone or similar	Make a portable sizes speaker that can be moved freely around the home	Achieve the flexibility of the phone without sacrificing the sound quality

Aesthetic directions

Together with the functional definition of the concept, the visuals of the solution is also explored. With the stories from the exploration in a previous chapter (See "Style boards" on page 61) serving as a catalyst for designing the visual aesthetics of the product, the solution is visualized as either a floor speaker pulling on the storyline of big and monumental lighthouse (Fig. no. 65), or a speaker placed on cabinet or TV unit, trying to tell a story of gathering around it and enjoying a nice time similar to that of a fireplace (Fig. no. 64).

Solution sum up

The solution consist of two parts: A small portable speaker, The Brain, housing all the controls to the entire system, meant for carrying around the home to enable the user to have music in multiple rooms. The Brain is connected to the internet allowing its user to quickly and easily put on playlists through its simple touch screen and dial interface.

The Brain can then be inserted into a bigger speaker called The Muscle, located at the television, thus allowing The Brain to make use of the bigger drivers in the muscle speaker. The combined system is connected to the television and is still controlled through the simple interface of the brain therefore providing a simple continuous interface presented to its user no matter which speaker situations is needed.

The use of the concept is acted out and visualized on the following page (Fig. no. 66 on page 65)

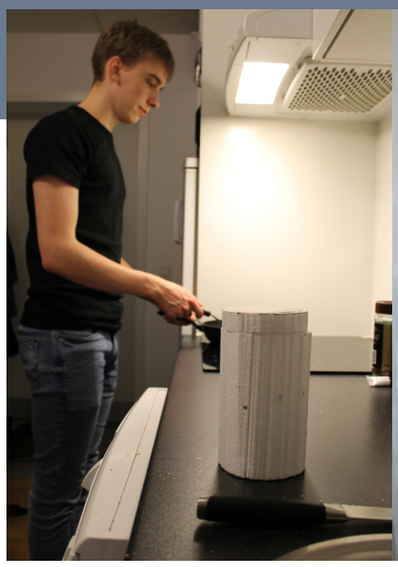
Fig. no. 64 *Concept variation 1*

Fig. no. 65 *Concept variation 2*

The user picks up The Brain from the docking station in The Muscle.

The user search for and select the preferred playlist or simply push play for continuing playing from where it picked off.

The volume is then adjusted on the top dial.



The user then brings The Brain to the kitchen where the speaker provides music while the user prepares and eat dinner.

When the user is done eating, The Brain is then placed back in The Muscle and the music starts playing through the bigger drivers of The Muscle.

The user then turns on is television and the speaker solution then automatically switches from playing music to playing the sound input received from the television.

Fig. no. 66 *User journey*

Does it make sense?

In the aftermath of an internal midterm presentation and a feedback call with Mads Møller from DALI. It was time to take a step back and look upon the project and reflect on the solution.

Trim the fat

Feedback from midterm presentation

Generally the concept was understood and most could see the value, but had a hard time understanding what real value The Muscle brought to the story and why The Brain couldn't play loud enough for most use cases.

Furthermore there were some concerns about why there should be a screen on The Brain and why people wouldn't just use their phone for selecting songs etc.

DALI feedback/input

During a phone call conversation with DALI contact Mads Møller, new insight were brought up and general feedback on the project was giving.

The idea of bringing the assembly and utilize DALI own in-house produced drivers in the solution will increase the cost significantly and thereby the selling price immensely. An increase in asking price that wouldn't be offset by made in Denmark value that this move would bring to be appreciated by the target audience.

Mads was clear in that we should emphasizes on locating and focusing on user values and think of what DALI "wants" afterwards.

Retail

A look back at the interview with the retailer from Hi-Fi Klubben, it became obvious that a hybrid / modular system like the imagined would be a hard sale. Who would actually be in the situation of needing and wishing to buy both a "soundbar/TV speaker" and a small portable one.

Reflection

Based on the growing doubt of what value The Muscle brings to the product solution other than being more sound. Removing the The Muscle, The Brain still furfilled most of the requirements and logic strings.

By focusing on the most severe pain of the users and solving that, the solution just became sharper. Between the designers in BK Design it was easier to communicate the concept with The Muscle part cut out and when pitching the idea for others it was clear that it had to go.

The core principle of The Brain will have to be refined so that its value proposition is clear. To stay within the DALI brand values and deliver a high quality sound experience, the standalone speaker will be increased in size to allow for better/larger speaker drivers.

LOGIC STRINGS

PROBLEM	INSIGHT	SOLUTION PRINCIPLE	VALUE
DALI does not have passion for the small portable speaker market	DALI values heavily favors their loudspeaker passion KATCH speaker is not produced or designed by DALI	Move production of the product solution to Norage	DALI embrace the portable active speakers as a part of their identity
DALI core values is not an obvious fit with the URBAN market	URBAN market is not Hi-Fi enthusiast	Create a speaker that act on the the URBAN market search of meaningfulness and general sense of quality	Enable DALI to make use of their competencies but framed differently to match the URBAN market
Users can not connect to their BT speakers	Users uses other devices for playing music because they experience difficulties with their Bluetooth speakers	Replace BT with Wi-FI and remove the phone from the use scenario, thus removing daily connection actions	Users confidently and successfully use their speakers for playing music every time.
Users are emotionally disconnected with their speakers	Users feels inadequate and get anxious when asked to operate their speaker	Increase the amount and joy of interaction with the speaker	Makes the user feel comfortable and happy to operate their speaker
Users wants a fast, easy, and reliable way to music	Users settle for radios, phones and lesser sound experiences because they work as needed	Make use of the fact that users almost always listens to playlist, and supply users with quick access to playlists	Enable users to effortlessly start listening to music
Users needs music in many different rooms	Users places radios in many rooms or carry around their phone or similar	Make a portable sizes speaker that can be moved freely around the home	Achieve the flexibility of the phone without sacrificing the sound quality

2 ½

Following the reframing of the solution and discontinuing the modular principle, a phase 2.5 was deemed necessary to explore more specifically towards a standalone portable home speaker.

In this ½ phase the focus have been to involve the users and the use scenarios in the development to help list the target specifications.

User research

With the modular concept gone and focus on a single speaker, new user research in regards to the standalone "Brain" speaker was needed. A look at where users currently place their portable speakers in the home. Then a dive into ways to carry the product around and which grip provides the best experience. Followed by feedback and observation of users testing the screen and dial orientation of the concept.

User placement

A look at where users place their speakers will help understand the need for directional speakers or 360 dispersion of the sound as well as possible size.

The product solution should operate in multiple location of the home and uncovering the space available for a solution in such locations. Since the kitchen and the bathroom are the smallest rooms in the house, these two are selected for this space test.

User pictures

Since most people have speakers a broad request for pictures of placement was posted on social media. Resulting in a high variety of pictures of different placements, which gave an extensive look into how users choose to place their speakers.

Most users place their speakers at a central location to provide sound in a large area. Regardless of room it is often placed in the corner or along a wall, resulting in situations where a directional speaker wouldn't always be able to deliver. This supports the need for an versatile speaker that can provide sound in a wide variety of scenarios and a 360 dispersion of the sound might be the way forward.

- A wide sound dispersion is required to make the most user scenarios possible.

Fig. no. 67 *User speaker placement*

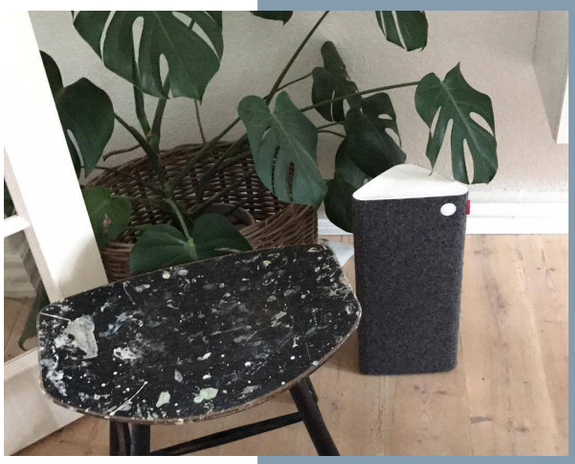


Fig. no. 68 *User speaker placement*

Fig. no. 69 *User speaker placement*

Grip

The increase in size put an interesting design task in making the speaker easily carried around while staying comfortable. It is important that it can be carried in one hand. With a quick mock-up and a bunch of 1,5 kg water bottles a quick and dirty test of weight, grip and position of handles was conducted.

Three principles

Objective of this test is to uncover the implications of different handle types. Going into this test it is known that the speaker must not exceed 3.5 kg, and that the center of mass would be concentrated around the lower part of the speaker.

Each principle was tested with two, one and without any 1,5kg water bottles attached at the bottom to simulate the weight and weight distribution.

The finger grip

The finger grip principle is that the device is carried by the finger tips at the top of the product.

With both 1.5kg and 3kg attached it was still a comfortable grip that didn't put too much strain on the wrist and finger joints.

The open grip

The open grip is graping the around the product with an open grip. It was tested holding it both vertically and horizontally. Vertically felt very heavy already when attaching 1,5 kg water bottle. While horizontally put a lot of strain on the wrist as you try to battle the center of gravity.

The closed grip

The closed grip was very similar to the open grip, but with a much firmer grip as expected. The conflict against the center of gravity is still present when adding water bottles.

Fig. no. 70 *Finger grip*

Fig. no. 71 *Open grip*

Fig. no. 72 *Closed grip*

Evaluation

If the open grip is chosen its very important that the weight is kept below 1,5 k.

If the weight are above 1,5 the finger grip or closed grip is the way to go. An important note is that in our test the finger grip were the most comfortable as you did not have to fight again the center of gravity, which you had to in our closed grip model.

Extending the finger grip

By extending the finger grip to let it rest on the next set of joints allowed for a better grip, especially when adding 3kg. It supported a firmer grip, similar to the closed grip principle.

Reflection

Simple as the test setups were it clearly showed us a principle important for creating a comfortable grip solution.

The axis of the handle should be perpendicular to the center of gravity such that the object would rotate along the axis of the handle in order to create a vertical relationship between the handle and the center of gravity.

- One handed carry
- Don't battle the center of gravity

Fig. no. 73 *Extended fingergrip*

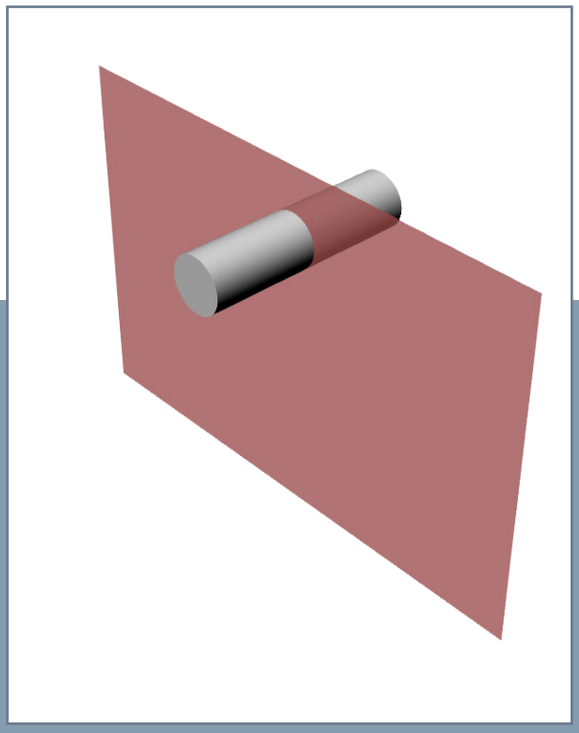


Fig. no. 74 *Handle axis / center of gravity*

Screen and dial orientation

Knowing the touchscreen were part of the concept together with a dial meant for increasing the physical interaction, the extend of the interaction concept was sought to be refined.

With simple foam models as catalyst for conversation about the subject, four test persons acted out interaction scenarios and gave feedback accordingly. The feedback in this session were focused on the orientation of the touchscreen on the speaker, and whether or not a dial would make sense to the test persons.

Touch screen orientation

Testing the interaction with different screen orientation the user supplied comments based on their immediate response (See "Orientations models - responses" on page 73).

Trough the sessions some interesting insights surfaced. If the product had a screen for interaction it might also serve as a display showing listeners what they a listening to.

Dial

For the test setup a foam dial was mounted to the different models on top of the screen thus testing a dial in all of the same orientations as the touchscreen (Fig. no. 76 on page 72).

Although a touchscreen could serve the purpose of adjusting the volume, the dial was positively received by the test persons. The dial is mentally connected to volume and most liked that a dial makes them consider the actual volume instead of "some numbers" displayed on a screen.

Sum up

Based on this primitive session it is assessed that a touchscreen with a volume dial oriented at an angle is desired for the speaker.

?

A deeper dive into what makes physical interaction desirable.

!

- Speaker have an angled screen with a dial around it (Fig. no. 76 on page 72)

Fig. no. 75 *User input*

Fig. no. 76 *User input*

FRONT

+

- Screen glare probably wont be a problem
- The screen i visible from a distance

-

- Speaker might tip over when touchscreen is pressed against
- Screen not visible when standing next to it = you have to hold it when controlling it

ANGLED

+

- The screen i visible from a distance
- The angled screen results in a comfortable distance to the speaker when you interact with the screen. Both placed on a table or in the hand.

-

- Screen glare might be an issue

TOP

+

- Pushing the screen in a downward directions is comfortable as the direction is normal to the tabletop

-

- Screen cant be seen from a distance
- You have to stand right at it or hold it in your hands to see the screen

Fig. no. 77 *Orientations models - responses*

Concept sum up

Summed up the speaker is larger portable speaker meant for primarily home use. The speaker is Wi-Fi enabled which allows its user to leave the phone and connection issues behind and focus on putting some music on. The speakers interface shall be user friendly and inviting by making a tactile system (Dial) and a minimal control interface, allowing its user to "only" select and play playlists which is desirable in most situations of the persona Anna's sound consumption.

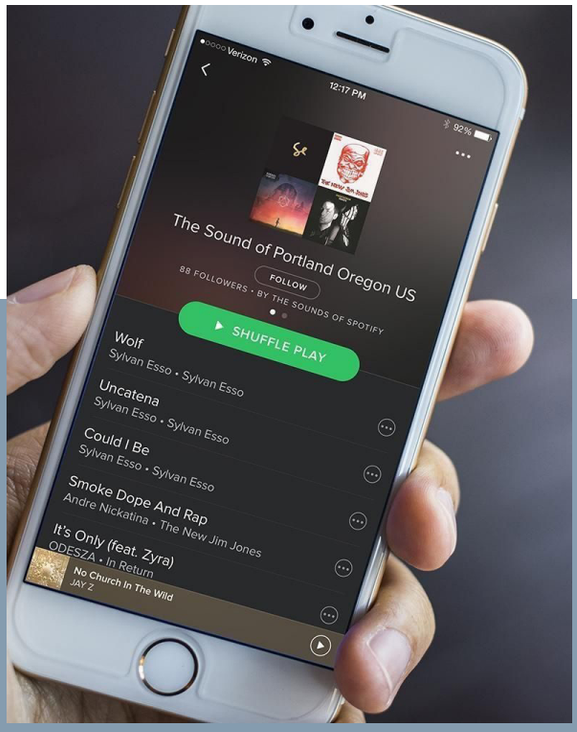


Fig. no. 78 *Phone as casting device*

Fig. no. 79 *Tertiary use case*

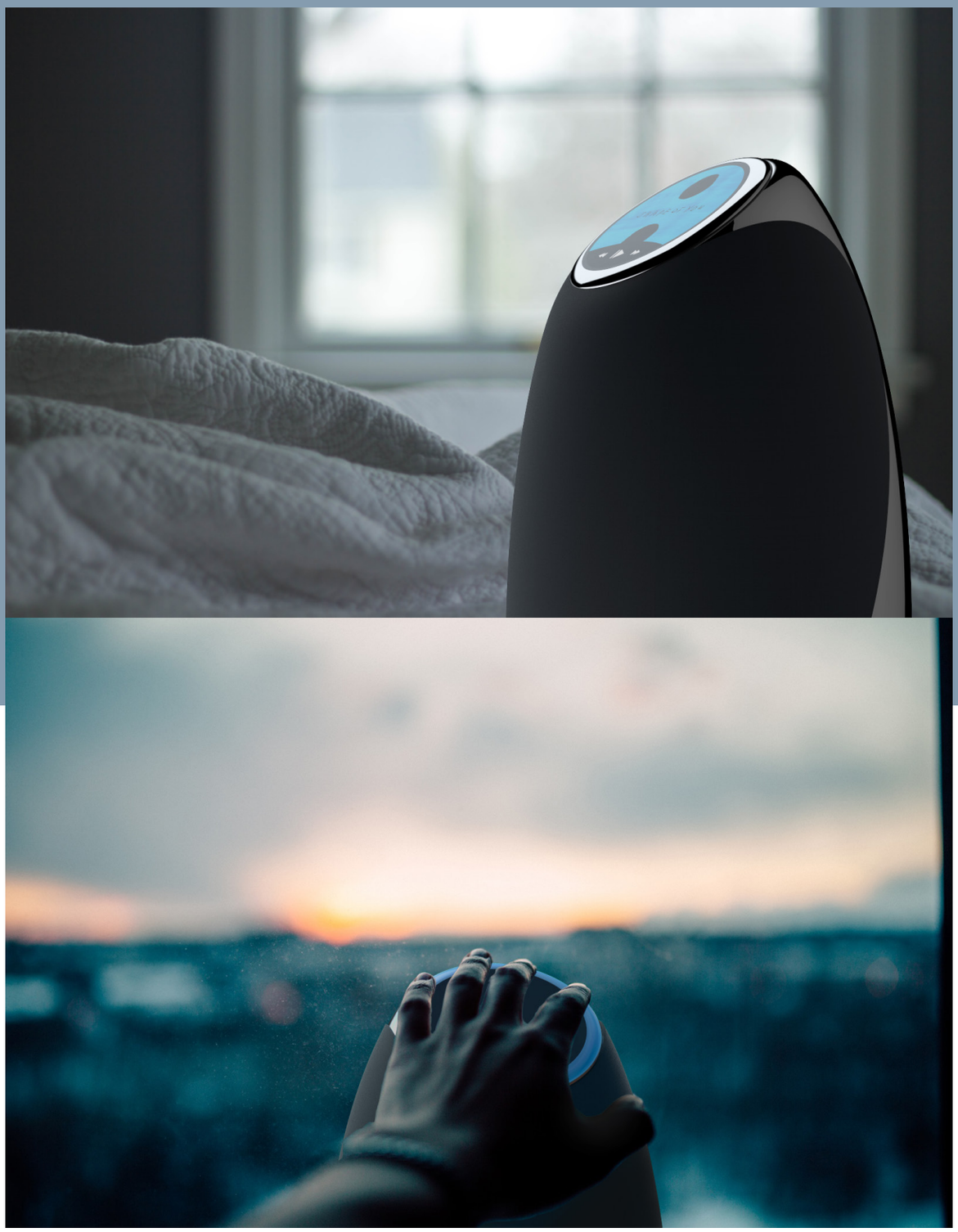


Fig. no. 80 *Consumer trend, curious and meaningful learning*

LOGIC STRINGS			
PROBLEM	**INSIGHT**	**SOLUTION PRINCIPLE**	**VALUE**
DALI core values is not an obvious fit with the URBAN market	URBAN market is not Hi-Fi enthusiast	Create a speaker that act on the the URBAN market search of meaningfulness and general sense of quality	Enable DALI to make use of their competencies but framed differently to match the URBAN market
Users can not connect to their BT speakers	Users uses other devices for playing music because they experience difficulties with their Bluetooth speakers	Replace BT with Wi-FI and remove the phone from the use scenario, thus removing daily connection actions	Users confidently and successfully use their speakers for playing music every time.
Users are emotionally disconnected with their speakers	Users feels inadequate and get anxious when asked to operate their speaker	Increase the amount and joy of interaction with the speaker	Makes the user feel comfortable and happy to operate their speaker
Users wants a fast, easy, and reliable way to music	Users settle for radios, phones and lesser sound experiences because they work as needed	Make use of the fact that users almost always listens to playlist, and supply users with quick access to playlists	Enable users to effortlessly start listening to music
Users needs music in many different rooms	Users places radios in many rooms or carry around their phone or similar	Make a portable sizes speaker that can be moved freely around the home	Achieve the flexibility of the phone without sacrificing the sound quality

Fig. no. 81 *Logic strings*

End of phase 2.5

Discontinuing the modular concept and focusing on curing the main pain of the user fast forwarded the development process.

The logic strings, problem statement and requirements have all been revised to fit the "new" focus. The revise is rather small which also proves the little value the modular concept provided.

Target specification

Moving into the detailing phase the focus will rely on determining the target specifications for the product solution. Some of the requirements and new insights can go directly into the list, but others will have to be determined in the next phase.

PRODUCT REQUIREMENTS

	QUALITATIVE	QUANTITATIVE
NEED TO HAVE	• Make the user feel adequate when operating the product solution • Create an easy and reliable way to start playing music • The interface should not include a long range of gestures that need remembering	• Portable speaker should maximum weigh in at 3.5 kg • The solution should incorporate a tactile interface • The device will be Wi-Fi enabled allowing access to the Internet • The solution is primarily operated without the use of a phone • The speaker should feature a physical dial • A wide sound dispersion is required to make the most user scenarios possible.
NICE TO HAVE	• Make a product solution that deviates from the aesthetic of a traditional loudspeaker setup • The solution should support multiple use cases • The solution should strive to support mindfulness in its use	• Build upon Google Cast technology • The solution should be flexible and support multiple use cases • The speaker should feature a touchscreen display, for playlist selection. • One handed carry • Don't battle the center of gravity • Speaker have an angled screen with a dial around it

More cutting ?

Another end of phase, another step back to reflect upon the project. Focusing on the main pain and solving that made the product and concept much clearer. Going into the detailing phase another attempt to tighten the concept by challenging the touch screen will be explored.

3

In this last phase of the project the goal is to define the solution and list the target specifications.

Starting out by challenging the touchscreen interface and then diving into loudspeaker theory. Followed by an extensive study in seductive design through buttons, knobs, dials and physical interaction.

This phase aims to provide solid foundation for the proposed product solution. That will be presented in the accompanying Product Report.

Challenge the screen

Reflecting upon the concept described in the previous chapter (See "Concept sum up" on page 74), a question arose; *have we gone all the way with what we wanted?* Looking at the concept it seems contradicting that in the effort to enable the user to have a stress free and mobile free morning, we have placed a screen on the speaker with the functionalities of the phone. This reflection caused a challenge of the screen, the values it contributes, and which features would be lost by removing it.

Level of control

Knowing the persona Anna often listens to playlist without managing her music much more than just selecting and starting a playlist, the assumption had been that the speaker needed a feature to select playlists together with the basic features of a speaker: on/off, play/pause, next/previous, volume, and a mute function.

Reflecting back on the user interviews and the persona Anna, it is assessed that selecting specific playlist just like on a mobile application is not the essence of what is needed, instead the ability to roughly adjust the type of music received in order not to get any unwanted music genres, similar to that of a radio.

Ideating on screen-less solutions to "select playlists", two promising concepts arose, one selecting music based on genres represented by icons, and one sleeting music based on color (Fig. no. 82).

The color selector was chosen based on its fit with the more expressive persona and target group and because it is assumed that a color selector could positively affect the joy of interaction (See "The joy of interaction" on page 84).
In addition to discontinuing the touch screen, the basic functions of the speaker is also revised. As the product solution needs to start immediately, it is never really shut down but only in a standby mode (See "Primary use" on page 94).This results in the three basic functions; on/off, play/pause, and mute being practically the same function, and is therefore combined into one. Likewise is the 'previous' function discontinued as the importance is only to pass on unwanted songs and not shuffle though the playlist until a wanted track comes by. The result is a even simpler set of controls (Fig. no. 83 on page 79).

Fig. no. 82 *Playlist selector*

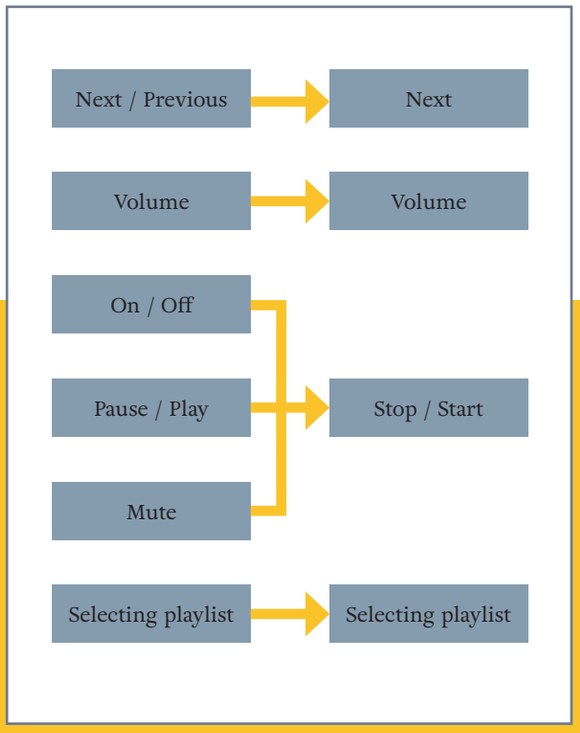


Fig. no. 83 *Level of control*

Combining color and music

Theory

A study combining color and music through emotions highlights that stimuli through visual colors and music connects to the same underlying emotions. Predefined "Happy" and "Sad" songs were played to the test subjects and they matched the happy songs with brighter and warmer colors and the sad with cooler and darker colors. (Barbiere, Vidal and Zellner, 2007)

A more recent study by researchers from University of Califonia, Berkerley, has expanded upon the study into music-color association through emotions. Where the test audience where to listen to a piece of music and then point a two to three colors on a palette of 37 different colors. The results was similar to the previous study, but the test subjects this time was from different cultural backgrounds and countries. The researchers went on to ask the test subjects to put emotions on songs and colors independently and then compared the results. It "almost perfectly aligned" with their prediction and previous experiment, that bright, vivid, warm colors were matched with happy. up-beat/energetic music while cooler, darker colors like were matched with slower more relaxed or sad music (Palmer et al., 2013)

In practice

To put the theory to practice combining the color associated emotion with a matching song or genre, a way of indexing the possibilities from Spotify is needed.

A quick brainstorm of how to categorize music was made, resulting in three methods to ideate upon.

Tempo

Indexing music by beats per minute, will give a precise indexing when it comes to Energetic and Calm. But tempo being an analytic approach will be difficult to separate in Happy and Moody categorize. It will also require to analyze every single songs bpm separately since the Spotify metadata doesn't contain bpm.

Search words

Matching each color with a list of preselected search words based upon naming of playlists. Locating search words that match both playlists and color associated emotions proved to be very hard. The end result is a color wheel filled with words that might as well be placed somewhere else along the wheel, making the hole task very subjective and personal to the individual making the list. (Worksheet no.: 35)

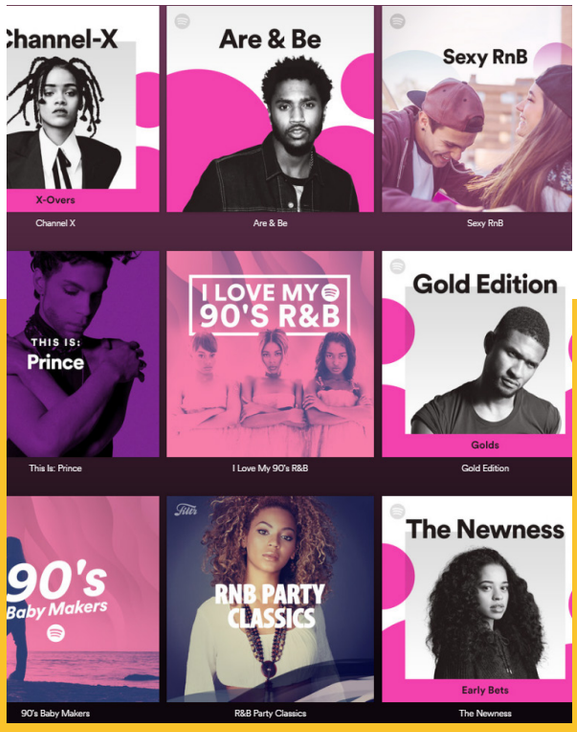


Fig. no. 84 *RnB Playlists on Spotify*

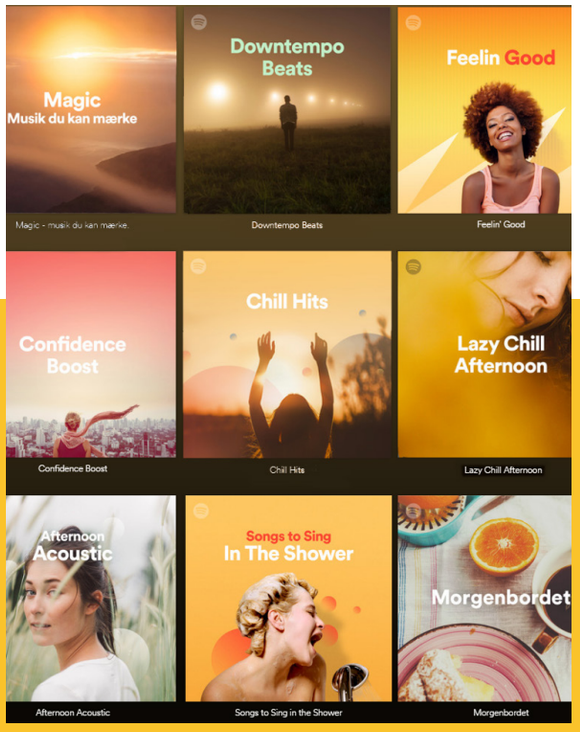


Fig. no. 85 *"Happy" playslist on Spotify*

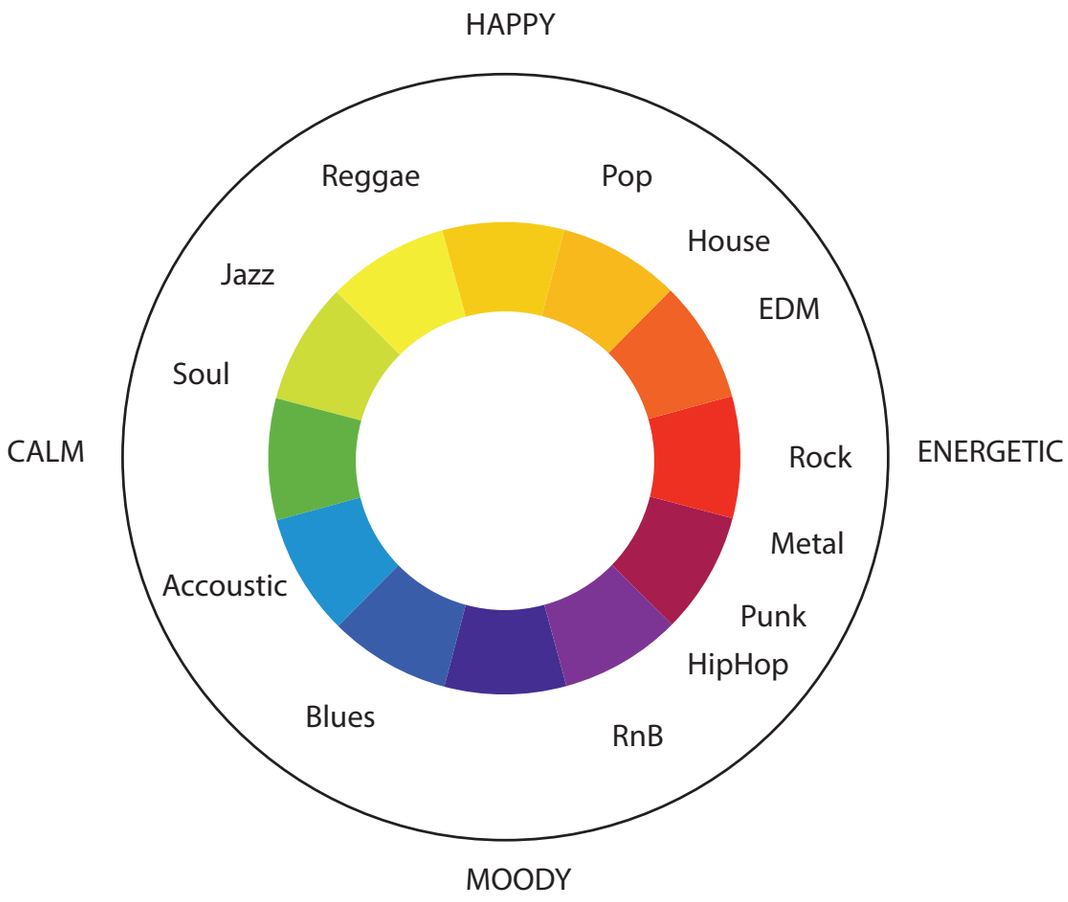


Fig. no. 86 *Color/genre association wheel*

Genres

Categorizing music into genres is a common way to index music. But with music being an art form defining music into a genre can be hard, which has led to an infinite number of subgenres and fusion genres. Furthermore a genre isn't bound to a specific mood or tempo. Spotify already have playlists based on genre which would make the indexing much easier.

While there were no obvious choice, genres felt more feasible. Having to analyze each song on Spotify and creating the index itself, would be very expensive, time consuming and might infringe copyrights.

Genres required the least of the software and provided an experience close to the desired one. Indexing different genres is not objective though and placing RnB, Punk and Metal so close to each other seemed unintentional, since they could be quite far from what the user desired in the situation. Providing the user with a way to select which genres they want to have available on their color wheel would reduce the chance of outright undesired music being played.

Evaluation

Even though researchers were able to accurately predict which color the test subject would choose when listening to a predefined song, it would be an extensive task to analyze each song in order to predict which color users would chose for it. Music is very personal, so is colors and their impact on mood and emotion. Predefining a perfect solution that fits all users personal taste and association between music and color is very unlikely. A solution where users are able to customize color/music association to their personal preference seems like the best option.

- Let users choose which genres to be available through a color dial.
- Provide the ability to personalize the color/music preset of the color dial.

Internal structure

Two ideas for an internal structure of the product solution from now on called DALI KOLOR was brought to DALI HQ for a creative discussion about the possibilities of the internal structure in a speaker of this size and function.

The True 360

The first idea was a speaker with two drivers, one tweeter and one woofer each concentric with each other along the vertical axis of the speaker. Both drivers will be directed towards an acoustic lens or convex reflector that directs the sound horizontally out of the speaker and creates a 360 degrees dispersion of the sound.

360 through multiple speakers

The second idea was to use several smaller drivers to directed the audio from the speaker in all directions and crease the sound all around the speaker.

DALI feedback/creative discussion

Through feedback on the two concepts for an internal structure and a creative discussion with project manager Mads Ullits and innovation director Kim Kristensen the two concepts was developed further.

Through their extensive know-how about speakers both the concepts was refined and debated in order for BK Design to choose the right direction for the project.

The combination

Combining the axial woofer with two or more directional tweeters was deemed more feasible than only have one tweeter concentric with the woofer. Since the high frequencies are the most directional making the tweeter and its reflector a very sensitive part. Whereas the lower frequencies from the woofer passes through objects easier and isn't too sensitive.

The woofers diaphragm size is crucial to its capabilities of reproducing the lower frequencies at a higher volume, since these take up a lot of surface area placing it downward facing at the bottom would allow for a larger woofer. Furthermore it could use the entire volume of the speaker enclosure to extend the bass reproduction. A larger woofer would require a larger volume in a sealed enclosure or passive bass radiators. Limiting the size of the woofer. Otherwise a vented enclosure with a bass reflex port would require less surface area but takes up internal volume instead and it opens the structure.

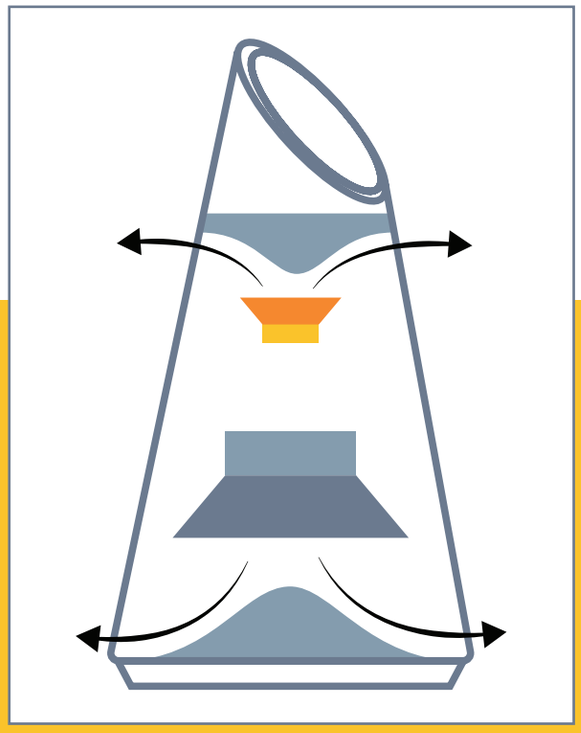


Fig. no. 87 *The true 360*

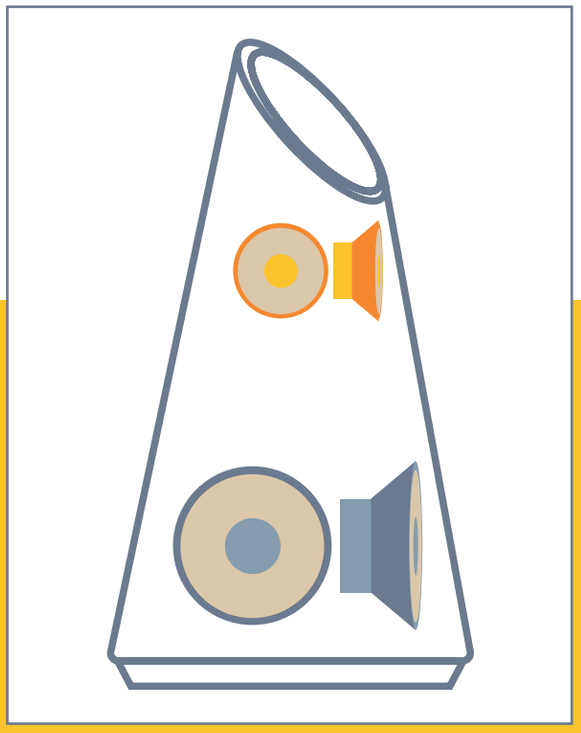


Fig. no. 88 *360 through multiple drivers*

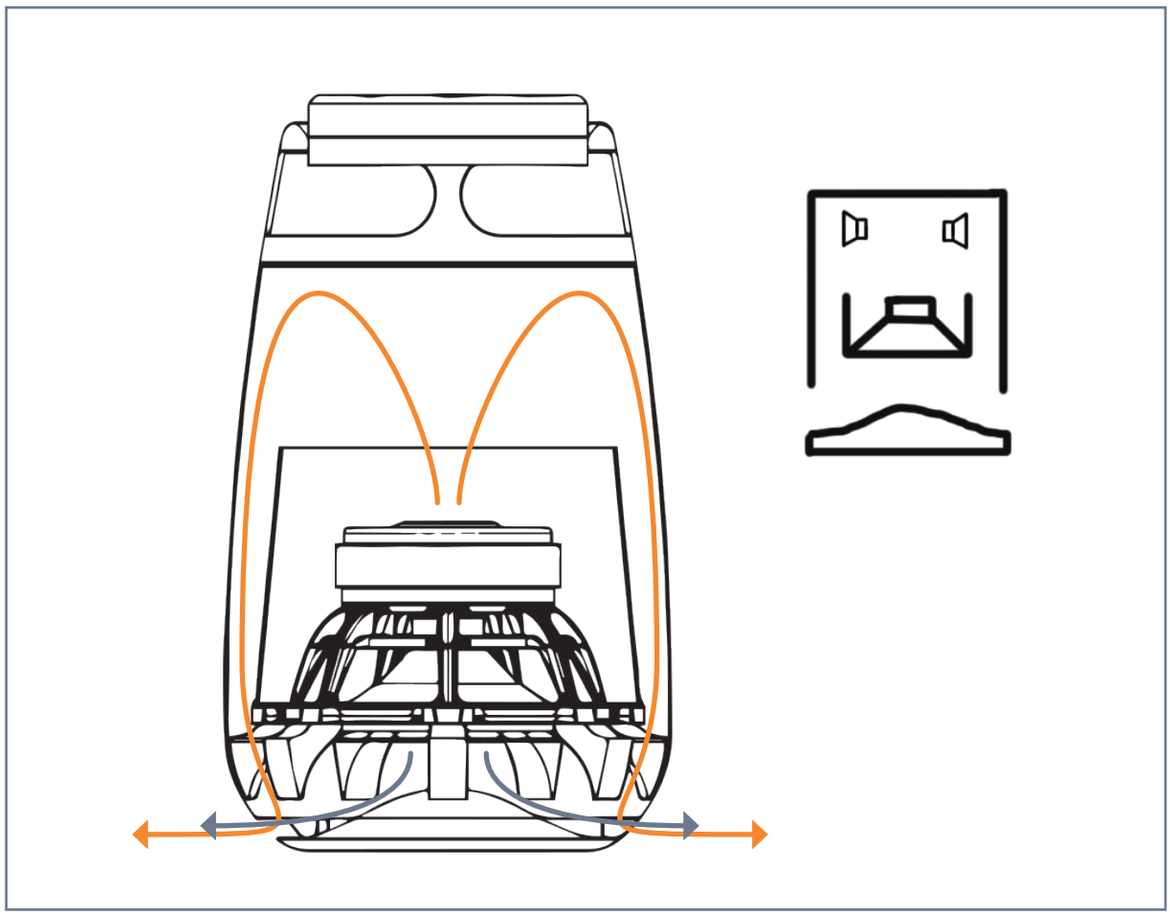


Fig. no. 89 *The combination with bass reflex port*

Reusing

Going with multiple driver units in each directions is also a feasible option. Two sets of drivers was deemed enough to create the perception of 360 sound dispersion similar to how the KATCH does it. In general reusing the KATCH drivers would make the technicalities of the speaker easier, since the same DSP and amplifiers could be used. And with the bigger volume of the DALI KOLOR it would be able to do a better reproduction of the lower frequencies.

5" woofer vs two 3"

Based on DALI's guidance two situations was listed, using a single 5" woofer (BK Design was able to borrow one from the Mentor 5 series for size reference, model making etc.) or two 3" woofers, same as the one found in the KATH.

Compared to each other, the 5" Mentor woofer would weight less, be cheaper and more energy efficient than the two smaller KATCH drivers. It would also be able to deliver lower frequencies but will have to have quite large passive radiators or a bass reflex port. The reflex port is cheaper and weights less but requires internal volume for the tube. As a rule of thumb, for the 5", a port would have to be between 50-55mm in diameter.

The two 3" woofers would produce a somewhat similar audio output and require less surface area for the passive radiators. But will also be more expensive and in total require more power from the amplifiers. An important factors was that they could be placed "back2back" and even out the vibration introduced by the movement of the woofers voice coil.

- A single 5" woofer pointing downward, creating the 360 dispersion of lower frequencies.
- Two KATCH tweeters on each side, with DALI signature wide dispersion.

The joy of interaction

Knowing that the interaction between the speaker and its user is a key aspect of this project, it is important that the design of the interface can captivate its users and support the meaningfulness and joy of interaction desired to aspire in the product solution. The following chapter is based on 'Emotional design' by Norman, D. (2005) with special focus on the behavioral design.

Seductive design

Seductive design as stated by Khaslavsky and Shedroff, 1999, is about three basic steps:

- **Enticement.** *Grab attention and make an emotional promise*
- **Relationship**. *Make progress with small fulfillments and more promises, a step that can continue almost indefinitely*
- **Fulfillment.** *Fulfill the final promises, and end the experience in a memorable way.*

With this knowledge about seductive qualities its clear that the product solution somewhat needs to be designed with these three steps in mind.

In order to broaden the understanding of the theory posed by Khaslavsky and Shedroff, 1999, and how others fit in the theory a field research were conducted. The research consist of analysis of select products, based on tools for analyzing seductive qualities from same authors (Khaslavsky and Shedroff, 1999). Specifically the analysis were conducted on 5 products (Worksheet no.: 42) and for this report a selection of three examples are shown, two which fulfills their emotional promises and one that do not (Fig. no. 90 on page 85).

Seductive qualities in product solution

Reflecting on the three basic steps to seductive design (Khaslavsky and Shedroff, 1999) and the analysis of the seductive qualities in existing products, the following reflection regarding the seductive qualities of the product solution have surfaced.

- **Enticement.** *Grab attention and make an emotional promise*

  Knowing from the requirements that the users wants to feel adequate, it is important that the product solution radiates simplicity and friendliness, and makes an emotional promise to its users that they without troubles can operate the speaker.

- **Relationship**. *Make progress with small fulfillments and more promises, a step that can continue almost indefinitely*

  When operated the user should discover that the interaction is not only simple but also surprising and 'nice', with a quality physical feel (Norman, 2005) promising that operating the speaker is also a joy and something the user would like to return to.

- **Fulfillment.** *Fulfill the final promises, and end the experience in a memorable way.*

  The product solution should fulfill the promises made by affording simplicity with its minimal tactile interface and the joyful interaction with said interface. Then the speaker shall end its experience with quality sound finishing a pleasant and joyful experience.

	NAIM MuSo	Marshall Stockwell	Volvo interior design knob
			
Entice by diverting attention	The speaker diverts attention with its unusual wave shape on the front, the levitating look because of the glass base, and the "giant" dial on top	The speaker diverts attention with its retro aesthetics, with leather, metal and brass.	The diamond pattern engraved in the knobs and dials is somewhat unusual and attracts the attention when looking at the interface
Deliver surprising novelty	When touching the dial, the feeling strikes one as very luxurious	When moving closing and experiencing the surprise that buttons on top is in fact dials that pop out when pushed.	One would expect it to be cool to the touch but is instead met with a plastic feel and loose hinges
Go beyond obvious needs and expectations	NAIM delivers the luxury feeling with few simple materials and just the right feel of a dial	The products have dials for volume, treble and bass and each of these have a satisfying feel of control.	Theres an uniqueness to the almost jewelery aesthetics of the diamond shaped knob and dial, creating a rather feminine visual
Create an instinctive response	The odd shape and levitating aesthetic creates curiosity and the feel of the big dial create the feeling of total control	The curiosity and surprise of the hidden dials is satisfactory and you instantly connect with the product and want to put music on and use the dials for their purpose.	At first the interior is expressing quality and luxury but when moving closer and touching the knobs and dials this illusion breaks as it is simple plastic with very little feedback.
Espouse values or connections to personal goals	The speaker could support the user in his wishes for being perceived as elegant, sophisticated, and a person who is in control of his environment.	The user of this speaker enable its user in being perceived as a music enthusiast that got the right equipment.	The interior and interface gives a feeling of luxury and high class with a twist of feminine aesthetics when looked upon. But disconnects with user expectations when starting to touch and interact with the interface.
Promise to fulfill these goals:	The MuSo speaker makes a promise about making its user feel in control and come across as sophisticated while being so.	The brass and black leather in a retro look promises to immerse the user in "old school rock and roll" feelings.	The knobs promises high class luxuriousness and elegance.
Lead the casual viewer to discover something deeper about the experience	The speaker does not teach anything directly related to sound, but teaches its user in how the simple act of adjusting the volume can be a joyful experience	The speaker enables the users to learn about the impact of treble and bass adjustments to music. A thing the pleasant dials will help the user to achieve.	From the knob and dial the user might learn that cars isn't necessarily a mans world, and that there is space for luxury similar to the luxury of jewelry stores.
Fulfill these promises	The MuSo speaker is a joy to interact with every time as it repeatedly deliver its promise of elegance, sophistication, and control.	"The speakers radiates old school rock and roll and the tactile feel of textured dials accompanied by the font of volume, treble and bass control supports that. The jump out dials are equally satisfying the tenth time as the first and second.	The knob and dial fails to deliver on its promises as built quality and materials simply contradict the expectations

Fig. no. 90 *Seductive theory matrix*

Fig. no. 91 *Buttons registration*

Physical feel of interfaces

With the importance of the physical feel of a product (Norman, 2005) together with the desired promise of a joyful interaction, a registration of interfaces were conducted. The goal of this registration is to quantify some of the parameters that constitutes a 'nice interface'. The registrations includes interfaces from a variety of products and is evaluated by the members of the project group, based on personal experience and the theory of affordance (Norman, 2013). A collection of video material from the registration can be seen in the appendix (Appendix no.: 4).

