A HOME HARMONY

Product report - Harmony 10

MSc04 - ID16 - November 2023

Antoine François Louis André Rouaud

AALBORG UNIVERSITY

DYNAUDIO

Title: A home harmony - Harmony 10

Theme: Master Thesis

Project start: February 6th, 2023

Submission: November 2nd, 2023

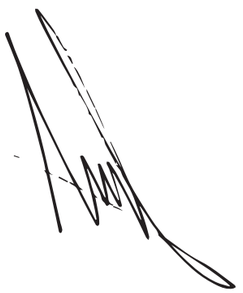
Project team: Msc04 - ID16

Supervisor: Mário Barros

Partnership: Dynaudio

Pages: 20

Antoine François Louis André Rouaud



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INTRODUCTION

Young adults aim to create a comfortable home environment where everything works together in harmony. The product report explores the design and functionalities for a new speaker that blends in their apartment, providing the freedom of enjoying the quality of a stereo sound system while having the convenience of a portable speaker.

Sound is an inherent part of their lives, young adults are constantly moving around their house while streaming music, podcasts, movies or radio in different rooms. Harmony 10 answers this needs and a scenario will be presented to introduce the working principles of the product. Their needs are also evolving as they are growing, the report includes a proposition for possible evolution in the product.

The business analysis aims to demonstrate how Harmony 10 can effectively meet the business needs of Dynaudio, showcasing its feasibility as a valuable solution.

THE OPPORTUNITY

The sound industry faces challenges as consumption is evolving toward a faster and wider selection of content with the apparition of streaming services. This shift has transformed the speaker market, moving from passive speakers to active ones. Indeed active speakers provide a more convenient music experience going away from the customization and immersive experience passive speakers can offer.

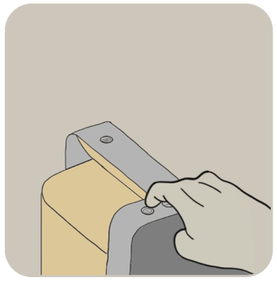
Today balancing accessibility and audio quality is crucial to follow the user's needs. The risk for new products is to end up being only trendy while not following the user journey in its interaction with sound. For a brand like Dynaudio the stakes are high as they have a huge history in high-end passive speakers. It is necessary for them to operate in this new market and reaching young adults with a new lifestyle speaker will help them to create a strong customer base they can fidelise to be further introduced to the world of high-end Hifi.

PLAY IN HARMONY

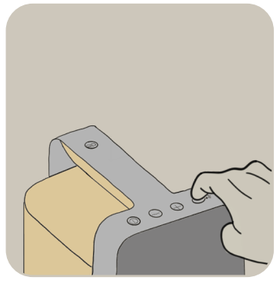
Harmony 10 is a perfect wireless companion for young audiophile adults.

Enjoy the full stereo experience in the living room and the comfort of playing sound in the background while doing home tasks or activities by carrying Harmony 10 around.

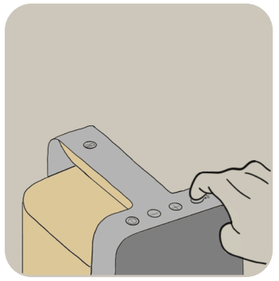
USER SCENARIO



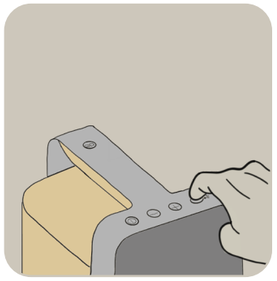
1. Starts the speaker by pressing the power button



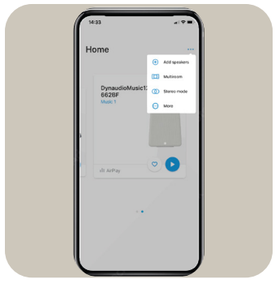
2. Press 2 sec the source button, the bluetooth light blinks



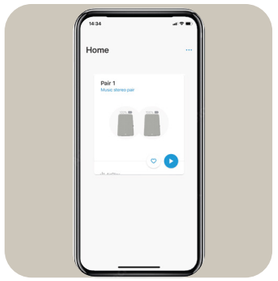
3. Press again 2sec on the source button, both lights are blinking



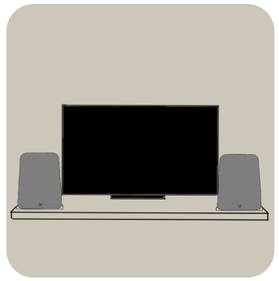
4. Ready to be set on the Dynaudio app



5. Create a pair of stereo speaker

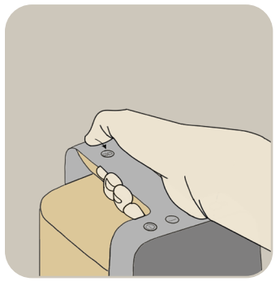


6. Ready to be used and controlled via the app



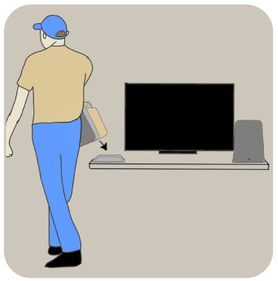
7. Enjoy the sound in stereo mode

8. Grab on of the two speaker unit

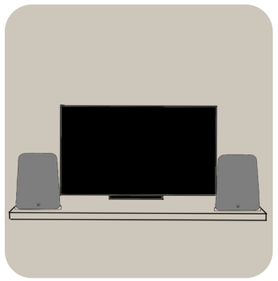


9. Press the pairing button to switch between the pairing and isolating mode

10. Enjoy music in the background while cooking



11. Place the speaker unit back



12. Enjoy the sound in stereo mode

FULL RANGE IN STEREO

Enriches your listening experience with the poignant listening experience stereo offers you. With two separate channels, one on the left, one on the right, dive into the depth of sound with an immersive auditory experience. It captures the nuances of sound in a way that mono cannot do. Enhances music, movies, gaming and all kinds of auditive sources.

MOVE IT

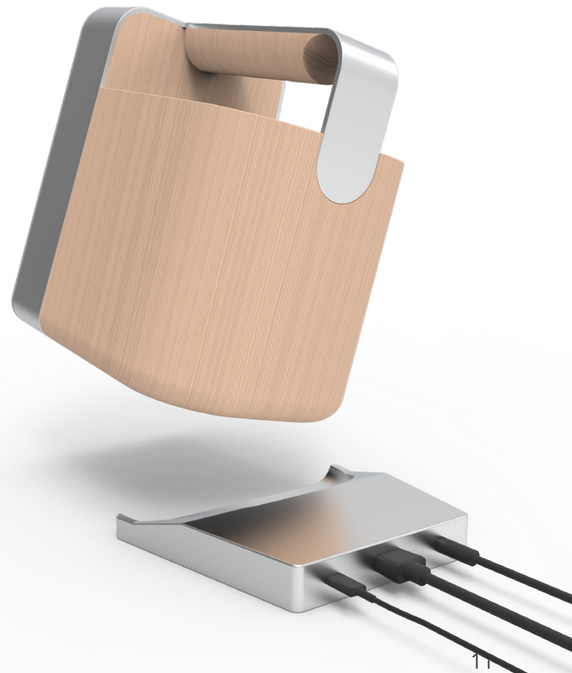
Grab one of the two speaker units and take it with you, sound continues playing on the one you grabbed while the other one stops automatically. If you want them to play both, tap on the pairing button.

The feeling will not only be in your ears but also in your hands, grab the handle to feel the texture and warmth of the wood finish.

INPUTS

Harmony 10 offers you the full sound experience with the convenience of a classic stereo speaker. The docking station includes two digital auxiliary inputs, a HDMI cable can be connected for any kind of audio video source and a mini jack for your external devices such as a turntable or a CD player.

Don't worry about the hassle of switching sources, the docking station does it for you. It automatically recognizes where the signal comes from. You just have to turn on your TV or your turntable and the music will automatically start to play on the speaker. With the digital input connected to the docking station, you can still grab a speaker unit and enjoy the sound in another room. It acts as a relay for the speaker.



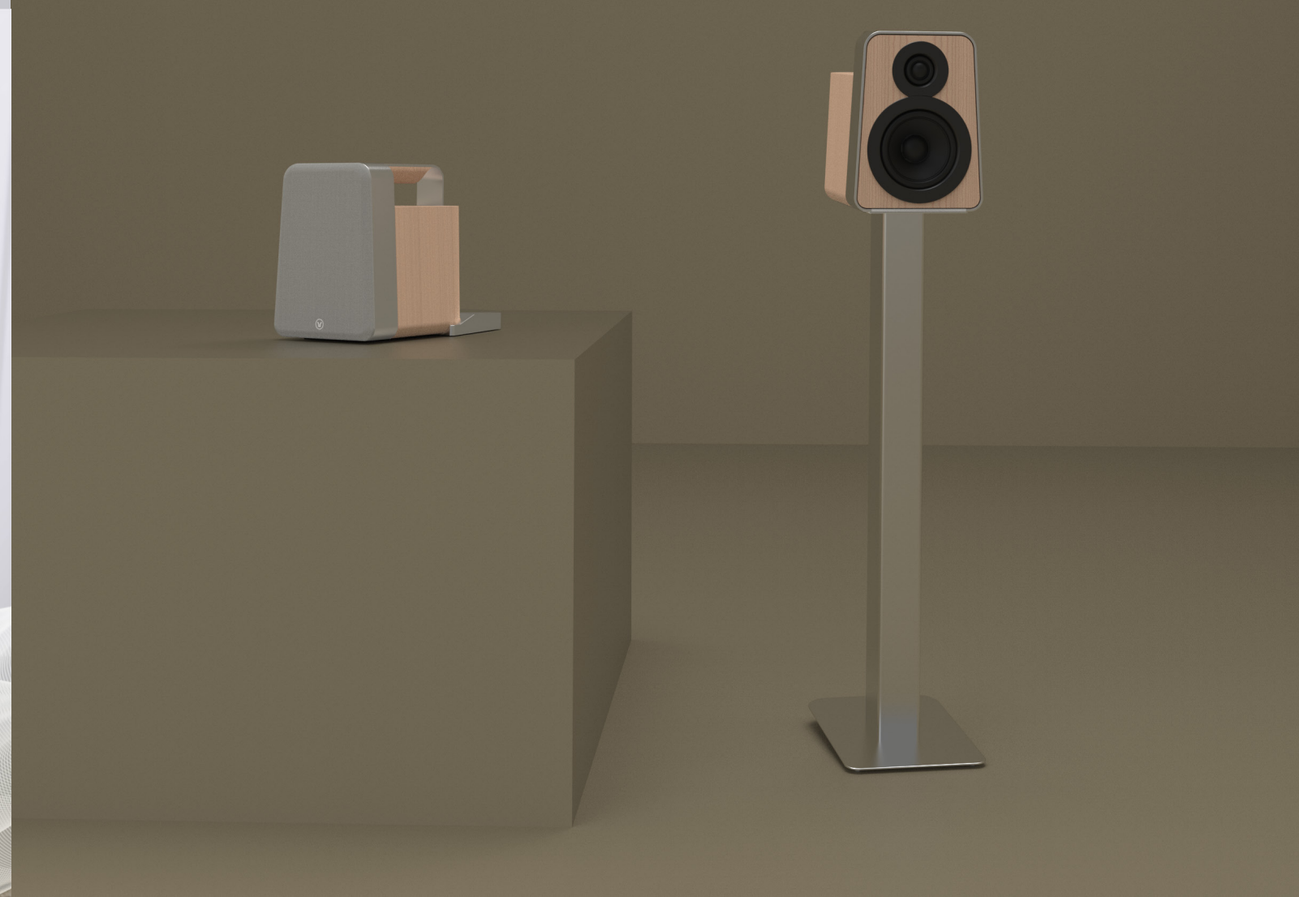
PLAY WITH YOUR EMOTIONS

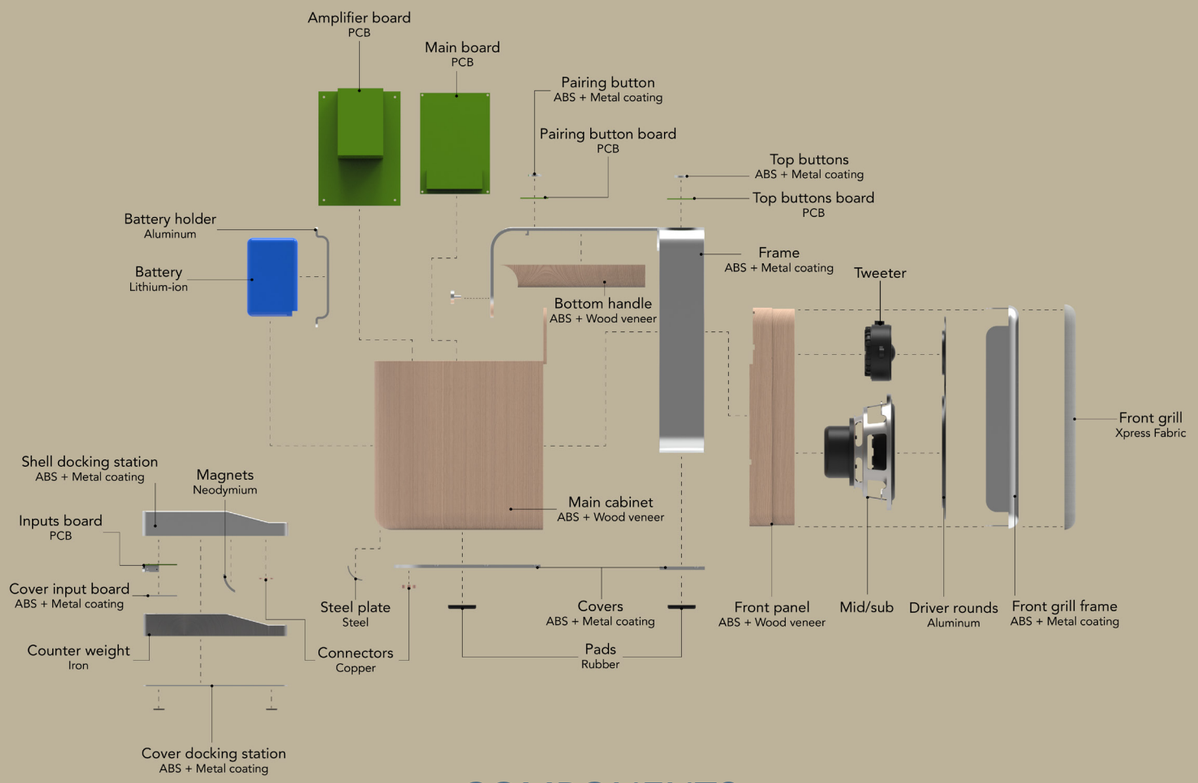
One Tweeter, one Mid-Range driver in each unit to achieve the same performances as the Dynaudio Music 1.

Proven performances for guaranteed thrills

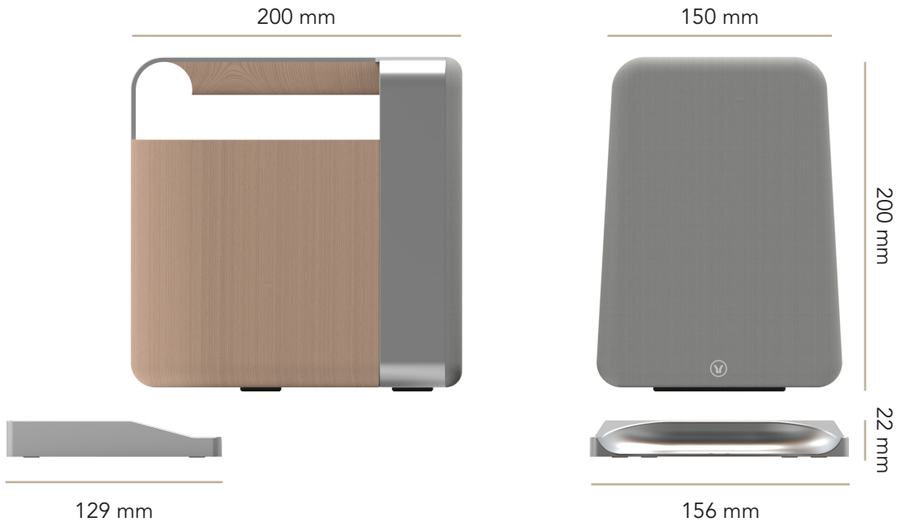
EVOLVE

Remove the front grill to enjoy a full sound range and a better aesthetic. The combination of wood with metal contours surrounding the drivers express the craftsmanship and attention to details Dynaudio loves to share. If you want more, add a stand for a better and more fixed speaker position, elevating your listening experience to higher levels.





COMPONENTS



DIMENSIONS

SPECIFICATIONS

Harmony 10 takes achieves the same great performance as the Dynaudio Music 1 but with a higher standard in the user experience

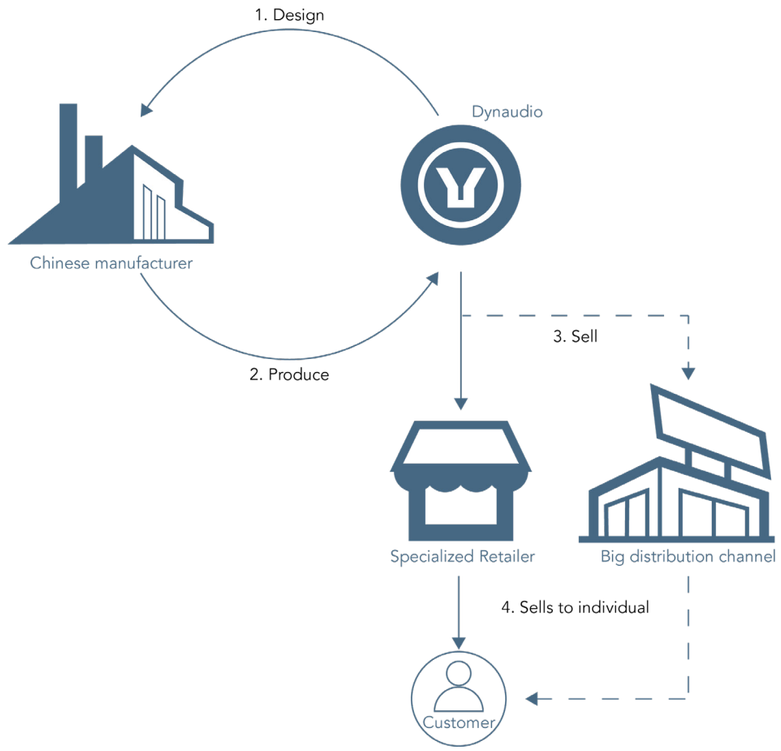
Segment	Home
Range	Harmony
Type	Stereo
Analog inputs	Mini Jack
Digital inputs	USB Type-C, HDMI
Network	Wifi (2.4/5.0) GHz
Bluetooth	4.0
Streaming	Apple Airplay, Spotify Channel, DLNA
Amplifier Power Sub (Watt)	40
Amplifier Power Tweeter (Watt)	40
AC Power Input	100-240V 50/60Hz
Lower Cutoff (Hz @85 dB +/- 3dB)	50
Upper Cutoff (kHz @85 dB +/- 3dB)	20
Tweeter	1 x 1 soft dome
Midrange/Sub	4in
Weight speaker unit kg	1,6
Weight docking station kg	1,1
Finish	Aluminium and Oak

COST

Unit	Cost (USD)
Components	49,26
Injection moulding	58,519
Metal manufacturing	5,12
Total Production cost	63,639
Assembly	0,955
Total (1 unit)	113,854
Shipping 2 units	0,48
Total 2 units	228,2

Price	USD	%
Manufacturing cost	228,19	
Constribution margin (Dynaudio)	148,32	65
Sales price (Dynaudio)	376,51	
Constribution retail	188,26	50
Retail price	564,77	
VAT	141,19	25
Retail price (incl. VAT) USD	705,96	
Retail price (incl. VAT) Dkk	4885,22	

VALUE CHAIN



The product is designed in Denmark and manufactured in China to lower the production cost. It is then sent to Dynaudio that handle the distribution.

A suggestion is made for Dynaudio to enlarge its distribution channels to bigger distribution stores and touch a larger base of customers.

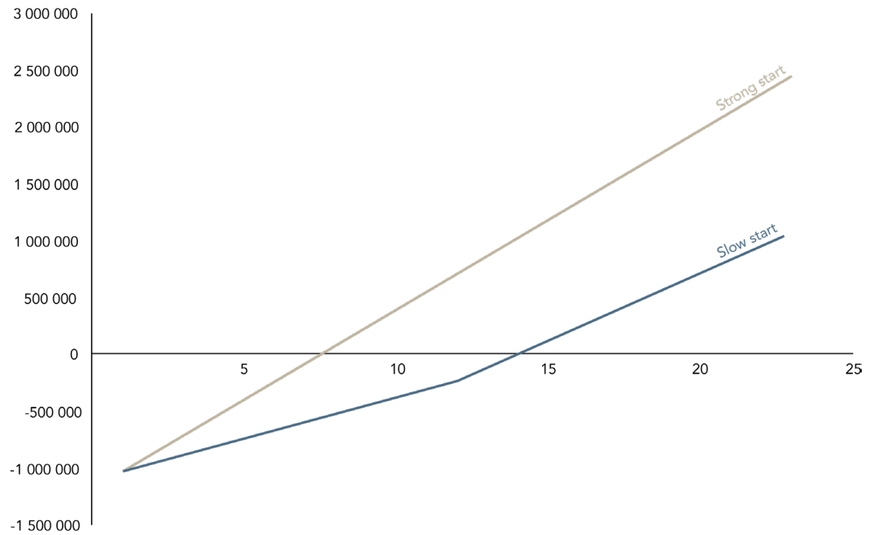
BUSINESS

STRONG START SCENARIO

Business case	Year 1	Year 2	Year 3
Units sold	5000	5000	5000
Sales price (Dynaudio) (USD)	376,51	376,51	376,51
Manufacturing cost (USD)	228,19	228,19	228,19
Turnover (USD)	1 882 551	741 611	741 611
Investment (USD)	- 1 169 580	712 971	1 454 582
Benefit (USD)	712 971	1 454 582	2 196 193

SLOW START SCENARIO

Business case	Year 1	Year 2	Year 3
Units sold	2500	3500	5000
Sales price (Dynaudio) (USD)	376,51	376,51	376,51
Manufacturing cost (USD)	228,19	228,19	228,19
Turnover (USD)	941 275,5	519 127,7	741 611
Investment (USD)	- 1 169 580	- 228 304,5	290 823,2
Benefit (USD)	- 228 304,5	290 823,2	1 032 434,2



In a strong start scenario Dynaudio would start to make profit in month 8 after launching the product on the market.

In the slow start scenario Dynaudio would start to make profit in month 15 after launching the product on the market.

CONCLUSION

Harmony 10 wishes to bond the user to the product by triggering feelings to create an emotional attachment, it will build user loyalty to Dynaudio and give a taste of what high-quality audio can be.

This new Dynaudio solution will connect the user, its environment and the product around sound.

Having possibilities for evolution will encourage the user to prolong the product journey, the concept evokes the possibility of evolving into a more serious hifi loudspeaker to meet the expectations of older users.

DYNAUDIO

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Appendix: 34 pieces - 169 pages

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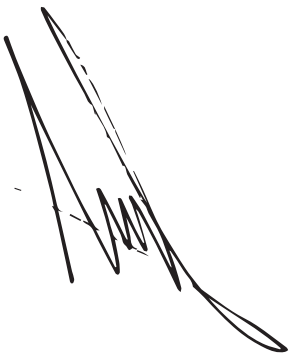

Abstract

This project is written by a student in Industrial Design for its master thesis at Aalborg University in Msc04 - ID16. The collaborative company is chosen according to personal interest and desire to acquire more knowledge in the audio industry, the designer acts as a consultant for Dynaudio A/S and a solution for a new lifestyle audio product is suggested.

The process is divided in 4 phases and explores the design and functionality of a portable stereo system targeting a young adults audiophile audience, providing them the freedom of enjoying the quality of a stereo set of speakers while offering the convenience of a portable speaker.

The first phase details the framing of the project with the objective to understand the user while exploring the opportunities for a new product on the audio market. Phase 2 uses the knowledge previously acquired and develops it into a concept, the maturation of this concept is done in Phase 3 and makes it ready for a business case analysis in Phase 4.

The final solution aims to facilitate the user's interaction between its environment and the way audio media are consumed.

Prephase & acnowledgment

This project is developed on 4. MSc and is the master thesis, it is done during the following period: 30.01.2023 to 31.05.2023 at Aalborg university in the department of Architecture, Design and Media Technology.

The project is done in partnership with Dynaudio A/S, thank you for their time and sharing their expertise in the audio industry while always giving constructive feedback for the progress of the project.

Reading guide

The project consists of a product and a process report. Appendix and technical drawings are external materials attached to the process report. For the reader it is advised to first read the product report and then the process report.

The product report is a description of the proposition underlining the main aspects of the product. In it the reader can find the value proposition, the functionalities, the construction and guidelines for using the product. As well as economic and financial aspects.

The process report describes the whole design process of the project, from the ideation to the concrete product while describing precisely all the steps, the decisions and the reflections. It involves all the discoveries and throughout the report there will be several boxes highlighting the reflections, the requirements and the important insights/findings.

The appendixes are complementary to the process report. It mainly consists of worksheets done all along the project. They bring deeper and more precise knowledge.

The technical drawings provides an overview of the finalized product and of some critical parts with their dimensions.

Reflection box

Result of the investigation turned into requirement.

Important insight/finding

illu. 01 - Symbols reading guide

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illu. 02 - Dynaudio headquarters

PHASE 0

/Scope

The following phase gives an introduction to Dynaudio and the initial thoughs of the project.

Introduction

Dynaudio is one the top brands for high-end audio with some of the best standards in terms of quality. In the last few years a change occurred in the audio market with a new way of consuming media as the use of streaming platforms increased. Today they are the most used services to play music and watch audiovisual, the products had to adapt to these changes and it implies a new and more "connected" way of playing sound. For years Dynaudio has developed its home segment around passive speakers and targeting an older audience with the objective of always delivering "authentic fidelity" to reproduce what the artist intended.

But there is now a desire to enlarge their portfolio with more active speakers, they thus developed 3 active products for different users. When going into the lifestyle segment Dynaudio faced difficulties with one of their products that achieved great performances but didn't find its users. The strategy to adopt when going in this segment is different and a deeper knowledge of the user is required.

This project targets young audiophile adults with the objective to develop a product that fits their needs. By going into this user group Dynaudio has the opportunity to touch younger users and have them develop emotional attachment and fidelity to the brand by discovering the quality and the history of Dynaudio products.

The final concept is made to follow the user in its journey and to be its companion around the house. To attract young audiophile adults Harmony 10 intend to achieve a flawless listening experience and to be developped around a story.

0.1 The process

The choice of developing a product for the audio industry is based on personal interest in this field, the partnership with Dynaudio is established following an exchange of emails. Before starting the project the only knowledge about the company is the product they have on the market and their reputation for doing high end hifi products. Therefore they are a good partner to better understand the audio industry. Before starting to work on the product it is then necessary to understand their values and history.

It is set that they will act as advisors letting the designer have its own findings and choose the direction. Along the process they bring feedback on the findings and allow them to put the product in a real life situation. Taking into account the user but also how it can benefit a company. With the project moving forward the more balanced it becomes through dialogue with Dynaudio, internal supervisor from the university and talks with the users.

Dynaudio is present in different fields for audio products: home audio, pro audio, car audio and custom install (Dynaudio,2023). It is set with them that the home audio segment is the most interesting for an industrial design project. They are seeking to touch a larger audience with more lifestyle products.

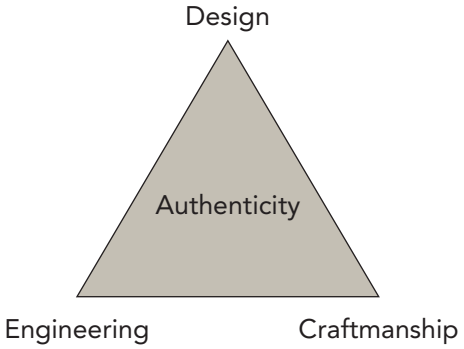
How to touch a larger audience with a company DNA strongly embedded in high-end hifi ?

Working as an external designer for a big company like Dynaudio brings many challenges, it is sometimes difficult to find the perfect balance between profits for tvhe user and profits for the company. It could have benefited the project to set some limitations from the beginning and avoid getting influenced too much on some decisions.

0.2 Collaborative company/Dynaudio A/S

Dynaudio is a Danish company based in Skanderborg, it was founded in 1977. They are specialized in loudspeakers with a high focus on technological innovation and wood craft, with high standards on sound quality. “True technological innovations were concealed inside the classically shaped, unusually solid real-wood veneer cabinets hand-crafted in Denmark” (Dynaudio - the history). Their customers are mainly audiophiles with a passion for passive loudspeakers. They value sound quality on top of everything. But this segment of customers is becoming more rare while the market for active speakers is expanding (Appendix 1).

The design related core values for Dynaudio’s product are as follow (Appendix 2):



illu. 03 - Dynaudio core values

0.3 Collaborators

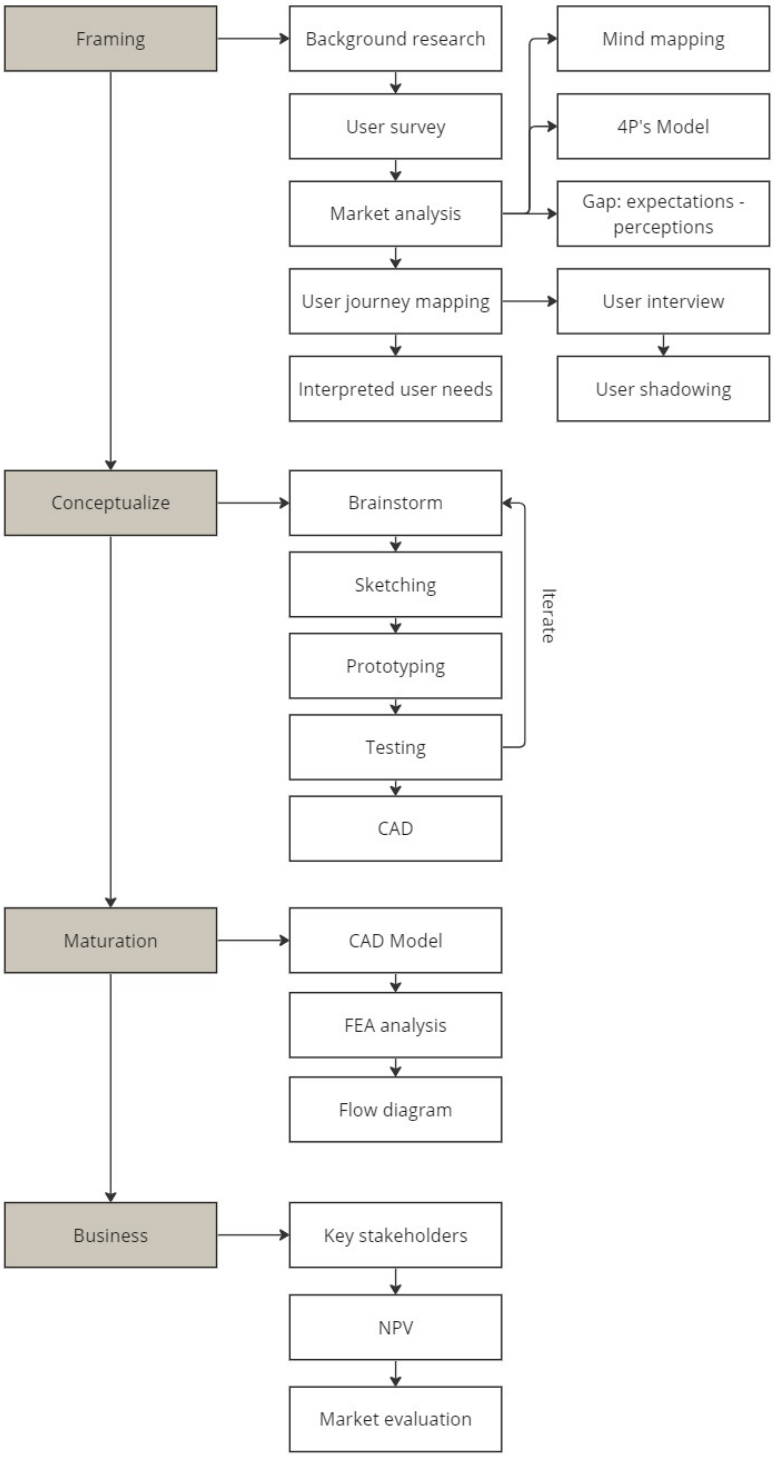
The main partnership is with the industrial designer team of Dynaudio, their feedback and knowledge about the industry has been a driver for the good development of this project. The acoustic engineer also helped in the final steps of the project to make the product more concrete and adapted for a real life scenario.

Marcus Abrahamsen	Katrine Timmerman	Stephen Entwistle
Industrial Designer	Junior Industrial Designer	Chief Engineer, Acoustics

0.4 Approach/List of methods

The process report is divided in 4 phases referring to 4 stages of the process. The framing is the path from the initiation of the project to the problem statement. The conceptualisation goes from the problem statement to the final proposal. The maturation details the construction of the product and proves that it can work. Finally the business details the launch of the product on the market in a company context.

Along the process several methods are used, they are listed in a chronological order in the following mapping. This allows the reader to have an overview on the list of theories for a better understanding of the process. At the beginning of each phase the methods used will be shortly explained in order to understand what are they used for and what it is intended to achieve.

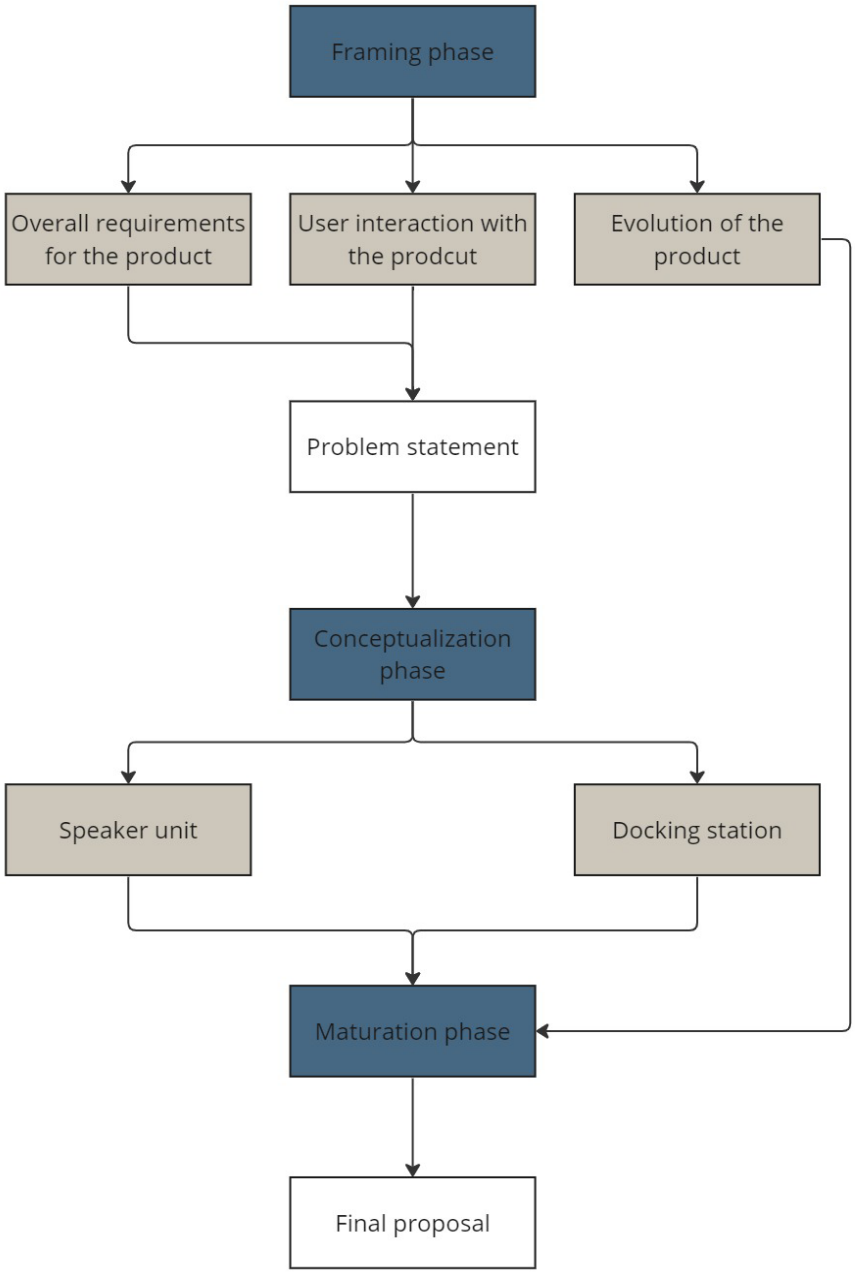


illu. 04 - List of theories

0.5 Organization of the user needs along the process

A good classification of the requirements facilitates a better development of the solution and makes it easier for the designer in the late development phases to make sure all the requirements are met.

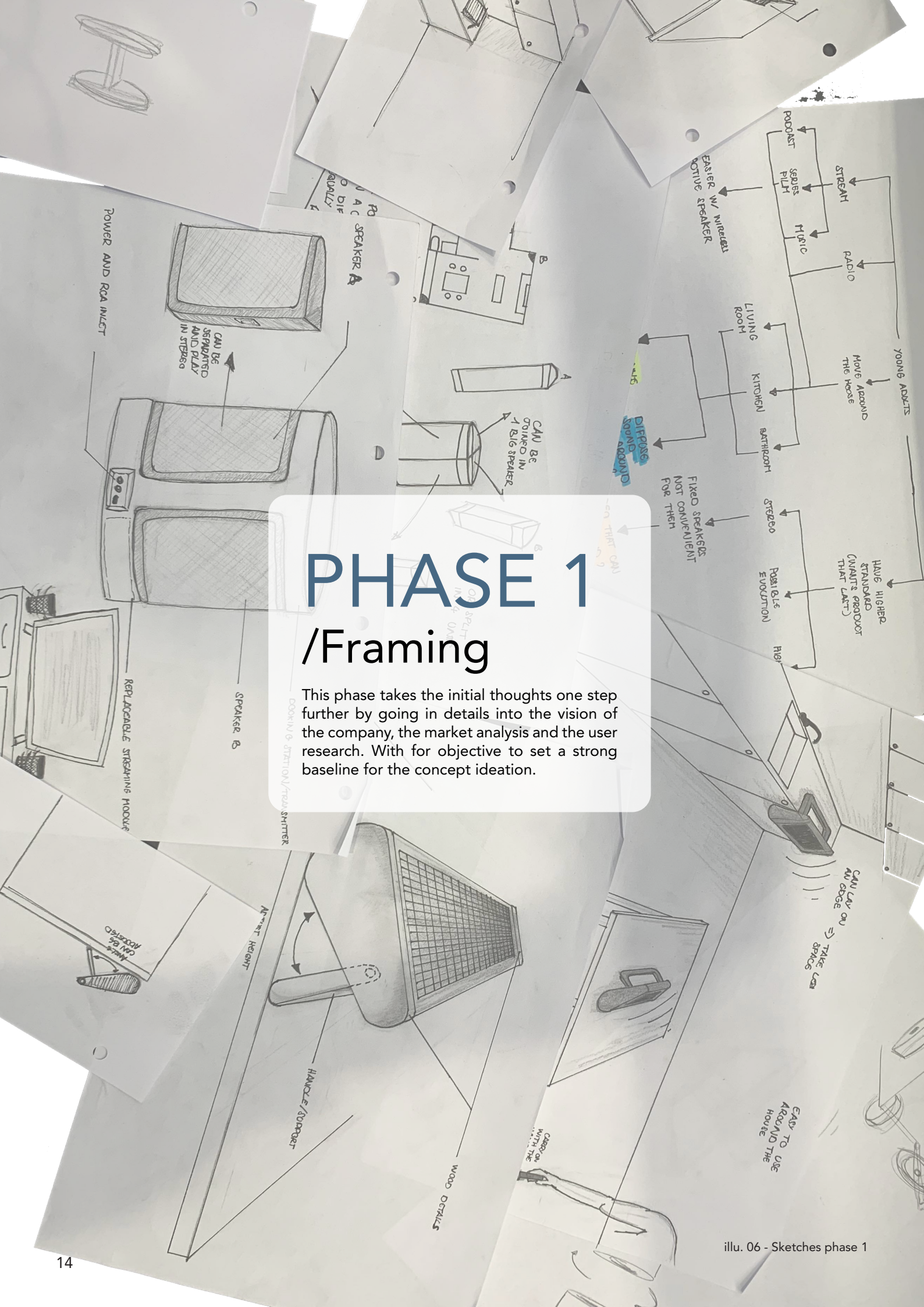
At the end of each phase a classification of the identified requirements is made for a better identification on what are the next actions for the process. After the first phase the needs are organized in different categories giving a concrete direction to take for the concept development. Along with phase 2 they are re-organized according to the findings to be finally merged into the final solution.



illu. 05 - Organization of the needs

PHASE 1
/Framing

This phase takes the initial thoughts one step further by going in details into the vision of the company, the market analysis and the user research. With for objective to set a strong baseline for the concept ideation.



illu. 06 - Sketches phase 1

List of methods

illu. 07 - List of methods symbols phase 1

Background research

Gathering informations from desktop research, interviews with the partner company and different audio shops. This initiate the project and gives insight on possible problem spaces

User survey

It consists of a set of questions to gather knowledge from a larger sample of users. It gives an estimate on how a general population will act to better understand their consumption ways and experience with a product.

Market analysis

By using different tools such as mind mapping, 4P's model and the user expectation-perception gap the market can be segmented into different categories. It is then possible to determine the direct competitors and how the market can be penetrated.

Interpreted user needs

This method allows to identify user needs by analysing the raw data gathered along the framing of the project. Then these needs can be turned into requirements serving the development of the concept.

Journey mapping

A journey mapping shows the different steps a user takes to accomplish a task. It is established thanks to interviews and user shadowing. As a result problem the user are facing can be identified to be later on turned into needs.

1.1/Passive and active speakers

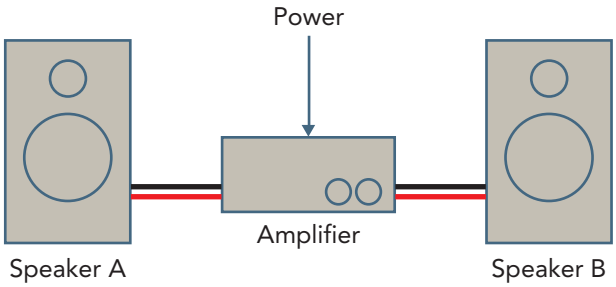
Speakers can be divided into two big segments: active and passive. In order for the reader to understand better the following choices a definition is necessary.

A passive speaker requires an external amplifier to work when an active speaker is self amplified. (Harley, 2022)

The advantage of a passive speaker is the flexibility for the user to choose all the components itself and have the possibility to make its system evolve over time by changing either the speakers or the amplifier separately. It's usually audiophiles that will invest in these kinds of products and they also are the biggest product segment for home audio at Dynaudio (Dynaudio, 2023). The main inconvenience is the cost of the components and the amount of space it takes. It is also less adapted to the current ways of consuming music. (Appendix 1)

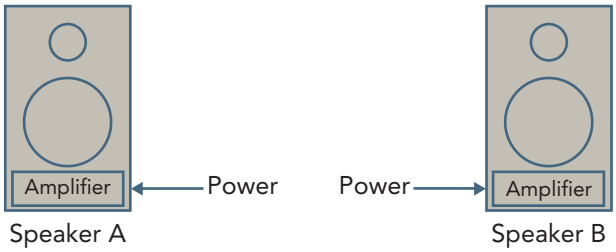
The advantage of active speakers is that it's easy to set-up and easy to use compared with passive speakers. Company wise it is also interesting because the engineers have a better control on all the system and can optimize the performance as much as possible. (Appendix 2). One of the main inconveniences is that once the speakers are bought it's complicated to make it evolve since the amplifier is directly integrated to the speaker unit.

Passive speakers



illu. 08 - Passive speakers

Active speakers



illu. 09 - Active speakers

1.2/The different audio segment

Dynaudio as its products portfolio split under 4 different segments.

Home Audio

Speakers unit specially developped for home use. The materials and finishes have simple and elegant lines to fit in all the home environments. For Dynaudio to breakthrough on the market this is the most interesting segment to dive in.

Pro Audio

These speakers are developed for music composer. It's meant to be functional and to sound as accurate as possible. The user is priorizing efficiency over functionality, there is therefore less potential for a product than in the home audio

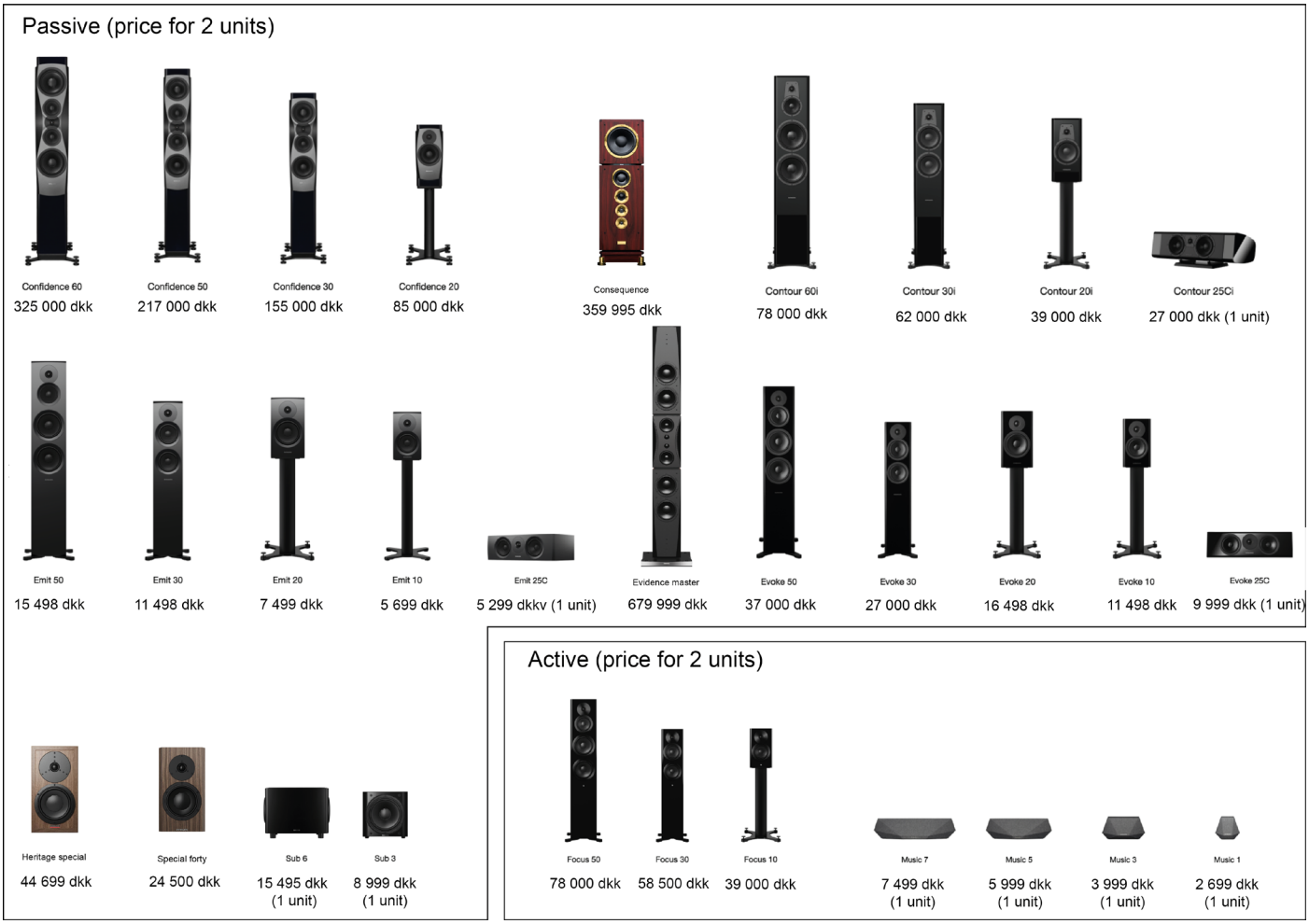
Car Audio

These system are specific to the car and requires mostly engineering rather than industrial design work.

Custom Install

These products are also more about engineering and are usually hidden into the walls, it's really specific to each case. Therefore there is no real opportunity for and industrial design project.

1.3/The home segment portfolio



illu. 10 - Dynaudio portfolio

The portfolio for the passive speakers is really well furnished and covers all the price ranges. It wouldn't make sense to develop a new passive speaker
Active audio products are almost not represented in their portfolio. The only speakers with 2 units for stereo sound and a real "speaker feeling" at home are the Focus range. With the Music range they could try to reach more people but this range is now discontinued. (Appendix 3)

Explore the active audio product in the home segment is then considered. Now it is necessary to determine more precisely the potential user and what needs they are facing.

1.4/Music range/Lifestyle products for a high end company

Lifestyle products are products that tend to understand better the user in their daily life and fulfill basic needs, sometimes putting quality aside for functions. (Stone, 2020)

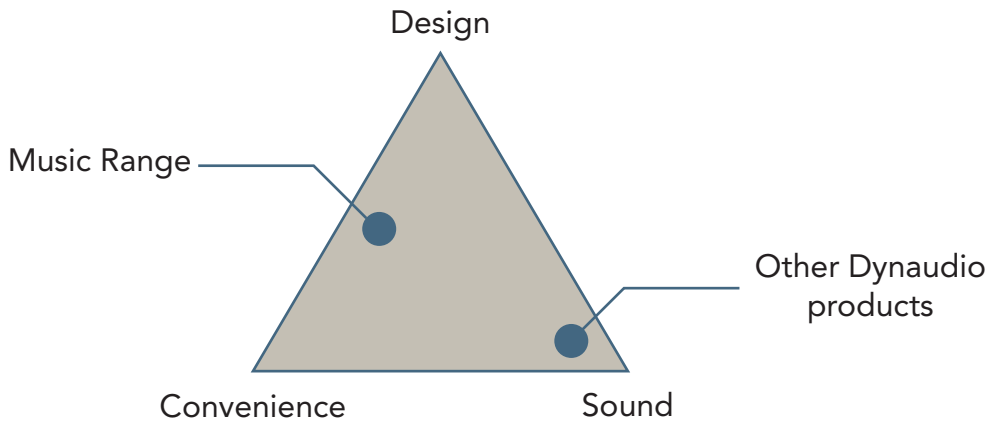
"It involves segmenting the market on the basis of lifestyle dimensions, positioning the product in a way that appeals to the activitvies, interests and opinions of the targeted market" (Sathish & Rajamohan, 2012)

Dynaudio tried to enter the market of lifestyle products with the Music range but they failed. Today the Music 1, Music 3 and Music 5 which were their entry products are discontinued. According to them the objective was to introduce Dynaudio to more people. (Appendix 2)

It is a good product with an unmatched quality sound for the price of these kinds of products. According to Dynaudio (Appendix 2) the main sale channel was through specialized retailers and audio shops which make it difficult for reaching a larger audience. It also has quite some basic functions and they are not really "different" than the competitors regarding functions and design. In the world of nomade bluetooth speakers most brands are doing similar products. It can be hard to break through for brands not specialized in this domain. The users have different needs and expectations than users for high end hifi.

The product position was radical for Dynaudio but rather incremental regarding the market. (Tidd & Bessant, 2013) (Appendix 4).

The Music range was branded as any other Dynaudio products even though it was sacrifying sound over convenience and design:



illu. 11 - Music range compared to other Dynaudio products

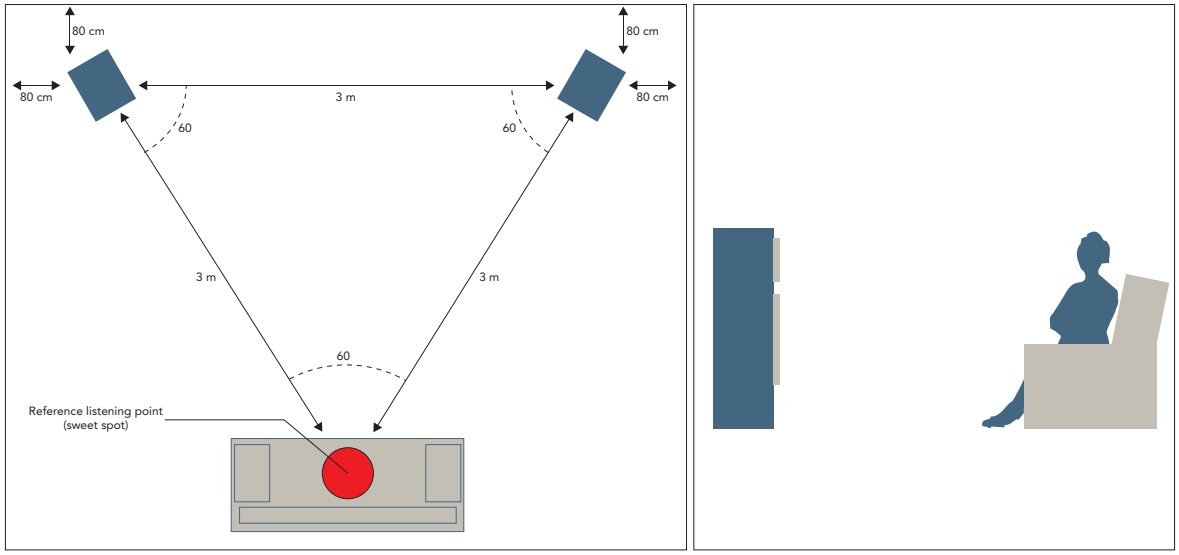
If a company is too radical when developping a product but doesn't align its vision with the users, the product will not find customers on the market.

1.5/Technical challenges/ The sweet spot

The sweet spot

To get more knowledge about the audio products and find a potential angle, a well known problem, the sweet spot effect, is investigated.

The sweet spot is the term used to define the focal point between 2 speakers. The listener can listen fully to the music as the artist intended to. It's the location at which all the wavelengths arrive simultaneously (Frank et al., 2014). To experience the music at its fullest the speaker should be placed according to the following position:



Placement in the room

Speakers height inline with the ears

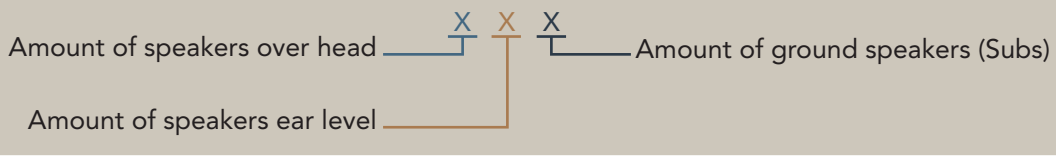
illu. 12 - Recommendations to place 2 speakers

Due to this effect there is only one position in the room where the music can be enjoyed at its fullest, to counter that different solutions can be used. The most common is to use a surround sound system to limit this effect.

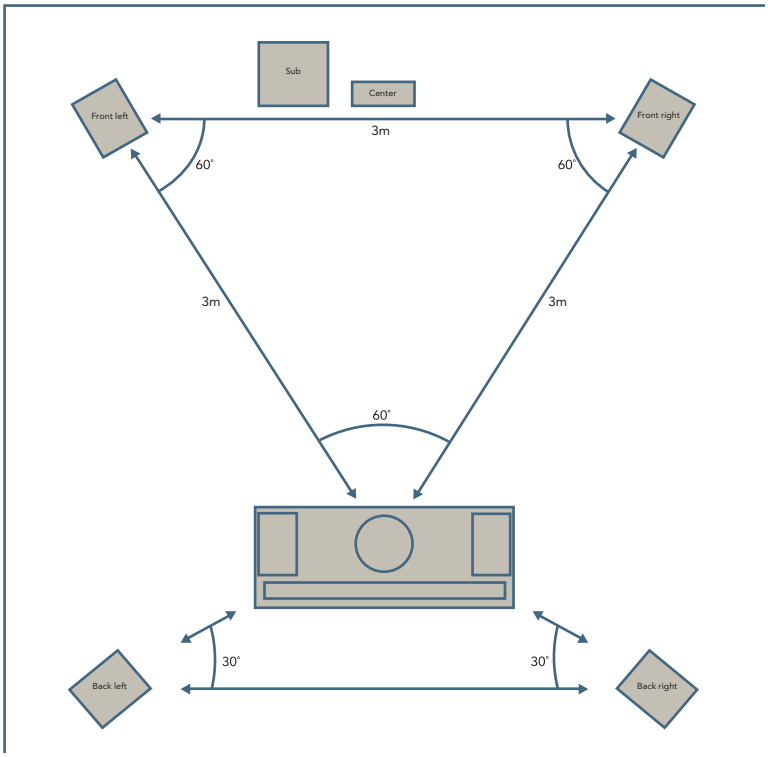
Surround sound

Surround sound is commonly used by cinema lovers that want the fullest experience. The principle is to place speakers around the room, when placed correctly the sweet spot effect will also be there but by enhancing the amount of speakers in the room the sound will surround the user from all sides and more people can enjoy the experience better.

The set-up can be defined by a code with numbers:



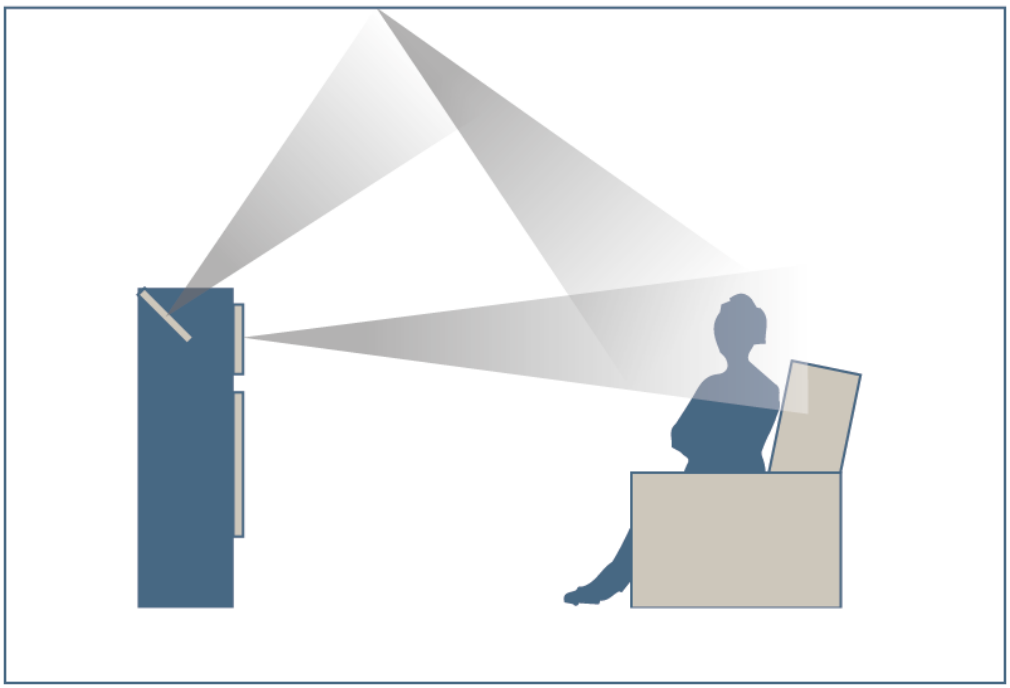
As an example the most common set-up is 5.1 with 5 channels at ear level and 1 sub. (Dolby, 2023)



illu. 13 - 5.1 Surround sound

Dolby atmos

Dolby atmos can be referred to as a "spatial audio" system. There is not really one sweet spot, the sounds are projected on the ceiling and directly in front of the user. The principle is to create a sphere around the users and create an immersive experience. More and more TV soundbars are using this technology and today most streaming services offer the possibility to listen in Dolby atmos.



illu . 14 - Dolby atmos system

Considering technical problems and solutions in the early stages is challenging due to the large amount of uncertainties in the design process. It can help to give a direction or gather knowledge about a product to be used further on. More research about the speaker market and the user are required to move further.