Buttons

When operation buttons on different products, three major aspects affecting the joy of interacting with these were noted.

Size

It is important for the experience that the button is as big as the finger pushing against it (See G on Fig. no. 91). Small buttons which is smaller than the finger, can create the feeling of pushing something down a hole as the finger starts touching the sides of the surface the button is placed on, and this feels uncomfortable. If small buttons are desired then protruded buttons eliminates the felling of pushing something down a hole (Fig. no. 92).

Affordance

In some cases the buttons are covered with soft material, thus removing the physical boundary between button and the surface (See B & E on Fig. no. 91). In these situations it is important for the experience that the product clearly states where to apply force in order to activate the button. This is best observed in the UE Boom (See F on Fig. no. 91) where the volume up and down are shown as two big symbols indicating a big button underneath, but in reality the button is small and hidden in the middle of the two symbols, creating a disconnection between the afforded use and the actual use.

Haptic feedback

Its important that the button 'tells' its user when it is activated and this is often done with a haptic feedback and a resulting 'click*'. The importance of this is very clear in the BeoPlay M5 (See H on Fig. no. 91) which have a big plate on top functioning as a button. This particular button have a spongy feedback increasing the resistance as you push it further down, this results in a doubt about whether or not the button has reached its limits or one just have to push harder to fully activate the button. In the case of this registration it resulted in uncomfortably large forces allied to the button.

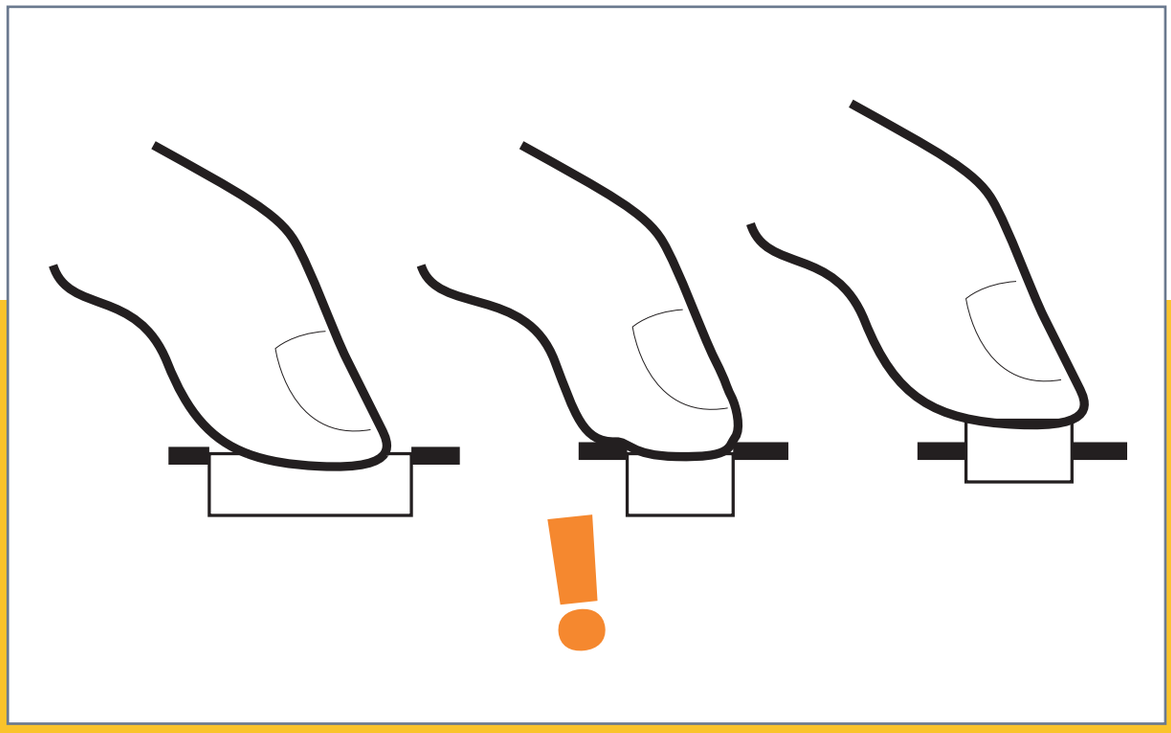


Fig. no. 92 *Button variations*

Dials

A dial is a cylindrical shape often fastened in one end of the cylinder but in some cases fastened in both ends (See C & K on Fig. no. 93). The dial is operated by rotating it either way around the axis of the cylinder.

There are observed three types of dial interactions: The infinite dial, which is the types of dials that can be rotated indefinitely in both directions.

Then there are dials with maximum and minimum value like a speedometer which starts at zero and stop at the top speed.

The third type works by a 'turn and hold' principle in which the user turns and hold the dial to continuously turn up or down the volume, if on a speaker. When released the dial then returns to a neutral state.

During the registration, four key aspect of the dials were assessed as important to the quality of interaction with dials.

Size

Big dials tend to attract more attention and seems more exclusive and interesting. In the BMW cars this effect were very apparent as all the cars interior is basically the same but in the expensive cars the dials are just bigger. There is exceptions to this rule, and this is evident in the BeoPlay M5 which top plate acts as dial, but its large size did not contribute to a quality experience (See L Fig. no. 93).

Materials

Dials made of hard materials, such as metals and glass, is perceived as exclusive and more precise in its interaction, in contrast to dials made of plastics or rubber which seems cheap.

Feedback

The resistance of the dials is linked to the quality of the physical feel, if the resistance is low to none then the dial feels cheap. Dials with more resistance have a positive effect on the experience of the dial.

Together with the resistance of the dials there is the haptic feedback of dials (The small bumps felt when turning the dial). Dials with no haptic feedback and therefor a smooth rotation is perceived as sophisticated and invites the user to more actively sense the adjustments he makes in contrast to dials with haptic feedback, which felt more mechanical, like controlling machinery, and makes users apply a logic of 'how many steps do i turn'.

It is noted that dials with haptic feedback allows users to apply a logic of numbers to the adjustments, "just turn it up to steps". Whereas dials with no haptic feedback forces the users to make use of other senses to asses the adjustments made eg. using the eye to asses when the focus dial on the camera is adjusted just right, or sensing the pressure and heat of the shower when turning the dials on the shower thermostat.

Rigidity

A big aspect of the perceived joy of interaction is the rigidity of the dials. As the dials is meant for rotating around an axis it is uncomfortable and devastating to the experience when the dial can move in other directions. Yielding dials is rapidly deemed cheap and low in quality.

Other interfaces

During the registration a few physical interfaces other than the buttons and dials were seen.

Multiple functions knob

In the cars included in this registration a type multi functional knob were found (See A on Fig. no. 94 on page 90). These knobs can be pushed as a button, rotated as a dial, and pivoted in four directions. This multi-tool makes the promise of full control and the feeling of controlling larger machinery, with its many functions and possible activations.

The switch

Some products have a toggle switch (See B on Fig. no. 94 on page 90). These switches have a on and off state and in contrast to buttons it can tell the user whether or not it is activated just by looking at it. In this particular observation it was placed on a speaker and clearly promising stories about old scroll rock and roll.

Fig. no. 93 *Knob and dial registration*

Slider
One of the observed products featured a slider for volume control (See C on Fig. no. 94 on page 90). Like the dial on the BeoPlay M5, this is a push and hold interaction that then return to a neutral position when released. For the use of this slider it is cleverly thought out that the user can keep his finger on the same pin for adjusting the volume in contrast to a solution with buttons, which would require the user to move his finger between the buttons.

Touch surface
Multiple of the speakers at Bang and Olufsen features a touch surface for interaction. By stroking your hand across the back of the BeoPlay A9 speaker, you can adjust the volume and by tapping the back you can pause and play. This interface felt different and interesting but fails at communicating the actions that are available to the user.

Defining the interface

Merging the knowledge achieved throughout this chapter, both regarding seductive qualities and the principle for interfaces, together with the needed controls (Fig. no. 83 on page 79), the interface is nearing its completion. (Fig. no. 95 on page 91).

Enticement
A big dials were a main cause of enticement in many other products, a big simple dial made of metal is chosen to entice the users to interact and touch the speaker.

Relationship
The button shall have a resistance to the rotation and no haptic feed back, to allow the user to make use of other senses when turning the dial, promising and fulfilling a experience of joy in interaction.

Beside the dial there is a touch surface on the top of the dial with indents in the dial to indicate the location of the touch surface. The surfaces two functions are a double tap for 'next' allowing the user to pass on the songs played, and a single tap for 'selection' that switches the dial from adjusting volume to adjusting the color. On the side of the speaker is the start/stop which switches the speaker between awake and stand-by mode the button is a small protruding metal button.

- The interface should resemble the one in Fig. no. 95 on page 91

Fig. no. 94 *Miscellaneous interface registration*

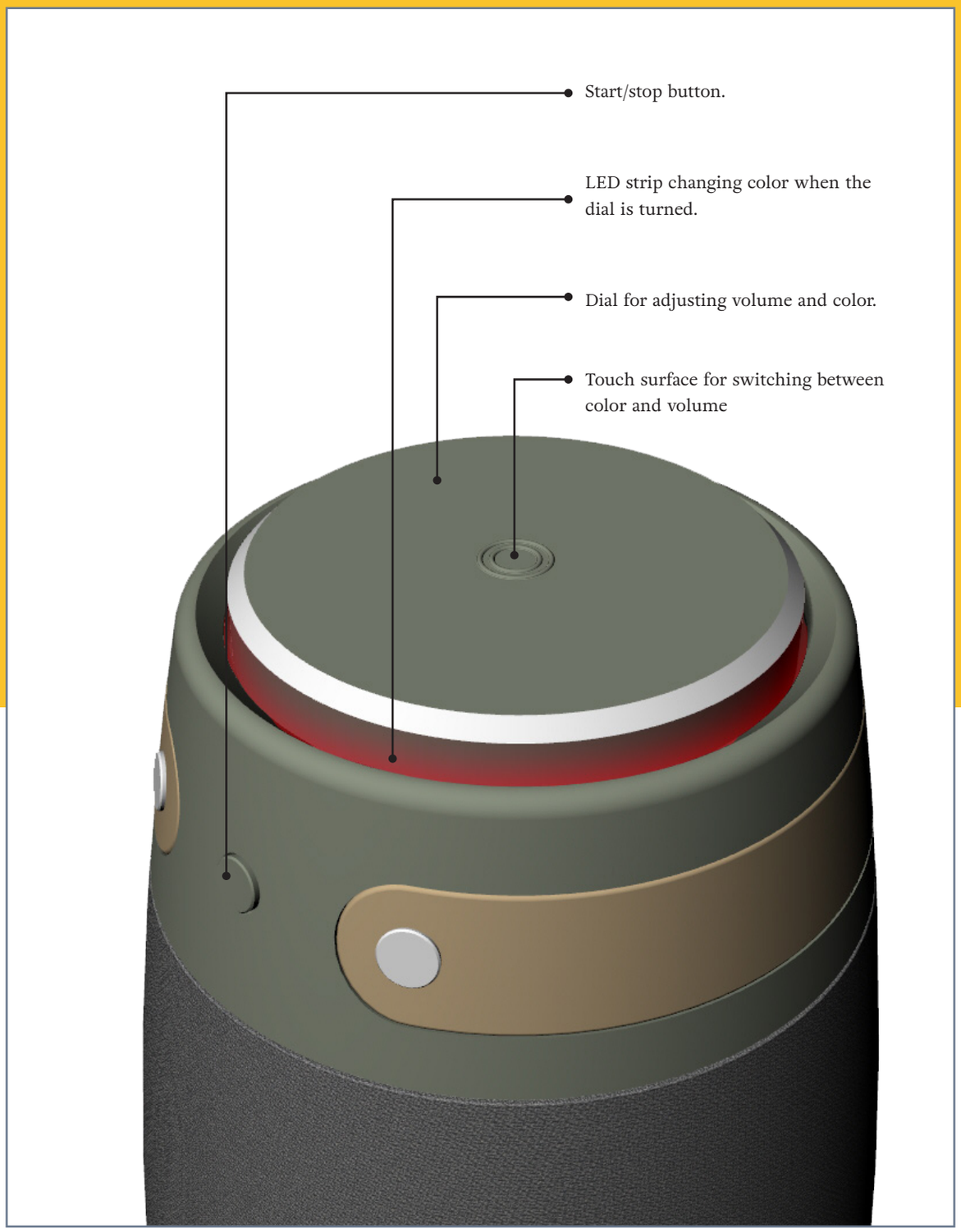


Fig. no. 95 *Overview of the color/volume knob*

Music streaming

Building the real speaker with the ability to draw music from Spotify, or similar services, would require a lot of electrical engineering skills as well as software. A simple test with some open-source software and a Raspberry Pi tinker board would be a close approximation.

Raspberry Pi

Knowledge from previous tinkering with DIY home media centers led to looking at the single-board computer, Raspberry Pi, with the free open source media player software Kodi.

The Raspberry Pi is a credit card sized single-board computer containing both digital and analog audio outputs and a SoC cappable of running Windows 10 or the Debian Linux distribution. Which is what the free open source media player software Kodi runs on. Built on Debian, Kodi has access to a wide variety of repositories where user created addons is available. Several Spotify addons are available building upon the Libspotify SDK that Spotify has made available for both users and companies to utilize in software and products in order to get data from the Spotify servers.

Test Setup

Using an Adafruit MAX9744 20W Stereo amplifier and a Raspberry Pi with Kodi and Spotify addon, we were able to pull music from Spotify servers, change playlists and find new playlists without the use of a phone or laptop. The Raspberry Pi, being a computer, needed user input, so a screen and keyboard was nescesarry. The MAX9744 amplifier, though very small, was able to power both the DALI Mentor 5" woofer borrowed from DALI as well as a full range 3.5 Peerless driver from a previous personal project.

This setup simulates the one intended for the product solution but with a few changes. The Raspberry Pi SBC is a bit overkill and has a lot of features not needed for the new DALI speaker. And the user input is to come from the color selection dial and matching playlist index insted of keyboard and screen. Initial setup and settings still has to be done. Users will have to give the DALI KOLOR their Spotify log-in information and further settings customization like equalizer, change of color preset is needed. All this, with inspiration, in the latest Google, Libratone and BeoPlay products will be put in a companion app. The Phone and app is needed for user settings and setup, but will then not be nescessary for operating the device.

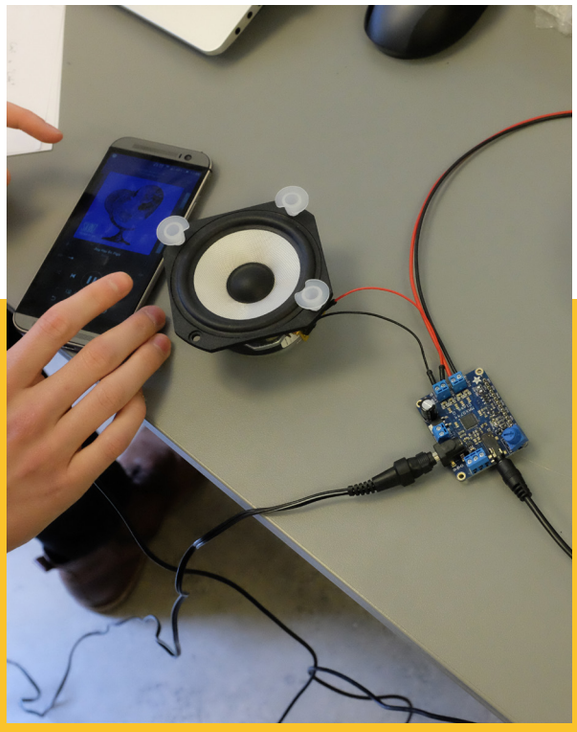


Fig. no. 96 *Test of amplifier and drivers*

Fig. no. 97 *Test of Raspberry Pi streaming*

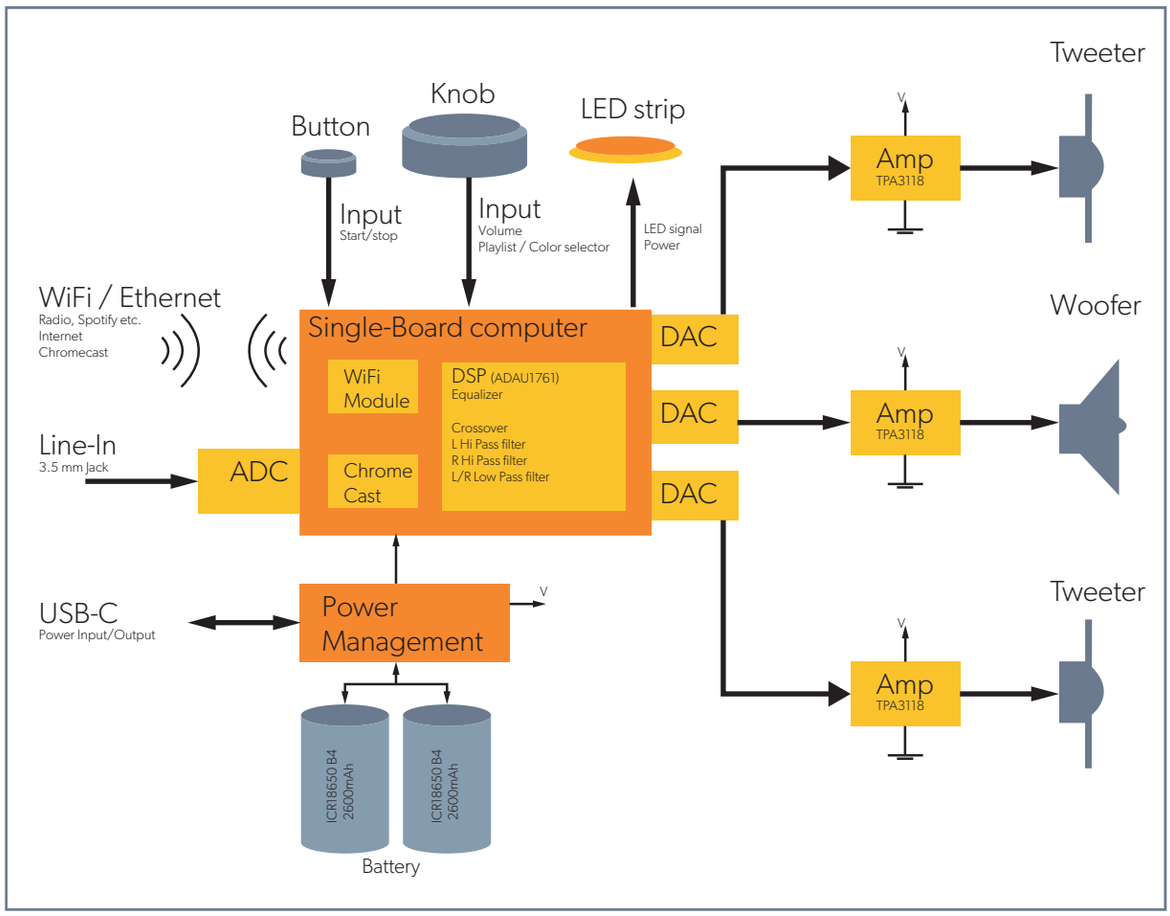


Fig. no. 98 *Block diagram*

Block diagram

Removing the phone as the primary source of music and control entails that a more advanced system has to be integrated in the device itself. An overview of the system is presented through a block diagram of the components.

DALI KATCH

To specify the DSP, amplifiers, battery etc. the DALI KATCH was used a inspirational platform for developing upon. DALI has already designed all the internal system of that system and found partners to produce them, so utilizing all that know-how would be beneficial and cost saving when the new Single-Board Computer would have to be designed without any prior knowledge.

The Single-Board Computer needed for this system, will have a Wi-Fi module, Chromecast, DSP, DAC and ADC embedded on the print board. And handle the input from the Touch Dial.

Digital Signal Processor

The DSP is the module that handles the digital audio signal from the Internet or ADC. The DALI engineers can fine tune the DSP settings to get the most out of the drivers. Furthermore it will function as the crossover separating the high and low frequencies from the left and right channels through Hi and Low bandpass filters. The separated frequencies is then sent to the DAC that converts the digital signal to an analog signal that the amplifiers understand.

Amplifiers

The amplifiers is selected in collaboration with DALI, and is the TPA3118D2 from Texas Instruments. It is similar to the amplifier found in the DALI KATCH and it is able to output 2 x 30 W / 8 Ohms @ 24 Volt. Each driver has a dedicated amplifier enabling them to be fine tuned for the specific driver. Since the signal is already separated through the crossover in the DSP, these amplifiers will be very efficient.

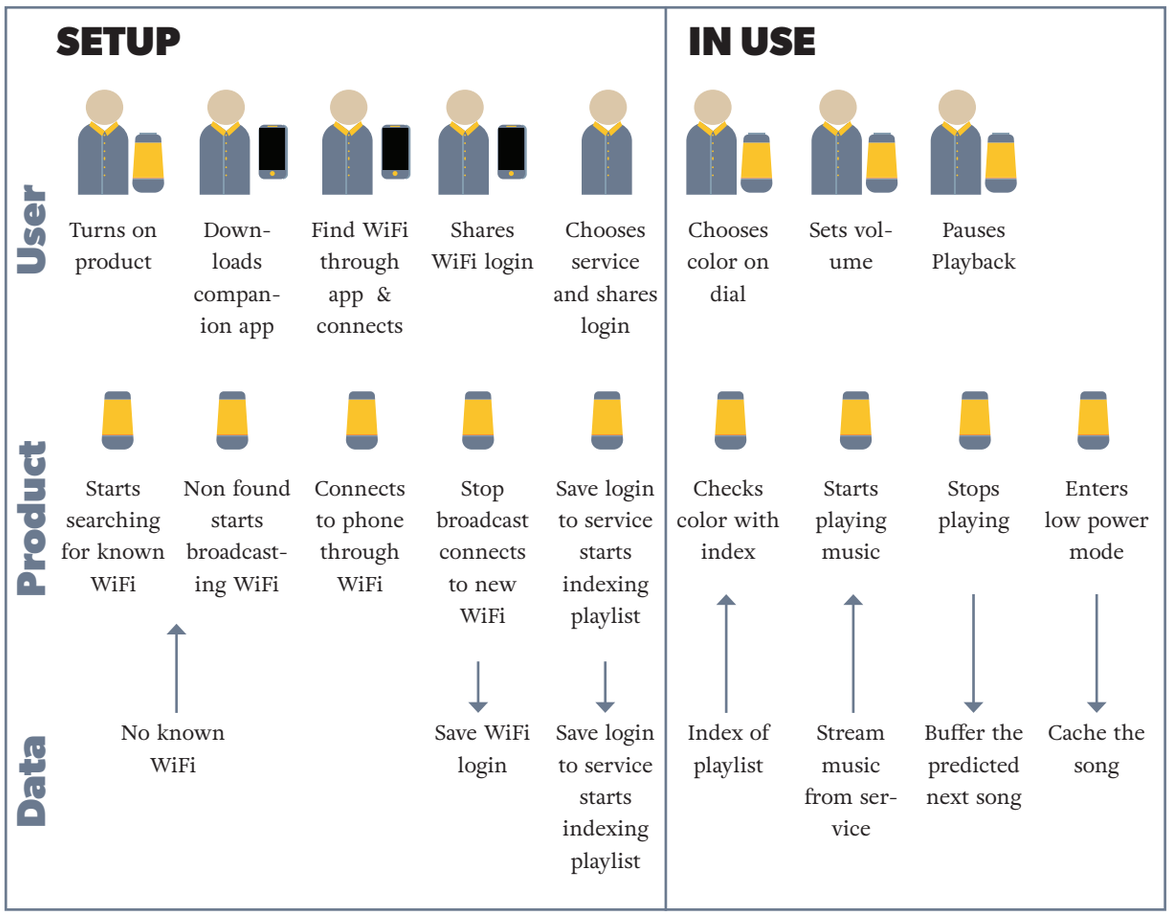


Fig. no. 99 *Blueprint*

Blueprint

To illustrate the intended user journey and what happens inside the speaker, a Blueprint is mapped.

Seperated into Setup, In Use and Personalize the blueprint shows what happens during the setup process, in use scenarios and when the users personalize the color/playlist dial.

Setup

The setup process is inspired by how Google has simplified the router setup in their Google WiFi, an otherwise complicated thing, or similar to their Chromecast setup.

The user uses their phone to connect directly to the device and share login credentials to both their home Wi-Fi and streaming services eg Spotify, SoundCloud or an internet radio service.

In use

Primary use

When ever the user then turns up the volume the speaker starts playback of the last played song or the next in the list while reconnecting to Wi-Fi. Giving the user the feeling of seamless playback and eliminating the wait time.

To ensure as low a wait time as possible when turning on the speaker it never really powers off. The Pause/Play button pauses the music playback but the SBC continues to buffer the next 30 seconds. A report on how Spotify streams music states that Spotify starts prefecthing the next song based on a predictable sequence algorithm that predicts the next song, either based on playlist or

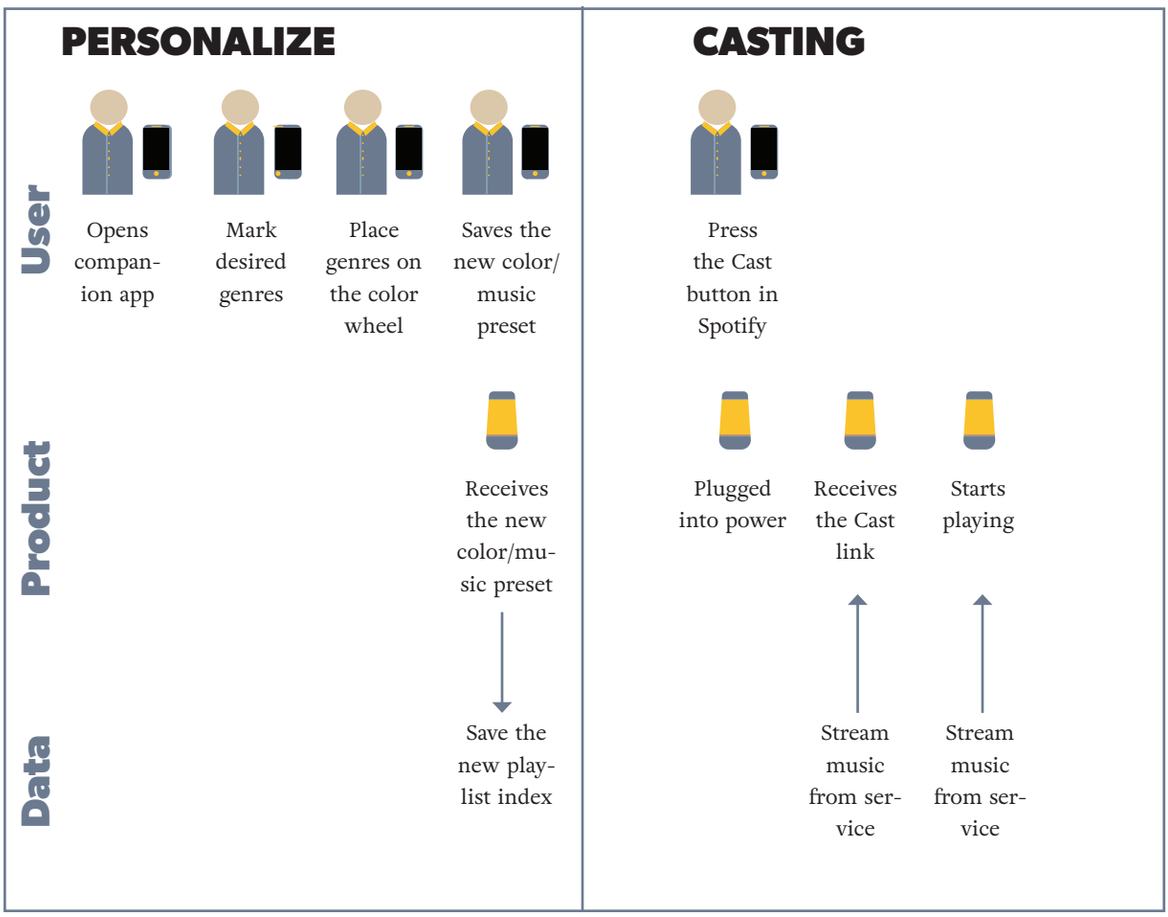


Fig. no. 100 *Blueprint*

shuffle list. The song is then stored in the cache(buffer) of the streaming device (Kreitz and Niemela, 2010). Utilizing this feature the DALI KOLOR is able to store the remaining of current song and the next song in the cache of the SBC before entering standby mode.

Secondary use

In its secondary use, the user is able to "Cast" music to the DALI KOLOR, like a normal Chromecast enabled device (See Chapter Wireless on page 23). If the user desires a specific song they are able to use another device to find the desired song and then cast it to the DALI KOLOR

Adding the Google Cast technology to the device enables it to be part of Google's growing ecosystem of Internet connected speakers and TV's. Making it possible to connect the speaker in a multi room setup of other Cast connected speakers, not necessarily from DALI.

Personalize

If the user wants to new genres added to the mix of playlists that is associated with each color. Or isn't satisfied with the color/genre matching they can customize it to their personal taste. The companion app, that handle setup and settings, provides a pleasant interface for changing these settings as well as light equalizer to personalize the sound to their specific taste or use case.

Power

To provide a true "always-on" feeling a look at the idle power consumption of both the Raspberry Pi and Chromecast Audio was done. Exploring the posibilities of having the device never turn off, but only idleling.

KATCH Battery

The ICR18650 Li-Ion batteries is the same as the ones found in KATCH, it delivers 2600mAh at 3.7V. The amplifiers need 12V so four of the ICR18650 are needed in series to power the KATCH's amplifiers. This could keep the KATCH playing for up to 24h at low volume with its two amplifiers and four drivers.

Keeping the batteries in sets of four will make the Voltage stay at in the 12V range. This gives the following possibilities for batteries:

1 x 4 Cell - ICR18650 = 2600mAh
2 x 4 Cell - ICR18650 = 5200mAh

More battery power is always nice, but will affect price, weight and takes up internal volume.

Idle power

The Chromecast Audio dongle was measured in both idle and active state with a watt meter. It operates with a 5V interface.

Idle - 36mAh (10 minutes measurement)
Active - 42mAh (10 minutes measurement)

Jeff Gerling, an online tinkerer, has made an extensive power draw measurement of the most common Raspberry Pi models. The Zero model is the one closest to what is needed for this project. (Geerling, 2015)

Zero Idle - 80mAh

There is a bit of overlapping features by using both an Chromecast Audio and a Raspberry Pi board. To ensure a conservative overestimate of the final products power consumption, the Rasoberry Pi was chosen, since it draws the most power in idle.

If we expect to get 70% efficiency of the batteries the Pi board idleling would result in the following battery time:

23 hours @ 2600mAh
45 hours @ 5200mAh

That is deemed too low in idleling mode without playback. Running only the Chromecast if we expect to get 70% efficiency, was a bit better.

50 hours @ 2600mAh
101 hours @ 5200mAh

But was still deemed to low and would lead to too many situations where the speaker simply would ran out of battery without the user even using it. Enabling standby mode with the Chromecast turned on only when plugged in to a charger.

Playback

An estimation for playback time is dependent on too many variables that can't be determined without having the precise components and extensive knowledge in electrical engineering field. A playback estimation will have to be conducted when entering the design for manufacturing stages later in the project process.

The DALI KOLOR introduces both the SBC as well as one more amp and a Wi-Fi module. So doubling the battery size is a good start.

- 5200 mAh battery.
- Disconnects Wi-Fi when entering standby mode on battery.
- Chromecast-ready in standby mode only when plugged in.

Form exploration

Finishing off the product solution, all inputs, insights and wishes for the product have to be combined into one product. Following sections tries to describe the considerations that went into the design, a visual aid can be seen on the following spread, and the final result can be seen in the accompanied product report.

General shape

The general shape where dictated by the wish of affording the 360 sound and housing the 5" speaker in the bottom (See "User placement" on page 69). These constrains resulted in the speaker having to be axial symmetrical and have section of it be at least 160 mm in diameter, in order to house the 5" speaker.

Handle

Designing the handle, the main constraint were the principle of not fighting the center of gravity (See chapter), together with battling unwanted associations to other products with handles.

One of the principles applied to the design of the handle were the idea of morphing the handle into the shape. This idea stoved upon the project in the revaltaion that some speakers features a handle only for affording the portability, even though the speaker might be carried without using the handle. This principle is seen in the BeoPlay A2.

Bottom

The bottom of the speaker needed vents to let out the sound produced by the 5" speaker and the bass reflex, and the design of the bottom have revolved around how to satisfactory afford that sounds comes out at the bottom without contrasting the general shape in a destructive way.

Interface

The interface at the top of the product is and its design is described in a previous chapter (See "Defining the interface" on page 90)

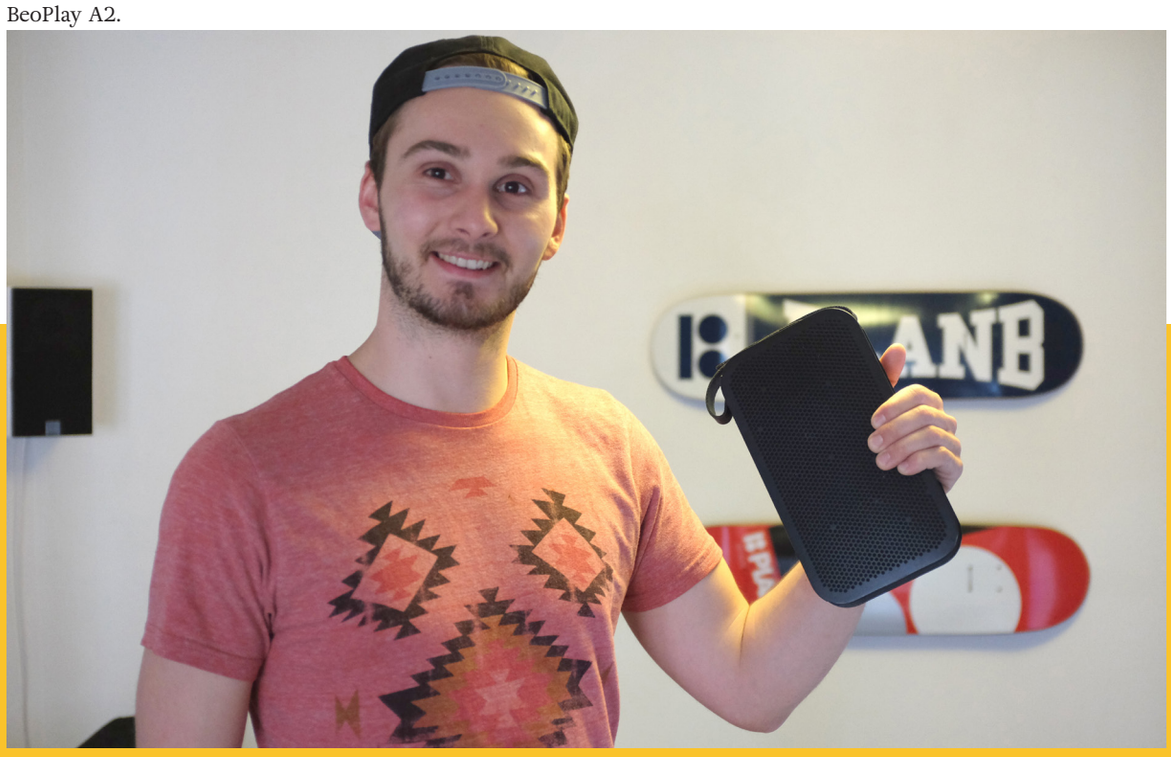
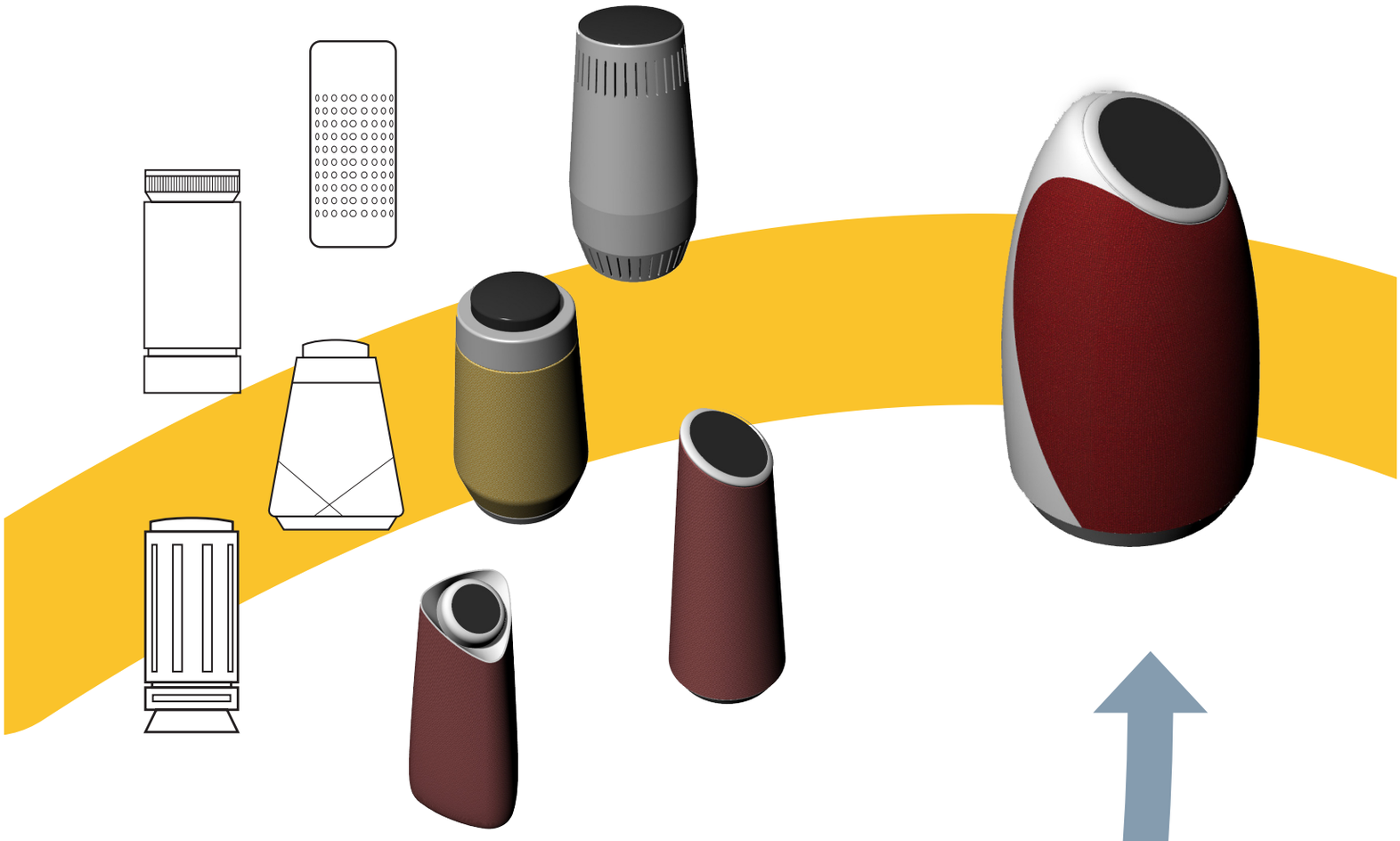
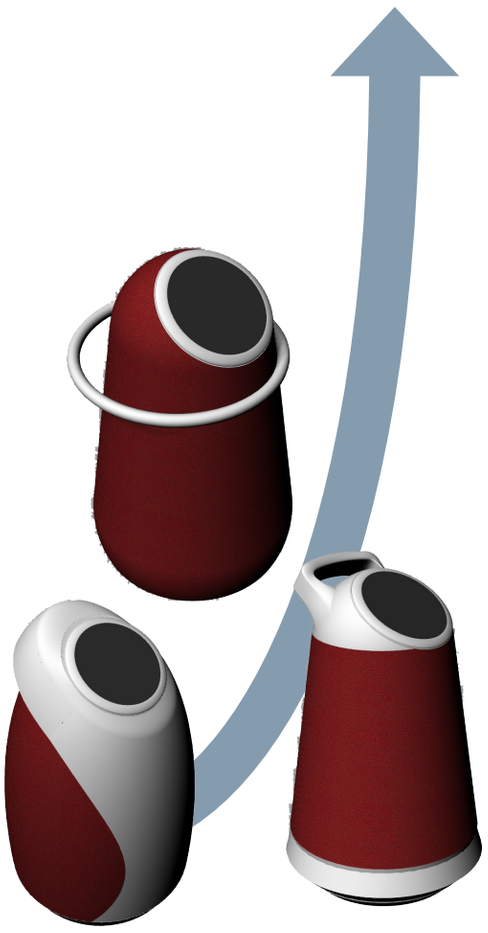


Fig. no. 101 *Christian holding his A2*

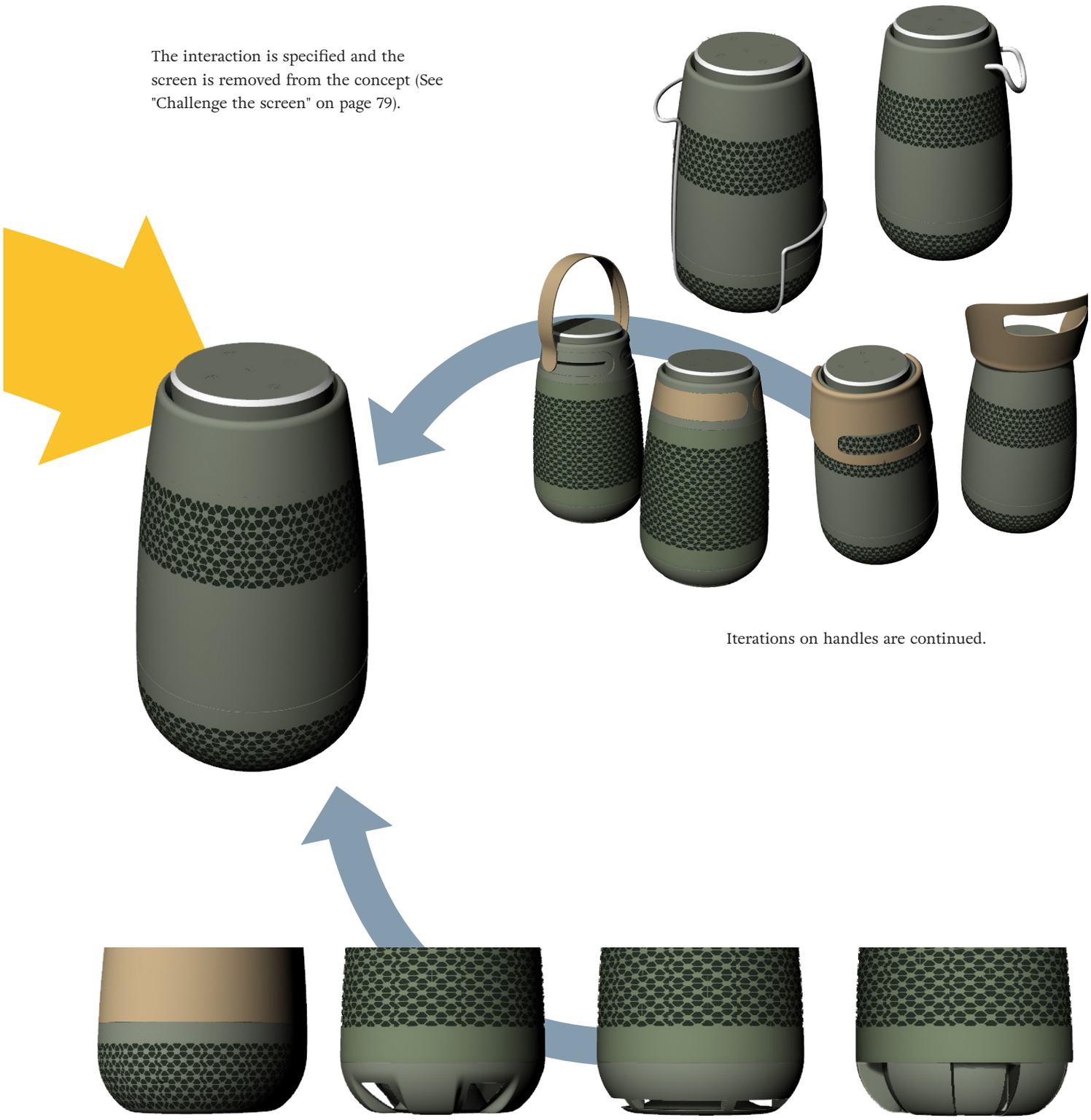


Early sketches originating in the style boards (See "Style boards" on page 61.



Different handle concepts are iterated based on the knowledge from the handle tests (See "Grip" on page 70).

The interaction is specified and the screen is removed from the concept (See "Challenge the screen" on page 79).



Iterations on handles are continued.

Iterations on the bottom of the speaker is made, trying different concepts for communicating that sound also flows out the bottom.

Economical Perspective

All the cost calculations are estimations based on assumptions and should not be considered final but as a qualified guess. To specify the economical aspect further communication with manufactures and sub-suppliers would be needed, a communication that is often first established when a project is accepted for market introduction.

Product coverage

DALI has an exclusive sales channel in Scandinavia through Hi-Fi Klubben retail stores. To calculate the production price based on the target retail price a top-down calculation on the DALI KATCH was made. The top-down calculation starts with the market price of the product and then deduct profit for each chain in the sales channel. An estimate of 35% profit for the Hi-Fi Klubben retail store and 10% profit for the distributor, which in this case is Hi-Fi Klubben A/S. Furthermore it is estimated that DALI is taking a 25% contribution margin when selling it to Hi-Fi Klubben A/S. With 25% VAT that make it a decrease by approximately 62% between market price with VAT and the cost of production.

The target cost estimation for the DALI KOLOR is then made with the target market price in mind and then top-down calculated to find the cost of production.

Project coverage

	KATCH	KOLOR
Market price	2.899 kr.	4.499 kr.
VAT(25%): 2899/1.25	2.319 kr.	3.599 kr.
VAT	580 kr.	900 kr.
HiFi Klubben retail sales price	2.319 kr.	3.599 kr.
Profit(35%)	1.718 kr.	2.666 kr.
1,35		
Profit	601 kr.	933 kr.
HiFi Klubben Distributor sales price	1.718 kr.	2.666 kr.
Profit(10%)	1.562 kr.	2.424 kr.
1,1		
Profit	156 kr.	242 kr.
DALI A/S Sales Price	1.562 kr.	2.424 kr.
Contribution Margin(25%)	1.249 kr.	1.939 kr.
1,25		
Contribution Margin	312 kr.	485 kr.

Fig. no. 102 *Project coverage*

Roll out plan

It is estimated that DALI will have to spend up to six months after BK Design delivers the project to optimize the design, refine the sound properties and develope the software and app. DALI will have to hire an software engineer to manage the communication and fine tune the software development. But otherwise both the software for the speaker as well as the companion app will be outsourced. A three year service plan is bought together with the software package, this service plan will ensure the app works with every new Android/iOS update. It is expected that a larger feature update could be necessary down the line, this has also been taking into account when estimating the investment.

After final development the marketing budget is covering both online and magazin advertisement through Hi-Fi Klubben. Furthermore it will cover sending out products to reviewers, but more importantly social influencers will promote the product through their reach on social media and then get to keep the product afterwards.

Project budget

Investment	# of people	Monthly pay	# of months	Cost
BK Design	2	30.000 kr.	4	240.000 kr.
Project manager	1	50.000 kr.	6	300.000 kr.
Electrical Engineering	2	50.000 kr.	2	200.000 kr.
Sound Engineering	2	50.000 kr.	2	200.000 kr.
Software Engineering	1	50.000 kr.	4	200.000 kr.
Salary				1.140.000 kr.
Approvals/Travels				650.000 kr.
Prototypes/ Material				1.250.000 kr.
Software Consultancy				1.500.000 kr.
Software Service (3 Years)				250.000 kr.
Software Feature Update				300.000 kr.
Marketing				660.000 kr.
Other				250.000 kr.
Total				6.000.000 kr.

Fig. no. 103 *Project budget*

Business case					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Amount	10000	15000	7500	3500	1250
Price	2.424 kr.	2.424 kr.	2.424 kr.	2.424 kr.	2.424 kr.
Cost price	1.939 kr.	1.939 kr.	1.939 kr.	1.939 kr.	1.939 kr.
Revenue	24.237.037 kr.	36.355.556 kr.	18.177.778 kr.	8.482.963 kr.	3.029.630 kr.
Expenses	19.389.630 kr.	29.084.444 kr.	14.542.222 kr.	6.786.370 kr.	2.423.704 kr.
Gross Margin	4.847.407 kr.	7.271.111 kr.	3.635.556 kr.	1.696.593 kr.	605.926 kr.
Break even analysis					
Investment	-6.000.000 kr.	-1.152.593 kr.	6.118.519 kr.	9.754.074 kr.	11.450.667 kr.
Coverage	4.847.407 kr.	7.271.111 kr.	3.635.556 kr.	1.696.593 kr.	605.926 kr.
Profit	-1.152.593 kr.	6.118.519 kr.	9.754.074 kr.	11.450.667 kr.	12.056.593 kr.
Return of Investment		1,019753086	1,625679012	1,908444444	2,009432099

Fig. no. 104 *Business case*

Return of Investment

The product is expected to peak in its second year. Being a lifestyle and smart device it is expected to be rather short lived, since the technology of this market moves fast. New product with new unforeseen features will be released in the KOLOR's lifetime and as such it is expected that the first three years are crucial. DALI should break even on the second year and see a return of investment of above three million after the third year.

DALI will in that time also have an increased know how in the software and app market for speakers and smart devices. A vital knowledge if the trends of IoT will keep on moving.

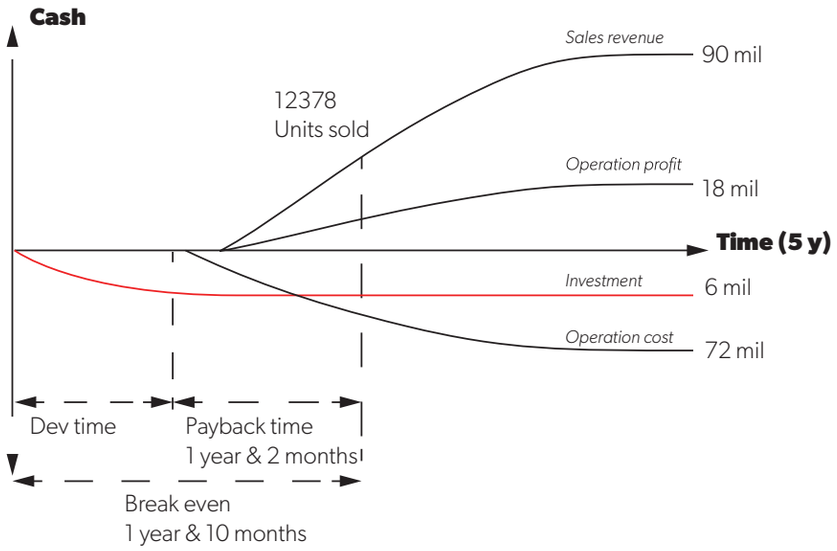


Fig. no. 105 *Business case graph*

Recap

The following pages contains a recap of the logic strings and product requirements that the project operates under. The final results of the process report can be found in the accompanying product report.

LOGIC STRINGS

PROBLEM	INSIGHT	SOLUTION PRINCIPLE	VALUE
DALI core values is not an obvious fit with the URBAN market	URBAN market is not Hi-Fi enthusiast	Create a speaker that act on the the URBAN market search of meaningfulness and general sense of quality	Enable DALI to make use of their competencies but framed differently to match the URBAN market
Users can not connect to their BT speakers	Users uses other devices for playing music because they experience difficulties with their Bluetooth speakers	Replace BT with Wi-FI and remove the phone from the use scenario, thus removing daily connection actions	Users confidently and successfully use their speakers for playing music every time.
Users are emotionally disconnected with their speakers	Users feels inadequate and get anxious when asked to operate their speaker	Increase the amount and joy of interaction with the speaker	Makes the user feel comfortable and happy to operate their speaker
Users wants a fast, easy, and reliable way to music	Users settle for radios, phones and lesser sound experiences because they work as needed	Make use of the fact that users almost always listens to playlist, and supply users with quick access to playlists	Enable users to effortlessly start listening to music
Users needs music in many different rooms	Users places radios in many rooms or carry around their phone or similar	Make a portable sizes speaker that can be moved freely around the home	Achieve the flexibility of the phone without sacrificing the sound quality

PRODUCT REQUIREMENTS

	QUALITATIVE	QUANTITATIVE
NEED TO HAVE	• Make the user feel adequate when operating the product solution • Create an easy and reliable way to start playing music • The interface should not include a long range of gestures that need remembering	• Portable speaker should maximum weigh in at 3.5 kg • The solution should incorporate a tactile interface • The device will be Wi-Fi enabled allowing access to the Internet • The solution is primarily operated without the use of a phone • The speaker should feature a physical dial • A wide sound dispersion is required to make the most user scenarios possible • Let users choose which genres to be available through a color dial • A single 5" woofer poiting downward, creating the 360 dispersion of lower frequencies. • Two KATCH tweeters on each side, with DALI signature wide dispersion. • The interface should resemble the one in Fig. no. 95 on page 91 • 5200 mAh battery • Disconnects Wi-Fi when entering standby mode on battery • Chromecast-ready in standby mode only when plugged in
NICE TO HAVE	• Make a product solution that deviates from the aesthetic of a traditional loudspeaker setup • The solution should support multiple use cases • The solution should strive to support mindfulness in its use	• Build upon Google Cast technology • The solution should be flexible and support multiple use cases • The speaker should feature a touchscreen display, for playlist selection • One handed carry • Don't battle the center of gravity • Provide the ability to personalize the color/ music preset of the color dial.

4

Phase four marks the end of the project process and the beginning of the project teams reflection upon the project period. The phase ends with lists of figures and references, and in the very end is a overview of the terms presented during this report together with an explanation of these terms.

Future work

The electronics team at DALI will have to define the possible solutions for software and specific hardware needed for the color wheel. BK Design has pointed towards a single-board computer that could integrate the DSP on the same board. But most crucial for going to market is the development of the software and companion app.

The sound engineers will have to specify the enclosure, drivers and bass port and then build prototypes to test the bass port in combination with the woofer and enclosure.

The construction and production of the KOLOR needs to be optimized based on the sound engineers prototypes and in collaboration with the specific manufacturer's of the solutions. The amount of parts is troubling as every seam has to be completely airtight to not accidentally create small “bass ports” that will whistle.

A wide user feedback on the concept and understanding of combining color with emotion and emotion with music genres is needed to verify the desire for such a product. But also for further refinement of the design.

Product reflection

The DALI KOLOR targets a need that is uncovered by the current market of speaker. The question then remains if this is the correct way of fulfilling the users wishes?

Regarding the forming of the DALI KOLOR, a big constraint to its shape have been the wish for a circular shape. This requirement is rooted in the earlier stages of the product solution and should maybe have been eliminated together with the previous versions of the concept. This have led to a restricted form language that have been explored which have sped up the development of the shape but hindered a broader search for form.

The product is not ready for production, but a with the knowledge attained during the project, it is known that sealing the constriction is important in a speaker design. This design of gaskets is challenging but none the less a aspect of the product the group would have liked to touch upon.

Process reflection

This project have been challenging as many others and started off with high expectations to the project and the collaboration with the company DALI which brought enthusiasm to group. The collaboration brought a realistic task to project which suited the group, as the project had a change of not ending as a theoretical project but could serve as real foundation for the upcoming speakers for DALI. This collaboration together with the groups approach of using 'Product Design and Development' (Ulrich, K. and Eppinger, S., 2012) as the framework for the project led to a benchmarking project. This resulted in the first period of the project revolving more around beating the competition on features than seeking problems to solve, but the group recovered from this after mentally returning from last semesters internship and dial down the assumed expectations from DALI.

This mental change from the professional to educational world also resulted in fail of documenting the early work of the process. This just postponed the workload in the project and though quickly adjusting for this, it was unwise to neglect the importance of documenting in an educational project.

Regarding project management, a version of scrum were used through the website scrumwise.com. Though effectively used in the beginning of the project period the care for managing the different task wared off. As the project changed focus to problem solving, the project management got more chaotic as the group navigated 'the fuzzy front-end' of the process and lost track with the management. After discontinuing scrumwise the group used rough weekly planning and made the status seminars act as milestones with goals to aim for at each status seminar (roughly 5 status seminars throughout the project period). As the project group consisted of only two people, this simple project management have worked sufficiently but returning to scrum could possibly have fewer planning sessions and a greater ability to accommodate goals beyond the upcoming status seminar.

The great enthusiasm for the speaker market and the collaboration with DALI have led the group to occasionally dive into technical details of speakers out of pure curiosity. Though existing, the dives have seldom had any applications to the project and have thus just resulted in the group sinking time into research that is nowhere to be seen in the project. This could have been avoided with a greater reflection upon the reasons behind the research which could have eliminated some of the technical dives.

Lastly the group have been to assuming in their approach to testing, especially regarding test of target group. Specifically the group have assumed the results of test, and then discussing the assumed result, instead executing the test. The test have all been carried out in the end, but the project have run a lot of risk by running on assumptions and then verify the assumptions much later in the process. Though the assumptions were right overall, this method have resulted in loss of some of the nuances that the tests bring, and the group could not account for before the test results.

Audio Dictionary

Passive or Active loudspeakers

A loudspeaker needs a amplifier to provide sound. This amplifier can either be integrated into the speaker itself, called an active speaker or be a seperate product, making the loudspeaker a passiv loudspeaker.

Drivers

The drivers are the actual speaker unit that creates the sound based on the electrical input.

Full-range

Full-range drivers, as the name implies, aims to deliver the entire frequency spectrum in one driver. They are often small in order to hit the high frequencies of a normal tweeter, where rapid movement is very important.

Mid-range

A mid-range driver is often designed to deliver sound between 250 Hz and 2000 Hz. This covers the most significant part of the audible sound spectrum, where human voice and most instruments provides sound. Since the human ear is very sensitive to this frequency spectrum, low distortion in the sound reproduction is very noticeable.

Tweeter

The tweeter is designed to produce the high frequencies from around 2,000 Hz to 20,000 Hz. The name is derived from birds who's sound is often high pitched. Tweeter design is often based on a very stiff and light material that helps it move rapidly, which creates the high frequencies. This material is often either cone or dome shaped based on the material used and the application of the tweeter. Another design of tweeter is the ribbon tweeter which DALI is known for using in their high-end products. Ribbon tweeters can provide a very wide horizontal dispersion and is capable of extended frequency response and high acceleration. The addition of a horn is often seen with tweeters. A horn is a funnel or hopper shaped structure placed in front of the tweeter to control the dispersion and to increase efficiency of the tweeter.

Woofer

The woofer reproduces the low frequencies in the sound spectrum and is very sensitive to the enclosure it is placed in. Woofers in combination with the enclosure can eliminate the need for a mid-range driver if it is combined with a tweeter designed that can work low enough. Furthermore it can eliminate the need for a subwoofer if the woofer can go low enough, often helped by the design of the enclosure.

Subwoofer

A subwoofer delivers the lowest frequencies in the audio spectrum. The subwoofer driver in combination with a specifically designed enclosure is aiming for the frequencies below 200 Hz and can sometimes even below 20 Hz were it is almost inaudible both can be felt by the amount of air the subwoofer moves. Because of these low frequencies subwoofers are very sensitive to unwanted resonances from the enclosure or surroundings.

Coaxial

A coaxial driver combines two or several concentric drivers in one unit. A tweeter or a mid-range driver is placed in front of a woofer. The woofer's low frequency sound is not that sensitive to being obscured by a smaller driver in front of it. This saves a lot of space and coaxial drivers is therefore popular in car audio systems and other places with limited space.

Amplifier

Power-amplifier

The power-amplifier amplifies the low-power analog signal from audio sources like electrical guitars. The strengthened signal is send to the loudspeaker's crossover or directly to the drivers voice coils. Amplifiers are often the last stage before sending the signal to drivers, depending on crossover type.

Crossover

The crossover is the electronic filter circuitry that splits up the audio signal into either two or more frequency ranges so that it can be sent to the drivers that are design for each range. A two-way crossover is splitting the audio signal into two frequency ranges typically a high-bandpass for the tweeter and a low-bandpass for the mid-range or woofer driver. A three-way is splitting it into three ranges.

Passive

A passive crossover splits up the audio signal from the power amplifier after it has amplified the sound. The passive crossover circuitry is commonly placed inside the loudspeaker enclosure and doesn't need additional power to work, hence the name passive.

Active

An active crossover is splitting up the audio signal before it has been amplified by a power amplifier. An active crossover requires the addition of a power amplifier for each output band, meaning that a two-way crossover will need two amplifiers and a three-way, three. With no energy being lost in the passive components of a passive crossover the required output of the power amplifier is considerable reduced.

Digital

Digital crossovers are active crossovers that can be implemented in the DSP chip. They can either use digital approximations of the analog circuits from the passive and active crossovers or FIR and IIR filters depending on processing power of the DSP.

Signal Processing

http://www.analog.com/en/analog-dialogue/articles/dsp-101-part-1.html

DSP

The Digital Signal Processor is a high-speed processor or microcomputer that processes a digital signal very fast in order to not introduce delays to the audio/visual experience. The digital signal that is processes can be an encoded .mp3 file that needs to be read and decoded to audio the DAC can convert to analog sound waves that the amplifier can send to the drivers. The DSP is also a filter, that seperates the digital audio stream in left and right channels or high and low band-passes as a crossover. Furthermore it is able to apply an equalizer to the sound like increased treble or bass. It can also control volume and receive input from the user interface.

DAC

A Digital / Analog Converter translates the digital signal of ones and zeroes into a analog signal of electrical waves that can be amplified to make the trancducers of the drivers move.

ADC

An Analog / Digital Converter does the opposite of a DAC, it converts a analog signal to a digital signal that computer can read.

Enclosure

The enclosure is the cabinet that the holds the drivers and ensures that the out of phase sound generated by the rear side of the diaphragm doesnt interfere with the ones produced from the front side of the drivers. The enclosure also manages the resonance and vibration creaed by the drivers.

Sealed/closed

A sealed loudspeaker enclosure is as the name suggest a closed enclosure often stuffed with damping material. They are not very common, since the enclosures often have to be very large.

Bass reflex - ported/vented

A ported loudspeaker uses a port/hole with a tube in the enclosure to enhance the reproduction of the lower frequencies. This increases the efficiency of the loudspeaker by utilizing the sound produced by the rear side of the diaphragm. The air inside the tube resonates with the air inside the rest of the enclosure when the loudspeaker is producing low frequencies. The effectiveness of a bass port is a combination of enclosure volume, woofer size and the diameter and length of the tube.

Passive radiator

Is another way to exnted the lower frequencies of a loudspeaker. A passive radiator is a diaphragm without the voice coil and magnet and isn't attach to a power amplifier. It is drived by the sound pressure created by the rear side of a active drives diaphragm similar to a bass port. Passive radiators are often a more expensive solution to extend the lower frequencies, and requires more surface area than bass ports but less internal space.

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List of figures

Appendixes

Worksheets

Phase 0

Phase 1

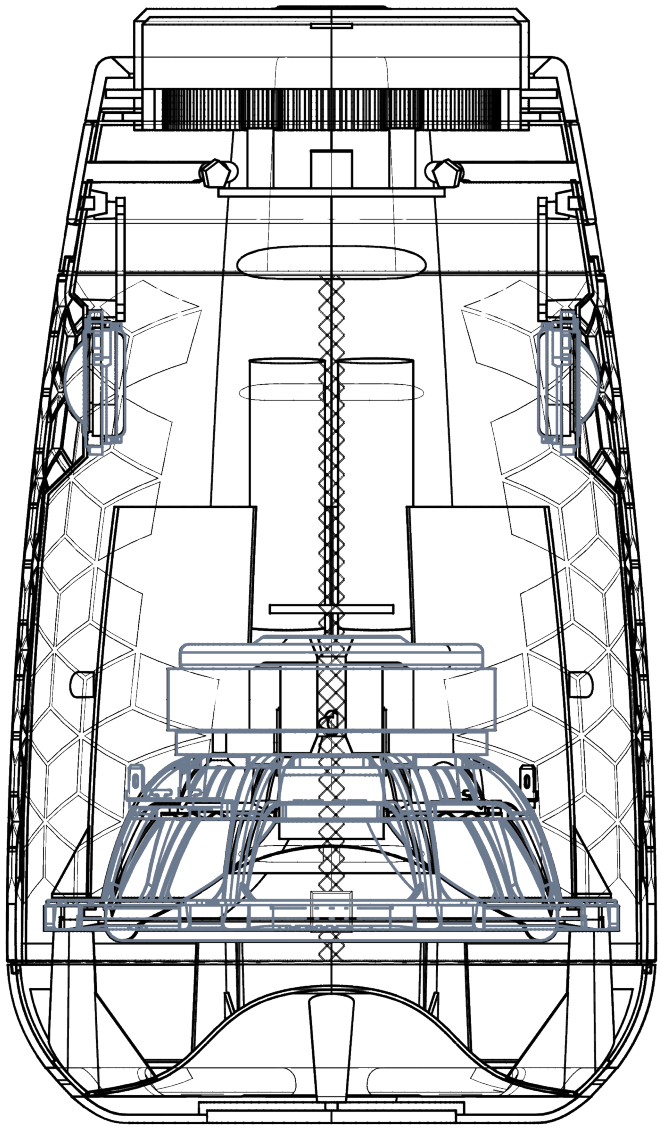
Phase 2

Phase 2.5

Phase 3

DALI KOLOR

Technical Drawings



Technical Drawings - MSc04 Industrial Design - AAU - MAY 2017
Andreas Sig Pedersen & Stefan Troels Larsen

DALI

IN ADMIRATION OF MUSIC

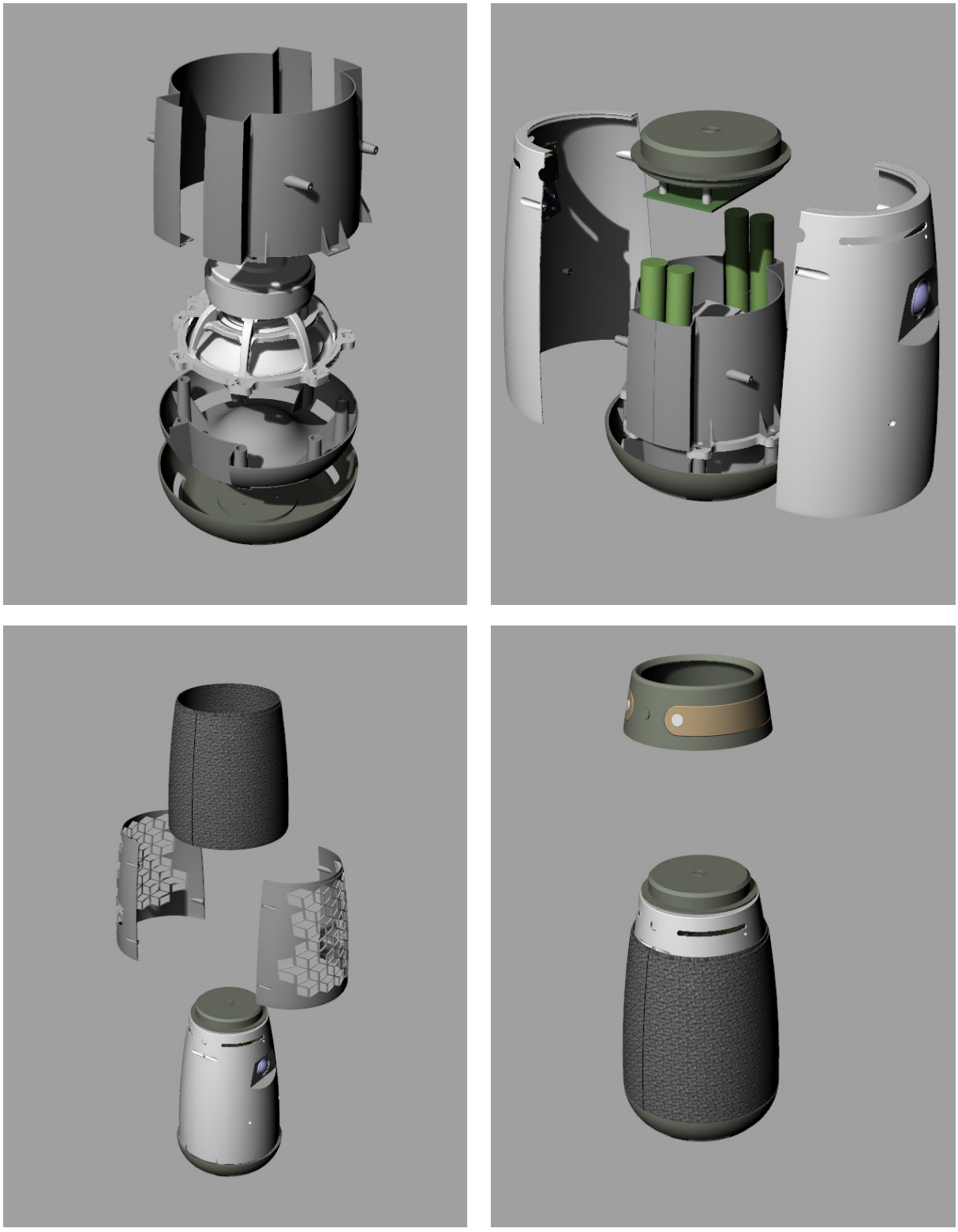


Figure no. 1 *Step-by-step assembly*

Technical drawings

The construction and production considerations have mainly revolved about the assembly of the speaker together with the molding of plastic parts and milling of aluminum parts. The following technical drawings are aimed at following the ISO 7200-2004 standards. And will present each part in an orthographic view with the main dimensions covered. Accompanying the technical drawings is a USB stick with the CAD models.

Table of content

Assembly

On the USB stick is also found a short animation showing the following step-by-step description.

First step

First step in the assembly consist of the 5' driver, three plastic shells, and the aluminum bottom. The two top shells, the driver, and the acoustic lens is all sandwiched and fastened to each other, the entirety is then fastened from the bottom to the metal cap.

The top two shelf make up one half of the bass reflector together with the surrounding shells. Some of the space for the airflow is confiscated in order to fit in the batteries needed for the speaker (See picture)(See chapter on batteries).

Second step

The control dial and all electronics are enclosed between the two outer shells of the bass reflex, they to house the tweeters, one on each shell. The two shells are fastened to each-other and to the inner shells of the bass reflex.

Third step

Third step contains a sub-assembly of two perforated plastic shells fastened to each-other, afterwards a sheet of fabric is sewn into a tube and then glued to the plastic shells. The entirety is then pulled over the speaker and inserted into the bottom aluminum shell.

Fourth step

Last step is capping off the construction with the top aluminum cap. the cap is then fastened to the outer shells with screws hidden under the leather strap.

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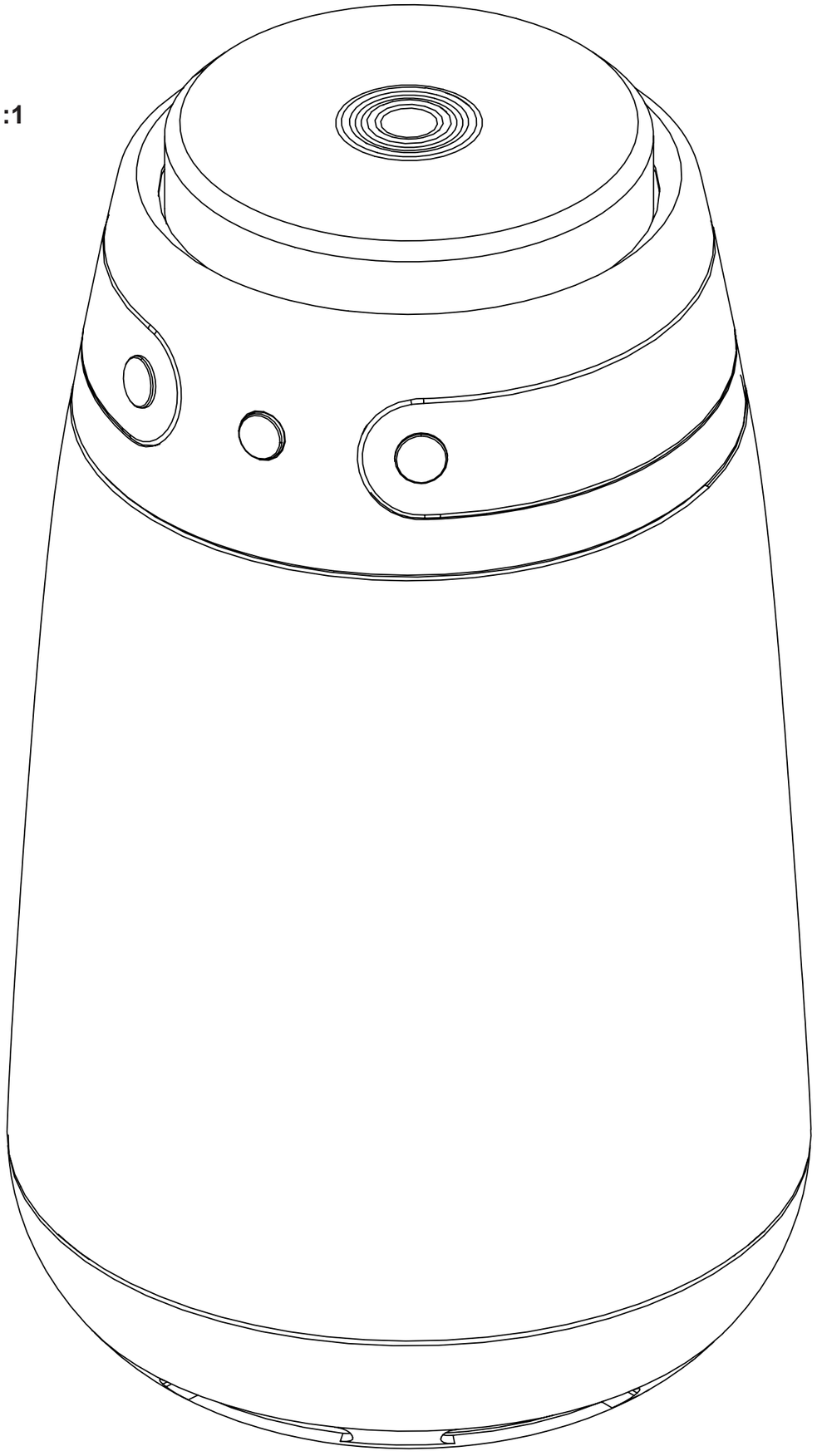

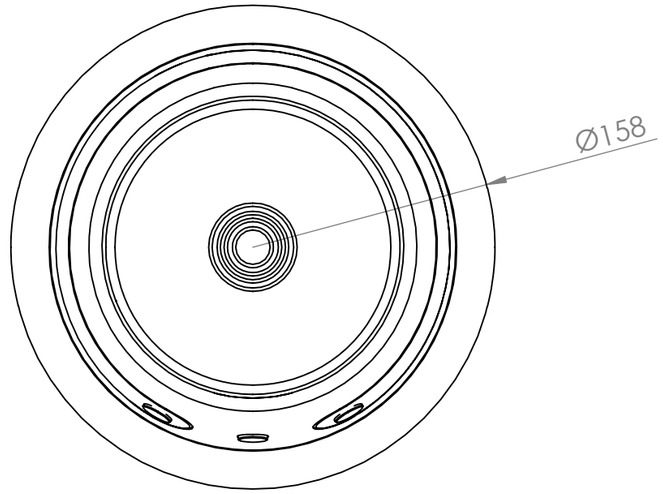

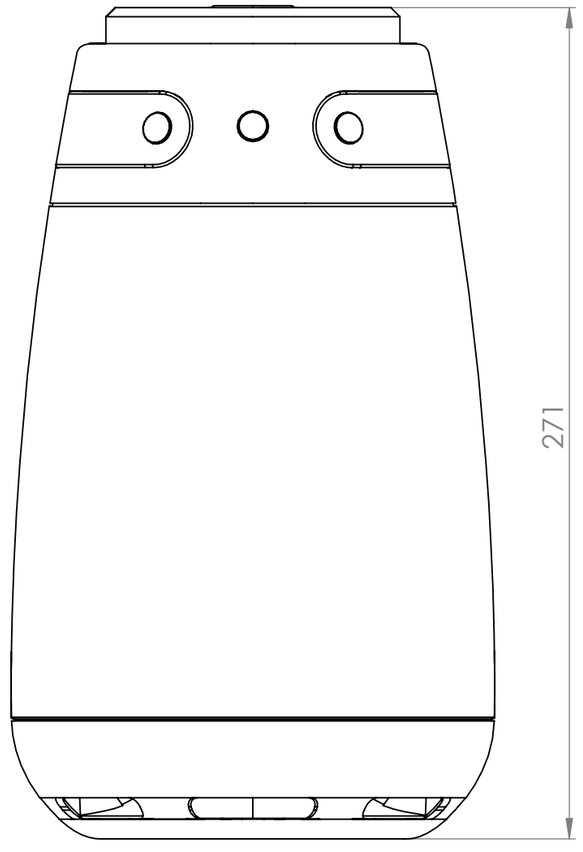

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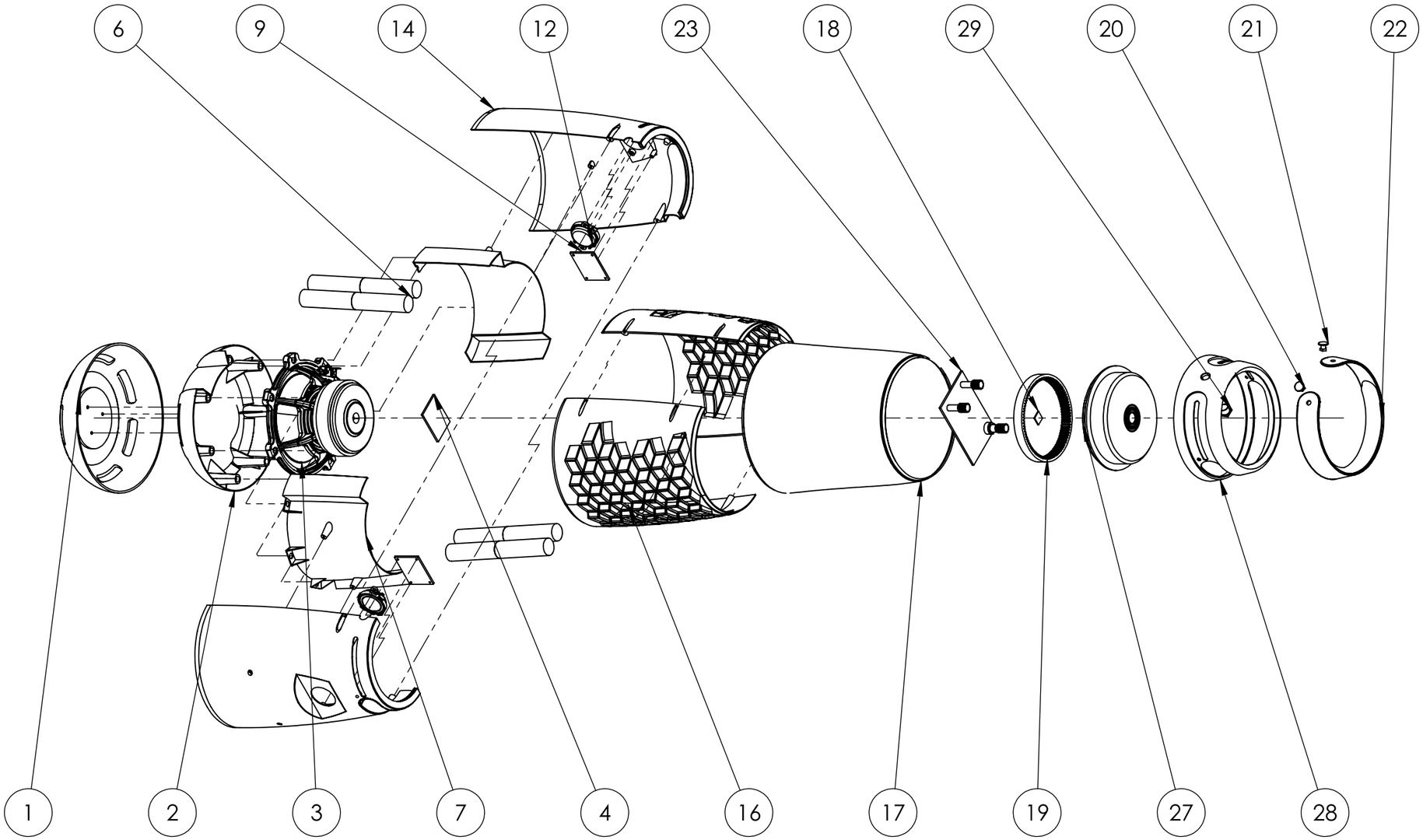

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Bill of materials

ITEM NO.	PART NO:	DESCRIPTION	QTY.
1	001-01	Bottom allu	1
2	001-02	Acustic lens	1
3	001-03	Sub woofer	1
4	001-04	Amplifier for Sub woofer	1
6	001-06	Battery ICR18650	8
7	001-07	Inner shell “bass reflex port“	2
9	001-09	Amplifier for tweeter	2
12	001-12	Tweeter	2
14	001-14	Outer shell	2
16	001-16	Grill	2
17	001-17	Fabric piece	1
18	001-18	Piezo sensor	1
19	001-19	Gear ring	1
20	001-20	Strap fastener	1
21	001-21	Strap fastener	1
22	001-22	Strap	1
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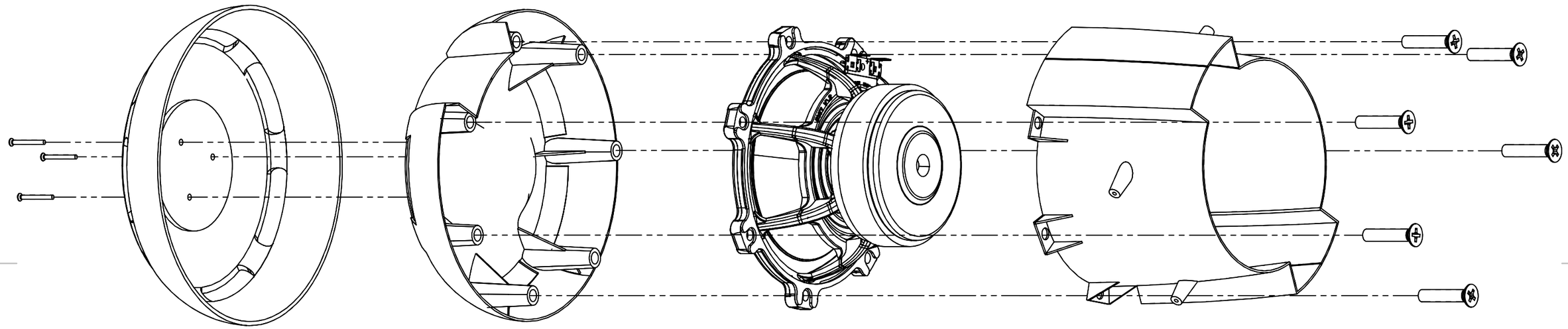
28	001-28	Top allu	1
29	001-29	Button	1



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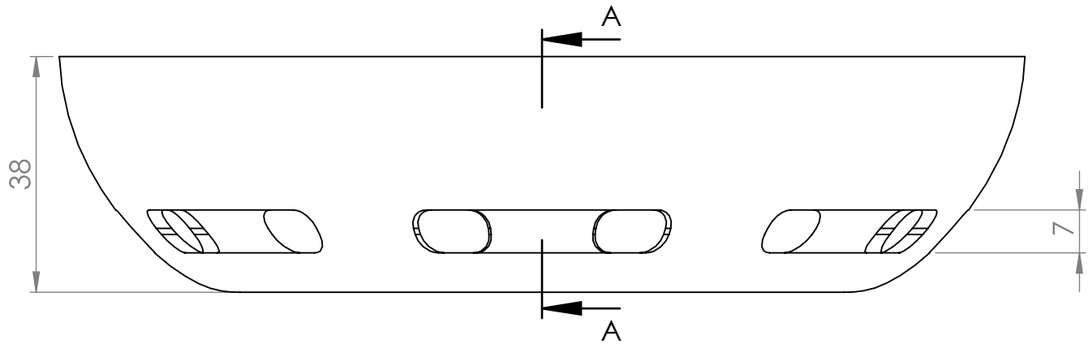
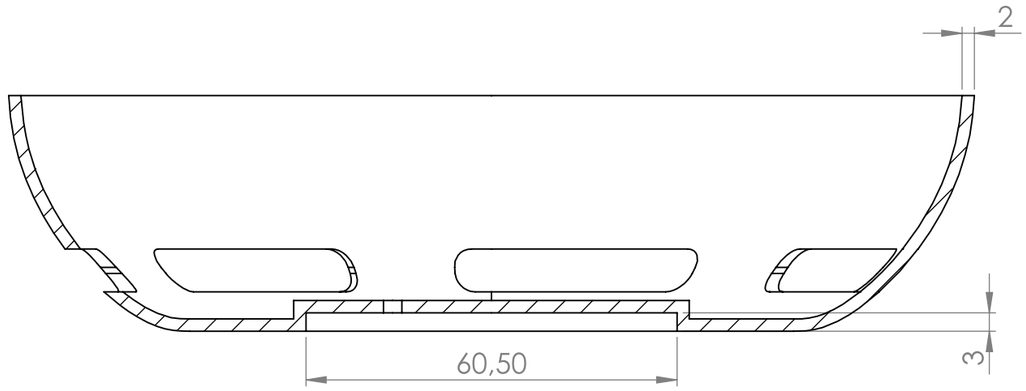
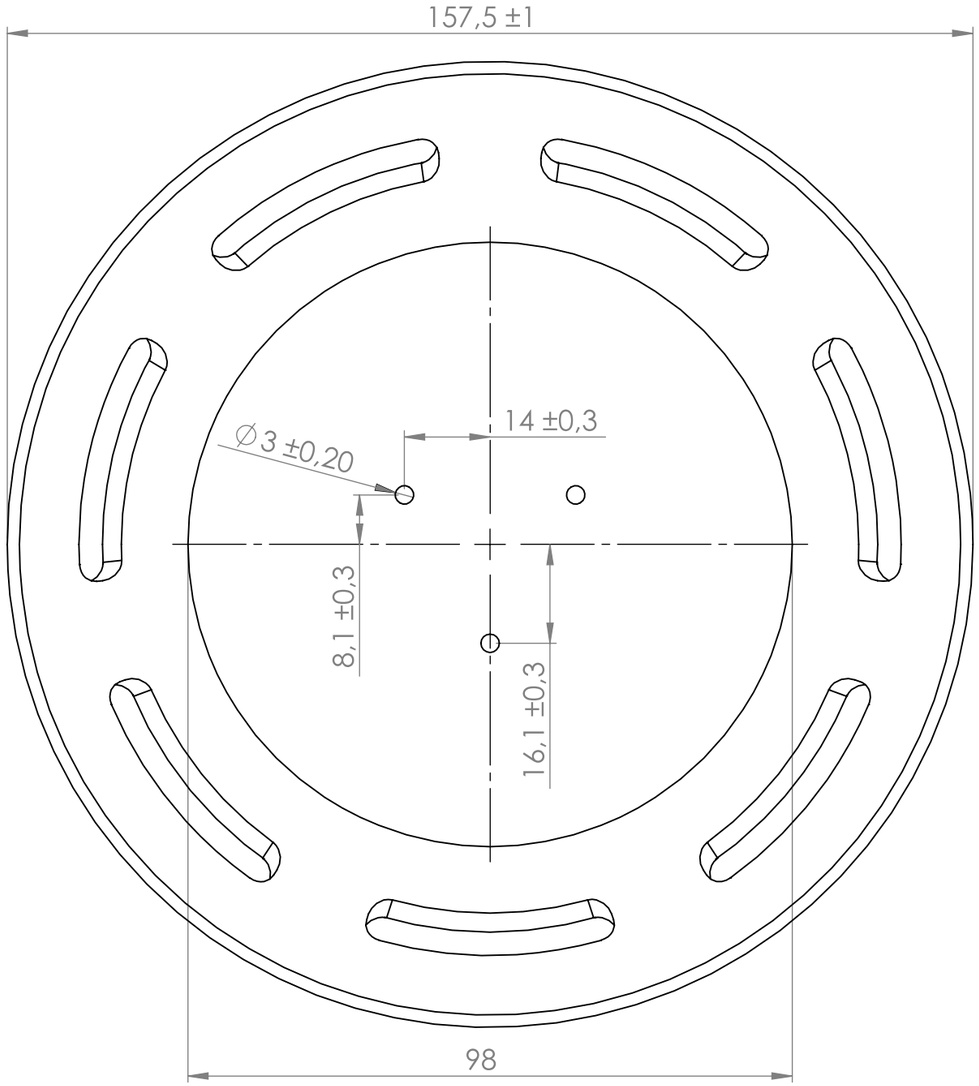
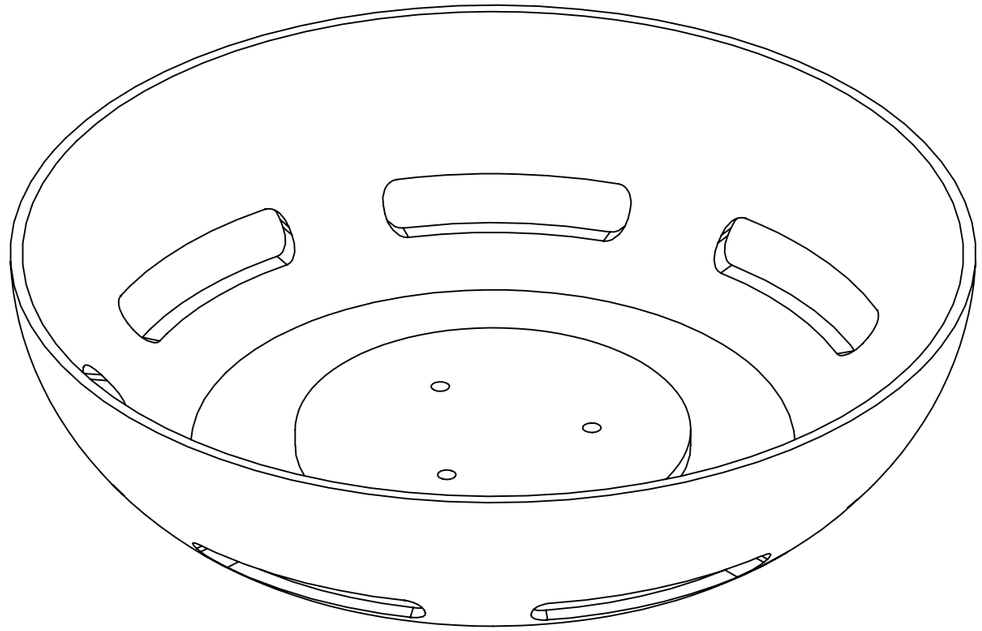




SECTION A-A





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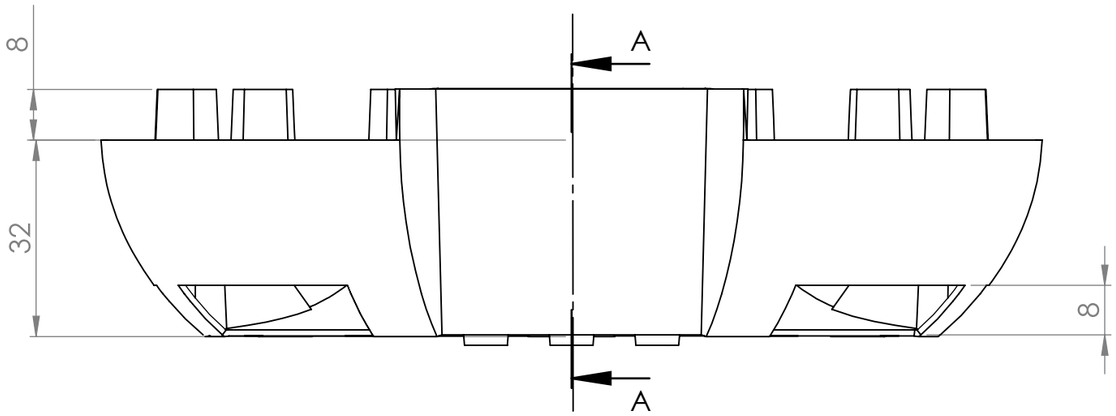