1.6 Media consumption/Streaming services and sound quality

The market is constantly evolving and the brands are adapting to it, it is possible to see that today, most audio brands have a lifestyle product segment or have completely changed their portfolio. One of the most striking examples is JBL, in 2012 (Carnoy, 2012) they released their first bluetooth speaker and started to move away from their core products line which were loudspeakers. This is mainly due to a change in the way of consuming media, with the apparition of mobile phone and streaming services it became easier to use portable devices.

It is possible to see a net increase of revenues from streaming media compared to physical media from 2015 to 2020 in Denmark:

Streaming foreign	208 mDKK	2015
	331 mDKK	2020
Physical foreign	36 mDKK	2015
	23 mDKK	2020

Source: Statistics Denmark, 2021

illu . 15 - Revenues from streaming media compared to physical media

This tendency is not only applied to audio media but also to audio visual media, the consumption of traditional TV dropped too. According to the medieforskning report (DR medieforskning, 2023), looking at the "Fordeling af danskernes mediebrug» survey, traditional TV dropped from 37% to 22% within 6 years when the streaming for audio visual went up from 10% to 27%. (Appendix 4)

At the same time streaming services for the larger audience such as Spotify and Apple Music have appeared and offered a wider and faster selection of music for the users. At first these services offered a lower sound quality playing MP3 files at a rate of 320 kbits/s. This is still the case for Spotify today (Spotify, 2023). But this is changing since the COVID-19 pandemic and people's awareness for sound quality is increasing (Appendix 6). To answer that Apple music increased the quality of their services in 2021 by launching Spatial and Lossless audio possibilities with a maximum rate of 192 kHz (Apple Music, 2023).

The audio brands had to adapt to the market, when going into lifestyle product they accepted to raise the sound quality of their products but today the awarness for the sound quality is raising. How it is possible for these brands to re-adapt to these new customers wishes ?

1.7/Media consumption of different age groups

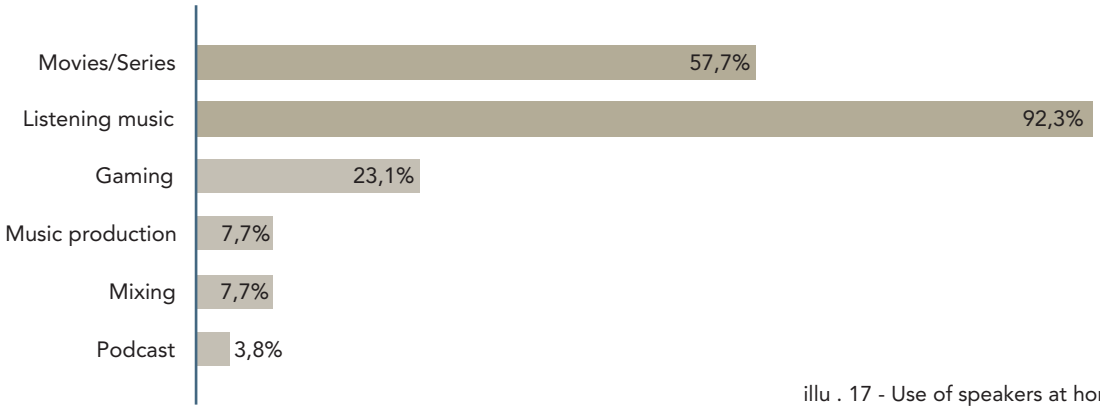
According to the "medieforskning" report (DR ,2023) for the year 2022 the ways of consuming media are at a turning point. The older people are as well more reliant on streaming services, they say: "change and digital evolution are not the preserve of the young." But young people are still the biggest streaming consumers and especially young adults between 25 and 31 years old. (Appendix 5)

AGE GROUP	STREAMING (min/day)	TRADITIONAL TV (min/day)
Young (15-24)	110	10
Young Adults (25-31)	154	12
Adults (32-46)	135	44

illu . 16 - Media consumption by age group

Young adults being the biggest consumers of streaming services they seem like an interesting age group to work with. By guts feeling they are also more influencable than older groups and start to earn money when they are done with studying. Further research will be done to understand them better and see if there is potiential for a new product.

The survey (Appendix 1) shows what pourcentage of the respondents are using their speakers for. 92,3% of them are using them to listen to music and 57,7% to enhance the sound while watching movies or series.

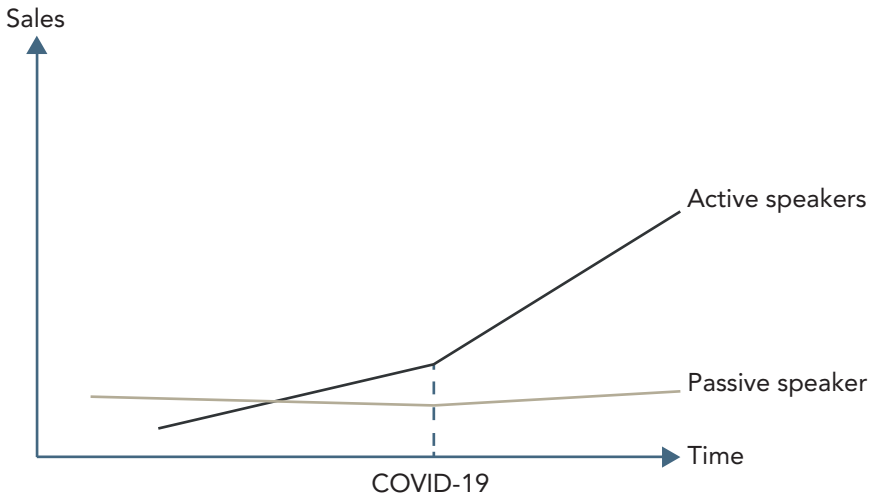


illu . 17 - Use of speakers at home

The new audio product must take into account the use for movies/series beside being listening to music.

1.8/Audio products/The actual state of the market

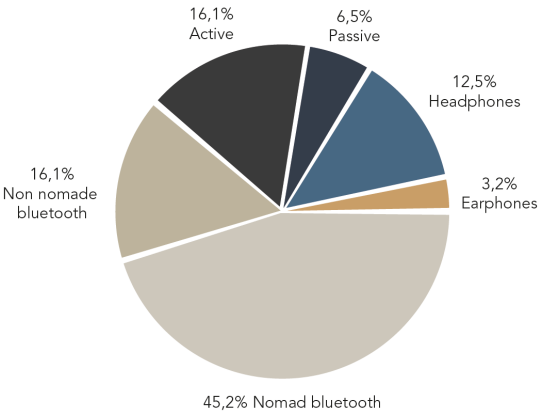
The change in the consumers behavior can be seen with the actual state of the market and the type of devices they possess. An interview was conducted at Lydspecialisten, it's a shop specialized in audio equipment that are selling both through online and in-store channels (Appendix 1). According to a salesman since the COVID-19 sales for active and passive speakers have both increased but in a different way. This can be represented in a "dummy" chart:



illu . 18 - Sales of active and passive speakers over time

For overall sales the market is largely dominated by active speakers. It can also be observed when looking at the most popular sales of different shops across Denmark, as well in specialized shops (Hifi-klubben, Lydspecilisten…) as in bigger distribution channels (Elgiganten, Bilka…) (Appendix 7).

In order to confirm this tendency a survey is realized among young adults from 22 to 30 years old (Appendix 1). It is observed that at home Nomade bluetooth speakers are the most used product. Afterward comes non nomade bluetooth speakers and active speakers. In total 77,4% of the products are active speakers against 6.5% of passive speakers.



illu . 19 - Repartition of audio devices among respondents

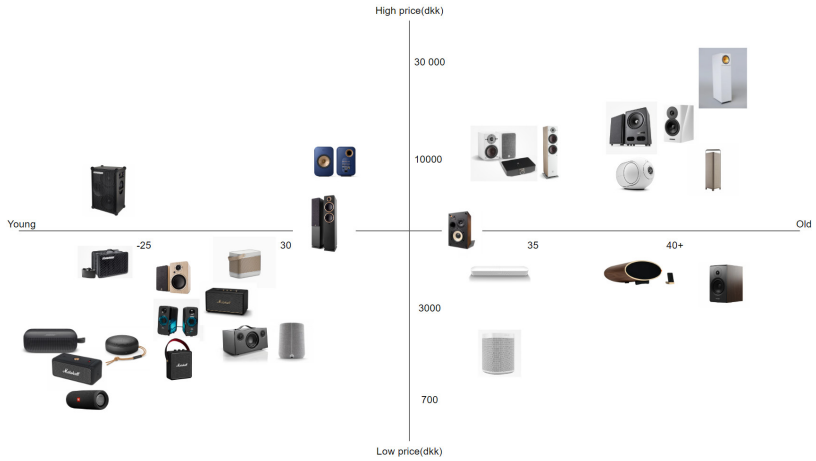
TVs are becoming more and more flat which let less space for good integrated audio, therefore people are buying external devices such as soundbars or stereo speakers to compensate (Kelly, Lee, Kim & Park, 2020)

The current research shows that the market is segmented in a lot of different kinds of speakers. Among the young adults it is seen that they use different kinds of products making it difficult for the designer to frame what they really want. In order to find out, some more market researches are necessary.

1.9/Market research

A desktop research is made to identify what are the most popular products among specialized audio shops (Lydspecialisten, Hifi Klubben, Top Sound) and bigger distribution channels (Elgiganten, Bilka) (Appendix 7). Depending on the kind of products and shops, the difference in the age groups targeted can be quickly identified. The specialized audio shops have a tendency to target older users with more expensive and exclusive products while big distributors aim to touch a younger audience. The retail price of the product is seen as really important and often will raise depending on the quality of the product. Therefore these products are mapped according to the age group of the user and the retail price. (Appendix 8)

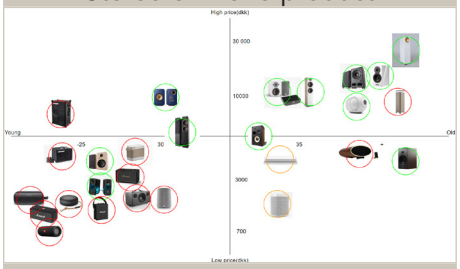
The objective is to identify a possible pattern and consumer habits in function of their age. The age is identified according to the previous research, the design language of the products, the reviews of the products and the interview with 2 audio shops in Denmark. A special attention will be given to the young adult segment as they are an interesting group to investigate.



illu . 20 - Map the products on the market

Different elements can be identified:

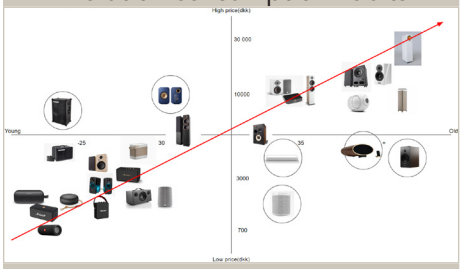
Stereo or mono product



illu . 21 - Stereo or mono products

It shows that younger user are mainly using mono products and that evolves towards stereo products that are more expensive when they grow up. The young adults are in between and the stereo products are generally aiming for an audiophile audience. Sonos is a bit special because the user can buy one product to evolve into stereo or multi room system.

Evolution consumption habits

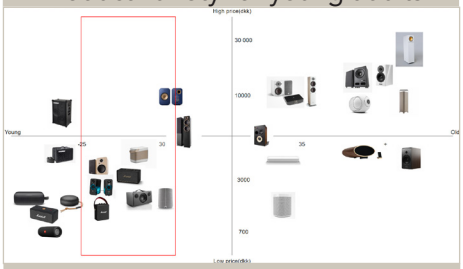


illu . 22 - Evolution consumption habits

The cost of the product is generally evolving with the age of the user. Few exceptions are identified:

- **Sonos and Soundboks** are offering a different kind of solution, the story behind the product and the functions combined to a strong marketing allowed them to breakthrough on the market.
- **The KEF LSX** is targeting young users despite its high cost. The fashionable design, the brand history and its knowledge in audio are strong sales argument for the younger audience.
- **The Tangent audio** product and the **Dynaudio emit 20** are cheaper than the other products but the brand knowledge "assure" the user that it's still a good quality product.

Product variety for young adults



illu . 23 - Product variety for young adults

In the young adults segment there is a wide variety of products (mono, stereo, nomad, fixed...). This could be explained by the user being in between 2 categories. Therefore it can be difficult to differentiate from other products, but by bringing something new on the, market it is seen that a brand like KEF despite the price of the product can be popular.

Dynaudio wishes to touch a larger audience with their products. The market research shows that young users generally go for cheaper solutions and seek for nomade bluetooth speakers, as a high end audio company Dynaudio doesn't fit well in this market. Dynaudio already has a lot of products targeting adults, they generally seek for a more standard solution with sets of stereo speakers, it wouldn't make sense for them to make a new solution in this market. The young adult segment is interesting due to the high variety of products, these users are more interested in products with new functionalities and can be influenced by the brand history and knowledge.The tendency for the users to go towards a more fixed solution when they grow up leads to the following insight: being in the young adult segment leaves more space for a solution that can evolve further on and follow the user in its journey.

A market research segmented in user groups depending on their age allowed to identify what are the consumptions behaviors of each group. It clearly shows that the older they get the more money they spend in audio products while seeking for stereo products. It also helps to identify the competitors and gives insights on the competitors and the successful products on the market.

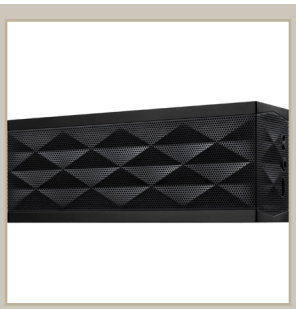
This tool is a way to have a better overview on the market while excluding some areas to go in, it is a way to narrow down the research. Thanks to it two successful competitors (KEF and Sonos) are identified by the difference they create from other products. "The market research lead to a question: What made them successful ?" This will be researched on in the following section.

- The new functionalities of the product should be tied to a story.
- Use the brand history and the brand knowledge to ensure a good quality product to the user.
- A solution for the product to evolve with the user.
- Target young adults

1.10/ Breakthrough of some audio brands/Jawbone, Sonos, KEF

The objective is to analyze the breakthrough of different successful products on the speaker market to possibly identify some patterns revealing different aspects that can be respected for a new Dynaudio product. Different theories can be used to get information about the products. Make an analysis in depth is complicated due to the available informations, realizing a deep analysis about the reasoning behind the design with non verified informations from the designers could lead to a high level of abstraction and non accurate results. To have better results and avoid misleading information the 4P's model can be used to clarify the position of the competitors and of Dynaudio on the market.

4 products will be analyzed. 3 successful products from competitors (Jawbone, KEF, Sonos) and 1 unsuccessful product from Dynaudio. Their position according to each aspect (paradigm, Product, Position and Process) will be compared to see if there are some common elements or differences between the products. (Appendix 9)

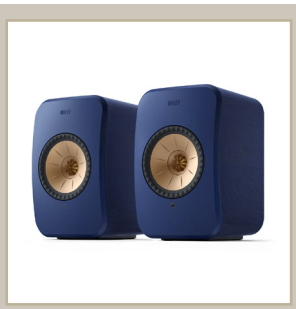


illu . 24 - Jawbone Jambox

The jambox had a successful breakthrough thnaks to high level of customization and unmatched functionalities for its price.

illu . 25 - Sonos play 1,3,5, Gen 1

Sonos is today the leader on the multi-room systems, before launching the Sonos Play they were struggling to touch a large audience.



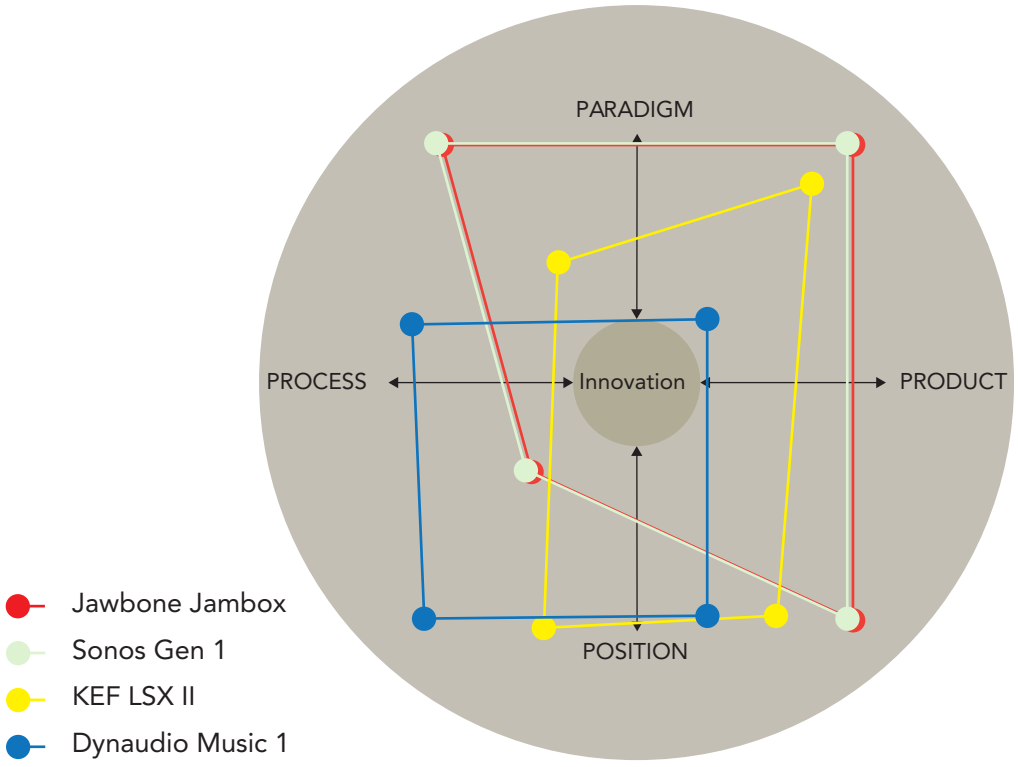
illu . 26 - KEF LSX II

The LSX II allowed this historical brand to touch young adults and introduce them to KEF and higher audio quality.

illu . 27 - Dynaudio Music 1

The Music had for objective to touch a larger audience and introduce Dynaudio on the lifestyle speaker market but it wasn't successful and is now discontinued.

After desktop research about the different products they are placed on a 4P model (Tid & Bessant, 2013) where they can be compared with each other's. (Appendix 9)



illu . 28 - 4P's Model

The main difference observed that could give insights on what made the success of the Jambox, Play and LSX facing the Music 1 could be the position the brand decided to take regarding the process and the product.

For the Jambox, Play and LSX we can see that the products are **rather incremental on the innovations regarding the process.** The brand knowledge previously acquired is used to develop a new solution that will ask for least investment or changes in the making of a new product. On another hand the Dynaudio Music 1 was completely new for Dynaudio and resulted in a radical innovation regarding the process.

The Jambox, Play and LSX have a tendency to be more **radical on the product.** This allowed these brands to be some of the first movers on the market and bring something new. On the opposite, Dynaudio is incremental with music 1 and therefore couldn't create a difference in regard to the competitors.

Regarding the paradigm it is different in all of these brands, KEF was rather in between/incremental but it didn't fail them to meet success, they could use the code of classic stereo speakers and by few changes touch a younger and larger audience.

In this position most of these brands tried something new compared to their portfolio and this can't really explain why one product would have more success than another one.

!

This analysis of different successful products in comparison with the Dynaudio music 1 showed 2 aspects that can explain a potential failure for this product.

As it is today Dynaudio acquired the necessary knowledge to develop a new solution for a nomad speaker allowing them to be **incremental on the process.**

To maximize the chances for a new solution to breakthrough, a **radical innovation on the product** is being considered. The product can be radical by the story it is telling or the way it interacts with the user, it could also be a product including a completely new feature or way to interact with sound.

1.11/ Product evolution and trends

Being only a trendy product can be risky because the user might get tired of it and not use it anymore. This can be supported by the user research (Appendix 10) and works specially for young adults. They might buy products on a whim but still want products they can have for a long time, if once bought it doesn't fit their needs or the environment they will get rid of it. In the interview with Emil (Appendix 11) it is seen that he bought a speaker but because he doesn't really have the needs, he is now selling it.

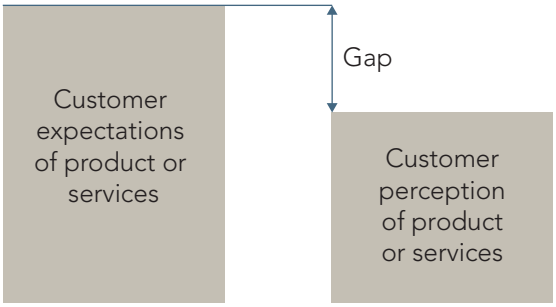
According to "Research Trend, 2023":
"On the other hand, following a trend can also expose you to uncertainty, volatility, and competition, and make you lose your identity and differentiation. Similarly, ignoring a trend can help you preserve your authenticity, uniqueness, and stability, and focus on your core competencies and strengths. But ignoring a trend can also make you miss out on new opportunities, markets, and customers, and become outdated and irrelevant"
To avoid being only trendy , different strategies are adopted by brands. The case of Bang & Olufsen with the B&O Level and of Sonos are studied.

Bang & Olufsen Level

The Level is sold as a product that can evolve over time in order not to become obsolete (Bang & Olufsen, 2023).

The battery is replaceable in case its lifespan is too low and the streaming module can also be changed if the updates become too heavy for the speaker to work correctly. By going into a modular approach the costs of the components are rising to make sure the connection will be strong enough. In the end the price of the product is really high for its sound capacity, it should be compensated by the modularity but according to the interview with Hifi-Klubben (Appendix 12) customers are quickly disappointed. This resulted in high sales at the launch but decreasing later on.

There is a gap between the customer expectations and customer perception (Hansen, 2021)



illu . 29 - Gap between customer expectations and perception

Users might buy the product on a whim when a lot of sales can be done at the beginning, but they will be disappointed later on and therefore there is a risk of losing their loyalty to the brand.

Sonos

The core of Sonos is to offer a wireless multiroom system working on wifi (Sonos, 2023). They have different kinds of products in their portfolio but they expect the customers to buy and add products to their existing system over time.

The case of an interviewee from the Ambient 1 master thesis is taken (Mohr, Abrahamsen & Knudsen, 2020):
Michael is 40 years old and has a Sonos multi room system that he has evolved over the years. Now he has Sonos speakers in all the rooms but because of the neutral colors and design he is getting bored of it, it is becoming "too mainstream". Because of that he has now started to switch for another brand Harman Kardon (Appendix 13).

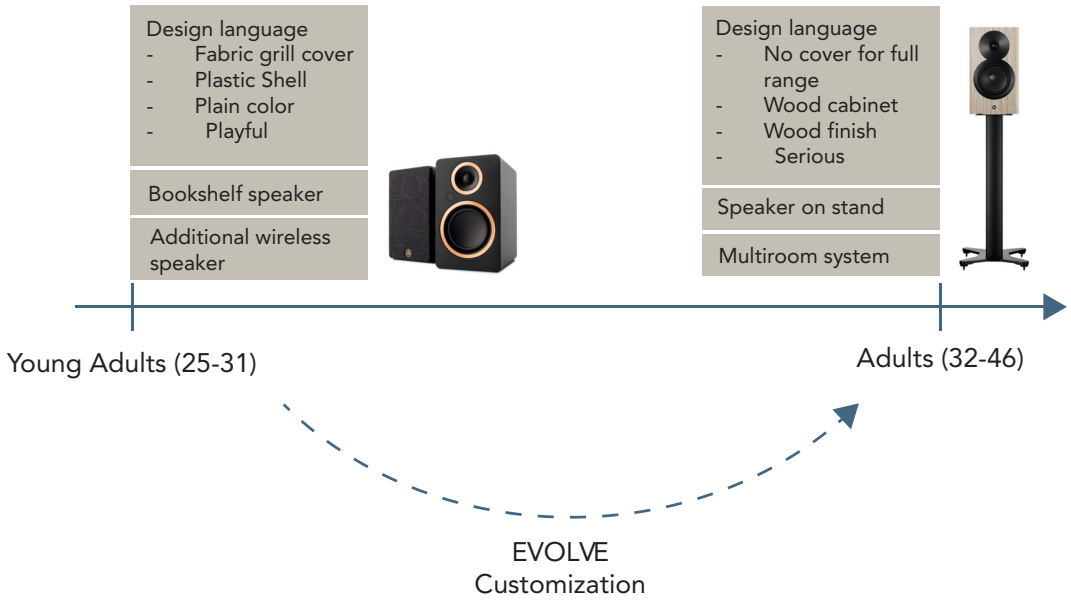
The needs of the user are changing over time but it can be difficult to predict what it will be in 10 years from now. Satisfying all the users with one solution is not possible but they can be attracted by the possibility for an evolution. Selling the idea of the product evolving doesn't mean that they will necessarily make it evolve.

The product should give the user the possibility to evolve.

1.12/Product evolution/Follow the user journey

Prolonging the lifetime of a product can be challenging as the user needs and tastes evolve over the years. With audio products the way users interact is changing. Audiophile young adults are more “nomade” and listen to music all around the house, they usually have a wireless speaker beside their stereo. But when growing adults have wishes for a fixed system and their aesthetic tastes also change (Appendix 13). It is also seen in the design language of the products when placing them on a graph with the age of the users (Appendix 8).

The product journey



Source for pictures: (Argon Audio, 2023) (Dynaudio, 2023)

illu . 30 - Map for product evolution depending the age of the user

This example illustrate it, on the left it’s the Argon audio Fenris A4 that fits better for young adults, with fabric can be placed on it, simple shape and a plain color finish.On the right it’s the Dynaudio focus 10 which is mostly used on a stand and offers a high level of detail, seems more “serious”and with a wood cabinet finish.

Having an idea of the needs from users being young adults to adults, the journey of the product can be established from beginning to end. Evolving with the user can be a way not to get outdated and prolong the product lifespan. Consider the possibility for an evolution as the core working principle in the early stages of development can be difficult because of the lack of informations and needs to start iterating on a solution. A proposition for an evolution will be made in later stages of the process with more knowledge about the user and the concept.

Some simple element can still be considered from the beginning of the process to offer a possibility for an evolution such as:

- A front grill that can removed.
- The possibility to add a stand.
- Be able to connect the product with other Dynaudio product for a multiroom system.

1.13/Focus on the young adults/Interview with Daniel

This interview (Appendix 10) helps to better understand the consumption ways of young adults that are done studying. Some important elements arise and will be used for the development of a design brief.

User profile

- 26 years old
- Bachelor in journalistic studies
- Starts to settle down
- Live with a partner
- Danish

In the bigger picture we can see that most of the expenses are made in the first 6 months of getting a new job. They spent the money on equipment for home to create a better comfort and living space. Money first goes into what he likes rather than being completely rational in its expenses.

E.g. With his girlfriend they love coffee and even though it's not a necessary product, they spent 6.299dkk on a coffee machine.

It unveils an interesting insight, young adults are more encline to buy expensive products related to what they love when they start to get their first salaries. It can be interesting to try reaching audiophile young adults at this moment.

At this age he is also developing brand loyalty, they use a Bang&Olufsen speaker because of their reputation and design. They will buy from them again because they are convinced by it and don't want to spend hours searching for a new product.

Young adults are tending to be more influenced by trends and are more sensitive to marketing.

When buying an e-product he would rather buy a new one that can last long because he will save money in the long run instead of replacing it too often, it also feels more sustainable.

With his girlfriend they first think about how it will fit in the house, the environment respecting the codes of New Nordic Design. At this moment of their life, young adults start thinking more and more about the environment they live in and how harmonious it should be.

The product should fit the user environment and respect the aesthetic codes of "new nordic design".

The product should target young audiophile adults.

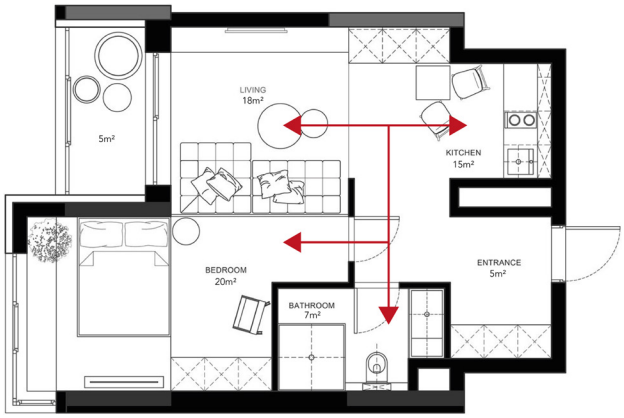
Young adults want a product that last.

1.14/Insights/User journey to prepare the 1st iteration

User shadowing is used with Daniel (Appendix 14) to see what are the different steps in the day of a user and its interaction with audio sources and product in general.

In the morning the user is using a nomade B&O bluetooth speaker to play radio and is moving it around the house while taking his coffee, going to the bathroom and dressing up. When going to work he is listening to music on the way. When coming back from work the bluetooth speaker is used to listen to music while showering or cooking and if he wants to relax in the living room he will turn on the sound of the TV to watch series.

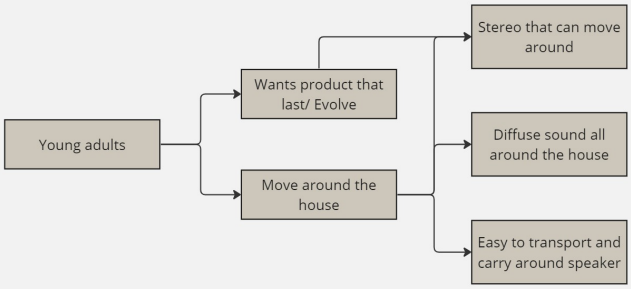
It is noticed that Daniel is listening or watching different kinds of media all around its appartment:



illu . 31 - Movement around the appartment

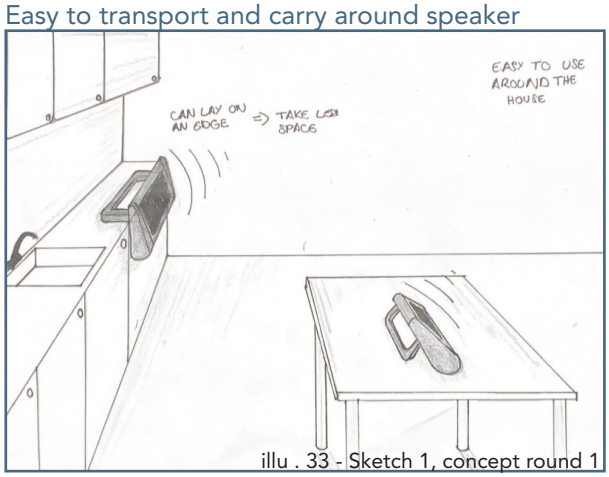
1.15/1st iteration/Approaches and solutions

This first round of concepts is to throw first ideas on paper in order to clear the mind. The needs are identified for the previous parts in the process report.



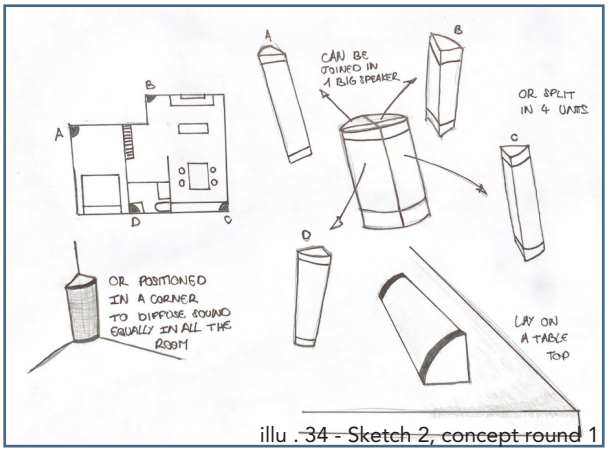
illu . 32 - Mapping to prepare round 1 of concepts

Easy to transport and carry around speaker



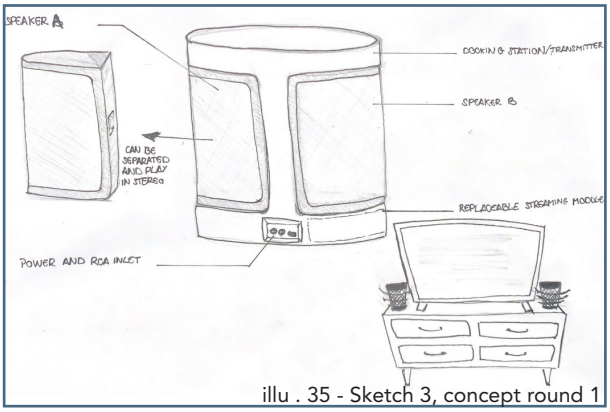
illu . 33 - Sketch 1, concept round 1

Diffuse sound all around the house



illu . 34 - Sketch 2, concept round 1

Stereo that can move around



illu . 35 - Sketch 3, concept round 1

Evaluation the concept round 1

The goal to reach is still vague but in term of innovation the Sketch 3 is the best solution. Sketch 1 and 2 are already seen products on the market and would not create a difference for the users. **Therefore the stereo that can move around is chosen as a starting point but more user research and a more precise user journey will allow to have a more precise problem statement for a better ideation and further iteration.**

1.16/Precise user profile/Young audiophile adults

Following the feedback from the Milestone 2 (Appendix 15) and from a meeting the 01/03 with Dynaudio designers team (Appendix 16) a sharper profile and analysis of the user is done.

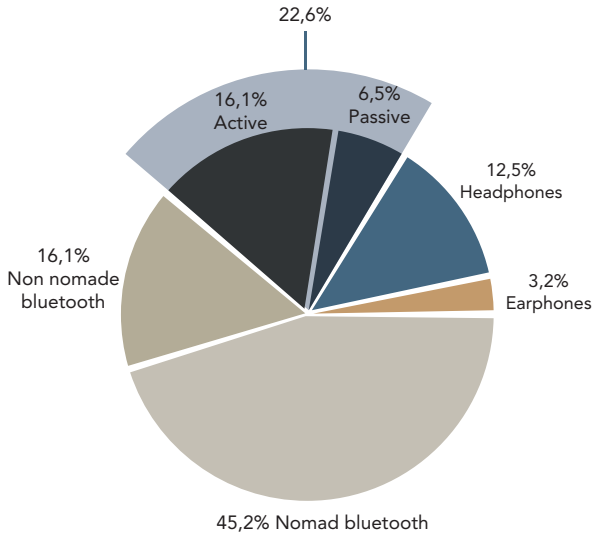
As discussed in the meeting (Appendix 16) and from reflection according to the actual results, it is chosen to focus on young audiophile adults. The interview with Daniel (Appendix 10) shows that young adults are more inclined to first spend money on what they like, their passion. Therefore young audiophile adults are now targeted.

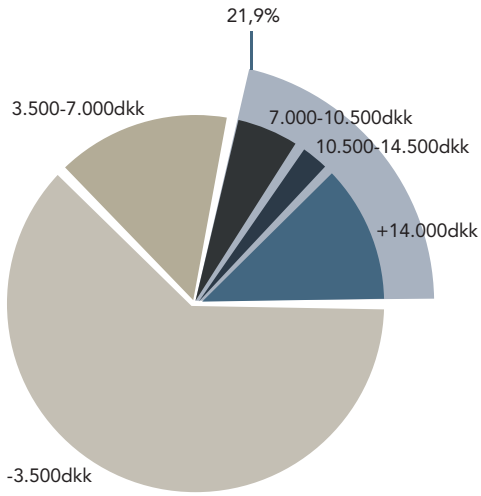
More interviews are conducted, to find a larger base of users. People selling their audio products on the "Facebook Marketplace" are contacted. How they used their products, why selling it and what potential problems they encountered, are asked.

These people are selling their speakers because the product didn't fit in their existing environment or couldn't adapt to it. Young audiophile adults usually tend to possess one bluetooth speaker and a stereo set of speakers or a soundbar. The first buy is generally the bluetooth speaker and the stereo/soundbar comes later when they have more money to invest into it.

By looking at the reply from the survey and replies from respondents in interviews (Appendix 1, 11, 17) in general the males like to talk more about their products and their technical characteristics, they also compare the products and seem to have a wider knowledge on the audio products market.

Looking back at the survey (WS 06) 45,2% of the respondents possess stereo speakers (active + passive) and can be considered as audio enthusiasts. 22,6% declare that stereo (active+passive) is the device they use the most at home. 21,9% spent more than 7.000 Dkk on audio equipment.





illu . 36 - Correlation between audiophile and retail price

These 2 numbers correlate meaning that young audiophile adults are willing to spend 7.000 Dkk on audio equipment. A retail price limit of 7000dkk is set for the product.

Precise user profile

- Young adult (25-31 years old)
- Audio/Movie enthousiast)
- Done studying and just start working
- Male
- Max budget 7000dkk

1.17/Young adults environment/ New nordic design

The requirement in section 1.13 says that the product should fit a new nordic environment as this is the most common style for Danish young adults, the user profile being more precise it is also necessary to better understand the enviro-ment the users are evolving in. This section aims to gather more knowledge about the New Nordic Design to identify some potential materials and aesthetic guidelines for the product.

What is it ?

The new nordic style started in 2005 and is following the heritage of classic Scandinavian style. Its values are relating to:"nature and climate, social models of welfare and equality, and pure, minimalist forms" (Skou & Munch, 2016). According to Gundtoft, 2015 it attracts by the simplivity of the design, the attention to detail and the high quality of materials. Another essential element of this style is the story the products are telling, it should be more than just a product.

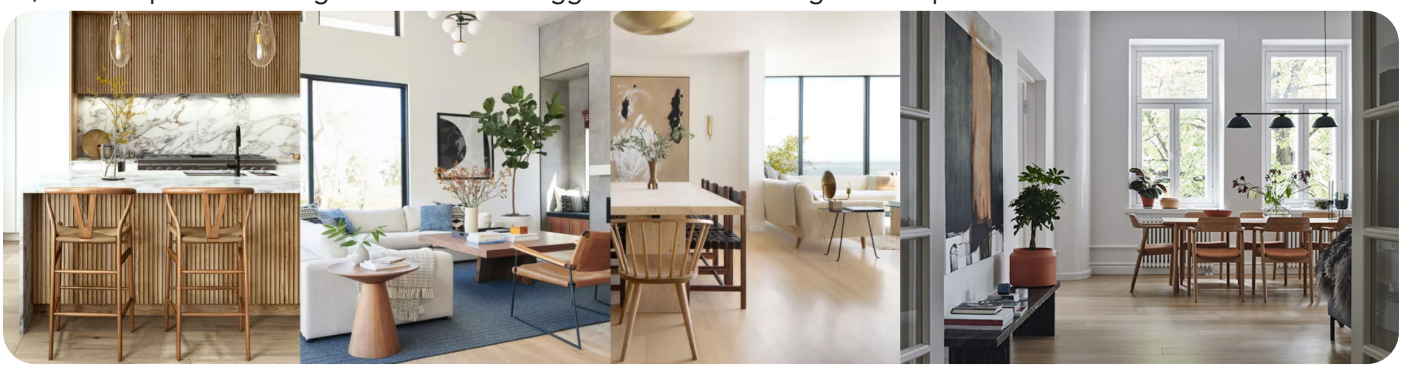
Across the interviews with the users and more specifically with Daniel (Appendix 10), the young adults can recognize themselves in the New Nordic Design, this style is common among them in Denmark (Appendix 18). The society is evolving towards more sustainable consumption ways and building an harmonious environment to live in. The colors, materials and aesthetic are supposed to translate these values into a product. The first criterion for Daniel when he buys an object is to know if it will pollute or not the environment at home. The interior is though for everything to fit together in harmony. By using natural materials, a simple design language and a high focus on the details the products are not just following trends and don't get outdated.

Examples/Inspiration

Classic elements such as the "PH-5" lamp by Poul Henningsen are combined with natural wood furniture and sober fabrics. To break up the simple colors, raw metal elements are often added as well as some colorful details.

illu . 37 - Daniel's apartment

To verify it a computer research is made on facebook marketplace to see interiors in Danish young adults (Appendix 18) and on specialized magazines to have a bigger databank of images for inspiration.



illu . 38 - New Nordic interiors from specialized magazines

From this section different materials such as wood, metal and soft grey fabric are identified to fit in this environment. Identifying the timeless elements of New Nordic Design will favorize a design that last. The importance of the story telling is also identified and should be included in the new product.

1.18/Levels of circular economy and e-product waste

Goals for a sustainable e-products consumption

Being influenced by the New Nordic Design promoting the respect of the environment and climate, young adults are changing their consumption ways, they tend to buy products with a longer lifespan that they can keep. For electronic products (e-products) these aspects can be hard to respect because of the difficulty in recycling the components. To limit the consumption of e-products users prefer to buy new ones and select good quality making sure it will last as long as possible (Appendix 10).

The number 12 out of the 17 goals for sustainable development set by the United Nations is to "ensure sustainable consumption and production patterns" (United Nations, 2022), it is specified that the vast majority of the world's electronics is not being safely managed. In 2019 the EU made the "Waste from Electrical and Electronic Equipment (WEEE)" directive. One of them being to improve sustainable production and consumption. (European Commission, 2022)

Beside that, in March 2020, the European Commission presented a new circular economy action plan that has, as one of its priorities, the reduction of electronic and electrical waste. The proposal specifically outlines immediate goals like creating the right to repair and improving reusability in general, the introduction of a common charger (USB-Type C) and establishing a rewards system to encourage recycling electronics. (European Parliament, 2020)

Respecting a fully circular economy for e-waste can be difficult because of the high number of different components in these products. To limit the wastes, circular economy and goals for a sustainable future can be respected on a lower level by increasing the lifespan of the products.

The position of Dynaudio (Appendix 2)

According to Dynaudio, sustainable consumption is already respected to some extent. The goal with their products is to design to last, it shouldn't be outdated and the user must use it for a long time. If the user desires to change products it will usually sell it as a second hand product and the product life will continue.

With passive audio it is more complicated to include recycled products because it wouldn't match the user expectations but with active products and mostly in a "lifestyle" range it can be interesting. Young adults are another generation with different views on the product and it can fit their needs.

A challenging problem to face is the streaming module. It's an electrical board that enhances the user experience with a faster and simpler connection. The danger is that streaming services can be outdated. B&O tried to answer this problem (Section 1.11) but according to one of the acoustic engineers at Dynaudio this solution comprises a lot of sound and the motherboard must be replaced when further on replacing the streaming module, it is a really expensive solution in the end. To face that their solution is to partner with one the leading and most stable companies in this domain to make sure the latest component they buy will last for many years. The software developers also understood it and their vision is changing, the solutions don't quickly become obsolete and past versions can work with the newer ones. E.g. if the user has a streaming module working under "Airplay 1" in its speaker but the phone as "Airplay 2" it will still work. (Appendix 19)

To follow the regulation from the EU the speaker must include a **USB-Type C charger**. The design language should respect the codes of New Nordic Design to fit the user environment and needs. Combined with **long lasting components and materials** the product will not get outdated. It should also **respect the principles of Circular economy on a lower level.**

1.19/Problem identification/Map the user journey

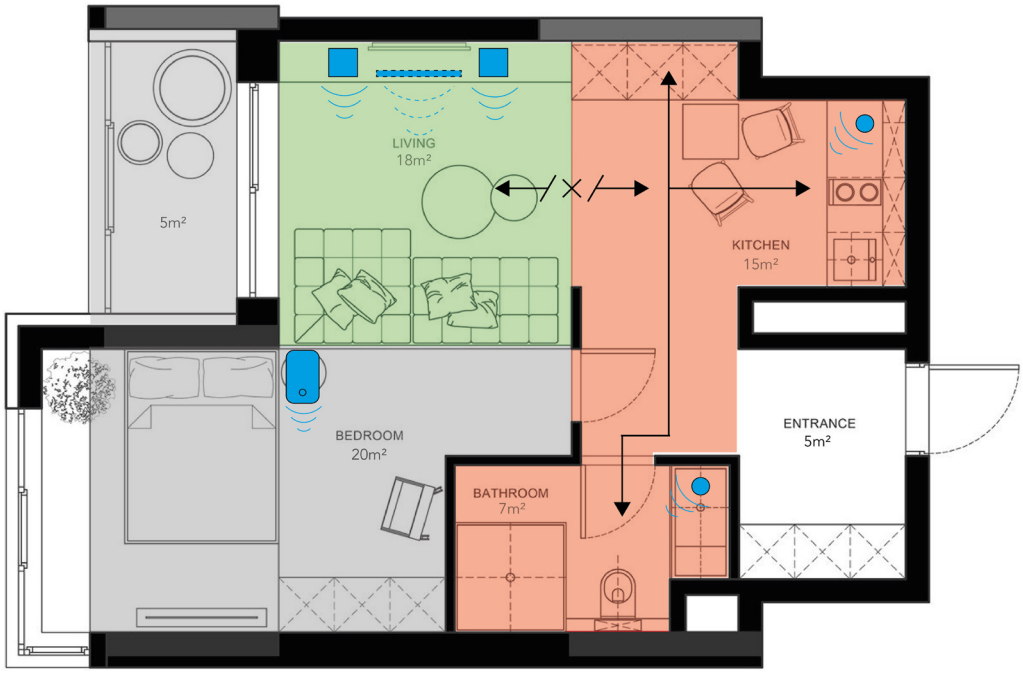
To understand how the different devices used data is collected from the Ambient 1 project (Mohr, Abrahamsen & Knudsen, 2020). These interviews have for objective to determine what devices are used in what room. 7 young adults between 24 and 26 years old are interviewed.

The number of respondent using a sound output in what room is then noted in the following board:

Sound output	Bedroom	Bathroom	Kitchen	Living room
PC/tablet/smartphone	4			2
Nomade bluetooth speaker	1	2	3	
Stationary bluetooth speaker				2
Hifi			1	4
TV				4

illu . 39 - Results from Ambient 1 thesis interview

From these results and all the detailed interviews (Appendix 10, 11, 14) a plan of the apartment with the devices and the interaction between the rooms is realized:



illu . 40 - Room interaction of young adults

In the bedroom the most used device is the phone/tablet/pc there is not a need for an audio product but in the living room, the bathroom and the kitchen people use an audio device. Audiophiles have a bluetooth speaker they use in the bathroom and the kitchen plus an additional stereo in the living room. When using the bluetooth speaker the user walks around the kitchen and the bathroom but when going in the living room it changes devices for the stereo. (Appendix 10, 11, 14).

This section shows that the young audiophile adults have different needs regarding audio devices in function of the room they are in. The new product should allow them to fulfill the needs in the different rooms. **In the living room the user want to enjoy a good sound quality**. **In the bathroom and in the kitchen the audio is more used in the background** while doing another activity.

!

The product will be used in the kitchen and the bathroom where it can be subjected to water splash. It should respect and IP54 standard to resist to this environment.

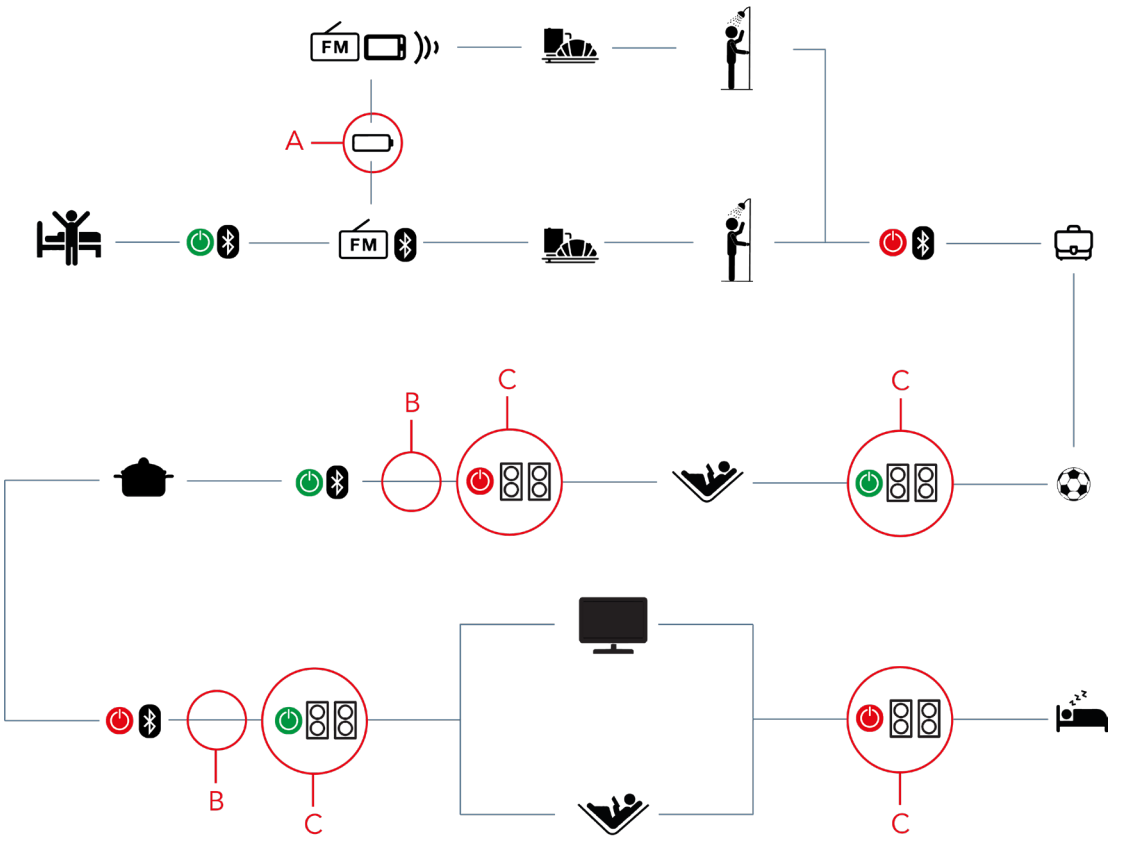
!

From the data gathered and user shadowing a user journey mapping is made. 3 problems are identified. It is then asked to a potential user named Martin to show how to resolve these 3 problems with its current equipment.

Some user needs are then found, to do so the following method is applied:

- The first part consists in clarifying the insights depending on this problem from previous user research.
- Afterwards the user will show to the designer how to solve the problem to establish a scenario.
- Finally some needs will be identified from this scenario.

The identified needs will be used later on in the process to establish a precise classification allowing the designer to follow a red line in the concept development.



illu . 41 - User journey mapping

3 problems are identified:

A	The user forget to charge the battery
B	A bad interaction and interferences between the bluetooth on the speaker and on the stereo
C	Difficult for the user to use the direct controls on the stereo

The user journey mapping leads to a concrete problem for the user. Problem B is seen as a top problem giving a bigger solution space where A and C can also be resolved.

It will be the starting point for the concept development and set a base for the next iterations.

When the user wakes up in the morning he wants to play the radio on its speaker but if the speaker is out of battery he will usually play it directly on its phone or use is earpods.

A

illu . 42 - Scenario charging the speaker

Before he can play music on it again it requires to wait 20min for it to charge. If he is in a hurry he won't even take the time to plug the speaker and charge for later in the evening. He would rather do it when coming back home from work. If the battery level drops there is an audio signal indicating it, this is important if the user is in another room or doesn't look at the speaker.

- An audiovisual signal indicating the battery level
- The speaker works as soon as it's plugged in
- Remind the user to charge the speaker

!

When the user is switching between his two devices (nomade bluetooth and stereo) he can experience some interferences. It can happen when going from the nomade speaker to the stereo and from the stereo to the nomade speaker.

B

illu . 43 - Scenario nterferances with bluetooth

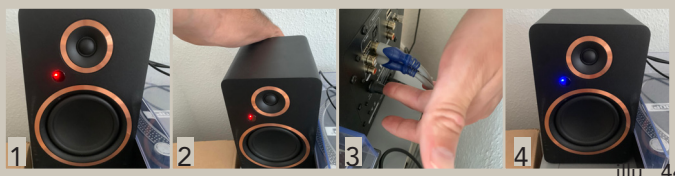
It is observed that when the stereo is off and the user wants to play music on the bluetooth speaker he will turn on the bluetooth speaker and press play on his phone. Even if the stereo is off, when pressing play it starts automatically because the stereo is recognized as a primary speaker by its phone. To be able to play on the bluetooth speaker the user will unplug the stereo to make sure it doesn't interfere. When playing again on the stereo the user will have to go plug it.

- The stereo shouldn't always activate as a primary device when a bluetooth signal is detected.

!

In some cases the user is not able to use the remote control for its stereo speakers. This can be because it's far away and the user don't want to search for it or because the remote control is lost. In both of these cases the user needs to use the direct controls on the speaker.

C



illu . 44 - ScenarioControls on the speaker

The user is struggling to reach the controls as they are located on the back panel. The controls are also not intuitive for the user, the same button is controling the sound, the power and the sources.

- A solution for controlling the device from a smartphone
- Easy access to the direct control on the speaker

!

1.20/Phase 1 sum-up

User centered approach

Along the process a user centered approach is followed, in the framing phase the three first stages in this method are used (empathize, define, ideate) to identify some user needs that can be reframed into a problem. From the next phase the following stages (prototype, test) are used to get more concrete results for the development of the solution.

Empathize: This englobes the background research, the user survey, the market analysis and the journey mapping. Thanks to these methods several user needs are identified.

Define: Once identified the interpreted user needs are classified in 3 distinct groups of requirements to have a better overview on them and be able to prioritize them:

- "The overall requirements for the product'' are the main requirements the product should respect, these needs are tied with the framing, they give a direction to take for the product development.
- "The user interaction with the product" is directly related with the next steps to act on in the process. They give a precise direction and problems the product should respect with interfaces and characteristics.
- "The evolution of the product" also gives precise problems the product should solve. But for a more linear development of the concept they will be considered later on in the process. They are quite precise but don't give a solution space for the concept itself.

Ideate: In this first phase it is quickly identified that young adults are moving a lot around their apartment giving an insight for the 1st iteration (Section 1.15). It allowed to throw first thoughts on paper and the idea of developing a stereo that can move around arose.

From the framing phase several user needs are identified, they are non-measurable statements that the product should fulfill to satisfy the user. Along the process the user needs become requirements that can be measured. The line between those two can be thin as they are relying on each other. To avoid confusion in the process, they are all stated as requirements in the phase sum-up. By reducing the number of sections in the classification, it's easier to group them together and define a path to follow.

Connect the elements

Trying to solve a wicked problem results in a lot of information shattered all over. The framing phase of the project gave a lot of elements and applying methods helps to connect the dots. Having a precise classification of the requirements gives a direction to follow when entering in the following phase, the concept development. Developing a new solution for an audio product is difficult by the amount of solutions already available on the market. The path to the solution is found by understanding how the young audiophile adults interact with sound in a home environment. By applying methods such as a detailed user journey mapping, a concrete problem to solve for the concept is found. Leading to a concrete solution that can be further iterated on.

The problem

Young audiophile adults are constantly moving around their apartment while streaming different kinds of media. The users generally possess a bluetooth speaker and a stereo set of speakers. By having all these different devices, some interference is caused and results in a bad user interaction when switching from one device to the other.

Statement of intent

How is it possible to develop a new audio product that aims to improve the young adult's experience at home, while offering more fluidity and avoiding interferences when switching from one media to another and from one room to another?

Solution

A set of stereo speakers that can also be used as a portative speaker. The user can grab one of the 2 speaker units and move it around its apartment. By doing that the workflow between the stereo and the portative speaker can be enhanced and avoid interferences.

User needs classification

Requirements	Section
Overall requirements for the product	
Avoid interferences between the different devices	1.19
The product should target young audiophile adults	1.13
Enjoy a good sound quality in the living room	1.19
Play music in the background in the kitchen/bathroom	1.19
Radical innovation on the product	1.10
Incremental innovation on the process	1.10
The maximum retail price for the product is 7000 dkk	1.16
The product should give the user the possibility to evolve	1.11
Respect the principles of circular economy on a lower level	1.18
The new functionalities of the product should be tied to a story	1.9, 1.19
Use the brand history and the brand knowledge to ensure a good quality product to the user	1.9
The product should respect an IP54 standard	1.19
User interaction with the product	
Easy access to the direct control on the speaker	1.19
A solution for controlling the device from a smartphone	1.19
The product should include an USB Type-C charger	1.18
The new audio product must take into account the use for movies/series besides being listening to music, it should expand the sound from the TV	1.17
The stereo shouldn't always activate as a primary device when a bluetooth signal is detected	1.19
The speaker works as soon as it's plugged in	1.19
An audiovisual signal indicating the battery level	1.19
Remind the user to charge the speaker	1.19
The product should include long lasting components and materials	1.18
The product should respect the codes of new nordic design with materials (wood, metal, soft grey fabric) and story telling.	1.13, 1.19
Evolution of the product	
A front grill that can be removed	1.12
The possibility of adding a stand	1.12
Be able to connect the product with another Dynaudio product for a multiroom system	1.12

Trying to frame a wicked problem into a concrete problem statement is difficult due to all the potential directions to choose from. During the framing it was identified that a solution that can evolve with the user was a potential direction but it was difficult to find a concrete problem to ideate from. Therefore a step back is taken and it was decided to look more in detail at the users and the way they interact with their environment, exploring this path led to a concrete user journey where it was possible to identify a concrete problem to solve. This direction is then chosen. But by having some requirements well organized it will be possible to look back at them later on in the process and tie the concept with a proposal for an evolution.

PHASE 2

/Conceptualize

This phase details the development of the concept according to the users needs previously set. Through several iterations the concept is refined until the development of a final proposal.

illu . 45 - Models phase 2

List of methods

illu . 46 - List of methods pictogram phase 2

Iterative process

Along this phase an iterative process is applied. For each new iteration more knowledge is gained about the user, leading to new insights and new iterations. The process is repeated until the final iteration. It aims to develop a solution within a user centered approach.

Brainstorming

After each test some new requirements are found, by reflecting on the tests and mapping the results some new ideas are generated for further iterations.

Sketching

Sketching help to throw the ideas on paper. It is a way to refine the solutions, by visualizing the concept some can be selected to be further developped into prototypes.

Prototypes

Prototypes are turning the sketches into 3D model. It helps to better apreciate the dimensions and have something physical to work on. These models can be presented to users to open a discussion.

Tests

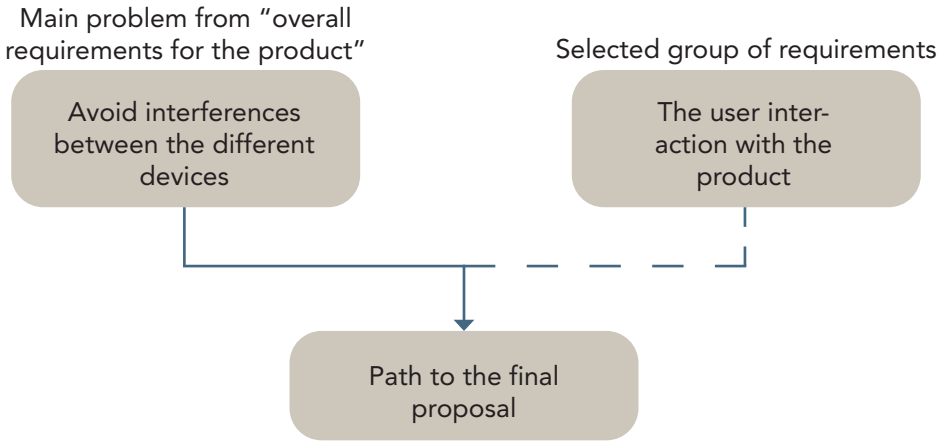
Acting out on the model put the prototypes in a real life scenario where new needs and requirements can be identified. The information gathered is then used for further iterations.

CAD

The model can be visualized in 3D giving a better appreciation of the proportions and the interactions between the components. It also helps in the detailing of the concept.