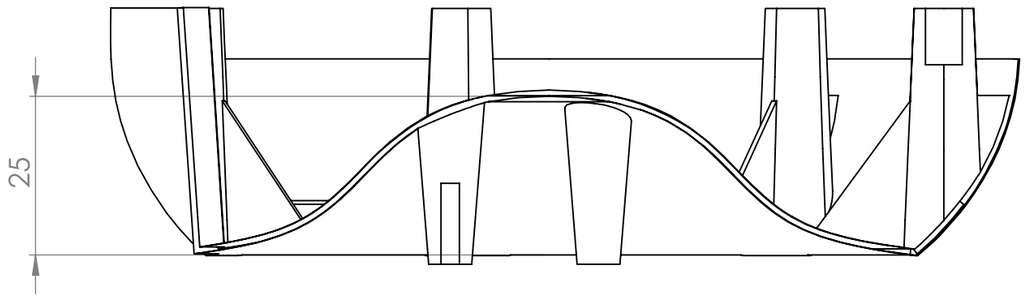

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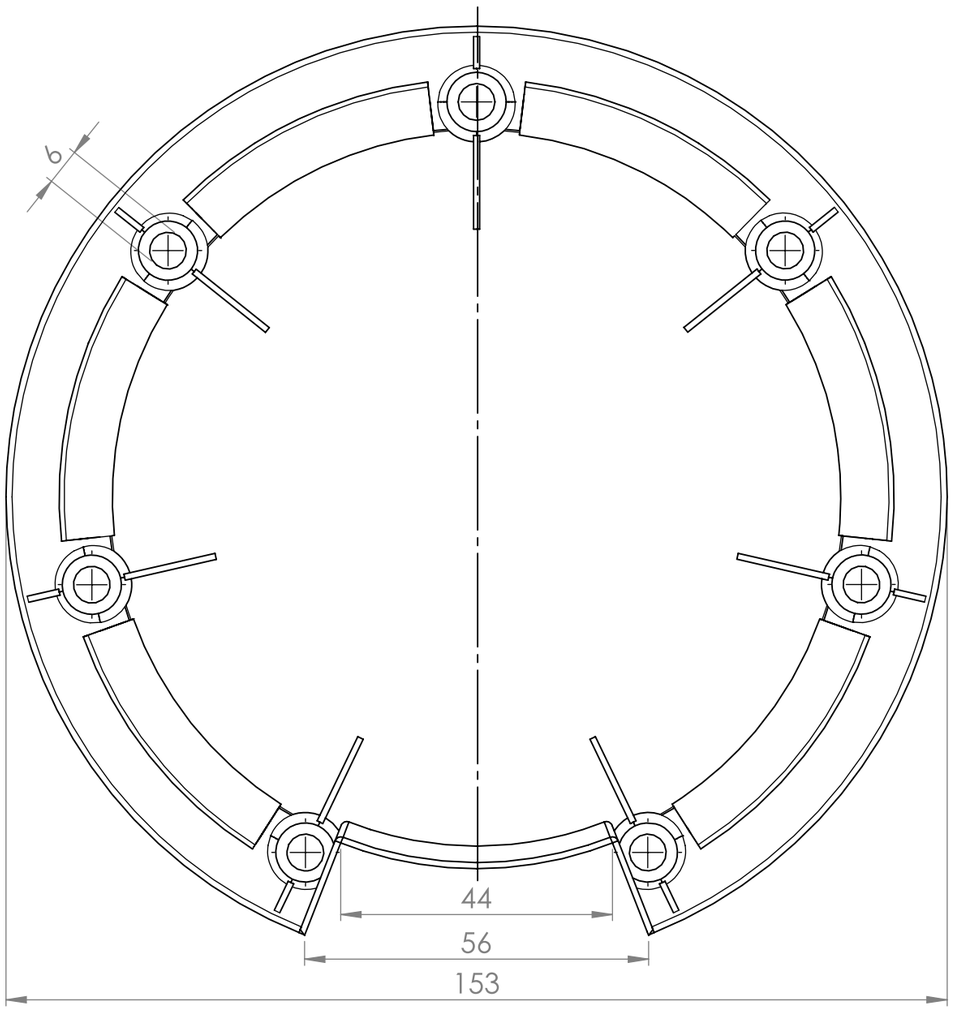

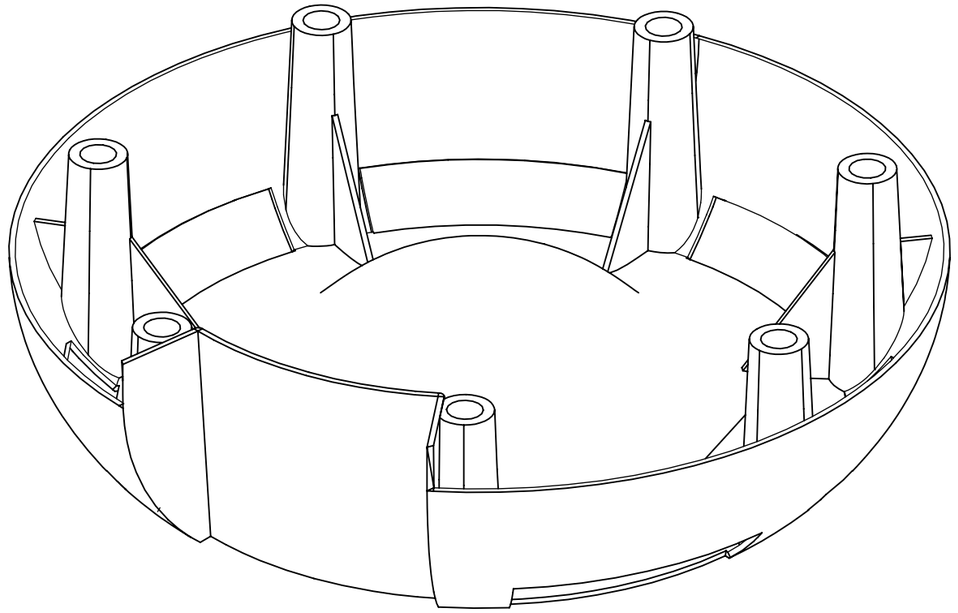

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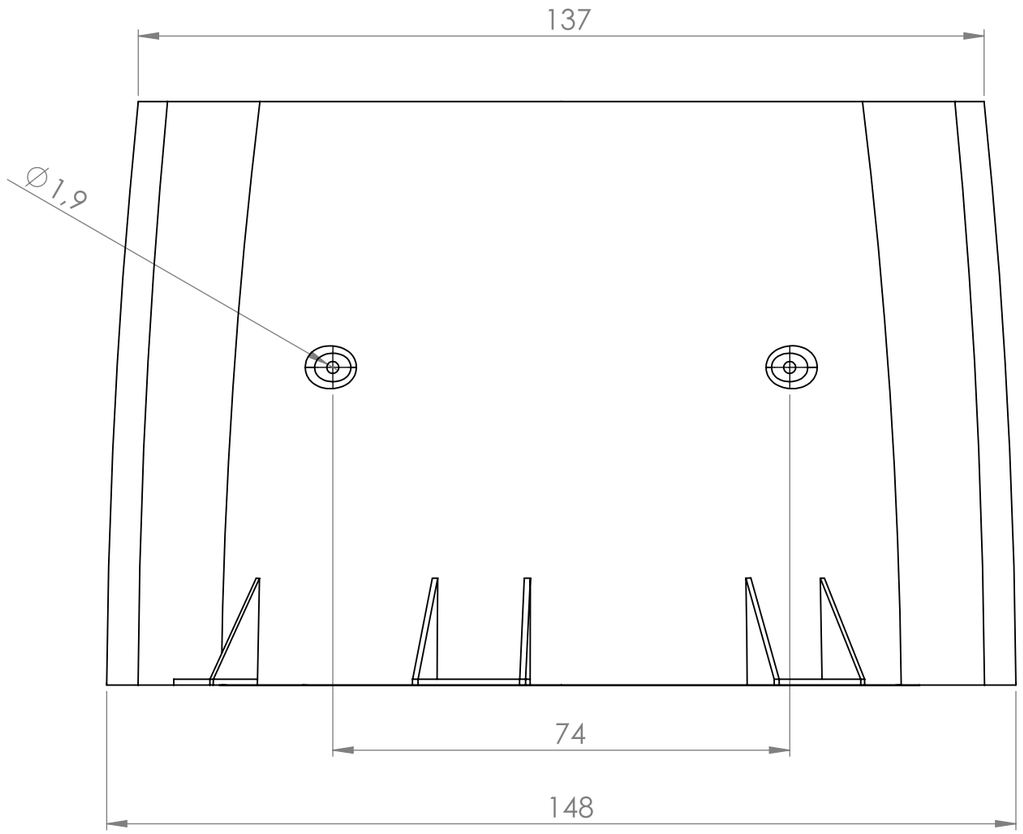

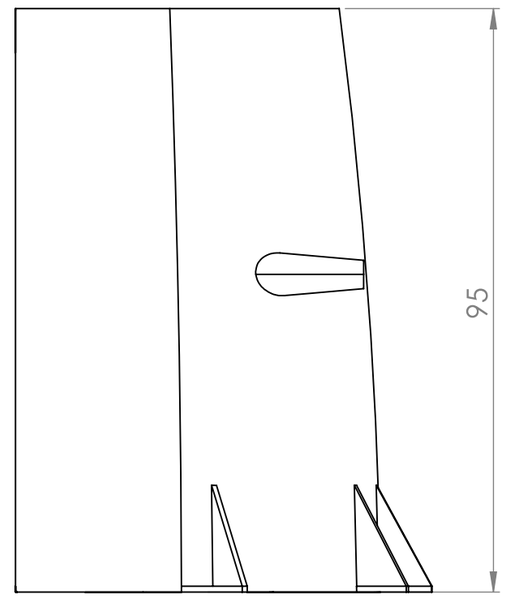

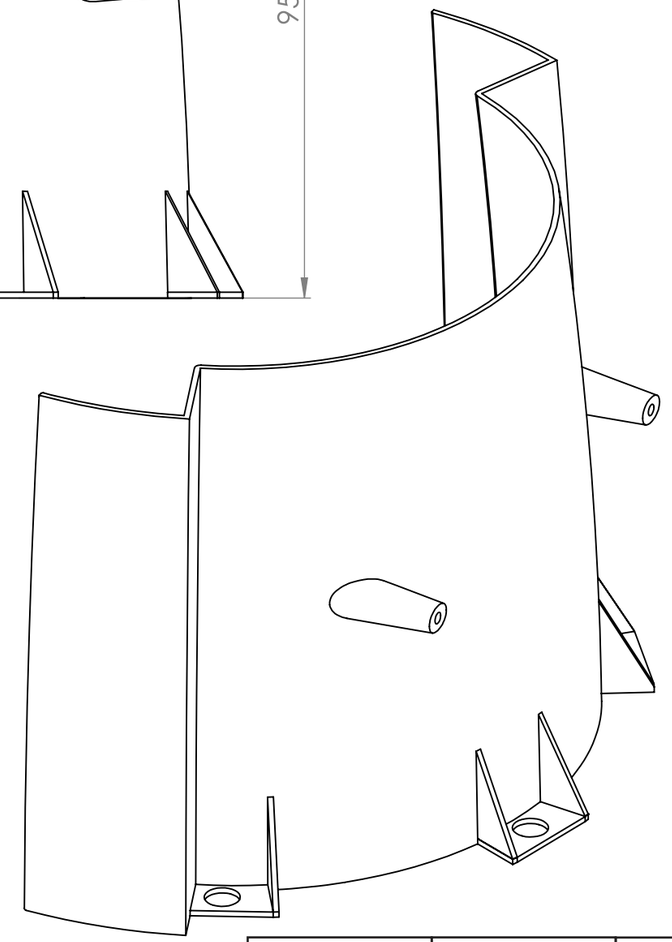

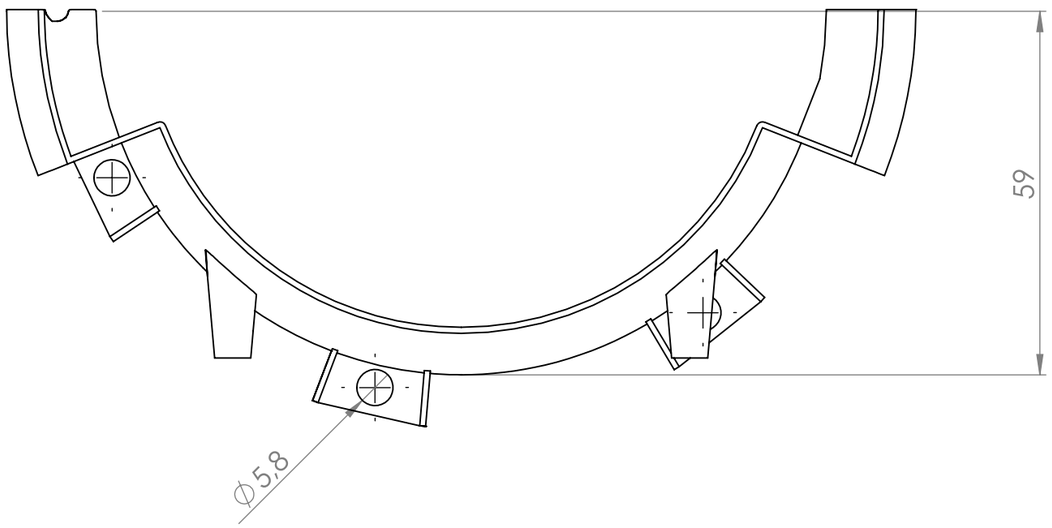

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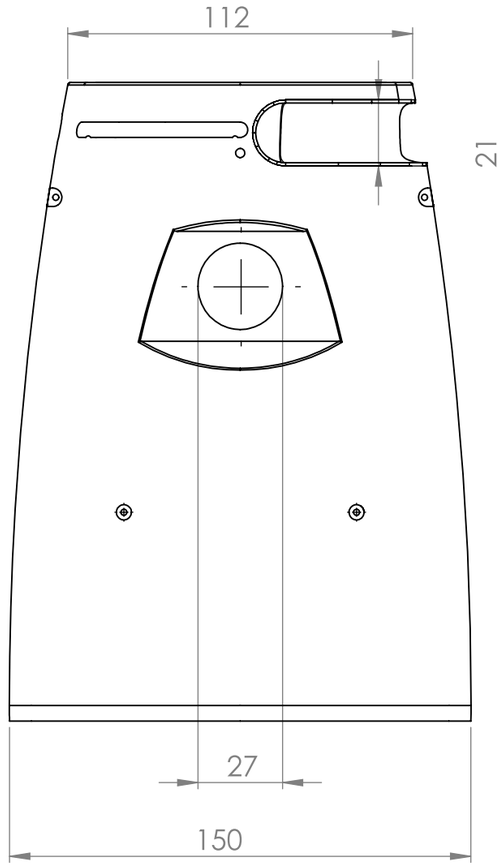

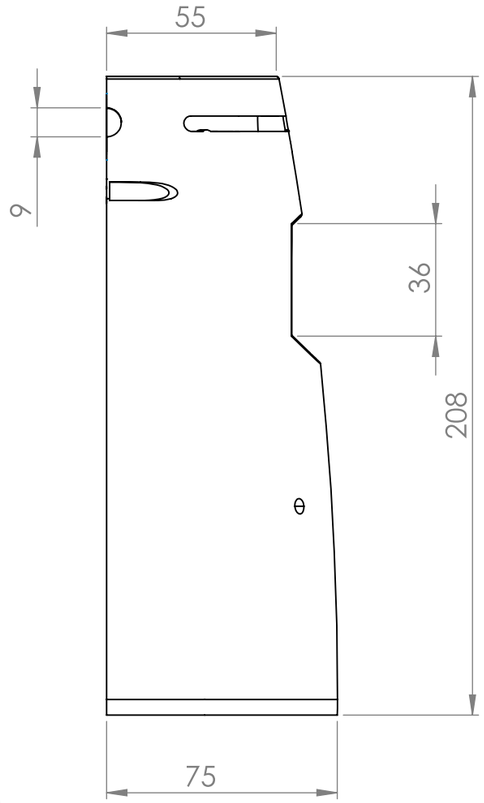

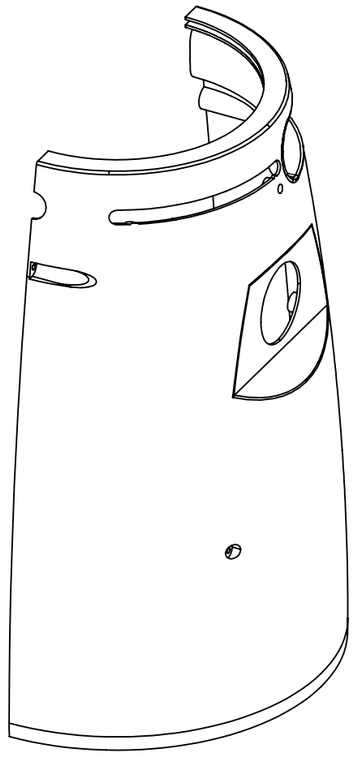

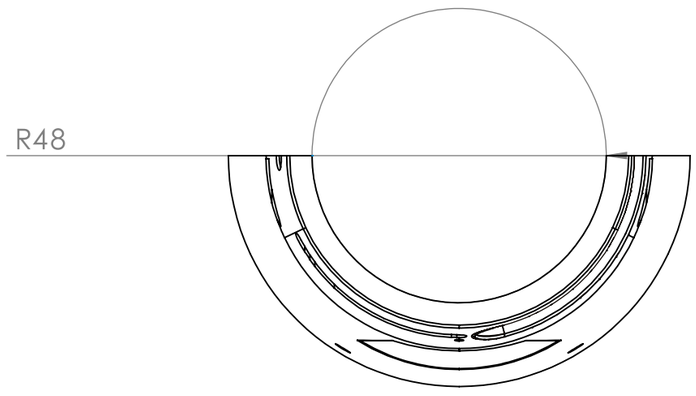

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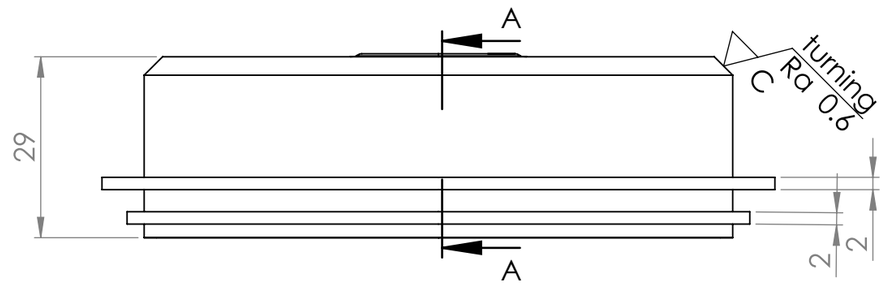

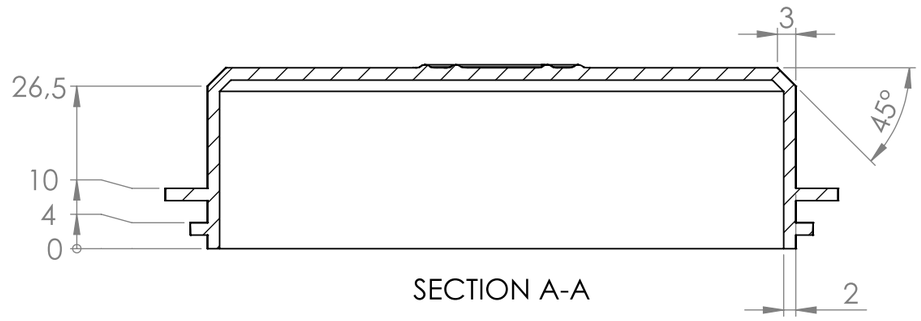

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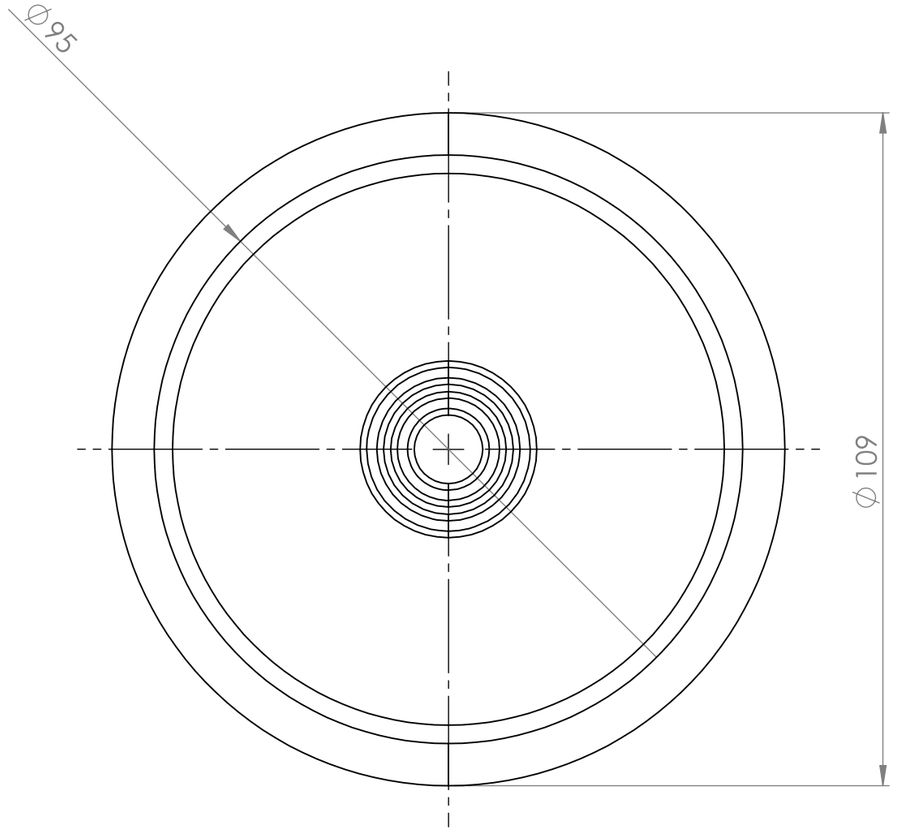

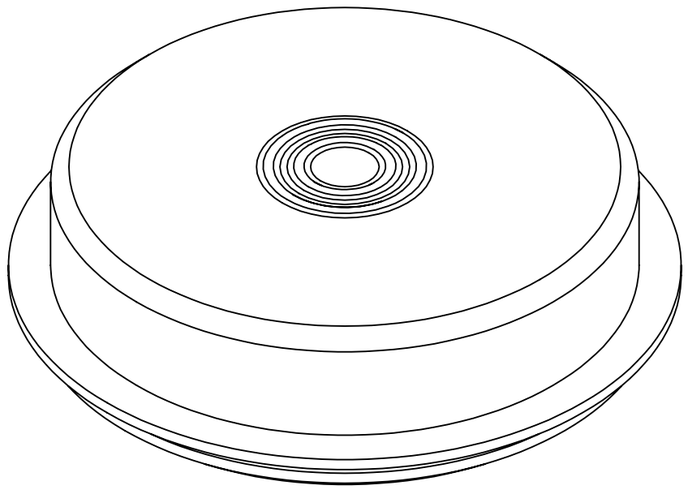

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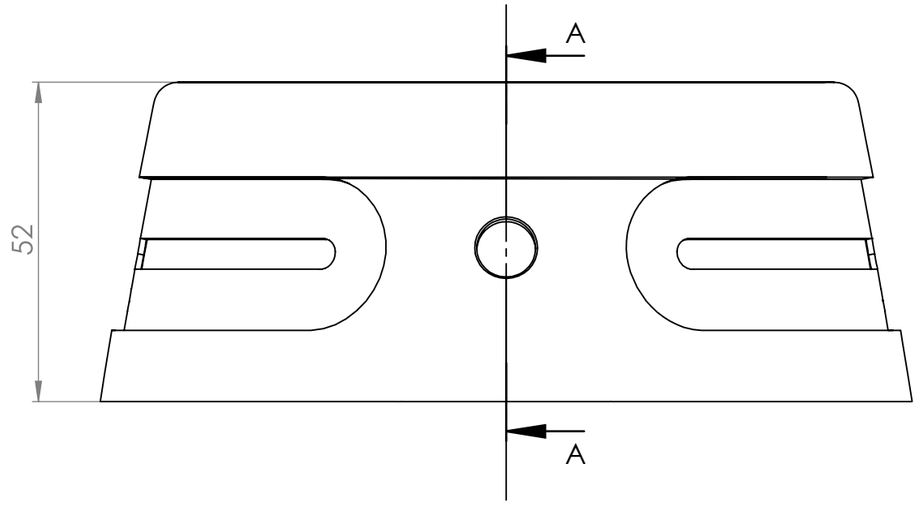

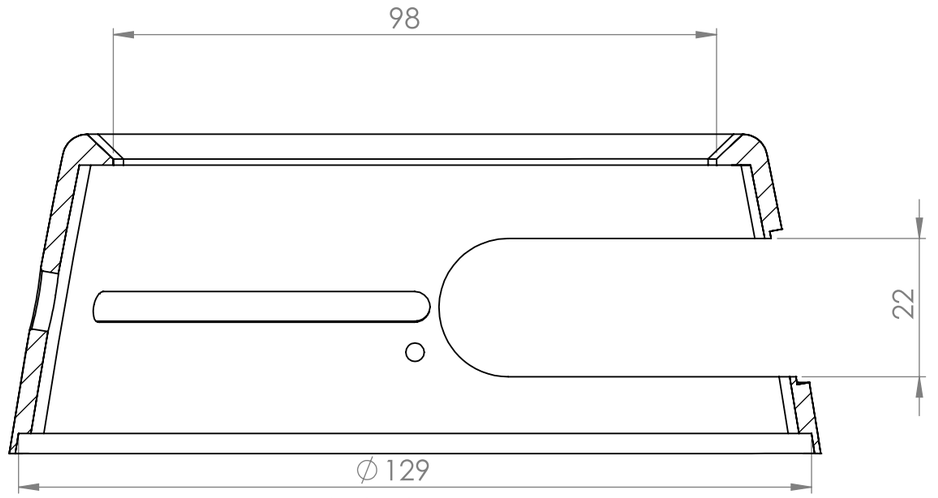

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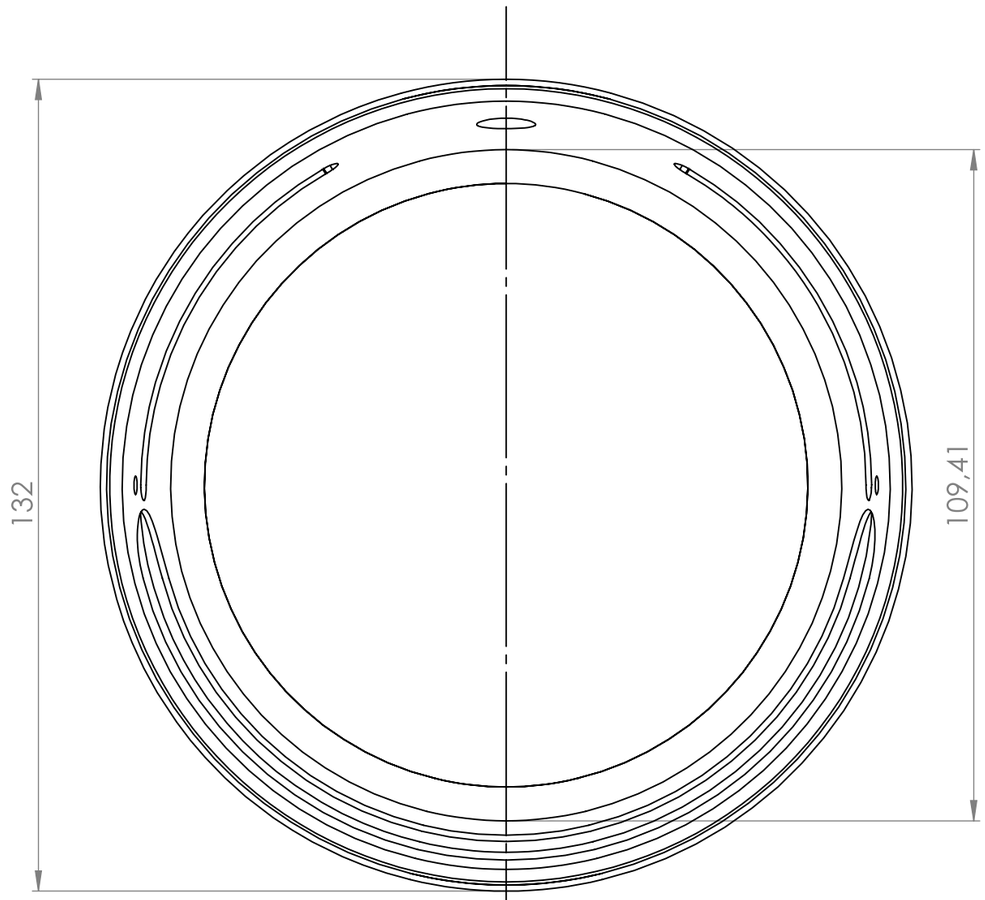

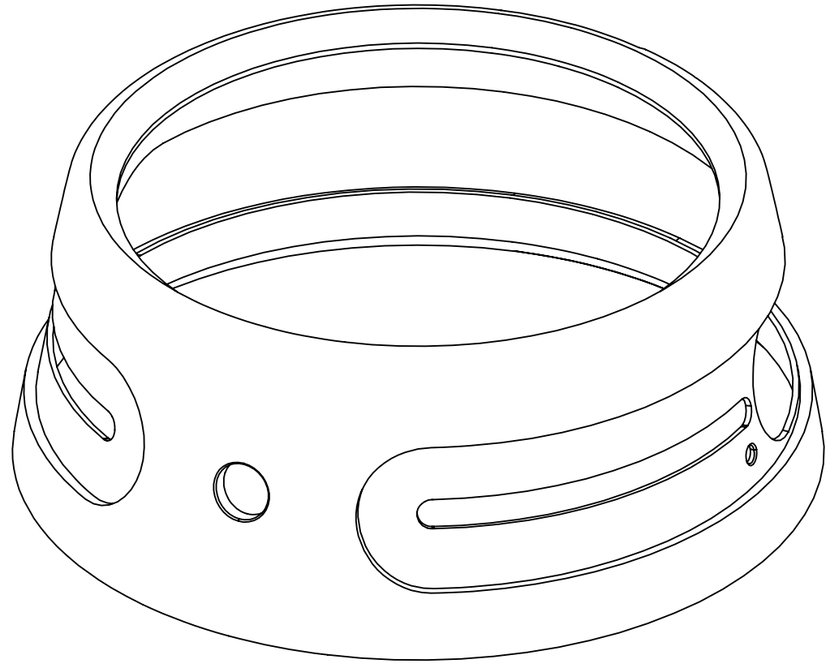

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	Type of document: Dimension drawing	001-28	**Release date:** 2017-05-18
	Title, additional title: Top allu part	**Created by:** Andreas Sig Pedersen	
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Market analysis

Worksheet no.: 1 Date.: x

Objective

In order to innovate in a market it is needed to analyze what is happening in the market and the primary competitors. The portable bluetooth speaker market is crowded and this analysis aim to help pin point where to hit the market with a new DALI product.

Experiment/Data

A dive into the competing products in portable speaker market showed that it relies heavily on Styling, Brand and Price, with little to differentiate the products in terms of features and user scenarios.

In the consumer electronics market we see a couple of trends that could lead to interesting opportunities for Dali A/S.
- Smart Home or Home Automation is a quickly growing trend of increased automation and control of the residence.
- The Digital Detox trend is a reaction to the increasing overload of digital connected devices and the “All-Ways-On” lifestyle.

Going further and looking at trends in audio products
- New Nordic Hi-Fi, nordic design and nordic hi-fi is blending togther in last couple of years, with Beoplay, Libratone, Vifa and now Dali’s KATCH. An increased awareness from manufactures that they make products for peoples homes and they should look like it.
- The Smart Speaker is another trend starting to rise, with the introduction of Google Home and Amazon Echo. Dali could be the first speaker manufacturer to enter this market. Like Libratone was for the launch of Apple AirPlay.

A word from the analytics

The global consumer electronics market is forecasted to reach US$ 3 trillion in global revenues by 2020. A rise from estimated US$ 1.45 trillion in 2015. The analyst at Future Market Insights states these trends to be the key drivers to this rise:

- The middle class in China and India is expected to see a rise in disposable income and create a steady demand for consumer electronics.

- The growing accessibility to internet in developing countries is expected to increase demand for consumer electronics.

- Low-cost consumer electronics is expected to remain lucrative in Latin America, the Middle East and Africa. (Future Market Insights, 2016)

Looking more specifically on the bluetooth speaker market the analyst from Technavio forecasts that the global bluetooth speaker market will grow at a CAGR of 32.81% during the period 2016-2020. In the 2014 report the analysts from Technavio expected the Bluetooth Speaker Market to be worth $7 Billion by 2019.

The Americas market is expected to account for 44% of the global Bluetooth Speaker market.

The key vendors is expected to be:

- Bose
- Harman
- Sony

The market drivers:

- Wireless streaming of audio content
- Increased Convenience
- Need for portability
- Automation trend
- Trend growing popularity of multi-room streaming
- Challenges in limited range

Evaluation

Reflection

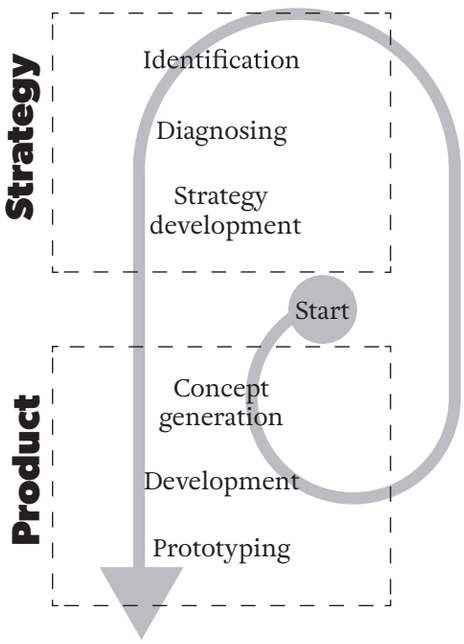
Initial Process - The step-back

Worksheet no.: 2 Date.: 20-03-2017

Objective

To better understand the logic string of the fuzzy front end of the project. A look back and sum-up of the process is needed and will be outlined in this worksheet.

Experiment/Data



Starting out with the confidential report on lifestyle segments provided by DALI and the recently released DALI KATCH. It was assumed that BK Design was to followed up on that product direction of portable Bluetooth speakers to the broad consumer market. During initial research into this market and direction questions arose regarding a miss match between DALI's brand and the target audience's values. BK Design had interpreted the confidential lifestyle segment report wrongly and interviewed users on this wrong interpretation and when entering the concept generation phase it became obvious that a step back was needed. The strategic decision to pursue this URBAN lifestyle segment wasn't clear and in order to develop a new product for DALI and this target audience a better understanding of both was needed and thus a step back was initiated.

The step into the strategic design aspect of product development proved necessary in order to understand why this target audience was chosen as well as how DALI can pursue this new market segment.

Designing a new active speaker that differentiate from the competitors is challenging thus the need for strategic design of where to hit the market and which values to offer the consumers.

Evaluation

Reflection

Analysis of the DALI legacy as well as the Danish loudspeaker history

Worksheet no.: 3 Date.: 02-03-2017

Objective

It is essential to know history in order to develop the future.

Understanding the DALI legacy is a crucial part of developing future products for them. It is even more important when moving into a new market, to keep the DALI brand values so that consumers get what they expect. Equally it is an opportunity to improve and update the brand.

Experiment/Data

Going all the way back to 1915 were the Dane Peter L. Jensen and his partner Edwin Pridham invented the first loudspeaker, DALI and Denmark in general has a had a big influence on the loudspeaker development and history. What started out as a Nordic sales company for the American loudspeaker brand Peerless, became the main supplier of speaker units in Scandinavia because of tariff barriers on imported speakers during the Great Depression in America. Peerless is just one of several big brand that grow or started in Denmark. Scan-Speak, Vifa, JAMO and others are all world recognized as some of the largest and among the best speaker unit manufacturers through the ages, but due to high competition on prize and higher wages in Denmark, most of them have shut down, sold the business or operate in China now.

Parrallel to Denmark's rise in loudspeaker production was the rise of Danish design from architects such as Børge Mogensen, Finn Juhl, Hans Wegner who became acknowledged word wide for their furniture design. They showed exceptional carpenter skills in their designs. Something that influenced the loudspeaker business too. Woodworking companies such as "Tistrup Møbelsnedkeri" and "Hornslet Møbelfabrik" became world famous for their loudspeaker cabinets production and delivered to high end brands such as Bowers & Wilkins.

The combination of world leading speaker manufactures and exceptionally skilled cabinet makers lay the foundation for Denmark to one of the world leading loudspeaker manufactures. Bang & Olufsen, DALI and Dynaudio are recognized world wide for their design and high end sound reproduction.

DALI, which stands for Danish Audiophile Loudspeaker Industries grew out of the Scandinavian hi-fi retail chain HiFi Klubben in 1985, because of high demand for loudspeakers to go along with the NAD or Denon amplifiers sold in HiFi Klubben. They started in 1983 by making NAD branded speakers for the Danish market but after two years became an independent company producing loudspeaker under the DALI brand. They gained immediate success on delivering high quality compact loudspeaker for unseen low prices at the time.

In a time where many choses to move production to China for cost savings, DALI chose to build all critical parts by themselves. They have previously designed everything but have them produced by other loudspeaker manufactures. The move to in-house production enables DALI to fine tune every detail with their engineers in close proximity to the production line. The move also sparked new technology developments for DALI, placing them on the cutting edge of technology developments in the loudspeaker industry.

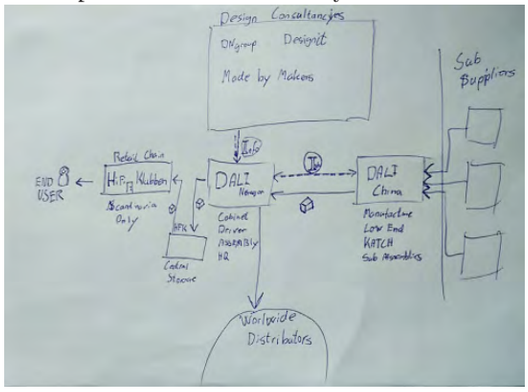
In 2007 opened DALI's first factory in China, this allowed them to produce certain components cheaper and get in closer contact with their Chinese sub-suppliers.

While DALI is in admiration of music and pursues the perfect reproduction of sound they have no ambition of moving into the very high end of loudspeakers. They always strives to become better yet they don't see the challenge in a "cost-no-object" loudspeaker and the sales would probably be relatively low.

DALI has in recent years moved into the active speaker business with KUBIK ONE and KUBIK FREE and last year also the portable bluetooth speaker DALI KATCH. The KATCH is their first speaker in pursuit of the URBAN speaker market, where BeoPlay, Libratone, Ultimate Ears and Bose among others has seen huge success in recent years.

The KATCH is designed by the Berlin based design consultancy Designit and produced entirely at the Chines DALI factory. Because of cost savings in this highly cost sensitive market, it doesn't utilizes DALI's own driver units.

Based on visits to DALI's headquarters in Nørager, meetings with Mads Utilits and desk research a system map showing the DALI business structure is presented to illustrator key actors and their functions.



System Map - (2007) Nicola Morelli, New representation techniques for designing in a systemic perspective, paper presented at Design Inquires, Stokholm.

Source: Danish Loudspeaker - 100 years by DELTA

Evaluation

This look at the history of Danish loudspeakers and especialy DALI provided insights to the DALI brand as well as the DALI legacy that needs to be inplemented in future product developments. In pursuit of new markets DALI has produced the KATCH, which seems contradicting to DALI legacy and core values. DALI is reliant on their know how and close development between engineers and production. But in a price competitive market, such as "URBAN" speakers DALI has let some of their core value slide.

Reflection

If DALI wants to stay true to its legacy and not changing their brand. Their products should be made in Denmark and branded as such. While visiting DALI HQ, the passion for the KATCH project seemed lacking from the engineers, since the project was pretty much done at the Chinese factory.

In order to innovate and create new markets with their products. BK Design sees DALI focussing on been made primarily at the Danish factory and entering a less crowded price competitive market.

Value porposition of loudspeakers

Worksheet no.: 4 Date.: 03-03-2017

Objective

To understand the values of DALI's main offering, the passive loudspeaker, an analysis of the values they offer has been made. And compared to the values giving by the new active loudspeakers in both portable and stationary form.

Furthermore an overview of how a passive speaker setup works compared to how an active is working.

Experiment/Data

A person who enjoys hi-fi is often called an audiophile;

"a person who is enthusiastic about high-fidelity sound reproduction" - Merriam-Webster Dictionary.

They are often connected with audio nerds and wrongfully accussed of caring more about the equipment than the music (Guttenberg, 2016). The enjoyment of the perfect reproduction of sound is tightly connected to the experience of live performance and the ability to reproduce the sound at home. And it is here that the passion for equipment also arises. Not only are the big passive speakers with an equally big amplifeier needed to fill a room with sound but in the pursuit of the perfect reproduction, audiophiles also optimize their room setup, buy expensive cables and turn-tables. They want every detail of the recording reproduced, they want the sound of the fingers sliding acrouse the strings of the guitar.

The contradicting part of todays sound and music usage is that almost all music is mastered digitally and compressed to fit on iPods and now streaming over users data-plan. And that compression and digital mastering often remove those small details in the sound. Futhermore a lot of music today is produced digitally and these small details were never there in the first place. (ArtistsHouseMusic and Calbi, 2010)

Another trend that decreased the audio quality and removed these small details is called "The Loudness War", which was a trend between music producers that increased the volume on the music to standout on the radio and on Shuffle playlists. (Deruty, 2011)

The setup

The setup of a passive loudspeaker system can be laborius but is very scaleable. From a stereo setup with two compact loudspeakers and an amplifier to a full surround sound setup with a AV Receiver. Present in both setups is the need for cables, between the amplifier and each loudspeaker. The cables is a topic of debate for many hifi enthusiastes, do more expensive cables improve the sound experience ?. And the setup of less expensive cables often include cutting and stripping of the wires before attaching the raw cobber wires to the left and right terminals of the loudspeaker and amplifier.

The setup of a typical bluetooth speaker is often reliant on the bluetooth interface on both the speaker and the source; smartphone, laptop, tablet. The bluetooth setup is done everytime a user want to connect another source device, making a smooth setup process very important for the experience of the bluetooth speaker.

Depending on the user, these steps in this extensive setup can both be a pain or a gain. Audiophiles and enthusiasts would properly find the setup as a part of the experience of buying a new hi-fi setup. The target audience requested by DALI and interviewed and interpreted in a later chapter doesn't enjoy the setup and finds this tedious and confusing ; ie. a pain.

The value

Stereo speaker
- 2x loudspeakers
- Amplifier
- 2x cables

- DAC
- AUX cables

Surround Sound Setup
- 4< Loudspeakers
- Center speaker
- Subwoofer
- 6< cables

- HDMI/Optical -> TV

Bluetooth
- Active bluetooth speaker

They offer different types of values that cater to different target audiences. What the bluetooth speakers looses in fidelity and sound experience it makes up for in a smoother setup and much less complex system. In use the surround setup aims to deliver the home theater experience when watching movies while the stereo speaker and bluetooth speaker is aiming for enjoyment of music. The portability and seamless input of a bluetooth speaker makes it more versatile than the stereo setup.

Stereo setup
- + High Fidelity music experience
- +
- - Extensive initial setup

Surround setup
- + High Fidelity home theatre experience
- - Relative high requirement of user
- - Fixed at TV location
- - Extensive initial setup
- - Lots of long cables for surround

Bluetooth speaker
- + Portability
- + Relative low requirement of user
- + No initial setup
- - Low Fidelity music experience
- - Low system integration

Evaluation

The passive loudspeaker setup offers values that cater to a differnt audience than what the bluetooth speakers offer. Espacially the extensive setup and complexity of a passive loudspeaker setup is putting off the audience of these new bluetooth speakers.

Reflection

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DALI company analysis

Worksheet no.: 5 Date.: 20/03-2017

Objective

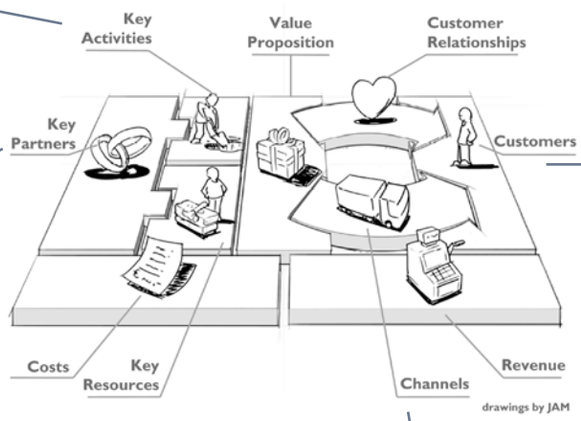
To locate strengts of DALI that could carry over into a new product solution thus helping to shape the product solution.

Experiment/Data

Dali delivers performance product at a competitive price point.
Dali Statements: State of the art technology, High quality, Innovative design, Value for money, best in class.
Dali offers a brand value as well
Dali want to broaden into covering convenience and Design.

Dali is present at multiple social medias and hosts an online community on their own web-page. Other than that the customer relationship with the end-user is governed by the salesforce at the retailers.

Production, tech development.



Buyer-supplier relations with retailers, and with manufacturing companies to supply capabilities beyond Dali's both technology and/or price wise.

Dali is a Niche market, focusing primarily on the Hi-Fi enthusiasts. Is trying to enter a broader market with their active speakers. With the launching of product focused on other segments.

Dali is primarily value driven, and operates with fixed cost based on the scale of the production.

Dali's only revenue stream is their asset sales of speakers at a fixed list price

Dali relies heavily on their own manufacturing plant to guarantee the quality of the speakers. Likewise Dali values their specialized human resources to create valuable intellectual property.

Dali is heavily dependent on their specialized human resources when developing and fine tuning their loudspeakers.

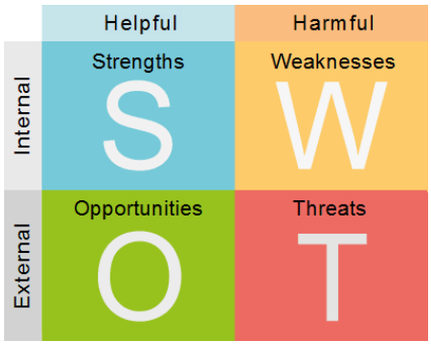
Dali was once part of a hi-fi retail chain, now they only sell to wholesalers, which then distributes to retailers.

Hi-Fi magazines and websites has been their main awareness channel. Release events and influencers on social media is one of their new ways of raising awareness.

Analysis of DALI strength and weaknesses. Should answer questions like: which DALI strength could be exploited in new product solution. Could DALI strenghts/opportunities help us differentiate.

This SWOT is made in considerations with the "Modular speaker" in mind. Date: 20-03-2017

- In house driver production.
- Made in DK/Danish design brand value
- Established brand to lean against in new product solution.



- Passionate about top of the line speakers

- Middle class buying power rises

- Major changes in connection technologies
-

Evaluation

Reflection

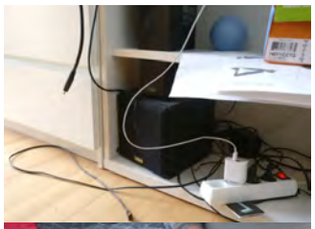
Interview Linda

Worksheet no.: 6 Date.: 09-02-2017

Objective

Interview Linda with regards to her consumptions of sound and use of speakers.

Experiment/Data



Linda had a speaker setup hidden in the bottom shelf together with other wires and chargers

Linda had gotton one BT speaker (Nordklang) from her brother as a present

Linda had a control unit attached to her shelving unit, connocted to the sub woofer below, shown on the first picture.

One of the speakers from the speaker system were placed under the television and hidden behind picture frames.

Question	Customer statement	Interpreted need
Typical uses	Tablet og starter spotify, og så har jeg et par højtalere med sådan et løst jack stik [Living room] (Stereo setup)	
	Jeg fik dem gratis, de skulle ellers bare smides ud. (Stereo Setup)	The solution is environmentally friendly
	Når jeg skal være der lang tid. [Bathroom] (BT speaker)	The solution is conviniently activated
	Jeg kan godt savne surround sound hjemme, som ved mine forældre	The solution provides a suround-sound experience
	Når jeg render rundt her hjemme.	The solution provides sound throughout the home
	Tager højtaleren med i fælleskøkkenet	The solution is tranportable
		The solution is hearable through social group activities
	Radio høre jeg fra min tablet	The solution allows for radio listening
	Den kunne godt stå der, men det ændre jo lidt på hvordan lyden er når jeg ser fjernsyn (Stereo setup)	The solution provides a pleasant experience regardless of placement
	Det sjældent jeg ser film, film på tvet for vi har fællesrum med store højtalere og projektor.	
	Stadigvæk, så er jeg nok opdraget en smule nærrigt. Det skal også være til at betale for.	The solutions percieved value exceeds the price
	Baggrundsmusik i hverdagen	The solutions provides the soundtrack to everyday life
	Ida og Mark hvis vi skal se film og ha' lyd	
	Det gør mig ikke noget, at den står et sted når jeg hører musik.	The solution can be operated from anywhere
	Jeg ville formenligt ikke kunne klare mig uden de højtalere	

Question	Customer statement	Interpreted need
Likes current solution	Den kan hives med ud på badeværelset. (BT speaker)	The solutions operates normally in humid areas
	Den er nem at flytte hen lige hvor man skal bruge den	The solution provides sound everywhere
	Spiller ikke så højt at det forstyrre naboerne	The solution solution provides an optional percieved low volume
	(Surround sound) det er noget andet når man ser en film	The solutions provides a surround sound experience
	Den er jeg glad for, den kan jeg godt lide (Stereo setup on/off volume switch)	The controls is conviniently operated and easily understood
	Den var virkeligt flot, der kunne jeg godt være lidt misundelig. (B&O A1)	The solutions design is reqognizeable
		The solution allows customers to reflect their person through the product
	Nok også mærket lidt, der er noget brand i. (B&O A1)	The solution emphazises the Dali brand
	Studiehøjttaler, altså, billig er godt	The solutions percieved value exceeds the price
	Den står stadig som fuldt opladt og jeg har brugt dem et par timer ihvertfald.	
	Det her er jo nemt. Kan godt lide nemt	The solution can be operated with no to little knowledge about hi-fi
Dislikes current solution	Den her vil ikke virke med tablet	The solutions provides a identical option no matter which peripherals used
	Så skal der skrues helt op og det er ikke helt optimalt (iPad)	
	Jeg kunne ikke få det til at lykkedes uden at det hele skal stå oppe ved tv'et. Det var ikke pænt (Stereo Setup)	The solution provides a pleasant experience regardless of placement
	Mange ledninger	The solution required little to no wires
	Skal jo flytte til sommer. Begrænset hvad man gider.	The solutions is easily setup
	Lidt misundelig over at jeg havde fået den her lille (B&O A1 vs Nordstrøm)	The solution allows customers to reflect their person through the product
	Ledninger er et helvede	The solution required little to no wires

Question	Customer statement	Interpreted need
Suggested improvements	Det betyder noget hvordan det kan gemmes væk. Ja hvor meget det fylder.	The solution blends in with the existing interior
	Når jeg køber en ny, vil jeg nok også tænke over hvordan jeg har sat op	
	Noget surround sound.	The solutions provides a surround sound experience
	Jeg synes godt der må være overensstemmelse med lyd / "design".	The solutions balance between design and performance is percieved equal
	Selvfølgelig god lyd og det må godt se nogenlunde ud.	The solutions balance between design and performance is percieved as an overwiegth to performance
	Rigtig lejlighed, så skal der også være rigtigt lyd og rigtig alting	The solution scales well, with different home sizes
	Lidt begge dele, vil nok gerne have noget der kan bruges til begge dele. SÅ jeg kan hører musikken over tv'et	The solution is operated similary during tv aswell as music experience
	50/50 med musik eller film.	The solution provides an equal experience when used for music or movies
	Det ville være så rart, så ville jeg kunne sætte det lige præcis hvor jeg har lyst	The solution provides a pleasant experience regardless of placement
	Hvis man kunne lade det op engang i måneden	The solution is low maintainense regarding power management
	Kabel nemmere end Chromecast	The solution can be operated with no to little knowledge about hi-fi

Evaluation

Reflection

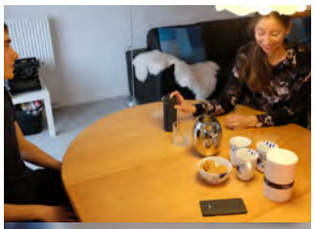
Interview Anne & Jan

Worksheet no.: 7 Date.: 10-02-2017

Objective

Interview Anne with regards to her consumptions of sound and use of speakers.

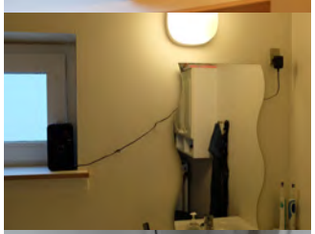
Experiment/Data

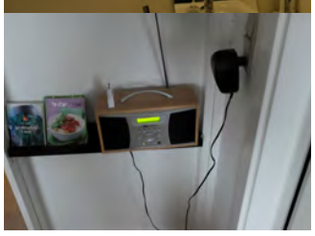


We spoke during the entire interview with both Anne and her boyfriend Jan

Anne had bought a UE Boom for her boyfriend as a present as he had wished for "better sound". She had chosen this as it was on sale and she liked the looks.

Anne and Jan had a radio in their bathroom they used when showering and getting ready in the bathroom





Anne and Jan had a radio in their kitchen as they did not bother to turn on their BT speaker in the morning.

Question	Customer statement	Interpreted need
Typical uses	Bruger den mest, bare når jeg går rundt her hjemme, gør rent og laver mad.	The solution operates normally in the kitchen and during cleaning
	Den plejer at stå derover (Hylden) Hvor ikke nogen ødelægger den	The solution easily fits on shelves
	Men det er meget når jeg går rundt og bruger den, så tager jeg den jo med ind i de rum hvor jeg så er	The solution provides sound at the users location
	Jeg har haft den lige med på ferie	The solution provides is transportable
	Vi kørte til tyskland, og så var det jo egentlig meget smart at have den med når den er trådløs.	The solution can provide a "non-mains-powered" sound experience
	De må godt stå sådan lidt diskret	
	Altså nu har vi to radioer	The solution provides sound in multiple locations
	Der er radioer både ude på badeværelset, og så står der en og kører der ude (køkkentet)	The Solution operates normally in kitchen and bathroom
	især om morgenen	The solution provides the morning soundtrack
	Det her (UE Boom) er mere til hvis vi er hjemme i længere tid	The solution starts playing music easily
	Om morgenen der er det bare...nemmere at sætte til, tænde på kontakten.	The solution is activated with one single action
	Altså sådan et anlæg har jeg engang haft, med sådan nogle små højttalere til et surround-anlæg.	The solution offers a surround-sound experience
	Der er en app der kan styre, tænde og slukke, skrue op og ned, og alt mulig gøgl. Men jeg går jo hen og trykker på de der plusser, det er jo lige meget.	The solution provides a simple, understandable user interface
	Når den lader, så tror jeg bare den lader der hvor vi lige kan finde plads til den...hvor der lige er et strømstik... det betyder ikke så meget.	Solution is chargeable from the same location as it is playing
	Men den står der primært (Hylder), Og så hvis den lader så ligger den måske der ovre, vi har nogle stik der ligger der ovre, og så ligger den derovre og lader	Solution is chargeable from the same location as it is playing

Question	Customer statement	Interpreted need
Likes current solution	Det kan jeg spille lige så højt som jeg vil (Headset)	
	Det godt den er trådløs, så man kan have den med	The solution is easily portable
	pæn, altså den er lidt stilet	The solutions fits in with normal interior design
	jeg kan godt lide det der med at den er rund, så lyden kommer hele vejen rundt	The solution provides omnidirectional sound
	Og så har den bare de der plus og minus knapper, det er meget simpelt.	The solution interface is simple and intuitive
	Og det kan se på den når den mangler strøm, for så lyser den rødt her	The solution clearly indicates the battery-level
	Og det fortæller den også på mobilen hvor man spiller fra, (See above)	The solution provides multiple indications of batery-level
	De var lidt mindre og...ja så var de bare lidt kedelige at se på	
	Jeg synes det er smart at den er rund, de andre de var firkantet.	The solution is uniqely shaped
	Altså jeg tænkte faktisk lidt dengang at jeg købte den, at det kunne være meget fint hvis man kunne have den med nogle steder.	The solution is easily portable
	Og jeg tænkte det var meget smart, at den var transportable.	
	koble det op til telefonen hurtigt. Og det er jo det det handler om.	The solutions connects to phone in a fast and easy way
	Ja for fanden! (Looks matters)	
	Den er sådan, det er ikke en der tager opmærksomhed. Den er ikke gul eller et eller andet.	The solution is available in neutral colours
	synes egentlig det der tv giver glimrende lyd.	
	Men den giver en god lyd!!	
	Den holder også batteri ret længe.	The solution requries charging less than once a week
	og så kan du bare spille videre mens der sidder strøm i	The solution opraten normaly during charging
	Ja det var start lyden, man ved altid hvornår den er igang.	The solution indicates when its activated
	Den dækker de behov for sådan en lejlighedsstørrelse her.	

Question	Customer statement	Interpreted need
Dislikes current solution	Totalt asocialt (Using headset)	
	Du havde brokket dig over at vi ikke havde nogle ordentlige højttalere.	The solution provides better sound than tv-speakers
	Vi brugte bare pc højtaler før, det var jeg satme træt af.	The solution provides better sound than pc-speakers
	Vi kan i hvert fald ikke få den til at virke (Ipad connection)	The solution connect equally easily to all types of tablets/phones
	De har ikke lavet en app desideret til det (tablets)	The solution connect equally easily to all types of tablets/phones
	Ej, det er sådan helt pinligt. Det er nogle virkelig gamle højtalere, men de faktisk ikke så dårlige. (Old speakers)	The solution is a symbol of wealth/tech/ design/interest
	Lyden var egentlig fin nok, det var bare pisse irreterende med ledninger og alt det der lort.	The solution is primarily wireless
	det lyder dårligt med telefonen (Playing through phone speakers)	The solution provides better sound than phone-speakers
	Jeg har aldrig været den fyr der har de der store klodser	
	Det jo noget med, at ens telefon ikke kan altså være super langt væk fra den før signalet ryger lidt.	The solution operates normally in abcense of user
	den helt gal med en android telefon	The solutions provides a identical option no matter which peripherals used
	vi prøvede tre forskellige android telefoner og ingen af dem kunne få kontakt få kontakt til den	The solutions provides a identical option no matter which peripherals used
	Generelt bare appen, altså selvom jeg har den så bruger jeg den ikke	All touchpoints of the solution are meaningfull througout the lifetime
	Ja den er lidt ligegyldig (The app)	All touchpoints of the solution are meaningfull througout the lifetime
	Men det jo så også det, hvis vi har nogle venner på besøg der skal bruge den, så skal de installere appen først.....Det synes jeg egenetlig heller ikke er så gennemtænkt.	The solution provides an adabtible experience based on user devotion
	Altså den har nogle underlige, connection issues	
	Især da vi holdte fester, så savnede vi lidt noget bedre lyd. (Old speakers)	

Question	Customer statement	Interpreted need
Suggested improvements	Ja det må godt se pænt ud. Simpelt.	
	Vi har snakket lidt om den kunne tåle fugt (UE Boom)	
	når vi engang får købt huset så ville vi gerne have det der lyd-anlæg hvor der er bare en højtaler der er i hvert rum	The solution provides sound at the users location
	fri for at have radioer over det hele	The solution covers all needs of music/ sound
	Og så vi ikke skal tage den med rundt. (If they had speakers in every room)	The solution provides sound at the users location
	så bliver det helt sikkert også købt efter designet	The solutions has pleasing easthetics for multiple tastes
	Det synes jeg er rigtig smart. Og det fungerer jo glimrende. Og øhm de gange vi har været til fest hos dem, der synes jeg det er ret cool at hvis du forlader stuen så bliver du jo egentlig i stemningen hele vejen, ligegyldig hvor du går hen og sådan noget ik.? (SONOS)	
	Men sådan et havde vi snakket om, det måske... for at give lidt mere lyd. (Soundbar)	The solution provides a greater sound than a tv-speaker

Evaluation

Reflection

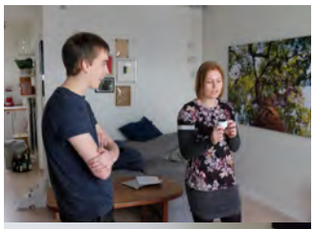
Interview Nikoline

Worksheet no.: 8 Date.: 10-02-2017

Objective

Interview Nikoline with regards to her consumptions of sound and use of speakers.

Experiment/Data



Nikoline showed us her SackIt speaker.

Nikoline and her boyfriend had a Loudspeaker setup from Dali, connected to the television.

Nikoline and her boyfriend had two SakcIt's they had bought when shopping for a bed. They bought one in grey for him and one in white for her. Her speaker were placed in the bathroom as she used hers when showering.

Question	Customer statement	Interpreted need
Typical uses	Egentlig så købte vi dem fordi vi ville have noget med lyd ude i badeværelset.	The soltion operates normally in the bathroom
	vi har også taget dem med i bilen	The solution can provide a "non-mains-powered" sound experience
	det var derfor vi købte to, for den ene kunne stå her ude og den anden kunne vi tage med.	The solution operates both at home and outside the home
	Jamen ehh, vi var ude og købe vores seng. Og så stod de sådan, var det her ikke noget. Så stod vi og kiggede på dem og sat lyden til og hørte. De var faktisk ret gode.	
	Jeg bruger også telefon, computer og tablet til musik.	The solution connect equally easily to all types of tablets/phones/pc's
	For lige at lave et eller andet, så hører jeg det jo bare på telefonen eller computeren. Det er kun hvis jeg ved jeg skal gøre det i lang tid at jeg gider sætte det til.	The solution starts playing music easily
	Herhjemme eller i hallen	The solution provides a satisfactory experiance in a gym hall
	Vi så Game of Thrones på et tidspunkt og der var noget vild lyd i. Noget krigslyd Så det skulle blowes totalt op.	The solution provides a greater sound than a tv-speaker
	Men sådan noget som at gøre rent, som er mega kedeligt, så skal der lige noget sjovt på.	The solution operates satisfactory during cleaning processes
	Han bestemte. Men han gjorde det sådan at jeg skulle også synes de må være her. agtig	The solution appeal visually to both men and women
	Jamen den lader inde i skabet, så den er i princippet sat til hele tiden	The solution operates normally during charging
	jeg har brugt den 3-4 gange i det halve år, for den er alligevel, den skal lige, kom nu, forbind, Er du med !?	The solution easily establish connection to playing device
	Jaja, fordi den her er jo så hans og den der er min.	The solution offers a "his n' hers" element

Question	Customer statement	Interpreted need
Likes current solution	Istedet for at have højtalere i alle rum, så var det dejligt så kunne man lige koble telefonen til og hører mens man er i bad	The solution provides induvidual sound throughout the home
	Og den passe lige i koppe holderen, så det var dejligt nemt.	The solution allows for convienient placement at every location
	tænkt den som at den kunne vi tage med udenfo	The solutions is protected against weather and outside use
	Og så stod jeg og tænkte arbejdsmæssigt, det var da egentlig ret smart	
	Og så fordi de kostede nærmest ingen ting, jeg tror vi gav 200kr for sådan en.	The solutions percieved value exceeds the price
	Solid og robuts, så kan den jo bare ligge i tasken.	The solution can easliy be carried "hands free"
		The solution is undamaged after multiple trips in a bag
	jeg har ikke noget imod at der ikke er noget larm i baggrunden, når jeg skal lave noget.	
	den er grå den er grim. Jeg tog en hvid, fordi den var sådan lidt girly.	The solution allows customers to reflect their person through the product
Dislikes current solution	det er jo ikke fordi det er besværligt, man drejer jo bare på en knap. Men åbenbart besværligt nok til at vi ikke gør det.	The solution connects with tv whitout the need of any actions
	den skal jo også kobles bluetooth til og den gider ikke samarbejde. Så dropper jeg at høre lyd og så går jeg bare i bad.	The solution easily establish connection to playing device
	hvis det tager mere end de der 10 sekunder at koble til, så gider jeg ikke.	The solution can connect and start playing in less than 10 seconds
	løber den tør for strøm og så gider den slet ikke. Det er ikke til at regne ud om den er med eller uden strøm.	The solution can continue operating in someway when the battery is empty
		The solution clearly indicates the battery-level
	den ene farve er radio og den anden er bluetooth og jeg kan aldrig huske hvad der er hvad	The solution clearly tells the user about relevant information
	man kan ikke hører telefonen nok ude i bruseren	The solution is hearable during a shower

Question	Customer statement	Interpreted need
Suggested improvements	Han går op i lyd, jeg går ikke op i lyd.	The solution can be operated with no to little knowledge about hi-fi
	Gråt, eller guld eller rosa, det er lige girlyt nok. Det kan jo blive for meget.	The solution allows customers to reflect their person through the product
	hvis jeg kunne starte computeren herovre, hvor jeg alligevel sidder og så går den automatisk på højtaleren	The solution can be operated wirelessly from a wide variety of devices, incl. pc/mac
	men hvis jeg skal ind og vælge den hver gang	The solutions provides an automated experience after initial setup
	Det skal være sådan at det nærmest er automatisk.	The solutions provides an automated experience after initial setup

Evaluation

Reflection

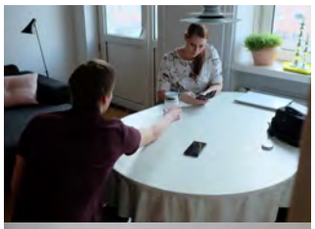
Interview Helene

Worksheet no.: 9 Date.: 13-02-2017

Objective

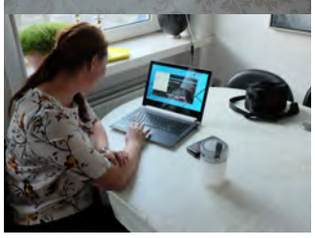
Interview Helene with regards to her consumptions of sound and use of speakers.

Experiment/Data



Helene showed us her SackIt speaker.

Helene had a Colors speaker which were placed and mostly used in the kitchen.



Helene used more than 5 minutes to get her speaker to play music when asked to start her speaker. She even had to switch from trying to connect from her phone to trying with her laptop.

Question	Customer statement	Interpreted need
Typical uses	Ellers har vi en der står ude i køkkenet, fordi det er der vi som reel hører musik.	The solution operates normally in a kitchen
	den er da meget fin og sådan meget handy. Har man den med ud på badeværelset fordi jeg står der ude og gør mig klar. Eller her når jeg vasker op.	The solution oprates normally in a humid environment
	Vores lyd vil jo nok altid blive nedprioriteret iforhold til billedekvalitet fx. Det vil helt sikkert være det jeg prioritere mest.	
	Jeg tager tit på stranden. Og tit ned i anlæget med veninderne og sådan nogle steder man tager den med.	The solution operates normally in outdoor environments
Likes current solution	The solution operates normally in outdoor environments	The solution is portable
	Det praktiske med lys.	The solution have extra "non-sound" features
		The solution can be easily operated in the dark
	Det er super lækkert du ikke skal hen og pille ved den. Den står bare klar så snart den modtager et bluetooth signal så køre den bare.	The solution can be oprated remotely
	Jeg havde ikke tvivlet hvis det ikke var fordi SU’en stadigvæk sidder og gnaver i baghovedet så havde jeg da købt sådan en.	The solutions percieved value exceeds the price
	Den er lækker at have med.	
Dislikes current solution	Den er jeg vældigt glad for, vil jeg sige og havde nok også købt en hjem til. Hvis ikke det var fordi de var så pisse dyre.	The solutions percieved value exceeds the price
	Den har jo ikke verdens bedste lyd, det er jo det man kan sige med de der højtalere. Jo større de er jo bedre lyd.	The solution visually radiates great sound
	Det er spotify og det er faktisk lidt en pain, hvad er det nu for en playliste og hvor er den der man hørte sidst. Og bliver røv træt af de der top 40 topsify liste.	The solutions is able to resume play from last known source
	Jeg nok ikke købt den her. Fordi halvdelen af den er lys, tror jeg.	The solution visually expresses being primarily a speaker

Question	Customer statement	Interpreted need
Suggested improvements	dobbelt klæbende tape. Noget der fungere lyn hurtigt til at sætte op.	The solution no knowledge and no tools to set up
	Jeg forestille mig en soundbar eller noget lignende. Lille og kompakt og ikke rigtigt noget man helt kan se hvad er.	The solution visually blends with the interior
	En gang i mellem ville det være fedt bare at have en generel playliste hvor man ikke skulle gøre så meget.	The solutions provides a shuffle/random play feature
	Noget der bare starter når man tænder computeren eller går ind i rummet, så starter der et eller andet.	The solution is automaticly activated based on user location

Evaluation

Reflection

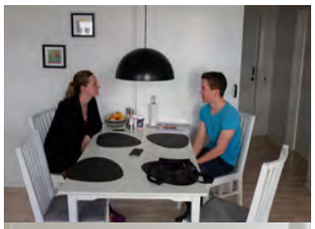
Interview Jeanette

Worksheet no.: 10 Date.: 22-02-2017

Objective

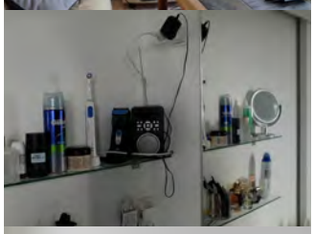
Interview Jeanette with regards to her consumptions of sound and use of speakers.

Experiment/Data

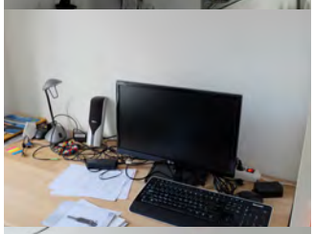


Jeanette and Andreas speaking

Jeanettes boyfriend had a loudspeaker setup from Dali



In the bathroom were a radio, that were used when showering and getting dressed



in the office were two active speakers which were seldomly used as the hifi system from the livingroom coul play loud enough to be heard from the office

The boyfriend had additionally two smaller Dali speaker which were not connected.

Question	Customer statement	Interpreted need
Typical uses	Jeg tror det er mest når jeg er alene hjemme, altså både når man er sådan lidt i dårligt humør, så kan man lige peppes lidt op.	The solution helps enforce the users mood
	Hvis jeg er hjemme sammen med Daniel, så er det mest noget radio vi hører.	The solution allows for a randomised music playing
	Jeg kan rydde op, eller lave mad, hvis jeg er alene hjemme.	The solution oprates normally when left for itself
	Det er Spotify eller Youtube, eller en eller anden radio, har vi også apps vi bruger.	The solution is compatible with most popular apps
	Vi har en lille radio ude på badeværelset, bare en meget lille en.	The solution operates normally in humid conditions
	Der er også bare noget der kører i baggrunden tit, altså hører radio eller et eller andet	The solution oprates normally when left for itself
	Et eller andet der giver lyd, så det ikke er sådan, trist.	
	Jeg hører musik, altså når jeg er i bad	The solution operates normally in humid conditions
	Hvis man lige går og laver et eller andet, eller bare har lyst til at hører musik.	
	Det er noget man hører når man er glad, og når man er ked af det	The solution enforces the users mood
Likes current solution	jeg kan godt hører forskel på om jeg spiller det på dem der eller nogle mindre nogle.	The solution
	Det giver selvfølgelig overhovedet ikke den samme lyd. Men eh.	The solution
	de her er pænere fordi de er mindre	The solution is smaller than floor loudspeakers
	Det har bare været et eller andet sted hvor det har været billige	The solution is percieved more valuable than its pricepoint
	Jeg synes også det er en fordel at man selv kan vælge	The solution allows for selection of music tracks
	Så er det vigtigt man lige selv kan få lov at vælge.	The solution allows for selection of music tracks

Question	Customer statement	Interpreted need
Dislikes current solution	Nu har vi nogle store højtalere der over, og det er min kæreste der går op i højtalere og hvis det stod til mig så var de nok mindre, kan godt acceptere dem	The solution is smaller than floor loudspeakers
	Altså så tænder jeg først der nede, lidt besværligt, så skal man vælge hvilken kanal det er, alt efter, vi har en audio chromecast og en almindelig også	The solution required little to no actions to operate
	Og det der system nu er en lille smule besværligt	The solutions controls is simple to understand
Suggested improvements	det skal helst være nemt ihvertfald, at der er vigtigt.	The solutions controls is simple to understand
	Det ville være rart hvis det bare, fungerede.	The solution can be operated with little to no knowledge
	Det skulle bare være nemt og ikke fylde så meget	The solution is campact in size and easy to operate
	Har ikke tænkt over om det skulle være pænt eller noget.	
	Jeg tror ikke jeg ser højtalere som noget der skal være pænt eller kan være pænt.	The solution appeal visually to the buyers
	Jeg ville nok kigge efter anmeldelser, om de havde god lyd.	The solution outperform speakers of similar pricepoint
	Men nogle der måske kunne blende ind	The solution visually blends into interior decor
	De skal helst være sådan nogle der ikke stritter for meget ud.	The solution is neutral/simple in its visual appearance
	Den skal bare virke, fungere når jeg connecter.	The solution requires no actions after connection

Evaluation

Reflection

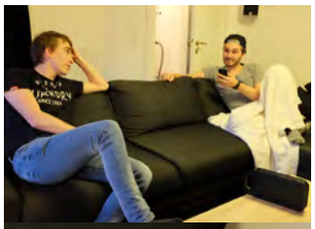
Christian interview

Worksheet no.: 11 Date.: x

Objective

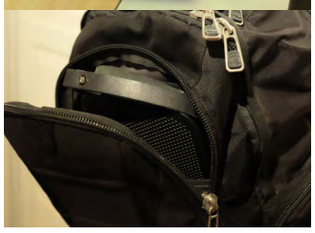
Interview Christian with regards to her consumptions of sound and use of speakers.

Experiment/Data



Christian and Stefan Talking

Chrisitan owns an BT speaker, BeoPlay A2



Christian brings his BT speaker around a lot, and carries it in his backpack

Evaluation

Reflection

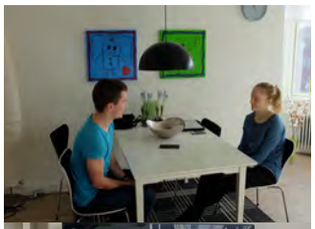
Pernille interview

Worksheet no.: 12 Date.: x

Objective

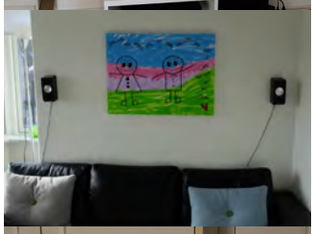
Interview Pernille with regards to her consumptions of sound and use of speakers.

Experiment/Data



Pernille and Andreas speaking

Pernille and her boyfriend have a small stereo setup connected to their television



Back speaker behind the couch

In the bathroom Pernille and her boyfriend have a small BT speaker, but this is not compatible with Pernilles phone, resulting in only her boyfriend using it.

Evaluation

Reflection

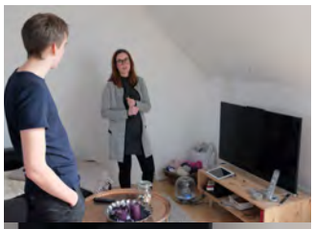
NAME

Worksheet no.: 13 Date.: x

Objective

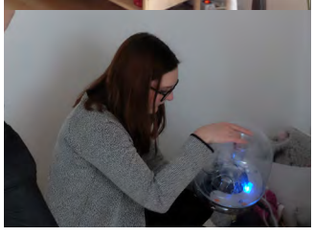
Interview Marthe with regards to her consumptions of sound and use of speakers.

Experiment/Data



Marthe and Stefab speaking

Marthe owns a small speaker setup, which is connected to the television



Marthe is showing off the transparrent subwoofer

Evaluation

Reflection

Persona generation

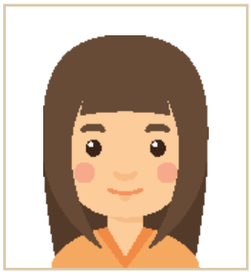
Worksheet no.: 14 Date.: 05-03-2017

Objective

Gather the data from the user interview sessions into one or two personas describing their use cases, pain and pleasures. This should result in some qualitative and gauntitative requirements.

Experiment/Data

Persona made from own perception of every interviewperson, combined into one persona.



Gains

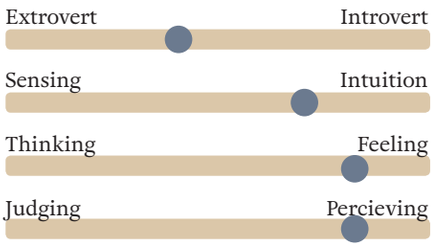
- To enforce the mood with music
- To have the perfect looking home
- To have music helping getting trough trivial tasks

Pains

- The speakers are to cumbersome to connect to the phone or laptop
- Feeling inadequate regarding knowhow of speakers

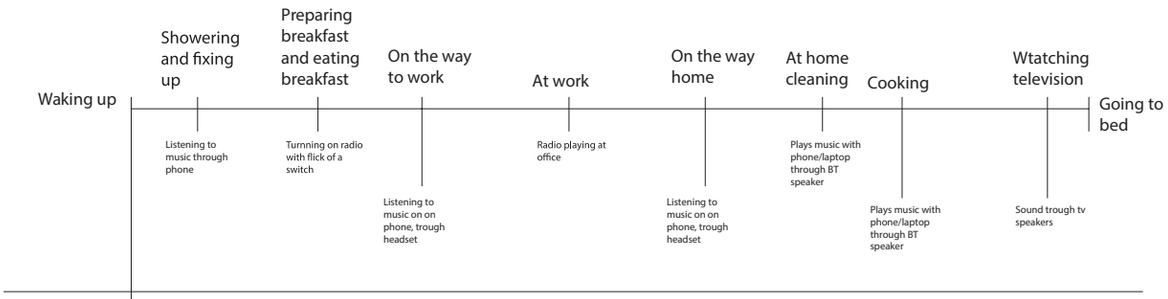
Motivations

Personality



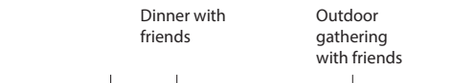
https://www.16personalities.com/articles/our-theory

Average day - consumption of sound



Engagement	Passive background music	Passive background music	Selecting song acording to preference	Passive background noise	Selecting song acording to preference	Favorite playlists as background music	Favorite playlists as background music	Actively listening
Value	Lightening up the mood / get the day started	Fill the silence of the room	Passing the time in transportation	Lighten the mood of the workarea	Passing the time in transportation	Adding favorite tunes to a boring task	Adding favorite tunes to a boring task	Passing the time in transportation
Speaker selection	Phone is easy and fast to setup in the morning	Radio started with flick of a switch	Privacy of headset	Radio in the middle of office	Privacy of headset	BT speaker	BT speaker	Privacy of headset

Other occasions - consumption of sound



Engagement	Selecting tracks and playlist to guide the mood	Carefully slected music tracks / playlists
Value	Setting the mood of the party	Creating an environment. Displaying fun lifestyle to others
Speaker selection	BT speaker, easy and loud enough	BT speaker that is portable

Needs received from interviews
(Important need highlighted in orange)

Wires

- The solution required little to no wires
- The solution can provide a "non-mains-powered" sound experience

Difficult Environments

- The solution scales well, with different home sizes
- The solutions operates normally in humid areas
- The solution is undamaged after multiple trips in a bag
- The solutions is protected against weather and outside use
- The solution provides a satisfactory experience in a gym hall
- The solution operates normally in the kitchen and during cleaning
- The solution can be easily operated in the dark

Placement

- The solution allows for convenient placement at every location
- The solution provides a pleasant experience regardless of placement

Sound follows

- The solution is transportable
- The solution provides same sound through multiple locations

- The solution provides individual sound through multiple locations
- The solution operates both at home and outside the home
- The solution provides sound at the user's location
- The solution is easily portable
- The solution can easily be carried "hands free"
- The solution operates normally in absence of user

Handling

- The solution can be operated with no to little knowledge about hi-fi
- The solution is conveniently activated
- The solution is activated with one single action
- All touchpoints of the solution are meaningful throughout the lifetime
- The solution provides an adaptable experience based on user devotion
- The solution easily establish connection to playing device
- The solution can be operated from anywhere
- The controls is conveniently operated and easily understood
- The solution provides an equal experience when used for music or movies
- The solutions is easily setup
- The solution no knowledge and no tools to set up
- The solutions is able to resume play from last known source
- The solutions provides a shuffle/random play feature

Connection

- The solution can connect and start playing in less than 10 seconds
- The solutions provides an automated experience after initial setup
- The solution easily establish connection to any playing device
- The solution connects with tv without the need of any extra actions
- The solutions connects to phone in a fast and easy way
- The solution is automatically activated based on user location

Sound modes

- The solution provides omnidirectional sound
- The solution provides a surround-sound experience
- The solution allows for radio listening
- The solutions provides the soundtrack to everyday life

Charging

- The solution is low maintenance regarding power management
- The solution can continue operating in someway when the battery is empty
- The solution operates normally during charging
- The solution requires charging less than once a week
- Solution is chargeable from the same location as it is playing

Product perception

- The solutions balance between design and performance is perceived as an overweight to performance
- The solutions balance between design and performance is perceived equal
- The solution blends in with the existing interior
- The solutions design is recognizable
- The solution solution provides an optional perceived low volume
- The solution is perceived as easily operational by a person with no knowledge about Hi-fi
- The solution visually radiates great sound
- The solution visually expresses being primarily a speaker

Indications

- The solution clearly tells the user about relevant information
- The solution clearly indicates the battery-level
- The solution indicates when it's activated
- The solution provides multiple indications of battery-level

Sound quality

- The solution is hearable through social group activities
- The solution provides a greater sound than tv-speakers
- The solution provides better sound than pc-speakers
- The solution provides better sound than phone-speakers

Other

- The solution is environmentally friendly
- The solution emphasizes the Dali brand
- The solution have extra "non-sound" features

Evaluation

The persona seems more or less true to the interviews it is based on. It might be to much to condens 8 persons into one and their might be subtleties lost in crating one. but it proved har to create two destinct personas.

Reflection

The persona can help us point to one place when selecting between solutions in the future.

Their migth be an opportunity to focus on the Lack og knowhow part, and possibly create bigger Hi-Fi setups with no required knowhow.

Trends outside consumer electronics

Worksheet no.: 15 Date.: 06-03-2017

Objective

Locate trends outside the market of consumer electronics in order to pinpoint opportunities to cut in front of the market of consumer electronics.

Experiment/Data

1. Multiplicity.

Products should make use of multiple sensory experiences at once. Products should tell multiple stories with multiple strands of narrative.
They are now craving active participation.

2. Hyper Efficiency.

This sense of intensity is also reflected in the desire for super-charged forms of efficiency. From health to homes, people are using every last bit of space and time. High-impact, superfast diets and fitness plans are gaining popularity, and – with space at more of a premium than ever – people are seeking smart ways to integrate a range of functions into one property.

3. The New Industrial Revolution.

People are becoming able to create things themselves. Coding has gone fully mainstream, and the rise of 3D printing is hailing a new era for industry. Soon everyone will be a manufacturer, able to create what they want, when they want it.

4. Escape.

In a turbulent and ever more serious world, there is a craving for silliness and outright frivolity. People are seeking occasions that allow them to let go of all responsibilities and inhibitions, and embrace outlandish hedonism.

5. Mindfulness.

In a world full of buzz and surface interactions, people are seeking more depth and meaning. Leisure is becoming as much about self-development as pleasure-seeking, and there is a growing sense of earnestness, consideration and thoughtfulness. People are craving time away from the stimulus of the internet, and are severing their connection to technology.

6. Super-personalized.

The cultural shifts we are witnessing show a move towards the wholehearted and intense. People want all aspects of their lives to be rich and full. These trends give us a clear sense of where culture is heading, and brands this year will have to work hard to meet consumers' demands and expectations. Nothing should be done by halves.

https://www.forbes.com/sites/onmarketing/2014/02/04/six-trends-that-will-shape-consumer-behavior-this-year/#633fef9e7125

5 Trends That Will Inspire and Engage Both Millennials and Gen Z

https://www.entrepreneur.com/article/281551

God rapport

1. Authentic brands need to turn the selfie stick inward.

They want to connect with real people who represent the brands they buy, and they want to see genuine posts on social media. Anything that feels prearranged or planned will be a turnoff. So show them who you are. But keep it witty and quick. Neither generation is known for long attention spans.

2. Find out where the kids hang out on social media.

Gen Z and Gen Y are less likely to be coaxed by traditional advertising, and they get annoyed by the overuse of ads on social media. What they do turn to is blogs, reviews and information from those they trust. The best strategies may come from marrying authentic brand advocacy with popular social media -- but it needs to feel real and be unique.

3. Traditional values but mobile state of mind.

Gen Y and Gen Z grew up with cutting-edge technology, but they still covet many of the same values as their elders.

A recent global study by Nielsen shows that most millennials and Gen Zers plan to someday get married, have children and buy a house -- although probably not as early as the older generations did.

But while conventional values are important to them when it comes to work and life, they also embrace everything mobile and cloud-based. They take for granted wireless communication and always being connected to the larger world through their smartphones and other devices. That desire for constant access and being wired-in and connected will undoubtedly continue to change the tech industry.

4. Quality products over brand loyalty.

Gen Z has been called retailers' worst nightmare. This is because brand loyalty is on the decline, and they are more likely to bounce from brand to brand than previous generations.

This has much to do with their ability to research the best product and pick quality over brand loyalty, something previous generations were not able to do as easily.

Gen Z isn't as concerned with keeping up with a brand. They are often looking for the latest trends in products and services. They seek products that cater to their lifestyle, such as wearable tech. Quality is king, and familiarity is passé.

5. Have an impact and make a difference.

One thing that connects the youngest members of society with their elders is their desire to make a difference. However, the young are more impatient to get started, more tolerant of social change and more open to differences.

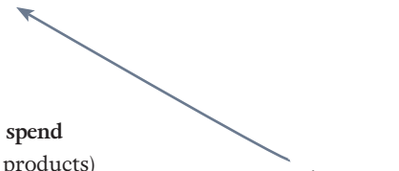
Gen Z and Gen Y have both grown up aware of public controversies and scandals, not to mention global climate change and increased unease throughout the world. They want to right the wrongs of the world, and they have a wealth of resources available to them, from vast social networks to access to technology.

In addition, growing up in this digital world, they have the prowess to use all the modern resources available to them and be heard.

Both of the youngest generations have made a name for themselves as volunteers and activists, but Gen Z especially is set up to become the next generation of entrepreneurs and creators. They expect the brands and products they buy to embrace and reflect these ideas.

Research paper about millennial women

https://www.insightsinmarketing.com/media/1170/women2020_millennial_051415__2_.pdf



God rapport

If you educate, inspire and invite them...they'll spend more! (price does matter) (In regards to beauty products)

Keep Evolving

Keep things interesting by changing/evolving, or she will be the first one to leave for thenewest and best offerings by your competitors. Products, brands and content geared tovariety, change and the "next best thing" will peak her interest online and in print.

Evaluation

Clear trends that could act as opportunities are:

Flexible

It seems like flexibility is required of product. It should be able to involve multiple senses and tell mutiple stories. It should keep engaging the user to keep interest.

Mindfullness

Making a liesuretime more sonsorial and meaningfull.

Engaging

Product should strive to be an integrated part of online social life.

Educating

In addition it seems like there is an opportunity to create a product that would educate the user.

Traditional values

Gen X and Y appreciate traditional values, but still needs the flexibility of the pressence

Reflection

The trends found in this session of reseach is closely related to allready exploited trends in the consumer electronics market, but might help to understand the underlying reasons for these trends.

On top of head opportunities from this reseach:

Introduce meaning / sensorial part into the passive use of speaker. Morning speakers.

Speaker that is highly adaptable in regards to look. seasonal looks, intice project around creting new looks to the product.

User sum up

Worksheet no.: 16 Date.: 12-03-2017

Objective

Locate how users consumer sound and their coping strategies. Value canvas / pain, gain and jobs.

Experiment/Data

MOTIVATIONS:

- Invogorate one self
- Kill off silence

BARRIERS:

- To much effort to play music
- Having to decide what to hear

COPING STRATEGIES:

1: Uses radioes placed in kitchen and bathroom in order to easily play music.

2: Carry a phone around which is easily operated as this is known to user.

MOTIVATIONS:

- Improve a tedious task
- Kill off felling of being alone

BARRIERS:

- Bring the music along through multiple rooms

COPING STRATEGIES:

1: Use Bluetooth speaker placed in one spot and then move it when the reach of the Bluetooth fails.

2: Use a loudspeaker setup and turn it up enough to play in every room

3: Bring laptop/phone around the home

MOTIVATIONS:

- Imerse in experience
- Relax and improve mood

BARRIERS:

- Confronted with ugly speakers
- High complexity in products

COPING STRATEGIES:

1: Ignore using any external speakers and use the speakers of the television

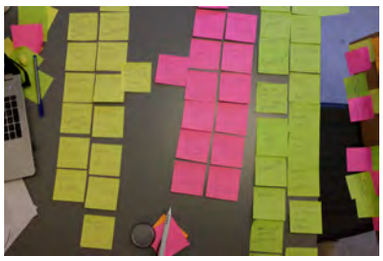
EFFORT ↓
FLEXIBILITY —

EFFORT ↓
FLEXIBILITY ↑

EFFORT ↓
FLEXIBILITY ↓

We see that the mental effort put into accomplishing their goals are low causing them increase their physical effort, by putting effort into moving their phones or laptop around.

The sub-tasks, pains, and gains where then collected into a value canvas describing the user, eliminating all duplicates.



Afterwards the sub-tasks, pain, and gains were ranked in order from most severe/important to minor/ unimportant.

MAIN PAIN

The main pain experienced by the customer is the transition from no music to music.
This is especially painful at times like the morning, where the users need to quickly access music whiteout any hassle.

After the initial hurdle of connecting the next hurdle is selecting a soundtrack. The users dont want to be faced with the many options of selecting sound. Instead they just want to hear music without having to decide on anything.

Worst case scenario for user

Wakes up.
Goes to the kitchen to prepare breakfast

Tries to connect to BT speaker but discover that the speaker is out of power.

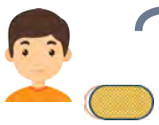
Plug speaker into outlet.

Tries to connect to BT speaker but experience troubles. tries to turn on and off both speaker and phone.

Finally connects

Need to open music app. Decide and search for desired playlist/ soundtracks.

Speaker starts playing.

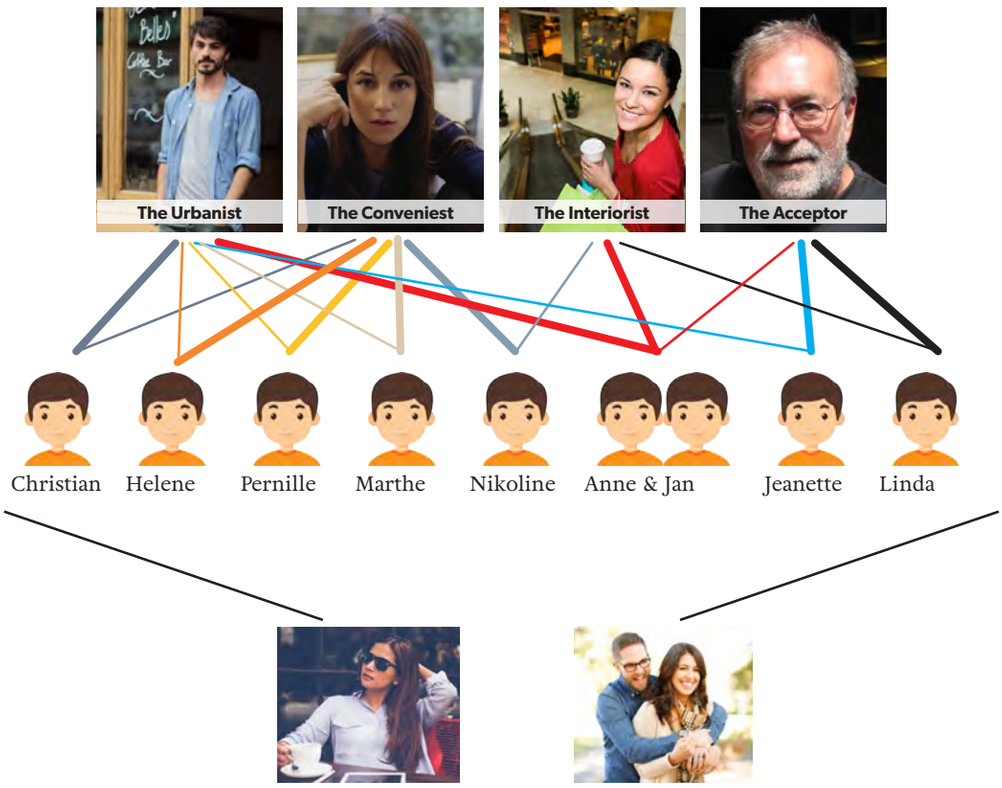


Turns off speaker

Waking up	Music when showering	Eating breakfast	Brushing teeth and beautifying	Transportation	Music at work	Transportation	House tasks
	• Removing the feeling of being alone • Invigorate one self • Reach profesional state of mind	• Removing the feeling of being alone (single) • Create a mutual activity (partners)	• Removing the feeling of being alone • Invigorate one self • Reach profesional state of mind	• Remove noise from outside world • improve a tedious task	• Improve tedious tasks • Create atmosphere of focus/relaxation/energy	• Remove noise from outside world • improve a tedious task	• Improve tedious tasks • Remove feeling of being alone • Connect to speaker • Outplay the sound of the hoover
	R Pleasant music E Speaker operates in bathroom D Works with all devices D Long battery life D Visually pleasing	R Pleasant music D Works with all devices D Long battery life D Visually pleasing	R Pleasant music D Works with all devices D Long battery life D Visually pleasing	Time goes fast Create a private atmosphere	D Improve workforce D Work with all devices D Visually pleasing	Time goes fast Create a private atmosphere	Improved mood Blend into interior Less tedious task Enjoyment of tasks
	• Speaker wont connect to devise • No power on speaker • Risk of ruining the morning • No help (feedback)	• Speaker wont connect to devise • No power on speaker • Risk of ruining the morning • No help (feedback)	• Speaker wont connect to devise • No power on speaker • Risk of ruining the morning • No help (feedback)	• Too much outside noise • Left out relevant noise • Cable management • Fear of loosing headphones • No battery	• Undesired atmosphere • Fear of being judged • Battery issue from source • Connection issues • Loss of property	• Too much outside noise • Left out relevant noise • Cable management • Fear of loosing headphones • No battery	• Keep in range • Loose connection • Failing at connecting • Not able to hear music in every room • Dead batteries • Ugly boxes

Leisure time	Cooking dinner	Eating dinner	TV / Watching movies	Go to bed
• Escape reality • Recharge "batteries" • Max relax • Improve mood	• Cleaning speaker	• Get close to partner • Remove feeling of being alone	• Connect to tv • Relax • Stay updated • Entertain oneself	
U Improve interor connected to all devises D Sound nomatter location	U Assist cooking E Resist grease and waterstains	Pleasant atmosphere	U Surround sound Seamless connection R Sound quality above phone/tablet Help imersing in movie	
• Incompatibility Devices Codex • Wires • Ugly boxes • Loosing device	• Speaker gets greasy	• No connection	• Finding and connecting speaker • Incompability • Big stationary boxes • Wires • Steep learning curve • Uninviting interface	

TASKS	GAINS	PAINS
• Imprve mood • Remove feeling of being alone • Create an atmophere • Escape reality • Recharge "batteries" • Invigorate yourself • Look good in fornt of friends • Improve tedious tasks • Engage group in activity • Display social status • Carry the speaker • Placement of speaker • Cleaning the speaker • Create a mutual activity • Connect to television	• Pleasant music • Visually pleasing • No action to connect • Improved mood • Blend into interior • Enjoyment of tasks • Social acknowledgement • Work with all devices • Sound quality above tv, phone, laptop. • Create a private space • Long battery life • Bonding with friends • Waterproof • Shared music control • Durable • Dont have to think about battery life • Surround sound experience • Imersed in movies • Assist cooking	• Connection issues, Bluetooth, lack of feedback • Compatibility issues; devices, codex. • Uninviting interface • Awkward silence • Ruining the interior design • Cable management • Loosing connection because of range • Batteries are empty • Initial volume level to loud • Not loud enough • Ruining the atmosphere • Placement issues; where to place it, unenven surfaces • Smudging the speaker • Fear of damaging the speaker • Miss out on important sounds like a doorbell


The Urbanist
The Conveniest
The Interiorist
The Acceptor
Christian
Helene
Pernille
Marthe
Nikoline
Anne & Jan
Jeanette
Linda

Evaluation

Users buy the dream of portable speakers but in reality almost exclusivly use it inside.