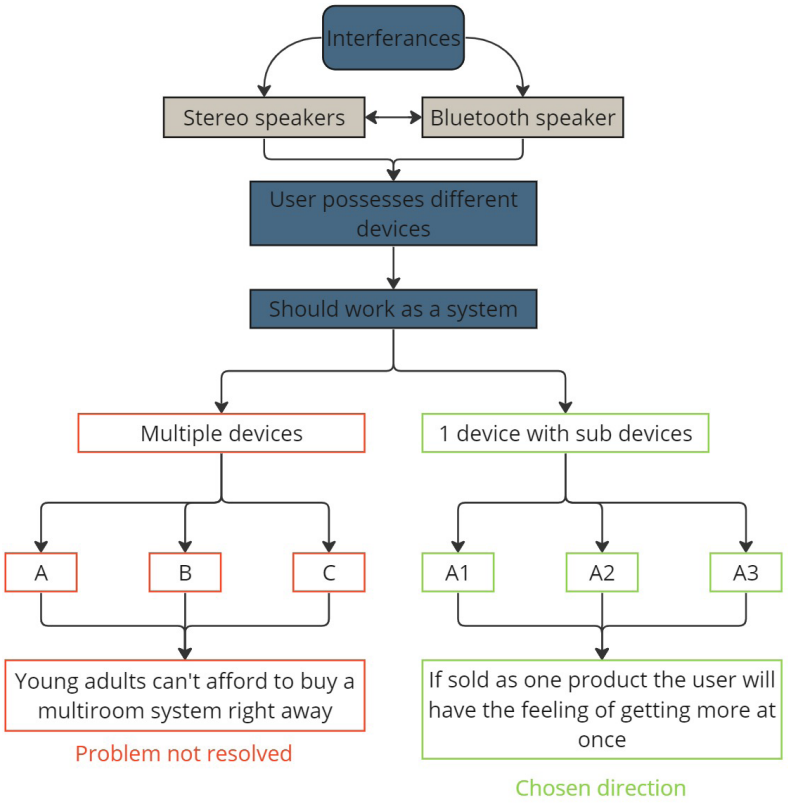
2.1/Initiation concept development

The next phase will detail the development of the concept starting from **the problem statement** to a **final solution**. **The user interaction with the product** group gives concrete requirements that the product should respect. Along the iterations this group of requirements will be developed and reorganized according to the findings and different interfaces or elements of the product.



2.2/2nd iteration/Ideation

With a clear view on the needs and a more concrete problem, the problem is taken and a brainstorming session is realized to prepare the second iteration.



illu . 47 - Mapping 2nd iteration

Young audiophile adults usually possess 2 devices (Stereo speakers + bluetooth speakers) that fulfill 2 different functions but don't work together as a system (Appendix 1). These users won't go away from stereo therefore **the product should give them the opportunity to play in stereo.**

Requirements

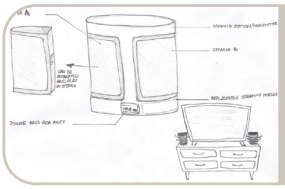
Thanks to the mapping 2 precise requiremens are found. The product should be made as one product with sub devices and it has to be able to play in stereo. When going back to the list of requirements (1.20) in the overall requirements for the product it is seen that the users have different ways of listening to the music according to the room they are in. Therefore the product should give the opportunity to the user to enjoy high quality sound in the living room and listen to music in the background in the kitchen/bathroom. All those requirements are used to start sketching the 2nd iteration.

The speaker should play in stereo

The product should be made of one device with sub devices

Play quality sound in the living room

Play background music in the kitchen/ bathroom

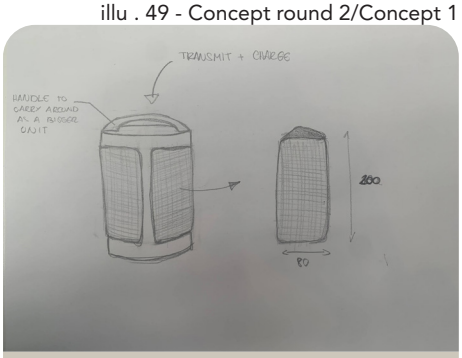


The concept 3 from the first iteration with the stereo that can move around answer to these needs with the possibility to grab one of the 2 units and use it in another room. 3 iterations are made on the concept with different solutions for the placement of the docking station.

illu . 48 - 1st iteration

Ideation

illu . 49 - Concept round 2/Concept 1

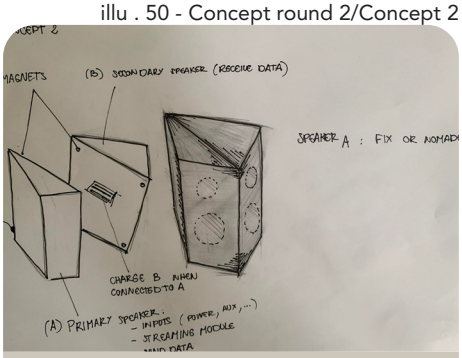


Concept 1 working principle

Elements:
- One docking station
- Speaker unit A
- Speaker unit B

The two speaker units can work independently, when the units are on the docking station it is possible to use it as one big speaker for a louder sound to carry around.

illu . 50 - Concept round 2/Concept 2

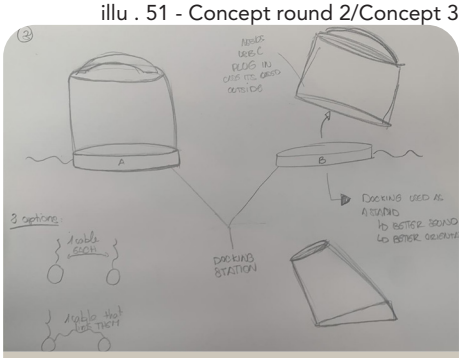


Concept 2 working principle

Elements:
- Primary speaker unit A
- Secondary speaker unit B

"A" acts as the main speaker with the charging input and receives the data from external devices to transmit it to "B". They can be put together and held with magnets. "B" is the one to be carried around.

illu . 51 - Concept round 2/Concept 3

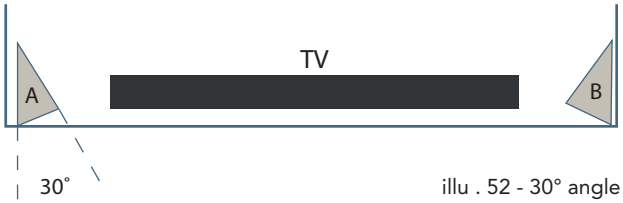


Concept 3 working principle

Elements:
- Docking station A
- Docking station B
- Speaker unit A
- Speaker unit B

They can work independently and both speaker units can be carried around. The docking station acts as a charger and interface for the different inputs.

While sketching the idea of using a triangular shape arose. In section 1.5 it is seen that for optimal sound the speaker should be placed with an angle of 30°, the triangular shape can help the user to instinctively place it the right way.

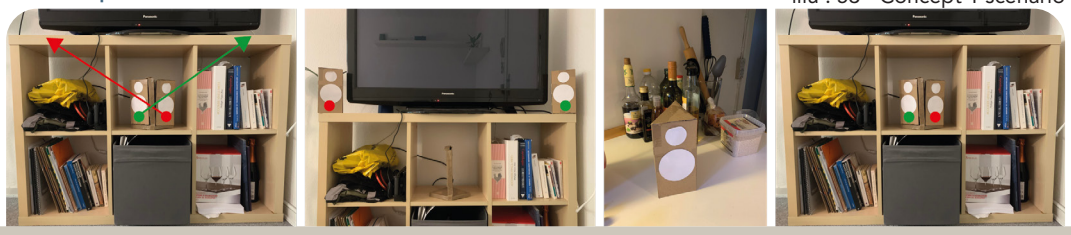


illu . 52 - 30° angle

2.3/2nd iteration/User test and evaluation

To better evaluate these concepts, cardboard prototypes are realized and are tested on 2 potential users. For a better understanding and more accurate results the concepts are put in a real life scenario (Appendix 20). It is aked for the user to try the 3 concepts and give feedback with pros and cons.

Concept 1



illu . 53 - Concept 1 scenario

Speaker Unit A

Speaker Unit B

Pros

- Once its plugged there is nothing to touch
- Feeling from the magnet is nice
- Involve few actions

Cons

- Doesn't place it with the right angle
- Flip the speaker around before finding the right position
- The wall on the docking station is too high
- Doesn't place it systematically back on the docking station
- Docking station takes a lot of space, it could be optimized
- Can't play in stereo when charging.

Concept 2

illu . 54 - Concept 2 scenario

Pros

- Magnet is satisfying

Cons

- Doesn't place it in the right position
- Complicated with the way you plug them, it's hard to differentiate
- Would be useful to have some visual information on where you grab it
- Need some shapes/visual informations for the buttons and interfaces
- Can't play stereo when charging

Concept 3

illu . 55 - Concept 3 scenario

Pros

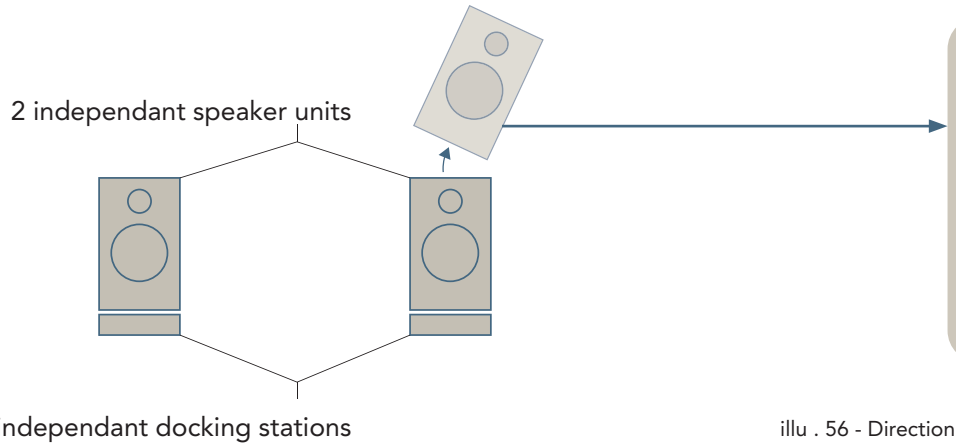
Easier concept to interact with
Can work independently
Can be used all around house
Can charge and play stereo at the same time
The user places the speaker back on the docking station after use

Cons

- Docking station walls are too high; it comes with the speaker when taking it out.
- Not really convenient to grab the speaker this way, the user doesn't know where to grab it.
- The user is turning the speaker around to find the right position to place it back
- There is a risk of it falling when the speaker is carried around

Direction

By giving pros and cons for each concept the user validates or not the working principle of each solution. It allowed to **chose the concept 3** as the most relevant, by having a docking station for each speaker it is possible to use them independently and ensure that they will always have battery when used in stereo. It is also the concept with the easier interaction for the user because of the few steps involved in the use phase.



The user can grab one of the two speaker units from the docking station and move it around its house. To enjoy the sound in stereo the user simply has to place it back on the docking station.

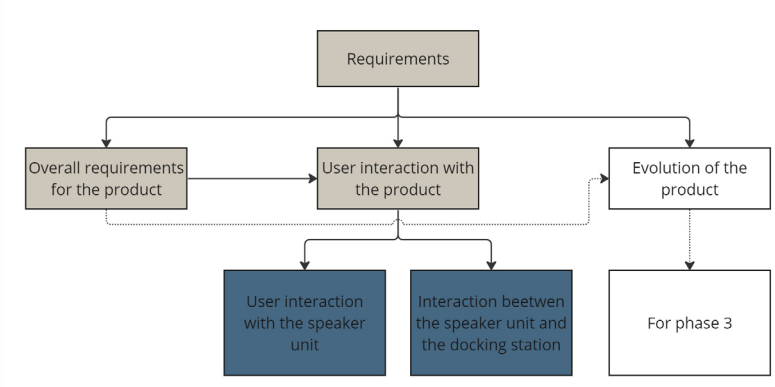
illu . 56 - Direction chosen - main working principle

The feedback of the users also unveiled some new requirements for the product:

- Both units should be able to work independently from each other's
- The docking station should have a low depth to make it easy to place in and out
- Have a visual/tactile indication on where to grab the speaker
- Ensure the integrity of the speaker if it falls
- Docking station shouldn't move when the speaker is taken in/out

2.4/Reorganization of the Requirements

With a more concrete concept the requirements can be reorganized to have a red line to follow for the next iterations. The category of requirements regarding **the user interaction with the product** is the main one used in the concept development phase to ensure a user centered approach. This group of requirement is now divided in 2 categories. **The interaction between the user and the speaker unit** and **the interaction between the speaker unit and the docking station**. New iterations will be made independently in each category and the results will be merged later on for the final solution.



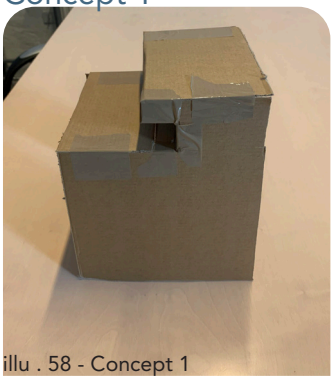
illu . 57 - Reorganize the requirements

Classifying the requirements from the framing into 3 groups allowed to have a better view on the direction to take for the iteration. In order to follow a user centered design approach the requirements directly related to the users are used for the next iterations. Getting more knowledge on the product allowed to refine these requirements in two categories where a red line can be followed. For the next iterations it will be easier to go back to these requirements and quickly identify which ones should be investigated for the right iteration.

2.5/Interaction between the user and the speaker unit/Handle

It is decided to first research the interaction between the user and the speaker unit to determine the shape and the main dimensions of the speaker before starting to iterate on the docking station. In the previous sections it is found that the speaker should have a visual/tactile indication on where to grab the speaker. 4 different concepts are developed and cardboard prototypes testing different working principles for the handle are realized to be tested on 2 users (Appendix 21).

Concept 1



illu . 58 - Concept 1

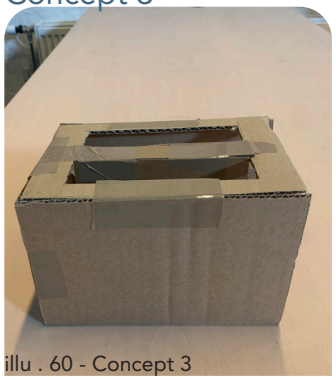
Both users don't like the sizing and the position of the handle. The users are afraid to drop it, one of the users is clenching the fingers too much and doesn't feel good grabbing it. The direction of the handle is also a bit weird for both users when they are walking with the speaker next to their bodies. When taking the speaker the users are twisting their wrist to align the speaker with their bodies.

Concept 2

illu . 59 - Concept 2

This concept feels easier to grab, the handle also feels safer to carry around without dropping it. The direction of the handle avoids the user twisting its wrist when grabbing the speaker.

Concept 3



illu . 60 - Concept 3

As in concept 1 the direction is a disadvantage to the users. There is also less space to fit the fingers and doesn't feels really natural to grab. When placing it back the user is a bit confused in the direction it should be placed in and has to think when doing it.

Concept 4

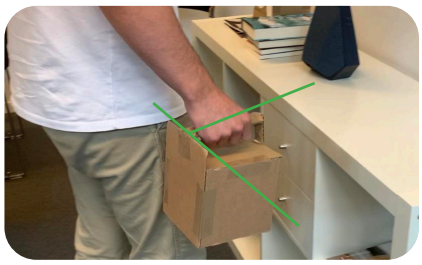
illu . 61 - Concept 4

The users like this solution, the hand can go completely around making it easy to grab and safe. Having the top a bit narrow is also nice when it's placed along the body. Both users think that it is a bit too big and that the size could be reduced. As for the other concept, having the handle in this direction is a bit weird when grabbing the speaker.

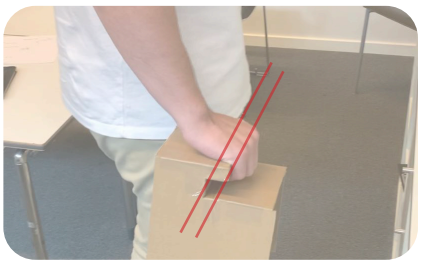
SELECTED CONCEPTS

Orientation of the handle

Both users gave feedback on the direction of the handle. Having it perpendicular or parallel to the body when carrying the speaker acts on the comfort while moving around. Both of them thinks that having the handle perpendicular to the body when moving around is better for handling the speaker.



illu . 62 - Handle perpendicular to the body



illu . 63 - Handle parallel to the body

!

Concept 2 and 3 are chosen to continue with further iterations, the orientation of the handle on concept 3 should be changed. Some requirements are also identified from this testing by observing and getting feedback from the users.

- The direction of the handle should be perpendicular to the body of the user.
- The user should have its hand going all around the handle for safer handling.
- The speaker should be well balanced for a comfortable handling

2.6/Interaction between the user and the speaker unit/Interfaces

For the next phase the needs from the past section and the needs from section 1.19 are used to conceptualize on the control of the speaker. The speakers giving the possibility for the user to be used as a nomad speaker should include some direct controls. Indeed the user should have the possibility to influence on basic controls on the speaker, it is seen with the Dynaudio engineer that interfaces for the power, the volume and a source button (wifi and bluetooth) should be included. 3 concepts are made and cardboard prototypes are realized to be tested on 2 users (Appendix 22).

The user should have its hand going all around the handle for safer handling

The direction of the handle should be perpendicular to the body of the user

The handle should be symmetrical

Easy access to the direct controls on the speaker

Concept 1

illu . 64 - Concept 1

Both users are easily identifying the function of each button. Having the power button and the source button placed on the handle is a bit odd as the user won't touch them while carrying the speaker. The capacitive touch is difficult to integrate as the user will most likely touch it without paying attention to it. Regarding the handle it doesn't feel well integrated to the shape but it's comfortable to grab.

Concept 2

illu . 65 - Concept 2

With the controls on the front, the access is easy and it's really intuitive. because of the round shape of the speaker it's tilting a bit when pressing a button and results in a bad user experience. The volume buttons are pretty classic but it's easier for the user to understand how it works. Having from left to right the power, the "-", the "+" and the source button is really nice as it follows the different steps to start and set-up the speaker. The handle is really nice to grab and both users think that it's better integrated into the shape.

Concept 3

illu . 66 - Concept 3

The overall shape and aesthetic is not appealing to the user. For both users it takes more time to figure out what is the function of each button and the way they are placed results in the user interfering with the buttons and a possible unwanted action. The handle is really comfortable but it should be more hidden, it looks a bit odd when it's also meant to be used as a stereo speaker.

SELECTED CONCEPT

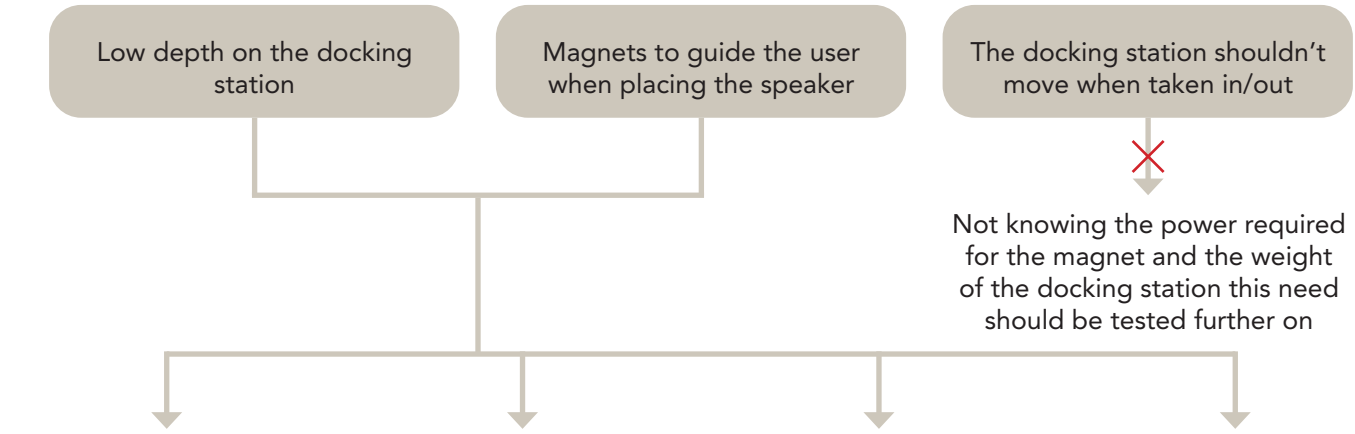
!

- The buttons should be placed on the edge and on the top of the speaker when facing the user.
- Some classic push buttons should be used to reduce the risk of unwanted interaction.
- The "-" and "+" buttons should be placed respectively on the left and on the right of one another.

2.7/Interaction between the speaker and the docking station

The objective of this activity is to make a first iteration on the docking station. It tests the shape and placement of the docking station as well as the feeling with the magnets. Different magnet strengths are tested. Few needs are identified for the docking station and this first iteration allows to "throw" some first ideas. By getting some user feedback new needs will be unveiled for more iterations. (Appendix 23)

To ideate previously identified requirements from the section 2.3 are used:



Concept 1

illu . 67 - Concept 1

Concept 2

illu . 68 - Concept 2

Concept 3

illu . 69 - Concept 3

Concept 4

illu . 70 - Concept 4

This test helped to understand better the interaction with the docking station. It is clear that positioning the speaker from the top is not the best direction to take because the user doesn't see where to place the speaker. Having the docking station at the back allows the user to place it instinctively. Clashes between two concepts can be observed, indeed the user wants to have a docking station as discreet as possible but also likes the idea of the stand. The user said: "When raised higher, it gives a sense of permanence, like it's meant to be there". It is observed that young adults are moving around and it's when becoming adults that they seek for a permanent solution. It confirms the need from section 1.12 that the possibility to add a stand in the future should be considered.

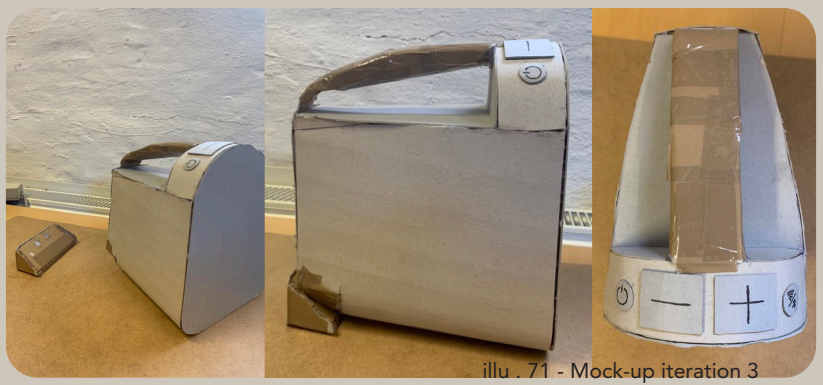
Some insights on the magnets are found, the magnet should be strong enough to guide the speaker in the docking station but should still be possible to remove the speaker without using the other hand to block the docking station.

!

- The docking station should be placed at the back of the speaker to avoid having anything in the way when the user places it back.
- The magnet should be strong enough to allow the user placing the speaker back without searching for the direction.
- The docking station should be discreet.
- The docking station should stay in position when removing the speaker.

2.8/3rd iteration/Merge results

The last findings about the interaction between the user and the speaker unit are now merged with the ones between the speaker and the docking station resulting in a 3rd iteration of the concept. A 1:1 mock up with the placement of all the interfaces and the right working principles from the last iterations (Section 2.5, 2.6, 2.7) will be presented to a potential user to validate them and give new insights for further iterations (Appendix 24). **The dimensions are taken from previous iterations and from the dimensions of a Dynaudio Music 1** (Appendix 26)**. The weight from the Dynaudio music 1 is also used for this model, along the process it is discussed with Dynaudio that it can be used as reference product.**



illu . 71 - Mock-up iteration 3

Achieved

Partially achieved

WORKING PRINCIPLES TO ACHIEVE

Handle position

The handle dimensions

Placement of the docking station

Buttons placement

This user test gave new insights on a "pairing button". The user asked: "*When I take the speaker out of the docking station, does the other speaker stop playing automatically ?"*

After an open talk with the user and a brainstorming session it is set that a pairing button should be placed on the handle near the thumb. It will allow the user to choose if the other speaker keeps playing or stops when removing one unit from the docking station. Several requirements are found for this button through the user feedback:

- A pairing/isolating button to manage non physical connection between both speakers.
- The pairing/isolating button should keep in memory the last action of the user.

The user also gave feedback on the wifi/bluetooth button. The user confirms that this button is required, at home the user uses the wifi to have a better sound quality. A visual signal should indicate what source is being used.

- A visual signal indicating if the connected source is bluetooth of wifi

Magnets feeling on the docking station

The magnet feeling on the docking station is nice but a way to avoid it to move should be found, the user asked: "How do you keep it in position ?"

- The docking station should stay in position when removing the speaker.

Buttons dimensions

Usually on nomade speakers you will have buttons placed in evidence so it is intuitive for the user but on stereo they would be a bit more hidden since you don't interact with it a lot. Therefore a nice balance between the aesthetic and the buttons staying intuitive enough should be found.

- The buttons shouldn't trigger too much the attention but still be intuitive for the user.

Marking a step in the process with the test of all the working principles on a 1:1 model allowed to get feedback on the concept. The user likes the way to interact with the product but it also showed that some working principles are partially met. It gave new insights and new needs for the product, giving a direction for the next iterations. **The following phases of the conceptualization will consider the development of a solution for the docking station to stay in position, the dimensions of the buttons and the implementation of a "pairing button"**.

2.9/Test on the docking station

The use of magnets will give a **pleasant feeling for the user** when placing the speaker on the docking station and removing it. The idea behind using a docking station is also to have a charging port for the speaker. Besides giving a pleasant feeling for the user the magnet will also **ensure that the speaker is placed correctly on the docking station for the connectors to hit the right spot** and make sure that the speaker will charge correctly.

Requirement previously set → The weight of the docking station should allow the user to place and remove the speaker without having to interact with its other hand.

It is then necessary to counter the force of the magnets. Several solutions are considered. Some suction pads, sticking stripes or a counterweight placed in the docking station. The first two possibilities could result in leaving some trace on the user's furniture therefore the counterweight is kept and different solutions are tested for its position. Some metal plates are bought and placed in a cardboard prototype, the model from section 2.8 is used. (Appendix 25)

Concept 1

illu . 72 - Concept 1

Concept 2

illu . 73 - Concept 2

Concept 3

illu . 74 - Concept 3

Concept 4

illu . 75 - Concept 4

The test showed that the solution 1,2 and 3 are moving when taking the speaker out. The solution 4 is not moving and is kept. Several requirements are identified from the results of the test.

- A counter weight placed at the bottom of the docking station
- The magnets should be placed in the middle of the docking station

This test showed that a solution with a **counterweight can be implemented**. **The next step will be to detail the shape of the docking station and include it in the model**. Beforehand it is necessary to iterate on the position of the buttons and their dimensions to have the final shape for the concept and be able to integrate the docking station.

2.10/The buttons/Sources (wifi and bluetooth)

The young adults are the biggest consumers of streaming services, playing media through these services requires a possibility for the user to play wirelessly on a speaker as it is accessed via a smartphone. Thanks to an interview with an acoustic engineer from Dynaudio it is stated that a possibility for a **wifi and a bluetooth connection is required**. The wifi allows streaming at a better quality and facilitates the connection of the different devices in a home environment while bluetooth can be a back-up solution in case the wifi crashes or can be used if the user wants to take its speaker out of its house.

The solution for this button is taken from the Dynaudio Music 1, it will facilitate the research and make it consistent with other Dynaudio products that use a wireless signal.

The wifi is used when setting up the speaker and to connect it to the Dynaudio application, once the speaker is set there is no need to connect it again unless the wifi crashes. The current solution on the Dynaudio Music is analyzed:

illu . 76 - Sources off

illu . 77 - Bluetooth

illu . 78 - Bluetooth+wifi

MAIN WORKING PRINCIPLE → The user turn the speaker on, no sources light are blinking → The user presses 2 seconds on the "source" button, and bluetooth light start blinking → The user presses again 2 seconds on the source button, both lights are blinking (wifi + bluetooth), the speaker is ready to be connected to the app

!

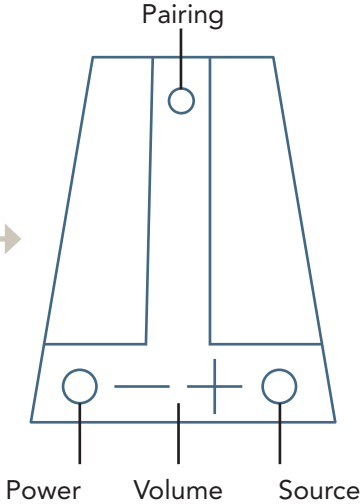
The main working principle is kept for the solution, some different concepts will be tested on the visual signal in order to be better integrated to the overall solution for the design of the buttons. Several requirements regarding the source button can be identified:

- When the speaker is turned on for the first time no wireless source (wifi or bluetooth) is activated.
- The user needs to press 2 seconds on the "source" button to switch sources.

2.11/The buttons/Pairing button

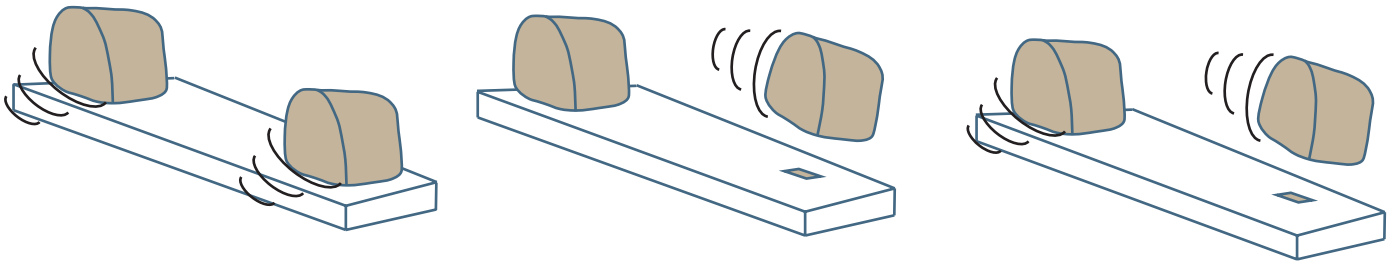
The feedback from the user on the 3rd iteration gave a new insight on the use of a pairing button. The button is meant to be used when the user will take the speaker out of the docking station and have its hand already placed on the handle. For easier access to this button it is decided to place it at the end of the handle near the position of the thumb. The buttons are placed as follow on the speaker (Appendix 24):

illu . 79 - Hand position on the handle



illu . 80 - Position of the buttons

Scenario for the pairing button



illu . 81 - Pairing button scenario

Both speakers are playing in stereo.

The user grab one of the two speaker, the other speaker stops playing. "**Isolating mode activated**"

the user press on the pairing button and the other speaker starts playing again. "**Paring mode activated**"

2.12/Integration of the buttons

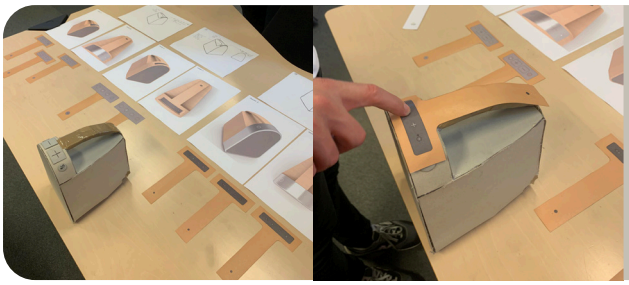
Several requirements and insights are identified across user tests. Realizing different concepts for each button would be too time consuming and could result in different concepts that are not coherent with each other. Therefore 3 concepts grouping all the last findings are made. The interfaces will be printed on paper for a better visualization on the dimensions and their placement. Some quick CAD models are also made to visualize how the interfaces can be integrated. (Appendix 27, 28)

The buttons should be discreet enough not to trigger too much the attention of the user but still be intuitive when the user wants to use them.

The speaker should include a visual signal on the buttons for the source, the power and the pairing.

Placement of the buttons is known

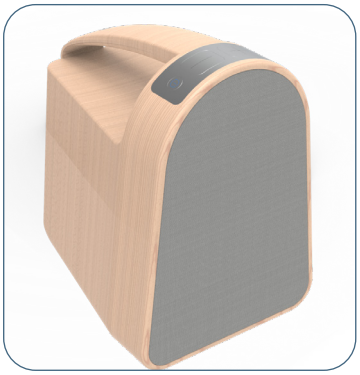
TO DETERMINE — Dimensions — Shape — Aesthetic — Visual signal



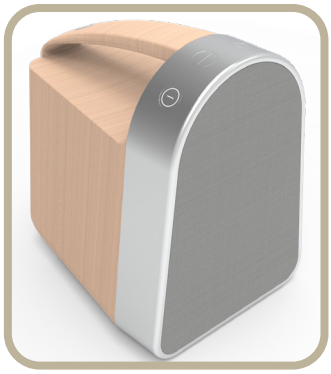
illu . 82 - Test on the integration of the buttons

The solution with the frame allows a good balance between being intuitive enough to quickly identify the buttons and keep them from being too visibly present. **Testing the dimensions, the shape, the aesthetic and the visual signals at the same time allowed to develop a coherent solution where all the buttons are well integrated to the shape and work together as a system.**

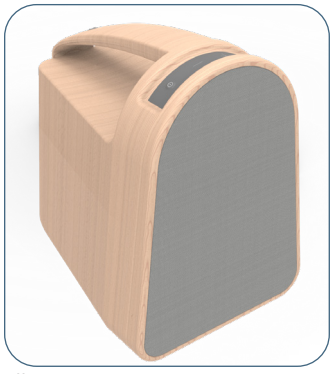
SELECTED CONCEPT



illu . 83 - Concept 1 - Integration



illu . 84 - Concept 2 - Integration



illu . 85 - Concept 3 - Integration

Several requirements for the buttons are found thanks to this user test:

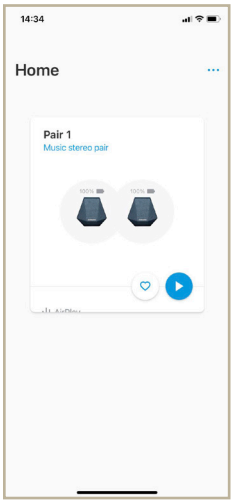
- The buttons should be integrated to a frame going around the speaker and the handle
- Have a white light on the power button when there is more than 20% of battery.
- Have a red light on the power button when there is less than 20% of battery.
- A voice signal indicating when the battery level is less than 20% of battery.
- Small white light and a pictogram on the side of the source button indicating what source it is connected to
- Pairing button placed on the handle with a small light indicating if it's paired or isolated.

2.13/Connect the speakers/Dynaudio application

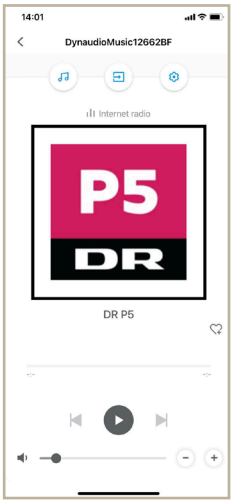
Besides the physical interfaces the research showed that a solution to control the speaker from a smartphone should be developed. Dynaudio already has some active speakers on the market using a smartphone application.

The application is used to set the speakers on the user's wifi network, from the phone the user will also be able to determine which speaker is the left one and which is the right one. Once everything is set the user can navigate through the application to control different settings on its speaker, stream music or play the radio. The new product can be connected to this app and no changes are required. (Appendix 29)

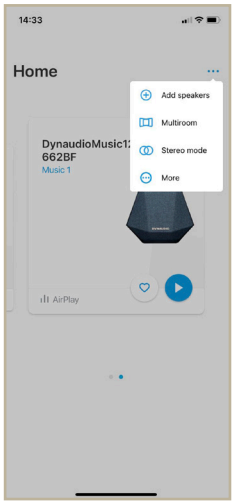
In the framing phase it is found that the speaker should offer a possibility for an evolution. An angle could be to develop a range of products that can be used in multi-room. The Dynaudio application already offers the possibility to the user to connect all their Dynaudio products in multiroom.



illu . 86 - Stereo pair



illu . 87 - Play radio



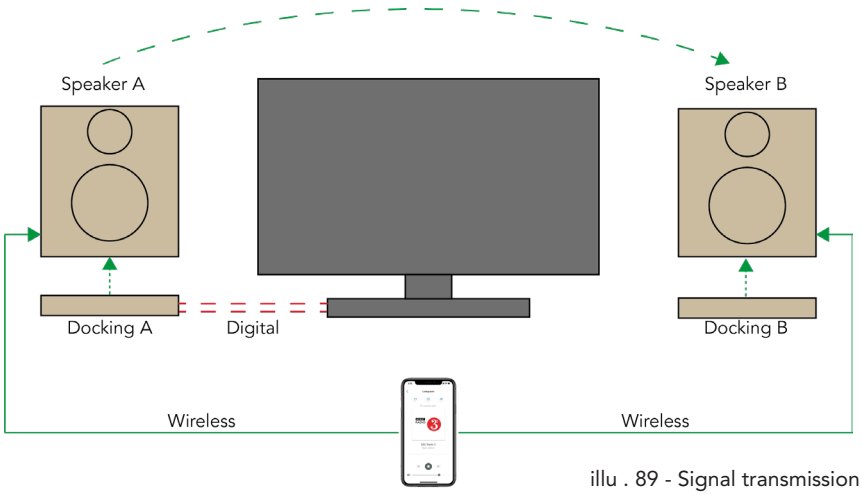
illu . 88 - Modes

Signal transmission

A proposition is made and has been discussed with Dynaudio's acoustic engineer (WS40) regarding the transmission of the signal between the two speakers.

For a wireless signal the principle is the same as it is today with their active products, once sent on wifi the signal is transmitted to both speakers at the same time.

If it's a digital signal sent from an external device, the signal is received in the docking station via the input ports and can be transmitted to the speakers wirelessly.



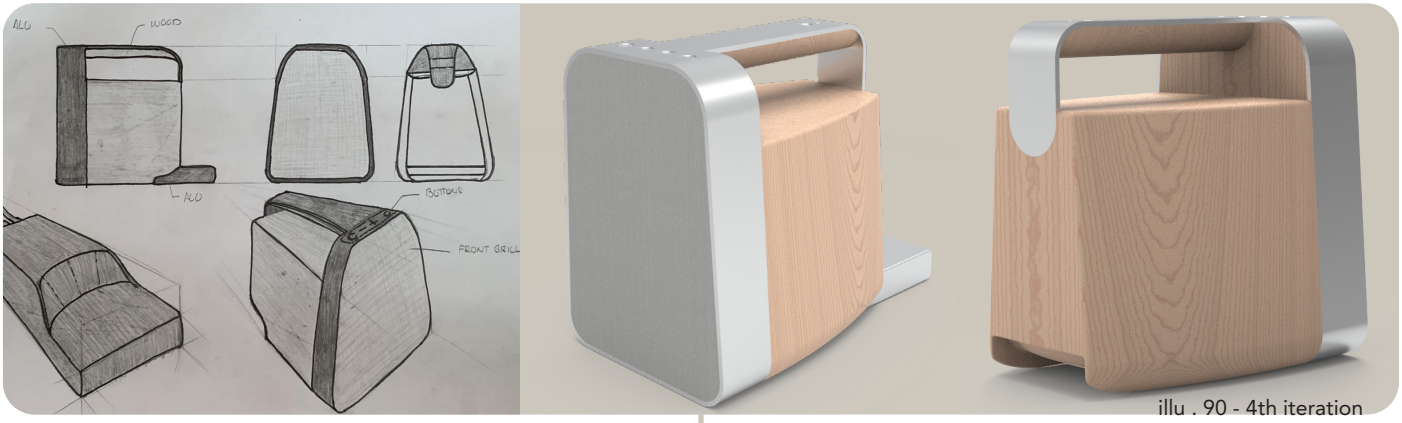
illu . 89 - Signal transmission

E.g. A TV is plugged in docking station A, the signal is wirelessly transmitted to the speaker unit A, the speaker unit A send a wireless signal to the speaker unit B.

2.14/4th iteration/Merge results

A drawing merging the last findings is realized. The overall shape is made a little bit more “boxy”. In the worksheet 61 some first renders are made but they looks too playful and the combination of materials with the wood and the aluminum doesn’t work out really well. Therefore to match better the aesthetic of the new nordic design the shape is refined.

The findings from the last tests are merged into a solution for a 4th iteration on the model. The overall aesthetic is changing to better integrate all the buttons and from the design thoughts. The docking station is now included in the CAD model. While making the 3D several questions arose regarding the docking station, the buttons and the front grill.



illu . 90 - 4th iteration

Insights for further researches

The finish of the surface for the buttons

When the docking station is removed a big recess is visible on the speaker and not pleasant visually.

A solution to remove the front grill should be developed.

Due to the time allocated for the project and because most of the working principles are already validated through testing and several iterations, a prototype is not realized. Using CAD software to make a 3D model allowed a better visualization of the concepts and unveiled new insights. They will not affect the main principles and are seen as refinement of the existing solutions but some tests should be realized to validate them.

2.15/Surface finish for the buttons

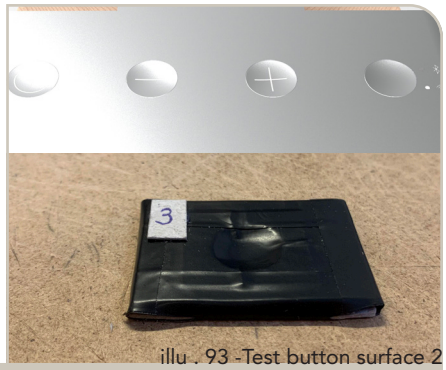
A new iteration on the buttons should be done to ensure that several requirements are respected. The purpose of this iteration is to try different finishes for the surface. 3 prototypes are made and will be tested to determine which solution meets these requirements the best. (Appendix 30)

The buttons should be integrated to a frame going around the speaker and the handle

The buttons should be discreet enough not to trigger too much of the attention of the user but still be intuitive when the user wants to use them.

illu . 91 -Test button surface 1

illu . 92 -Test button surface 2



illu . 93 -Test button surface 2

To be discreet but still intuitive a diameter of 12mm is tried as in the previous test on the buttons the user felt that 10mm was too small and 15mm too big. On concept 1 it is easy to feel where the button is placed, the feeling is not really smooth as we can feel the edge. On concept 2 it is really difficult to identify where the button is. We can feel a little bit but it is necessary to search for it while looking at it. For concept 3 it is easy to feel the position of the button, the curved button englobes the finger and makes it smoother than on the first concept.

After testing, the **concept 3** is a good mix between aesthetic and a practical solution, it is also more pleasing to touch than the other concepts. Therefore this concept is chosen.

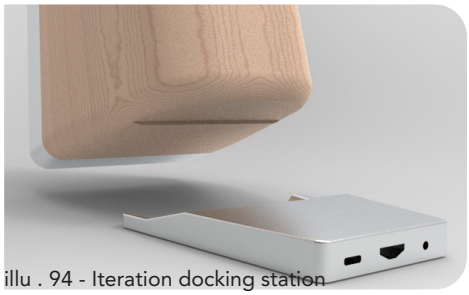
Some requirements are set:

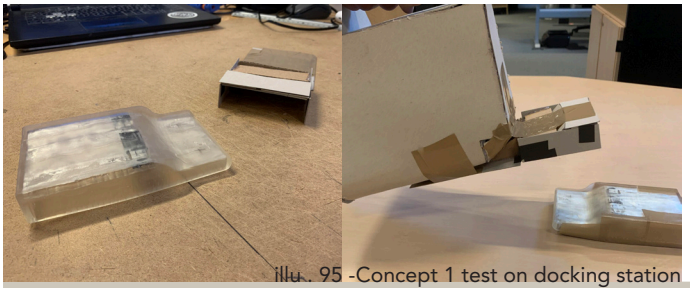
- The buttons should be curved
- The diameter of the button should be 12mm

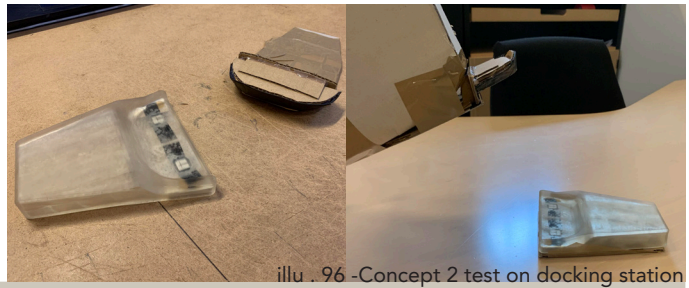
2.16/Iteration on the docking station

In section 2.14 the actual findings for the docking station are not satisfying and it is decided to make a new iteration. Another proposition is made. The current solution and the new one are 3D printed to work with a physical mock up. The docking station is an important element of the concept and working on a mock up with the right dimensions makes it easier to understand the design concept and quickly identify the possible flaws. (Appendix 31)

Having a mock-up will allow to test the magnets and the counterweight in a real life scenario allowing to validate the corresponding working principles.


illu . 94 - Iteration docking station


illu . 95 -Concept 1 test on docking station


illu . 96 -Concept 2 test on docking station

In both solutions the counterweights work really well and the docking station is not moving when taking the speaker in and out. The concept 1 makes it difficult to place the speaker back, it is not really intuitive and aesthetically pleasing therefore it is abandoned and **the concept 2 is kept** and will be implemented in a new iteration of the speaker. For both concepts it is also observed that there is tendency for the docking station and the speaker to "slide" on the table top, it was tested on wood with lacquer and could annoy the user therefore some rubber could be added to avoid this.

Identified requirements:

- The docking station should go around the back of the speaker.
- Some rubber pads should be added to the docking station and the speaker.

2.17/Magnets pulling force

The previous test allowed validating a new shape for the docking station and showed that the solution with magnets and a counter weight can work, but no precise user requirements are currently set on the pulling force of the magnets. First, some background research on the different types of magnets is made to determine in which material it should be, further on some tests and calculations on the pulling force of the magnets can be realized.

The different types of magnets

Magnets can be made with different materials resulting in various pulling forces, the operating temperature can also have an influence on the efficiency of the magnet. On the market different types of magnets are commonly found. (Magnet Expert, 2023) (Appendix 32)

- The neodymium magnets which are the strongest magnets available on the market. They have a maximum operating temperature of 80°C.

- The alnico magnets are less strong than neodymium magnets but also commonly used and can operate until 500°C.

- Ferrite magnets are the most common ones, they are cheap and have a high resistance to corrosion but a really low pulling force. They can operate up to 200°C.

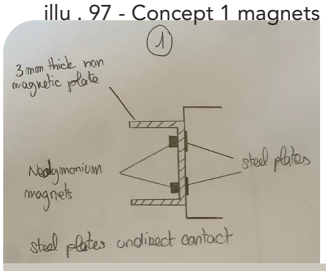
It is seen that when magnets are exposed to high temperature their longevity and their magnetic properties can be impacted. For most common chargers available on the market the maximum temperature can reach a maximum of 65°C and therefore will not affect the magnetic properties. (Appendix 32)

Some Neodymium magnets and ferrite magnets are found to try how their pulling force feels. The neodymium magnet is on the left and the ferrite one on the right. The size of the ferrite magnets is a big disadvantage, it is bigger than the neodymium one but the pulling force is lower and would result in a bad user experience (Appendix 23).

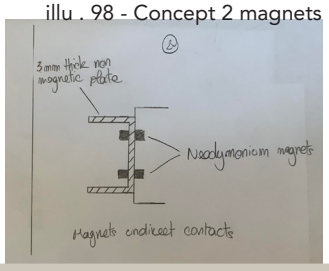
The neodymium magnet by its size and its pulling force is a good solution to answer this need for the docking station:

The magnet should be strong enough to allow the user placing the speaker back without searching for the direction.

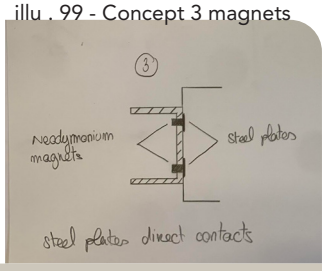
illu . 97 - Concept 1 magnets



illu . 98 - Concept 2 magnets



illu . 99 - Concept 3 magnets



The solution 2 as a force of attraction too high for the speaker, it is difficult to take it off the docking station. The solution 3 has a high force of attraction but is pleasant to use, but that results in putting a lot of weight in the docking station to counter the force. The solution 1 has a really nice feeling when taking the speaker on and off, it guides it in the right position and it's easy to take it off while offering a small resistance. The weight in the docking station will also be lower.

Calculating the pulling force

The pulling force is calculated from "K&J magnetics - magnet calculator". We are in the pull force case 1 with a distance of 3 mm from a steel plate.

Pull force = 0.85 lb = 0.39kg.
2 magnets are used therefore the total pull force is: **Tpf = 0.78kg.**

In order to counter the pulling force of the magnet the total weight of the docking station should be a minimum of 0.78kg. To ensure that the docking station will stay in position the total weight of the docking station should be 1kg.

- The total attraction force for the Neodymium magnets should be 0.78kg
- The total weight of the docking station should be 1kg
- Steel plates should be added at the back of the speaker and be separated from the magnets by 3mm.

2.18/Iteration on the front grill

In section 1.17 it is seen that young adults tend to seek for a new nordic environment in their home. They are buying products that will be easily integrated in their home. Several materials are identified to fit in this environment: Natural clear wood, metal elements and soft gray fabric.

In the actual model wood is used for the cabinet, the metal finish as a frame and the fabric is the logical choice for the front grill. It is also discussed with the designers and acoustic engineers of Dynaudio (Appendix 19) that a fabric cover for the front grill is commonly used for bluetooth speakers. It is matching better with the needs of young adults as they move around the house and protects the drivers to avoid unwanted interaction that could damage them.

On the other hand when the users are getting older they will move less around the house and are generally seeking for a permanent speaker with no front grill, this is identified in the market research (Section 1.9). According to the Dynaudio engineer (Appendix 19) adults will in general not use the protection to have a full sound range and avoid the damping effect of the fabric.

The user should be able to remove the front grill

The front grill should be made with fabric

Stay visually pleasing with the front grill on or off

illu . 100 - Concept 1 - Front grill

illu . 101 - Concept 2 - Front grill

illu . 102 - Concept 3 - Front grill

illu . 103 - Concept 4 - Front grill

The concept 1 and 3 are not visually pleasing therefore the concepts are abandoned. **The considered solution is to combine the concepts 2 and 4**. The guiding rails will allow to keep the grill in the right position when moving the speaker around and give a nice detail between the front panel and the frame while the magnets will ensure the front grill to be correctly snapped to the front panel.

illu . 104 - Selected concept Front grill

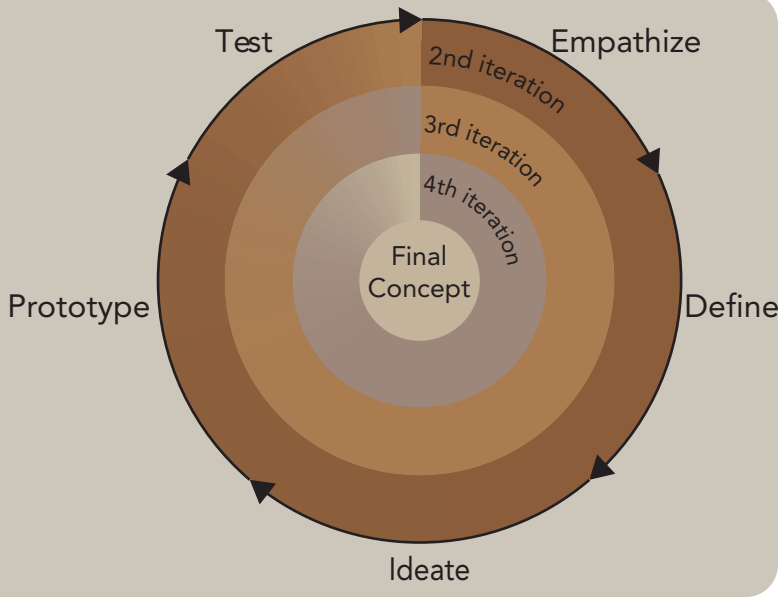
Due to the time and the available resources it is difficult to develop some precise prototypes for this element. To test it well 4 models should have been realized with the right dimensions for the speaker. According to the finding the grill will be removed only once. Therefore some assumptions are made and a solution is proposed. Before manufacturing the product some more testing should be realized for the front grill.

2.19/Phase 2 sum-up

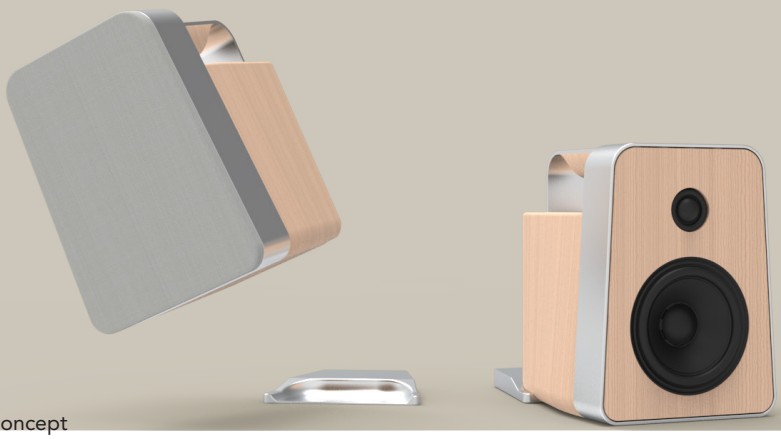
This phase turned the problem statement into a concrete product proposal by applying an iterative process within a Design thinking frame. The knowledge acquired from phase 1 lead to a 2nd iteration, by prototyping and testing new insights on the user and the product is gained allowing to empathize, define and ideate, prototype and test again for a 3rd iteration. Then the process is repeated until reaching the final concept.

By following a design thinking method and iterating in respect to the 5 steps (Empathize, Define, Ideate, Prototype, Test) the path to the solution can be constantly refined leading to a solution based on the user experience and the context in which the product will be used.

illu . 105 - User centered approach



All the findings from this phase results in a 4th iteration that aims to facilitate the way young adults interact with sound around their apartment, achieving a flawless experience with 2 speaker units and 2 docking stations. Allowing the user to enjoy the quality of a stereo sound system with the convenience of a nomad speaker. The user can grab one of the speaker units and use it while doing a task in their home. Along this phase several requirements for the product are set and frame the maturation phase where the construction and the implementation of the components will be detailed for the proposal of the final concept. In the construction phase few changes are made on the product to finalize the solution without affecting the requirements previously set.



illu . 106 - Final concept

The process starts with the identification of main user needs and requirements that are turned into a problem statement for the development of a concept. Along the iterative process the requirements become more precise. The user needs represent the fundamental problems of the user to achieve with the product. The requirements are actionable and measurable statements for the product to meet the user needs. Along the process some needs and requirements collide and makes it difficult for the designer to fulfill them all. Grouping them in two distinct categories (the interaction between the user and the speaker unit, the interaction between the speaker and the docking station) allowed to have a clear vision on all of them and avoid getting lost in the process. After the 4th iteration most of the requirements are met or partially met, the next phase will detail the maturation part of the product that aims to fulfill them all.

Requirements	Section
Interaction between the user and the speaker unit	
The product should give the user the possibility to play in stereo	2.2
Both units should be able to work independently from each other's	2.3
A pairing/isolating button to manage non physical connection between both speakers	2.8
The pairing/isolating button should keep in memory the last action of the user	2.8
Pairing button placed on the handle with a small light indicating if it's paired or isolated	2.12
Have a visual/tactile indication on where to grab the speaker	2.3
The direction of the handle should be perpendicular to the body of the user	2.5
The user should have its hand going all around the handle for safer handling	2.5
Ensure the integrity of the speaker if it falls	2.3
The buttons should be discreet enough not to trigger too much the attention but still be intuitive for the user.	2.8
The buttons should be placed on the edge and on the top of the speaker when facing the user	2.6
Some classic push buttons should be used to reduce the risk of unwanted interaction	2.6
The "-" and "+" buttons should be placed respectively on the left and on the right of one another	2.6
The buttons should be integrated to a frame going around the speaker and the handle	2.12
Have a white light on the power button when there is more than 20% of battery	2.12
Have a red light on the power button when there is less than 20% of battery	2.12
A voice signal indicating when the battery level is less than 20% of battery	2.12
A visual signal indicating if the connected source is bluetooth of wifi	2.8
When the speaker is turned on for the first time no wireless source (wifi or bluetooth) is activated	2.10
The user needs to press 2 seconds on the "source" button to switch sources	2.10
Small white light and a pictogram on the side of the source button indicating the source connected	2.12
The buttons should be curved	2.15
The diameter of the button should be 12mm	2.15
Interaction between the speaker unit and the docking station	
The docking station should have a low depth to make it easy to place in and out	2.3
The docking station should go around the back of the speaker	2.16
The docking station should be placed at the back of the speaker to avoid having anything in the way when the user places it back	2.7
The docking station should be discreet	2.7
The magnet should be strong enough to allow the user placing the speaker back without searching for the direction	2.7
The magnets should be placed in the middle of the docking station	2.9
The total attraction force for the Neodymium magnets should be 0.78kg	2.17
Steel plates should be added at the back of the speaker and be separated from the magnets by 3mm	2.17
The docking station should stay in position when removing the speaker	2.7, 2.8
The docking station should weight 1kg minimum	2.17
A counter weight placed at the bottom of the docking station	2.9
Some rubber pads should be added to the docking station and the speaker	2.16

PHASE 3
/Maturation

The different iterations in respect to the user needs allowed to set some precise user requirements to initiate this phase. The concept is now taken to another level, making it ready for an implementation on the market with detailing of the interfaces and the components.

illu . 107 - Final concept

List of methods

illu . 108 - List of methods pictogram phase 3

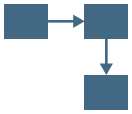
CAD

In this phase the CAD model is taken to another level of detail. With a final concept and precise informations about the components a final 3D model can be realized. The final concept can then be validated and made ready for manufacturing.

FEA

The Finite Element Analysis is a way to ensure the structural integrity of the concept. To do so a final CAD model with all the components and the right connections must be realized. It is a way to prove the concept.

Flow diagram

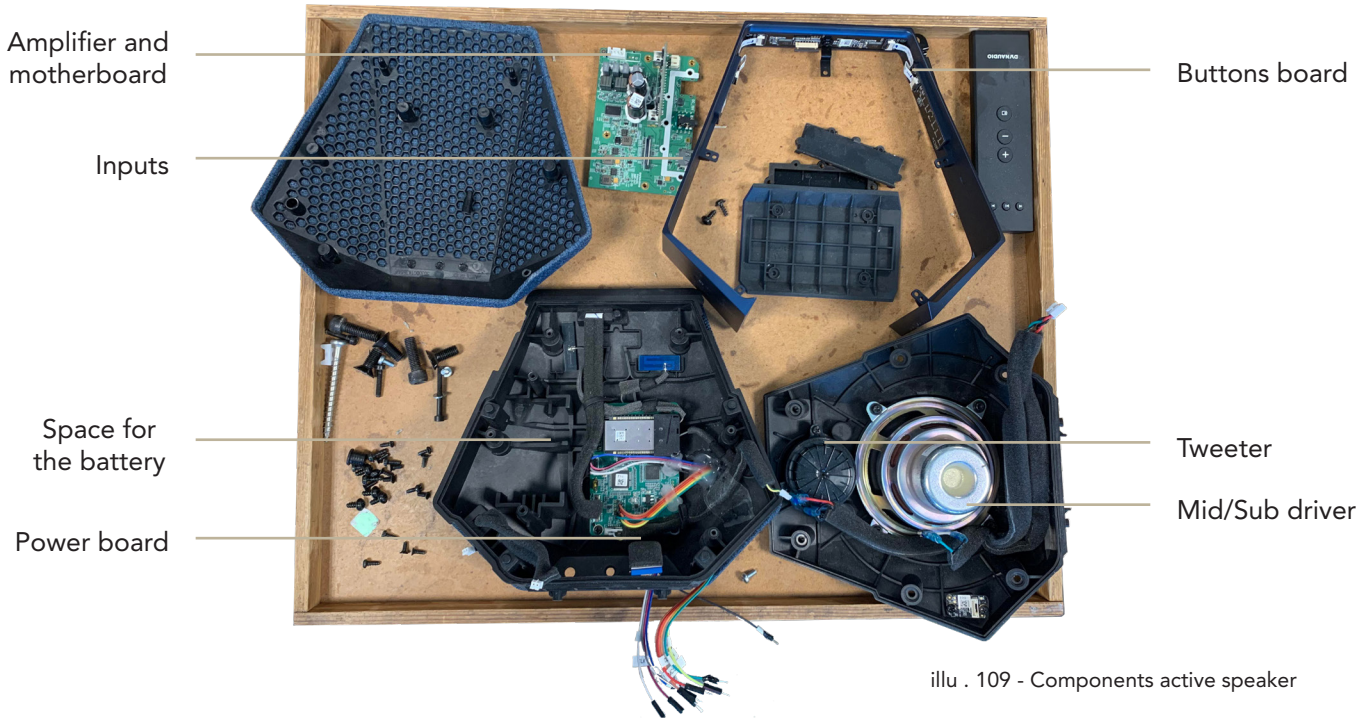


This method gives an overview on the functioning of the concept. It implies a deep knowledge on the product and the interfaces. It displays the action of the user on the product and what they are resulting in. The flow diagram details how it works from starting to powering off the product.