Users experience big barriers in regards to connecting to their devices.

Users are disconnected with big hi-fi- setups.

The perfect stereo system is not valued and users have no preferences in regards to sound direkction when watching movies.

Users feel loudspekaers are big black ugly boxes and strive to keep a "magazine like" interior.

Reflection

Blue ocean canvas

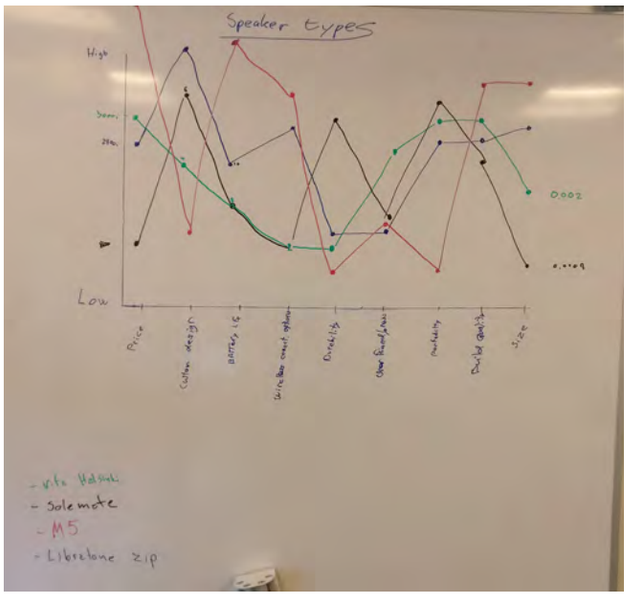
Worksheet no.: 17 Date.: 15-03-2017

Objective

Plot the different types of speakers into a blue ocean canvas to clearly pinpoint where and how the product solution needs to differentiate itself.

Use previously made blue ocean canvas of multiple specific products as reference, but this time make the blue ocean canvas on Archetypes of speakers. This should result in a clear statement of how the product solution differs from others

Experiment/Data

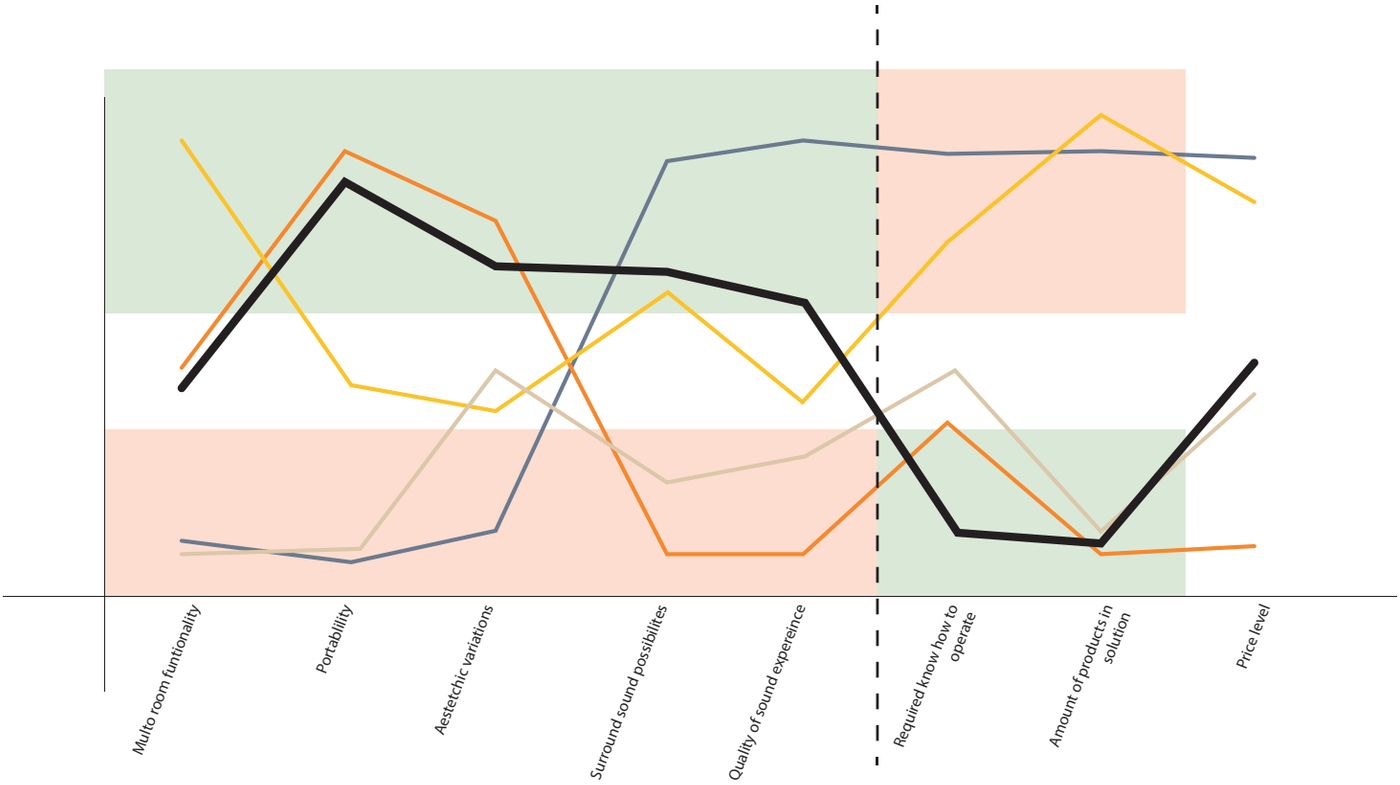


From the first blue ocean canvas it were hard to see opportunities.

Reflekting on the first blue ocean canvas it seemed that a rough idea of a possible product solution were needed in order to arrange the parameters to highlight the areas of opportunity. Even though this way of appraoching the blue ocean canvas semmed unintended, it was decided that since the rating of the parameters were subjective that this way needed a test when an idea of the product solution were more tangible.

Funny note: From the litterature on blue ocean canvas, it is stated that a product solution with a volatile graph would be a sign of a bad solution? So one have to have a preconcieved idea of what he wants to plot?

(Kim and Mauborgne, 2005)



Loudspeaker setup

Portable speakers (Katch)

Soundbar

Multi room setup (SONOS)

Looking at arch types of speakers, it is clear that the room for new solutions are slim.

The black line in the graph is made biased on the idea of a Modular speaker: A bigger speaker with one or multiple detachable speakers to cover the user needs of providing sound in different locations and providing the option to opgrade a music experience with a surround setup.

By making a two in one solution, we fulfill all user needs and never end in the "Red zones". The solution should strive to incorporate the sound quality of the loudspeaker setup, but maintaining the simplicity and flexibility of the Portable speaker.

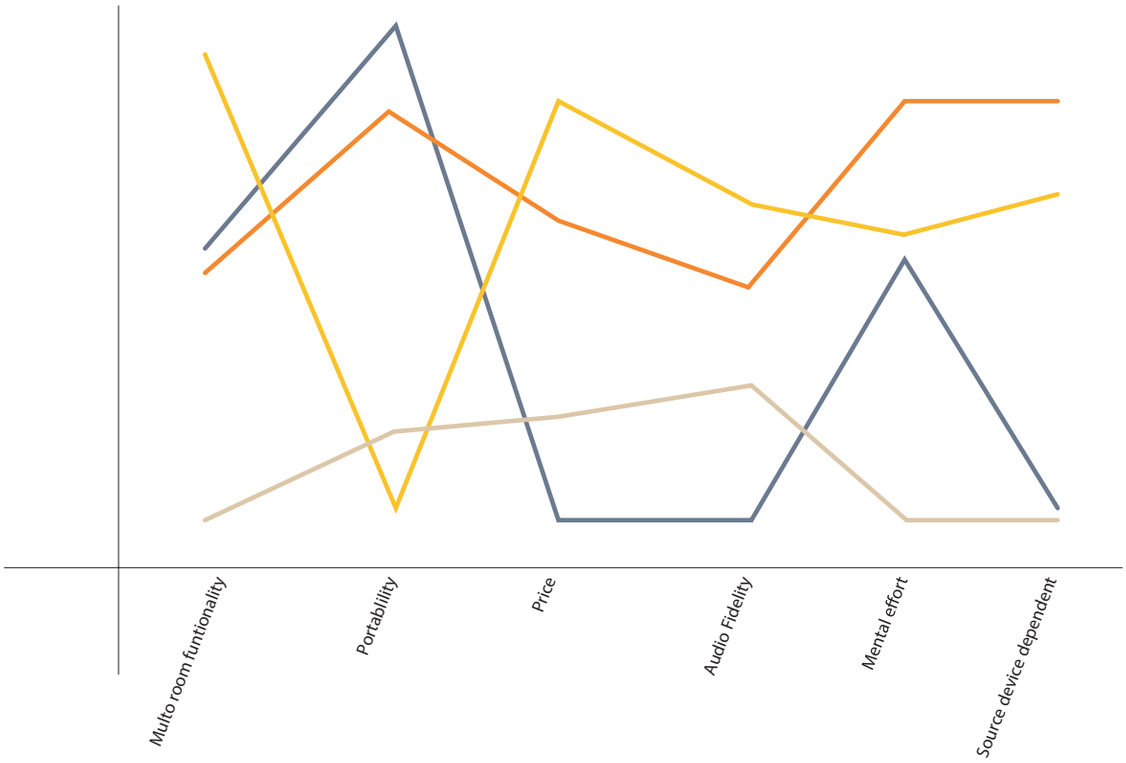
Evaluation

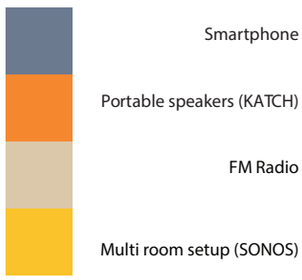
The Blue ocean canvas did not not show a clear open gap in the market, but that wasent expected in a market like the speaker market.

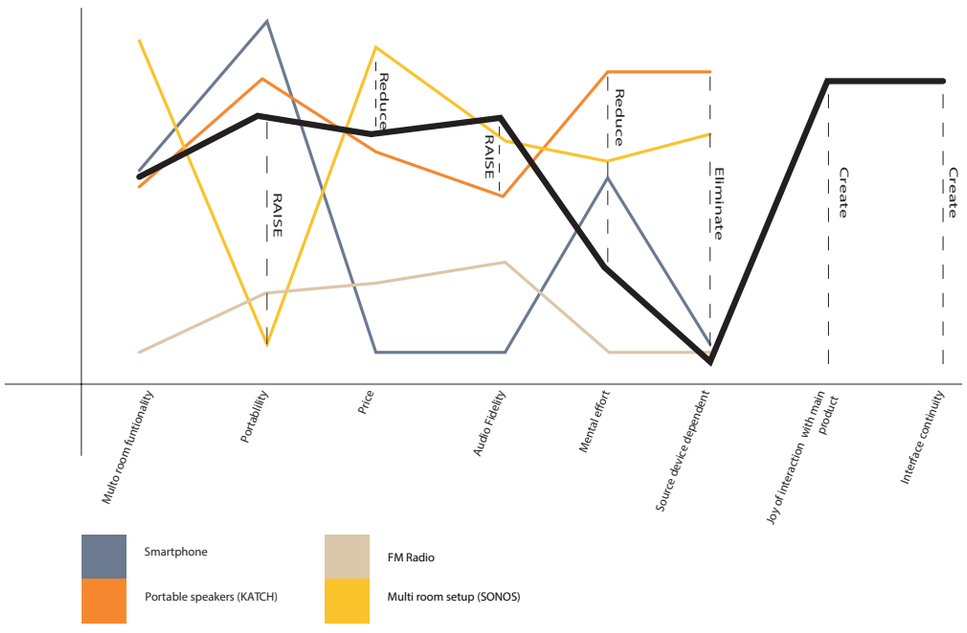
The plotted product solution may not offer a completely different value but instead offers a new an better mix of the existing values.

Reflection

It may prove difficult to state the product solutions differentiations from the market, and we (BK design) need to be exstra clear in our differentiations from each product category as we are troying to make something of a hybrid.


Multo room funtionality
Portability
Price
Audio Fidelity
Mental effort
Source device dependent


Smartphone
Portable speakers (KATCH)
FM Radio
Multi room setup (SONOS)


Reduce
RAISE
RAISE
Reduce
Eliminate
Create
Create
Multo room funtionality
Portability
Price
Audio Fidelity
Mental effort
Source device dependent
Joy of interaction with main product
Interface continuity
Smartphone
Portable speakers (KATCH)
FM Radio
Multi room setup (SONOS)

BT Test with Users

Worksheet no.: 18 Date.: 20-02-2017

Objective

The users experience trouble connecting with Bluetooth. A test of how long and what steps are needed in order to connect was conducted with 8 users.

Fieldwork, observation, time tracking etc. ?

Experiment/Data

Bluetooth is a wire-replacement technology that aims to replace cables with low-power consumption over short distances.

Linda -

Nikoline - 14:45 , check power level, finds another, 16:15, back with a turned on SACKit. 16:45, activate Bluetooth on phone. 16:58 SACKit starts playing.

Helene - 14:20 asked to turn on music. 14:42 back with speaker. 14:50 speaker turned on. 15:50 restarts speaker. 16:22 switches to Mac laptop instead. 17:16 starts talking about something else. 18:09 Connected. 19:03 cant start music. 19:19 Mac starts playing. 19:28 Loose connection. 20:28 Connected, 20:38 Sound through BT speaker. 20:57 Music achieved.

Range

Bluetooth 3.0 which is quite common with the cheaper competitors has a theoretical maximum range of 10 meters. The newer version, 4.0, has a theoretical max range of 60m. Furthermore ranges are divided into Class ranging from 1 to 4. The Class rank is determined by max permitted power output affecting the typical range. Most battery powered Bluetooth devices are Class 2 which means they have a typical range of 10 meters in direct line of sight. The range is determined by the device with the lowest power in the system. Meaning that a 4.0 Class 1 device and a 3.0 Class 4 device will be limited by the low permitted power of the Class 4 device.

Devices doesn't have to have visual line of sight with each other, but obstacles will limit the range. Bluetooth uses a frequency and wavelength somewhat similar to 2.4GHz Wi-Fi but at a much lower power-consumption, resulting in a similar behavior when passing through obstacles but weaker. Operating in the same 2.4 GHz band introduces a lot of interference and noise on the connection. Most Wi-Fi devices operate in the 2.4 GHz band, as well as Car alarms, baby monitors and microwave ovens, so there is a lot of other products that can interfere with the signal between two Bluetooth devices and limit the range and stability of the connection.

Modes

Paired

Pairing mode - Discoverable mode , Inquiring mode

A look at Bluetooth implementation in products.

Asus N56VZ Laptop w. Windows 10 - Built-in Bluetooth V4.0

HTC One m8 - Bluetooth v4.0, A2DP, aptX

OnePlus 2 - Bluetooth v4.1 , A2DP

Mi Bluetooth Speaker - Bluetooth 4.0

Jabra Solemate - Bluetooth 3.0 with NFC for pairing.

Sennheiser Momentum 2.0 - Bluetooth 4.0 +EDR, A2DP + AVRCP + HSP + HFP with NFC for pairing.

Office space, laptops etc.

Asus -> Mi Sp audible distor

HTC - Mi Spe audible distor

Asus -> Mom audible distor

HTC -> Mom audible distor

The OnePlus 2 simple wouldn't connect to the Jabra Solemate and since the OnePlus doesn't support NFC, there were nothing to do different.

When ever the Laptop connected to any of the Bluetooth speakers and started playing it would sound downright awefull until the laptop exited inquiring mode which didn't seem to be under user control, other than closing the Bluetooth settings tab.

The HTC One would sometimes require a restart of the phone in order to achieve playback. It connected easily enough to the devices, but no sound would come through.

The NFC pairing of the Solemate and Momentum was unreliable and would sometime not connect to the HTC One phone.

Looking at the instruction manuals to the Momentum 2.0 and Solemate showed the numbers of steps or complicated interface of the bluetooth technology.

For most phones the Jabra instructions for connecting to the Solemate consists of 9 steps in order to achieve music playback between a new phone and the Solemate.

The Momentum relies on one power button and a multi colored led for interacting with the Bluetooth interface. Resulting in a situation of restarting and reseting the headphones when connecting to a new device.

LED indications during operation

LED	Meaning
	The headphones switch on
	Pairing with a device is successful
	The headphones switch off
	The headphones are in pairing mode
	The headphones are disconnected from the device
	The headphones, with an almost empty battery, are disconnected from the device
	The pairing settings are cleared from the headphones

1. Even if a Bluetooth enabled phone has not been tested, it may well still work with your hands-free device. Find the basic instructions for pairing a phone to your hands-free device below.
2. Go to the Bluetooth section of your phone, usually in **Settings**
3. Ensure Bluetooth is turned **On**
4. This will start the phone searching for devices
5. Slide the **On/Off** switch to turn the JABRA SOLEMATE on
6. Slide and hold the **On/Off** switch up, until you have a rapid flashing blue LED
7. Select the **JABRA SOLEMATE** in the list, If a pin code is required type in 0000 (4 zeros)
8. The JABRA SOLEMATE is now paired
9. The JABRA SOLEMATE and Apple iOS 9.x pairing instructions are now ready to be used

Bluetooth Profiles are some of the underlying protocols and technologies that can be added to the Bluetooth devices. There are above 30 different profiles with more than five affecting audio playback devices. The profiles are all listed as acronyms when looking at product specifications, but some of them are very important to the audio quality passing through the wireless signal.

Especially the Advanced Audio Distribution Profile (A2DP) is important, since it allows for commonly used codecs such as MPEG. Which will send the exact same digital information through the wireless bluetooth signal instead of the typically compressed signal that Bluetooth normally do. Both devices will have to have support for the profile to even allow this and furthermore have it enabled by the manufactures of the "sink" device. Otherwise the Bluetooth signal will compress and re-encode the digital information before sending it wirelessly to the "sink". aptX is a codec that is developed to increase the audio quality over Bluetooth to a advertised "CD quality" level and while this is theoretical true it is still a compression and re-encode of the digital information and both the source and the sink will have to support this format. It is a touchy topic with no clear answer to whether or not this aptX codec is enough.

The Bluetooth module in the source device receives the digital audio signal and compresses and encodes the signal to the Bluetooth patented SBC codec. The sink devices then receives this signal wirelessly and decodes the signal and converts it to a analogue signal that the power amplifier can amplify and output through the speaker drivers. (A2DP - Advanced Audio Distribution Profile, 2012)

https://www.lifewire.com/what-to-know-about-bluetooth-3134591

https://www.quora.com/How-much-quality-is-lost-when-streaming-full-quality-lossless-audio-over-Bluetooth

http://www.techradar.com/news/audio/bluetooth-vs-aptx-vs-airplay-which-is-better-and-which-should-you-use-to-stream-your-music-1322312

Evaluation

The Bluetooth technology wasn't originally developed for audio entertainment products and even though it has seen a lot of development and adoption towards this it still shows that it isn't ideal. The complex setup process and lake of interface and feedback makes the users not understand their devices and leads them to find easier solutions.

Reflection

The test could have been more scientific in its approach, with a more controlled test environment. But already with the observed troubles of the users it was obvious that Bluetooth might not be the right choice.

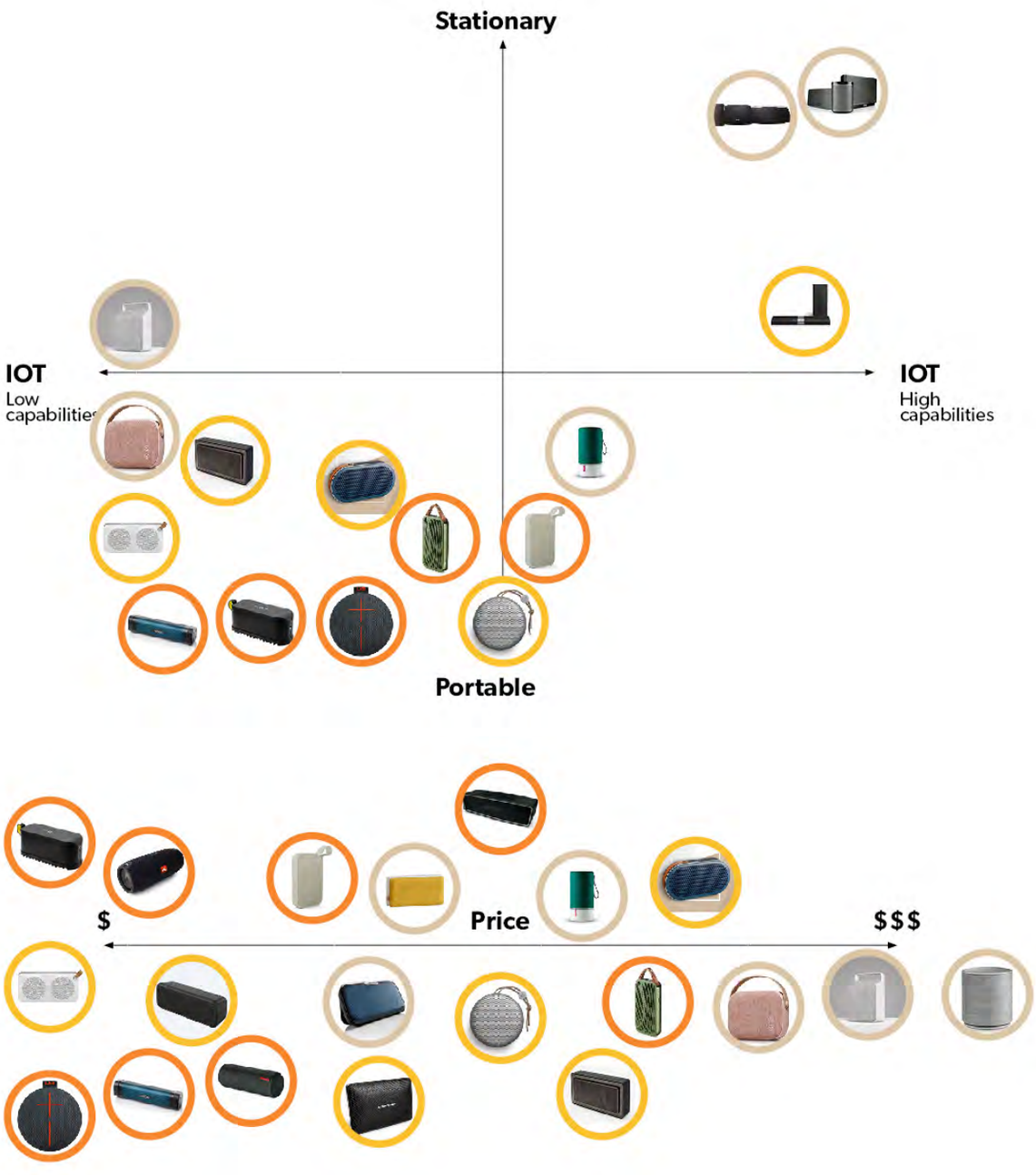
Market Positioning

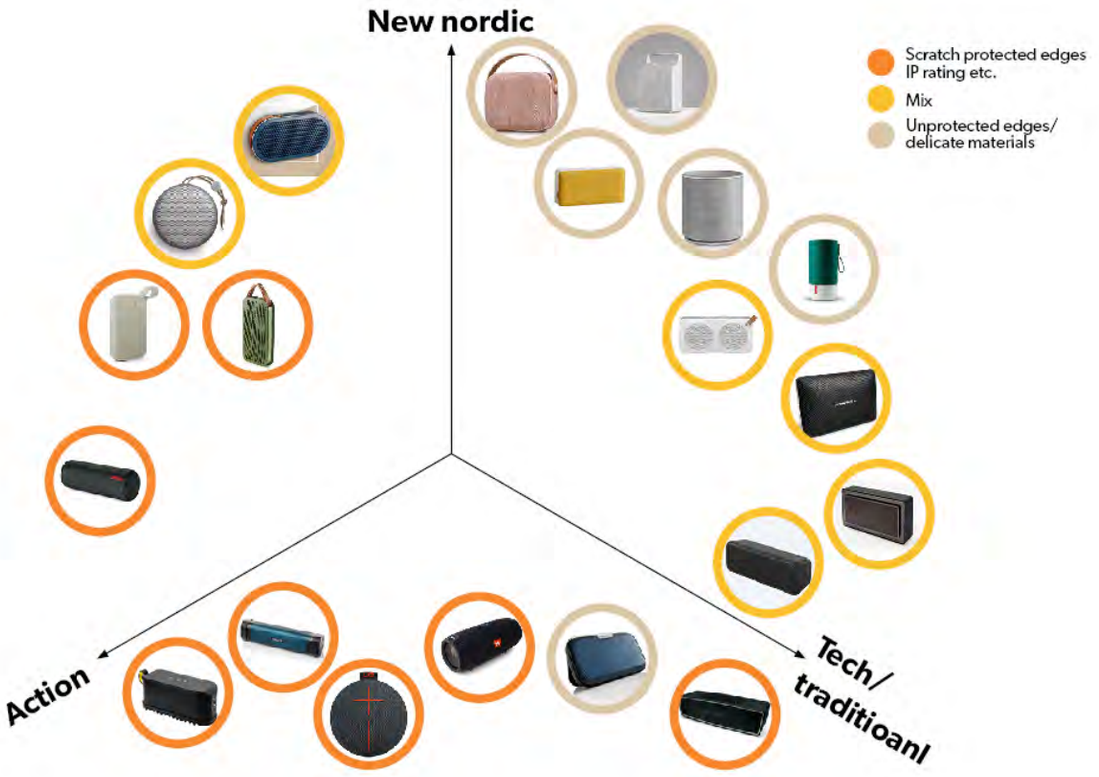
Worksheet no.: 19 Date.: 27-03-2017

Objective

Make a perceptual map of where the new DALI product development should aim for.

Experiment/Data





Evaluation

Reflection

Price & Features comparisson

Worksheet no.: 20 Date.: 20-03-2017

Objective

DALI has an agreement with Hi-Fi Klubben as their exclusive retailer and as such it is know wich product the next DALI product will share shelvespace with. A look a price and features will help pinpoint where the new product development could place itself in the market.

Experiment/Data

1,599 DKK

2,899 DKK

5,199 DKK

1,699 DKK

6,999 DKK

2,448 DKK

5,999 DKK

7,998 DKK

7,499 DKK

Experiment/Data

Evaluation

Reflection

Wireless transfer of Audio and Control

Worksheet no.: 21 Date.: 08-03-2017

Objective

If it is assumed that Bluetooth isn't a valid solution, what other technologies can provide wireless transfer of audio and control and maybe even provide at better user experience.

Experiment/Data

From research into both market trends and competitors products a list of technologies that can transfer audio wirelessly are long but many of them build on the same specifications. The WLAN or Wi-Fi technology to either send and receive data locally or accessing the Internet.

Distinct technologies

FM Radio

DAB

WiSA

Bluetooth

WLAN / Wi-Fi

The interesting thing with WLAN is that not only does it create a local network that your devices can interact within it is almost always connected to the Internet as well. Making all products that are connected to Wi-Fi are Internet connected and enable all the possibilities of the World Wide Web.

Proprietary technologies like AirPlay, Qualcomm AllPlay, Play-Fi and Google Cast are all utilizing the homes WLAN network to operate. Sonos is also reliant on home Ethernet for user input and accessing streaming services, but has a proprietary mesh technology that transfers audio between Sonos speakers.

Focus

Bluetooth isn't providing a good enough experience for users but in a time where almost all music consumption is streamed from the Internet a device connected to the Internet is needed. The Phone is typically this device, even with AirPlay, AllPlay, Play-Fi etc. it is still the Phone that streams the content and then sends it over Wi-Fi to the Wi-Fi connected speaker.

Evaluation

Reflection

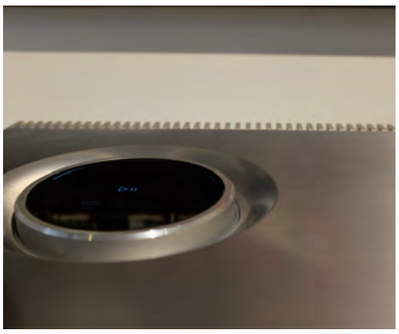
Interaction exploration

Worksheet no.: 22 Date.: 29/03

Objective

Its a shame that speakers often dont invite to interaction, so the objective of this exploration is to look at the brand B&O who does invite into interaction in some of their top shelves product. Observe what their products do, what works, and what doesn't work.

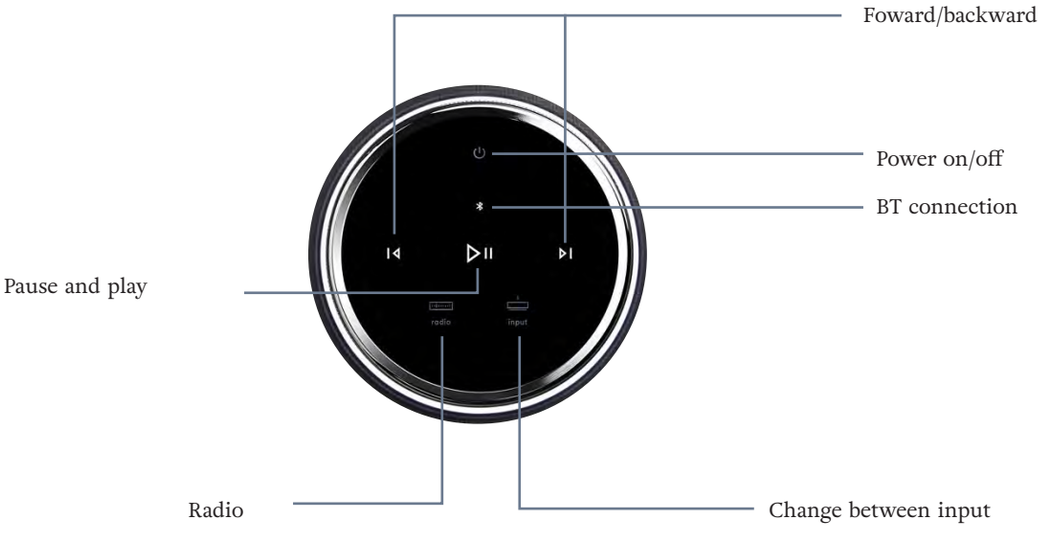
Experiment/Data



Lydspecialisten:

In "lydspecialisten" we saw the Niam speaker which have a luxurus dial interface with a screen in the middle.

The dial was nice on the touch and the interface on the touch screen in the middle were simple. The dial seemed to adjust the volume while the touch screen housed functions such as:



B&O:

B&O have a range of products with atypical interfaces, that seems interesting, and in most of the cases unintuitive (Our perception)

Two of the B&O products had a linear swipe touch interface with a range of commands.

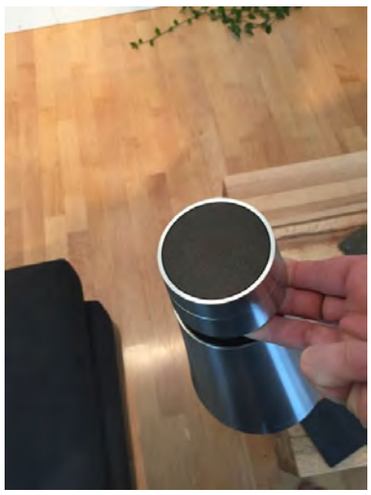
Swipe along to adjust volume. Tap once to pause and play. Tap once in the right and left most area to change songs.

Beosound 1 and 2 have a dial and a touch interface in the middle similar to the naim speaker, but in this case the touch interface is not a screen and therefore the different swiping commands needs to be remembered like the other B&O speakers.

Positive: the speakers somehow recognizes the location of the user, such that swiping right is always next song, no matter the orientation of the speaker.

This speaker is the one Petrea and her friends could not figure out how to connect two despite many attempts with many different devices.

No wonder, the speaker have a + - button for volume, and a B&O button for what we presume is Bluetooth connection.



In visiting the B&O shop we learned that the Beosound 1 is portable and is meant to be lifted as shown in the picture. This was very uncomfortable as the speaker was too heavy to carry with just the fingertips

Evaluation

Interaction in physical ways give the products a nice luxurious feeling, but in many cases the controls were to minimalistic and cryptic to operate beyond volume and play/puase.

Reflection

Loudspeaker 101

Worksheet no.: 23 Date.: 18-03-2017

Objective

Dive into the technical world of loudspeaker construction. To design a new loudspeaker some basic knowledge is needed. This will provide an insight into the technicalities of loudspeakers and what influence each elements has on the sound.

Experiment/Data

Drivers

The drivers are the actual speaker unit that creates the sound based on the electrical input.

Full-range
Full-range drivers, as the name implies, aims to deliver the entire frequency spectrum in one driver. They are often small in order to hit the high frequencies of a normal tweeter, where rapid movement is very important.

Mid-range
A mid-range driver is often designed to deliver sound between 250 Hz and 2000 Hz. This covers the most significant part of the audible sound spectrum, where human voice and most instruments provides sound. Since the human ear is very sensitive to this frequency spectrum, low distortion in the sound reproduction is very noticeable.

Tweeter
The tweeter is designed to produce the high frequencies from around 2,000 Hz to 20,000 Hz. The name is derived from birds who's sound is often high pitched. Tweeter design is often based on a very small and light material that helps it move rapidly, which creates the high frequency. This material is often either cone or dome shaped based on the material used and the application of the tweeter. Another design of tweeter is the ribbon tweeter which DALI is known for using in their high-end products. Ribbon tweeters can provide a very wide horizontal dispersion and is capable of extended frequency response and high acceleration.

The addition of a horn is often seen with tweeters. A horn is a funnel or hopper shaped structure placed in front of the tweeter to control the dispersion and to increase efficiency of the tweeter.

Woofer
The woofer reproduces the low frequencies in the sound spectrum and is very sensitive to the enclosure it is placed in. Woofers in combination with the enclosure can eliminate the need for a mid-range driver if it is combined with a tweeter designed to can work low enough. Furthermore it can eliminate the need for a subwoofer if the woofer can go low enough, often helped by the design of the enclosure.

Subwoofer
A subwoofer delivers the lowest frequencies in the audio spectrum. The subwoofer driver in combination with a specifically designed enclosure is aiming for the frequencies below 200 Hz and can sometimes even below 20 Hz were it is almost inaudible both can be felt by the amount of air the subwoofer moves. Because of these low frequencies subwoofers are very sensitive to unwanted resonances from the enclosure or surroundings.

Coaxial
A coaxial driver combines two or several concentric drivers in one unit. A tweeter or a mid-range driver is placed in front of a woofer. The woofer's low frequency sound is not that sensitive to being obscured by a smaller driver in front of it. This saves a lot of space and coaxial drivers is therefore popular in car audio systems and other places with limited space.

Crossover

The crossover is the electronic filter circuitry that splits up the audio signal into either two or more frequency ranges so that it can be sent to the drivers that are design for each range. A two-way crossover is splitting the audio signal into two frequency ranges typically one for the tweeter and the other for a mid-range or woofer driver. A three-way is splitting it into three ranges.

Passive

A passive crossover splits up the audio signal from the power amplifier after it has amplified the sound. The passive crossover circuitry is commonly placed inside the loudspeaker enclosure and doesn't need additional power to work, hence the name passive.

Active

An active crossover is splitting up the audio signal before it has been amplified by a power amplifier. An active crossover requires the addition of a power amplifier for each output band, meaning that a two-way crossover will need two amplifiers and a three-way, three. With no energy being lost in the passive components of a passive crossover the required output of the power amplifier is considerable reduced.

Digital

Digital crossovers are active crossovers that can be implemented in the DSP chip. They can either use digital approximations of the analog circuits from the passive and active crossovers or FIR filters.

Signal Processing

DSP

The Digital Signal Processor is a high-speed processor or microcomputer that processes a digital signal very fast in order to not introduce delays to the audio/visual experience. The digital signal that is processes can be an encoded .mp3 file that needs to be read and decoded to audio the DAC can convert to analog sound waves that the amplifier can send to the drivers. The DSP is also a filter, that seperates the digital audio stream in left and right channels or high and low band-passes as a crossover. Furthermore it is able to apply an equalizer to the sound like increased treble or bass. It can also control volume and receive input from the user interface.

DAC

A Digital / Analog Converter translates the digital signal of ones and zeroes into a analog signal of electrical waves that make the trancducers of the drivers move.

ADC

An Analog / Digital Converter does the opposite of a DAC, it converts a analog signal to a digital signal that computer can read.

Evaluation

Reflection

USER Journey w. product

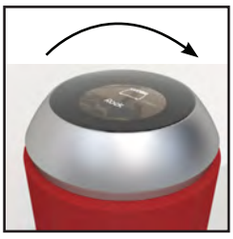
Worksheet no.: 24 Date.: 05-04-2017

Objective

Experiment/Data

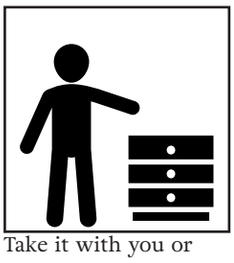
Wake up in the morning

Go to living room



Turn on the speaker

Pick it up and bring it with you



Take it with you or place it somewhere

Finish you morning rutine with music

Turn off the speaker

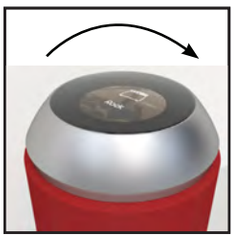
Leave for work/day

Finds the speaker

Activate speaker with touch on touch screen

Swipe right through playlists

Touch screen to select playlist



Turn up the volume

Place the speaker in kitchen

Cook food with music

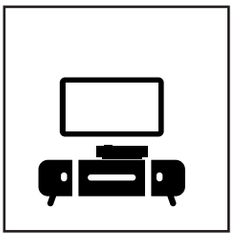
Set the table, including the speaker

Change playlist

Turn the volume down

Eat with music

Place the speaker back in dock



Turn on tv

Enjoy home theatre sound

Turn the TV off, speaker turns off

Evaluation

Reflection

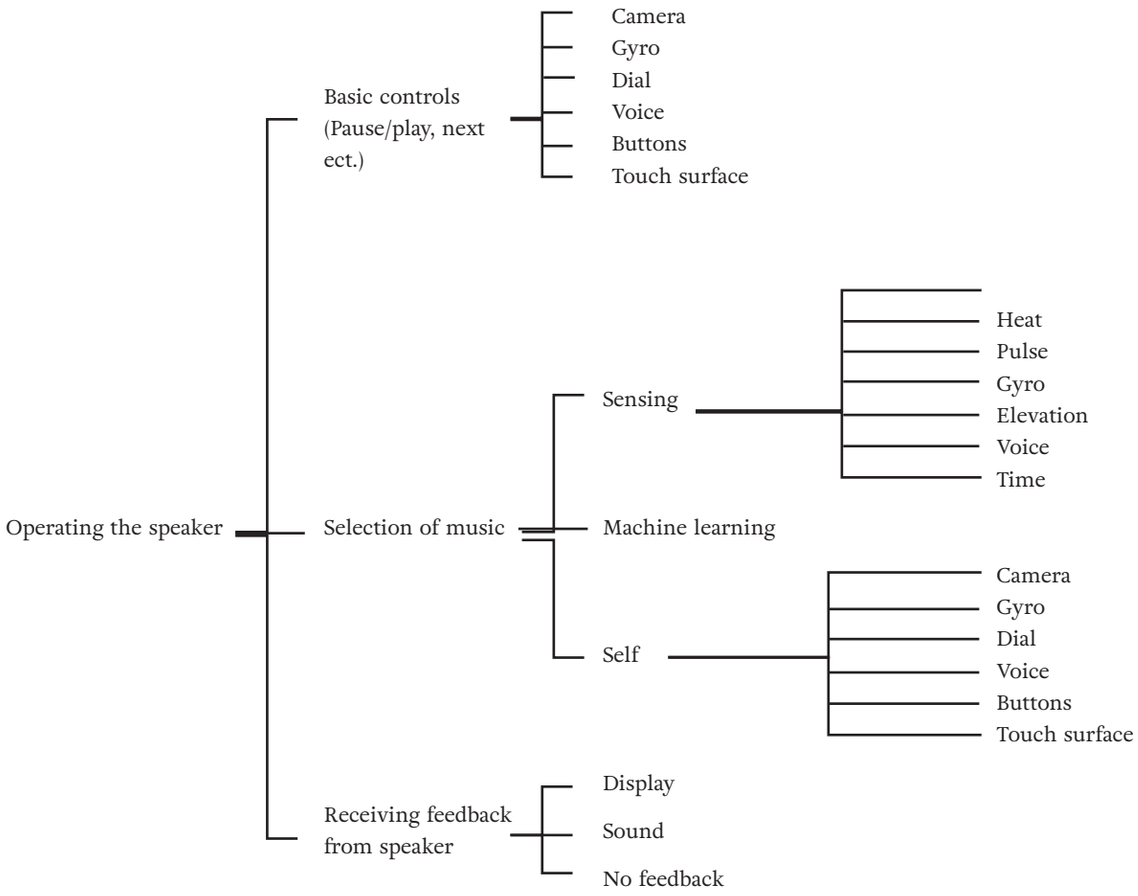
Exploration of physical interaction possibilities

Worksheet no.: 25 Date.: x

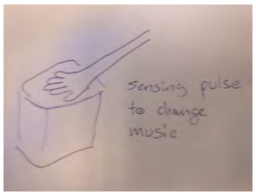
Objective

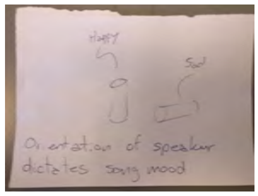
The objective is to explore the solution space for the 'Brain' (Small part of the modular system) in relation to its interaction.

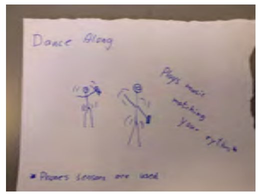
Experiment/Data

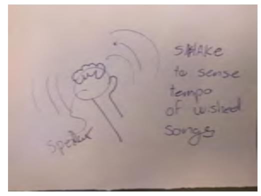


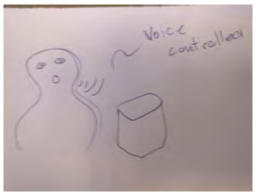

Sing Along

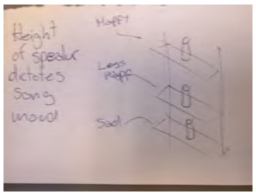

Sensing pulse
to change
music

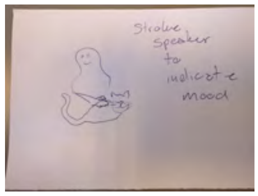

Happy
Sad
Orientation of speaker
dictates song mood

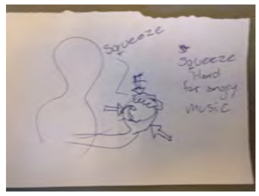

Dance Along

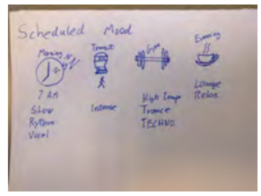

Shake
to sense
tempo
of wished
songs
Speaker

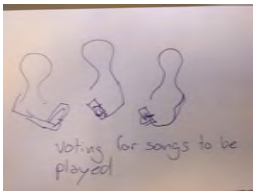

Voice
controlled

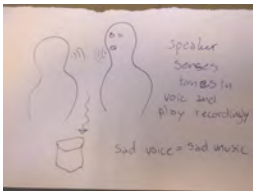

Height
of speaker
dictates
song
mood
Happy
Less
happy
Sad

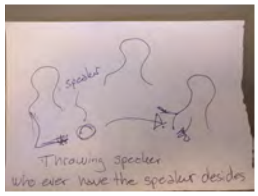

Stroke
speaker
to
indicate
mood

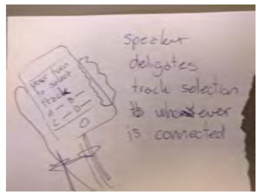

Squeeze
Squeeze
hard
for angry
music

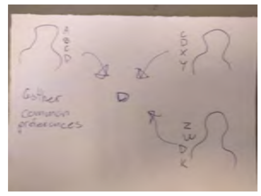

Scheduled Mood

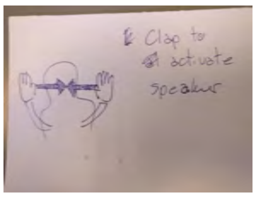

Voting for songs to be
played

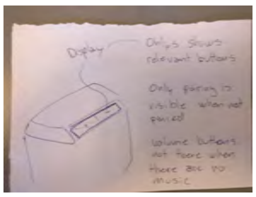

Speaker
senses
tones in
voice and
play accordingly
Sad voice = Sad music


speaker
Throwing speaker
who ever have the speaker decides

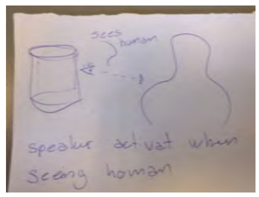

Speaker
deligates
track selection
to whoever
is connected


Gather
common
preferences


Clap to
activate
speaker


Display
Only shows
relevant buttons


No smartphone needed!


Sees
human
speaker activat when
seeing human

	Understandability	Usability	Physical feel
Basic controls: voice controlled Music selection: Sensing voice Feedback: Sound	2	2	0
Basic controls: Dial Music selection: Touch face Feedback: Display	2	1	2
Basic controls: buttons Music selection: machine learning Feedback: none	1	2	1

Function, understandability, usability, Physical feel.
(Donald, emotional design, p. 70)

Evaluation

Reflection

Styleboard

Worksheet no.: 26 Date.: 28-03-2017

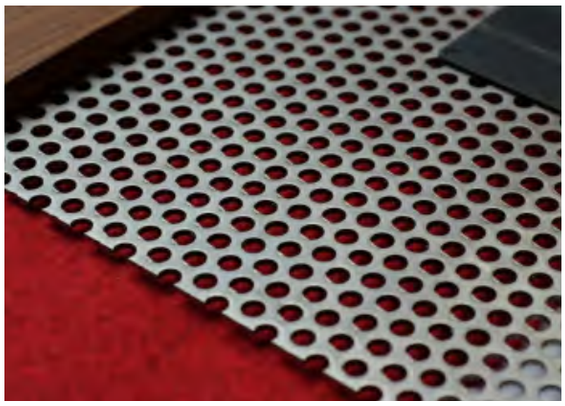
Objective

Search the identity of the product solution, both a visual identitiy coupled with a storytelling aspect connected with the visual identity.

Result in 2-3 directions of style/mood/storytellling that can direct and inspire a future forming of the product.

Experiment/Data

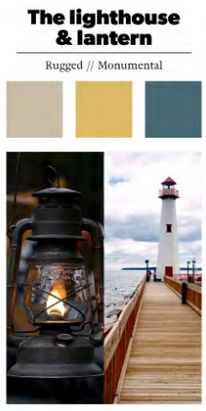
The group took a dive in the material library of the create building and combined different materials while in evolving different storylines based of the material combination or vice versa.