3.1/Components of an active speaker/Dynaudio Music 1

To better understand how an active speaker works and gain knowledge about the placement of the different parts for the maturation, the basic principles and components are detailed in the following section.(Appendix 26)

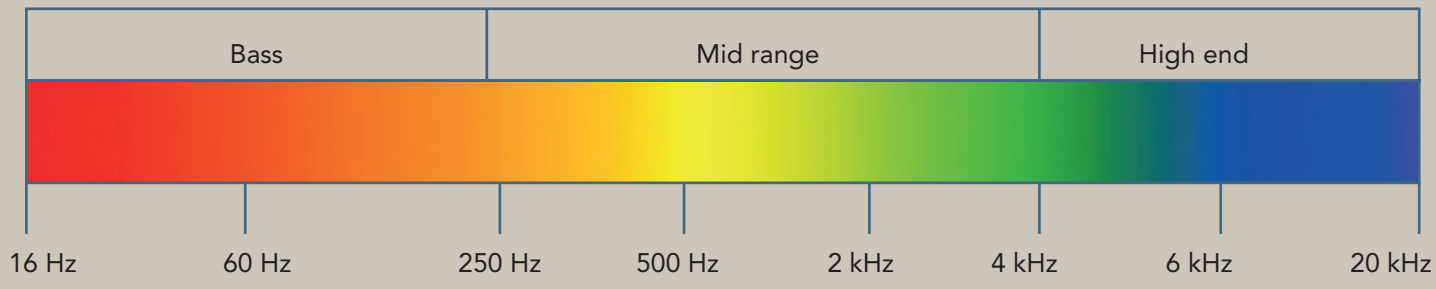
A Dynaudio Music 1 is dismantled to identify all the components and their placement:



illu . 109 - Components active speaker

Drivers/Frequencies

Drivers are usually divided into 3 big categories. The tweeter to play the high frequencies, the Mid range for the medium frequencies and the woofer for the low frequencies. This means the more driver for each range, the more detailed the sound will be, because it can treat every range individually. It is also possible to find some drivers treating a wider range of frequencies, e.g. Mid/Low drivers that will play both medium and low frequencies.

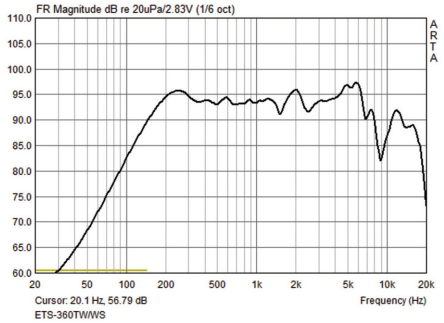


Source: (Smoot, 2020)

illu . 110 - Sound frequencies spectrum

Frequency response

A speaker frequency response is the range of sound frequencies it can reproduce. The more "flat" the curve is, the more accurate the speaker is to reproduce the intended sound from the artist. The X axis represents the frequency spectrum in "Hz" and the Y axis the sound pressure in "SPL". Every small peak on the curve symbolizes a "jump" in the sound pressure meaning it's not fully accurate to what the artist intended.

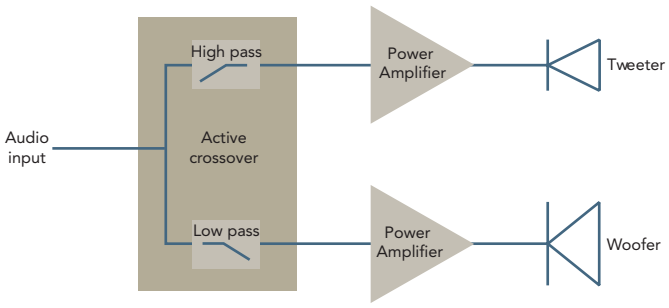


illu . 111 - Frequency response

Amplifier and active crossover

In section 1.1 the convenience of active speakers compared to passive speakers is explained. As mentioned before, the amplifier is integrated in the cabinet of the speaker. This allows the acoustic engineers to have a better control on the components and optimize the sound as much as possible.

To enhance the performance an "active crossover" is filtering the signal to separate the frequencies. It's using a High-Pass filter to split the high frequencies in the direction of the tweeter and a Low-Pass filter for the low end frequencies and send it to the Woofer. This means that each driver will receive more power at the right frequencies and it will be possible to always exploit the maximum capacity of the driver. (Dolan & Speakers, 2022). When the signal from the input reaches the crossover it must be treated and separated, in most active speakers DSP (Digital Signal Processing) is used, it is more accurate than Analog Signal Processing. (ECSTUFF4U for electronics engineer, 2023).



Source: (Dolan & Speakers, 2022) illu . 112 - Active crossover

Wifi and bluetooth/Chips on the power board

Wireless is essential but the bluetooth is compromising the quality of the audio files. On the other hand it is possible to use a wifi connection to play at better quality. To transmit the file over bluetooth it has to be compressed to send the data without interferences. When wifi can transmit more files at a higher rate and doesn't have to compress the file. (Kelley, 2018). Because all the users are not aware of the difference between bluetooth and wifi it is necessay to include both in the speaker.

Streaming module

The streaming module is directly connected on the motherboard. It is one of the key elements for enhancing the user experience with active speakers. It allows the user to connect and play faster on the speaker, even when the speaker is off it is only necessary to press play on the phone and it will start playing automatically.

The most used streaming services are Apple and Spotify. They both offer a direct connection with Airplay or Spotify connect. Chromecast is also used more and more for audio products. It allows you to stream anything from your device directly on the speaker. With high end audio, a connection to Tidal or Qobuz must be possible. They can stream music at a higher quality rate.

Using the Music 1 components

A meeting with one of the acoustic engineers at Dynaudio is set to find the optimal components for the intended use. The discussion led to the conclusion that the components of the Music 1 will be used. They match the needs for the product. The dimensions of the components are set as requirements for the new product and will be included in the CAD model.

The components from the Dynaudio Music 1 are used for the product

Part	Amount	Dimensions
Tweeter	1	Ø50 x 25 mm
Mid/Sub driver	1	Ø104 x 60 mm
Motherboard + Amplifier + inputs	1	100 x 70 x 30 mm
Power board	1	90 x 55 x 5 mm
Battery	1	70 x 45 x 45 mm
Top buttons board	1	120 x 15 x 2 mm
Side buttons board	2	55 x 15 x 2 mm

In the Music 1 the inputs are on the motherboard. In the new concept the inputs are in the docking station and can't be in the speaker unit. A proposition for the input is made according the Music 5 board but the dimensions should be adapted to the product by the engineers.

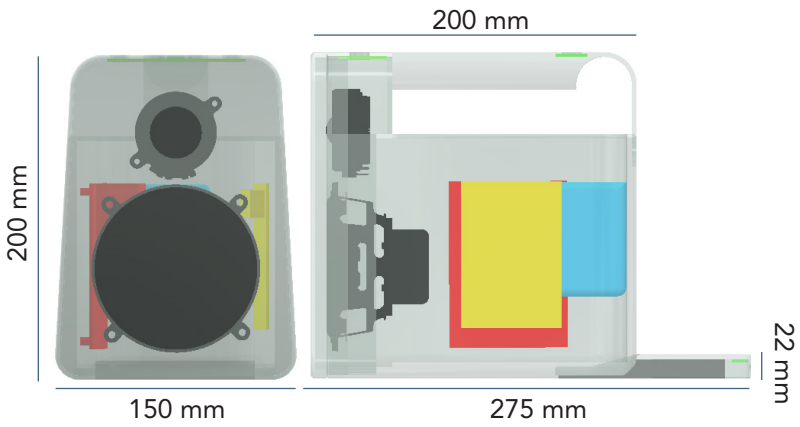
3.2/Adjust the dimensions/Place the components

It is also required to let enough air volume for the drivers to work (Appendix 19). The tweeter from the Music 1 doesn't need additional volume because it has its own back chamber but the Mid/Sub driver needs a minimum volume of 1.9L of air to work.

!

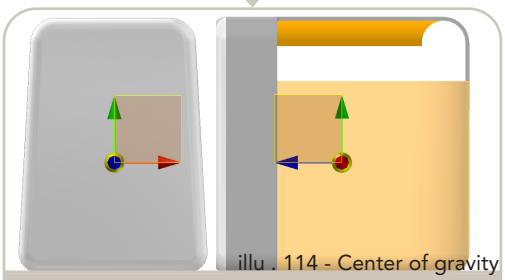
The dimensioning is done directly on Inventor professionals and the components from the Dynaudio Music 1 are placed in the model. Some brackets are added to mount them and size is adjusted to fit them all. When placing the components it is necessary to take into account their effect on the balance of the speaker when it's carried around. An unbalenced product would result in a bad user experience.

The Music 1 components are integrated in the product



illu . 113 - Main dimensions of the concept - integrate the components

The speaker should be well balanced for a comfortable handling



illu . 114 - Center of gravity

In Inventor professional the "Center of Gravity" function determines its position. The right materials and weight for the different components is entered and results in a well balanced product.

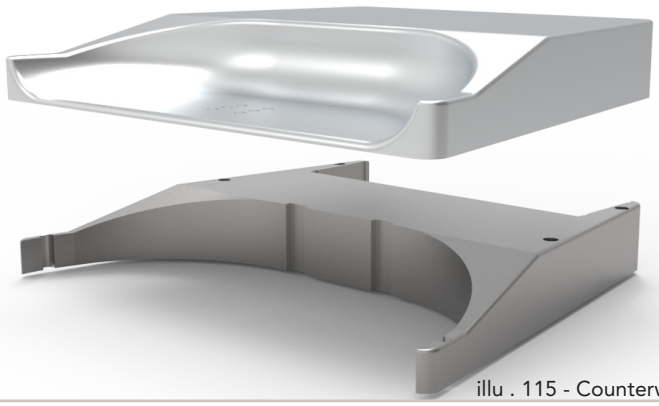
3.3/Detailing the docking station

All the user needs and requirements for the docking station need to be validated. All of them are taken into account and results in changes on the final model. These changes are detailing and don't affect the concept, therefore no user tests are done.

Balancing the force of the magnets

A counterweight placed at the bottom of the docking station

The docking station should weight a minimum of 1kg



illu . 115 - Counterweight

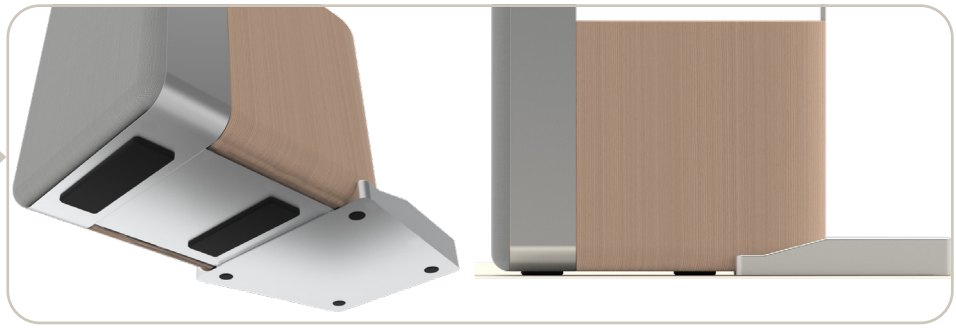
The weight of the counterweight is verified in Inventor.

W = 1.1 kg

Rubber pads

The rubber pads will avoid the speaker and the docking station to slide on a slippery surface. They are also used to level up the speaker and align it with the docking station.

Some rubber pads should be added to the docking station and the speaker

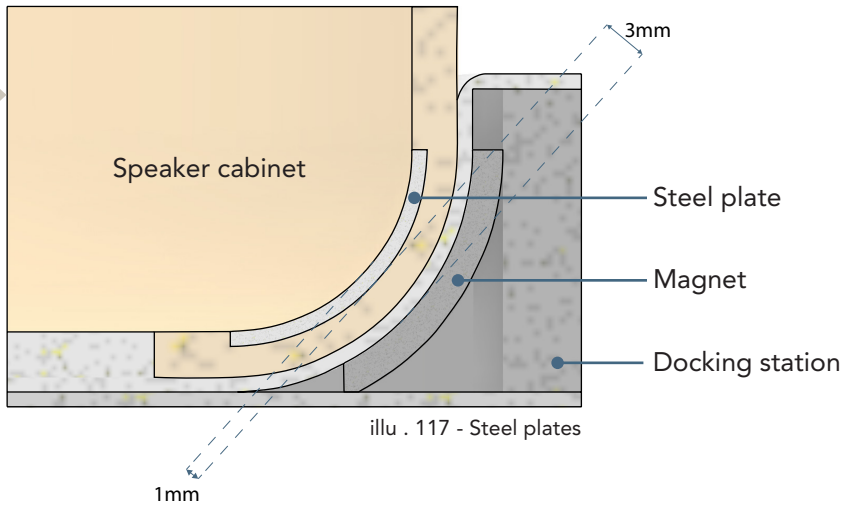


illu . 116 - Rubber pads

Steel plates

Thanks to the steel plates the speaker magnetizes to the docking station and ensure the speaker to be well placed on the charging port. They are placed at the back of the speaker cabinet and separated by 3mm from the magnets with the shell, the shell being in a non magnetic material it will not interfere.

Steel plates should be added at the back of the speaker and be separated from the magnets by 3mm



illu . 117 - Steel plates

Inputs

The docking station is used to charge the speaker and for the digital inputs, during the process the following user need is found:

"The new audio product must take into account the use for movies/series besides being listening to music, it should expand the sound from the TV". Thanks to an interview with an acoustic engineer at Dynaudio (WS40) the required input is set to be an HDMI port. The engineer also said that an auxiliar input for a mini jack is necessary to plug any kind of audio devices.

In the framing phase a requirement for the product to include an USB Type-C charger is set.

The product should include an USB Type-C charger

The product should include a HDMI port

The product should include a mini jack port

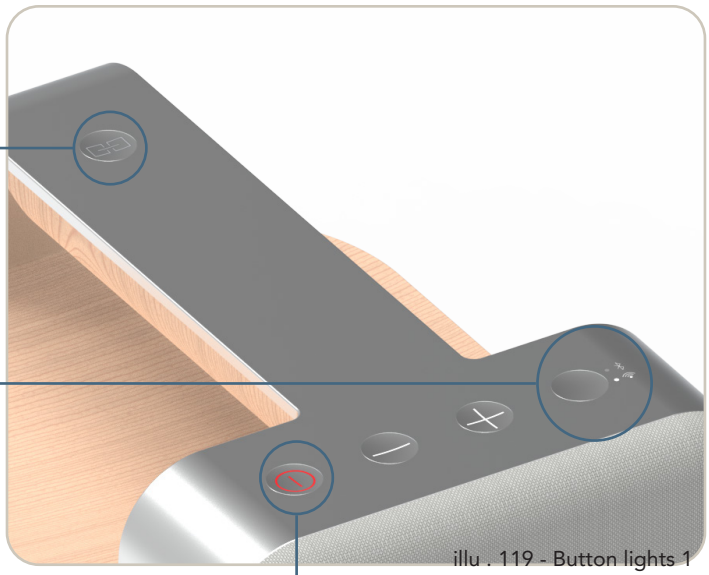
illu . 118 - Inputs

3.4/Introduce the lights

The lights on the buttons are visual cues to guide the user. Some requirements are set and implemented on the product (Appendix 24, 27):

Pairing button placed on the handle with a small light indicating if it's paired or isolated

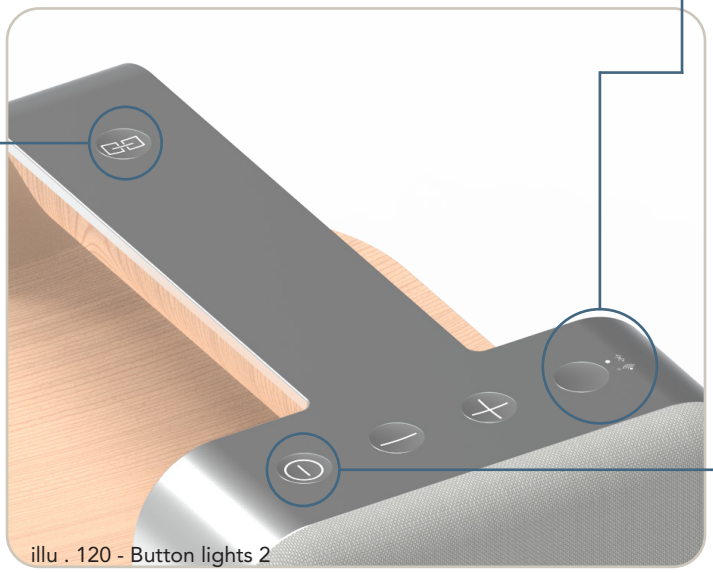
When the light of the pairing buttons is on, it means that the speaker is in pairing mode and even if one speaker is removed from its docking station the music will play on both speakers. When it's off the speaker is in isolating mode and music plays only on the speaker removed from the docking station.



illu . 119 - Button lights 1

Small white light and a pictogram on the side of the source button indicating the source connected

When the speaker is running the light will be indicating what source is used to ensure the user that it's connected to the right source.



illu . 120 - Button lights 2

Have a red light on the power button when there is less than 20% of battery

When the product is under 20% of battery the visual signal is doubled by a voice signal. It ensures that even if not looking at the speaker the user will get the information.

Have a white light on the power button when there is more than 20% of battery

While the speaker is running this light will be on to ensure the user that speaker is on.

3.5/Material selection

First assumptions are made for the materials and discussed with a Dynaudio's engineer (Appendix 19). The first idea is to have a wood cabinet and an aluminum frame. The wood cabinet is abandoned because it doesn't match with the product requirements. It would be too expensive and too heavy and for such a small volume that is carried by the user. The aluminum frame could be difficult to manufacture and it will be difficult to have a good connection between the different parts. The selection of the materials is done according to the needs found during the process and by discussing the different options with the Dynaudio engineer (Appendix 19).

The product should respect the codes of new nordic design

Respect the circular economy on a lower level

The product should include long lasting materials and components

Ensure the integrity of the speaker if it falls

Shell and bottom handle: R-ABS + Wood veneer

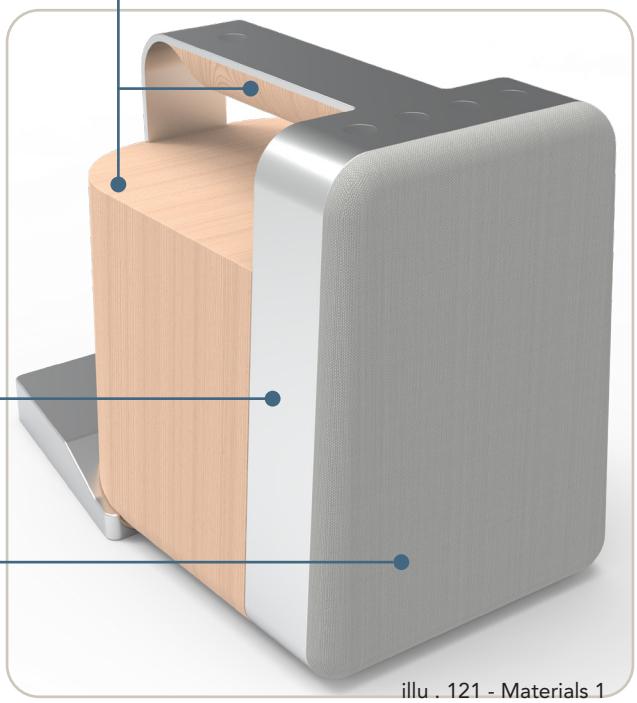
The shell is the part the user will interact the most with. A combo of recycled ABS (Cirplus, 2023) with a wood Veneer for the finish is chosen (Danket, 2021). Using these materials combined will give the same finish and feeling as if it was a wood cabinet but keep the product lightweight and shock resistant. Using ABS also allows it to have a more harmonious form following the complexity of the shape. Using ABS means that the product should have a volume big enough to meet the standard UL 94 which is the «Standard for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances testing» (UL standard, 2023), with a volume higher than 1.9L the standard is met.

To match the requirements of entering in circular economy, recycled ABS (R-ABS) is used with FSC certified wood veneer. For e-products it is difficult to match all the criterias for a fully circular economy, but in using R-ABS it acts on the recycling part and participate in limitating residual waste (European Parliament, 2021). The FSC label ensure that the trees are harvested in a responsible way (FSC, 2023).

It is also discussed with Dynaudio (Appendix 02) that for lifestyle products, using recycled and sustainable materials is a way to better reach young adults because their awareness regarding sustainability is growing (Appendix 10).

Frame and top handle: R-ABS + Metal coating

For the frame a first proposition with aluminum is made but according to Dynaudio (Appendix 19) using ABS with a metal coating will reduce the weight of the product and the cost. By coating ABS the finish will be better and it will protect the material over time (Olivera & Muralidhara, 2016). The manufacturing process will also be easier as the main material is the same for the shell, it will be easy to connect the parts together. By playing on the elasticity of the material the part with the handle can be placed around the shell.

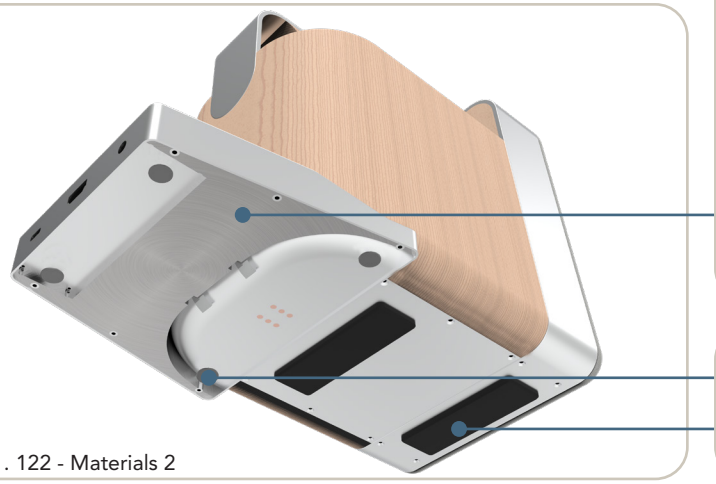


illu . 121 - Materials 1

Front grill: Xpress fabric

For the front grill of the Music range Dynaudio used the Medley fabric from Gabriel (Gabriel, 2023) but this fabric has a weight of 510 g/lm and damp the sound. It is used because of purely aesthetic reasons. For lifestyle products, reaching full range performance is not the biggest need.

To still match the young adults' aesthetic expectations but to deliver better performances a lighter fabric from Gabriel is used. The Xpress with a weight of 270 g/lm.



illu . 122 - Materials 2

Counterweight: Iron

3 common metals used for counterweights are considered, tungsten, steel and iron. Tungsten has a really high density and would allow a smaller docking station but its manufacturing cost is 8 times higher than steel (Tungsten Grooves, 2023), the counterweight should be 1kg and would result in a manufacturing cost way too high in comparison of the product. Steel is also more expensive to manufacture than iron but they have the same density, therefore iron is chosen.

Pads: Rubber
Rubber is a cheap material and easy to manufacture, it is also anti-slippering.

3.7 Proposition for the connection of the different elements

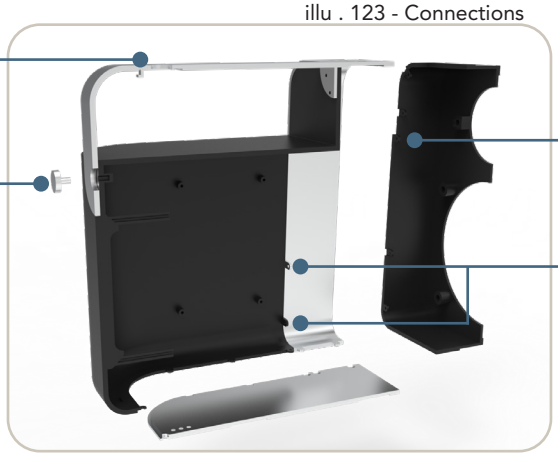
For the connections and the mounting of the parts some propositions are made. For a more detailed and accurate design the product should be reviewed by Dynaudio engineers. The principles are taken from the Dynaudio music 1 with a back and a front panel connected together and englobbed by a frame that ensure the sealing of the product. To respect the circular economy on a lower level the solution requires no glue and all parts can be dismantled.

Connection between the parts

The bottom of the handle is mounted with a bracket at the end and fixed with some screws on the other hand

To fix the frame a flat head fastener is designed at the end of the handle for a better finish.

illu . 123 - Connections



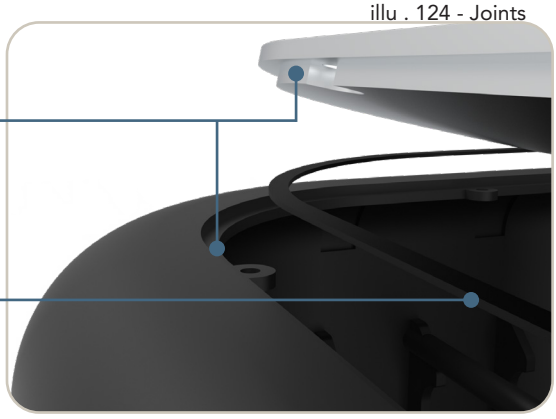
Brackets with holes for screws are designed to hold the main parts together. They will ensure the connection between the main parts

Sealing

The product should respect an IP54 standard. To seal the product some contact surfaces are designed on the edges. They ensure a good connection and the enclosure of the cabinet.

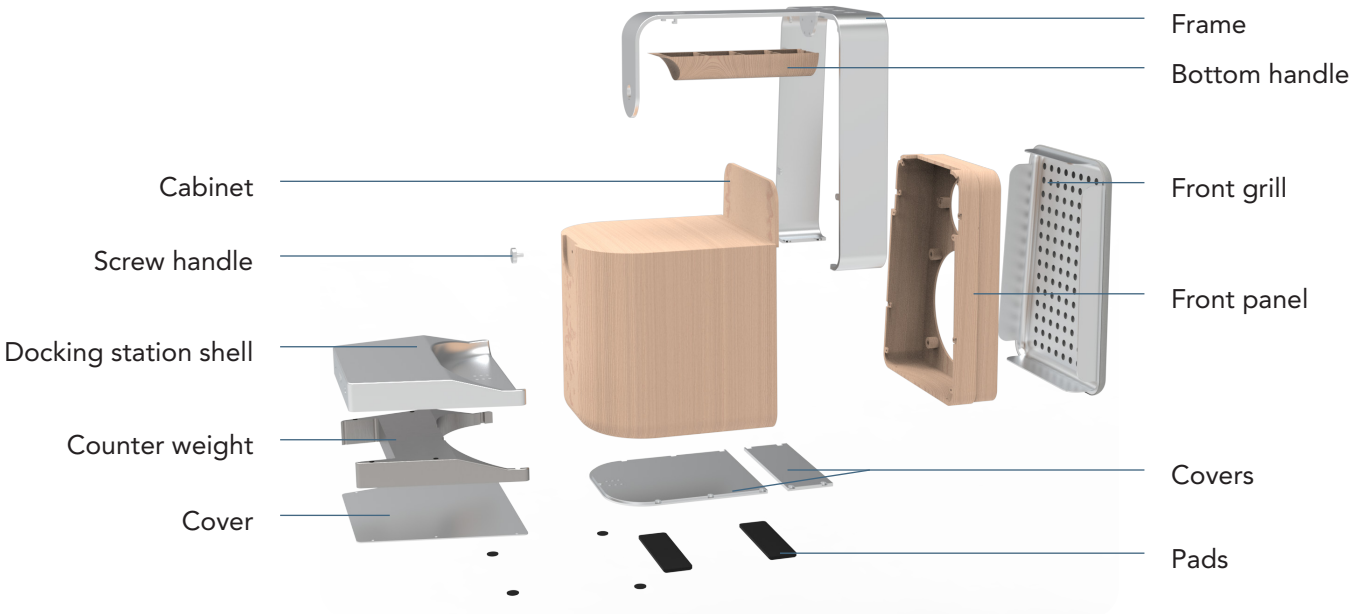
A joint is placed in between the components to avoid water splash or dust to go in. It will also reduce the vibrations and enhance the sound quality.

illu . 124 - Joints



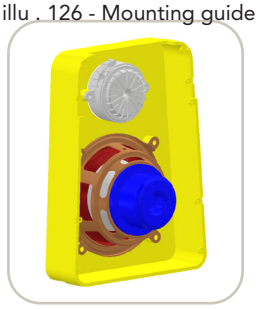
Main components

The following components are the main structural elements of the speaker with the right coating and wood veneer placed on.

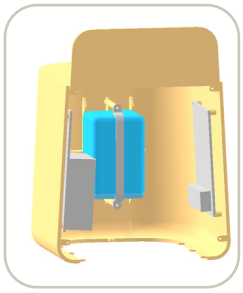


illu . 125 - Main components

illu . 126 - Mounting guide

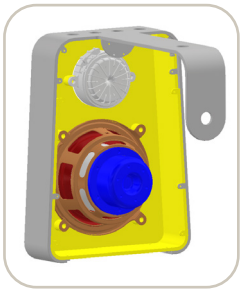


1. Drivers attached to the front panel.

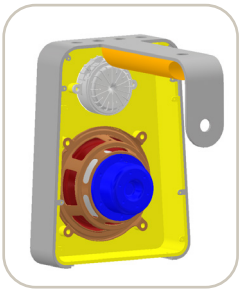


2. Boards and battery attached to the cabinet

3. Buttons board attached to the frame

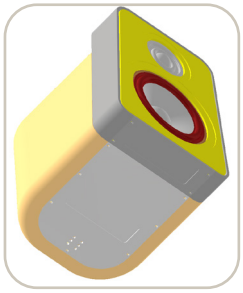


4. Frame and front panel attached

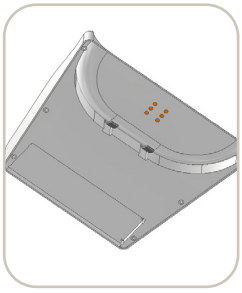


5. Bottom handle attached to the frame

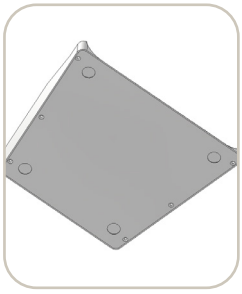
6. Front panel + Frame attached to the cabinet



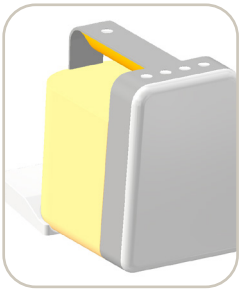
7. Covers placed on the bottom



8. Components put in the docking station



9. Docking station closed with the cover



10. The speaker is ready

Due to the shape and the choice of materials the product should be made with injection molding. Designing brackets is challenging due to the need to consider a lot of different factors. It includes part geometry, tooling design, assembly, cost optimization… Balancing these factors for a perfect solution is difficult with the available resources, a first proposition is made and should be reviewed by Dynaudio engineers for a better detailing. With the assumptions made it will still be possible to give an estimation of the product cost.

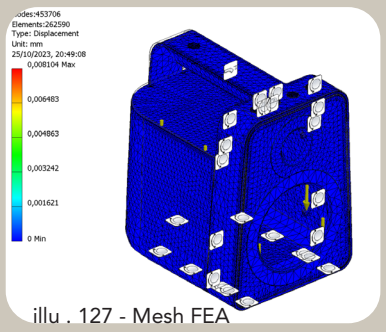
3.8/ FEM analysis

When the speaker is laying on a table the cabinet is subject to the forces occurring by the shell and the components but it is lower than when the user will grab the speaker to move it around. This simulation aims to calculate what are the stresses when the speaker is moved around

The information regarding the weight of the components is taken from "Mohr & Abrahamsen, 2020". The weight of the shell is calculated with the CAD software. Once known the magnitude of the force applied on each bracket can be calculated. Further on these forces are applied to each bracket. Then a "pin" constraint is used for the screws simulating the thread. A "fixed" constraint is placed on the handle to simulate where the user is grabbing the speaker cabinet. (Appendix 33)

Component	Weight (g)	Number of brackets	Force on each bracket (N)
Speaker shell	600	-	5,89
Tweeter	120	2	0,59
Mid/Low driver	100	4	0,24
Mother board	200	4	0,49
Amplifier board	280	4	0,69
Battery	300	4	0,735
TOTAL	1600		15,69

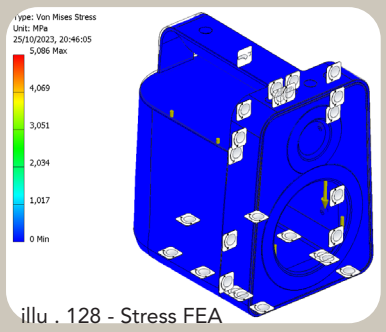
Mesh



illu . 127 - Mesh FEA

It is generated to prepare the analysis, the mesh is thinner around the edges and the brackets to have a better calculation around the spots where there is a concentration of constraints.

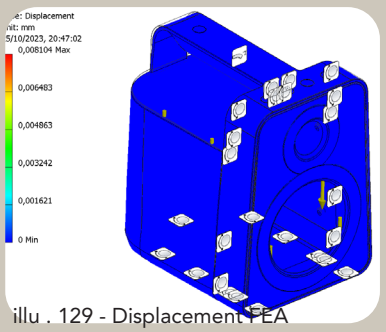
Maximum stress



illu . 128 - Stress FEA

The results are then compared to the mechanical properties of ABS which is the main material for the speaker cabinet. We can see that the maximum Von Misses stress of 5,9 MPa is under the maximum stress of 29Mpa the material can accept before entering in plastic deformation

Displacement



illu . 129 - Displacement FEA

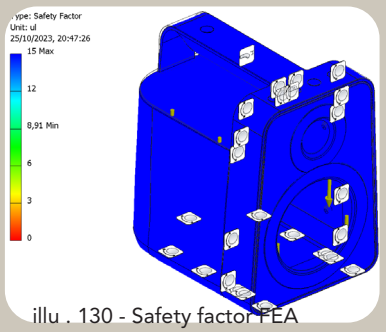
The maximum displacement occuring is 0,008 mm and will not affect the integrity of the speaker

Evaluation

Ensure the integrity of the speaker if it falls.

The FEA analysis shows that the integrity of the speaker cabinet is respected when being carried around. The maximum safety factor is 15 and the minimum one is 8,91.
The risk for the speaker is to be dropped from a human height while being carried around, a test that requires a fully functional product and to do some repetitive simulations to see how many times the speaker can be dropped before breaking. The software used doesn't allow this kind of testing, a physical test should be done. Due to the available resources (time and no final products yet) it is not possible to realize it in a physical way.

With a minimum safety factor of 8,91 it is assumed that the speaker should resist shocks, the selected material also has some good properties for shocks, it is often used for working tools.



illu . 130 - Safety factor FEA

3.9/Present the product/Harmony 10

Product name

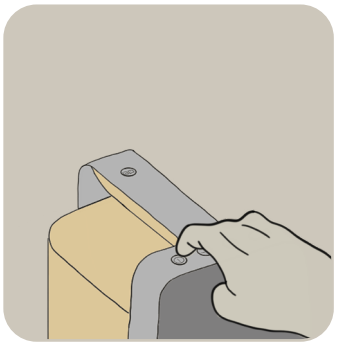
The new functionalities of the product should be tied to a story

The names from Dynaudio's home segment are trying to give meaning to the product, it reflects its story. (E.g. Confidence, Evidence, Focus…). Harmony comes from "harmos" meaning "joint" in Greek, in musical terms it is the combination of musical notes that intend to create a pleasing effect for the audience. Young adults aim to create a home environment where all the elements are matching well with each other. At the same time the product is meant to work around the house and facilitate the experience when switching from one device to the other by joining 2 separate elements into one system. The 10 refers to the size of the speaker, this is the number Dynaudio uses for small bookshelf speakers. Using the number "10'' gives space for further development of the product into a different size version.

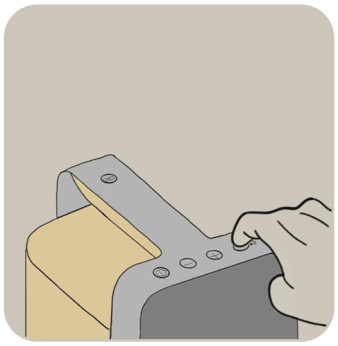
Use case scenario

illu . 131 - User scenario

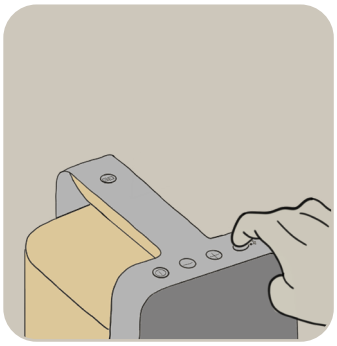
Set-up, to do only once



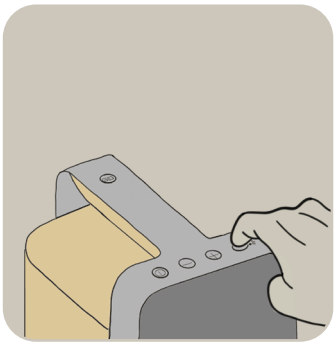
1. Start the speaker by pressing the power button



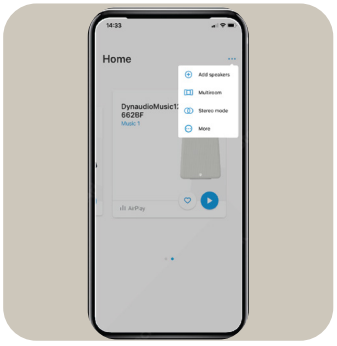
2. Press 2 sec the source button, the bluetooth light blinks



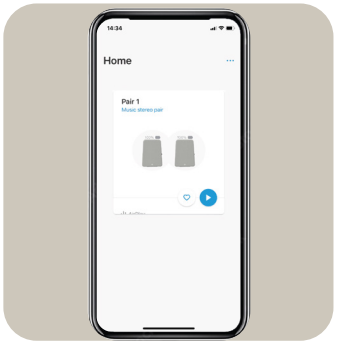
3. Press again 2sec on the source button, both lights are blinking



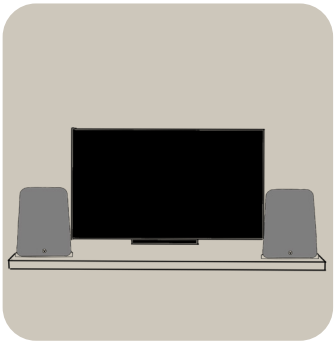
4. Set-up the speaker via the Dynaudio app



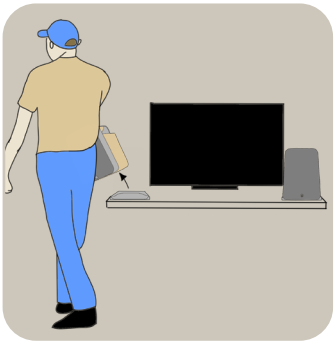
5. Create a pair of stereo speaker



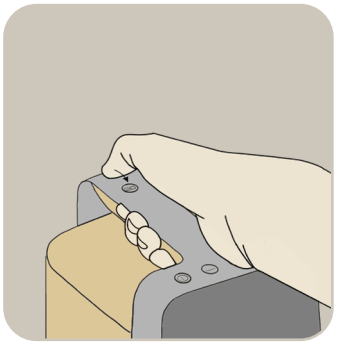
6. Ready to be used and controlled via the app



7. The product is ready to be used in stereo

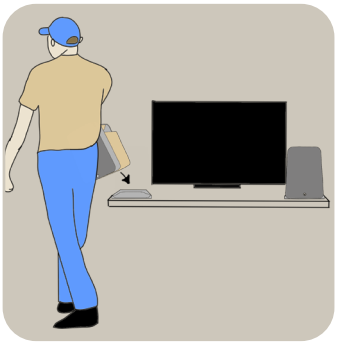


8. Grab on of the two speaker unit

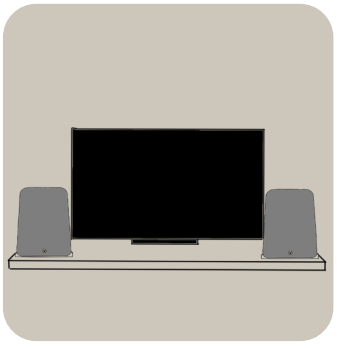


9. Press the pairing button to switch between the pairing and isolating mode

10. Enjoy music in the background while cooking



11. Place the speaker unit back



1. Enjoy the sound in stereo mode

Design language

The product should respect the codes of new nordic design

Harmonious 10 intends to facilitate the interaction between the user and its home environment. To make it effortlessly comprehensible for the user the forms are trying to follow functions. In addition to the functions it is also important for the product to match with the environment in terms of aesthetic. To respect the codes of new nordic design in its visual expression it must use natural materials, have a simple design language and a high focus on the details. To match these criterions the overall aesthetic results in a sober but elegant design that blends in with the decor, in this way it is easy for the user to project the product in his home without wondering if it will stand out from the rest.

The main working principles

The front grill

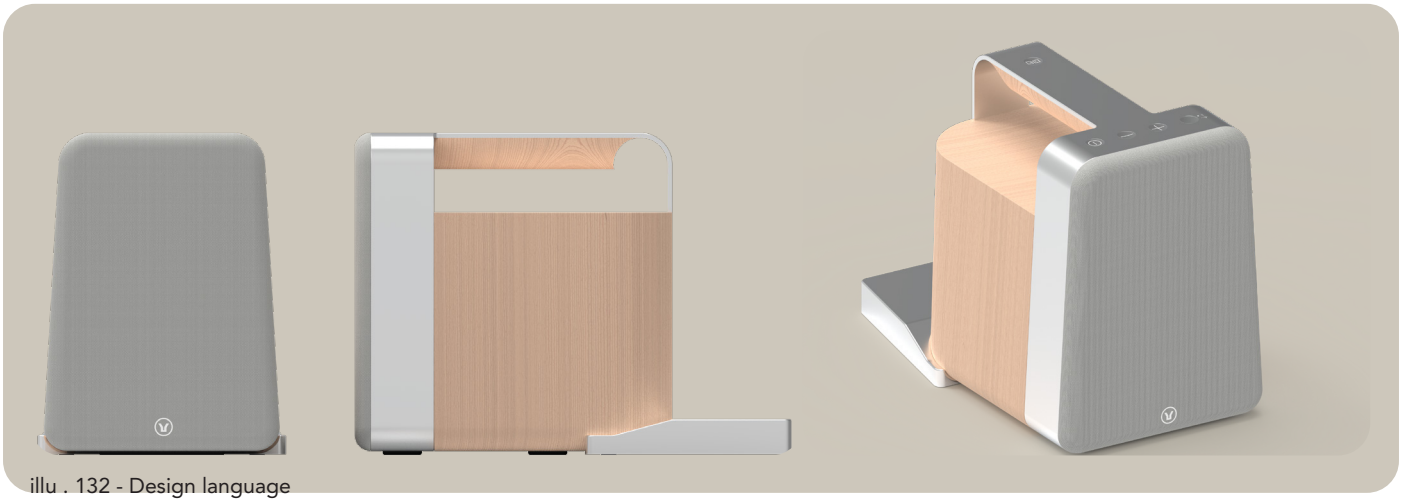
The fabric gives a warmer feeling for the product and with its soft color it's easy to integrate it in a young adult home environment. Thanks to the magnets it can be snapped on or off to give a new meaning to the speaker and offer a full sound range.

The handle

The form is following function and makes it intuitive for the user on where to grab the speaker and the sizing offers a safe handling of the speaker when it's carried around the apartment. It is covered in wood veneer to feel the warmth and texture of the wood, it creates an emotional connection with the product and encourages the speaker to be grabbed.

The speaker unit

By being independent from the docking station the user can grab one of the two units and move it around its house as a nomad speaker. The materials have soft colors and a finish that reminds classic stereo speakers.



illu . 132 - Design language

The buttons

They are placed on the top and easy to identify. Having them organized from left to right depending on their importance ensures a steep learning curve for the user. With the curvature on their surface they are easy to spot. With the source button the user can select if wifi or bluetooth is used. The pairing button placed under the thumb makes it easy to switch between the "pairing" and "isolating" mode while grabbing one of the two units.

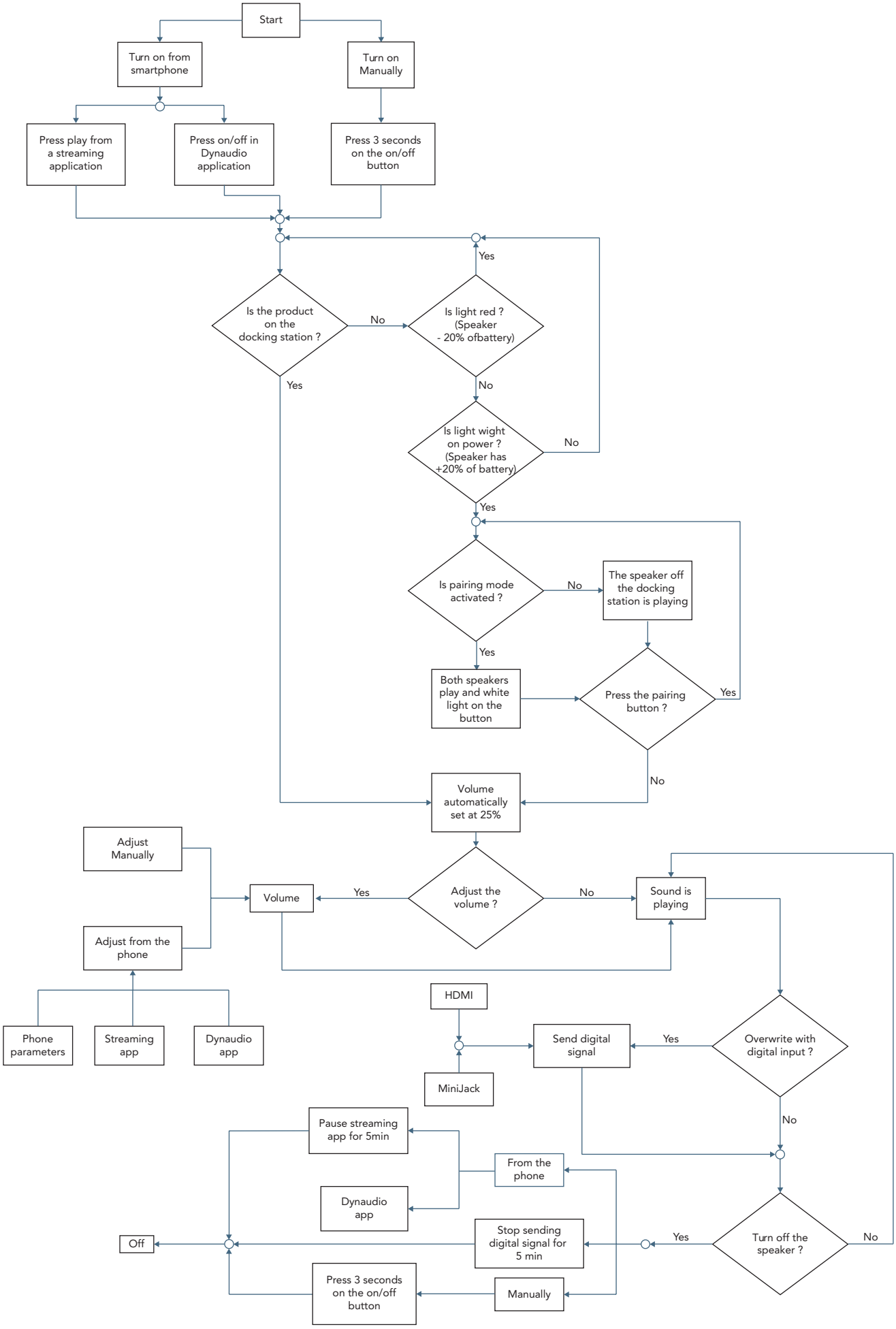
The docking station

It's placed at the back of the speaker to stay discrete, thanks to its shape and the magnets it is easy for the user to place the speaker back without searching the direction. The magnets also give a satisfying feeling and encourage the user to place the speaker back. It will also encourage the user to charge the speaker and always have battery to listen to the radio in the morning.

Dynaudio application

The smartphone application allows the user to set the speakers and control the setting or the media to play.

3.10/Flow diagram



3.11/Proposition for evolution/A future prospect ?

illu . 133 - Lifestyle speaker

As seen in section 1.12 a proposition for the product to evolve with the user should be made. The current product is fitting for young adults and is meant to be sold as a «lifestyle» bookshelf speaker.

The requirements for the evolution identified in the phase 1 are taken for the proposition:

The product should give the possibility for the user to evolve

The possibility of adding a stand

A front grill that can be removed

illu . 134 - No front grill

As a detailing, some aluminium rings are added around the drivers for aesthetical purpose, a better finish and to match with this classical element of Dynaudio's products. (Appendix 3)

To fit with some of the identified aspects of speakers targeting adults (32-46 years old) (Appendix 8) a proposition is made for the evolution of the product. The docking station is now replaced by a stand that can be sold separately, the stand is made with a grey aluminum finish to match with the current aesthetic. The front grill can be removed offering full sound range for the speaker. The proposition aims to give a different look to the speaker and make it look less "playful". The system is still the same, it can be taken out to be carried around. But adults have wishes for a more fixed system and would rather invest in a multiroom system. It is still possible to do it by using the Dynaudio application and grouping Dynaudio's active speakers together (section 2.13).

illu . 135 - Stands

Insights about the evolution for the product were identified at the beginning of the process. Over the last decade the ways of consuming music have been constantly evolving, designing for evolution requires anticipating how the needs of the users may change over time. To develop a solution within this frame a deep understanding of different user groups is required making it more difficult to identify a concrete problem. By developing a product targeting a specific user group, a more concrete problem can be found and it is easier to develop the solution. Thanks to a basic understanding of older users some insights on how the product could evolve are found leading to the proposition for evolution. Not developping the needs for the evolution it is also easier to include them in the final solution, the risks of having them colliding with each other's is then limited.

3.12/Phase 3 sum-up

Throughout phase 3 the final concept is taken to another level of detail. All the components are now included in the product and a finite element analysis is realized to validate the structural integrity of the concept. The main working principles and the user scenario are also presented. With all these elements it will now be possible to make a business analysis and see how this product can be launched on the market.

Along this phase few requirements are found for the model and are all validated:

Requirements	Section
Speaker unit	
Drivers	
The Mid/Sub driver needs a minimum volume of 1.9L of air to work.	3.2
Tweeter dimensions: Ø50 x 25 mm	3.1
Mid/Sub dimensions Ø104 x 60 mm	3.1
Mother board + Amplifier dimensions 100 x 70 x 30 mm	3.1
Power board dimensions 90 x 55 x 5 mm	3.1
Battery dimensions 70 x 45 x 45 mm	3.1

Evaluation of the Requirements

After this phase an evaluation of the requirements can be done. It is seen that all the requirements from the phase 2 (conceptualization) are met by the product. From the phase 1 some need to be validated or not in the next phase as they are directly related to the business analysis and the implementation on the market.

Requirements from the framing/ Phase 1	Evaluation
Overall requirements for the product	
Avoid interferences between the different devices	yes
The product should target young audiophile adults	yes
Enjoy a good sound quality in the living room	yes
Play music in the background in the kitchen/bathroom	yes
Radical innovation on the product	no
Incremental innovation on the process	no
The maximum retail price for the product is 7000 dkk	no
The product should give the user the possibility to evolve	yes
Respect the principles of circular economy on a lower level	yes
The new functionalities of the product should be tied to a story	yes
Use the brand history and the brand knowledge to ensure a good quality product to the user	no
The product should respect an IP54 standard	yes
User interaction with the product	
Easy access to the direct control on the speaker	yes
A solution for controlling the device from a smartphone	yes
The product should include an USB Type-C charger	yes
The new audio product must take into account the use for movies/series besides being listening to music, it should expand the sound from the TV	yes
The stereo shouldn't always activate as a primary device when a bluetooth signal is detected	yes
The speaker works as soon as it's plugged in	yes
An audiovisual signal indicating the battery level	yes
Remind the user to charge the speaker	yes
The product should include long lasting components and materials	yes
The product should respect the codes of new nordic design	yes
Evolution of the product	
A front grill that can be removed	yes
The possibility of adding a stand	yes
Be able to connect the product with another Dynaudio product for a multiroom system	yes

Requirements from the conceptualization/Phase 2	Evaluation
Speaker unit	
The product should give the user the possibility to play in stereo	yes
Both units should be able to work independently from each other's	yes
A pairing/isolating button to manage non physical connection between both speakers	yes
The pairing/isolating button should keep in memory the last action of the user	yes
Pairing button placed on the handle with a small light indicating if it's paired or isolated	yes
Have a visual/tactile indication on where to grab the speaker	yes
The direction of the handle should be perpendicular to the body of the user	yes
The user should have its hand going all around the handle for safer handling	yes
Ensure the integrity of the speaker if it falls	yes
The buttons should be discreet enough not to trigger too much the attention but still be intuitive for the user.	yes
The buttons should be placed on the edge and on the top of the speaker when facing the user	yes
Some classic push buttons should be used to reduce the risk of unwanted interaction	yes
The "-" and "+" buttons should be placed respectively on the left and on the right of one another	yes
The buttons should be integrated to a frame going around the speaker and the handle	yes
Have a white light on the power button when there is more than 20% of battery	yes
Have a red light on the power button when there is less than 20% of battery	yes
A voice signal indicating when the battery level is less than 20% of battery	yes
A visual signal indicating if the connected source is bluetooth of wifi	yes
When the speaker is turned on for the first time no wireless source (wifi or bluetooth) is activated	yes
The user needs to press 2 seconds on the "source" button to switch sources	yes
Small white light and a pictogram on the side of the source button indicating the source connected	yes
The buttons should be curved	yes
The diameter of the button should be 12mm	yes
Docking station	
The docking station should have a low depth to make it easy to place in and out	yes
The docking station should go around the back of the speaker	yes
The docking station should be placed at the back of the speaker to avoid having anything in the way when the user places it back	yes
The docking station should be discreet	yes
The magnet should be strong enough to allow the user placing the speaker back without searching for the direction	yes
The magnets should be placed in the middle of the docking station	yes
The total attraction force for the Neodymium magnets should be 0.78kg	yes
Steel plates should be added at the back of the speaker and be separated from the magnets by 3mm	yes
The docking station should stay in position when removing the speaker	yes
The docking station should weight 1kg minimum	yes
A counter weight placed at the bottom of the docking station	yes
Some rubber pads should be added to the docking station and the speaker	yes

PHASE 4
/Business

With the design proposal made, this phase put the concept in a company context by identifying all the stakeholders and the business approach of Dynaudio, by evaluating the cost of the product and production a retail price can be estimated. Further on the product is put in a market context and the missing requirements are evaluated.

illu . 136 - Factory

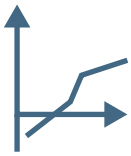
List of methods

illu . 137 - List of methods pictogram phase 4

Key stakeholders

Identifying the different stakeholders from the manufactuging of the product to the distribution gives an overview on who is involved. The current channel used by Dynaudio can then be challenged.

NPV



The NPV gives an estimation of the profitability of an investement. To realize a precise estimation on the cost of the product is realized. This tool can be used to convince a company to invest in the project.

Market evaluation

With a cost estimation the product can be compared to competitors on the market. The area of differentiation from existing solution is also determined as well as the angle to take to penetrate the market.

4.1/Key stakeholders and selling channels

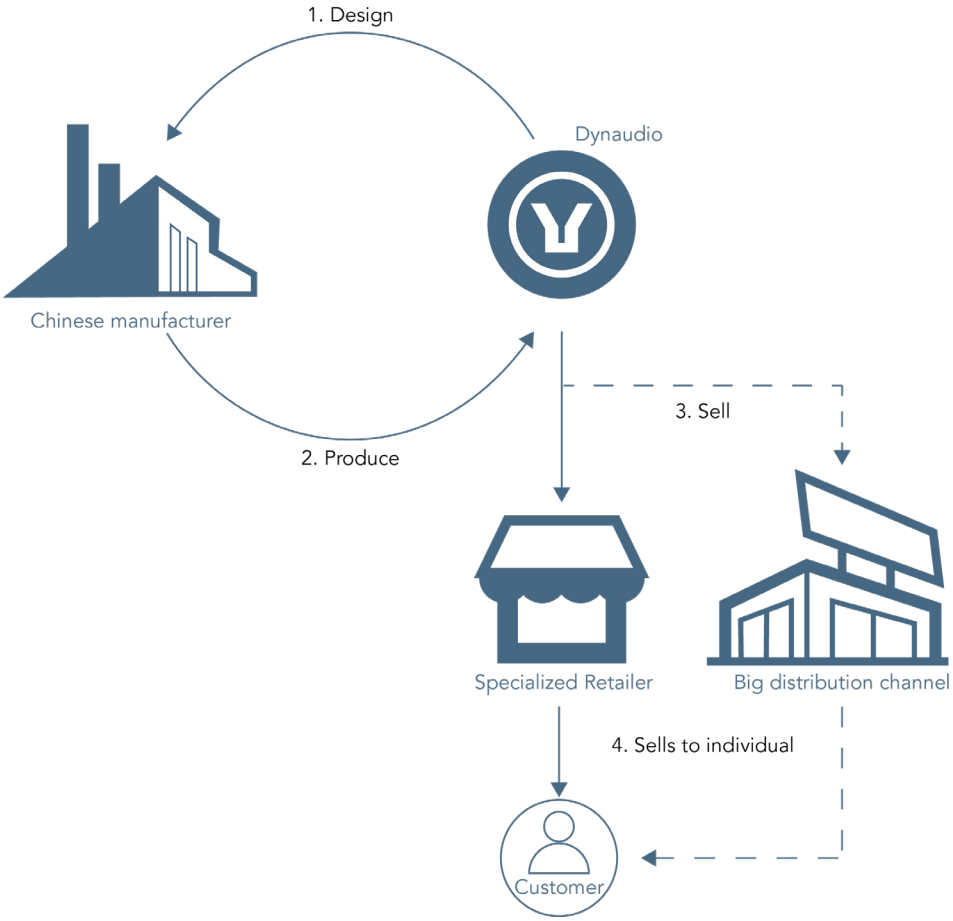
Key stakeholders

Their products have been distributed by TC group until 1999, at this date Dynaudio restructured their selling channels and decided to handle the distribution operation in-house, it allowed them to be one step closer to their customer and have a better view on the market. But the distribution is still in a B2B approach where they sell only to professional partners that are then selling to direct customers.

Regarding the stakeholders in play, the majority of Dynaudio's shares are possessed by a Chinese parent partner, Goertek, which is a company specialized in acoustic equipment.

Distribution channels

The same manufacturing and distribution channels as the Dynaudio Music range. Dynaudio doesn't have the knowledge to produce "lifestyle" products in house as they don't have the machinery to produce polymer parts, it would be too big of an investment for them. Regarding the distribution channel of the Music range it is the same as the other Dynaudio's product but this is potentially one of the reasons why the product has not found its audience, indeed the product is distributed in specialized audio shops as their other products. But it aimed to touches a larger audience. A solution for Harmony 10 to undergo the same effect can be to expand the distribution to non specialized audio shops, going also by general electronic shops will allow to present the brand to a larger audience. It is seen that young adults don't know about Dynaudio products (Appendix 1) and that they are mainly buying audio products from non specialized shops such as Bilka or Elgiganten for Denmark (Appendix 10).



illu . 138 - Distribution channels

4.2/Production methods

Most of Dynaudio's products are branded with high-end hifi and are made with wood cabinets, these products require high skills in craftsmanship and a sharper control in terms of quality. Going into a lifestyle product such as Harmony 10 doesn't mean that it shouldn't be a "bad quality" product but the production channel is different. As they did with the Music range the production should be outsourced to lower down the initial investment.

To produce the parts of the cabinet and the docking station, Chinese manufacturers are considered because of the low production costs and because the parent organization, Goertek, is located in China, Goertek being specialized in acoutsic components they already have some working partners in China.

Injection molding

According to Dynaudio a good objective for such a product would be to sell around 5000 products a year. By considering the chosen material, the amount of products and the complexity of the parts injection molding is the logical choice.

For the aesthetic of the pieces wood veneer will be applied on the cabinet, the front panel and the bottom handle.

The frame, the front grill, the docking station and the covers will have a metal coating applied.

CNC

For the counterweight a CNC Milling machine is used. It is the most common method to produce metal components with a high precision. Indeed the counterweight should fit in the docking station with a high tolerance to avoid moving inside.

4.3/BOM

The components will also be bought from China and everything is assembled together in China. This will reduce the total production cost and limit the transportation of components.

All the information about the cost of the components is gathered directly from Dynaudio suppliers, the Ambient 1 master thesis (Mohr, Abrahamsen & Knudsen, 2020) and from computer research. It isn't possible to find the cost of all the components but all the main ones are found.

The estimation for the injected and CNC parts is done with the calculator available at «http://www.custompartnet.com/». It also includes the cost of operation and the average wage for a Chinese machine operator.

The BOM is established and the total production cost of the product is estimated, the cost of operations and of the assembly by a Chinese worker are also included (Appendix 34).

Unit	Cost (USD)
Components	49,26
Injection moulding	58,519
Metal manufacturing	5,12
Total Production cost	63,639
Assembly	0,955
Total (1 unit)	113,854
Total (2 units)	227,708
Shipping/2 units	0,48

4.4/Business case

All the detailing for the businees case can be found in (Appendix 34).

Initial investment

The production cost of the product is then multiplied by 5000. The investment for the Acoustic engineers englobe the further development of the product to have it ready for the market and the production. A development of 6 more months is considered taking into account the working hours the average salary for a Danish acoustic engineer. The tooling being outsourced extra investment from Dynaudio is not necessary.

Initial investment	USD
Product	1 140 940
Acoustic engineers	28 640
Tooling	-
Total	1 169 580

Retail price

The maximum retail price for the product is 7000 dkk

Price	USD	%
Manufacturing cost	228,19	
Constribution margin (Dynaudio)	148,32	65
Sales price (Dynaudio)	376,51	
Constribution retail	188,26	50
Retail price	564,77	
VAT	141,19	25
Retail price (incl. VAT) USD	705,96	
Retail price (incl. VAT) Dkk	4885,22	

Knowing the production cost of the product and the distribution channels the retail price can be estimated. It takes into account the margin of Dynaudio, of the retailers and the VAT (Value Added Taxes) of 25% for the EU market.

The total retail price for a pair of stereo Harmony 10 is 4885,22 Dkk, this is under the maximum price of 7000Dkk established in section 1.14.

NPV

With all this information the NPV for the project can be calculated, it represents the difference between the cash inflow and cash outflow over a period of time, this will allow the estimate when Dynaudio will start to make a profit on the product. 2 cases are taken, one where Dynaudio has strong sales from the start and can sell 5000 products from the first year and another one where the sales are slower with 2500 products the first year and then they increase their sales.

Strong start scenario

Business case	Year 1	Year 2	Year 3
Units sold	5000	5000	5000
Sales price (Dynaudio) (USD)	376,51	376,51	376,51
Manufacturing cost (USD)	228,19	228,19	228,19
Turnover (USD)	1 882 551	741 611	741 611
Investment (USD)	- 1 169 580	712 971	1 454 582
Benefit (USD)	712 971	1 454 582	2 196 193

In this scenario Dynaudio would start to make profit in the first year and more precisely in month 8. (Appendix 34)

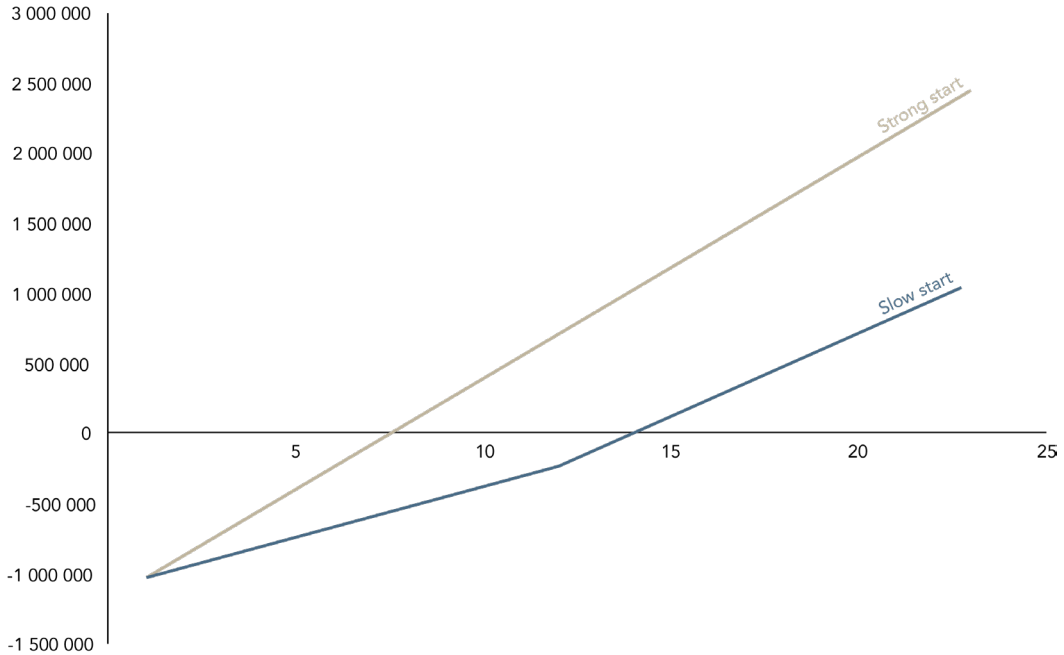
Slow start scenario

Business case	Year 1	Year 2	Year 3
Units sold	2500	3500	5000
Sales price (Dynaudio) (USD)	376,51	376,51	376,51
Manufacturing cost (USD)	228,19	228,19	228,19
Turnover (USD)	941 275,5	519 127,7	741 611
Investment (USD)	- 1 169 580	- 228 304,5	290 823,2
Benefit (USD)	- 228 304,5	290 823,2	1 032 434,2

In this scenario Dynaudio would start to have the money back on investment from the second year and more precisely in month 15 (1 year and 3 months). (Appendix 34)

In the first year there is a benefit difference of 939 295 USD between the 2 case scenarios.

Comparison of the two scenarios

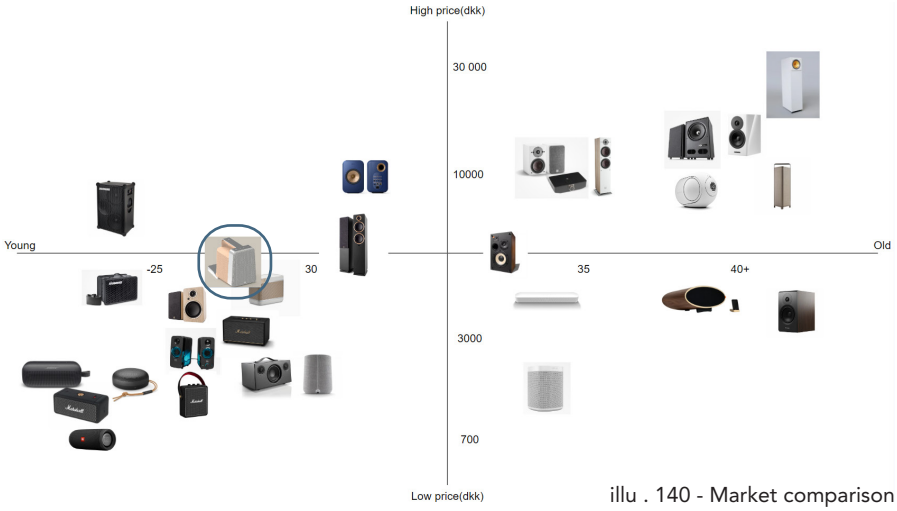


illu . 139 - NPV

Harmony 10 can be a good business for Dynaudio but to avoid being in the slow start scenario Dynaudio needs to enlarge the distribution of products to larger and non-specialized retailers (e.g. Elgiganten), they would touch a larger audience. Later on new investments will be required for the evolution of the product, to estimate if the evolution will allow Dynaudio to make more profit it is necessary to analyse the sales when the product is launched in function of the case scenario they are in. The estimation will need to account the additional investment for evolution with the initial investment in the project.

4.5/Market position and area of differentiations

Through the framing phase different aspects and needs are identified to favorize a potential breakthrough of the product on the market. The final product can be placed on the mapping from the market research. Harmony 10 is targeting the young adults (25 to 30 years old) and located in the price range of the competitors. The risk for Dynaudio is to have difficulties to differentiate from competitors and find success. To estimate a potential breakthrough the product is evaluated according to these needs.



illu . 140 - Market comparison

Incremental innovation on the process

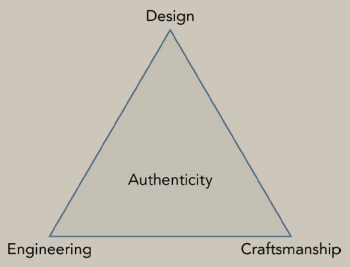
This need ties in quite well with the product, by using the same components and technology as the Dynaudio Music 1 it will require a low investment from Dynaudio to make the product ready for the market. They already have the manufacturing channels for the components.

Radical innovation on the product

This aspect is respected to some extent. The new product offers a new experience for young adults to interact with sound at home. When presenting the solution to Dynaudio they said: "Harmony does what a Music 1 can do but does it better"
Therefore it can be difficult to show to the user why it is better and where is the need for this product. To answer that some needs identified give a direction.

Use the brand history and the brand knowledge to ensure a good quality product to the user:

Dynaudio has the historical background in the audio industry to influence the customers. The people that already know about them have confidence in the brand and know that for the price they pay Dynaudio always delivers a high quality sound. It can also be a strong sales argument to introduce the brand to new customers.



illu . 141 - Dynaudio product related design core values

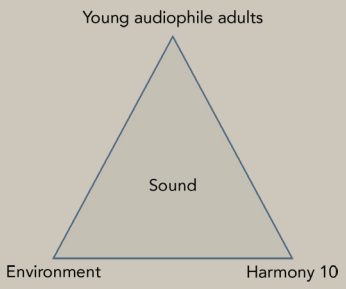
Harmony 10 tends to reflect "the product related design core values" of Dynaudio through the design, the engineering and the craftsmanship. The product design is simple but with a high focus on the user experience. Regarding the engineering it is packing a powerful and detailed sound reflecting the years of Dynaudio's work in the industry. Finally the craftsmanship is expressed through a wood finish cabinet and high level of detailing.

The new functionalities of the product should be tied to a story.

To express the new functionalities offered by the product, to link it with a story will allow to create an emotional connection between the product and the user (Bernabei, Freeman, & Power, 2011). According to "Aliotta, 2023" The storytelling is achieved through the process with 5 steps.
1. Understand your protagonist and the purpose of the product: it is done through background research and identified an area to investigate for a potential new product.
2. Define the structure of your narrative: The first step is taken to another level of detail where the market and user research allows to determine a precise user group to investigate
3. The beginning: By identifying precise user needs a concrete problem statement is defined. These needs set the direction to take for the development of a concept.
4. The middle: It can be called the confrontation, the needs are turned into requirements through iterations and user tests on different concepts.
5. The end: Finally the final concept achieving the initial needs and precise requirements gives a story to tell for the user.

Storytelling

Harmony 10 is the new active speaker solution from Dynaudio for young audiophile adults. You can experience the detail of stereo sound for movies and music with the convenience of a nomad speaker for background sound. Say goodbye to connection problems by grabbing a speaker unit and the sound will follow you achieving a flawless experience for a home in harmony.



illu. 142 - Connect the user, Harmony 10 and its environment around sound

Rewriting the rules of the audio industry with a completely new kind of product is difficult by the amount of solutions available on the market. By diving into a concrete problem for the user, a solution can be developed. Tying that to a strong storytelling a new meaning can be given for a new product and create an area of differentiation from competitors.

4.6/Product journey

Fidelise the users

Young adults are in an age segment where they can easily be influenced by trends and marketing (WS15). It can at the same time be an advantage and a disadvantage for a brand like Dynaudio. It means that if Harmony 10 finds its user the trend effect can allow Dynaudio to sell a lot of products but it also means that users can get bored from it. These users will first be attracted by the functionality, the aesthetic and the uniqueness of the product but if there is a gap between the user expectations and the user perception of the product (Hansen, 2021) the product would get outdated (Section 1.11).

Harmony 10 tries to fill the gap and match both aspects by having a simple design and evolving with the user, the objective is to fidelise the customers and make them understand what Dynaudio can do. If later on they want to upgrade in terms of sound quality for a high end product they will buy a Dynaudio product again. In the case where the user wants to change for a higher quality product the end of life must be considered. Dynaudio wishes to develop products that can last a lifetime and due to the price the user will not throw the product, 2 scenarios can be considered.

The user is now an adult and has kids. The user buys a high end hifi system and decides to give the product to its children, this is the best case scenario for Dynaudio as the children will create emotional attachment to the brand and will likely buy Dynaudio products in the future.

In another case the user will sell the speakers as a second hand product and Harmony 10 can continue its journey.

Product end of life

In the case where the product is thrown away, not having glued parts allows it to be dismantled entirely and divide the different parts according to the materials.
The iron can be recycled at 100% without losing its properties, the recycling is also consuming little energy. (Metals, 2022)

The electronic wastes are more difficult to recycle but a plan of action is proposed by the EU with the objective to improve the collection and the recycling of e-wastes to move towards a circular economy by 2050. As an example, today Croatia is recycling 81,3% of its e-wastes (European Parliament, 2023).

The combination of wood veneer and R-ABS makes it difficult to recycle as it is 2 different materials connected by an adhesive layer. It can be either removed by hand with a scrapper but that would take too much time on a large scale. For a faster process a veneer peeling machine can be used (Raute, 2023).

The process to recycle e-wastes is not optimized yet. Having a big entity like the EU setting objectives for a circular economy and making regulations will help to develop and facilitate the recycling process of e-wastes and all materials in general. To better fit in these requirements further development on the product should be done. This is for future prospects.

EPILOGUE

The epilogue consists of the conclusion, the reflections about the process and the product, the references and finally the list of illustrations.

CONCLUSION

Thanks to several methods applied along the framing phase the knowledge gained about the active speaker market and the targeted user, resulted in a problem statement, giving space for a new solution. A new active speaker targeting young audiophile adults is developed. Understanding the users and their ways of moving around their apartment unveiled how dependent they are to sound. Within their home, audio media are played through different devices and follow them in most of their tasks.

The current lifestyle speakers Dynaudio offers didn't find its success among users and is now dismissed, Harmony 10 fills this hole in their portfolio by offering a set of stereo speakers that can be moved around the home environment achieving a flawless experience with sound.

By analyzing the market and direct competitors several aspects are identified. They will favor the breakthrough of the new solution among the diversity of products already available. Having a solution that can be developed fast by Dynaudio will allow them to move fast on the market. Also, using the brand knowledge and history of Dynaudio, the product carries some strong values that can be transmitted to the user. Moreover through its concept the product tells a story that touches the users and where they can identify themselves. With a product that can create a difference in front of the competitors the risk to compete is lowered for them to touch more potential users that can further fidelise to the brand.

The design of Harmony 10 respects the principles of New Nordic Design, including its aesthetic codes to trigger the customers' attention. However it ensures to stay a captivating product for the users as it avoids being simply a trendy speaker. The timeless elements of this style are expressed through a wooden finish cabinet and a frame with a metal finish. The importance of the story telling is also expressed through the design with the form following function. By evolving into a speaker on a stand with a full sound range the product can take a whole new meaning and prevent the user from getting bored of it.

Trying to create a difference by looking at the speaker market can be difficult as it is already saturated with a wide range of options, making it challenging for a new product to stand out. Taking a step back and adopting a user-centric approach allowed the designer to reframe the way users can interact with sound around their home, trying to make it a more harmonious place to live in.

REFLECTIONS

Second attempt

For this second attempt the knowledge gained in the first one is used. To start again on the process it was necessary to first identify what went wrong. Lot of theories were used in an approximative way resulting in drifting from developing a solution within a user centered approach.

A big step back is taken to dive again in the framing phase of the project. By reviewing the worksheets and doing more research the market analysis and the user journey are further developed. Some more concrete results are obtained and resulted in a new set of user needs. The classification of the requirements is then changed and organized with a better structure setting the base for the concept development phase. The main idea of the concept is kept but the path to the final solution changed. A user centered approach is leading the way for each iteration where the new knowledge acquired is constantly used to refine the solution until the final product. Along the process constant reflections are done with the organization of the requirements to always have a clear view on what the next steps are. It resulted in a concept development phase where no dead ends were hit and with a solution tied to the user.

Working with speakers

Being innovative on the speaker market can be difficult because there are already a lot of existing solutions but that is what made this project challenging and interesting. The final solution differs from other products and is reframing the way 2 wireless speakers work in stereo. Working with speakers was more complex than initially expected. At first it seemed like an easy product to work on with a high focus on the design. But framing a problem was a big part of the process as the market is already full of different solutions, making it difficult to create a difference in front of the competitors. It's by targeting a precise user group and identifying a really specific problem that a solution space could be found. At first it was thought to include the evolution of the speaker from the beginning of the process but the partial knowledge acquired from the end user (adults) was not sufficient enough and working in parallel with 2 problems could have resulted in getting lost in the process by mixing the different requirements. To avoid that, one problem is developed resulting in precise requirements to fulfill while few requirements are kept for the evolution and could be easily integrated to the final concept.

Work with a big structure

Working in partnership with such a big company as Dynaudio is really beneficial in terms of resources and knowledge brought to the project, it helps to better understand what are the stakes in the market. But being a consultant for a big structure can limit the design process because the company already has a clear vision of what they want to achieve for the future. In the early stages of the process it was difficult to break away from Dynaudio and be fully in the user perspective. It's when the balance between profit for the user and for the company was found that the project took another start and a solution emerged. Letting more space for the user lets more space for a solution.But working with them also benefited the project a lot. Not having an assigned technical supervisor for the project, their help was essential. They could give insights on new technologies and the functioning of active speakers. With their knowledge it was possible to quickly identify what would work in the real world and exclude some directions that could have led to a dead end. They also brought a lot of general knowledge about the industry and the state of the speaker market, always giving constructive feedback for the project.

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A HOME **HARMONY**

Appendix - Harmony 10
MSc04 - ID16 - November 2023

Antoine François Louis André Rouaud

AALBORG UNIVERSITY

DYNAUDIO

TABLE OF CONTENT

IMPORTANT NOTE:

The appendixes are not following the chronological order of the project, it follows the order of apparition of the appendix along the process report.

Appendix 1: User interview

Objective

Conduct poles and interviews among 22-30 years old students in order to understand their way to understand and listen to music. What are their expectations? Questions must be asked so they are giving their own personal thoughts.

Another interview part will be conducted with retail shops to see what their best sells are and what kind of speakers they are selling the most for what age.

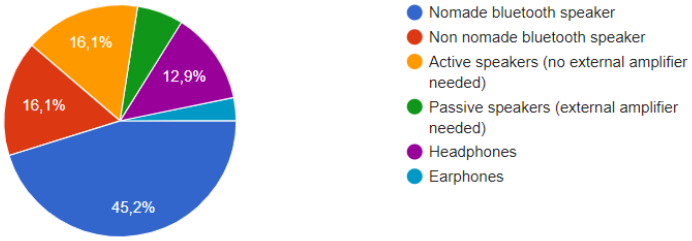
Experiment / Data

A/Full result of the pole:

https://docs.google.com/forms/d/1dkcInuV6IQ_jABGt9kkZKH0eG7WhfgINhIIEm0IHMIo/edit#responses

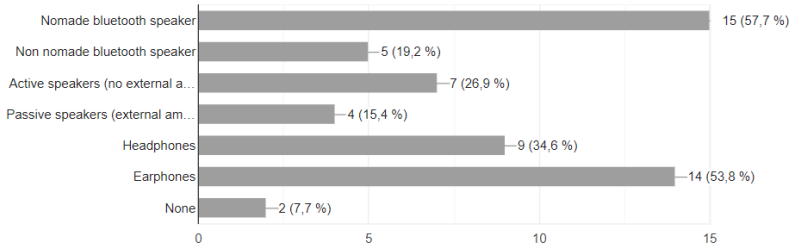
B/Characteristical data:

- Age of respondents: 73% are 20-25 and 26% 25-30
- Most used device at home:



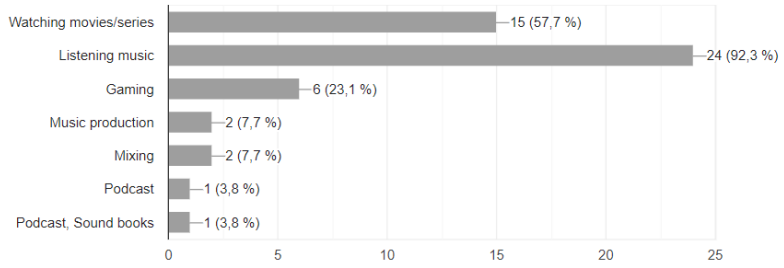
Nomade bluetooth speakers are the most used at home but they are not taking all the majority (42,3%) and when combined non nomade bluetooth speakers and active speakers represent 38,4%. This shows that "fixed" speakers are still used a lot when not passive. 15.4% of the participants said they have passive speakers but they are not using them.

- It showed that everyone possessed at least one other device at home than headsets or earphones.



We can see that nomade bluetooth speakers and earphones are the biggest parts in the market.

- Use of speakers at home:



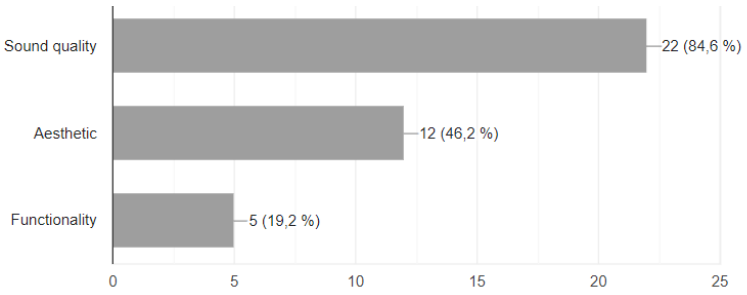
That shows there is still a great interest from people to use speakers for listening to music and watching movies. There is still a market.

- The most possessed brands are Bose(5) and JBL(5). Then comes UltimateEars(4) and after Marshall(2), Sony(2) and Krk(2). KRK is a brand specialised in studio monitors and pro audio (mainly for music production use).
- The most cited brands are:

JBL	18
Bose	14
Sonos	6
Sony	5
Marshall	4
Dynaudio	3
B&O	3
Dali	2
Devialet	2
Apple	1
Beats	1
Bogo	1
Bowers and wilkins	1
Genelec	1
KRK	1
Pioneer	1
Samsung	1
Scheneiser	1
Soundboks	1
Ultimate Ears	1
Yamaha	1

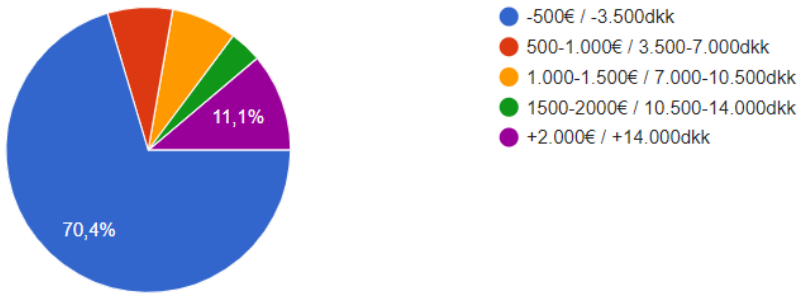
  It confirms that JBL and Bose are the 2 most popular brands in the speakers industry.

- What is the most important factor for people when selecting speakers

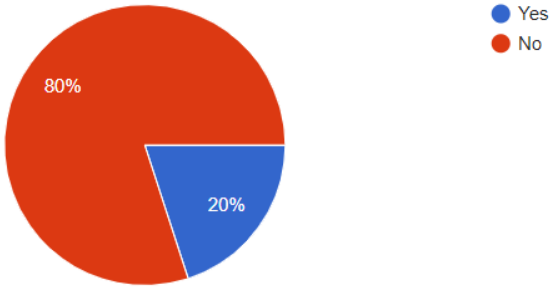


  This shows quite an interesting data. Because Sound quality is far in front of aesthetic and functionality. But at the same time the most possessed speakers are JBL and Bose nomade bluetooth speakers which are “basic” speakers. The sound quality is nothing compared to more advanced brands like Dynaudio or Dali. It confirms that the image of the brand is extremely important. Bose and JBL are both brands with a huge past in the music industry and still today they are doing high end audio equipment. They are using that image to sell small nomade bluetooth speakers.

- When asking the responders what good sound quality means for you ? The main answers are a good balance, feeling the bass and no saturation when reaching higher volume. Which are not the main quality of a nomade bluetooth speaker.
- Most people don't invest that much into audio equipment:



- When asked if some audio equipment have been passed on from family reply was:



  Could it be that this change and then target are young parents that would invest later on in better equipment and pass the one they just bought ?

- When asking people what music represents for the respondent it shows that music is an essential part of their life, it follows their emotions, their feelings and rhythm a lot of people these days. "Ambient sound of my life" "Best form of art" "Cozy evenings and morning Hygge"

C/Interview with Søren from Lydspecialisten

Lydspecialisten is an audio shop in Aalborg specialized in all kinds of speakers but with an entry level price of 8.990dkk.

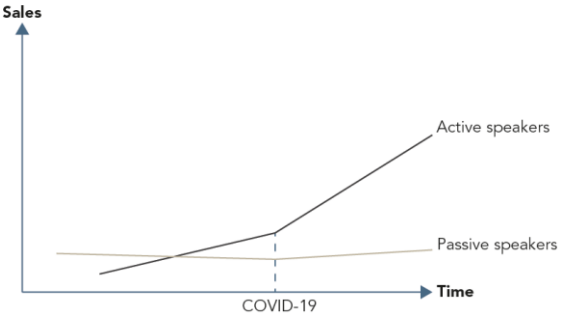
During corona the sales increased in the quality audio equipment. People understood that if you are at home and want to listen to music or watch movies, having good equipment makes a big difference.

Their customers are usually +30 years old due to the price of the equipment.

People that come in the shop are usually coming because they want to try before buying and it is also for really expensive gear and preferably passive audio. But most of their sales are online, so a lot of people are calling before to have advice. Since Covid less and less people are coming to the shop though.

Their biggest part of sale are active speakers and the most sold ones are the KEF LSX. This is mainly because they are "trendy" in Copenhagen as he said and for their price that is really affordable compared to many other ones (9999dkk the pair). Active speakers are a really growing market because of the convenience compared to passive and the "plug and play" feeling. Even audio fans are buying more and more active speakers. They are also distributing dynaudio and their active serie, "Focus"; but lot of people that are non-initiate to hifi don't understand the price (entry price 39.000 dkk), so it is mainly for people that like it and can afford it and they use it as a piece of furniture.

Dynaudio had an active series called Xeo that is now discontinued. The entry price was 10.500 dkk. It was discontinued because of the bad wifi and bluetooth connection, and a lot of latency.

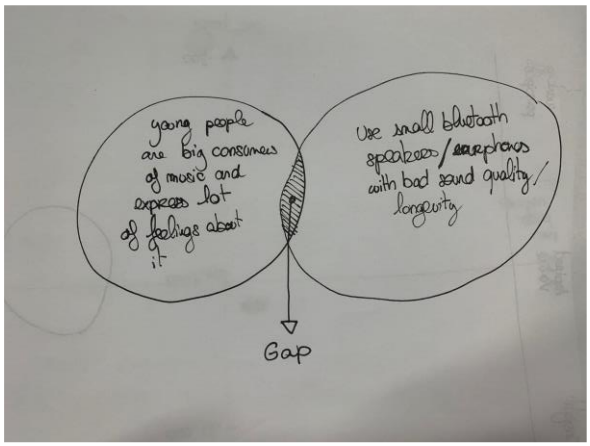


KEF LSX

Evaluation

The pole and the interview have raised a lot of good elements. It was a good way to better understand the user groups for audio products. They can be split in 2 categories:

- Under 30 years old
    - The survey shows that young people have a great interest in music and care about sound quality with all the feelings it brings (see parts where asked what music represents for you). But at the same time we can notice that nomade bluetooth speakers and earphones are the biggest parts in the market. They are also the ones with the smallest longevity and sound quality when compared to non nomade bluetooth speakers and active speakers. We can see a gap.



    - Young people are also often on the move, might be studying, going from places to places and therefore it feels complicated to invest in a stereo sound system.
    - Young people are also the biggest consumers of music.
- Over 30 years old
    - Usually have more money and can afford more expensive material to play music on. Passionate people usually buy passive speakers and will upgrade their sound system all their life. But the growing market for the majority of people are the active speakers. Therefore once investing in an expensive stereo sound system it's not really possible to upgrade it, it has to be replaced.

Reflection

What makes music so special ? The variety of genre and subgenre and sub-sub genre is insane. It offers infinite possibilities and everyone has its one special taste and way to consume music. How to make the best out of it ?

Music can be seen from many different perspectives but everyone agrees on the feelings and emotions it translates. People do care about sound quality but are obviously resilient to the idea of paying a lot of money for a pair of speakers unless it's their real passion.

Brands like bose or jbl have completely changed the market and way to consume music with bluetooth speakers. Still today they are put in front of the stage and they are the most branded products from them. Just by opening their website it is easy to see it. For home use other brands like Sonos are really popular among older group age due to the easy to use system.

It showed that young people have a real interest in music but they don't have the possibility to afford a speaker from a brand like Dynaudio. When entering active life after their studies they still have interest in music and have more money to invest in music. This is usually around 25 years old or more. This group is interesting to look at because it's at this moment that brand loyalty can be built.

The next move is to investigate this user group to understand them better and try to identify some problem.

The choice is made to continue with active speakers, the interstate for passive speakers is lower and Dynaudio already has a furnished catalog.

Appendix 2: This worksheet is collecting the work that will be shown to Dynaudio the 16/02/23

Objective

Have a better overview of the work done and the findings. It will also be a way to structure the meeting with Dynaudio and get the most information out of it.

Meeting with Marcus Heinrich Abrahamsen and Katrine Timmermann

Experiment / Data

A/Price range of Dynaudio product and user group

Why have you started doing active audio products ?

There are many advantages with active products. The main one is that we have full control on the choice of the amplifier and the components of the speaker. This means we can optimize the performance at its fullest. It works better with streaming services, the connection is faster and doesn't require extra investment or expensive amplifiers that include this function.

(from what i could feel you have a lot of passive products for everyone, maybe you wanted to touch a different public, still trying to reach only audiophiles or want to expand even if losing in quality? What was your objective with the focus line, the targeted group and why ?

In the end you don't lose in quality. The focus line is a way to show what active speakers are capable of and to offer a solution to people who love good sound but maybe don't have the space to have a big installation with passive speakers.

(Survey showed that the customers for passive speakers are mostly divorced or single men that are doing it more as a hobby). Therefore it's a way to touch people that have a family and still love the good audio.

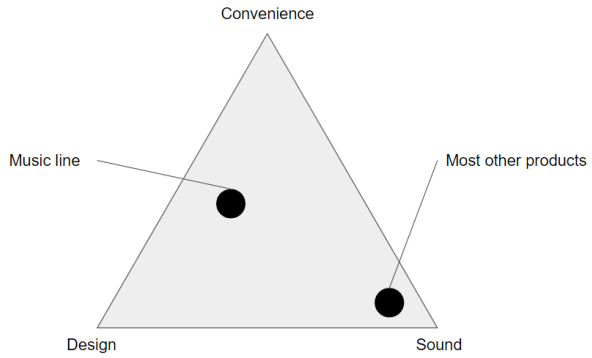
(Focus line is using the cabinet from the evoke line)

Same question for the music line, do you know if it is a line that you sell a lot ?

The idea with the music line was to introduce Dynaudio to more people. The product has really high finish and an unmatched sound quality for the price but it was sold through Hifi specialist shops and people that go there usually don't buy this kind of product.

The Music line will be discontinued soon. We should have probably sold it through a bigger production line to touch more people.

They are sad to discontinue it, because it's an amazing product, the sound is really, it can be used in stereo… Their mistake was to not target the right user group. It also has a wifi connection which is faster and delivers way better sound quality than bluetooth.

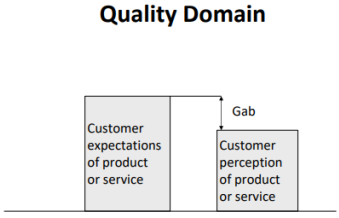


Positioning of the Music product within the brand compared to the others existing products.

It never reached its target because it was branded like any other product at Dynaudio; it should be done in a "lifestyle" line with a new branding.

Before you had the Xeo line as an active product but you discontinued it, why (you kept developing it from 2012 to 2018, you believed it would work?) ?

The Xeo line was discontinued for its quality that was not matching with Dynaudio requirements and consumers.



Bad connection and small latency, sound of the product.

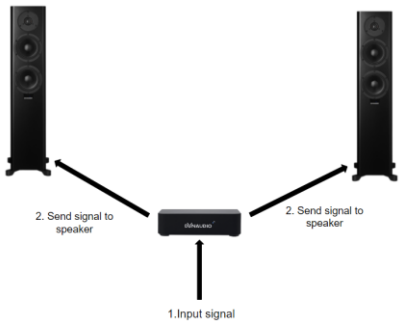
What was the user group targeted ?

The idea was to have an entry level active product for Dynaudio. A convenient product (streaming services, connected to TV…) with a good sound. We tried to have a user centric approach.

Side question: What are pros and cons of having a transmitter with it (don't have one in the Focus line)?

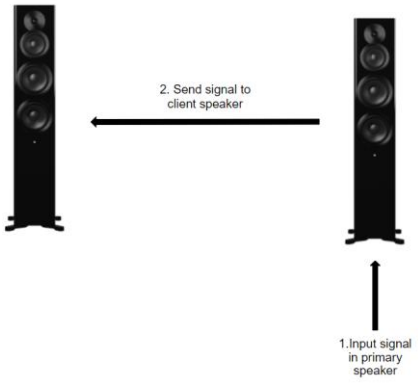
With the Xeo transmitter you avoid having cables everywhere, you only need the power cables. For the focus line the transmitter is built in the speaker. The advantage of having the transmitter on the side is the flexibility, you can place it close to the product you need to send the signal from everywhere in the room. It can also transmit to speakers in different rooms.

Xeo line signal transmission:



The problem is that if the transmitter is not placed in the middle the speaker placed the farthest will receive it with a small latency.

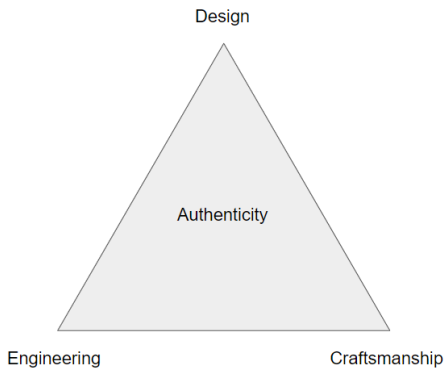
Focus line signal transmission:



The advantage is that the transmission of the signal doesn't require extra components. The transmitter is within the primary speaker.

Was it going away from the core values of Dynaudio ?

Dynaudio core values are represented this way:



The Xeo line might be a bit away from the engineering value, the system wasn't functioning really well.

If you had to describe the core value of the company what would it be ?

(See triangle above)

When talking about the design it should represent what the brand is, the past and history of the brand. The engineering is essential for the company, they have been recognized for that (e.g. Esotar tweeter). The craftsmanship is represented by their ability to deliver a beautiful finish. For the music line even if it's not wood the product is thinked in every detail. The other lines are originally made with wood cabinets but it's really expensive and it's not the best for the acoustic properties. In a solid wood piece the density is not exactly the same everywhere. Today they are using MDF (same density everywhere) with a natural wood looking finish on top.

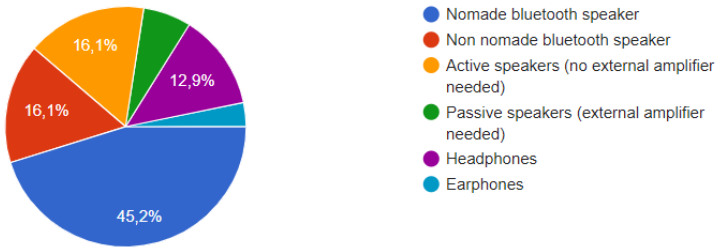
(personal experience: when touching it it looks like a piece of wood, the feeling is amazing.)

One of their current ideas is for example to use some small wood pieces to make joints between 2 walls and make it look like it's all wood. Craftsmanship is then adapted with current technique but the product should always show that. (touch feeling, details, finishes)

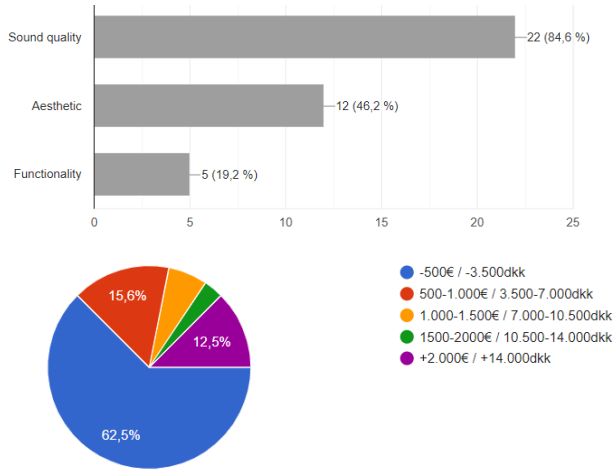
B/Research

Survey main findings

⅔ where 20-25 years old and ⅓ 25-30

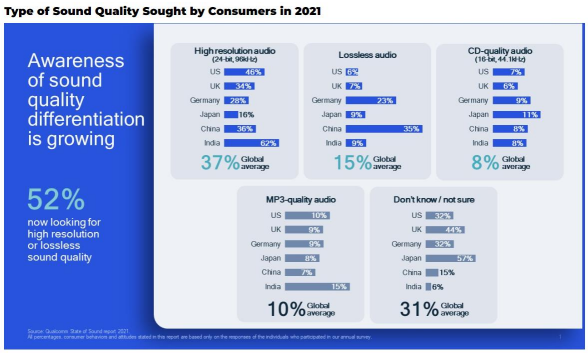


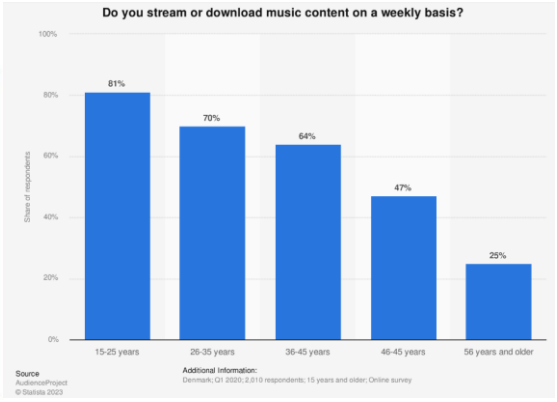
JBL, Bose, Sonos are the most cited brands

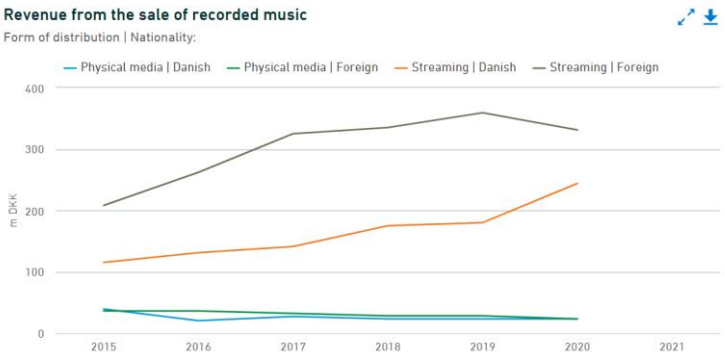


62% have less than 3500dkk of audio equipment at home (match with the age of participant).

General tendency







Do you have any research or statistics about your most sold product and what is the age of the customers ?

Can't share that but it is going in the same direction as what I found.

Market research focused on active speakers

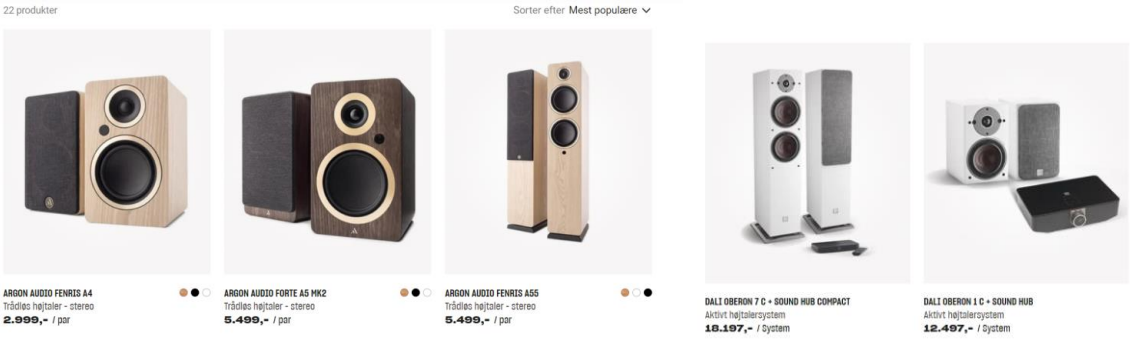
From the first meeting we had I could understand that active speakers are an interesting direction for you, same when looking at your portfolio it seemed evident that you are missing products here.

Let's talk about the market and try to see where Dynaudio is positioned (if you have any comment don't hesitate !):

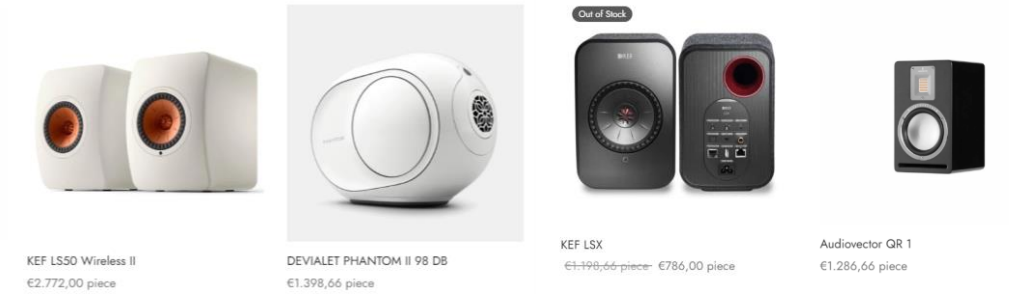
I looked at the bestsellers active speakers on the market in audio specialist and "big distribution" shops.

Audio specialist:

At Hi Fi Klubben the most popular products are their brand Argon audio and Dali.



At lydspecialisten (most sales are 30+) (I went there to talk with them) KEF, audio vector and Devialet are the best-sellers (online) (He said: "We sell KEF because they are trendy" Same goes with Devialet. ("Sales for non nomade bluetooth speakers dropped")

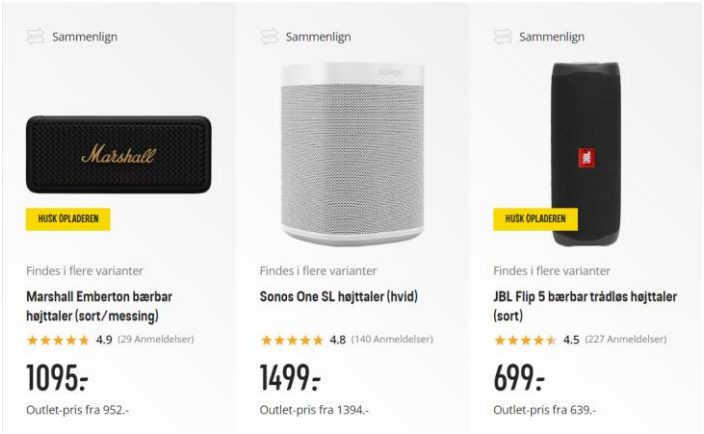


When I went to the shop they told me that in general (passive included) dynaudio and KEF are the best sales. But for the active people who are a bit scared of the price of the focus line, it's usually the one coming in the shop and trying them out that understands it but over the phone they don't.

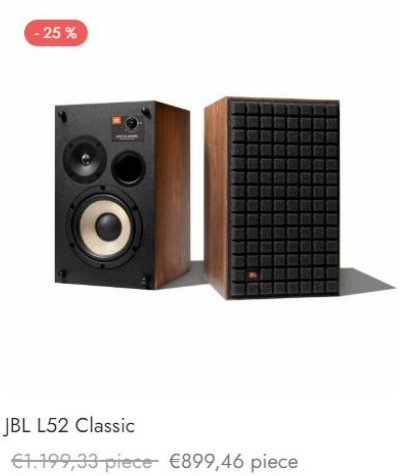
Conclusion: These brands are willing to lower audio quality to touch the most people. Argon audio for example will say that you have an unmatched sound for this price. When KEF or Devialet focus more on the design and the marketing of the product.

Non audio specialist:

Obviously the biggest parts of the sales are nomade/non nomade bluetooth speakers. But they are targeting the majority. With marshall, sonos and JBL.



It's interesting to see how JBL, which started as a Hifi specialist, switched their vision and tried to adapt for everyone with their bluetooth speakers. Today the majority know them for that and not for historical products.



From what I could find, that is their only Hifi product right now and you can only find it in specialized shops. (Even hard to find on their website)

Conclusion: To touch people at a large scale, an historical brand can revisit their values and adapt to the trend.

Conclusion

My conclusion for now is that Dynaudio is not ready to fit in this market. Seems more interesting to look at young adults (25-30 or +) that are starting to settle down. They have more money to afford it, it can also be a way to introduce them to the brand and later on they will invest in more audio products from Dynaudio. If you want to touch younger people you would have to reduce the cost and therefore compromise on the quality.

My opinion is that Dynaudio has a huge history in technical development and knowledge. The product should be a way to open the doors to this passion you try to share with your products.

The interest in good sound quality is increasing, mostly since apple music introduced the "lossless" format. According to Lydspecialisten the sales for Hifi (active and passive) are rising with active taking a biggest part of the market. People don't want to have cables everywhere and they want something they can use easily from their phone or TV.

They agreed on my market research, I should analyze some products that are direct concurrent more in depth (Devialet and KEF LSX) both are interesting products that are "out of the pack"

They confirmed that this is an interesting target and that I should continue the research with this user group. Might be interesting to ask the ones who have shelf speakers and see how they are placed, if they are on a stand or not ?

C/Side research:

Side research showed that e-wastes are a growing problem. For electronic 3 options are to be considered:

- Use of more recycled products
- Use the products and components for a long time
- End of use products are collected and recycled to a high standards

At Dynaudio when designing, are you considering some of them ?

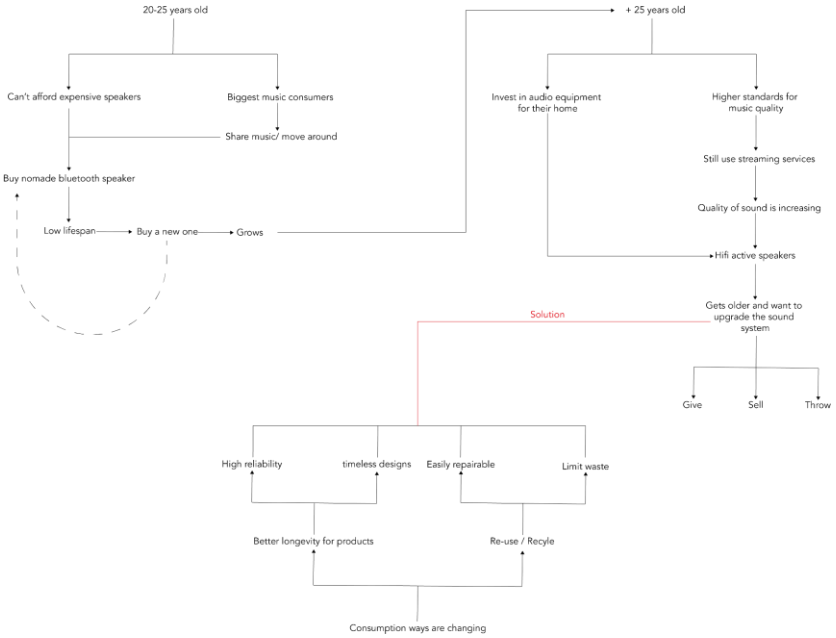
Always nice to look into recycled products, for passive products it might not match with customers expectations but for active products it can be interesting, it's another generation of people with different views on the product. Would like to look more into it.

The goal at Dynaudio is to design to last, the products shouldn't be outdated, you should be able to use them for a long time. When looking at streaming services always integrating the ones that are here to last, that's one of the dangers with these services, it's that it can be outdated at some point. Need to think about the interface and how the speaker connects with the world around.

One way to be more sustainable is also to scale down the production and have a local supply chain.

D/Possible direction

Taking into account all the current research I'm having a first idea on how to build customer loyalty:

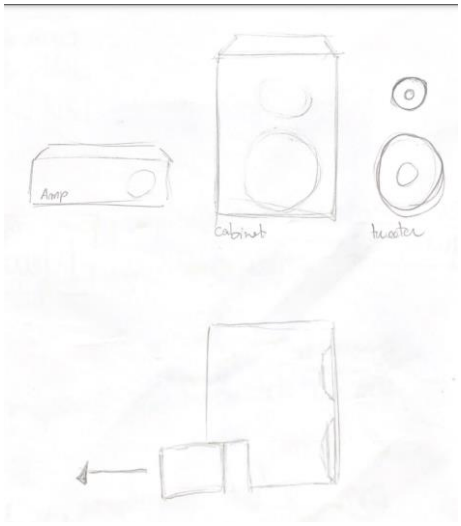


How to create customer loyalty ? Look into the iphone, their customers once they use the iphone have difficulties to move away from it.

Doing a timeless design is more and more difficult. Young people will focus more on trends and aesthetics. When doing an entry product the colors, materials and bound the product to a story is super important. Represents the new nordic design. A good example for that is the muuto lamp E27, the product is really simple but the story the product tells and the simplicity of the design are working really well.

Timeless can also be difficult to reach with complicated products. Processors can get obsolete or fashionable interfaces can get out of date.

Solution: Buy an active speaker system that keeps the advantages of active speakers (no cable, easy connection…) and that can be upgraded or have a single part replaced easily.



This solution might be complicated to implement, if you are able to modulate a product it will often mean that the connections will be a bit weak and become loose after using them a lot. It's more complicated to have a good finish on this kind of product. Some brands tried to do it but today they are moving away from it.

What is important: Upgrade or the thought you can upgrade ? Selling the idea that in the future you can upgrade.

Technically what are your ressources ? Do you have any kind of limitation ?

At Dynaudio they can do pretty much everything, if it's too complicated or not in their competencies they can outsource the production (e.g. the music line).

Are you producing everything in Denmark ?

Not really it comes from a bit everywhere, they are assembling in Denmark some products but a lot of elements are from other countries.

I saw that you use Pascal amplifiers for the Focus, are they built on demand ? Or are you adapting their models to your speakers ?

The Pascal amplifiers are bought from their existing catalog, they try to see which one fits the best. They will only add the inputs and the streaming module.

E/Supp questions

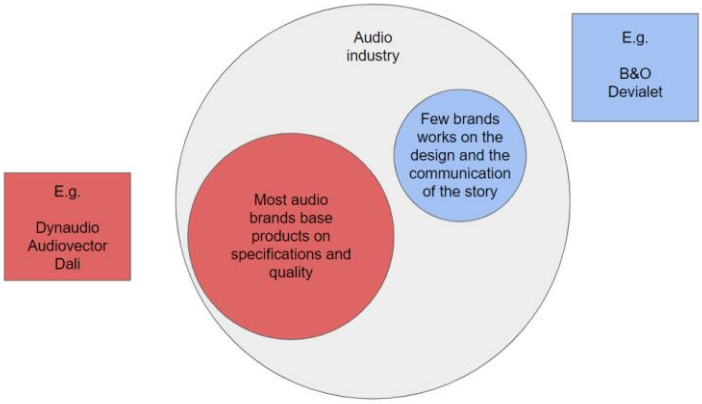
For the prototype I'll have to build, do you know if there is a possibility for Dynaudio to help with some components ?

Yes that should be possible to some extent, depending on what will be done.

F/Important external not from discussion

Their active line is gonna lack product since they are discontinuing the music line. They want to touch more people and have a way to introduce people to the brand, build customer loyalty. It is also necessary to develop it because the active will take a bigger part of the market in the future (see APPENDIX 1). Passive Hifi is becoming a niche product for passionate people, they are also from a certain age usually. One day these people will die and be replaced by younger generations that have been growing with active speakers. It is important for them to be prepared and start to furnish their portfolio with active speakers.

We also talked about soundbars. Their sales are growing a lot because they can stream from phone, TV, usually placed in the center of the room. Due to their shape they can do stereo and offer surround sound effects. There is an authentic fidelity.



Some brands are more recognized by "non passionate" people because they are differentiated from others with a story, design and the communication. This can be an interesting angle to look at for a "lifestyle" or entry level products for Dynaudio. Dynaudio has a huge past and big background in the music industry → can be used in a story for a lifestyle product.

https://tg0.co.uk/ → new kind of button, can be interesting to look at in detail. If wood is used this could be placed underneath and the user would have to touch the wood to control, it gives a better feeling.

https://www.bang-olufsen.com/en/us/speakers/beosound-level → B&O level, really interesting product, first cradle to cradle speaker. Can change some parts if broken or upgrade if the technology evolves. It's interesting to look at it and can give good ideas.

Can base the future product on the music 5 from Dynaudio if it needs to be in the same price range. The functions and sounds are amazing for the price.

Evaluation

This meeting helped to better understand the vision of the company for the future and their own vision on the past and why some products were discontinued. They also confirmed some thinking and helped to narrow down the angle.

Reflection

The research and the talk with Dynaudio confirmed that a product for -25 years old is not the best option, they can't rival Argon audio (Stereo active speakers) or JBL (with bluetooth speakers). Therefore the first angle was abandoned, it was too wide. The research angle is now limited to young adults (+25) that start to settle.

It would be more interesting to position themselves for 25-30+ years old. To target young adults that are starting to settle down and want to start investing in a nice pair of speakers without spending too much money (a direct concurrent would be KEF LSX).

It brings some different reflexion points:

- How to catch the attention of young adults that don't know them ?
- How to create brand loyalty ?

To do so it is important to understand the user group better. A more specific use case scenario must be made, it will help to see what are the problems, how is the product used and what's the potential ? It can be done with interviews from users, to find some, a research will be made on facebook groups dedicated to music.

To have a deeper understanding on the past mistakes of Dynaudio with their 2 failed active speaker series, analysis will be made for the music and xeo products.

Appendix 3: Price range of Dynaudio speakers

Objective

The goal is to have a better overview on all the products and their price. It will be possible to see where they are missing products in their portfolio. It will also be easier to define what are the user groups and which ones are missing. By comparing the results with some research on the needs from users it will be possible to define an open market space for Dynaudio.

The focus will be on the home audio.

Experiment / Data

Price range high to low (passive):

- Evidence master / 679 999
- Consequence / 359 995
- Confidence / 325 000 - 85 000
- Contour / 78 000 - 39 000
- Heritage Special / 44 699
- Evoke / 37 000 - 11 498
- Special forty / 24 500
- Emit / 15 498 - 5699

Price range high to low (active):

- Focus (78 000 - 39 000)
- Music (7499 - 2699)

Evaluation

The analysis of the cost shows that for the hifi speakers all the prices are covered from entry prices to high end products. Dynaudio is worth shipping quality products and what they deliver with the Emit 10 is unmatched in terms of price and quality. It is the perfect entry in the hifi world of passive speakers.

https://audiograde.uk/review/dynaudio-emit-10-loudspeaker-review/

Active speakers are almost not represented in their portfolio. The only speakers with 2 units for stereo sound and a real "speaker feeling" at home they have are 3 of them in a pricey series. They have bluetooth and portative speakers in quite a wide range from entry price to more exclusive one.

Their bluetooth wireless speakers are even adapting to its position in the room: they have a really high engineering level in their products.

NOTE: Since beginning the Music products are discontinued

Reflection

The interesting area to fill would be active speakers with a more affordable range. From intuition it also seems like today there is more and more demand for this kind of product.

But in order to confirm that some user research and user needs must be made.

Could fit a market where parents want to introduce their kids to music and might offer them that as the first good sound system or pass it on when upgrading.

They are doing active speakers portative as well as fixed with a wide price range. Therefore it is possible to assume that they have the resources to produce any kind of speaker.

Appendix 4: Understanding why the Xeo and Music series failed.

Objective

The objective is to understand better why this series was discontinued and how it affected the brand image of Dynaudio.

Experiment / Data

A/The Xeo series

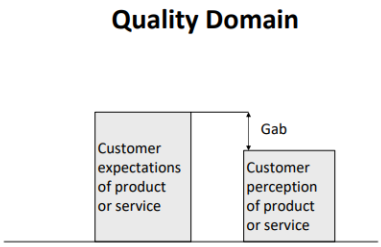
Model	~Cost (pair) (dkk)	Launch date
Xeo 2	10.450	2015
Xeo 3	13.600	2012
Xeo 4	14.900	2014?
Xeo 5	17.400	2012
Xeo 6	27.800	2014?
Xeo 10	10.900	2018?
Xeo 20	16.400	2018?
Xeo 30	26.800	2018?
Xeo Transmitter	1.995	2012?

Note: Xeo Transmitter was used to connect an external source to it and send a signal to the Xeo speakers.

Business context analysis

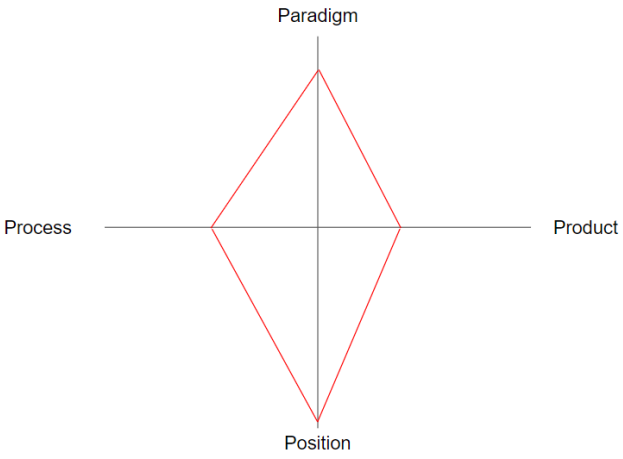
The next step is to analyze the Xeo speaker from Dynaudio that more or less matched the price range and target but see why it didn't work, explain with this theory.

- Quality domain



There is a gap between the customer expectations and perception, they were expecting for a high end wireless speaker but in the end the functionality didn't match with the intended use. Therefore the product was not sold that much.

- What's the 4P model (Tidd & Bessant (2009)) / Innovation Landscape



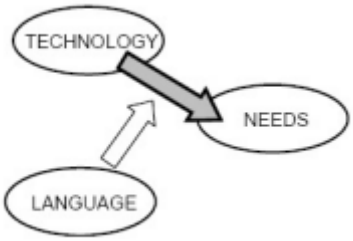
Paradigm is high because it's a new kind of product and if it works it can create a big change in the market. It is also the first time they are moving away from passive speakers for home audio.

Product is lower because they use existing technology but that was not really adapted for the product in the first place.

Position is high because they are alone in this market.

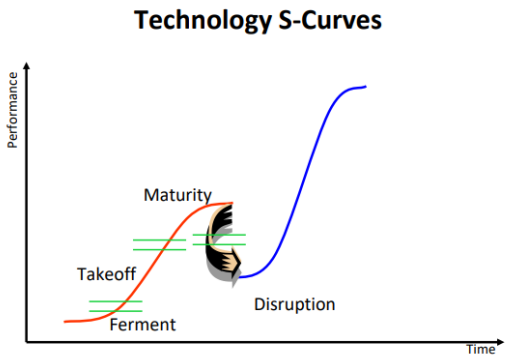
Process is not too different from other speakers, they are already doing active speakers for pro use, the only difference might be to include a new module but that doesn't mean radical changes.

- Technology push



We can talk about a technology push, the design was there and they implemented a new technology into an "existing" product. But it didn't work as well as expected.

- Technology S-curve ? That's what happened with the Xeo ?