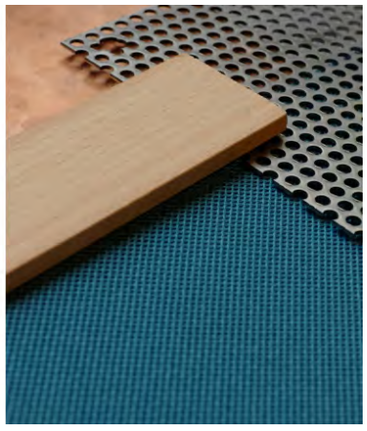


The fireplace and the candle: A story about the atmosphere created when gathering around the fire and enjoying each others company. Likewise the speaker could be center for a time of "hygge" and warmth.

The lighthouse and the lantern is based on the monumental shape of the light house that spreads light far and wide. while the lantern basically do the same but in a different scale.

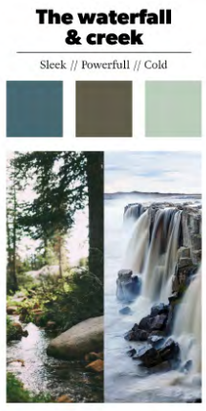
The product in this story should be monumental, a centerpiece of attention.

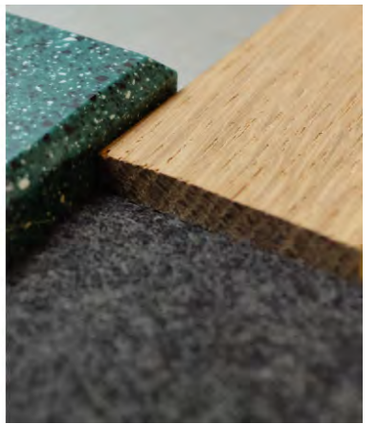




The waterfall and the creek is more abstract than the first two as this isn't based on objects per say but rather on an experience.

The story is about the small calm creek delivering a small relaxing experience, and in contrast we have the big thundering waterfall, that delivers a dramatic yet beautiful experience. Its also a story about the small and fragile vs. the big and rustic.





Evaluation

The result is three storylines each with a different feel.

The process was free and playful, and it was aperrant that the quality of the work rapidly increased over time.

Reflection

The storylines is not based on the personas and might lack a connection with their needs.

The pictures might help with the forming of the product, but a danger could be to obvious form references to the products mentioned in the stories.

MODULAR Concept

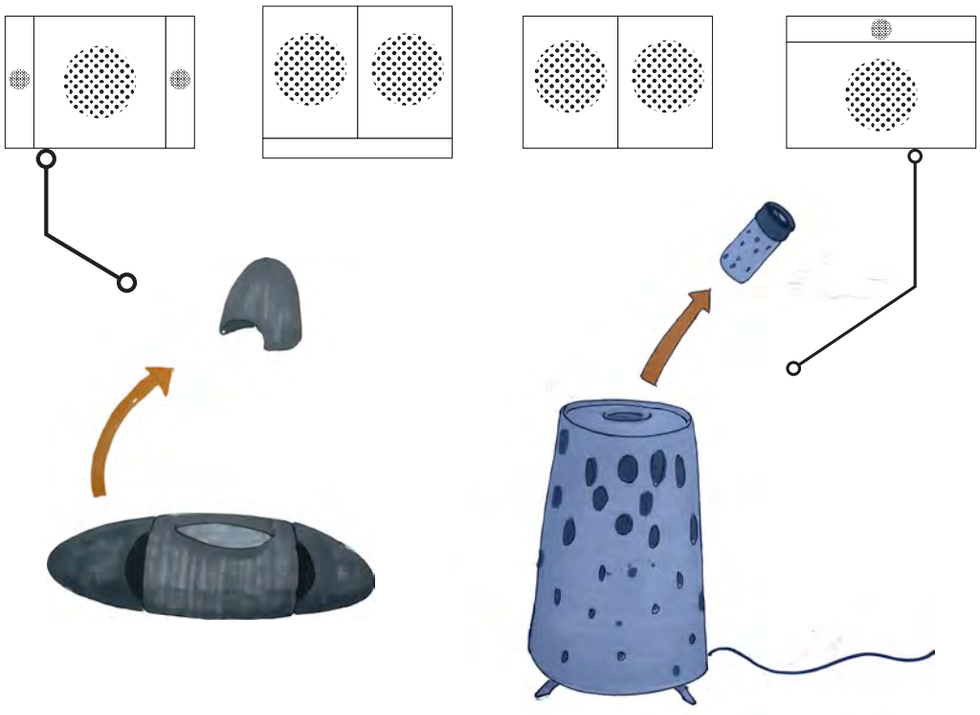
Worksheet no.: 27 Date.: 27-03-2017

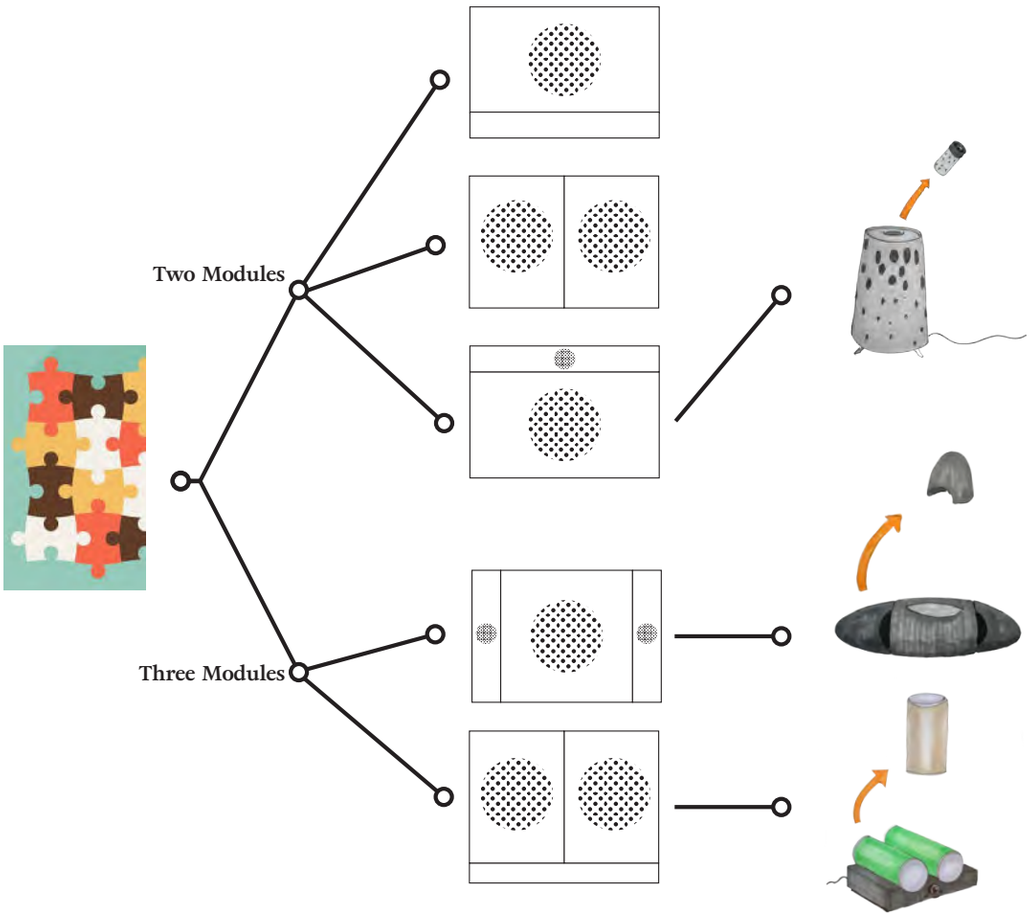
Objective

Expand on the solution space within the modular speaker in order to hone in on few variations while reflecting on these variations fit in the user scenario and the value they each aspire to give.

Using classification tree (See Ulrich 132)

Experiment/Data





Evaluation

Reflection

Bathroom/Kitchen space

Worksheet no.: 28 Date.: 06-04-2017

Objective

As the product solution should operate both in the kitchen and bathroom among multiple location theres a need for uncovering the space available for a solution in such locations. Since the kitchen and the bathroom are the smallest rooms in the house, these two are selected for this space test.

The output of this test should be measurements of shelving space, or similar.

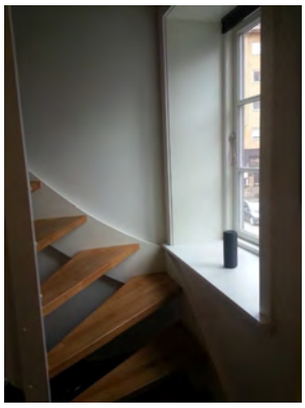
Experiment/Data

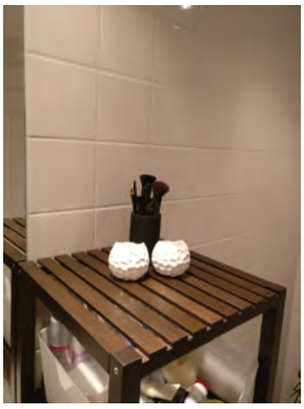
The procedure for collecting data for this test is as follows:

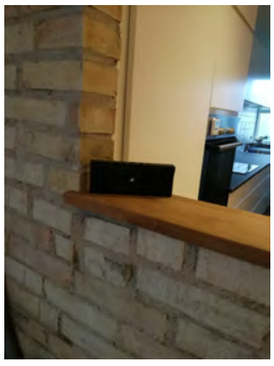
Request target group to take a picture of their kitchen and bathroom (An overall picture). Take a picture of a area in the room, which is best suitable for placement of a speaker (Prefereably with a ruler in the picture). Measure out the area and note it down.

The costudents on Industrial Design was asked to take pictures of where they normaly place their Bluetooth speaker if they have one. A lot of pictures and thought on why they placed it where they did was received. In summary most people choose a central location, so that the music is heard in most places of their appartments.

Compared to the user behavior in Chapter 2, this further highlights the need for a versatile solution that can support most at home scenarios.







Evaluation

Reflection

Weight/Grip Test

Worksheet no.: 29 Date.: 14-04

Objective

Objective of this test is to uncover the implications of different handle types.

Going into this test it is known that the speaker would weigh around the 3 kilo, and that the canter of mass would be concentrated around the bottom of the speaker.

Experiment/Data

The finger grip

Finger grip

Comfortable

Finger grip + 1,5 k

Not getting uncomfertable

Finger grip + 3 k

You can feel the weight in the fingers now, but its still not uncomfortable

Open grip

Open grip vertical + 1,5 k

Its okay comfortable, but the angle feels unnatural. Feels a somewhat heavy

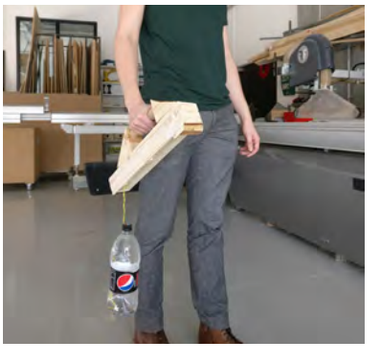
Open grip horizontal + 1,5 k

There is a lot of strain on the wrist as you try to battle the center of gravity.

Open grip vertical + 3 k

This feels vey heavy. Afraid of loosing it.

Closed grip



Closed grip + 1,5 k

Got a firm grip, but you still have to fight the center of gravity

Closed grip + 1,5 k

Same as last, the more you try to battle the center of gravity the more you have to strain your wrist

Closed grip + 3 k

Your dont feel like youre going to loose it, but you defenetly do not want to fight the center of gravity.

Finger grip extended

Finger grip extended

Nice to get more space for the fingers, feels like you can carry more.

Finger grip extended

It feels similar to the first finger grip but more comfortable that you can use more joints of your fingers

Evaluation

If the open grip is choosen its very important that the weigth is kept below 1,5 k.

If the weight are above 1,5 the finger grip or closed grip is the way to go. An important note is that in our test the fingergrip were the most comfortable as you did not have to fight againt the center of gravity, which you had to in our closed grip model.

Reflection

Simple as the test setups were it clearcly showed us a principle important for creating a comfortable grip solution.

The axis of the handle should be perpendicular to the center of gravity such that the object would rotate along the axis of the handle in order to create a vertical relationsship between the handle and the center of gravity.

Drive and sound design with DALI

Worksheet no.: 30 Date.: 12-04-2017

Objective

A meeting with Design Manager Mads Ullits at DALI and input from Innovate Director Kim Kristensen, should help gain insight into the sound design of the DALI KATCH as well as some of the pros and cons of the internal construction and placement of drivers in the proposed design.

Experiment/Data

Smaller single device speakers can¨t create the same Stereo image or soundstage that a setup of two speakers can, like a normal stereo setup with an amp. Almost all music is recorded and mastered in a stereo mix, meaning that they have 2 Channels of audio streams. Often called left and right, like the typical placement of speakers.

In a single device it is possible to play both channels, like a stereo setup, given that there are enough drivers in the speaker. Typically you will need covering of the entire frequency spectrum for both channels. A individual device will have a hard time creating the stereo image/soundstage since both channels are played by the same device and from the same location. If a device doesn't have enough drivers to enable playback of two seperate channels it is possible to either drop one channel entirely and only play one of the two, or downmix the stereo mix to a mono mix consisting of only one channel of audio.

Looking at the DALI KATCH, it handles the question of stereo staging, it doesn't downmix, but plays both channels by two pairs of tweeter and bass-midrange drivers. The KATCH is developed to provide a sphere of sound coming from the device and not intented

Stereo

Smaller single device speakers can¨t create the same Stereo image or soundstage that a setup of two speakers can. Almost all music is recorded and mastered in a stereo mix, meaning that they have two channels with separate audio streams. Often called left and right, like the typical placement of speakers and the placement of a humans ears.

In a single device it is possible to play both channels, like a stereo setup, given that there are enough drivers in the speaker. Typically you will need covering of the entire frequency spectrum for both channels. A individual device will have a hard time creating the stereo image/soundstage since both channels are played by the same device and from the same location. If a device doesn't have enough drivers to enable playback of two separate channels it is possible to either drop one channel entirely and only play one of the two, or downmix the stereo mix to a mono mix consisting of only one channel of audio.

DALI KATCH

Looking at how the KATCH handles the question of stereo staging, it plays both channels by two pairs of tweeter and bass-midrange drivers. The KATCH is developed to provide a sphere of sound coming from the device and not intended to give the listener the perception of a stereo image. Furthermore the two audio channels are combined with a set of drivers in each end of the device and not on each side.

User perception

The objective of this test is to understand the users perception of sound direction and soundstage. The hypothesis is that although speakers like the KATCH plays stereo, with right and left channel in opposite directions, the users place the speakers facing them, resulting in users primarily receives the right channel (or left).

With the Solemate speaker as test object, ask target group how they would place the speaker in relation to themselves.

The Solemate speaker only have drivers on one side and a bass radiator on the opposite facing side, effectively only making it play in one direction despite its symmetry suggesting it playing in two opposite directions.

Kenneth

Kenneth places the speaker facing him on the top of the shelving unit.

He decides the orientation based on the text on top of the speaker, which is readable from his position. In addition he places the speaker the right side up, as he states "The buttons should face upwards".

Ida

Ida start placing the speaker inside the shelving unit as this would be the place she would store it when not playing. When playing Ida wants the speaker on top of the shelving unit, when placing it she peaks at the tiny holes in the grid and spots that theres only speakers on one side, this dictates her to place the speakers facing her.

Andreas

Andreas assumes that it plays sound in both directions because of the mesh grill. So he would never place it against something and always with a good distance from a wall. Then he would face it towards the direction where he would be located. He would never use the strap.

Evaluation

All test persons acknowledge the two speaker faces and naturally places one facing the room. Only half of the persons were aware that only one side of the speaker contained drivers. Users prioritize the speakers facing them and didn't care about stereo imaging but preffered a wide dispersion of the sound to cover more use cases.

Reflection

Screen placement & Interaction

Worksheet no.: 31 Date.: 06-04-2017

Objective

In order to design a new interface on the speaker it is necessary to understand how the users interact and perceive different placement of the screen and control dials/knobs.

Experiment/Data

Interview and observe as well as act it out and bodystorming with the users with 1:1 models. Observe the users approach to screen placement and orientation when interaction with a speaker. Compare Touch screen only interface with touchscreen + physical volume knob/dial.

Andreas, 24 years old, engineering student.

IT op - Vil irritere mig, da jeg sætte den og går væk. Vil gerne kunne se skærmen, fra afstand. Se ny sang fra playlist, se hvor langt der er tilbage af sang. - Den fjerne jeg direkte.

Skrå - Den har en rimeligt vild vinkel, afhængigt af skærm/glas, så frygter jeg for genskin. Men ellers kan je

Lettere at komme til, men interface vs. IT front, ville ikke irriterer mig. Hvis det er touchskærm, så er orienterende god.

IT front - Jeg kan bedst lide den her, den kan jeg se. Jeg er ikke bange for sol og genskin. Vægten har stor betydning for om jeg kan lide at trække ind på frontet. Hvis fysiske knapper, så er den her bedst.

I hånden.

IT Op - Man griber den ikke rigtigt, for at anvende top interfacet. - Fungere ikke.

Skrå - Den her er jo sådan set behagelig at holde, som sådan. Men man griber den som en GameBoy, og så lang tid gider jeg ikek bruge den. Hellere anvend og placer.

IT Front - Anvende den hurtigt og så sætte den. Den her størrelse kan man sagtens tippe den.

Fysisk Dial

Det virker hurtigere at justere noget, jeg kan hurtigere lige skrue ned/op. Minder mig om en normal forstærker, man er ikke klar over om det skal op på fem istedet for tre. Så en dial er bedre, da man har mere følelse med “lyden”.

Dial afkoblet fra skærmen giver mest mening. Måske en skub ud skærm, så man kan vende den i alle retninger.

Jesper, 25 years old, engineering student.

Retning og orientering

Skrå - Jeg kan bedst lide den her. Fordi den (front) skal jeg holde et andet sted på den.

Top - jeg har ikke så let ved at se den.

I hånden

Top - Den bliver tohånds, for det er ikke sådan lige til at betjene interface med den hånd man bærer.

Front - Her kan jeg betjene interfacet og bære den med en hånd.

Skrå - Den her kan jeg bedst lide, det er lettere at holde omkring den. Og jeg kan betjene interfacet. Den har en bedre vinkel i forhold til mit håndled.

Dial

Skrå - Det er stadig den skrå jeg bedst kan lide. Dial er en fin måde at give en tredje input. Nem adgang til volumen.

Front - Her fungere dial også godt.

Det er bedst at der er et sted jeg interagere med produktet. Hvis det skal være adskilt kan jeg bedst lide at have skærm på toppen og dial på siden.

Enhånd og dial fungere ikke rigtigt, pga af størrelsen på højtaleren. Det er svært med den her størrelse at kunne bruge både Dial og skærmen.

Dial på siden af den skrå. Jeg kan lettere interagere med begge dele på samme tid.

Kenneth

Skrå - Skærmen kigger på en, hvilket er godt.
Front - Super træls orientering af skærm
Top - Klikker nedad på den hvilket giver mening når bordet er i modsat ende.

I hånden
Skrå - giver god mening

Dial

Dial er godt, giver mere kontrol, bedre end knapper, skal man ikke tage stilling til hvor meget man skruer op, skal bare dreje.

Front - god mening
Top - Nemmere end front placering
Skrå - Bedste orientering af dial. bedre når den skrå flade er højt oppe.

Ida

Orientering:
Skrå - God på afstand og under interaction
Front - Kan ikke se hvad den spiller, god når man står og kontrollerer den.
Top- Skal enten tippe den eller side i huk når man skal interagerer.

I hånden:
Skrå- underlig i hånden

Dial:
Knap er naturlig i forhold til skærm. Intuitivt, folk kender til sammenhæng mellem dail og volume.

Evaluation

When having a display on the speaker, it seems logical (to the test persons) that the screen can display the songs being played and see it from a distance.

Dial is intuitive to the test persons, and they all like it better than only touch screens.
A dial have an gradual increase in volume compared to the steps of button controlled volume.

Reflection

Level of music control

Worksheet no.: 32 Date.: 06-04-2017

Objective

Users complain that the level of control on current speakers isn't intuitive and not enough. With the increase in interaction with the speaker that BK Design aims for in the new product development, further understanding of how users wants to interact with speakers and what level of control they need in different use cases.

Experiment/Data

Interview users about their need for controls and in what scenarios they need which kind of control.

Andreas, 24 years old, engineering student.

Musik om morgenen

Spotify top 50, trending. På min lille BlueTooth speaker på badeværelset BitsWolf/BeatsWulf.

Lagt mobilen uden for badeværelset, da jeg ikke vil have vandskader eller damp for telefonen.

Jeg acceptere hvad der kommer, skifter ikke sang.

Hjem

Ofte bare top playlister.

Vælge ofte sang igennem playlister, søger meget sjældent. Skriver ikke ind for at søge, vælger sang gennem playlist.

Jesper, 25 years old, engineering student.

Musik vaner

Morgen

To måder, enten har jeg mit anlæg. (Min radio virker ikke). Jeg har nogle CD'er på mit anlæg og så kører den i en halv time før den stopper igen. Wake-Up indstilling.

Hjem

Nogle gange tænder jeg bare min computer og høre musik på den. Andre gange er det anlægget med CD, shuffle på cd.

På PC, store playlister, alt det musik jeg har. Eller på Spotify med 1000 sange hver. Men det crasher playlisten. Ellers radio eller discover på Spotify. Sjældent jeg vælger selv. Primært type/genre af musik.

Kenneth, xx years old, engineering student.

Morning

Uses his UE Boom, listening to radio, interact through his phone only use the UE Boom to adjust volume. Uses the tap function of the UE Boom when in shower.

Evening / when home

Listens to own playlists and radio, still interact through phone. Moves his UE boom a lot around with him in his house

Specific song selections happen rarely

Ida, xx years old, engineering student.

Ida would like the product to have the play/next song....basic functions.
Would like to be able to see and select playlists. She states she wants to search for songs, and then goes on to say she rarely does so herself.
She rarely chooses songs herself.

Morning
Radio

Evening / when home
Podcast and "lydbøger" when cleaning doing stuff. She uses her small UE Boom for this, as the big hifi setup is to comprehensive and she can carry the small one around with her.

Other:
Her UE Boom have bad feedback and "hard" buttons. She only places it on its head when charging it.
She recently got a new phone which does not connect automatically with her UE Boom. Dont know about the "tap" function of her UE Boom.

Evaluation

Playlist/radio in allmost all scenarios. Song searching happens primarily in social gatherings.

Song selection even happens by looking through chosen playlists.

They use volume buttons and play/next buttons. Kenneth uses "next song" function when showering if the song is terrible.

Reflection

4 persons is a stretch when deciding on interaction capabilities. But the 4 persons confirmed our own hypothesis and each other by stating the same needs.

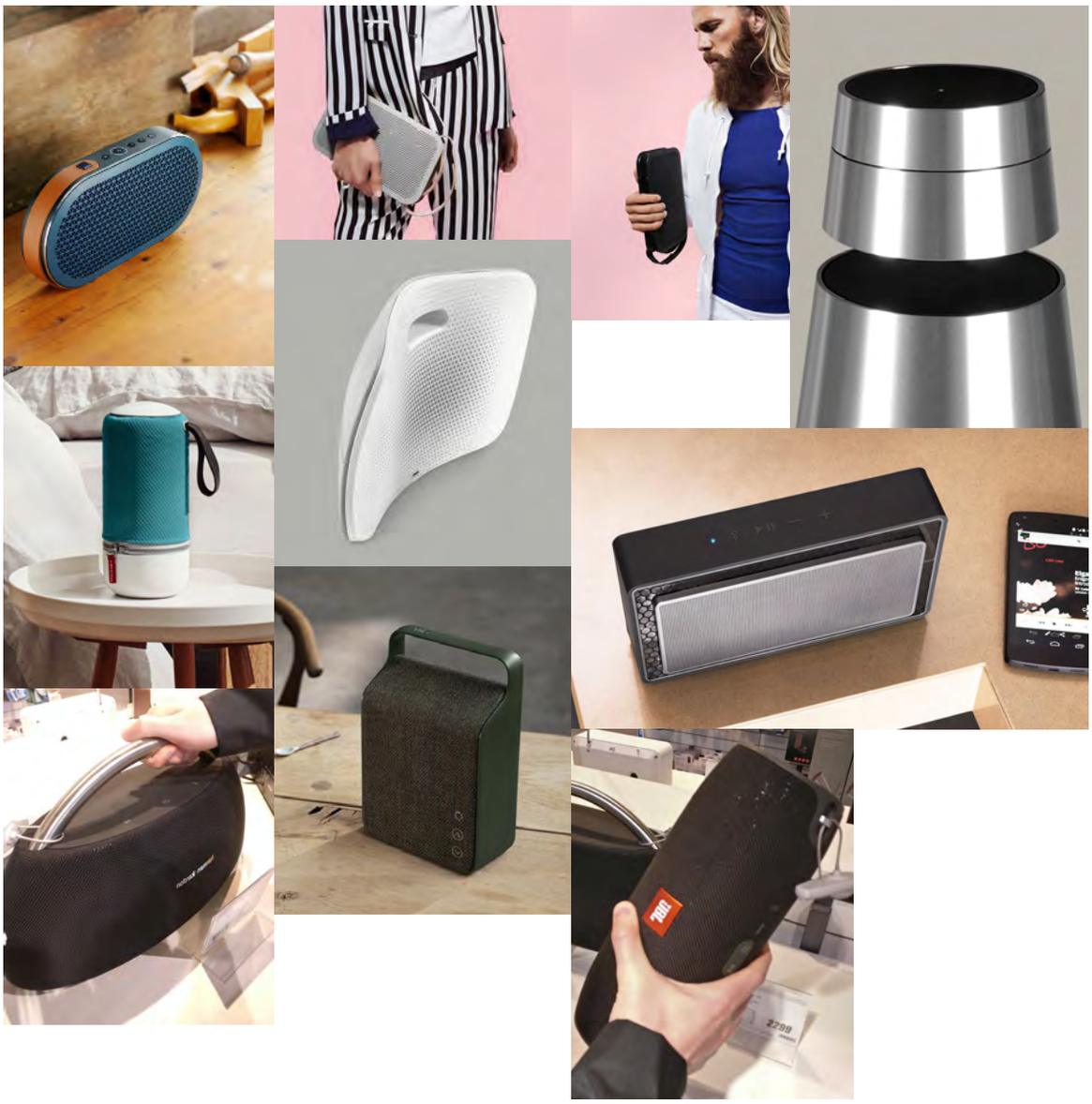
Affordance

Worksheet no.: 33 Date.: 24-04-2017

Objective

Draw inspiration from other products and their perceived affordance with basis in Donald Normans definition. Explore how other products give the preceived affordance of a portablility.

Experiment/Data



Donald Norman used the term perceived affordance to describe the possible actions that a user perceives when presented with a product, in his book The Design of Everyday Things. A term then widely adopted by interaction designers and human-computer interface fields.

Designing products that the users will understand and use succesfully require the designers to communicate, through the product, their conceptual model. The users mental model of the product will have to match the designers cenceptual model in order for the user to understand what the designers though when designing the products use case. (Norman, 2013)

The DALI TOUCH being a product that should be moved around the home even though it is rather big is important to invite the user to carry it. It is also important the users are invited to touch and interact with the speaker physically, something that isn't normal around high-end DALI loudspeakers, and in the case of the DALI TOUCH engage with the Dial to change playlist and volume. This will be explored in the following chapter where a dive into knobs, dials and buttons will give insight to what stories they can tell.

Smaller sized portable speakers like the BeoPlay A2, DALI KATCH and Libratone Zipp Mini have added a leather strap to show and invite the users to pick it up and bring it with them. Even though they are small enough to be grabbed around the product the leather strap tells the signal of portability.

Looking at bigger portable speakers, like the Beosound 1, Harman Kardon Go+ Play and Vifa Oslo, it becomes apparent that they have concluded similar to the weight/carry test in Phase 2, that the center of mass and top placed handle gives a pleasant experience. The Harman Kardon and Vifa uses a somewhat similar approach by adding a big clear handle to the top of the devices, one as a part of the overall frame and the other as a structural add-on to the speaker below. Whereas the Beosound 1 simply hides the handle entirely in the "floating" top, but removes the invite to carry it around entirely. Even with supervision from a salesperson it was still very uncomfortable to carry the Beosound 1 in two fingers so close to the tweeter membrane.

Evaluation

Reflection

BLOK Diagram and considerations

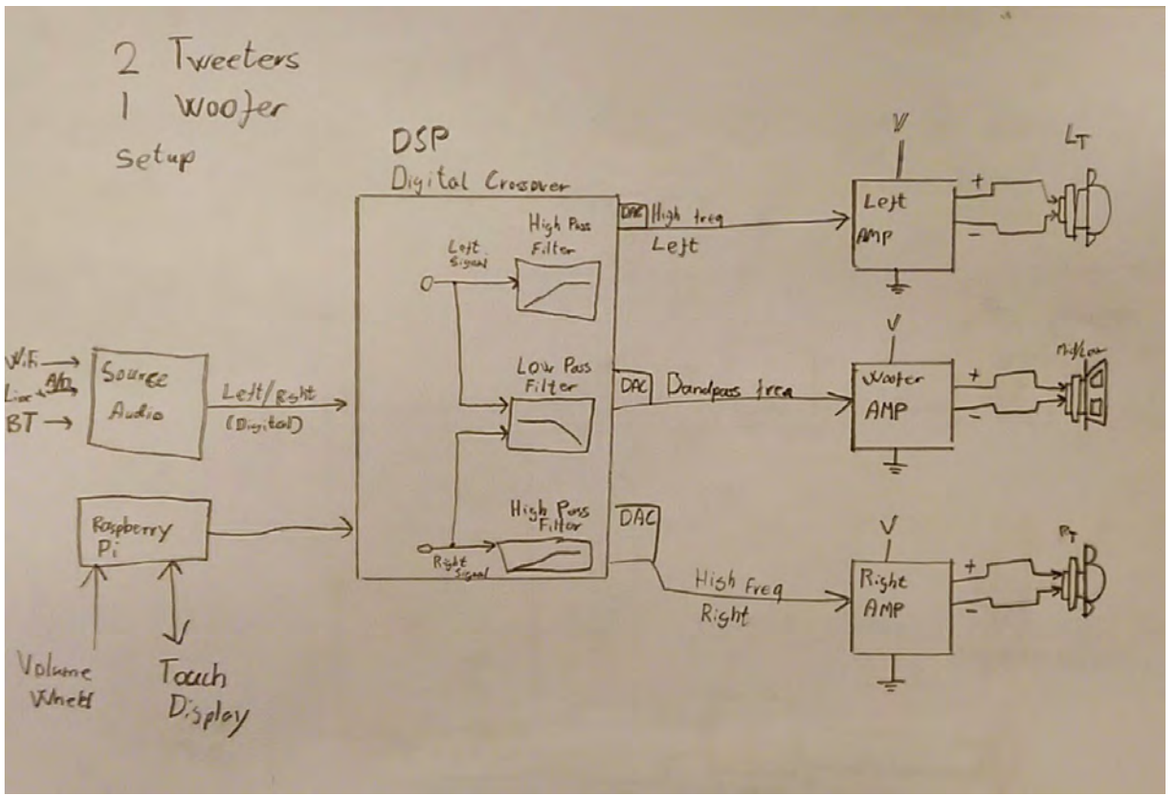
Worksheet no.: 34 Date.: 16-04-2017

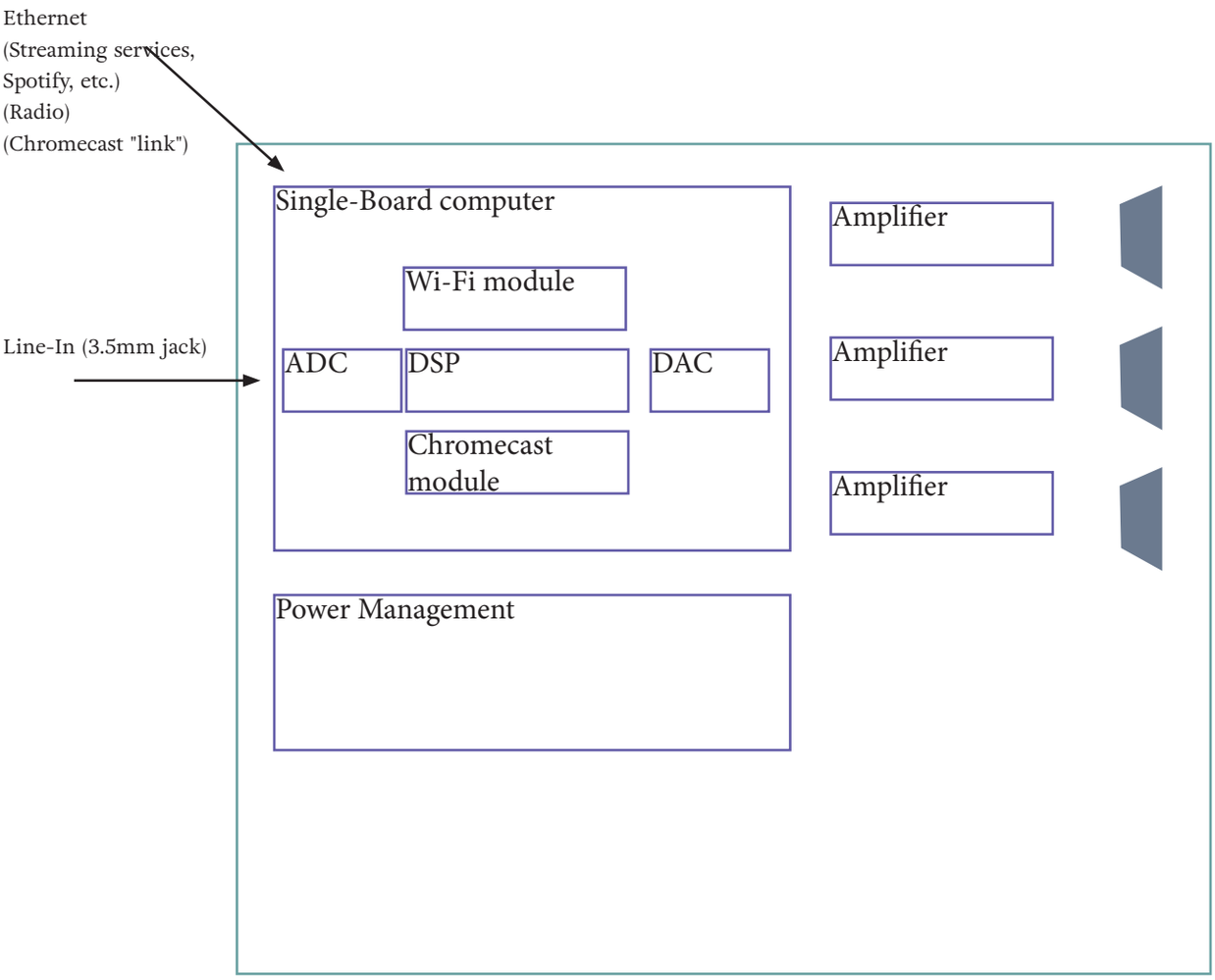
Objective

Experiment/Data

Digial crossover and DSP - https://www.minidsp.com/applications/digital-crossovers/digital-crossover-basics

Stereo AMP - https://www.adafruit.com/product/1752





Evaluation

Reflection

Color, Music, Emotion

Worksheet no.: 35 Date.: x

Objective

Experiment/Data

A study combining color and music through emotions highlights that stimuli through visual colors and music connects to the same underlying emotions. Predefined "Happy" and "Sad" songs were played to the test subjects and they matched the happy songs with brighter and warmer colors and the sad with cooler and darker colors. (Barbiere, Vidal and Zellner, 2007)

A more recent study by researchers from University of Califonia, Berkerley, has expanded upon the study into music-color association through emotions. Where the test audience where to listen to a piece of music and then point a two to three colors on a palete of 37 different colors. The results was similar to the previous study, but the test subjects this time was from different cultural backgrounds and countries. The researhers went on to ask the test subjects to put emotions on songs and colors independantly and then compared the results. It "almost perfectly aligned" with their prediction and previous experiment, that bright, vivid, warm colors were matched with happy. up-beat/energetic music while cooler, darker colors like were matched with slower more relaxed or sad music (Palmer et al., 2013)

Evaluation

Reflection

Indexing Playlist

Worksheet no.: 36 Date.: 01-05-2017

Objective

Index the Playlist of Spotify into search words for the ColorWheel Playlist Selector.

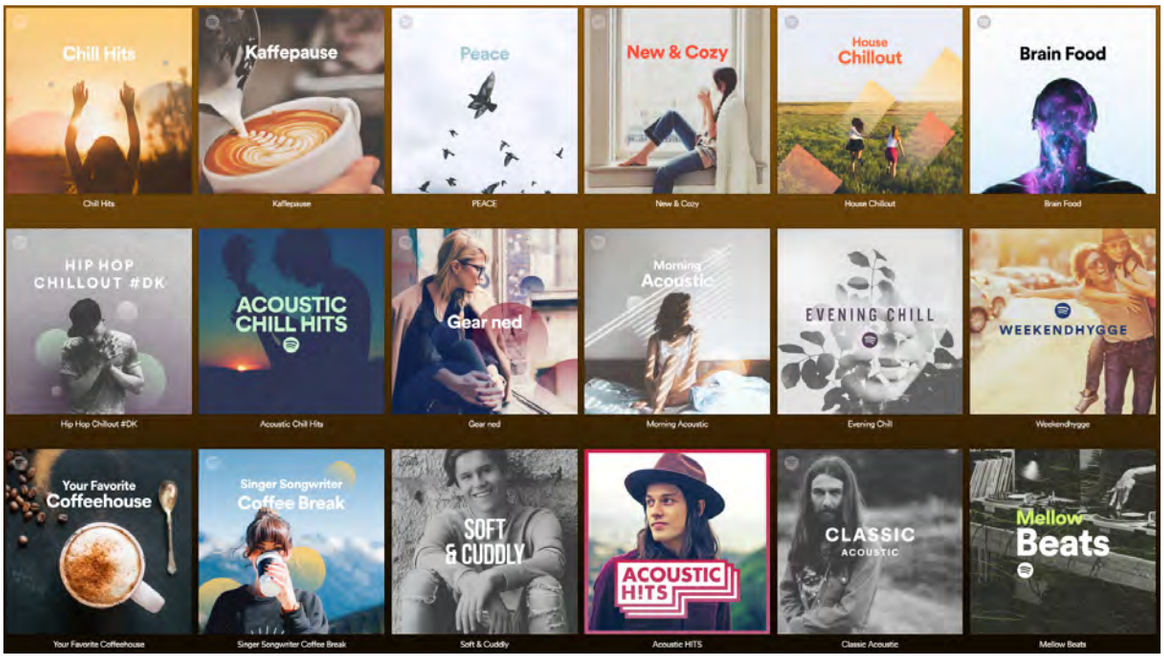
- Locate patterns and words that can be matched with moods for the Color Wheel.

Experiment/Data

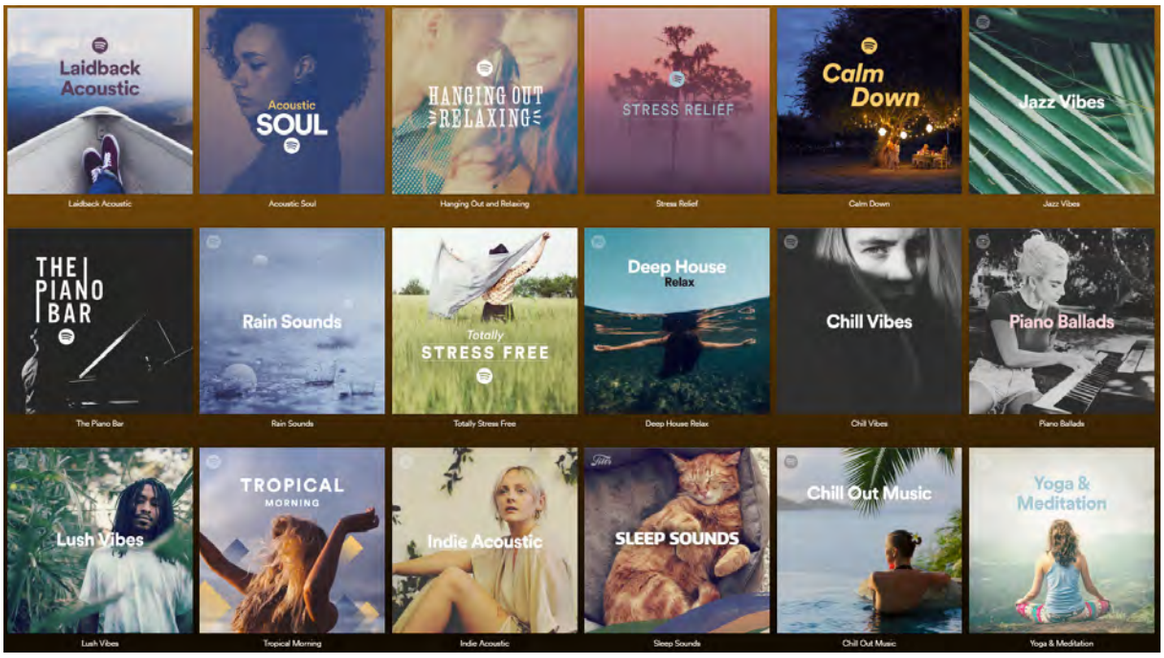
With inspiration from the Color,Music, Emotion research, a bunch of screenshots of the top playlists on Spotify was analized. Each combining Mood with a color and then index the Playlists into each color based on search words.

Evaluation

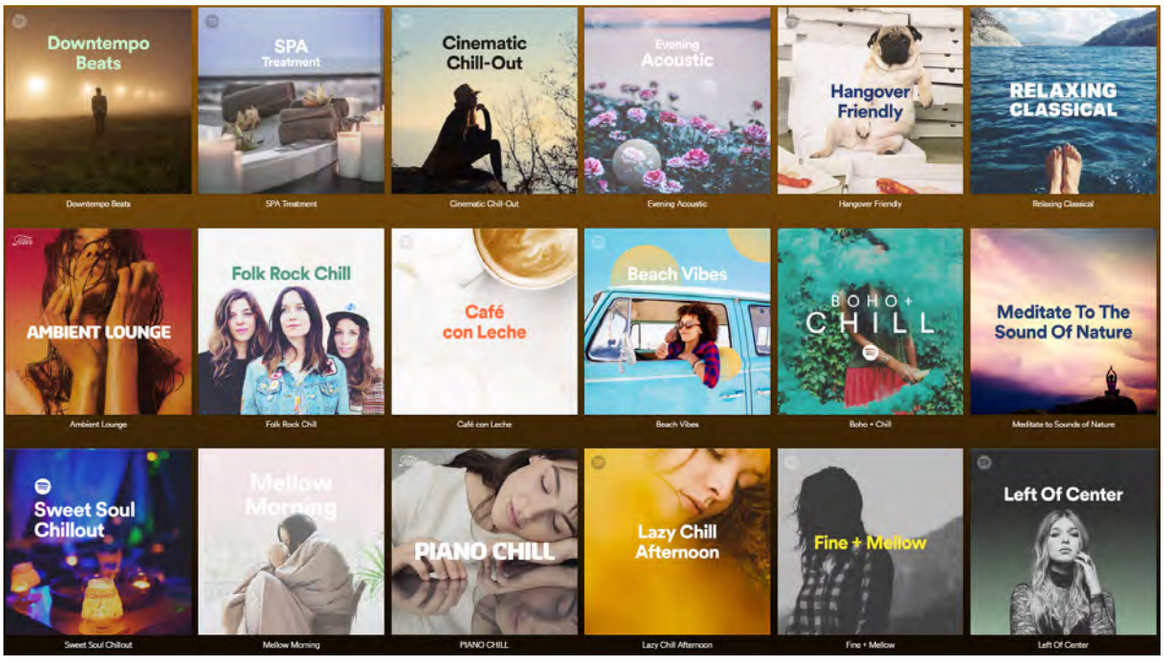
Locating search words that match both playlists and color associated emotions proved to be very hard. The end result is a color wheel filled with words that might as well be placed somewhere else along the wheel, making the hole task very subjective and personal to the individual making the list.