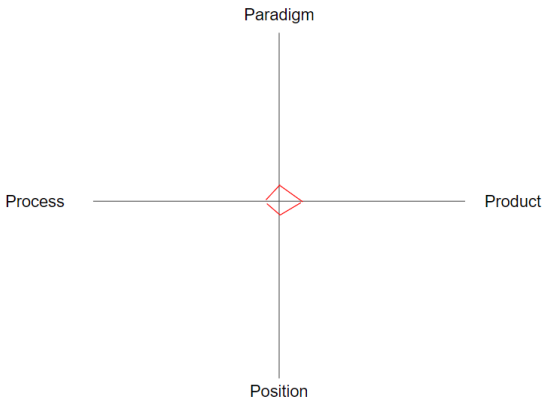
Xeo series was one of the first high end audio wireless active speakers (https://dynaudio.com/home-audio/xeo). They first launched it in 2012 (to put in context that's when JBL had their first bluetooth speaker out (JBL Flip 1)(need to find a valid source)). The technology was there but not perfectly adapted to the high end hifi. From an interview with Lydspecialisten the connection and quality were the main reasons why the product was discontinued. Xeo has then been discontinued and replaced with the Focus line that is more expensive but that has way better sound quality and connection.

B/The music series

The music is a line of bluetooth speakers from Dynaudio, they are a good product with high quality sound and a fair price but they haven't been a big success as was expected. According to Dynaudio the main sale channel was through specialized retailers and audio shops. They were designed to reach a large audience but didn't succeed. They also have quite some basic functions and they are not really "different" in terms of design than the competitors, in the world of nomade bluetooth

speakers most brands are doing similar products. It can be hard to make a difference without a position in this market already strong enough.

This can be demonstrate with the 4P model:



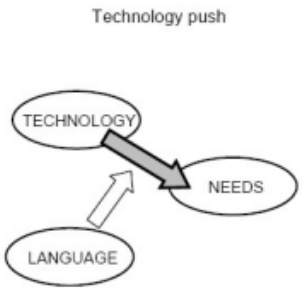
This product was maybe radical for Dynaudio but when looking at the market it wasn't at all. It was taking the codes from other brands that succeeded on this market

Talking about core values, look into bose and JBL, did they affect their core values ? What have they changed ? (look at theory timeless/timely)

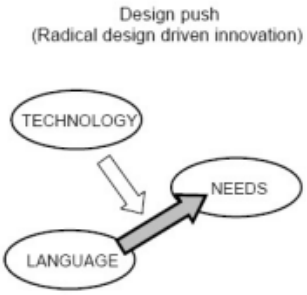
Make a study about the direct competitors. (value, product, scope)

C/Devialet

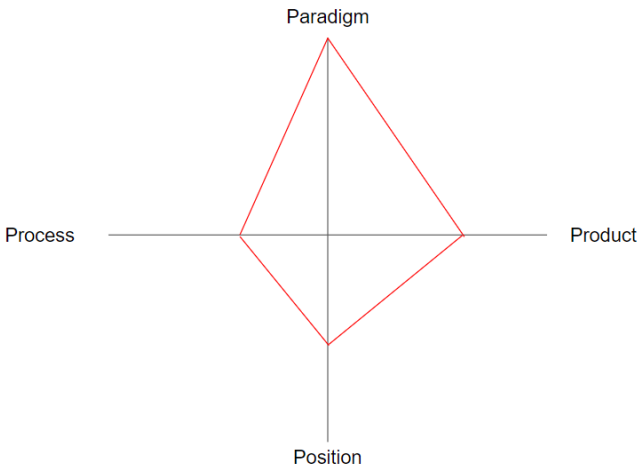
The Devialet phantom has been a revolutionary product when it was first launched in 2015 (https://dirigeants-entreprise.com/entreprises/devialet/) Devialet succeeded in entering the wireless Hifi (https://www.sitegeek.fr/article-technologie/audio-video/test-devialet-phantom/). They focused a lot on the marketing of the product, they targeted a user group with more money. The technology was the result of several years of development. They introduced different patents and offered a different sound distribution for this kind of product. Therefore we can talk about a technology push.



As a new brand entering the market they understood that they should create a strong brand identity to differentiate themselves and that goes by the marketing but also by the aesthetic of the product. They managed to use technological development and build the aesthetic around it. This resulted in a design never seen before on speakers.



https://www.devialet.com/en-dk/?country=DK



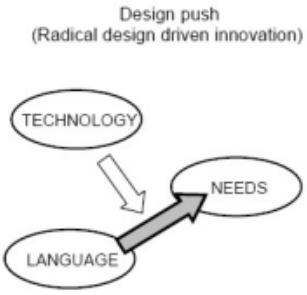
Paradigm is high because the product is really new in this category. Product is in between because even if it was different the technologies were taken from other products and not completely ready, some people struggled with updates (See interview with Gerald). Position is also halfway because it was different but wireless hifi already existed before. Regarding the process there are no major changes compared to other products that already existed.

D/KEF LSX

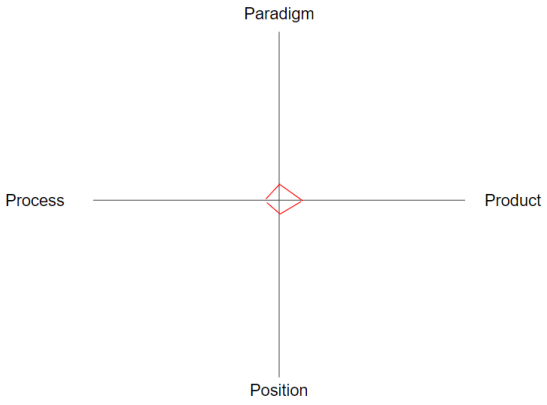
Price 10990 dkk

According to Lydspecialisten these speakers are a big hit and mainly due to a mode.

https://www.youtube.com/watch?v=REHUPWWXV3Y https://fr.kef.com/products/lsx-2 From what the commercials are saying and the way they are presented on the website it is clear that the main focus was on the aesthetic. "Fabric that looks like the ones on furniture" were used. The colors used are also more "modern" and playful than most of the regular speakers, which attracted younger adults. It has been thought to fit perfectly in a young adult environment. The colors also give an impression of having a more personalized product. KEF is also an old brand (1961) that used the brand history with knowledge in high quality audio. Need to reframe the product more than develop it. They seem like a direct concurrent with what Dynaudio is trying to do. FInd a good formula to break through the market.



Therefore they clearly focused on a Design push.



We could compare the 4P model with the one from the music line. They arrived in a market already filled with similar products but by creating a story and identifying the customer environment they managed to raise.

E/B&O Emerge and Level

(B&O emerge 5590dkk) (B&O Level 10490dkk)

They are both part of the beosound series.

The emerge speaker has been thought about a speaker that is really discret, the design is inspired from books that are a timeless product. (https://www.youtube.com/watch?v=X5GyWpHwaTM) (https://www.bang-olufsen.com/da/dk/hoejttalere/beosound-emerge?gclid=CjwKCAiAl9efBhAkEiwA4Toris7DSrk82Q3SyIsrIvVcxz03LaYDtibCl_tkBDM6EOgUlMe__BszLhoCRzgQAvD_BwE)

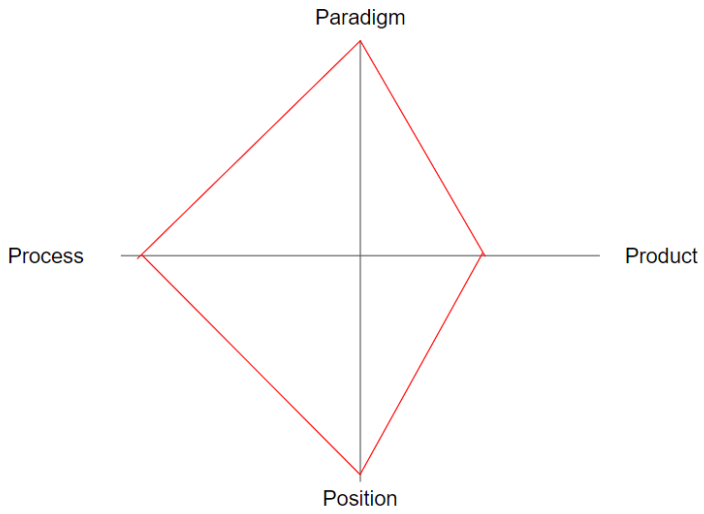
As usual Bang Olufsen products are differentiating themselves with their clever design. It is supposed to be compact and can be carried around the house or in the garden. It doesn't look like it but delivers quite a high sound.

The Level are taking some of the same codes, it should be able to use it everywhere and for any source, it can be paired in stereo. The main difference is that they are selling it as a product that should never be obsolete because the streaming module or battery for example can be replaced in the future when the technology evolves.It is highly modular and can be carried everywhere. https://www.bang-olufsen.com/da/dk/hoejttalere/beosound-level?gclid=CjwKCAiAl9efBhAkEiwA4TorijVl-uJ58uumlhZxjIOAombfIlgvpAFuCYRytDetjTmCHf8GRRh_ghoCiLYQAvD_BwE

We can see a technology push

Regarding the 4P model the emerge is not really differentiating from other products by offering new functions or new elements but more by understanding the environment it should evolve in.

The B&O Level 4P model:



The Level is innovative in every aspect, the way to consume audio products is redefined. But with the product it is around the middle because it is still not proved that this technology will work and how well it will be updated. Is it offering the possibility to do it or people will really do it?

Evaluation

The failure of Dynaudio for these 2 active products can be explained. The Xeo because they tried to do a new kind of product in the high end Hifi world but the quality of the product wasn't matching with the kind of customers, it was still reserved for a smaller audience. With the Music they wanted to touch a bigger audience and fit in another market. But originally it's not their customers, in order to break through a new market they should have brought something new and better target the group when designing it as well as the sale channels.

We can see that the latest successful product in the audio industry made a difference in the market. By the design or the technology. Understanding the user and environment better is essential.

NOTE: Xeo 10, 20, 30 have been relaunched, Music are discontinued except Music 7 (new updates). Therefore create shelf speakers doesn't seem like a relevant option.

Reflection

For their 2 failed active products Dynaudio failed on the user group analysis. If they want to develop to more people it's important to understand this new group and the needs that come with it.

The next step is to analyze the environment of the potential user and see what are the key elements that can be used for a new Dynaudio product. In order not to do the same mistakes.

Appendix 5: Have a better understanding of the media evolution in Denmark on the year 2022

Objective

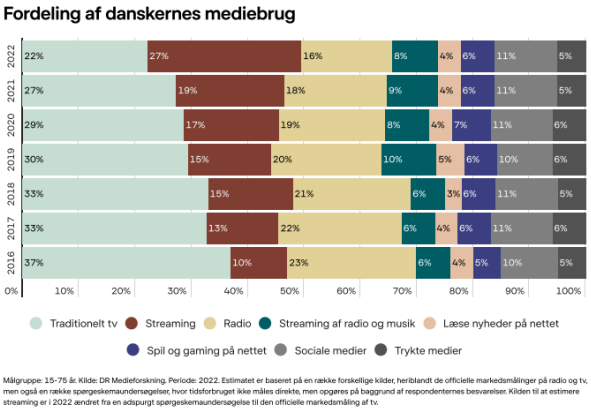
The objective is to understand better the way of consumption of the Danish population in the past year.

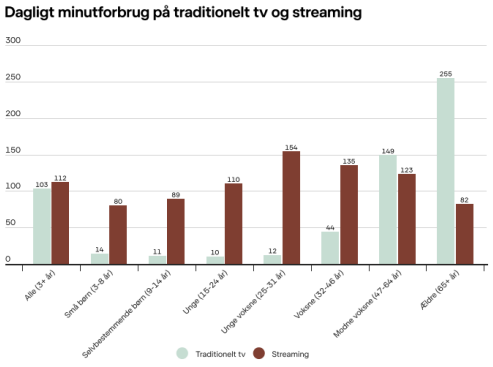
It should help to understand the consumption habits of young adults (25+).

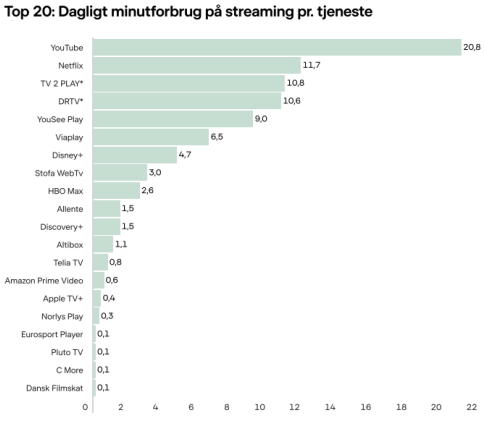
Experiment / Data

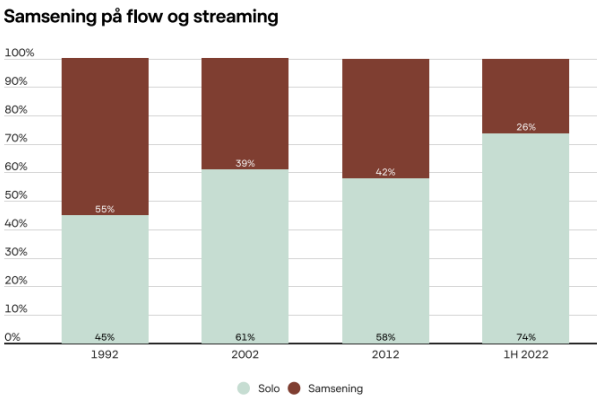
https://www.dr.dk/om-dr/fakta-om-dr/dr-i-2022/den-aarlige-rapport-fra-dr-medieforskning-er-klar-saadan-var

"When older people change their habits, it is very evident in the averages, and this is perhaps one of the most important lessons of 'Media 2022'. Change and digital evolution are not the preserve of the young."According to DR the year 2022 showed a real change in the consumption ways. Streaming services are more present than ever.









Evaluation

Young adults are really dependent on streaming services. We can also see that since covid it kept evolving. Youtube is the most used one before netflix. Over the years more and more people are watching/listening to content alone.

Reflection

Our ways of consuming media are changing a lot and even after covid the habits we took didn't stop, it kept evolving in all the age groups. This confirms that today having a device to play sound should interact easily with all these services. (TV are also becoming thinner and thinner and therefore less space for audio system = audio quality degrading)

It's important to take into account the growing percentage of people watching something alone. Could an audio device be developed for this situation ? Might be watching alone but annoying the neighbors.

Possible direction could be to look at changes in audio quality on the TV and cross that with the fact that people are watching TV more and more alone.

Appendix 6: side research

Objective

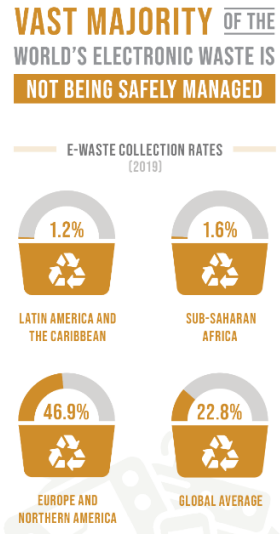
Try to find interesting topics that could be related to music industry and speakers developpement in general. Find problems.

Experiment / Data

A/17 goals for sustainable development

https://sdgs.un.org/goals

https://wdo.org/resources/world-design-agenda/



We can see that across the globe only 22.8% of all the electronic parts are recycled → why ?

https://environment.ec.europa.eu/topics/waste-and-recycling/waste-electrical-and-electronic-equipment-weee_en

The amount of electrical waste is also increasing every year. *"It is now one of the fastest growing waste streams."* (European commission)

"modern electronics contain rare and expensive resources, which can be recycled and re-used if the waste is effectively managed." (European commission)

Improving the collection, treatment and recycling of electrical and electronic equipment (EEE) at the end of their life can

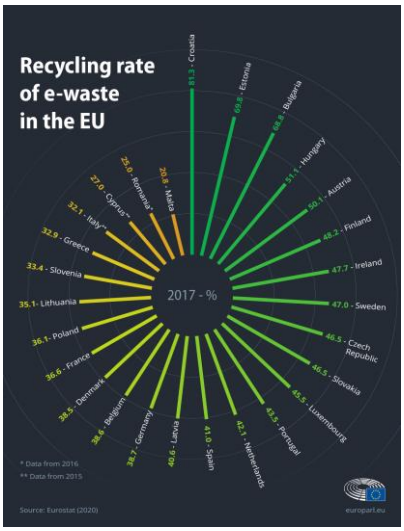
- *improve sustainable production and consumption*
- *increase resource efficiency*
- *contribute to the circular economy*

(European commission)

B/Circular economy

https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits

Denmark is only recycling 38.5% of their E-waste



What is the EU doing do reduce e-waste?

In March 2020, the European Commission presented a new circular economy action plan that has as one of its priorities the reduction of electronic and electrical waste. The proposal specifically outlines immediate goals like creating the right to repair and improving reusability in general, the introduction of a common charger and establishing a rewards system to encourage recycling electronics.

https://www.europarl.europa.eu/news/en/headlines/society/20201208STO93325/e-waste-in-the-eu-facts-and-figures-infographic

EU recommendations are repairing or re-using electronic materials.

C/The place of technology in today's society

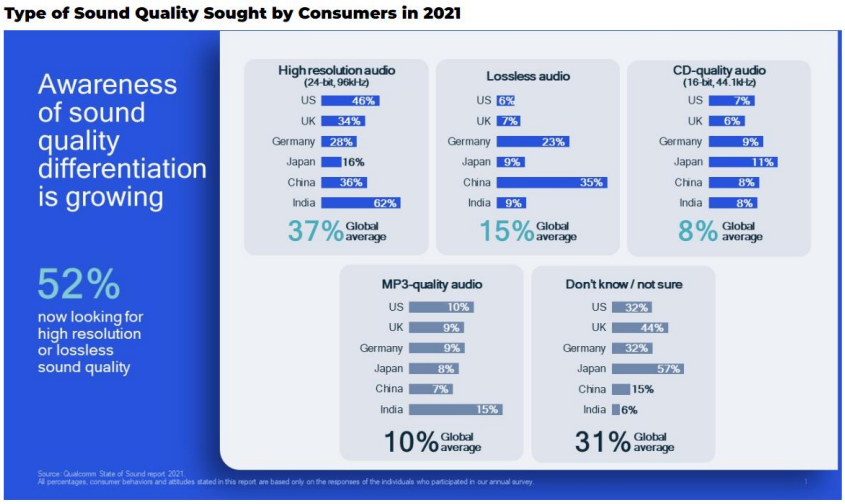
https://www.dezeen.com/2018/08/01/le-corbusiers-villa-savoye-sunk-danish-fjordasmund-havsteen-mikkelsen-installation/?fbclid=IwAR1BW-78ln5BZvslTEyGp48vJPB5x6Hck2XNRfsoUsTcZSHZGZoGEYcsGh8

Here the artist is criticizing the place of technology in our society and how it can affect a presidential campaign and votes from the people. It leads to thinking about how technology influenced our consumption ways within the music industry ?

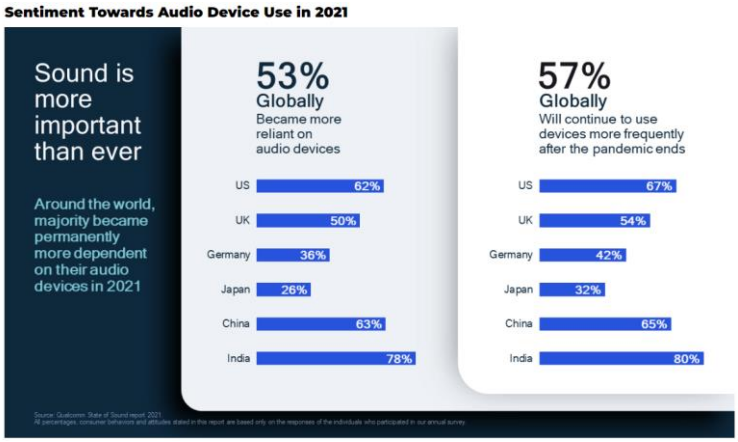
https://reader.elsevier.com/reader/sd/pii/S0148296308001768?token=9AE4F23322F1D563DDF38A1FA030339A281AF1E39179F2DA0815563C636A4A1BDD647E904EFA6FDF8CF93DA127F9EB3B&originRegion=eu-west-1&originCreation=20230213094105

"This means that adoption decisions may be influenced not only by one's own attitude about a product but also by socialization forces due to the desire to align one's behavior with referent group norms" (Songpol Kulviwat, Gordon Bruner, Obaid Al-Shuridah ; 2006)

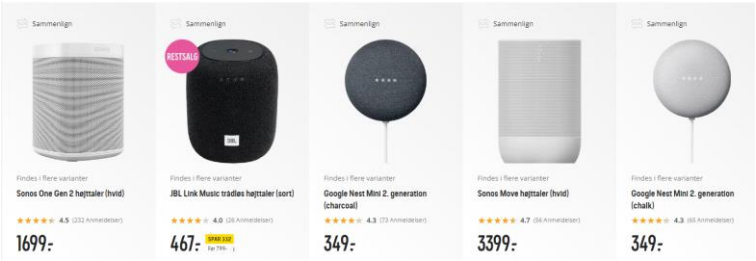
"Social influences affect intentions."



source: Qualcomm



source: Qualcomm

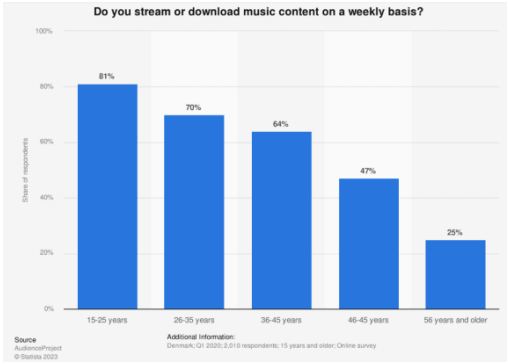


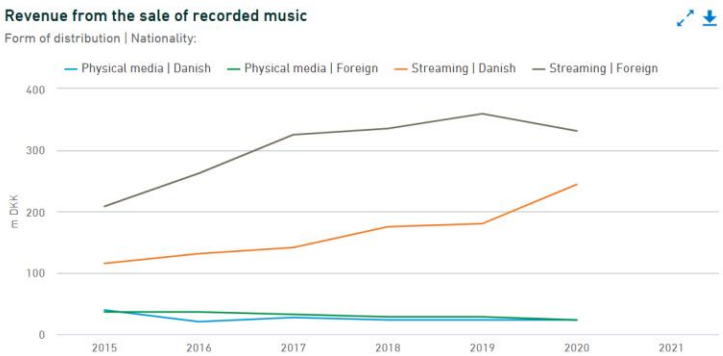
We can still see today that the most popular speakers for a big distributor like Elgiganten are mainly bad quality speakers that focus more on price and functionality.

(However, this emphasis on consumption and the rapid pace of technological change can also have negative effects on the audio industry. The focus on quantity over quality can lead to products being produced more cheaply and with less attention to detail, resulting in lower-quality audio experiences for consumers. Additionally, the constant introduction of new and improved audio products can make older products quickly become obsolete, which can be problematic for both consumers and the environment.

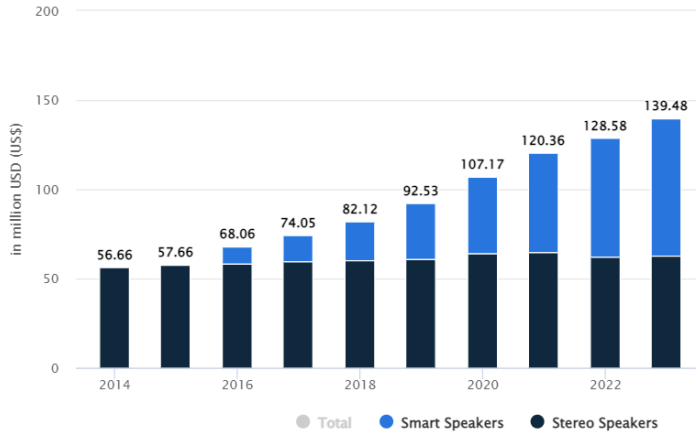
Overall, the impact of a consumption-oriented society on audio products has been both positive and negative. While it has led to a wider range of products and improved technology, it has also created a focus on quantity over quality and a constant cycle of technological change that can be unsustainable in the long term.)

D/Statistics



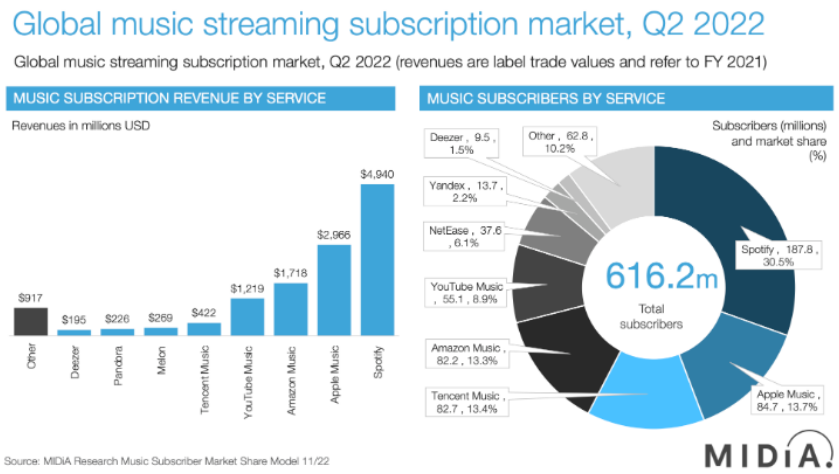


from dst.dk



source: statista

https://midiaresearch.com/blog/music-subscriber-market-shares-2022



How do young adults spend their money ?

https://www.economist.com/business/2023/01/16/how-the-young-spend-their-money?utm_medium=cpc.adword.pd&utm_source=google&ppccampaignID=18151738051&ppcadID=&utm_campaign=a.22brand_pmax&utm_content=conversion.direct-response.anonymous&gclid=Cj0KCQiA3eGfBhCeARIsACpJNU-bff6FiiMlgMFuzolvfOQh93x2tLGWggkWVnU3H5ZeqEDW-XK5nwEaArAgEALw_wcB&gclsrc=aw.ds

https://youngandtheinvested.com/millennial-spending-habits/#:~:text=Millennials%20spend%20more%20on%20convenience,and%20retirement%20than%20previous%20generations.

https://www.worldbank.org/en/programs/icp/brief/foodpricesfornutrition#:~:text=DATA%20HIGHLIGHTS,was%20slightly%20higher%20at%20%243.35.

Evaluation

The UN defined new sustainable goals to respect for a more sustainable development. Regarding electronics, the goal is to safely manage the waist. This relates to the circular economy. (https://pacecircular.org/action-agenda/electronics) There are 3 axis to work on for a more "circular" economy on products:

- (1) New products use more recycled and recyclable content
- (2) Products and their components are used for longer
- (3) End-of-use products are collected and recycled to a high standard

Dynaudio has the ability to act mainly on number 1 and 2.

The pandemic has affected the way people consume music and buy audio products. It allowed people to reconsider the feelings music can bring and how a good sound quality can be important. Statistics show a neat increase in the use of streaming services over the years with spotify and apple music being the most used services, respectively (30.5% and 13.7%). To answer this demand of higher quality apple music found a solution:

- Apple music lossless (24 bits/192 kHz) for high audio quality have been implemented only in 2021 (https://www.apple.com/newsroom/2021/05/apple-music-announces-spatial-audio-and-lossless-audio/)
- When on Spotify the highest quality available is mp3 equivalent (320 kbit/s)(https://support.spotify.com/us/article/audio-quality/) which is still compressed files when apple music uses uncompressed files.

At the same time smart speakers sales have increased over the years and if today we look at the most popular speakers it is still quite low quality.

Reflection

Regarding the sustainable goal it should be seen further on in the project and be taken into account in the development of the product and the functionality. It might be difficult to use it as the main development point of the project.

Our consumption of music and audio products have evolved a lot these past years. We went from high audio quality standards to lower ones due to streaming services and support but today there is a change in the society and we are going back to higher standards. Covid helps to realize how important consumption ways matter. The longevity of a product is really important and that is one of the main aspects of Dynaudio speakers. Usually longevity means better quality in the components and the audio.

Therefore, how to invite people to change their way of consumption ? It is seen that they want to but it is still no happening.

Appendix 7: User research

Objective

Find out about different speakers for different applications and see what are the best sellers.

Is there a pattern in function of the category of shops and buyer ?

Experiment / Data

The research is made for Denmark in order to limit the range and because Dynaudio is a danish company. It will also be easier to get in contact with shops and users. From a first meeting with Dynaudio it was seen that the products are first developed according to the danish (and european) market and then some few changes are made for chinese market which is one of their biggest markets.

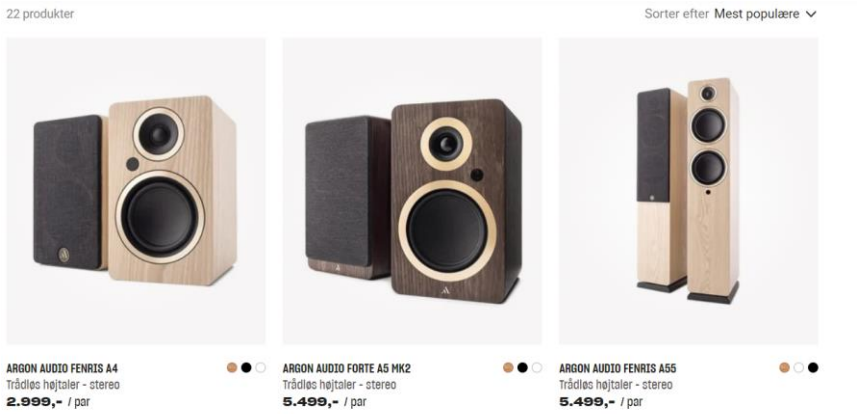
A/Best sellers in specialized shops:

regarder sur des sites spécialisés (thomann, hifi klubben,...) and see what the best sales are in different categories

pre amplified for bar and restaurants ? or personal use

Hifi Klubben

most popular activ speakers) (https://www.hifiklubben.dk/hojtalere/aktive-hojtalere/)



ARGON AUDIO FORTE A55 MK2
Trådløs højtaler - stereo
8.499,- / par

ARGON AUDIO FORTE A4 MK2 + SOLO
Trådløs højtaler - stereo
6.498,- / System

ARGON AUDIO FORTE A55
Trådløs højtaler - stereo
7.999,- / par

DALI OBERON 7 C + SOUND HUB COMPACT
Aktivt højtalersystem
18.197,- / System

DALI OBERON 1 C + SOUND HUB
Aktivt højtalersystem
12.497,- / System

ARGON AUDIO FORTE A5
Trådløs højtaler - stereo
4.999,- / par

most popular in general:

SOUNDBOKS (GEN. 3) + BATTERYBOKS
Trådløs højtaler med batteri
7.499,- ~~8.999,-~~ / System

ARGON AUDIO FENRIS A4
Trådløs højtaler - stereo
2.999,- / par

SENNHEISER AMBEO SOUNDBAR
Soundbar
14.999,- ~~18.999,-~~ / stk

SOUNDBOKS GO + BATTERY
Trådløs højtaler med batteri
5.199,- ~~6.299,-~~ / System

SONOS BEAM (GEN 2)
Soundbar
3.749,- / stk

DALI OBERON 5
Gulvhøjtaler
7.398,- / par

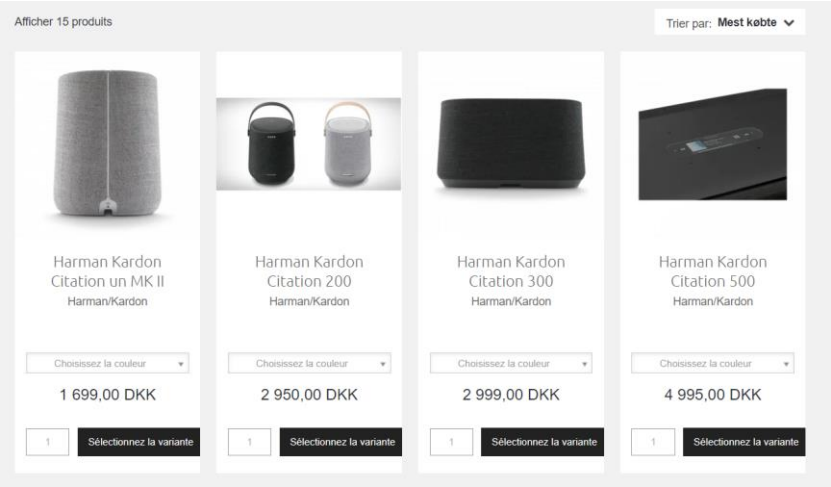
SONOS ONE (GEN 2)
Trådløs højtaler
1.588,- / stk

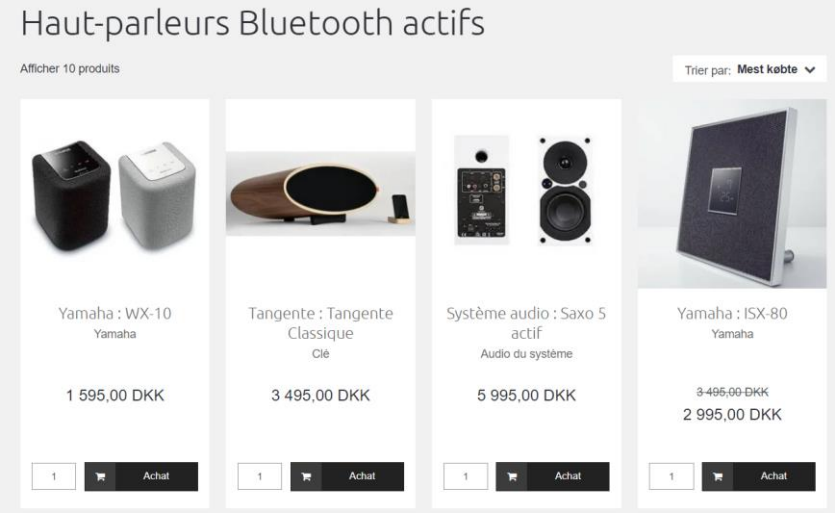
BANG & OLUFSEN BEOLIT 20
Trådløs højtaler med batteri
3.999,- / stk

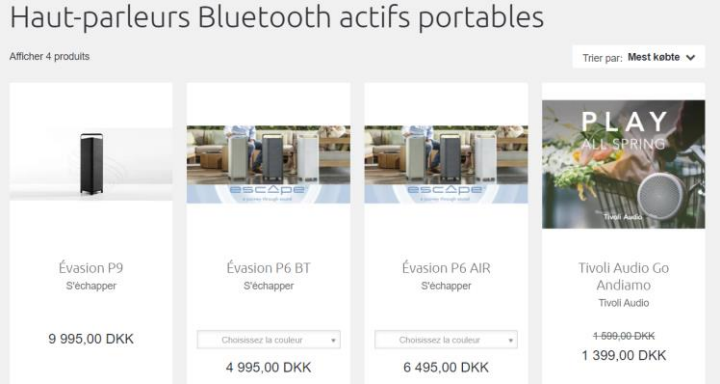
VESTLYD V12C
Gulvhøjtaler
9.998,- / par

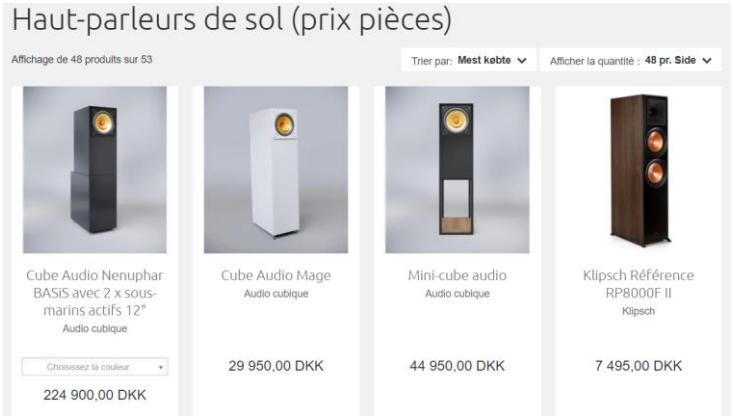
Topsound

most popular (https://www.topsoundhifi.dk/shop/26-aktivetraadloese-hoejttalere/)



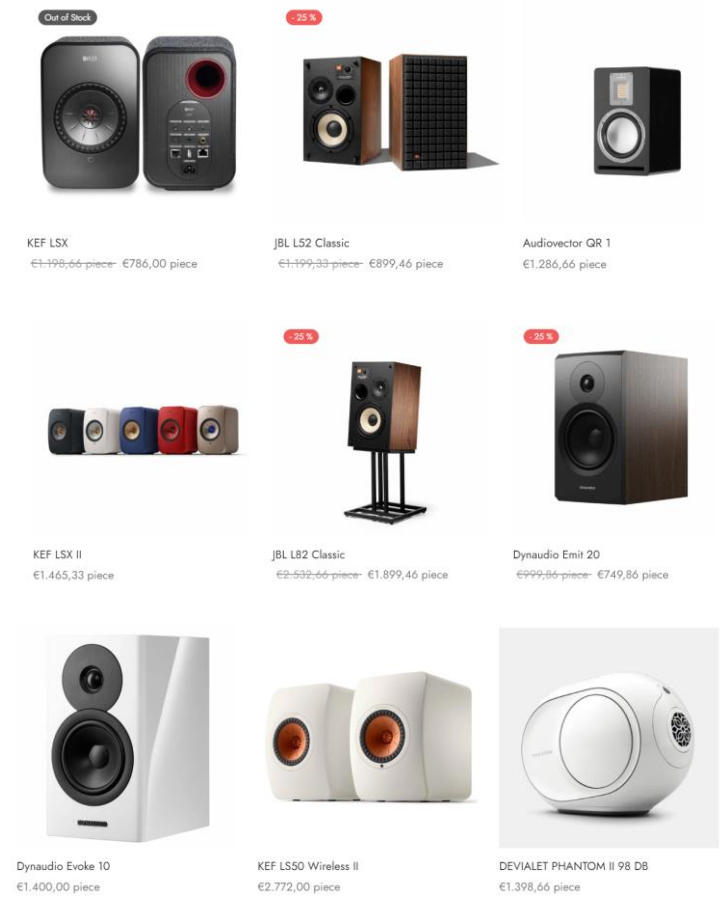






Lydspecialisten

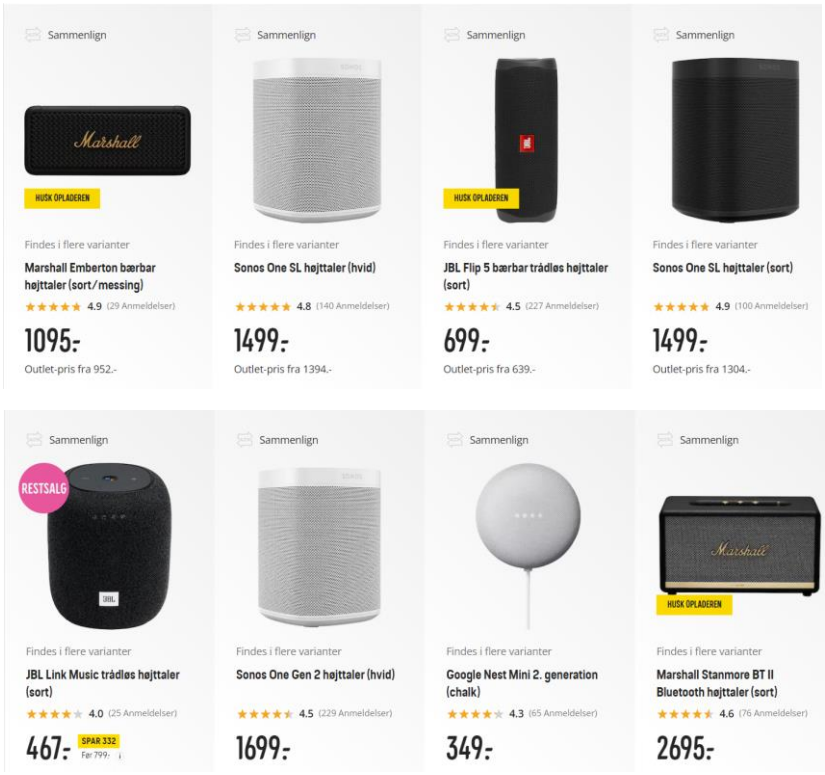
https://www.lydspecialisten.dk/en/speakers/?orderby=popularity (located in Aalborg → should go visit them at some point)



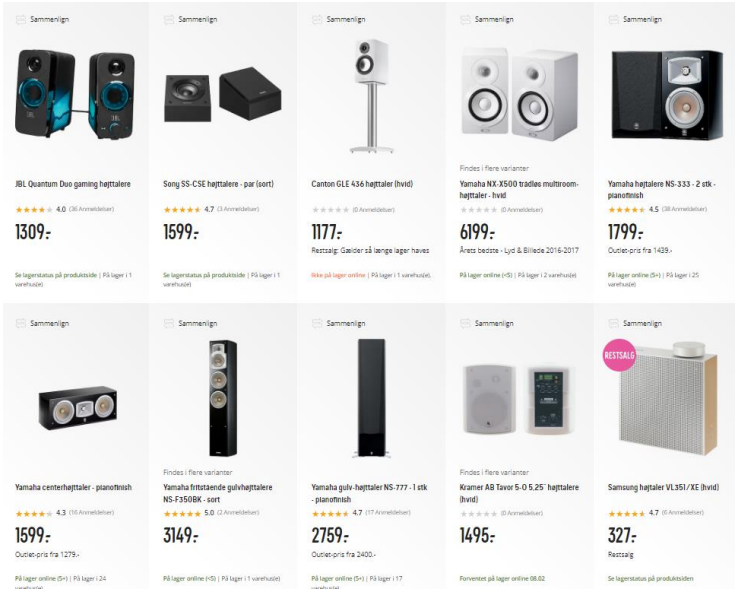
B/Best sellers in all public shops:

Elgiganten (https://www.elgiganten.dk/tv-lyd-smart-home/hojtalere-hi-fi?sort=FFCheckoutCount:desc)

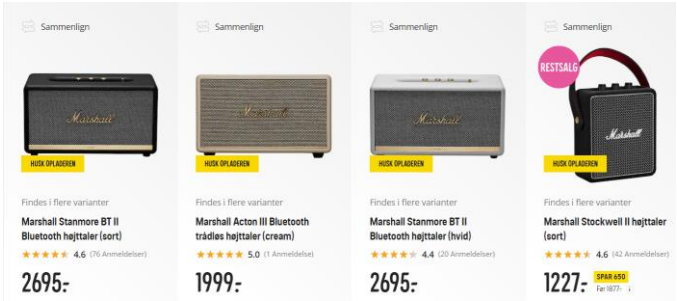
General (all active) (speakers + bluetooth speakers)

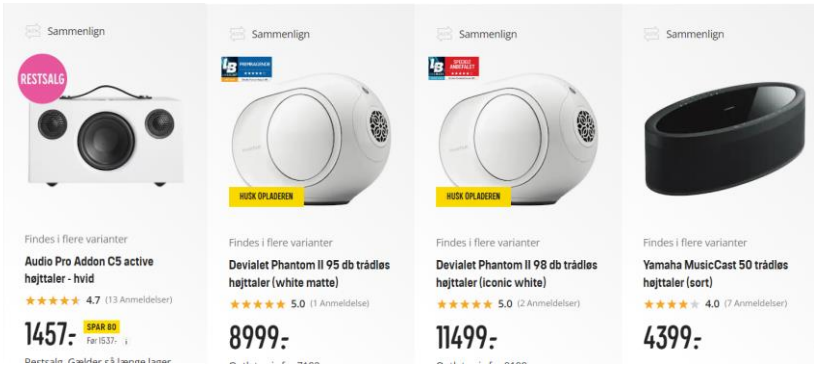


Hifi speakers

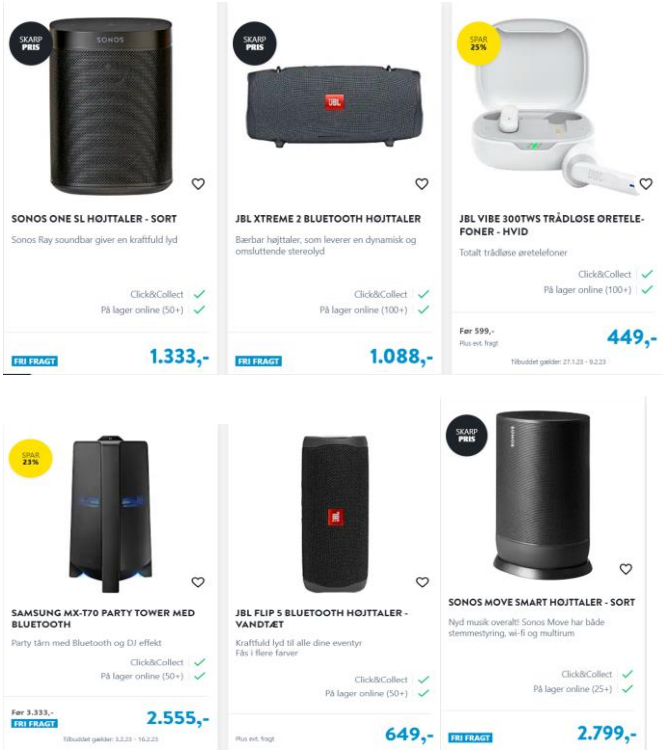


Speakers (all active)

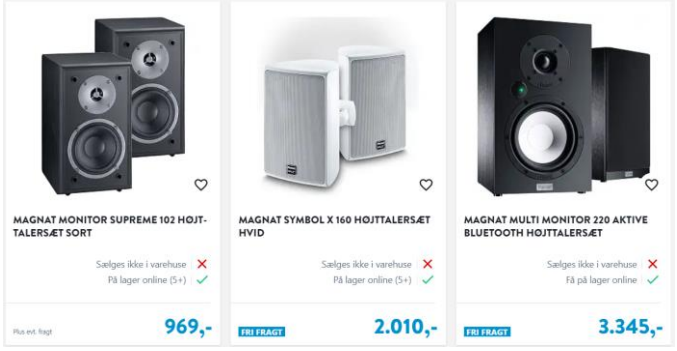




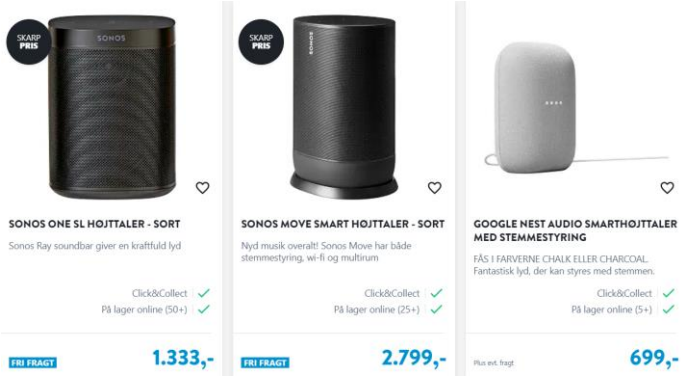
Bilka



Hifi: Passive speakers



Hifi: Active speakers



C/Upcoming brands and products:

We can see that a lot of new brands are taking a huge part of the market such as Sonos, Escape, Devialet for example. Some other more historic brands such as JBL, KEF, Bower and wilkins, and Sonus faber for example found a way to reinvent themselves with new products using the last functionality.

https://www.gearpatrol.com/tech/audio/a42258232/most-interesting-hi-fi-and-audio-gear-2022/

What allowed them to do that is to use the new kind of streaming services, new ways to connect the speakers to other gear, innovant smartphone applications are examples. When some other brands such as Dynaudio, Dali or Klipsch are still communicating on their historical products and experience in the audio industry. To touch a large public today this might not be the best way to do it.

A brand like Marshall managed to use historical design and history with guitar amplifiers to turn it into design and have a strong part of the market. Could that be an option for Dynaudio ?

Evaluation

It allows a fulfilled database with some speakers that are the most popular ones from different categories, mainly active speakers (bluetooth, shelves and ground speakers).

Reflection

This research showed a market filled with a lot of similar products for different uses. The next move will be to conduct a user interview in order to understand better what the needs of the users are. What kind of speakers are they using? And for which purpose.

To identify some kind of pattern a meaning frame analysis will be conducted on selected speakers from different categories.

We can see that the way to consume audio products have changed over the years and the brands that could understand these new markets first and allowed themselves to reinvent their way to think about music are today more recognized among the big audience.

Appendix 8: Positioning of audio products on the market - revised

Objective

Review the market analysis previously made to better determine what products are the most popular ones on the market and what are their positions on the market. The goal is to make it ready for the process report and better detailed.

Experiment / Data

The different products identified in the APPENDIX 7 which are the most popular ones on the market are put into a graph in function of the age of the user group and the price of the product.

Links for the pictures:

https://www.hifiklubben.dk/hojtalere/aktive-hojtalere/

https://www.topsoundhifi.dk/shop/26-aktivetraadloese-hoejttalere/

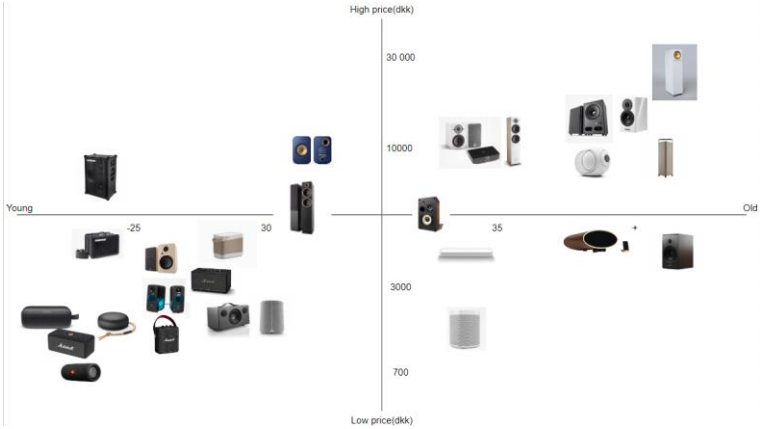
https://www.lydspecialisten.dk/en/speakers/?orderby=popularity

https://www.elgiganten.dk/tv-lyd-smart-home/hojtalere-hi-fi?sort=FFCheckoutCount:desc

A/Position of the products on the market

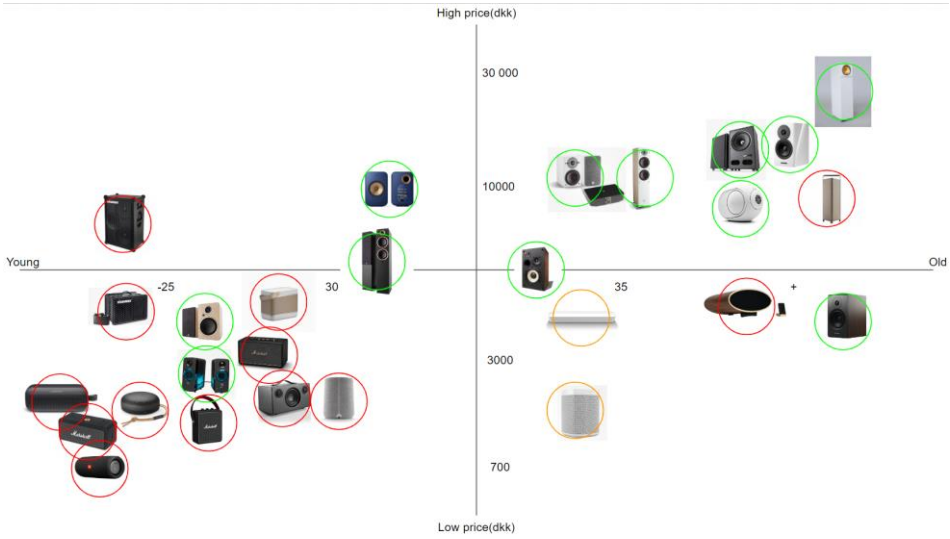
In the APPENDIX 7 some products are identified as the most popular ones among different audio retailers in Denmark. They are then placed on the following graphic according to their retail price and the age of the users. The objective is to identify a possible pattern and consumer habits in function of their age.

The age is identified according to the previous research, the design language of the products, the reviews of the products and the interview with 2 audio shops in Denmark.



B/Stereo or mono product ?

The first thing we can see is that there are products meant to be used in stereo with two units and some meant to be sold as a single unit for a mono use.



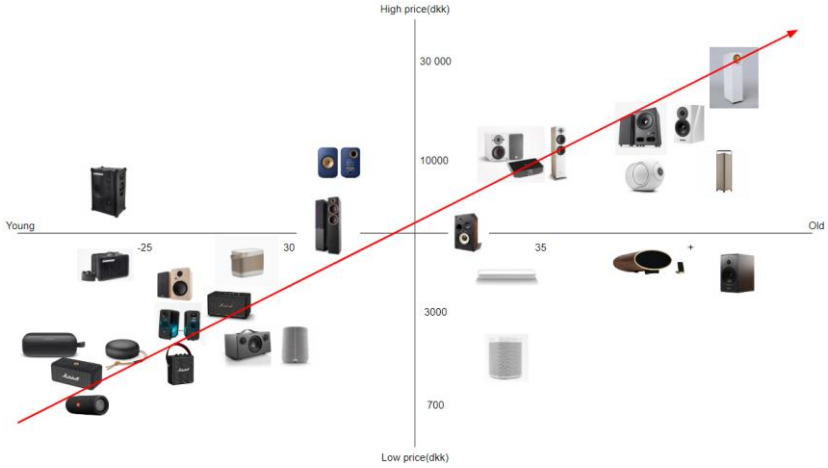
In red the products are sold as a single unit and meant to be used in mono. In the young segment (under 30 years old) they are the most represented. For the adult segment few products are present, this can be explained by the products mainly being sold as a secondary product. These older users will most likely have a pair of stereo speakers and an extra in another room. As seen in the user research (APPENDIX 13) youngs will most likely move around their house and need a nomade solution, this could also explain why they are more present in this segment. Most of these nomade speakers can be paired to play in stereo if a second one is bought but the research showed that when growing up the young adults will most likely buy a set of stereo speakers on the side.

In green these are sold as a pair of speakers, few speakers are present in the young segment as they are usually more expensive but few products are still present and targeting the young audiophile that want to enhance the music experience. Adults will usually have more money to invest in a stationary sound system that will give a more exclusive feeling.

In orange these are a bit special. In orange it's a soundbar from Sonos, it can play in stereo but it will also be sold as a single unit. It enhances the sound of the TV and it is a good compromise between a single speaker and a set of speakers for the price. In this segment of users the user usually has more money and will buy a second speaker.

Going from mono to stereo will enhance the audio experience but the stereo products are often more expensive. Meaning that users will start from mono products and evolve towards stereo products.

C/Evolution in the user consumption habit



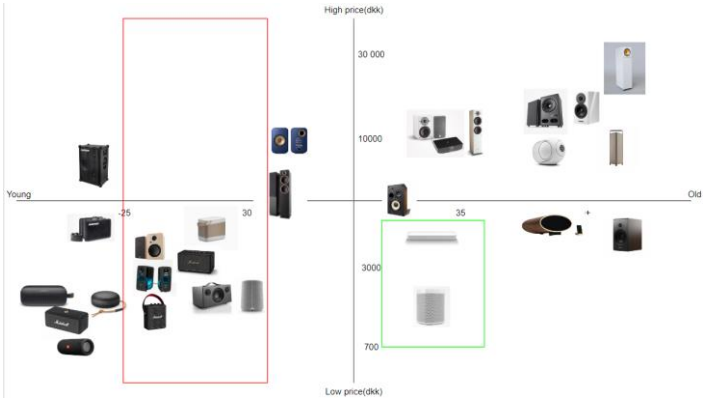
We can see a density of products along this line meaning that the older the user is the more money they put into audio products. Few exceptions are identified with Soundboks, Sonos, KEF, Tangent audio and one of the Dynaudio speakers. They are managing to get "out of the pack" by offering a different kind of solution. This is mostly seen with the Soundboks and Sonos, the story behind the product and the functions combined to a strong marketing allows them to break through.

The KEF LSX is still targeting young users but as a high quality product with a fashionable design. It is also the brand history and knowledge as a sale argument.

The tangent audio product and the Dynaudio emit 20 are made by highly recognized brands in the audio industry and even though they are cheaper compared to other products in this segment, because they are from these brands they "assure" the user that it's a good quality product.

The evolution in price of the products is related to the user going from mono to stereo product. Developing a new solution for a speaker while being in the mainstream can make it difficult to breakthrough on the market.

D/The young adult segment



When looking at the young adult segment it is possible to see that there is a wide variety of products.There are some mono and stereo products, nomade and fixed solutions. This could be explained by the user being in between two categories, the nomade speakers and the more permanent solutions.

The case of Sonos is a bit specific as these speakers are targeting mainly adults by the design language and the possibility for it to be multiroom but some young adults are also attracted by the connectivity they offer and the sound quality for its price (APPENDIX 11).

Could a hybrid product offering the convenience of nomade speakers and the quality of stereo speakers be a solution to touch young adults ?

Evaluation

To breakthrough and make a difference from other products some brands are using different strategies. It can be by focusing on the functionality of the product (Sonos, Soundboks) or relating to the brand history (KEF, Tangent, Dynaudio). It is also seen that young adults are in between 2 categories of products where they have some functionality, a nice interaction with the product and products that enhance the sound experience.

Dynaudio has both the brand history and the technical knowledge to develop such a solution, therefore a new Dynaudio product should include both of these aspects to breakthrough on the market.

Reflection

The research showed that young adults are an interesting group to target for several reasons. Analyzing the different products on the market according to the price and the age segment lead to insights on what should include a new Dynaudio solution for a potential breakthrough.

The next step is to have a closer look at some successful products to understand what were the brand strategies to breakthrough on the market and possibly identify some key elements for a potential success.

Appendix 9: Breakthrough analysis - revised

Objective

The objective is to analyze the breakthrough of different successful products on the speaker market to possibly identify some patterns revealing different aspects that can be respected for a new Dynaudio product.

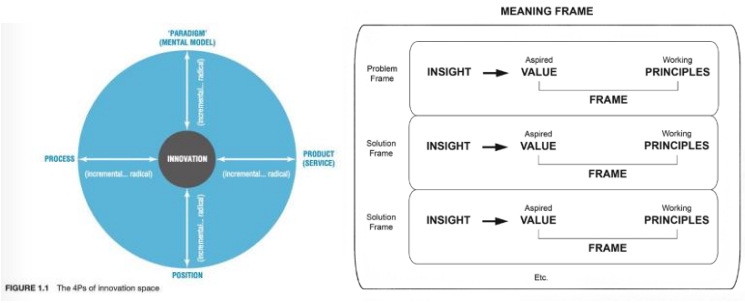
Experiment / Data

4P show incremental innovation process and radical innovation on the product

product architecture / evolve with the user are linked from 4p model

A/Theory used

It is discussed in a supervision session that 2 theories could help to identify some patterns, the 4P's model and the meaning frame analysis.



Tidd & Bessant (2009) / Haase&Larsen (2019)

The 4P's model can help to clarify the position of competitors and of Dynaudio on the market. It will give an overview but doesn't allow you to go in depth. To do so the "meaning frame" analysis can be used.

A first attempt was made in APPENDIX 35, the results of the 4P's model showed interesting insights but the "meaning frame" analysis made it too confusing. It was difficult to get valuable information as these products were analyzed from desktop research and there was no real discussion with the designers of these products. Getting information directly from the designer is quite difficult and requires an interview with them. Some of these products are still on the market and could give important information to competitors therefore making a precise analysis that could give accurate results is too complicated. The "meaning frame" analysis is then abandoned.

B/Products

The 4P's model will be used on 4 products. 3 products from competitors' brands that had a big breakthrough on the market and 1 product from Dynaudio that wasn't successful.

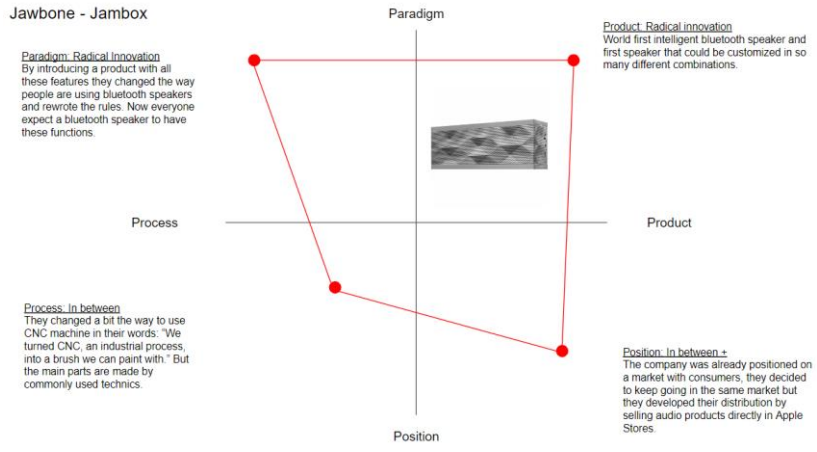
In this way some first assumptions can be made on what didn't work on this Dynaudio product in comparison with the other ones. The objective is to identify some similar elements and direction these brands took in the process, the position, the product and the paradigm that can further on be applied on the new product.

A/The Jambox by Jawbone

https://www.dezeen.com/2010/11/23/jambox-by-yves-behar/#

The Jambox by Jawbone is chosen as a case because of the rise and fall of the brand. The Jambox has even been mentioned as "design of the decade" by the Industrial Designer Society of America. The Jambox was developed to touch a lot of people and they succeeded. By offering a known technology but with newer options that improves a lot on how to use the product and giving more flexibility in the customization than the other. The need to change the position and the process wasn't big so they could save money on production cost and deliver a product with low prices but still delivering good quality and versatility. Later on Jawbone decided to go into another field with fitness equipment which is one of the main reasons for this failure. They tried to expand too much from their original core products by going into fitness and not giving up when the competitors in this domain were doing better (Fitbit, Xiaomi fitness tracker).

https://history-computer.com/the-real-reason-jawbone-failed-spectacularly/#:~:text=Unfortunately%2C%20Jawbone's%20demise%20is%20a,to%20believe%20it%20could%20succeed.



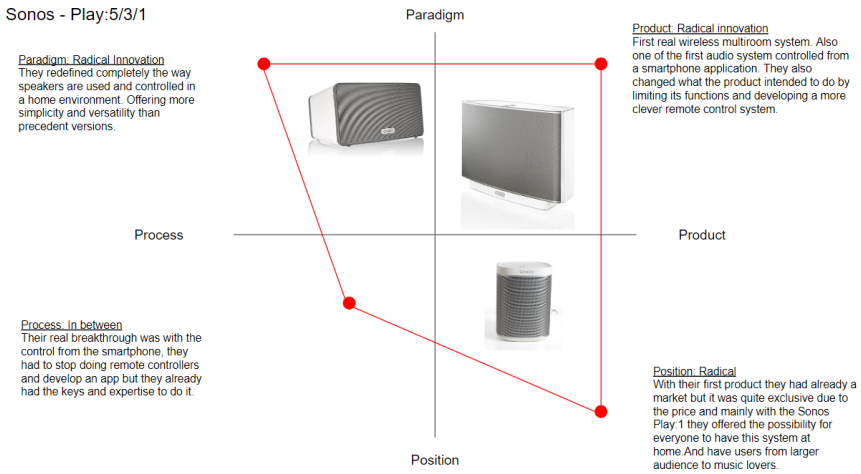
B/Sonos play 1, 3 and 5

https://www.techradar.com/reviews/audio-visual/hi-fi-and-audio/hi-fi-and-av-speakers/sonos-play1-1189345/review

The first generation of Sonos' "play" product was chosen as it was a huge breakthrough on the speaker market and is still to this day. With their products they revolutionized the market by implementing a solution for a multiroom system working on wifi. They have been the first movers on this kind of product and that allowed them to stay competitive with the other by always being a step ahead.

Today they have one of the best multi room systems that is used in a lot of bars, restaurants or at home. It's possible to buy the products separately and add-on products over time. For the market analysis we will look at their breakthrough in general and not one product specifically. They are selling an entire system with more than one product. The breakthrough analysis will be made according to their biggest improvements over time and mainly with Play:5, Play:3 and the Play:1 (Gen 1).

https://www.sonos.com/fr-fr/how-it-started

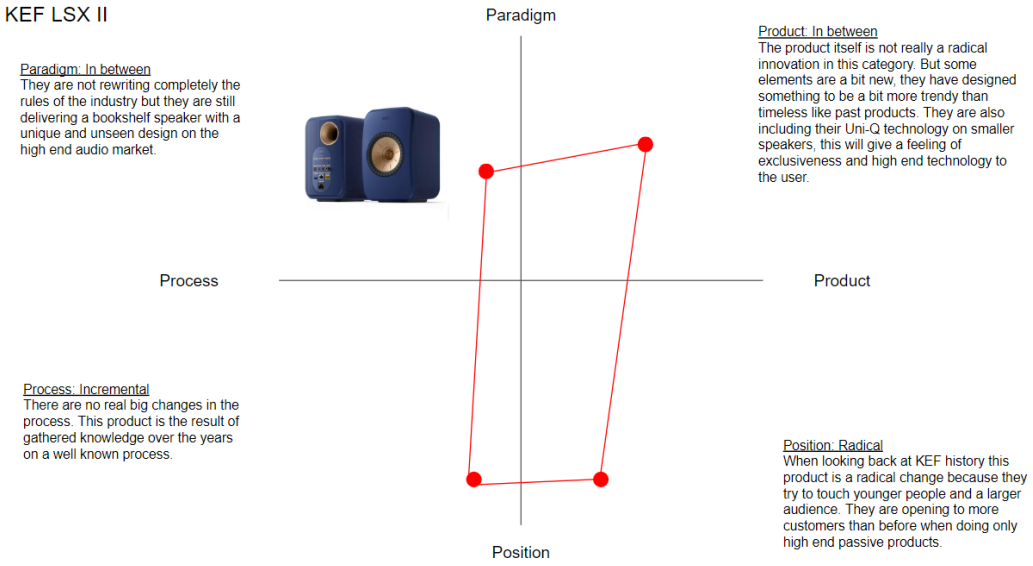


C/The KEF LSX

https://www.lydspecialisten.dk/kef-lsx-ii/

The KEF LSX is chosen because this product reflects the brand history of KEF combined with newest technology. Their breakthroughs in the market have been quite linear over time and is the result of years of engineering in this domain. Their speakers have been reserved for passionate people but today they managed to touch a larger audience with their new LSX speakers and convince younger people to use them.

They are meant to be used in stereo and are quite standard bookshelf speakers. According to Lydspecialisten they touch younger people thanks to their design that is quite trendy and the brand history is also a big argument that convinces a younger audience reflecting the quality of the product.



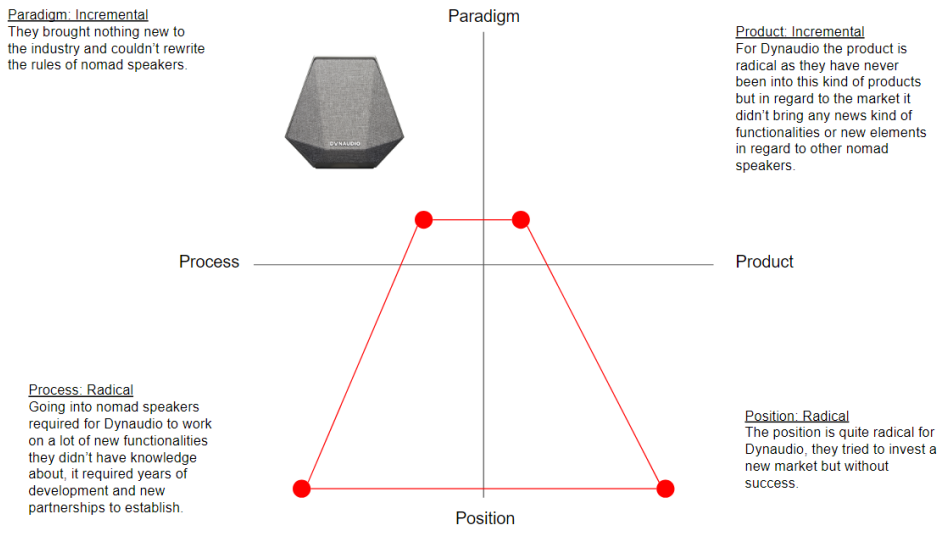
https://fr.kef.com/

(interview with lydspecialisten APPENDIX 1)

D/The Dynaudio Music 1

https://dynaudio.com/home-audio/music/music-1

Dynaudio is a historical brand in hifi equipment that has had quite a linear breakthrough over the years thanks to their high technical knowledge always bringing high quality sound. They wanted to touch more people and a younger audience with the music range but failed to do so. This can be explained by different reasons such as the design of the product, their marketing and the selling channels. For the price the product delivers a really good sound quality but it didn't reach out to users. The Dynaudio music 1 is meant to be used as a nomad speaker and sold as one unit.



(From Talk with Dynaudio designers)

Evaluation

The main difference observed that could give insights on what made the success of the Jambox, Play and LSX facing the Music 1 could be the position the brand decided to take regarding the process and the product. For the Jambox, Play and LSX we can see that the products are rather incremental on the innovations regarding the **process**. The brand knowledge previously acquired is used to develop a new solution that will ask for least investment or changes in the making of a new product. On another hand the Dynaudio Music 1 was completely new for Dynaudio and resulted in a radical innovation regarding the process. The Jambox, Play and LSX have a tendency to be more radical on the **product.** This allowed these brands to be some of the first movers on the market and bring something new. On the opposite, Dynaudio is incremental with music 1 and therefore couldn't create a difference in regard to the competitors. Regarding the paradigm it is different in all of these brands, KEF was rather in between/incremental but it didn't fail them to meet success, they could use the code of classic stereo speakers and by few changes touch a younger and larger audience. In this position most of these brands tried something new compared to their portfolio and this can't really explain why one product would have more success than another one.

Reflection

This analysis of different successful products in comparison with the Dynaudio music 1 showed 2 aspects that can explain a potential failure for this product. As it is today Dynaudio acquired the necessary knowledge to develop a new solution for a nomad speaker without being radical in the process. To maximize the chances for a new solution to breakthrough a radical innovation on the product is being considered. The product can be radical by the story it is telling or the way it interacts with the user, it could also be a product including a completely new feature or way to interact with sound.

Appendix 10: Interview with Daniel, potential user.

Objective

The objective is to understand the user better and have an overview of the environment. It will give their needs and consumption ways.

Experiment / Data

User profile

Daniel Hovalt

25 years old

Done with Journalistic studies → don't know if we go on a master

Young adults that start to settle down.

Danish

Questions

What kind of e-products do you have ?

TV, smartphone, headphones (airpods normal (~1000 ish), B&O headset (2000dkk), Playstation, bang olufsen beoplay A2 (2.799dkk)(battery dies fast) (audio total=5799dkk)

What is your wage ?

27000/month and amanda 33000/month (in first 6 months after getting the first salary start spending lot of money and then low down a bit) total = 6000dkk/month

Do you know how much you invest in home equipment ?

since stopped studying 12000 in home equipment ish (in 8 months)

Including 6.299dkk for espresso machine (they love coffee and that's the first thing they bought)

We might buy a new speaker soon because the battery of our speaker is dying.

What are the last products you bought ? (for home in general)

The TV, top for coffee table, carpet

What are you first looking at before buying something ?

Colors, summer house or new nordic style, fits to the other things, connection between furniture, have a blue table → want the blue colors to break with new nordic style / price comes after trying to spend in a clever way. Try to buy something and keep it for a long time. Think a lot when buying something more expensive so keep it longer and on the long run it's less expensive.

Are you more second hand or new products ? (Same question with audio products)(where buy audio products)

a mix between new and second hand. Big stuff is new (tv, carpet,couch) and small stuff is usually second hand. If you want important stuff in the house, prefer to buy new because imagine that it will last longer. Would always buy new electronics in general. Bought audio at a retailer store (elgiganten). Airpods same from elgiganten. Don't go directly to the brand. Tend to go to Elgiganten so I think that he has more choices there. Price may be cheaper.

What is the next thing you will buy for your house ?

Next, think of buying art or posters. Will change his phone soon, try to keep the phone alive but will go down soon.

How important is comfort at home for you ? What is comfort for you ?

We value comfort but tend to look at what looks good above confort. Comfort is having beautiful stuff to look at. Have a cozy place. Create a cozy atmosphere at home. At home the same as when studying.

When you are home what are you usually doing ? What do you do when you have nothing to do ?

Mostly watching TV or reading a book, cooking is what we do the most. When cooking we usually talk and always have music in the background, so we put the speaker in the kitchen. Wouldn't buy a speaker that is fixed, needs to be transportable.

What kind of audio/video media are you consuming ? How often ? When during the day ?

mostly radio (every morning), streaming TV and netflix. Can't choose what you watch. In the winter almost every day.

What do you think about the sound of the TV when watching a movie ? Have you ever thought about that ?

Did complain about the sound when watching on the computer. Not really with the TV

What kind of music are you listening to ? In which context ?

Amanda most on 2000's and Italian rock, and really diverse, frank ocean and this style and Danish small artist. Satisfy with their speaker, fits their needs. And if more into music that wouldn't be enough. If the battery dies I would buy a new one and probably the same both because because don't want to spend time researching, like the look of it and satisfy the needs. (kinda hooked to the brand). Brand loyalty!!! They like habit. Know I won't be disappointed.

Which platform or device do you use to play the music (stream, cd…) ?

Use phone and bluetooth and even when listening to radio. (Spotify and Yousee music because free with the phone service)

I can see that you have a vinyl turntable, are you using it ? If not, why ?

Don't use it at all, it is on the shelf. Speaker was integrated in it.

What music represents to you ?

I need to think about meaning and stuff, lyrics. Music is more to feel some sort of emptiness. If walk or home alone like to put on some music

Can you describe the kind of problems you encounter while using audio devices ?

with airpods only one of them connects, a problem with technology. Don't have any issue with the speaker, just the battery slowly dying.

How much did you invest in audio equipment in total (personal and for the house) ?

see before and make the sum

(What is the last product you bought ?)

airpods

When you buy audio products what are you looking at first ?

the brand and the design. B&O as a rumor of being quality. I think its quality will be good.

Can you cite some audio brands ? Which ones do you think are high end/quality audio brands ?

B&O

Do you know Dynaudio ? Where do you know them from and for what products ?

not at all

Can you describe or show me what you do first when going home, and "user scenario" when using your audio devices ?

unpacking, ordering stuff in the closet.

Evaluation

This interview was a way to understand better the consumption ways of young adults that are done studying. Some important elements arise and will be used for the development of a design brief.

In the bigger picture we can see that most of the expenses are made in the first 6 months of getting a new job. They spent the money on equipment for home to create a better comfort and living space. Money first goes into what they like rather than being completely rational in their expenses. Even though it's not a necessary product they spent 6.299dkk on a coffee machine.

→ this is an interesting angle for the product. Develop a product within this price range and made for music lovers that will first spend their money on audio for their own comfort at home.

When Dynaudio develops a product they are usually doing different products in one "range". Could be that there is one more affordable (like Music 1 for the most people) and one more expensive for music lovers. The design should be an extension from the first one, offering the same convenience but with a better sound. → touch more people.

They are developing a certain brand loyalty. They use B&O products because of reputation and design. They will buy again because they are convinced by it and don't want to spend hours searching for a new product.

They are consumed in a more responsible way even towards e-products, they want them to last as long as possible. Because they know it's more sustainable. Feel like it's a shame that on the bluetooth speaker they have, it's the battery that is dying. And when it dies they will replace the whole product, and would like to be able to change only the component that doesn't work.

The product should fit the environment and respect the aesthetic codes of "new nordic design". They first think about how it will fit in the house. At this moment of their life young adults start thinking more and more about the environment they live in and how harmonious it is.

Reflection

This showed really interesting results and a more precise user definition and where to trigger their attention. This can be used to develop a first design brief.

Dynaudio tried to touch more people with the Music range. Prices were affordable and corresponding to this segment. But the product wasn't easy to integrate in this environment and wasn't sold through the right channels.

Appendix 11: Refine the user analysis.

Objective

The objective of this worksheet is to have a sharper user analysis and reduce the focus on one kind of user to facilitate the design process.

How users interact with music products at a certain age will also be evaluated in order to have a view "in the future" and not only design for now but be able to think at what the product can become in the future ?

Experiment / Data

The current user group is for young adults that are starting to settle down. The new user group will be refined by adding young people that like music especially and that are especially attracted to audio products.

A/User research

To find some users a research on the facebook marketplace was made to find young adults selling some speakers. After that a few questions were asked to these users in order to understand why they are selling their speakers and what problem they might encounter while using them.

Emil, 25 years old, male

He is selling a Black Bose home speaker 500, retail price: 3199 dkk

I mainly sell it because I do not really use it to the extent that I initially thought I would. That and I do own other speakers that I use more frequently.

Since it's a stationary speaker and it needs to be connected to a power outlet at all times, I only used it in my living room. I also possess bluetooth and Hifi speakers. So at home I would use the bluetooth speaker when moving around the house, if I need to cook for exemple and when I'm in the living room I use the Hifi speakers for movies and listening to music.

Rastislav, 26 years old, male

He is selling a Samsung HW N410 soundbar, retail price: 1222dkk

I used it mostly as a soundbar to expand the sound of the tv, and sometimes for the music. The reason I'm selling is that I upgraded and bought Sonos beam gen 2 with two sonos play speakers to have better sound music and most importantly, for movies to have 7 channel sound with dolby atmos - since I am quite into movies, volumetric atmos sound was important for me, so I saved and upgraded.

I would also go as far as 7.1, hence buying sonos subwoofer, but it's out of my budget now and the beam gen 2 plus two play one already provide surprisingly powerful bass. Also, in a perfect universe I would go straight for Sonos arc but it's too expensive right now.

Sonos system worth: 3999 + 1499 + 1499 = 6997 dkk

I chose to go for Sonos because of the sound quality plus the internal system and the fact that you can expand to multiroom with no problem and set up sound in the whole house… When I will be able to afford it I want to have good quality sound in whole house

Camilla, 31 years old, female

She is selling a Marshall acton BT II, retail price: 1995 dkk

I am selling it because I bought a new speaker. It stands in the kitchen and it needs to be plugged in the power outlet all the time to keep it powered on. Therefore I don't have any flexibility and don't use it enough.

I have a Google Home speaker, it's convenient but it's not really powerful. To replace the Marshall I bought a harman kardon Onyx studio 7, so I can use it around the house and it's quite powerful.

Google home speaker: 349 dkk + Onyx studio 7: 2999 dkk = 3348 dkk.

Typical user

!! By looking at the reply from the survey (Appendix 1) and replies from respondent in interviews the males are more technical and also spend more money into speakers → Males are targeted

Statistics shows that most people are in a relationship (https://www.statista.com/statistics/714172/uk-current-relationship-status-residential-population-by-age-group/) Therefore the product should be for people in a couple.

Notable aspects

The user might buy an extra bluetooth stationary speaker but not use it because it's placed in the living room and therefore can't be used in other rooms. If going around he uses a nomade bluetooth speaker. In the living room music is meant to be listened to or watch a movie when in other rooms it's more for background music.

A good way to answer this problem is to have a system that can be used everywhere. With a Sonos system the user can have more speakers in the living room for watching TV or listening to music but just single speakers in other rooms to have only background music. The problem is that it's expensive because it requires you to always buy extra speakers and they have a fixed cost. Could it be to have a speaker adapted for each room and have some elements with a lower price ?

It is noticed that the way to interact with music is different in each room. The kitchen and the living room are often a shared piece and therefore Hifi speakers placed in the living room could be used to have background music in the kitchen but in other rooms they can't be used.

This leads to an extra question: What is the "sweet" spot when listening to Hifi speakers, are people really considering it when listening to music ? And what about when they watch a movie ?

B/User journey

How are the devices used:

Young adults that care about sounds will in the general way end up with this system and have one hifi (*+ soundbar*) system in the living room and have a nomade bluetooth speaker to carry around the house and use in other rooms. Soundbar not being the number one priority it is usually an add on to an existing system.

Hifi speakers:

They will usually be connected to the TV, the phone and an external sound source. Like a vinyl turntable for exemple, which is becoming more and more common. Active speakers being more convenient it's also more common.

The content the device is playing will be music and sound from TV.

Bluetooth speaker:

The bluetooth speaker is usually only connected to the phone.

It will be used to play music, radio and podcasts.

Evaluation

Profile of the user

- Male
- 25-30 years old
- Couple

It's interesting to see why users are selling their products. In all these cases it's because the product didn't fit in their existing environment or couldn't adapt to it. Rastislav preferred to switch to a brand like Sonos because it offers the possibility to upgrade your system over time and add on some products.

Reflection

If Dynaudio wants to be able to build brand loyalty and make users “stay” it’s necessary to have a system that can be upgraded with new or current Dynaudio products. Therefore once a product is bought instead of selling it to buy a new one users will buy a new Dynaudio product to “complete” their system. It’s also a way to give an impression of modularity and flexibility that a passive sound system can offer (APPENDIX 1 and 10).

The living room is the room with a need for better listening experience, a problem is the “sweet spot”. With most stereo products there will be one sweet spot where the experience is maximal but in the rest of the room it will not be as good. In a further worksheet a research on what is it more precisely and if there is existing technology to counter this effect exists.

Their way to interact with audio products in each room is different in this age segment. Therefore it will be necessary to determine if it can be a system with similar elements or if different products must be developed according to each environment.

Appendix 12: Hifiklubben customers

Objective

What are the customers at Hifi klubben and what products are “a big hit” ?

Experiment / Data

The age of the customers is quite wide, I would say it goes from 20 to 60 years old mainly. They are selling mostly active speakers and the biggest sales are with the Argon audio bookshelf speakers. The customers for this product are mainly students. These same people are also buying more and more turntables, it’s become quite frequent and with it they need stereo.

The bang&olufsen level is not a big hit. We sold quite a lot at the beginning but then the hype went a bit down. They are nice but really expensive. For the same price in terms of sound quality you can get much better. But the design and the convenience are its strengths. The software is really clever. To gain space and have bigger drivers they are slightly inclined. Most customers for these speakers are 40 years old and older.

Evaluation

Hifiklubben have a different target group than Lydspecialisten, they are trying to touch more people. Like in Lydspecialisten the products they sell the most are the cheaper ones. The quality is a bit lower than at Lydspecialisten.

Reflection

The selling channels are really important. And even if a product is lower in quality if the design and the backstory are put forward it can be sold to most people. Most of the people are not super technical when choosing, they are attracted by what the sellers are saying to them and the story around the product. For the argon audio they are really good at explaining what it is and how cheap it is compared to the value of the product and also because it’s their own brand they put it forward and therefore sell it a lot.

The interview with potential user will help to understand where is the attention triggered.

Appendix 13: Collect more data from past projects interview

Objective

The objective is to collect more data from a past master thesis project from AAU students. It will allow me to see if it confirms what I gathered and if it can reveal new aspects. Since it's from another project it's important to be critical of the data and see what points can be valid or not.

Experiment / Data

A/Ambient 1 project context

From Ambient 1 abstract:

This project has been about developing a speaker for newly built houses. The vision for this project was to design a suggestion for a speaker for Dynaudio that can reposition and introduce them on the mainstream market in the future. As technology evolves so do the devices using them. Conventional passive speaker systems aren't as popular as they once were. They are deselected in the favor of soundbars and smaller bluetooth speakers, as these types of speakers require less effort to use and because they are less visible in the interior. By user studies and trend investigation of user demands in regard to sound reproduction, we managed to create a solution space in which our solution was developed.

User investigated

This product is targeting families and parents as main buyers. But in their process they tried to understand different types of users. They have interviewed young adults (25-30) living with a partner in order to understand their way of using music. They have also been working with Dynaudio and specified that the target user from this company is audio enthusiast as mentioned in my research.

B/User interviews

B/1/Male in their 40's

(interesting to see for future comportment of user and how a new Dynaudio product could be adapted along the life of the user)

Common background of the interviewees:

- Both are male house owners in their 40's.
- They both live in the same newly built neighborhood with a wife and two kids each.
- Sonos Bluetooth speakers placed around their houses for music streaming.
- They like the interaction and system that Sonos provides.
- They don't like the aesthetics and space that the Sonos speakers take up.
- Both of them have Sonos as a compromise due to the price and convenience of competing products.

User 1:

Peter, 50 year old

They have a Sonos system (Sonos 5 and Sonos 1) with speakers in the living room and in the bathroom. Kids have a JBL Boombox. He would love to have a surround sound in the living room but it's complicated because it lacks some plugs.

User 2:

Michael, 40 years old

Sonos in all rooms and garage, had started to switch to harman kardons, well satisfied with

functionality of sonos. Think it's design wise boring and boring that it's a bit mainstream. Bit much money to change if it needs to be changed in every room.

1x playbar - 2x sonos play 1 + sub in living room

2x play 1 + sub in kitchen

2x play 1 in garage

Reflection

This joins the interview with Dynaudio (APPENDIX 2). After a certain age when people start to build a family convenience is important, audio enthusiasts that are using passive speakers are mainly single males. When living in a family it's necessary to make compromises and that's a big advantage active speakers offer by having less boxes and cables.

The fact it gets boring after a moment because of the design and mainstream aspects and that it's a lot of money to change everything is interesting. That's where a well thought out design that fits for a specific room comes into play.

It's important to notice that the aim of Ambient 1 project was different and answers are according to a product developed for families. But it reveals that even when they get older the versatility of the product is still interesting for them and the fact that it can be connected in all the house. It's missing some more precise information on the interaction with the product and support used to play it from.

→ For a new Dynaudio product being able to add on in the future is important, in this way people when having more money will keep buying

B/2/Young adults

Søren, 24 years old

Common Content

- Background music if we do something together:
- Running automatic playlists from Spotify - chill playlist

- If one is started on something the music stays if the other joins
- Shared music is if kitchen on bluetooth speaker via phone and otherwise the stereo in the living room
- Eat at coffee table, and watch some shared TV - shared TV show (something simple ala masterchef), opt out
- content you have to keep up with
- When both are home, most things are done together

Individual Content

- If one has to do something by themselves, it's the person who encapsulates themselves with headphones.
- If nails are being done, it is done but content from the TV and the partner has the option to isolate themselves from it.

Lars, 26 years old

Common Content

- For fun and atmosphere. Cooking together and listening to music -> top 50 or boyfriend chooses
- Watching TV while eating -> shared series.

Individual Content

- Watch youtube tutorials on computer -> in living room with computer sound while boyfriend sleeps
- Watching youtube tutorials on computer -> office with headphones so as not to bother or be bothered by boyfriend
- Girlfriend sits in living room with computer playing music
- System is not plugged in so that the bass does not bother others
- Finds personal content if he cooks himself.
- One sleeps and the other reads on mobile, or watches shows with sound from tablet → Background noise helps the other person to fall asleep.

Frederik, 24 years old

Common Content

- Watching news on TV, with sound from speaker
- If both are reading, music is playing in the background from a phone or computer -> don't bother to spend time setting it up.
- Eats with evening news from TV -> background noise
- Sitting together watching a movie or a shared series.

Individual content

- Sitting and reading with music from a phone and computer - random music or radio

- Watch youtube in bed separately in bed and watch interest videos, from phone with sound but low so as not to disturb the other.
- Plays console on TV turns down console and plays music together so both can be there and boyfriend can read.

Alexander, 24 years old

Common Content

- Watching reality together while eating → fun to set the mood (smartphone + TV + stationary speaker)
- Continue with some reality afterwards
- Streaming from phone despite having a smart TV

Individual content

- Social media while eating
- Streams music with headphones in fitness → premade or own HBO, netflix, viaplay & tv2 play
- In the evening gets split up one on computer and one on ipad
- Girlfriend watches TV with speakers on.
- Twitch stream computer headphones in computer
- Turns it on speaker when he's home alone
- Listening to music on a bluetooth speaker in the bathroom.
- Boyfriend streams TV on the ipad in bed, He streams twitch on ipad audio from the ipad
- If boyfriend is cooking or doing other things, series may be playing -> Background noise

Anders, 26 years old

Common Content

- Hear jazz with breakfast at the weekend
- Watching movies/series together
- The speaker in the living room is used for eating or cleaning - background noise. (smartphone + stationary bluetooth speaker)

Individual content

- Watching series or movies on TV in the morning while home alone -> background noise
- Listening to podcasts for school/work - at school it's spotify
- Boyfriend watches youtube on phone while watching shared movies and series on TV
- Watching a series by himself while cooking -> boyfriend listens to music if cooking by himself.
- Boyfriend watches youtube in bed occasionally, he reads or goes to bed.
- If focus is needed headphones are put on
- If one watches movies and the other cooks the door is closed in between
- Music in the kitchen is on a small bluetooth speaker

- Music in the living room is on a larger bluetooth

Janne, 26 years old

Common Content

- Puts radio on bluetooth speaker from phone and takes it around
- First man in the kitchen puts on shared music for cooking
- Watch TV while eating -> indifferent TV
- Watching common series, movie or serial or playing console together half half whether they happen together or whether they go each to their own.
- Watch series together on ipad in bedroom

Individual Content

- Girlfriend watches youtube in bed in the morning
- Turns on flow TV in the afternoon, as background noise → TV speaker
- Boyfriend plays computer in bedroom with headset
- Girlfriend watches youtube before bed - she sleeps - he gets headset out if she complains

Jonas, 26 years old

Common Content

- Shared 50/50 music while cooking.
- Silence while eating
- Watching shows after dinner in the room sometimes separately.

Individual Content

- Watch TV on computer with sound from computer - either in living room (if alone) or in room
- Meditates with noise reduction headset from phone.
- Plays drums (living room) with two headsets on → one for music from phone and one for drums.
- Puts music on when cooking, either on stereo in kitchen (fixed speaker) or headset (if there in the living room)
- Headset with streaming when cleaning
- Podcast in headphones from phone → active listening in kitchen if necessary
- Can see each other's stuff on each other's computers

Sound output	Bedroom	Bathroom	Kitchen	Living room
PC/Ipad/Phone	IIII			II
Nomade bluetooth speaker	I	II	IIII	

Stationary bluetooth speaker				II
Hifi			I	IIII
TV				IIII

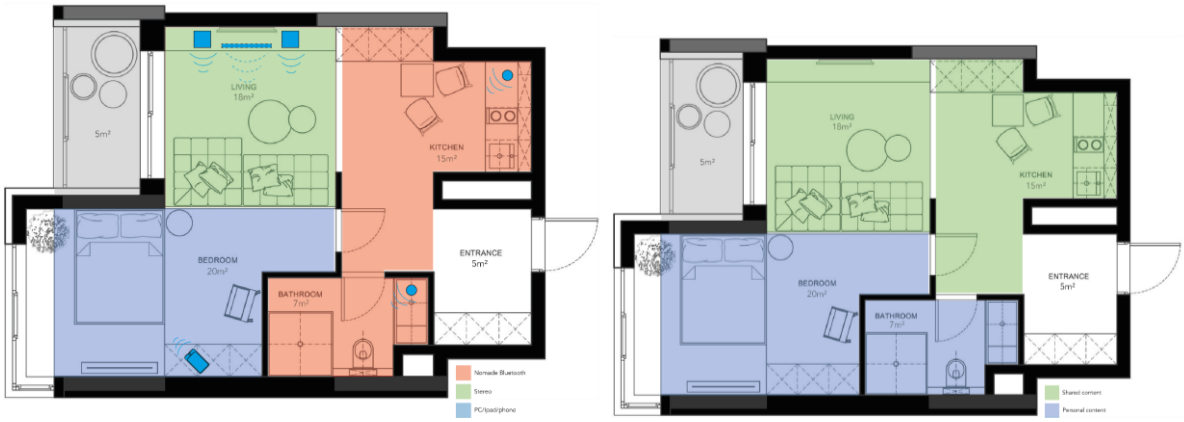
In the Bathroom and the Kitchen bluetooth speakers are the most used and usually are mentioned for background music.

In the living room it's mainly for listening to music or listening to TV. Or the speakers are connected to TV and therefore the user is searching for a better sound quality.

In the Bedroom it's usually used as a background noise and mainly on the PC/Ipad/Phone because it's when users go to bed and they don't want to bother the other one by using a speaker. They also don't want to spend time setting up the sound output used in the living room and mainly for background noise.

These results confirm the following representation:

We can also make a plan according to the most used device in each room of the house according to the results from interviews from Ambient 1, same for shared and personal content:



Reflection

These interviews enlightened a general tendency on how young adults are interacting with audio media in general in function of the room.

Bedroom, Bathroom and Kitchen are usually for background content and Living Room for listening to the content and a need for better audio quality. In the bedroom the speakers from the source are used when in the bathroom/kitchen it will be a nomad speaker and in the living room it is stereo speakers or the TV directly. The content is usually shared in the living room and in the kitchen when in the bedroom and bathroom it's often more personal content.

→ How is the sound of TV and the rise of sales in soundbars need to be studied in a worksheet.

These interviews were useful to have a better picture on how the devices are used in every room and where couples are sharing or not the content.

Evaluation

Both interviews showed interesting data from users in different age segments. There is a neat difference in how it is used. Young people tend to have a fixed system in the living room and a nomade speaker to be used in the other rooms. When adults living in a family environment will invest more money in a system that can work together all around the house.

It's important to note that for the family users they focused on Sonos users. Therefore it might not be accurate for all families. But when relating to other users (APPENDIX 11 and APPENDIX 17) it shows that a complete system you can evolve with and add elements over time is a good way to build customer loyalty and have them build fidelity over your products.

Reflection

Therefore one requirement arised: It should be possible to upgrade your system in order to provide a way to display sound around your house or have a better sound system in one room.

But to keep the user interested in the product for a long time the product should offer some kind of customization/evolutions. For example one of the Sonos users bought everything he could from this brand but because it's "boring design wise" the user is now trying to change. The user should feel like it has the hand on the product. (A good example is the iphone, you have the end on customizing the interface and all kinds of functionality to make it exclusive to yourself, we will see how this can be done with different brands in the audio industry in a new worksheet).

Regarding young adults this worksheet displayed facts and use cases but not a really deep understanding of the problem the user can face while using these products. For a better problem definition one user should be followed in his daily routine and some problem will be identified in a new worksheet.

Appendix14: Make an user scenario

Objective

Make an user scenario with precise action of the potential user with a precise profile. This will help to know what functions the product must include and how the user will interact with it.

Experiment / Data

A/Daniel profile

Daniel is 25 years and done with a bachelor in journalistic studies. He is a young adult that starts to settle down. He has a job as a journalist and is paid 27.000 dkk/month. He has lived with his girlfriend for 3 years in the same apartment in Aarhus, together the total amount of income represents 60.000 dkk/month, she is also working as a journalist. Since they started their new jobs they earn around 5 times more money than when living on SU.

As soon as they started to earn more money they spent most of their money on home equipment for a better comfort of living. They bought a TV, a couch, a coffee table, a coffee machine and talked about buying a new speaker because the battery of their current speaker is dying.

When they buy an important product (electronic, couch, coffee machine) they want a new one because they don't know how it was used by the previous user if it's a second hand product. Now that they can afford it they want to invest in a product that lasts long, therefore it will be cheaper in the long run. They try to create a new nordic atmosphere in their apartment, when buying something it's important that it fits in the room. They first look at the colors, the aesthetic and then the price. For them confort is to have beautiful things to look at.

B/A normal day in the life of Daniel

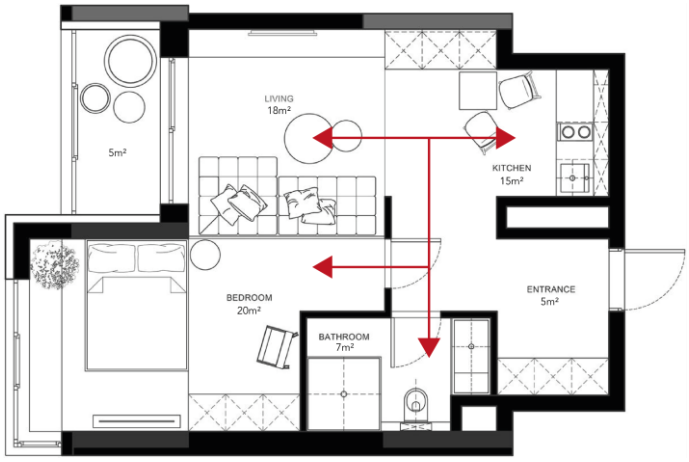
→ Wake up in the morning

- Go to the bathroom
- Make coffee, radio playing on bluetooth speaker
- Take breakfast, radio playing
- Get ready for the day in the bathroom, radio playing
- Dressup, radio playing
- Pack his bag
- Go to work, listen to music on the way

→ Come back from work

- Unpack his bag
- Order his stuffs in the closet
- Go running or some kind of activity
- Shower, play music on bluetooth speaker

- Watch TV or read a book, Sound of the TV on
- Cook, play music on the bluetooth speaker
- Eat
- Watch TV or read a book, Sound of the TV on
- Get ready to sleep
- Sleep



He is then moving around and using the speaker in different rooms.

C/Home environment and decoration of Daniel and Amanda

D/Classic danish new nordic style living rooms




E/Common piece of furnitures/decoration found in this environment




M

F/What does it mean for the design ?

The pictures collected can give a better idea of possibilities in terms of materials, colors and shapes.

Materials:

- Wood
- Stainless steel
- brushed brass could fit in too
- Fabric (e.g. Hallingdal fabric from kvadrat)

Colors:

- Natural wood
- Light brown
- Off-white
- Beige
- Black
- Could be declined in a version with something more colorful like blue or green for example. We can see that it is used in some living room to break the the colors and bring some detailing.

Shapes:

- The shape can be diverse, it shouldn't be too edgy. Having some rounded shapes will fit better.
- Can play on the shapes with a combination of materials.

G/Concurrent, what's on the market ?





https://www.google.com/url?sa=i&url=https%3A%2F%2Fav-viborg.dk%2Fvare%2Fbeolit-20-grey-mist%2F&psig=AOvVaw2zZTlw-aUCmdrBXVS9mcMC&ust=1677594207413000&source=images&cd=vfe&ved=0CBEQjhxqFwoTCKig14H5tf0CFQAAAAAdAAAAABAD

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.hifiklubben.dk%2Fargon-audio-forte-a5-traadloes-hoejtaler-med-bluetooth%2Fargfortea5wh%2F&psig=AOvVaw3OWKe8eOG5f8KLK4lnmlh5&ust=1677594373929000&source=images&cd=vfe&ved=0CBEQjhxqFwoTCNiE_Pb4tf0CFQAAAAAdAAAAABAD

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.hifiklubben.dk%2Fsonos-one-gen-2-traadloes-hoejtaler%2Fsononeg2bk%2F&psig=AOvVaw0zryO9UgKTA9CFmmn2pubz&ust=1677594435554000&source=images&cd=vfe&ved=0CBEQjhxqFwoTCIjP9u74tf0CFQAAAAAdAAAAABAD

https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.t3.com%2Freviews%2Faudio-pro-c5-mk-ii-review&psig=AOvVaw17ff53-cXMTfvr_0JXhi4X&ust=1677594515789000&source=images&cd=vfe&ved=0CBEQjhxqFwoTCMi20tr4tf0CFQAAAAAdAAAAABAD

https://www.urbanoutfitters.com/shop/marshall-stanmore-ii-bluetooth-speaker?color=001&type=REGULAR&size=ONE%20SIZE&quantity=1

Evaluation

This worksheet summarizes the different findings regarding the environment of the speaker. It will give some keys regarding the drawing and the design.

Reflection

The next step is to draw some concepts.

Appendix 14 bis: Review the detailed user journey

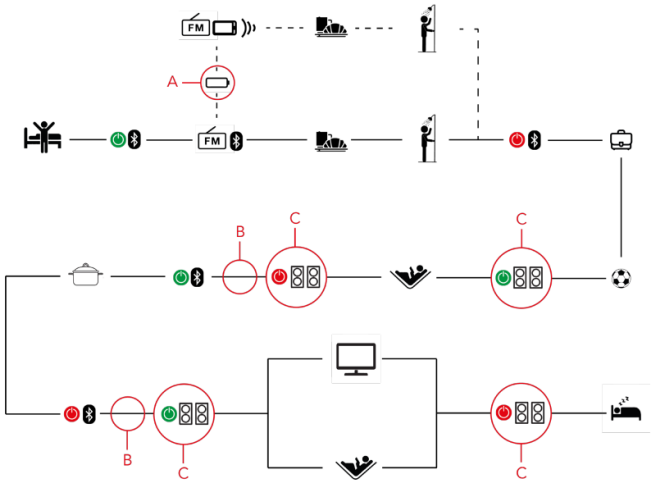
Objective

The objective of this activity is to go back to the user journey and make a detailed one for each problem. This will allow us to identify more precise user needs and justify better the choice of direction for the selected problem.

Experiment / Data

A/Overall user journey

In the APPENDIX 72 a visual user journey is made and in the APPENDIX 73 3 problems are identified. The current user journey is as follow:



A. Forget to charge the battery.

B. Bad interaction between bluetooth on the stereo and on the portable speaker.

C. Difficult to use direct controls of the stereo.

This mapping is the correlated result of some user shadowing and some interviews. The results are put together into a short text simulating a normal day in a young audiophile adult life. It is then illustrated for a better visualization. 3 potential problems are identified:

A.Forget to charge the battery

B.Bad interaction between bluetooth on the stereo and on the portable speaker

C.Difficult to use the direct controls of the stereo

These 3 problems are taken, for more precise information a scenario will be made for each one of these problems.

B/ A.Forget to charge the battery

insights: The user is using the bluetooth speaker at 2 different times in a typical day, when waking up and when cooking in the evening. When the user wakes up it happens that the bluetooth speaker is out of battery because he forgot to charge it. When the speaker is out of battery the user has to charge it but it requires a certain amount of time before being able to play (20min with the official Ultimate ears charger/40min with a regular charger). Since he is in a hurry in the morning he will

usually not wait for it to have battery again and simply use the speaker on his phone making it difficult to hear the radio.

scenario:

1.The speaker is out of battery, red light blinking and a voice:"speaker is out of battery, wait for it to charge"	**2.**Plug the cable in the back, white light pulsating meaning the speaker is charging	**3.**Wait for ~20 min before being able to use the speaker. Press on/off button red light is not blinking anymore and no voice alert meaning it can be used.	**4.**Takes up to 2.5h for the speaker to be fully charged. The red light turns into a white one.
			
Note: The user says that if he wakes up in the morning and he sees that the speaker is out of battery he will not wait for it to be charged. He would rather use the speaker from the phone or his earpods. If he is in a hurry he won't even take the time to plug the speaker and charge for later in the evening. He would rather do it when coming back home from work. If the battery level drops there is an audio signal indicating it, this is important if the user is in another room or doesn't look at the speaker.			

identified needs:

- An audiovisual signal indicating the battery level
- The speaker works as soon as it's plugged in
- Remind the user to charge the speaker

C/ B.Bad interaction between bluetooth on the stereo and on the portable speaker

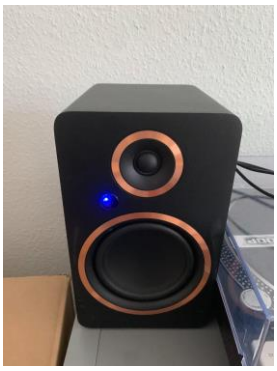
insights: When switching from one device to the other (bluetooth speaker and stereo) the user can experience some interferences. This happen in different ways:

- From the bt speaker to the stereo → works fine with remote control/doesn't work with back panel
- From the stereo to the bt speaker → interferences even when stereo is off resulting in having to unplug it
- When turning on the bt speaker the stereo will detect the bluetooth signal and turn on automatically resulting in the sound being played from the stereo. To avoid that the user has to unplug its stereo set. → work in the same way as the stereo to the bt speaker (also not working with airplay, it always switch back to the stereo)

The workflow is bad and results in a bad user experience, therefore the user will limit the use of one of the devices. In this case the user is almost never using its bluetooth speaker.

<u>scenario (pictures):</u>

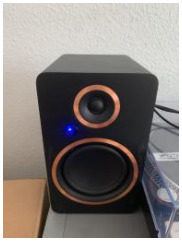
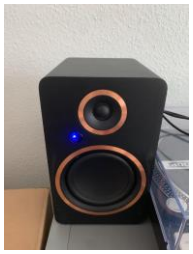
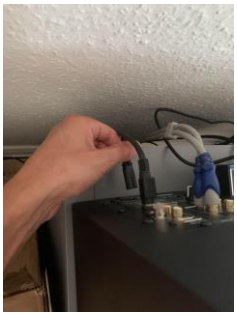
From the bt speaker to the stereo

1.The bt speaker is turned on and the music is playing	**2.**The stereo speakers are turned off	**3.**The user use the remote control to turn the speaker on	**4.**The user use the remote control to switch the bluetooth on
			
Note: The stereo speaker takes the "advantage" over the bt speaker, meaning that when the user turns the bt on on the stereo it will switch automatically. Therefore there is no real problem noted.			

From the stereo to the bt speaker/Turning on the bt speaker while stereo is off

remark: in these cases it works the same way, before turning on the bt speaker it is seen that the user will first turn the stereo off and therefore end-up in the same scenario.

1.Stereo on with bluetooth on	**2.**Turn the stereo off	**3.**Turn the bt speaker on	**4.**Start to play music on a smartphone connected to the bt speaker

			
5.When pressing play on the smartphone bt is turned on and music plays from the stereo	**6.**To make sure it's not interfering the user has to unplug the stereo speakers	**7.**User connects the smartphone to the bt speaker again	
			
Note: In the other case scenario the stereo taking the "advantage" over the bt is not a problem but in this case it will result in a bad user experience and interaction with the products.			

identified needs:

- Avoid interferences between the different devices
- The stereo shouldn't always activate as a primary device when a bluetooth signal is detected.

D/ C.Difficult to use the direct controls of the stereo

insights: Sometimes the user will use the direct control on the stereo speakers. It can be because the remote control is far away or because it is lost.

- The remote control is far away
- The user lost the remote control

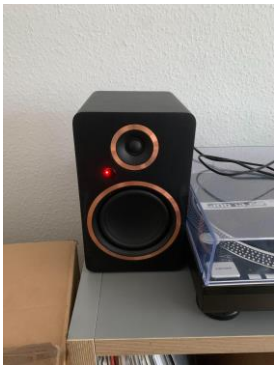
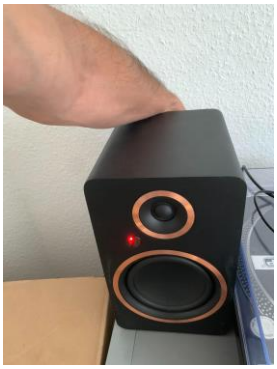
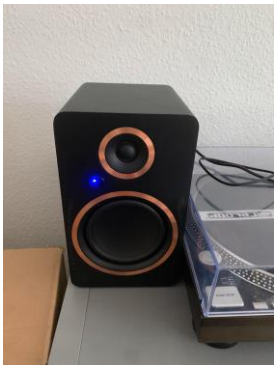
scenario:

With the remote control

1.Stereo is off, the user grabs the remote	**2.**The user can press the "BT" button directly

control.	and the speaker switches on bluetooth.
	
Note: With the remote control it is extremely easy for the user to control the speakers and select the desired channel. There is no real problem observed. But the user thinks that the remote control is annoying because he is always searching for it. He says that his smartphone is always with him and that a solution for better control directly from the smartphone could be better.	

Without the remote control

1.The speaker is off	**2.**The user has to access the back panel of the speaker	**3.**The user needs to look at the back to find the control button. Press 3 seconds and the speaker is on.	**4.**To find the bluetooth channel the user needs to press on the button without holding position until the light is blue.
			
Note: This is not practical for the user, when the remote control is far away (or if it's lost) the user is struggling with the controls. The experience was bad.			

<u>identified needs:</u>

- A solution for controlling the device from a smartphone
- Easy access to the direct control on the speaker

Evaluation

This activity enlightened several problems the user can face while having a set of stereo speakers and a bluetooth speaker. Thanks to this several user needs are seen:

- An audiovisual signal indicating the battery level
- The speaker works as soon as it's plugged in
- Remind the user to charge the speaker
- Avoid interferences between the different devices
- The stereo shouldn't always activate as a primary device when a bluetooth signal is detected.
- A solution for controlling the device from a smartphone
- Easy access to the direct control on the speaker

Reflection

To prepare the next round of concept it will first be necessary to have a look at all the user needs already identified. A classification should be made according to the different areas of differentiations. This will allow the designer to better prepare the next round of sketching for new concept development.

Appendix 15: Preparation for the milestone 2

Objective

Gather the content for milestone number 2 in order to prepare the presentation. Presentation should be 4 min long with 6 min for feedback.

Experiment / Data

A/Changement in Dynaudio portfolio

The music line entry models are now discontinued

Music 5

Music 3

Music 1

2.699dkk to 5.999dkk

- They love the product in the company
- Objective was to touch a larger audience but they didn't succeed
- Wrong sale channels (only via specialized audio shops)
- Wrong user analysis

→ Fit with the targeted user

→ Advantage: they already have the knowledge and suppliers to build nomade speakers

B/ User identification

Deeper focus on young adults settling down (25-30):

- Done studying
- Go from living on SU to first real salary
- Suddenly start buying more expensive products on a whim
- But want the product to last long
- They are the one who stream the most (audio/video combined) (DR medieforskning 2022)

E/Materials and colors

should fit in

think about how it will fit in the room in term of colors aesthetic and price after (Daniel + Survey)

Evaluation

It's necessary to align myself better between the market and the company. As it is right now I'm focusing too much on the company and trying to design a product for Dynaudio but not for the market. The result is that I'm taking a lot of trends into account when thinking about the product. In the end that might not end up being an innovation. To answer this problem I should go back to the

user research and try to reframe and show a more detailed analysis of the user. And talk more into user needs rather than company needs. Who am I providing value to ? The user or the company, it should be the user. To develop the product it's better to focus on a really specific user and then enlarge. That was not specific enough. The user should be a young adult that is done studying and have a passion for music and audio products rather than all the young adults. This will give a more detailed profile to look at and have a product answering a more specific problem. Lot of young adults are for example buying more and more vinyl turntables, that could be one user for example. (an idea to find someone would be to search on "market place" for people selling vinyl turntables). In my different concepts the concept 1 and 2 for example are really different and don't answer the same problem. This comes from a problem from the user not specified enough. It's necessary to find what difference I can create from other audio products. For example I should try to see how Sonos and Jawbone made a breakthrough in the market:

- jawbone speaker modularity (https://fuseproject.com/)
- Sonos
    - Who are they providing value to ?
    - How did they positioned themselves on the market when it went out and what are their positions now ?
    - Link it to the user now and in 5 years.

It will help me to understand how to position myself. I need to try identifying how my value proposition will hold in 5 years from now and how I can overcome just being a trend. One way to see that better could be to make a scenario for someone that is 25 years and using this speaker. How do they use it when they are 30 ?... Once I get some answers and needs I can map them together. This might help to find gaps and future proof strategies. How can the product evolve or be used along time life ? One example could be the emotional attachment. Could it also be linked to other Dynaudio products for example ? By identifying how people are using speakers at 25, 30,... it's possible to have a better idea on how the people will behave in 5 years from now and therefore give them a product that can evolve along that.

Reflection

This milestone enlightened a lot of points to have a better vision on a potential product. In order to get more knowledge and have a strong analysis different worksheets will be made:

- A worksheet with a deeper analysis on the user at different ages. (25-30-35 years old). This requires precise user journeys and actions in the day to see how they use it.
- A worksheet with the analysis on different audio products to understand better their breakthrough will be made. The product analyzed will be Sonos, Jawbone and re-use the analysis on KEF speakers and see how they used the trend. Will the product still be sold in 5 years ?
- A worksheet using the information from both of these worksheets to cross the information and enlight use at different ages and make an hypothesis on how a product can evolve or be used along a lifetime.

Appendix 16: Meeting with Dynaudio 01/03/23

Objective

Talk about the milestone and the last findings in order to evaluate the advancement of the project.

Experiment / Data

Presentation of the last results from the milestone: (see worksheet 20)

Design for a trend can be dangerous because it can easily get outdated and not be bought after several years of production. Developing a good product architecture can be a way to change some elements easily. (Look at Poul's course on product architecture). But in trends some elements stay the same. In Danish furniture design for example a lot of products are constantly re-used and designs are re-made (by changing the color). A way to go around trendy aspects can be to identify some products and materials that stay the same in the new nordic environment (Chairs, lamps… are good examples). It's necessary to be aware of which elements are trend based. It can be easier to adapt a classic to a new trend rather than making a classic that will last. Styles in the interior can be very blended because everyone tries to adapt to their own wish and styles, a good product architecture could answer this problem.

It's necessary to be really sharp on defining the target audience, the music lover audience could be aiming for the same product as a larger audience. Therefore refining and looking more into music lovers can be a good way to reduce the user span and diversify for more people afterwards. If the product architecture is good the cost can be reduced and components adapted. When taking a user case scenario and defining the user it's necessary to define if it will be men or women, if it's both. Do they have children, and if yes, when ?. How big is the space they interact with? It's needed to go back to the user journey and maybe clear out a bit the requirements and define precisely what is the use case ?

When talking about the breakthrough of some brands like sonos it's important to also take in consideration the actual market and technology, when for example Sonos arrived on the market they were on of the first brand to offer such an easy to use interface and their success is due to that and because they were some of the first wifi speakers.

For Dynaudio the sound quality can be compromised but not too much, they are not aiming to be a budget brand. When they did the Music range the fabric in front of the drivers was seen as "a crime" because it reduced the sound quality but they needed to adapt to the kind of customer. But it still feels like buying hifi equipment and this aspect is important for them.

It's always nice to look at new potential technology, it can give ideas or a way to "work around" the intended idea but by using simpler objects. For example when doing the thesis "Ambient 1" they looked at how the sound can be divided in the same cinema room so people could listen to the same movie but in different languages.

Today the rate from wifi routers might evolve and diffuse at a higher rate. Today it's on 2.4 and 5 gHz. Some of the new speakers are operating at 6gHz and people are afraid that it could create an interference.

https://system-audio.com/here-is-the-wireless-technology-youve-been-looking-for/

https://www.wired.com/story/what-is-wi-fi-6e/

2 important points arised from the talk and the milestone:

- Speaker to be used in all the house
- Should see in the future and could be upgradable

Don't be stuck on the fact that the speaker should be transportable, it's meant to be used in the house. It could be a product range and that is nice for Dynaudio because it means we can sell more products for different applications. It's important to keep in mind to investigate different things. Designing a product to cover every part of the house can be risky because the product could be developed to be used in the bathroom for example but in the end people would use it more in the living room.

Evaluation

To go further and find a better angle the use case should be refined and more sharp. This will allow development for a certain type of person. If the product has a good product architecture it's easy to widen the range and make one for older people or other users. It allows to have a product that will not be obsolete quickly and also an easier evolution in the future.

The user case might be more precise but it doesn't mean that the design requirements should be developed for every kind of use. If it's too wide the risk is to forget some essential elements for the main user.

Taking upcoming technologies in consideration is also a way to see in the future and have a product that can be adapted to them in the future.

Reflection

This talk confirmed some elements discussed in the milestone and that some future worksheet should be related to that.

- Worksheet on the user must be more sharp and therefore remade.

New worksheets should be made:

- A worksheet with upcoming technology that can be interesting to consider.
- A worksheet that intends to correlate How a good product architecture can be a way to overtake obsolescence in terms of technology and trends. To do so, worksheets on technology might be used and identify elements of a trend that stay the same or how they can be adapted to a trend. (WS 13 and Poul's course on product architecture will be used).

Appendix 17: User group analysis and understanding

Objective

The objective is to understand the group of users better (25 and +). It will help to identify some problems and give a user-centered approach. The research will be made thanks to the results already obtained from interviews with Lydspecialisten and the survey.

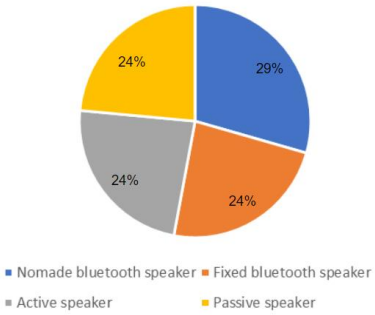
Audio groups on facebook will also be a way to get answers from people that might have problems with their speakers and also help to give a better context and persona.

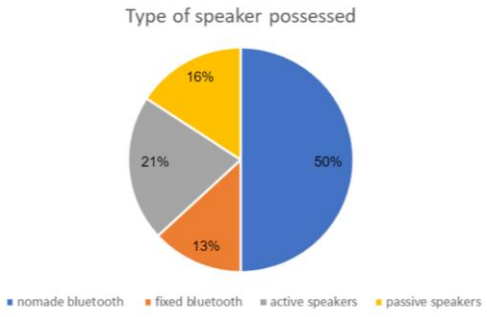
Experiment / Data

A/Useful data from the survey

Total amount of respondent = 31

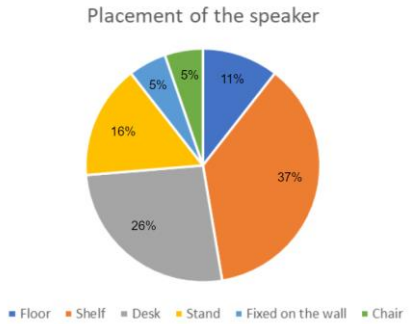
+ 25 years old amount of respondent = 12



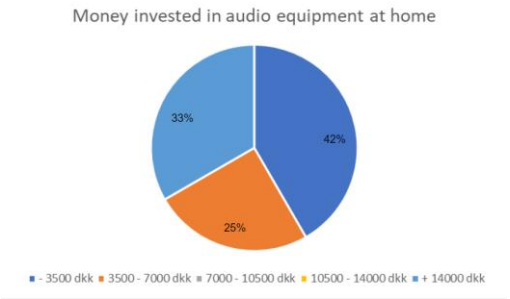


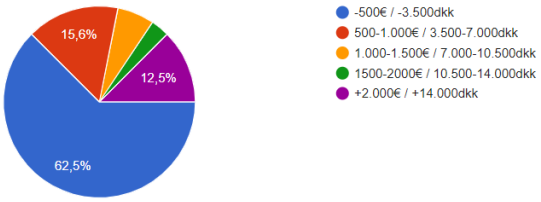
\+ 25 years old - 25 years old

We can see that after 25 years the ways of consumption are changing. Less people possess a bluetooth speaker and "fixed" speakers represent 71% in total against 50% for the -25 years old.



Dynaudio is interested in the placement of the speaker, they want to know more about it. When a speaker is on a stand it sounds better but most people are just placing them directly on the support. Only 16% are using a stand.





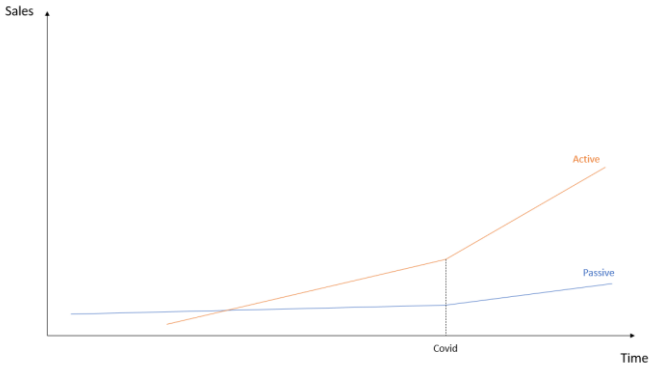
In the group of people that are +25 years old we can also see a neat increase in the money invested in audio equipment. 58% invested more than 3500 dkk when it was 37,5% of the whole population.

Problem identified by +25 years old:

- No volume knob on the back of active speakers is ridiculous
- Easier accessibility for adjusting the volume
- Nice to have the speaker on wifi because can be turned on directly from the phone, doesn't have to do turn the speaker on before and then use it more
- Bad sound quality
- Aesthetic
- Distortion at high volume

<u>B/Useful data from interview with Lydspecialisten</u>

Since Corona the sales are increasing for higher quality audio equipment (both active and passive) but with a faster growth for active speakers. Can be represented in a graph:



Sales for "entry" products are online. People that come in the shop usually want to try out expensive equipment. It's mostly for passive audio equipment.

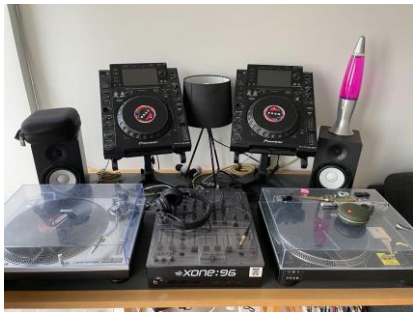
Since Covid sales are more and more online.