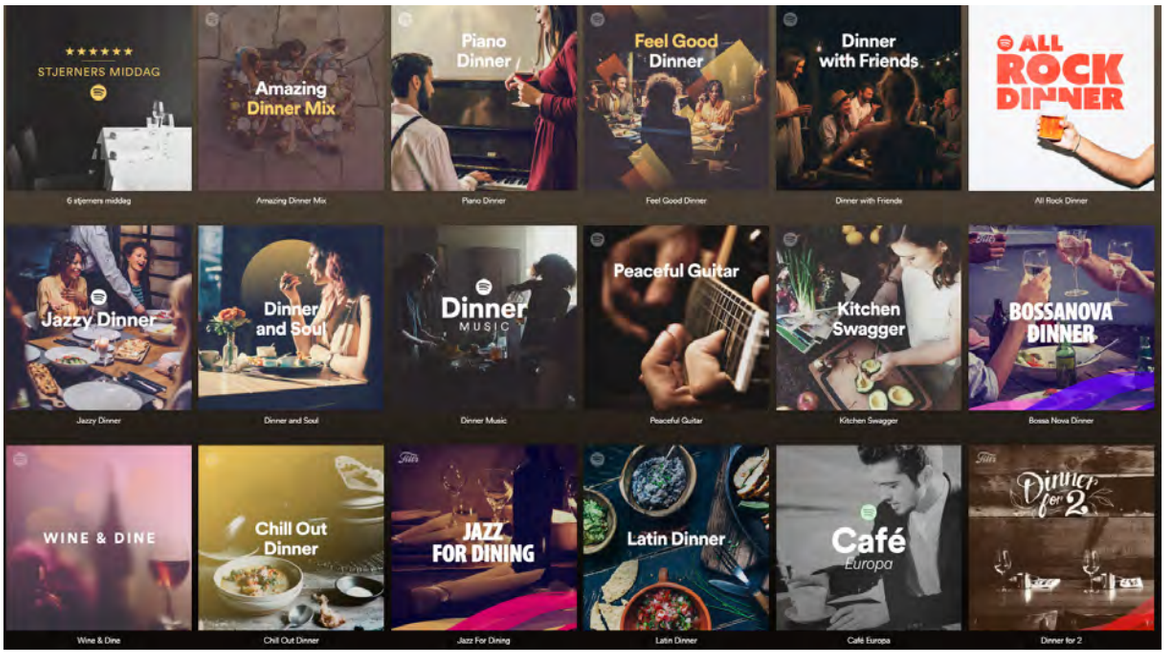
Chill 1



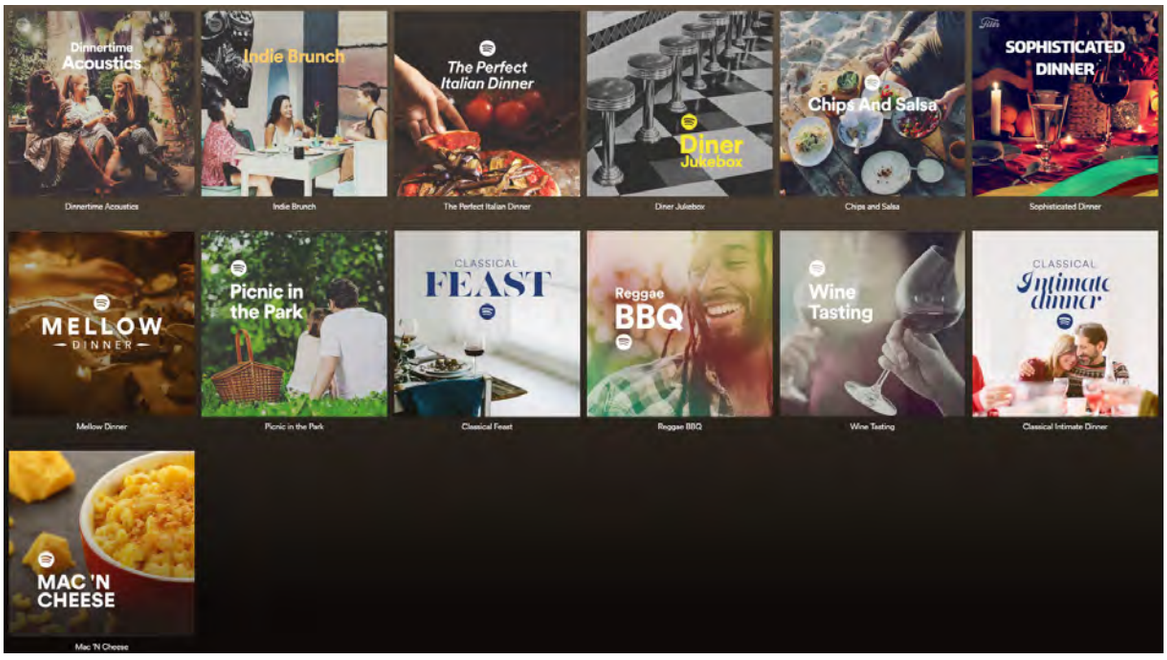
Chill 2



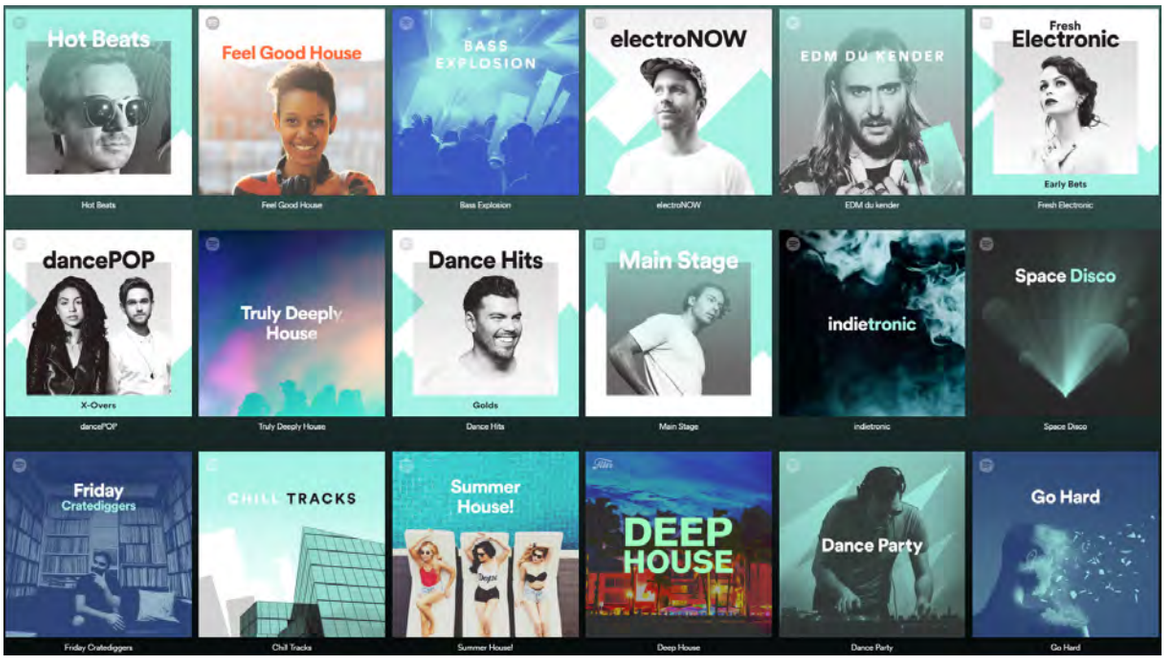
Chill 3



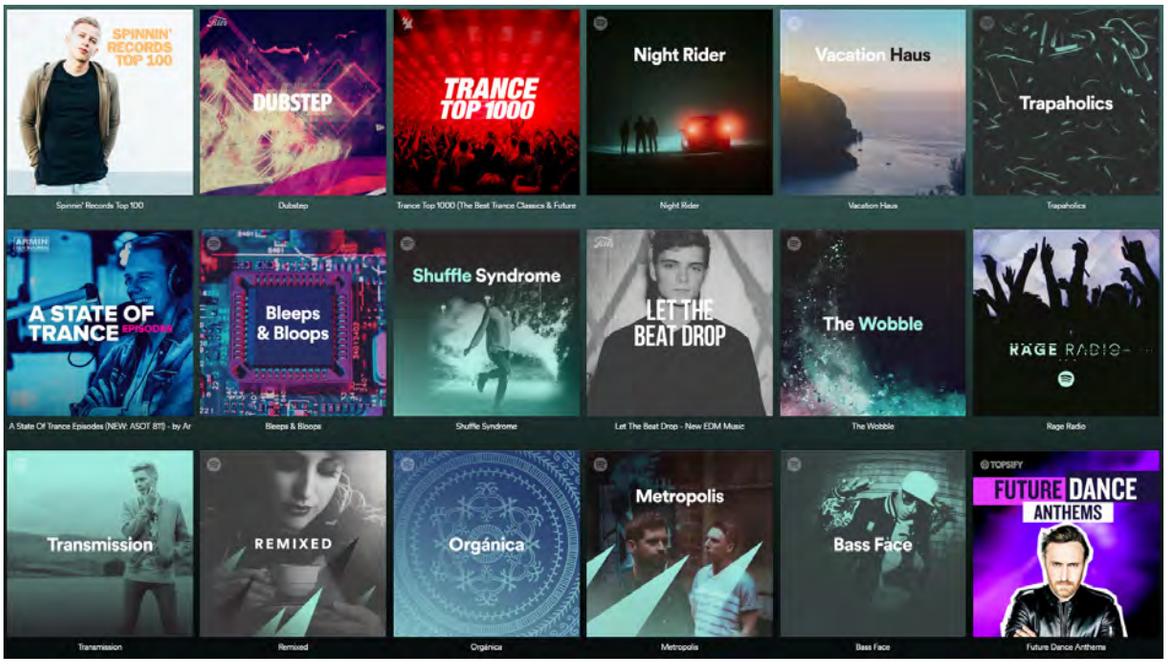
Dinner



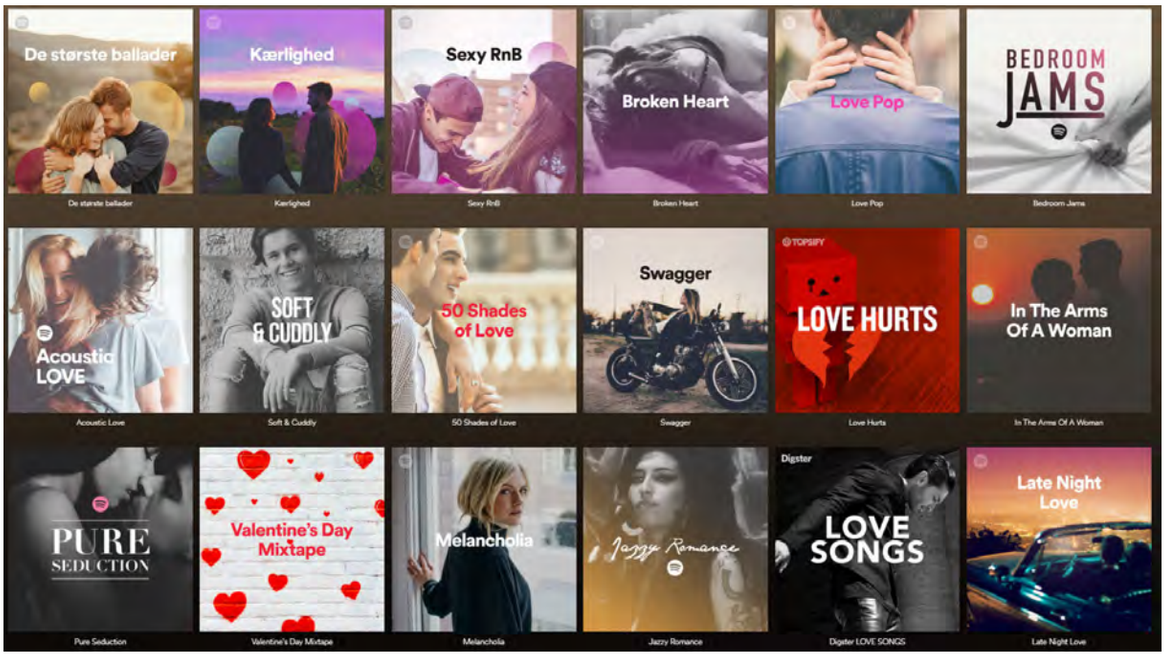
Dinner 2


Hot Beats
Feel Good House
BASS EXPLOSION
electroNOW
EDM DU KENDER
Fresh Electronic
Early Bets
dancePOP
X-Overs
Truly Deeply House
Dance Hits
Golds
Main Stage
indietronic
Space Disco
Friday Cratediggers
CHILL TRACKS
Summer House!
DEEP HOUSE
Dance Party
Go Hard

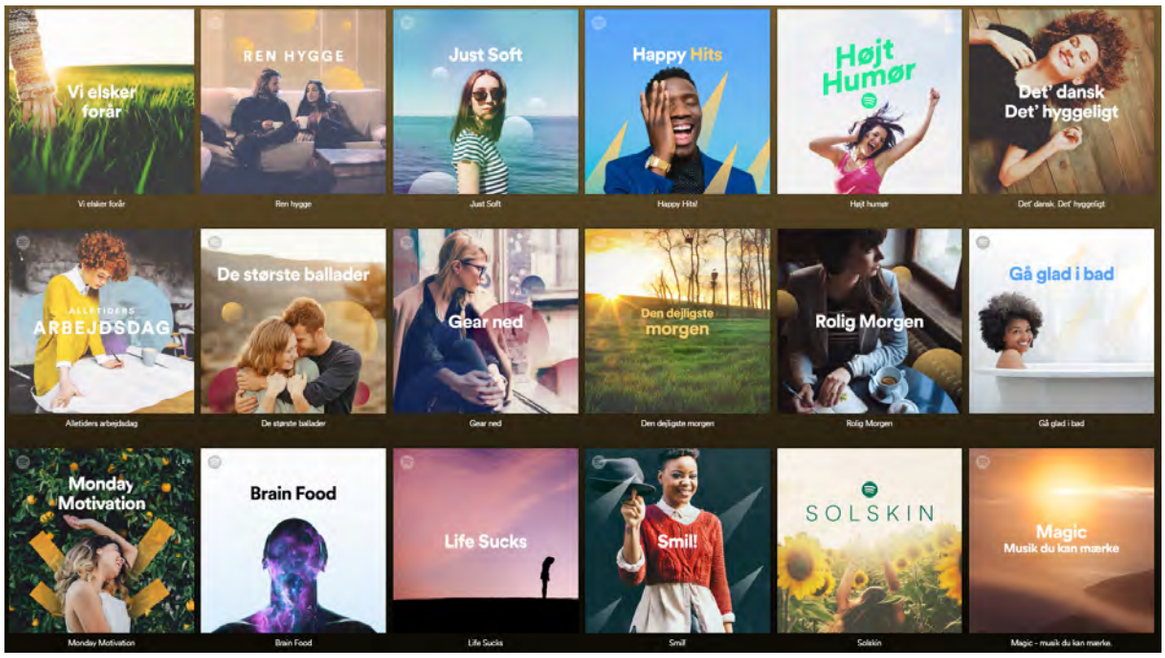
EDM 1


SPINNIN' RECORDS TOP 100
DUBSTEP
TRANCE TOP 1000
Night Rider
Vacation Haus
Trapaholics
A STATE OF TRANCE
Bleeps & Bloops
Shuffle Syndrome
LET THE BEAT DROP
The Wobble
RAGE RADIO
Transmission
REMIXED
Orgánica
Metropolis
Bass Face
FUTURE DANCE ANTHEMS

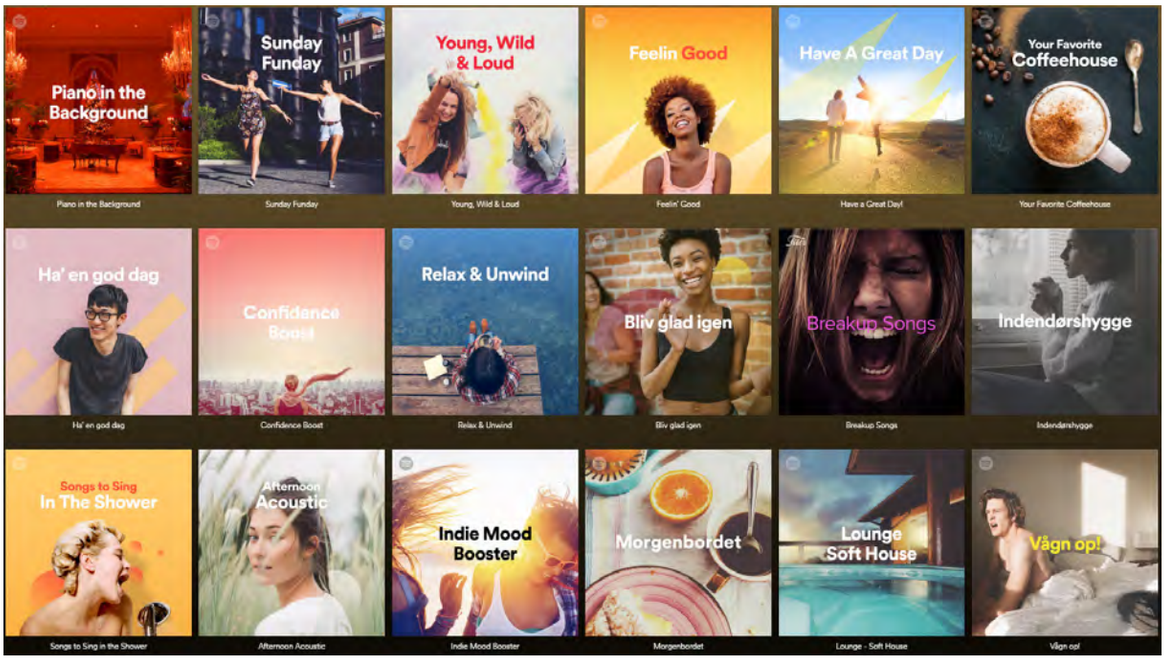
EDM 2


De største ballader
Kærlighed
Sexy RnB
Broken Heart
Love Pop
BEDROOM JAMS
Acoustic LOVE
SOFT & CUDDLY
50 Shades of Love
Swagger
LOVE HURTS
In The Arms Of A Woman
PURE SEDUCTION
Valentine's Day Mixtape
Melancholia
Jazzy Romance
LOVE SONGS
Late Night Love

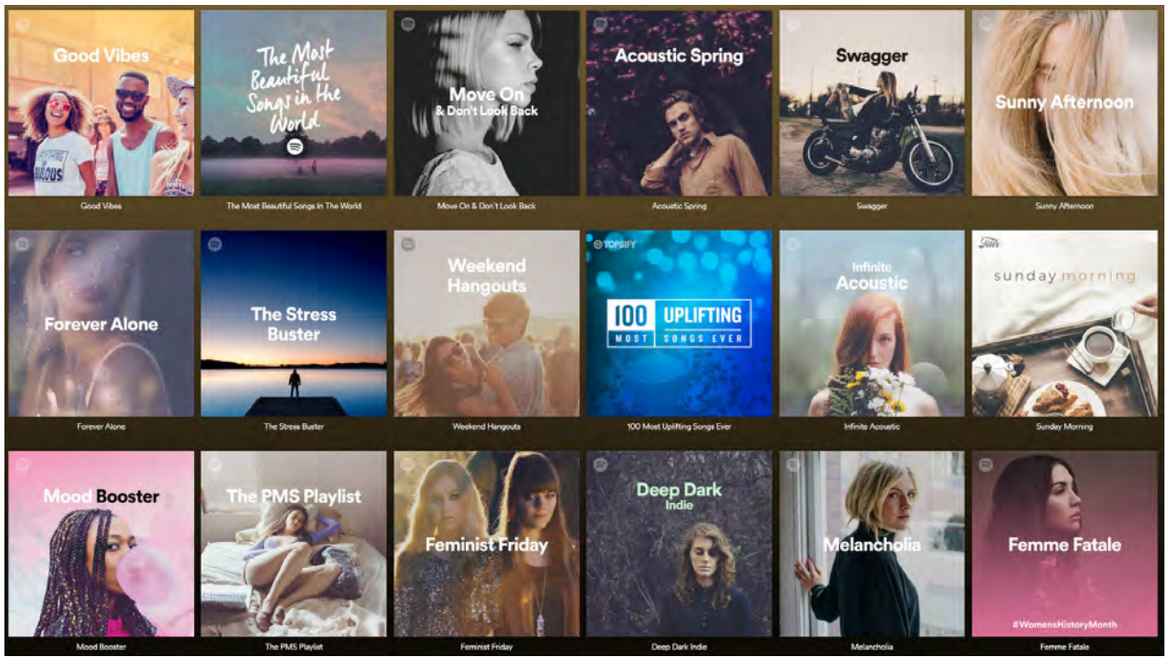
Love 1


Vi elsker forår
REN HYGGE
Just Soft
Happy Hits
Højt Humør
Det' dansk Det' hyggeligt
ARBEJDSDAG
De største ballader
Gear ned
Den dejligste morgen
Rolig Morgen
Gå glad i bad
Monday Motivation
Brain Food
Life Sucks
Smil!
SOLSKIN
Magic
Musik du kan mærke

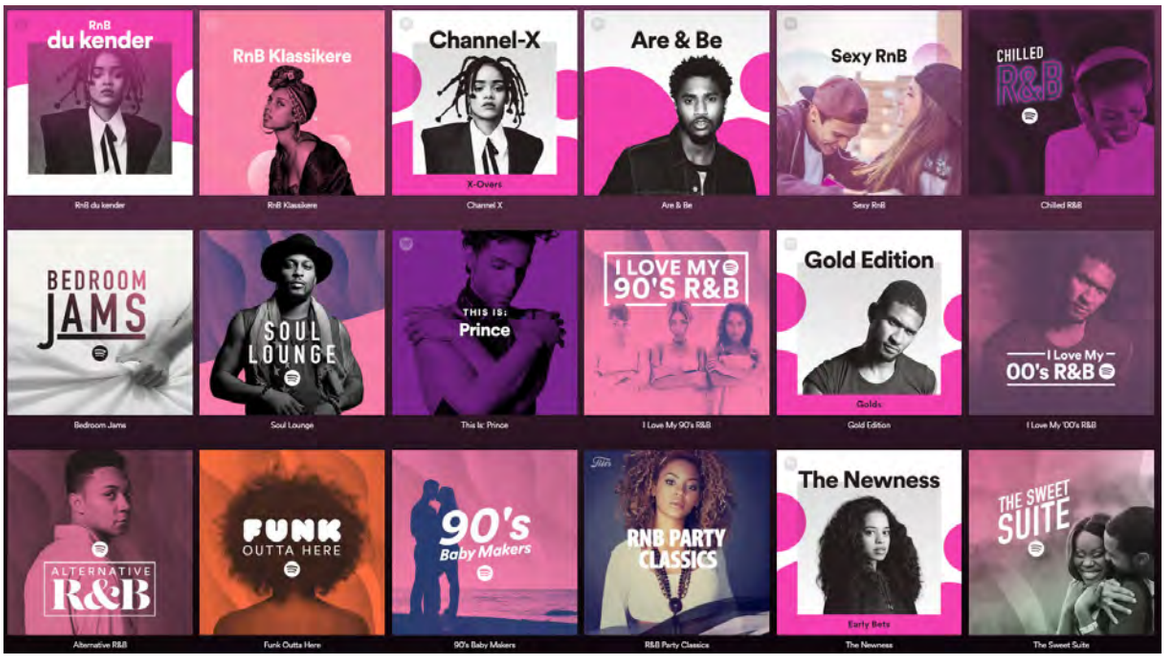
Mood 1


Piano in the Background
Sunday Funday
Young, Wild & Loud
Feelin Good
Have A Great Day
Your Favorite Coffeehouse
Ha' en god dag
Confidance Boost
Relax & Unwind
Bliv glad igen
Breakup Songs
Indendørshygge
Songs to Sing In The Shower
Afternoon Acoustic
Indie Mood Booster
Morgenbordet
Lounge Soft House
Vågn op!

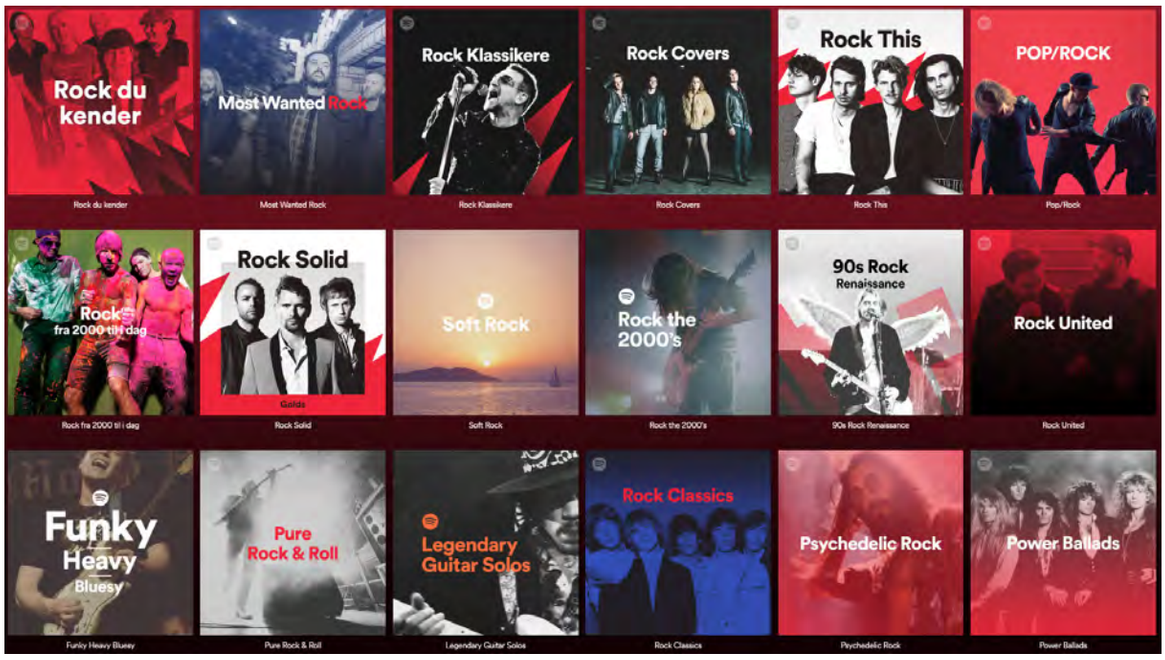
Mood 2


Good Vibes
The Most Beautiful Songs in the World
Move On & Don't Look Back
Acoustic Spring
Swagger
Sunny Afternoon
Forever Alone
The Stress Buster
Weekend Hangouts
100 UPLIFTING MOST SONGS EVER
Infinite Acoustic
sunday morning
Mood Booster
The PMS Playlist
Feminist Friday
Deep Dark Indie
Melancholia
Femme Fatale
#WomensHistoryMonth

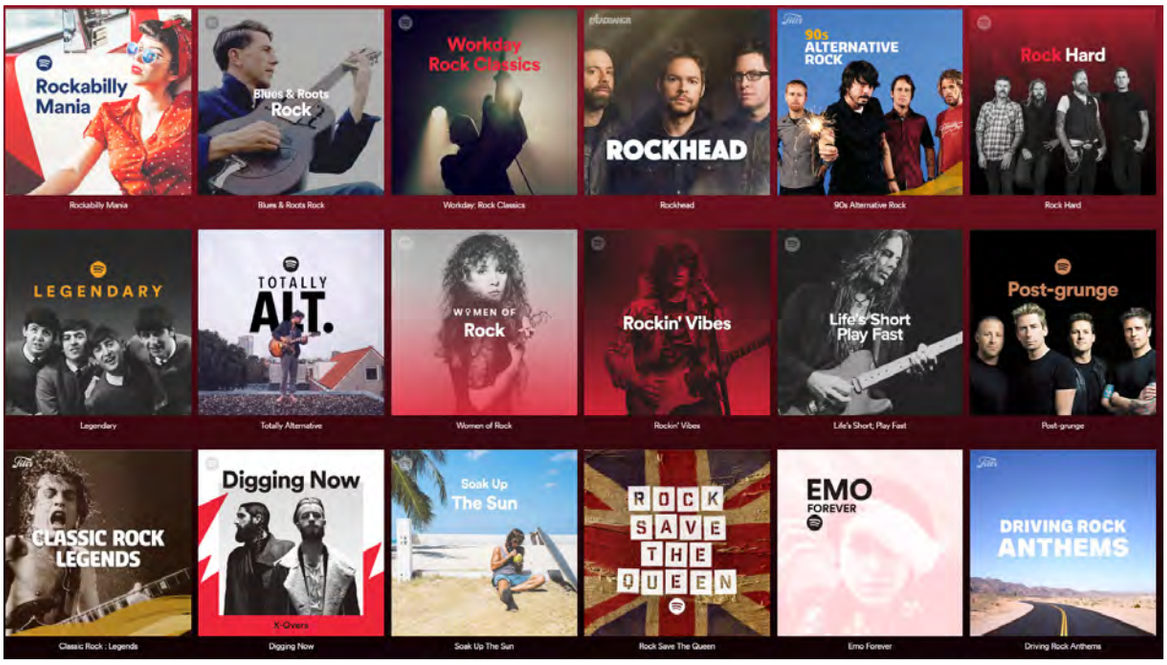
Mood 3


RnB
du kender
RnB Klassikere
Channel-X
X-Overs
Are & Be
Sexy RnB
CHILLED
R&B
BEDROOM
JAMS
SOUL
LOUNGE
THIS IS:
Prince
I LOVE MY
90'S R&B
Gold Edition
Golds
I Love My
00's R&B
ALTERNATIVE
R&B
FUNK
OUTTA HERE
90's
Baby Makers
RNB PARTY
CLASSICS
The Newness
Early Bets
THE SWEET
SUITE

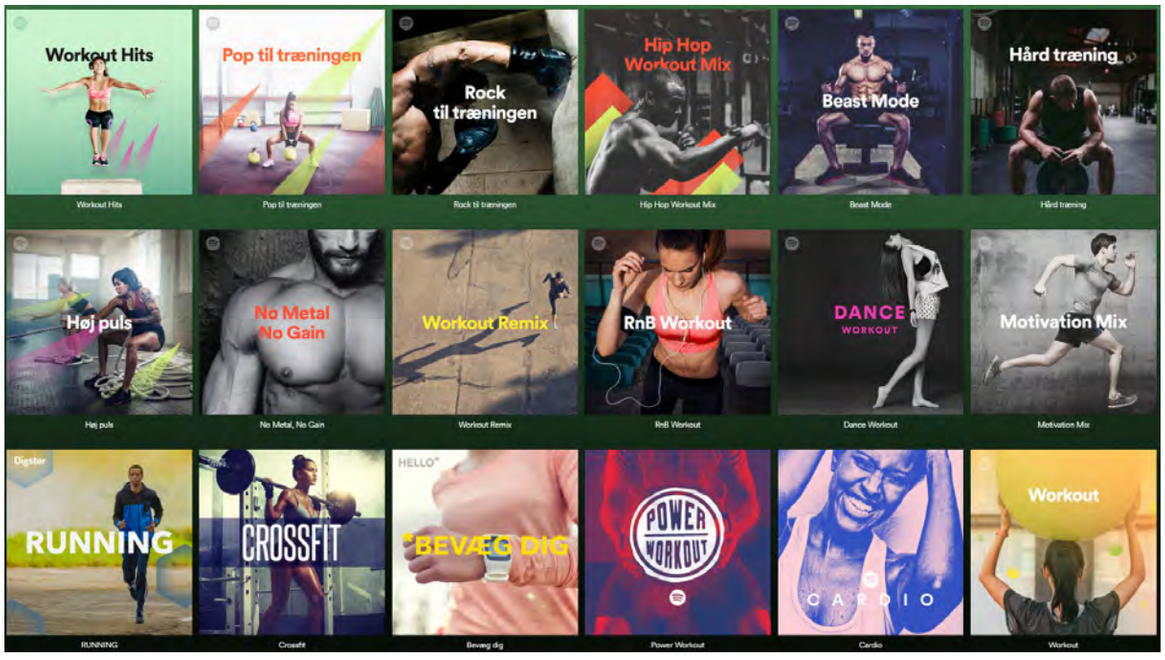
RnB 1


Rock du
kender
Most Wanted Rock
Rock Klassikere
Rock Covers
Rock This
POP/ROCK
Rock
fra 2000 til i dag
Rock Solid
Golds
Soft Rock
Rock the
2000's
90s Rock
Renaissance
Rock United
Funky
Heavy
Bluesy
Pure
Rock & Roll
Legendary
Guitar Solos
Rock Classics
Psychedelic Rock
Power Ballads

Rock 1



Rock 2



Workout 1

Internal structure

Worksheet no.: 37 Date.: 09-04-2017

Objective

Determin the pros and cons of the two suggest internal structures. Receive feedback from DALI.

Experiment/Data

Two ideas for an internal structure of the devices was brought to DALI HQ for a creative discussion about the possiblities of the internal structure in a speaker of this size and function.

The True 360

The first idea was a speaker with two drivers, one tweeter and one woofer each cocentric with each other along the long vertical axsis of the speaker. Both drivers will be directed towards an acoustic lens or convex reflector that directs the sound horizontally out of the speaker and creates a 360 degress dispersion of the sound.

360 through multiple speakers

The second idea was to use several smaller drivers to directed the audio from the speaker in all directions and crease the sound all around the speaker.

DALI feedback and creative discoussion

Through feedback on the two concepts for an internal structure and a creative discussion with project manager Mads Ullits and innovation director Kim Kristensen the two concepts was developed further. Through their extensive know how about speakers both the conceps was refined and pros and cons for each was listed, in order for BK Design to choose the right direction for the project.

The combination

Combining the axial woofer with two or more directional tweeters was deemed more feasible than only have one tweeter cocentric with the woofer. Since the high frequencies are the most directional making the tweeter and its reflector a very sensitive part. Whereas the lower frequencies from the woofer passes through objets easier and isn't so sensitive to direction.

The woofers diaphragm size is crucial to its capablities of reproducing the lower frequencies at a higher volume, since these take up a lot of surface area placeing it downward facing at the bottom would allow for a larger woofer. Furthermore it could use the entire volume of the speaker enclosure to extend the bass reproduction. A larger woofer would require a larger volume in a sealed enclosure or passive bass radiators. As a rule of thumb the surface area of the passive radiators will have to be 1.5 times the size of the woofers of the speaker. Limiting the size of the woofer. Otherwise a vented enclosure with a bass reflex port would require less surface area but instead internal volume and it opens the structure.

Reuseing

Going with multiple driver units in each directions is aslo a feasible option. Two sets of drivers was deemed enough to create the perception of 360 sound dispersion similar to how the KATCH does it. In general reusing the KATCH drivers would make the technicalities of the speaker easier, since the same DSP and amplifiers could be used. And with the bigger volume of the DALI TOUCH it would be able to do a better reproduction of the lower frequencies.

5" woofer vs two 3"

Based on DALI's guidance two situations was listed, using a single 5" woofer (BK Design was able to borrow one from the Mentor 5 for size reference, model making etc.) or two 3" woofers, same as the one found in the KATH.

Compared to each other, the 5" Mentor woofer would weight less, be cheaper and more energy effiecient than the two smaller KATCH drivers. It would also be able to deliver lower frequencies but will have to have quite large passive radiators or a bass reflex port. The reflex port is cheaper and weights less but requires internal volume for the tube.

The two 3" woofers would produce a somewhat similar audio output and require less surface area for the passive radiators. But will also be more expensive and in total require more power from the amplifiers. An important factors was that they could be placed "back2back" and even out the vibration introduced by the movement of the woofers voice coil.

Evaluation

Reflection

Perceived understanding of speaker direction

Worksheet no.: 38 Date.: 06-04-2017

Objective

The objective of this test is to understand the users perception of sound direction in "two way stereo" speakers. The hypothesis is that although speakers like the DALI Katch plays stereo, with right and left channel in opposite directions, the users place the speakers facing them, resulting in users primarily receives the right channel (or left).

Experiment/Data

The procedure of this test:

With the Solemate speaker as test object, ask target group how they would place the speaker in relation to themselves.

The Solemate speaker only have drivers on one side and a bass radiator on the opposite facing side, effectively only making it play in one direction despite its symmetry suggesting it playing in two opposite directions.

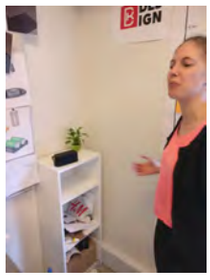
Kenneth:

Kenneth places the speaker facing him on the top of the shelving unit.

He decides the orientation based on the text on top of the speaker, which is readable from his position. In addition he places the speaker the right side up, as he states "The buttons should face upwards".

Kenneth own a UE Boom which he does not think about the orientation except which end it stands on, as he experiences the sound sounding wired when turning it upside down, which he have done before. (UE Boom does not have an apparent downward facing side, resulting in Kenneth placing it upside down)

Ida:



Ida start placing the speaker inside the shelving unit as this would be the place she would store it when not playing. When playing Ida wants the speaker on top of the shelving unit, when placing it she peaks at the tiny holes in the grid and spots that theres only speakers on one side, this dictates her to place the speakers facing her.

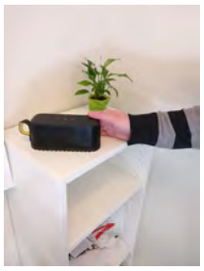
Andreas:

Lyd ud begge veje, pga gitter. Så aldrig sætte den helt op af noget, med god afstand fra væggen. Og skråt ud fra et hjørne, så lyden kommer bedre ud i rummet. Peje den imod den retning hvori jeg skal “lave noget”. Vil ikke holde der hvor “strappen” sidder.

Jesper:

Placere den skråt ud i rummet. Sat lidt yderligt så dan kan ramme hele rummet.

Jeg kan se at der er to højtalere og noget der ligner en bas. Observere tydeligt at den skyder i en retning.



Evaluation

All test persons acknolegde the two speaker faces and naturally places one facing the room. Only half of the persons were aware of the one side of the speaker containing the the drivers.

Users prioritize the speakers facing them, this leads us to think that this would be the same if the speaker plays stereo left and right.

Reflection

Power Input - USB C ?

Worksheet no.: 39 Date.: 11-04-2017

Objective

Explore the possibilite for USB Type-C as the main charging input.

Experiment/Data

http://www.pcworld.com/article/3017182/hardware/usb-c-charging-universal-or-bust-we-plug-in-every-device-we-have-to-chase-the-dream.html

http://www.usb.org/developers/powerdelivery/

USB Type-C with the new USB Power Delivery 3.0 spec, can theoretically deliver up to 100W power at 20V and 5A. Type C supports a Bi-Directional power direction, which allows the products to be charged and charge other products through the same port.

Going for a USB Type-C as the power interface enables the product to be charged by a wide variety of chargers coming into the market. Laptop, phones and game consoles are all adopting the Type-C interface because of its increase in Power delivering capabilities and reversible design.

With more products adapting the Type-C charger it will be the universal charger for battery driven devices in the foreseeable future.

Our speaker is aimed for portable in-home use and using a universal charger increases the ease of operation for the users quiet a lot.

But with a universal charging interface arises the problem of off-brand and counterfeit chargers that operate at other voltages or amperes.

A study by PCWorld.com has tested several chargers with different power outputs on laptops and phones and found that even a small 15W phone charger was able to deliver power to a MacBook 12 though at a slower rate.

Even though the power consumption of this speaker hasn't been determined yet. A look at the mains powered speaker BeoPlay M5, it only uses 10W when streaming through bluetooth at 30% volume. The M5 has three amps running at 30W and one at 40W. Streaming through WiFi will arguably require more power and higher volumes will increase the power consumption too. At 10W even a phone charger is able to power the device and put a bit of juice into the battery.

Using a laptop Type-C charger or the DALI specified one that will accompany the product when purchase will allow for the best music and charging experience. But smaller chargers from phones will be able to charge the device at lower volume or slower when powered off.

https://www.beoplay.com/products/beoplaym5#techspec

Evaluation

Reflection

Software - Kodi&Spotify

Worksheet no.: 40 Date.: 13-04-2017

Objective

Research the posibilities of removing the phone and moving the streaming device to the speaker device. And present the findings in a visual way.

Experiment/Data

Knowledge from previuos tinkering with DIY home media centers led to looking at the single-board computer, Raspberry Pi, with the free open source media player software Kodi.

The Raspberry Pi is a credit card sized single-board computer containing both digital and analog audio outputs and a SoC cappable of running a Windows 10 or the common Debian Linux distribution. Which is what the free open source media player software Kodi runs on. Built on Debian, Kodi has access to a wide variety of repositories where users created addons is available. Several Spotify addons are available building upon the Libspotify SDK that Spotify has made available for both users and companies to utilize in software and products.

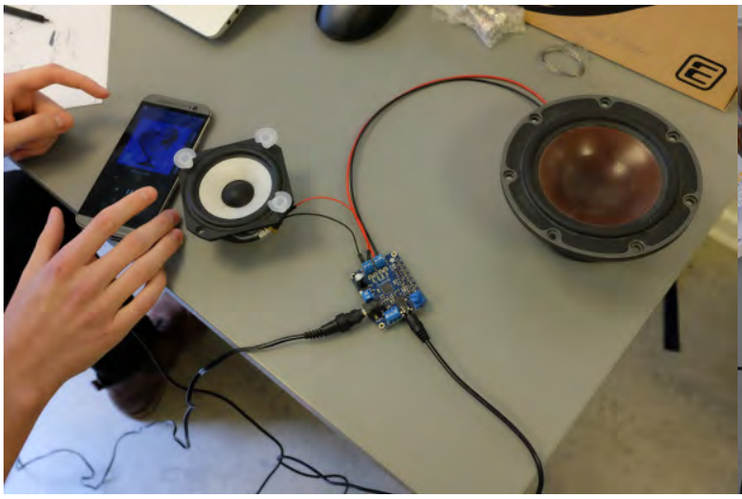
https://kodi.tv/
https://en.wikipedia.org/wiki/Raspberry_Pi
https://developer.spotify.com/technologies/libspotify/
https://www.htpcbeginner.com/install-kodi-spotify-addon/
https://learn.adafruit.com/adafruit-20w-stereo-audio-amplifier-class-d-max9744/overview

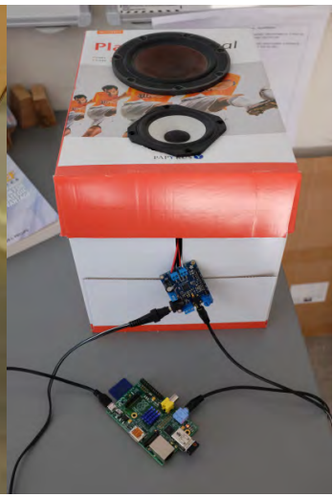
Using a Adafruit MAX9744 20W Stereo amplifier and a Raspberry Pi with Kodi and Spotify addon, we were able to pull music from Spotify's servers, change playlists and find new playlists without the use of a phone or laptop. The Raspberry Pi, being a computer needed user input though, so a screen and keyboard was nescesarry. The MAX9744 amplifier, though very small, was able to power both the DALI Mentor 5" woofer borrowed from DALI as well as a full range 3.5 Peerless driver from a previous personal project.

The benefits of placeing both speakers inside a mock-up enclosure was imidiately heard, even though it was a cardboard box. Further tweaking through a software crossover, the signals was seperated with a hi-pass filter for the full range and a low-pass filter for the woofer.

This setup simulates the one intended for the product solution but with a few changes. The Raspberry Pi SBC is a bit overkill and has a lot of features not needed for the new DALI speaker. And the user input is to come from the color selection dial and matching playlist index insted of keyboard and screen.

Initial setup and settings still has to be done. Users will have to give the DALI TOUCH's SBC their Spotify log-in information, like we did to the Raspberry Pi, and further settings customization like equalizer, change of color preset etc is needed. All this, with inspiration, in the latest Google, Libratone and BeoPlay products will be put in a companion app. The Phone and app is needed for user settings and setup, but will then not be nescessary for operating the device.





Evaluation

Reflection

Economical Perspective

Worksheet no.: 41 Date.: 28-04-2017

Objective

Explore the economical possibilities

Experiment/Data

X	KATCH	TOUCH
Market price	2899	4499
VAT(25%): 2899/1.25	2319.2	3599.2
VAT	579.8	899.8
HiFi Klubben Retail sales price	2319.2	3599.2
Profit(35%)	1717.925926	2666.074074
1.35		
Profit	601.2740741	933.1259259
HiFi Klubben Distributor sales price	1717.925926	2666.074074
Profit(10%)	1561.750842	2423.703704
1.1		
Profit	156.1750842	242.3703704
DALI A/S Sales Price	1561.750842	2423.703704
Contribution Margin(40%)	1115.536316	1731.216931
1.4		
Contribution Margin	446.2145262	692.4867725

Components	Name	Price (DKK)	# in product	DKK
Amplifier board	SANWU® TPA3118 PBTL	34.06	3	102.18
Digital Signal Processor	ADAU1761	50.6664	1	50.6664
Battery	LG ICR18650 B4 2600mAh	6.12	2	12.24
Single-Board Computer	Raspberry Pi B+	185	1	185
WiFi Module	ATWINC1500 WiFi	135	1	135
Tweeter		?	2	
Woofer		?	1	
				485.0864

Experiment/Data

DALI has an exclusive sales channel in Scandinavia through HiFi Klubben retail stores. To calculate the production price based on the target retail price a top-down calculation on the DALI KATCH was made. The top-down calculation starts with the market price of the product and then deduct profit for each chain in the sales channel. An estimate of 35% proft for the Hi-Fi Klubben retail store and 10% profit for the distributor, which in this case is HiFi Klubben A/S. Furthermore it is estimated that DALI is taking a 25% contribution margin when selling it to HiFi Klubben A/S. With 25% VAT that make it a decrease by approximately 62% between market price with VAT and the cost of production.

The target cost estimation for the DALI TOUCH is then made with the target market price in mind and then top-down calculated to find the cost of production.

All the cost calculations are estmations based on assumptions and should not be considered final but as a qualified guess. To specify the economical aspect further communication with manufactures and sub-suppliers would be needed a communication that is often first established when a project is accepted for market introduction.

It is estimated that DALI will have to spend up to six months after BK Design delivers the project to optimize the design, refine the sound properties and developed the software and app. DALI will have to hire an software engineer to manage the communication and fine tune the software development. But otherwise both the software for the speaker as well as the companion app will be outsourced. A three year service plan is bought together with the software package, this service plan will ensure the app works with every new Android/iOS update. It is expected that a larger feature update could be nescesarry down the line, this has also been taking into account when estimating the investment.

The product is expected to peak in its second year. Being a lifestyle and smart device it is expected to be rather short lived, since the technology of this market moves fast. New product with new unforseen features will be released in the TOUCH's lifetime and as such it is expected that the first three years are crucial. DALI should break even on the second year and see a return of investment of above three million after the third year.

DALI will in that time also have an increased know how in the software and app market for speakers and smart devices. A vital knowledge if the trends of IoT will keep on moving.

Evaluation

Reflection

Seductive qualities registration

Worksheet no.: 42 Date.: x

Objective

The objective of this test is to collect data on different physical interfaces, than analyse the date, in order to establish working principles for seductive design

Experiment/Data

SEDUCTIVE QUALITY	NAIM MuSo	BEOSOUND 2	Marshall Stockwell	BMW	VOLVO
Entice by diverting attention	The speaker diverts attention with its unusual wave shape on the front, the levitating look because of the glass base, and the "giant" dial on top	spunk190@gmail.com Seductive qualities Seductive qualities Comments Share	The speaker diverts attention with its retro aesthetics, with leather, metal and brass	The big knob attracts attension with its big size, ribbed surface, and arrows on top indicating that this knob can control "everything"	The diamond pattern engraved in the knobs and dials is somewhat unusual and attracts the attention when looking at the interface
Deliver surprising novelty	When touching the dial, the feeling strikes one as very luxurious	The speaker surprises as it seemingly have no buttons or controls of any sort.	When moving closing and experiencing the suprise that buttons on top is in fact dials that pop out when pushed.	The knob have a surpricingly range of actions that can be applied to it: Rotate, Push in four directions, Tilt in four direction.	One would expect it to be cool to the touch but is instead met with a plastic feel and loose hinges
Go beyond obvious needs and expectations	NAIM does not deliver luxury with shiny gems and gold plated surfaces, but delivers with few simple materials and just the right feel of a dial	The speaker breaks all expectations of what a speaker should look like and the fact that a speaker needs buttons or dials	The products have dials for volume, treble and bass and each of these have a satisfiyng feel of control.	The knob contrdict the typical perception of amount of control is directly related to amount of buttons and dials	Theres a uniqueness to the allmost jewelery aestetchics of the diamond shaped knob and dial, creating a rather feminine visual

SEDUCTIVE QUALITY	NAIM MuSo	BEOSOUND 2	Marshall Stockwell	BMW	VOLVO
Create an instrinctive response	The odd shape and levitating aestethic creates curiosity and the feel of the big dial create the feeling of total control	The shape and big clean surfaced invoke curiosity and a puzzled emotion. "What is this?"	The curiosity and suprise of the hidden dials is satisfactory and you instantly connect with the product and want to put music on and use the dials for their purpose.	The knob creates a 'gadgetty' feeling with the amount of controls. It makes one feel like controlling bigger machinery	At first the interior is expressing quality and luxury but when moving closer and touching the knobs and dials this illusion breaks as it is simple plastic with very little feedback.
Espouse values or connections to personal goals	The speaker could supports the user in his wishes for being percieved as elegant, sophisticated, and a person who is in control of his environment.			The added control an tactile feedback with every action (clicks) tells a story about users being in contol og the big mashinery of a car.	The interior and interface gives a feeling of luxury and high class with a twist of feminine aesthetics when looked upon. But disconnects with user expectations when starting to touch and interact with the interface.
promise to fulfill these goals:	The MuSo speaker makes a promise about making its user feel in control and come across as sophisticated while bieng so.			Apart from promise of control, the knob also promise a feeling similar to a master key, this knob makes you the master of the machine	The knobs promises high class luxuriousness and elegancy.
Lead the casual viewer to discover something deeper about the experience	The speaker does not teach anything directly related to sound, but teaches its user in how the simple act of adjusting the volume can be a joyfull experience		The speaker enables the users to learn about the impact of treble and bass adjustments to music. A thing the pleasant dials will only help the user to achieve.	The knob teaches that a lot of control dosent have to involve large series of buttons and dials.	From the knob and dial the user might learn that cars isnt nescecarily a mans world, and that there is space for luxury similar to the luxury of jewlery stores.
Fulfill these promises	The MuSo speaker is a joy to interact with every time as it repeatedly deliver its promise of elegancy, sophistication, and control.		The speakers radiates old school rock and roll and the tactile feel of textured dials accompanied by the font of volume, treble and bass control supports that. The jump out dials are equally satisfiyng the tenth time as the first and second.	The knob fails at delivering the promised goal of feeling in control and mastering the mashine, as the actions apllied to the knob is disconnected from the result of these actions. This results in the many possible actions just confusing the user.	The knob and dial fails to deliver on its promises as built quality and materials simply contradict the expectations

Evaluation

Reflection