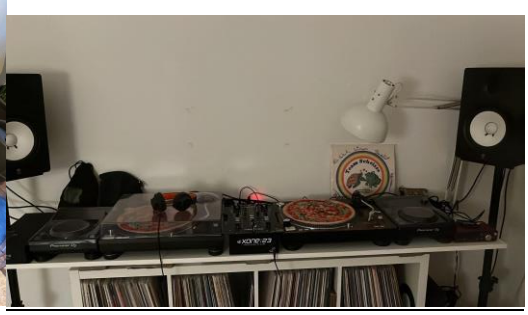
Active speakers are growing because it's more convenient and audio fans are also buying more and more active speakers. (can be linked to what Dynaudio says about the user group and people buying passive are usually single men, passive more convenient in a family context).

Biggest sales were made with the KEF LSX:

Price is affordable and they are quite trendy in Copenhagen mainly thanks to the design.

C/Pictures from users





In the first picture we can see that the placement is quite random. For pictures 2 and 3 even if these people are DJs and care about sound they are not using stands or any support to optimize the sound or the angle of the speaker. Only in the last picture the user is concerned about it.

Here the speaker is just placed on a shelf next to the bed. The user said "I'm not using it inside because it's too loud for my roomates, I'm only taking it out in the summer for barbecues"

It's interesting to not that even if it's not a really flexible system it's taken out in the summer. For the rest of the time he is using a small bluetooth speaker. The investment in both could be the same as one speaker that can do both things. How to touch this kind of people ?

D/Facebook questions

Hi, I'm doing my master thesis within the speaker industry. I'm interested in smaller speakers, bookshelf speakers, soundbars, and fixed bluetooth speakers. If some of you would be interested to answer a few questions and send it to me in a private message or by commenting on the post that would be awesome !

- *If you have one of these kind speakers, in which room are they placed ? And on what (directly on the ground, a shelf, a stand made for it…) ? (Don't hesitate to send a picture of your set-up and the room they are placed in 🤓)*
- *What are the main problems you encounter (technical and placement problems) ?*
- *If you move around the house or another room, would you let them on, turn off or use a nomade bluetooth speaker ?*

Sorry if it's not an usual post, and thank you in advance for your answers !

Sauvan Pannetier (25 years old)

If you have one of these kind speakers, in which room are they placed ? And on what (directly on the ground, a shelf, a stand made for it…) ? (Don't hesitate to send a picture of your set-up and the room they are placed in 🤓)

Placed in the living room. Floor speaker so directly on the floor.

What are the main problems you encounter (technical and placement problems) ?

No stereo, only one speaker. Therefore the sound is only on one side when eating. Still a big unit so I think that the neighbors can hear it. It works only with a jack, there is no bluetooth (or any wireless connection), that would be really nice.

If you move around the house or another room, would you let them on, turn off or use a nomade bluetooth speaker ?

He would let it on and keep listening to the speaker.

Gerald McMullon

Hi, I have been using active speakers since 1980.

If you have one of these kind speakers, in which room are they placed ? And on what (directly on the ground, a shelf, a stand made for it…) ? (Don't hesitate to send a picture of your set-up and the room they are placed in 🤓)

1980 Pair of Meridian M1 floor standing speakers.

1996 Pair of Bose Videomate powered speakers to use with a computer

2012 B&W PV1 active subwoofer (used three pairs of JR149 for five channel)

2013 added a pair of Meridian D600 floor standing speakers to use as rear speakers, a Meridian M60C for center channel with the M1 and PV1.

2014 added a spare pair of Meridian D600.

2017 Pair of Devialet Phantom Gold speakers on stands

2022 Pair of B&O Beosound Emerge and B&O Beosound Level Speakers. Bookshelf table top speakers.

I have done a lot of research in order to replace my 1980/89 equipment not to improve sound but to avoid the maintenance costs.

What are the main problems you encounter (technical and placement problems) ?

My source is the computer. I originally used a 6 channel USB external sound card but it started to have issues including the chip not supported with Windows. I now have a HDMI debedder to get 8 channels of analogue line level audio out. I have not AV receiver so some of those features (DSP, room correction are absent). The B&O Mozart speakers have a 330ms latency issue. Apple computers, iPhone, iPad users do not have this problem using Airplay. Windows and Android have no solution and work arounds need 2 seconds adjustment and reset at the end of every film watched. Wireless DSP steaming active speakers only sometimes work with computers or televisions and seldom scale up to surround sound systems. Analogue only active speakers don't have this issue. Many speakers that are powered (amp in one cabinet) have passive crossovers and are called active but have no active crossover.

The B&O Level crashes. Like a bad computer. Often. Too often. I have to take the 12 screws out of the battery as the reset button does nothing. With the Emerge unplug from the mains works.

If you move around the house or another room, would you let them on, turn off or use a nomade bluetooth speaker ?

I have the centre channel always on. The sub powers down with no signal. I would usually leave the main stereo speakers playing or powered and silent when working in the kitchen or another room. The B&O speakers are voice activated and left on standby if not in use.

Conclusion

Answers from Gerald shows that over the past few years there is a real change in the speaker industry and even active speakers. He is passionate about it but he is still changing his vision. He

stated that to replace his old speakers he wanted “not to improve sound but improve maintenance”. Extra questions to better understand his position are asked:

- *For you, what is the main advantage of active speakers ?*
  Active crossover and the amplifier and speakers designed together to be the most effective. I have the Bose powered speakers amp in one box but both speakers have passive crossovers. Less boxes and less cables but half way design. The active Meridian speakers have amps for each driver and an active crossover. The sound for the majority of sources was better in the A/b testing I did. Now the steaming DSP active speakers pack everything into one pair. It reduces choice - the failure to get the right match. I took my turntable amp and speakers to "upgrade" My amp and speakers were excellent. Punched well above their price but were not a good match. Amp needed for efficient speakers and the speakers a more capable amplifier. For no difference in cost a better combination or match would have been a great deal better.

- *I can see that you bought Devialet and B&O speakers, what attracted you to these products ?*
  When the Phantom Gold came out the YouTube reviews were glowing. These are very impressive life style speakers. My daughter listed Bluetooth speakers at the top of her list and the Phantom Gold are indeed the best Bluetooth speaker you can by. However she never switched them on. Refused to take with her to university or explain why. She has also lost a pair of B&O earphones, Sony Bluetooth earphones, run her chair over several earphones and left a mobile phone in the back hedge for a year! No idea why. The last pair to be destroyed where the AKG Y20. My AKG K240 were given to me in 1978 and are near mint but have had the ear cups refoamed. I don't understand but there it is

  The Devialet Phantoms were full of software bugs. The software on the PC would not scale so on laptops and tablets the words would wrap over each other and disappear. IT would loose optical wireless connections and lip synch on movies was terrible. They fixed the software by blocking it. You can not control the phantoms from a desktop computer. You need a mobile phone. uPnP works from a PC but it was possible to select a PC directory as a drive and play the music. You can not do that. They make it for iPhone users and iPad. Streaming services have been removed but the software is more stable, less disconnections but users still have issues with pairing over wifi. They promised multi-room and multi-channel and then said it is not possible. They do have custom speakers using Ethernet and Danty with ROON for surround. 14000 EURO for Phantom II (the little speakers) in a 5.5 surround.

  B&O Mozart speakers have a module of electronics that can be removed and replaced. Updates are part of the design. Steaming DSP active speakers. For the tiny size of the box they deliver more bass and a greater range than boxes double the volume. There is room correction. However the latency is 330ms and when using Airplay from a PC or laptop you have to dial in a 2 second delay. Unlike Apple iPhone which automatically does this correctly the PC needs to be reset after each movie played. DNLA from a PC using Windows Media player is limited in file formats. Over wifi is clear much better than the same file played over Bluetooth. B&O promised a surround sound system L/R centre from a TV 18 months ago but this will not happen. Casting from a PC often fails to find the speakers. The speakers can't find the DNLA servers. It is not just B&O problem as Microsoft kill connection with new

software updates. I have to reinstall software to keep connection to other Windows PCs and even with the same software and versions on each they see and don't see each other the same way. So the B&O Emerge and Level are incredibly good devices. Whilst not £6000 floor standing speakers will stand in for them and free up lots of space. Being able to pair and unpair quickly pick up a Level and move it on battery power to the workshop or garden for 16 hours listening to internet radio or wifi playback of a music library bring back into the room, pair up and watch YouTube (if you have a Mac Airplay or Apple 4K TV) but no so far as surround. Under software you could assign the speakers front or rear. You could add centre and bass (a Balance for example) and have a £6000 steaming wireless DSP active surround system and not need £23000 for Beolab 28 and Beosound Theater and Beolab 19 sub. But at least WiSA systems do work from video sources.

- *When talking about avoiding maintenance costs, what kind of maintenance and cost are you talking about ?*

  My Meridian speakers I bought in 1980. The D600 are from 1989. 30 and 40 year systems break down and in recent years often. Finding a repair center to take on old equipment is difficult. They have long lead times to repair. My Meridian MCA was £600 and failed next time I powered it up. It has been in the workshop for 4 years. The M1 was returned to me after 6 months with no fault. I found another place who charged £800 and fixed the speaker (also recapped). So getting something under 7 years olds avoids the high and problems to get old equipment repaired

  I seek to find an acceptable modern system but prices of hi-fi are several times inflation. e.g. the £1500 for the M1 would be in 43 years about 4x2 x or some £6000 for the speakers. Meridina DSP 5200 their cheapest three way are £13,000. I need four, centre and sub. £44,000. I got my system on 5 months salary as a teacher (Linn, meridian), now for 6 channel system (source computer and steaming, now turntable, tuner, cassette or CD player) I need two years at the current salary level for the same job. I have a list of over 80 powered and active speakers with specifications to consider.

  In the Meridian M1 speakers it was the amplifier in one of them. The other amp has had a single fault and was quickly repaired. Speakers sometimes have foam rot but usually are fine. Abuses had damaged the cones. Kef refurbished the bass unit of a JR149 many years ago. The amplifier was blown out (Cambridge P80). The Meridian MCA (1983) has several repairs over the years because the design meant a charge was held after paoer removed and static discharged when the modules pulled apart. Adding a new input blew it out. The power supply goes on the MCA nd parts not available. The Uher Z141 had blown capacitors and at £70 replacement before they blew again expensive repairs. So the 1980 M1 did well. It was not until 2010 that lots of issues in one amp started. Russ of Mr Tech Guy recapped the amplifiers. Possibly not needed but would be going forward. Tracing the issue is difficult. It might happen in minutes or not until in use for 20 hours. Russ changed a lot of components and got help from friends in Meridian who remember the 1978 speaker. The D600 LCD panel failed. Russ has a new circuit and found the digital inputs on the D600 do not work. This is not fixed. I don't use it. These are now 33 years old. Digital circuits are worse than analogue to get repairs.

A lot of modern systems will not be repairable. Besides digital hardware the software systems will not run on new mobile phones and services will disappear. Kef buggy software in LS50 Wireless will never be updated or fixed. Sonos bricked older speakers from working in current network systems. Pure radios will not get BBC internet radio stations later this year and no update provided.

- *Where did you buy your last speakers ?*

Devialet was from reviews as none in shops locally. I purchased on Facebook and second via eBay. The B&O Emerge I went to the shop and reviewed Level and Emerge. Got a pair of Emerge new but got the Level pair on eBay.

It used to be possible to try out in the shop demonstration rooms all the speakers on a short list. Even then getting one place to have your two top picks was hard. Now most of those I am interesting in I might find after hours of drive and equally distance in another direction another speaker. Other than main stream the darlings of the reviewers e.g. Kef LS50 wireless II and LS60 you will not find most. Even B&O 28 are not in all B&O shops or if they are they are not wired up to listen. I have hear those but not even against the 18 or 20. Buchardt for example are direct sales and have a return policy. It helps as you only "loose" the postage costs to trial for a month, but you are still not going to do A/B comparisons.

Jimmy Smith

Well if you go for a sound bar as far as I understand is that the side walls will help recreate the surround sound format. Simple as it may be, the sound quality imo is good but not great. Book shelves on stands for me is a much better idea because your drivers radiate more air movement which may give you a fuller sound. However there's plenty more that goes into and is rather a complex subject. What your budget is the room and room size aesthetics. How you want to listen to the program materials as background or as the art was meant to be heard. Once you answer those questions you may be able to move forward

Evaluation

After 25 years old the % of nomade bluetooth speakers decrease significantly and the amount of money put into audio equipment raises. We can also see that the most common placements are shelves and desks rather than stands. There are some key points to respect: the aesthetic (it should fit with the environment), the sound quality and wireless functions (wifi and/or bluetooth).

Active speakers sales are increasing and are the number one sales at Lydspecialisten. Their biggest sales are smaller active speakers like the KEF LSX and mainly to young people settling down. They are also subject to mode effect and “influenceable”. Even the audio fans are buying more and more active products. It will fit better in a family context, easier to place and take way less space.

We can see that even with people that invest a lot in audio equipment (see pictures of the DJ) the stand is not a number one priority, usually the speakers are placed directly on the surface. To offer a better sound quality, including a stand in the design could be interesting.

Flexibility is also important for the user. We can see that one of the users might not use its big speaker at home because he is afraid to bother people around and would rather use a small

bluetooth speaker. In the summer he would take the big one outside. That's not the best environmentally (lot of "boxes") and cost wise.

The interview with Gerald showed that even with a lot of research and knowledge in audio equipment it's hard to find the perfect mix. There will always be a problem somewhere. Today a lot of people are using the web as sales channels and trust reviews more and more, before people used to go to shops to listen, therefore an eye catchy design is important. Today avoiding maintenance cost is his main priority, we can see that he had to repair a lot of his older speakers, even more important than the sound quality. Shows that today it's important to have a system that has the sensitive modules replaceable and upgradable (looks like it's mainly the amplifiers and software). Today the speaker prices are rising a lot and it's more difficult for average people to get a big soundsystem. Seems like the smaller product but that can paired together are a good compromise. Even for him flexibility is important, pair and unpair easily to work in other places in the house or in the garden and then just plugging it in to charge is really nice. Today speakers are made mainly for phones and tablets (mainly iphone/ipad), he is using his laptop a lot and it's complicated to pair well, same goes with the tv.

Is it meant to be to listen as the art was made or as a background ?

Reflection

We can see that when turning 25 young adults will invest more in the audio equipment and care more about the sound quality. As it was discussed with the specialized retailer, mode effects are still really present. Introducing a Dynaudio product at this age can be a good way to build customer loyalty.

A big problem is the evolution of streaming services, the software is updated really often and some speakers can't keep up with it. Would be interesting to look at how to work around that.

From Gerald's experience it is hard to find a system that works with everything, usually manufactures focus on one specific use → can be interesting to see how it could adapt to everything.

In order to make a first design brief with precise requirements an interview with the targeted group of users will be realized. People that are in the transition phase from student to young adult life. It will allow them to see the environment, how they consume the media… It will then be easier to have a context to design the product in.

A research must be conducted on the different technologies within active speakers to better understand their functioning and what are the different options. This will have a direct impact on the speaker. The way the signal is transmitted from the source and from one speaker to another is essential.

streaming module/battery replaceable

IP54 → resist kitchen and pool/garden splash

Appendix 13: User environment

Objective

The objective is to have a better vision on what is the environment the speaker should be developed for. The color code, shapes… It will help with the aesthetic.

Experiment / Data

A/User profile

- Between 25 and 35 years old
- Danish
- Done with studies and already with a job
- Starts earning money
- Investing in home comfort
- 25-29 (87424 dkk/year) and 30-34 (234606 dkk/year) (https://www.dst.dk/en/Statistik/emner/arbejde-og-indkomst/formue) Most customers will be above 30, wealth is way lower before 29 because lot of people lives on SU.

(same target as KEF speakers)

B/User environment

Pictures are taken from Marketplace on Facebook by looking at the profile of the user to see if they are fitting in the user category. Pictures of furniture.

Lejlighed i Aarhus to spot the decoration in the apartments

Evaluation

All these interiors are taking some codes from New nordic design. Soft colors and shapes. Few colors and simple interiors.

https://larseneriksen.com/blogs/chronicle/the-long-shadow-of-scandinavian-design

New nordic design must be Functional/ Hygge, Democratic/Affordable, Natural/Sustainable

Reflection

This will help for the aesthetic. But to get more information on how to interact with the environment a user scenario must be made. To do so an interview with Daniel will be realized, he is the targeted user group.

Appendix 19: Meet with Dynaudio's acoustic engineer

Objective

The objective of this meeting is to talk about the technical challenges the product will face, get more information about the drivers, the space required, the components to be used and their sizes.

This will unveil some new constraints and allow a more precise concept.

Meeting with: Stephen J. Entwistle

Experiment / Data

Note from the meeting:

- The concept is duable, a prototype can even be made with the components they actually have in stock. The size and use it is intended for is similar to having a pair of Music 1. Necessity for changing some parts to be better adapted to the environment. Mid drivers from the music 5 are smaller because it included a sub. But by having 2 units drivers can be bigger on each one of them and then reach a similar level of performance. Use the same drivers as Music 1.
- Regarding the inputs, it can be optimized to offer bigger flexibility to the users. Mini jack instead of RCA (it works with more devices and RCA can always have an adapter to mini jack(optical mini jack?) if needed. Having an HDMI(eARC, search it more in details) input for the TV is needed, this is the most common one and it works with old and new TV. We can develop it so it knows which source is playing automatically, if both are playing the user has of course the possibility to choose.
- The base for the speaker can be the same for both of them. With the Dynaudio app it is easily possible to set a parent and customer speaker. Both speakers can be paired together via the app. But it still needs an interface for wifi on the speaker. It must be able to connect to it.
- For the volume this principle can work easily, look into capacitive touch.
- For your prototype we will check if we have a pair of music 1 we can give you.
- USB Type-C can work with that, it's a good idea but look at USB type-C thunderbolt connection like for macbook.
- In your prototype you might need to create a physical connection.
- Including the bluetooth chip in the speaker unit is totally fine, today they usually come together with the wifi chip.
- Regarding the materials:
    - The cabinet will be cheaper with a plastic cabinet (ABS + fiberglass) and then put on a thin wood layer for decoration. With the volume I have it is easier to respect the "VO standard" by doing it this way. (Talk about 5000 units a year to make money on it).
    - Regarding the frame it can be aluminum or plastic frame with metal coating.
    - For the "grill", the best is of course to have nothing. But they agree that with the "lifestyle" line people usually seek for decoration. A possibility could be to have

different options for the people to choose, it is easy to remove and replace. One that sacrifices sound a bit (medley clothes?) and another that offers a full range sound. Knowing that Dynaudio usually intends to compromise sound as little as possible.

- Regarding the cost. Usually count a x10 multiplier between Dynaudio factory and the price the user pays, this takes all the steps into account. e.g. Music 1, 40€ in the factory and 400€ in the shop. *Could be an angle of reflection for the business part, how to reduce the cost for the user and increase margin for Dynaudio by removing some intermediate and invest in distribution channels. (That's one of the things Hifi Klubben is doing with creating their own brands) they also try to sell only via specialized stores. Might not be the best option ?*
- A streaming module is nice because it offers easier interaction for the user and a more stable connection. Music 1 as a streaming module. When talking about replacing it (like in B&O level) it doesn't work really in the real world. It compromises the sound a lot because a lot of money goes into that. And when replacing it you also need to replace the whole motherboard. Therefore it costs a lot of money. It has become really complex. So today Dynaudio started a partnership with one of the leaders on the market. They actually are the most stable company and they know that they can keep what they have and use the same streaming services for at least 10 years. Moreover, companies like Apple, Spotify or Tidal will always make all their past versions compatible with their new version. (e.g. if it has Airplay 3, you can use Airplay 1 on it.) → in today's world it also makes sense, so the software developers try not to have everything obsolete quickly anymore, this vision is changing.
- Regarding the components see APPENDIX 26:Deconstructing a music 1. The size of the new components picked from music 1 is detailed.
- In the music 1 there is a microphone that can be used for phone calls and also the speaker uses it to adapt to the room environment.
- Current music 1 battery can last 3h
- Add an input usb type-c on the speaker unit for charging if user take it outside the house (can also be for usb sticks or plus external device)
- Consider volume in the speaker for air to circulate for drivers

Evaluation

Meeting with the lead acoustic engineer at Dynaudio confirmed that the concept has potential and that it is possible to make with the components they have now and therefore be incremental on the process.

Some modifications and precision are made by Stephen

Reflection

The next step is to change the components on the actual 3D model to refine it and adapt the dimensions.

By having more precise components it will also be possible to do a business case and consider the possible evolution for the product.

Appendix 20: Evaluation of the 2nd iteration

Objective

The evaluation of this iteration has already been made but not consistently enough. The goal is to take a step back and have again a look at it to get some more precise user needs for further concept development.

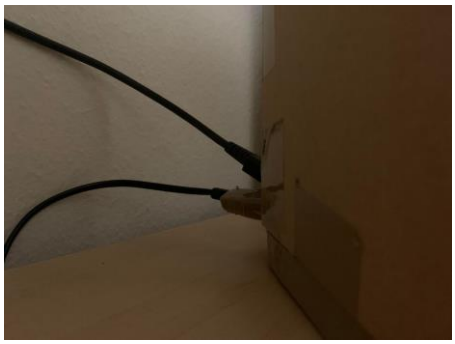
Only the evaluation part from the APPENDIX 39 is taken. To have the presentation of the concepts look at WS 29.

Experiment / Data

A/Concept 1 - scenario

1.System is charging

2.Connect power and TV to the docking station

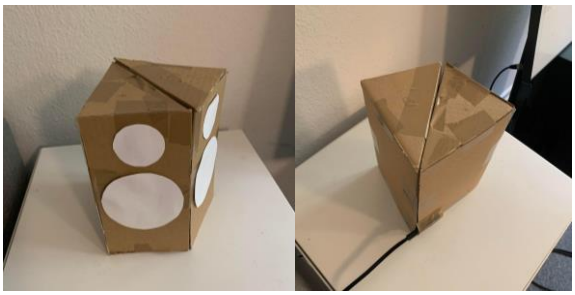


3.Place the speakers

4.Take a speaker when you want to cook

5.Put them back when battery is low

B/1/Concept presentation



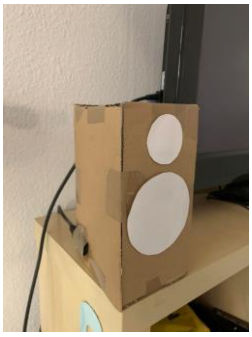
It's composed of 2 speakers, one sends the signal (A) and the other receives it (B). The sender is fixed and the other one can be carried around. To charge B the user simply has to connect them together by putting them next to each other and magnets will do the rest.

A has inputs for power and aux.

B/Concept 2 scenario

1. Charging

2.Power and TV connected to sender speaker



3.Take one speaker and use it when cooking

4. Place it to listen in stereo

C/Concept 3 scenario

1. Both speakers are charging on their docking station

2. User take a speaker and go in the kitchen

3. Place it back and listen in stereo

D/Evaluation of the concepts

USER 1

Concept 1	
-	+
- Because of the triangle shape it's not possible to have the speaker in the front when docked and keep the 30° angle. The left speaker when docked becomes the right speaker when positioned and that is counterintuitive → not convenient at all when trying to position it. - If interfaces on the docking station to control both might be annoying when carrying one of the speaker around - If the signal is transmitted to the docking station what about transmitting the signal when the speaker is far from it ? - If I want to carry the speaker somewhere does it mean I need to take the docking station with me ? - Docking station takes a lot of space, it could be optimized	- Once its plugged there is nothing to touch - Feeling from magnet is nice - Easy to use in general, pretty convenient and involve few actions, it's just positioning them in stereo that is quite annoying

Concept 2	
-	+
- I don't like the idea of having one plugged, would it be better to have a dock for both of them to charge? - limitation of having receivers in one piece, if you have an apartment with double piece walls would it receive well ? - Too complicated to interact with, asks to many steps - not placing it back in the right position - Only one with the charging is weird, need to put them together when charging and it can't play in stereo when charging. - Only one with the charging is weird, need to put them together when charging and it can't play in stereo when charging.	- The magnet feeling is really satisfying

Concept 3	
-	+
- Docking station walls are too high; it comes with the speaker when taking it out. - Way you grab it: maybe not good to touch the speaker right away, should be safe for you to take the product out and for the product too.	. - Easier concept to interact with - Can work independently - Can be used all around house - Can charge and play stereo at the same time

USER 2

Concept 1	
-	+
- Doesn't place it with the right angle - Flip the speaker around before finding the right position - The wall on the docking station is too high - Doesn't place it systematically back on the docking station	- The magnet feeling is nice - Grabbing the docking station feels nice too and interesting if you want to transport the speakers outside

Concept 2	
-	+
- Doesn't place it in the right position - Complicated with the way you plug them, it's hard to differentiate - Would be nice to have some visual information on where you grab it - Need some shapes/visual informations for the buttons and interfaces	- Magnet feeling again is really nice - Could imagine a version of this where it's quite modular, add on some extra speakers like a lego for example.

Concept 3	
-	+
- It's not convenient to grab - It's difficult to place back in the docking station, the user is turning the speaker around to find the right position	- Easy to use and quite intuitive - The user places the speaker back on the docking station after use - better interaction than with the two other concepts

- If it's grabbed and carried around it would need a good strength to avoid breaking, there is a risk of it falling - When taking it out the platform is moving around (probably because it's cardboard)	

Evaluation

Both users prefer the Concept 3. According to their feedback and the pros and cons of each concept it also seems to be the more interesting concept to continue with. From this evaluation several user needs can be taken:

- Use of magnets for placing the speaker in and out of the docking station gives a nice feeling
- Both units should be able to work independently from each other's
- The docking station should have a low depth to make it easy to place in and out
- Have a visual/tactile indication on where to grab the speaker
- Ensure the integrity of the speaker if it falls
- Docking station shouldn't move when the speaker is taken in/out

Reflection

Some concrete user needs arise from looking back at the evaluation of the 2nd iteration. They will be used in combination with the user needs from APPENDIX 14 to develop new concepts.

Appendix 21: Iterations on the handle

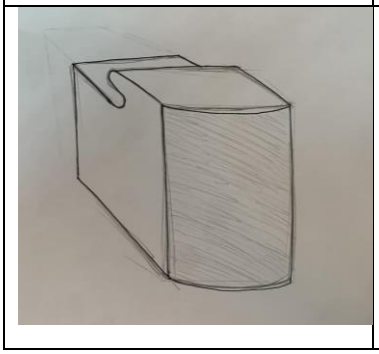
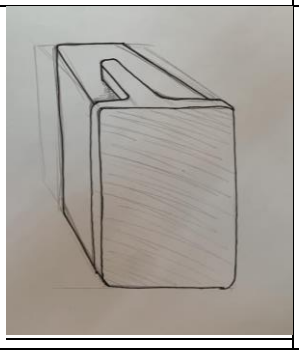
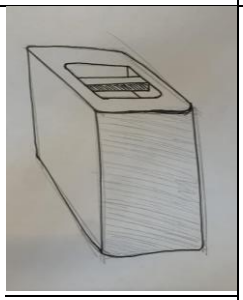
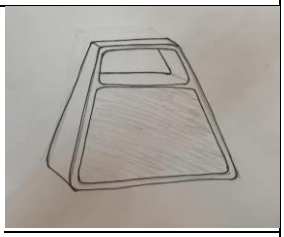
Objective

Determine the placement of the handle and the control of the speaker. The overall shape of the speaker will result from the placement of these features and from discussion with the user.

Experiment / Data

A/The handle

→ From brainstorming, The user should be able to grab the speaker directly without involving an extra action (pushing button…) This could be annoying for the user after a while and create unnecessary problems.

Concept 1	Concept 2	Concept 3	Concept 4
			

After a brainstorming session some ideas are put on paper for different kinds of handles. Some cardboards prototypes are realized to be tested on users. It will open a discussion about the handle and potentially give a direction.

Different configurations are tested with different directions for the handle. This will open the discussion with the user on what feels natural or unnatural and what actions are involved.

Concept 1	Concept 2	Concept 3	Concept 4
			

Note user 1:	Note user 1:	Note user 1:	Note user 1:
- Where should I grab it - part where you grab is not really big - be afraid to drop it - it's easily just the fingertips that holds on to the edge - have to grab it tidely not to drop it - not the most comfortable feeling to the fingertips	- More stable - not afraid to drop it - real handle, feel natural - obvious on what to do - can not misunderstand where to grab it - ergonomically i like it but not aesthetically - prefer this direction for the handle, it feels more natural	- try to grab it from the back for the front to be carried in the front. Twisting the direction of the speaker. - really easy and nice to grab - How much room would I have for my hand ?Able to put all my hands in it ? Or only my fingers ? - would be afraid to drop it if can't have the full hand around it	- Like that - really easy to grab - a bit big as a handle - convenient - Feel safe to grab it because the hand can go around. - like the shape of that one
			
Notes user 2:	Notes user 2:	Notes user 2:	Notes user 2:
- Hard to tell without the weight in it - Unnatural feeling to grab like that - feels more comfortable when grabbing on	- Much easier to grab - likes it contour the hand - ergonomic - be careful on how wide it is, otherwise it the body when carrying	- Same problem as the concept 1 - could work if it's oriented the other way around - definitely prefer the concept 2, depending on the size of the holes could put	- think it's still easier to grab something as in concept 2 - come closer to the body with the triangle thing - top is narrow so fits closer to the body

the side - when carrying it the further it is from the body the bigger the leverage is, feels quite unnatural when walking with it - not enough depth for the fingers, have some kind of a lip for more comfort - have something to grab on to better - he is twisting it when placing it	it - nice to be symmetrical in case someone is left handed or right handed - colors/shape intuition ? - obvious on where to grab it that's good - maybe nice if buttons are on the handle almost look like a remote control like that - The most ergonomic solution, like it to be symmetrical	pressure on the fingers - not really ergonomic - it's too boxy I don't like the aesthetic	- like the shape
			

Extra pictures:

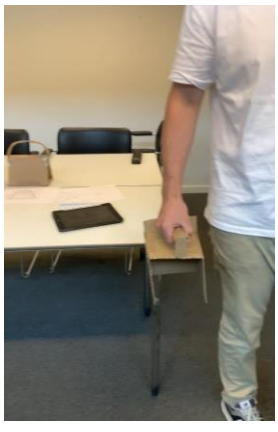
The second user noticed that when the handle is facing the user, it is necessary to twist the wrist many times and it leads to an uncomfortable position when walking. If all the steps are taken into account: picking up the speaker, carrying it in another room, dropping it there and bringing it back to the docking station, it will twist the wrist 4 times and it feels unnatural and therefore not comfortable.

But when the handle is turned perpendicular to the user, the user will grab it and naturally carry it along the body. Therefore no extra steps or no thinking is required in how to position the speaker. The sound output will always be facing the user.

Case 1: Handle perpendicular to user

			
To grab the speaker the user twists its wrist (“feel unnatural”)	Then the user twists it’s wrist once again and has its hand in a natural position while walking.	Walk.	Twist it’s wrist again and place the speaker on a table/kitchen surface.. He had to think a bit in the direction to place it with the speaker facing the right way.

Case 2: Handle facing the user

The user grabs the handle directly without twisting its wrist. "Feels more natural and intuitive".	The user walks with the speaker on its side, it's not hitting the hips or anything because it's along the body. Feels more comfortable.	Walk.	Just place it back with no extra steps or movements. It's directly placed back facing the user.

Conclusion

- Both users prefer the handle in concept 2. It feels more comfortable and safer to grab. They are not afraid to drop the speaker.
- It is also obvious to grab it there.
- Both users like the aesthetic of the concept 4.
- The orientation of the handle in concept 2 feels more natural for both users and requires less "uncomfortable" actions.
- Being able to have the hand going around feels safer. Don't like to have only the fingertips holding on to it.
- The shape of Concept 4 with the "narrow" top feels more comfortable along the body
- Nice to have a symmetrical handle for left/right handed people. The flow is more natural.

Evaluation

<u>Needs from user test</u>

- The direction of the handle should be perpendicular to the body of the user.
- The user should have its hand going all around the handle for safer handling.
- The handle should be symmetrical.
- The speaker should be well balanced for a confortable handling

<u>Remarks</u>

- The users don't like it to be too "boxy"
- A triangular shape with a narrower end feels more comfortable when walking with the speaker.

Reflection

Some new needs and remarks from the user are taken from this user test. It will allow us to make a new iteration on the concept and make it ready for the next round of research.

The next round will focus on the different interfaces on the speaker unit.

Appendix 22: Placement of the different interfaces on the speaker unit

Objective

Make a new iteration on the solution according to the latest results from the user test in APPENDIX 21. A concept will be developed to allow the testing of the different interfaces on the speaker unit. The placement of the different interfaces on the speaker might result in a change of shape or aesthetic.

Experiment / Data

Results from APPENDIX 21:

- The direction of the handle should be perpendicular to the body of the user.
- The user should have its hand going all around the handle for safer handling.
- The handle should be symmetrical.
-

Needs for interfaces:

- Easy access to the direct control on the speaker
- From the APPENDIX 19 (meeting with acoustic engineer at Dynaudio) it is necessary to consider interfaces for (on the speaker unit):
    - On/Off
    - Volume
    - Connection to wireless source wifi/bluetooth

Concepts:

3 concepts are developed according to these needs. The results from APPENDIX 21 are also considered in the development of these concepts. The handle is placed perpendicular to the speaker front face. It offers space for the hand to be placed all around the handle. The handle is symmetrical, therefore it doesn't matter if the user is left or right handed.

User test:

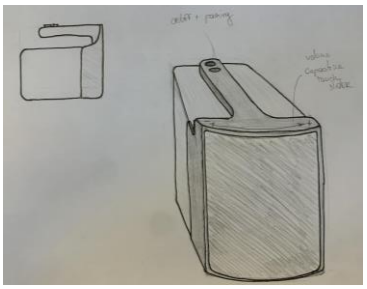
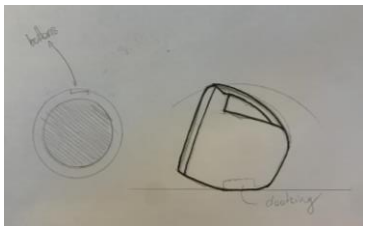
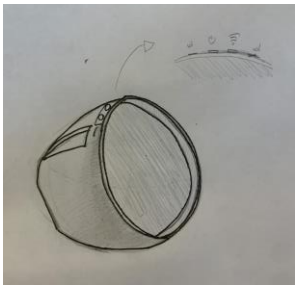
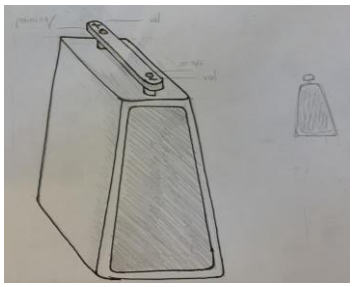
- Present the different solutions and what need to be tested
    - 1: one capacitive touch interface placed on the front and control buttons placed on the handle
    - 2: all interfaces placed on the front, classic buttons
    - 3: interfaces placed on both sides of the handle
    - The objective of this test is to determine what is the easiest access to the interfaces and what feels the most "natural" for the user / when are they most used ? on the docking or in the kitchen ?
- Ask to the user what products he/she currently have at home and when the interfaces are used/ what interfaces are used
- Simulate the working scenario:

- Speaker is placed on the docking station/standing still when taken out of the box
- Ask the user to turn the speaker on
- Ask the user to press on the pairing button
- Speaker is paired and ready to be used
- User need to take it from the docking station and placing it somewhere else
- Ask to turn the volume up

→ Simulate for each solution

→ Ask for the user feedback

- placement of the interfaces
- choice in the positioning of the buttons
- Does the button interfere with your hand when you grab the speaker ?
- What's the most comfortable to use

Concept 1	Concept 2	Concept 3
	 	
		

Note user 1	Note user 1	Note user 1
Observations: press on the power button and pairing button without searching for it (attention: needs rigidity in the handle) set the volume after putting the speaker on the table The user didn't try to use the buttons while carrying the speaker Feedback: would like more space for fingers under the handle The user likes the capacitive touch for the volume but it's missing some kind of response to know the volume level. The buttons are really visible like that but the user doesn't see any use in having them there. The user didn't try to push the buttons on the handle, would always place it first and then use the buttons. The user mentioned that there could be some lights as an indication and that there should be enough lights to have a span big enough in order to be quite precise. "The capacitive touch is more in time with the era, today we are sliding everything more, we remove the buttons on pretty much everything, and could feel more connected	Observations: It tilts a bit when pressing the buttons (no weight in it) Observations are the same as on the other model. The user is not searching for the buttons, it doesn't seem confusing. The user doesn't touch the buttons when grabbing the handle. Feedback: It is more intuitive with the volume like that and the user said that "it can get the exact volume I want". It is pretty classic with buttons like this, it works really fine. The capacitive touch is nice though, it brings something new in the way to interact with the product. But maybe on a product that you need to carry around it's not the best idea. Can it work well enough on such a small product ? The user like that - and + are on these sides/ it's intuitive to go from left to right to go up. The shape should be more stable, if it falls will it roll ? Might need heavy weight on the bottom to stabilize buttons could be a bit on the side to avoid people touching them by accident. Like the handle, it is easy to	Observations: It takes more time to figure out where to press the buttons. When the hand is on the handle it is touching the buttons and seems hard to avoid touching them. Feedback: A bit more critical towards this solution. It is not really appealing in the aesthetic and in the functionality. Why are the + and - not on the same side, it seems a bit weird in this solution not to have them together. The good thing about this solution is that it's convenient to grab.

with the young people" as the user said.	grab and well integrated in the shape, on the other solutions the handle doesn't feel like a part of the product.	

User 1 wrap-up

Conclusion on the handle and aesthetic:

In conclusion the user likes the concept 2 better because of the shape and the way the handle is placed, the shape is also different from what people are used to with speakers, can be really nice but also a bit risky. It feels a bit more "exclusive". The user said: "I Like the shape of concept 1 but the handle feels odd, the handle does not look like a very integrated part of the speaker. And the concept 3 looks too much like a handbag, it is not very appealing for a speaker". The user also said: "I like that the handle is rigid, it feels really comfortable to grab the speaker, it is not moving around, it is easy to take it and put it back on the table".

Conclusion on the interfaces:

The user is not using the buttons while carrying the speaker, therefore there is no need for having the buttons on the handle. The buttons should be placed on the edge and on top of the speaker for easy access and interaction such as in concept 2. As the speaker is quite small and meant to be carried around, capacitive touch might be too big of a constraint, the user interacts a lot with the speaker and could touch it by accident. Some classic push buttons should be used. Having the - on the left and the + on the right felt intuitive for the user. If the shape of the concept 2 is kept it is necessary to make some tests on the placement of the buttons to prevent the speaker from rolling.

Note User 2	Note User 2	Note User 2
Observations: Don't use buttons on the handle while walking. The user touches the capacitive touch slider with the palm of the hand. Feedback: The idea of the capacitive touch is interesting, the user likes the interactive part of it. But it's interfering with the handle and the palm of the	Observations: The user place its hand on the side of the speaker while pressing the button to avoid it tilting Feedback: This concept is a bit unstable but probably due to the cardboard. It should be necessary to have some weights at the bottom. For the user this might be too many interfaces, it can be	Observations: Don't use buttons on the handle while walking touch the buttons with the palm of the hand Feedback: don't like this one because of the buttons placement + and - are really far away so difficult to go from one to another, if goes really loud then difficult to quickly

hand touches it. But the user also said that in this case he would rather control the volume from its phone directly, therefore the capacitive touch sensor is a bit more like an accessory. It makes the product complicated for not a lot of benefit	possible to remove the button to connect the speaker to the wifi. He mentioned that on his speaker at home the same button does the on/off and the wifi connection and it's more than enough. The user has to connect the speaker to the wifi only once when receiving the speaker. But then what for the bluetooth ? Is it connected through the app ?	reach the minus The handle itself is comfortable but aesthetically it's not the best to have it like that. It looks better on the solutions 1 and 2. A bit more "hidden".

User 2 wrap-up

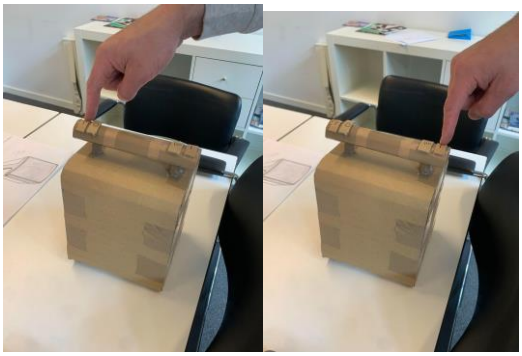
The user disregards the concept 3 completely for aesthetic reasons and because of the functions and the way they work but it brought an inside on the distance between the 2 volume buttons. If the user wants to change the volume quickly because it's too high or too low too suddenly then it's better to have them close to each other.

The idea of the capacitive touch is discontinued for some classic "+" and "-" buttons. The wifi buttons should now be integrated to the on/off button. A proposition will be made to replace the "wifi button" by a possibility for a bluetooth connection. It is mentioned by a user in APPENDIX 39 that his Sonos speaker doesn't have a bluetooth possibility and that can be really frustrating not to have it if a friend comes home and wants to connect quickly or when the wifi is down.

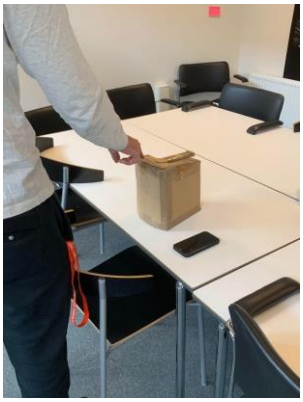
Regarding the shape and the aesthetic the user prefers the Concept 1 even though it's still a bit too bulky. The way the handle is integrated in the Concept 2 is better. A proposition could be made to combine elements from the Concept 1 and 2.

Pictures illustrating:

The palm of the user hand touches the capacitive touch slider.



There is a big distance between the two volume buttons.



The user usually places the speaker back on the table before changing the volume.

The pairing button seems a bit too much for the user.

Evaluation

Several user needs are identified in the user research:

- The buttons should be placed on the edge and on the top of the speaker when facing the user.
- Some classic push buttons should be used to reduce the risk of unwanted interaction.
- The "-" and "+" buttons should be placed respectively on the left and on the right of one another.

- The speaker shouldn't roll or tilt when the user is pressing the different buttons.
- The speaker unit should now have an on/off button that integrates a command for connecting to the wifi and a button to connect to the bluetooth.

Remark on the aesthetic:

Both users disliked the shape of concept 3. One user said that the handle on concept 1 doesn't feel like well integrated to the speaker but it is on concept 2, this user also preferred the shape of the concept 2 but mentioned that a round shape might be nice but also risky and wouldn't be sure to buy it. The other users like concept 1 better than the other regarding the aesthetic but thought that it was still too bulky. Therefore the integration of the handle in the concept 2 is kept and a new design will try to merge both solutions for a less bulky product.

Reflection

The identified needs will later be gathered in a board grouping the needs for the conceptualizing phase of the product.

The next step is to make a concept proposal for the docking station. The next concept will also take into account the needs identified in this worksheet for the speaker unit.

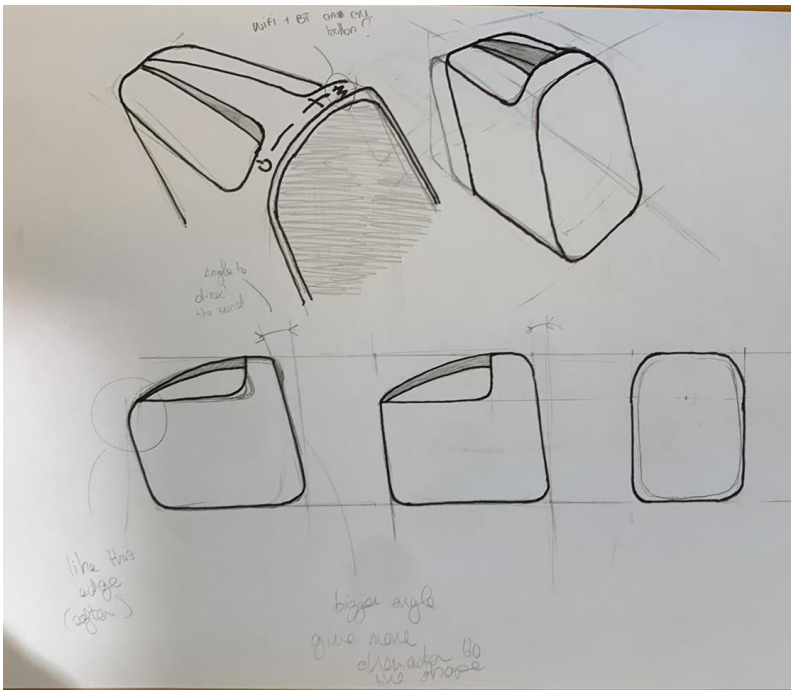
Appendix 23: Interaction between the speaker and the docking station / Iteration 3

Objective

The objective of this activity is to make a first iteration on the docking station from the user needs taken from APPENDIX 20. Few needs are identified for the docking station and this first iteration should allow "throwing" some first ideas and by getting some user feedback to get new user needs for further and more precise iterations.

Experiment / Data

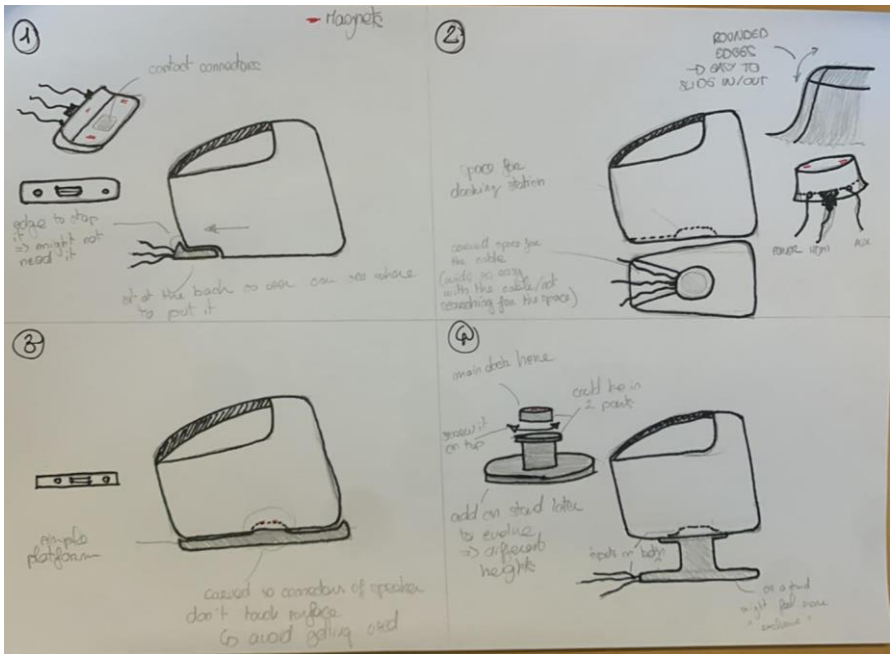
First a new concept is drawn respecting the previous results from the user test in APPENDIX 22.



Some needs for the docking station are currently identified:

- Magnets to guide the user when placing the speaker
- Low depth on the docking station
- The docking station shouldn't move when taken in/out

Different concepts grouping these needs are realized:



4 prototypes for each concept are then realized to be tested on different users. A dummy model is made of cardboard. The weight is not put in to not cancel the strength of the magnets. This test aims to give the feeling of the magnets to the user and test the different position of the docking station. When the docking station is chosen a prototype with the exact shape and the right weight should be realized to give the exact feeling to the user. Doing it for this step would be too time consuming, the concept should be further developed to test the exact feeling of the product to the user.

Magnets are placed in the bottom and on the back to test all the concepts with one speaker unit. The magnet placed on the bottom is weaker than on the back to see what the user prefers.

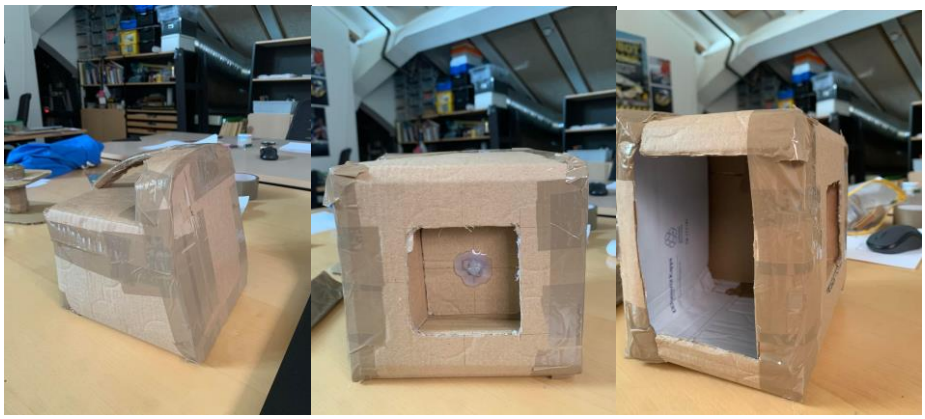
The platforms will be taped on a table to simulate the weight they will have and not come off with the speaker when removed. The platform should weigh enough to counter the force of the magnet.

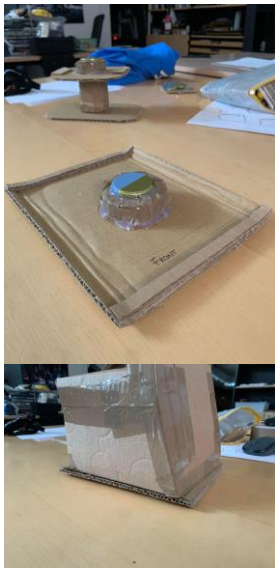
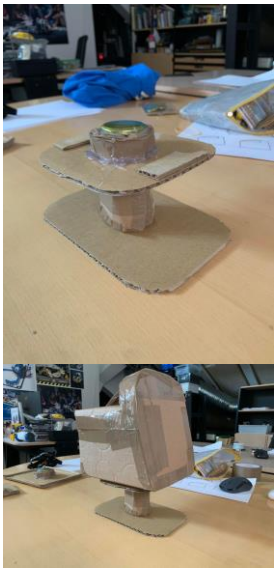
The concept 2 and 4 have detailed functions but testing them now might influence the choice of the user in the potential interaction with it. If one of these concepts is selected the function should be further developed in other concepts.

User test scenario:

- The speaker is placed on the docking station
- The user has to take it off and bring the speaker somewhere else in the room
- The user place the speaker back on the docking station
- After testing the 4 concepts a discussion on the feeling, the placement of the docking station and the aesthetic is made. (To talk about the aesthetic and space it takes in the room the drawings are presented to the user).

The different concepts have the magnets placed symmetrically to follow the movement of the arm when the user takes the speaker in and out of the docking station.



Concept 1	Concept 2	Concept 3	Concept 4
			
It is a docking station placed on the back, the concept is that the user can see where the speaker is placed and doesn't have to search for it. On this one some strong magnets are placed for a bigger resistance.	The docking station is placed on the bottom, the concept test if the magnet helped to direct the speaker well enough when placed on the bottom and the user not seeing the platform. The magnet is less strong as in the concept 1	The docking station is placed on the bottom but is bigger than the concept 1 and 2. It tests if the user prefers to have a bigger platform and if he/she is not bothered by the size and the space it takes when it's laying in the room without the speaker. The magnet is less strong as in the concept 1,2 and 4	The docking station is a stand that elevates the speaker. Having a stand stabilizes the speaker and ensures a good sound quality. It also brings a more "exclusive" feeling to the product. It will test the positioning and how the user interacts with it. The magnet is less strong as in the concept 1

Feedback user 1	Feedback user 1	Feedback user 1	Feedback user 1
It’s the user's favorite concept. It is easy to find where to place it back, the magnets are strong and direct the speaker without asking too much effort. Since it comes from the front there is nothing in the way to the magnets, it goes exactly where it needs to. The user says that he can’t see with his eyes where the platform is but it doesn’t matter because it goes there almost by itself. The user also prefers the feeling from the stronger magnets.	The user doesn't like this solution, the fact of having just a small docking station placed in the middle is frustrating. It feels uneasy, the user is not sure on where to place it, the magnets help a bit but he is not sure it’s well placed. “It's like finding a power plug in the dark”.	The user likes it better than the concept 2 but still not the best. The pate helps to place it back the right way, having borders the user figure out easily where it should go. But on another hand it seems a bit unnecessary to have something that big just for guiding visually the speaker. It takes a lot of space in the room for not a lot of value added to the product. Would look messy having this exposed.	Aesthetically the user likes the fact that it’s raised. When something is placed right on the table it seems more temporary but when raised higher gives a sense of permanence like it’s meant to be there. But when the speaker is not on it, it looks a bit weird. You don’t want to have a dock with nothing on it. For example if some guests are here and you have one speaker in the kitchen it would look a bit messy.
			

Conclusion:

This test helped to understand better the interaction with the docking station. It is clear that positioning the speaker from the top is not the best direction to take. The user prefers to place from the front in order to have nothing in the way and not think if it’s well connected or not. A more discreet solution is also better. Therefore concept 1 is chosen.

But an interesting insight arose from concept 4. Aesthetically the user likes it better to have the speaker placed on a stand. He said: “When raised higher, it gives a sense of permanence like it’s meant to be there.” Therefore a possibility for the integration of a stand in a possible evolution

for the product will be considered.

Several needs can be taken out from this user test. The docking station should be placed at the back of the speaker to avoid having anything in the way when the user places it back. The magnet should be strong enough (such as in solution 1) to allow the user placing the speaker back without searching for the direction. The docking station should be discreet. The weight of the docking station should allow the user to place and remove the speaker without having to interact with its other hand.

Evaluation

User needs before user test:

- Magnets to guide the user when placing the speaker
- Low depth on the docking station
- The docking station shouldn't move when taken in/out

This user test allowed the designer to specify these user needs.

User needs:

- The docking station should be placed at the back of the speaker to avoid having anything in the way when the user places it back.
- The magnet should be strong enough to allow the user placing the speaker back without searching for the direction.
- The docking station should be discreet.
- The weight of the docking station should allow the user to place and remove the speaker without having to interact with its other hand.

Remarks:

- In a possible solution for an evolution the possibility to include a stand can be considered.

Reflection

Thanks to this worksheet and the previous ones sufficient data is gathered to start a first CAD model.

Now that the function and placement of the different features is decided a new iteration can be done on paper to have a better idea of the aesthetic and the exact placement of the different interfaces. Once that is done a CAD model will be developed and a 3D printed model will be used to do more precise user testing.

Appendix 24: Mock up testing the working principles

Objective

Make a better looking mock-up with the placement of the interfaces and the aesthetic following the drawings. This mock-up will help to group all the working principles from the last iterations (APPENDIX 21-56-57), it will be presented to users to test the concept. It will open the talk for further iterations on the maturation of the product.

Experiment / Data

A/Dimension

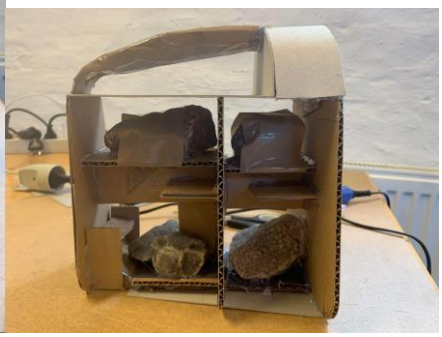
The general dimensions are taken from the previous proposal and according to the dimension of the components of the Dynaudio music 1 that is used as a reference product.

B/Mock-up

A Mock-up is realized to have a physical expression of the function and give a better feeling on the shape and the product. Because of the time for development a model is made with cardboard but respecting the right shape and dimensions. The model has the main physical function with the interfaces (on/off/bluetooth/wifi/volume) and a docking station with the magnets. This model will give the user the right feeling on the physical interaction. It also helps to better visualize everything for potential changes. The weight of the speaker is also respected (from WS41).

A test will be performed on users. The objective of this test will be to talk about the ergonomy of the product.






C/Testing

The test will help to evaluate the concept on users and see how they interact with the product:

1.To test the concept 2 speakers will be used to show the difference in sound between stereo and a mono speaker. A Dynaudio Music 1 is used coupled with the prototype from the first attempt. This phase of the test will just show the difference to the user.

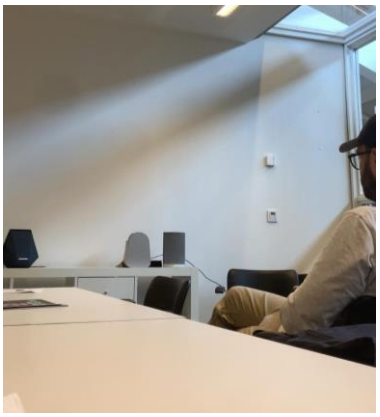
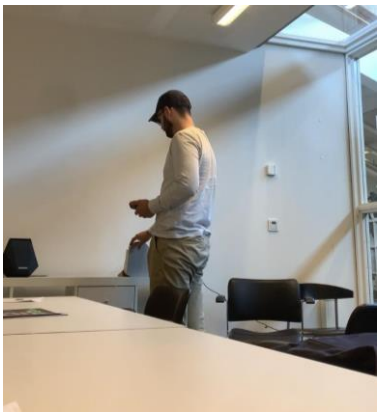
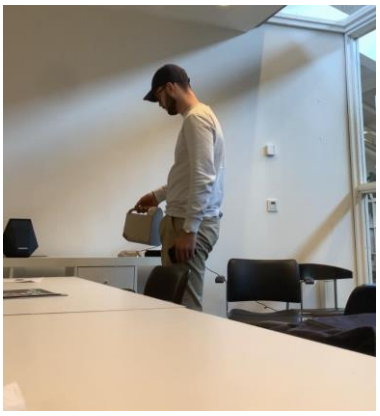
2.The second part of the test will be to talk about the new concept. The mock-up and a Dynaudio music 1 will be placed on a shelf/table as if it was two speakers in stereo.

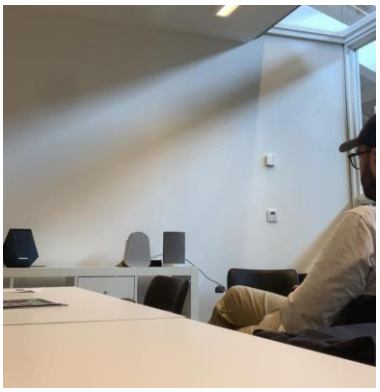
3.The speakers are plugged on a laptop with jack cables. A camera is set in the room to film the interaction of the user with the speaker.

4.The user is asked (everything is controlled by the designer on its phone to simulate the action of the user via the Dynaudio app):

- to turn the speaker on by pressing on it
- the user will start playing music from its phone
- the user listen to music in stereo mode
- the user pick up one of the two speaker unit (designer unplug jack of one of the speaker)
- music stops on the speaker that stayed on the docking station
- user place the speaker on another table
- turn the volume up or down
- place the speaker back on the docking station
- music plays again on both speaker

Note: this test aims to test the physical interaction with the product. Sound is used to help put the user better in the context. All the tests regarding the connection between both speaker and the docking station will be made further on, this test should help to unveil some user needs for it.

1.	2.	3.
		
The user is listening to the music and experiencing the sound in stereo.	He is turning the speaker on and pressing play on his phone to start music.	He picks up the speaker to go around.

4. 	5. 	6. 
He puts the speaker on a table.	Music playing on a single speaker.	The user turns the volume up.
7. 	8. 	9. 
The user picks up the speaker and brings it back to the docking station to enjoy music in stereo.	Put it back.	Enjoy the music in stereo.

D/Feedback

This user test gives some insights and user needs on the next phase of development regarding the non physical interaction between both devices and the visual of the interfaces. It will allow us to move on in the maturation of the product.

- Regarding the difference between music in stereo and in mono the user said: "There is a massive difference, I can feel that in mono the sound is isolated". With both speakers you feel better the music, there are way more emotions.
- Regarding the interaction with the speaker the user said that the shape and the handle makes it really comfortable to carry around, the dimensions are really nice according to the user. The docking station being at the back and the strength of the magnet is also still nice.

- The user gave interesting feedback on the buttons:
    - Usually on nomade speakers you will have buttons placed in evidence so it is intuitive for the user but on stereo they would be a bit more hidden since you don't interact with it a lot. Therefore a nice balance in the aesthetic should be found to have buttons that are quite intuitive but also that you don't see a lot when the speaker is standing still.
    - The way the buttons are placed is nice because the most important one is placed on the left with the power button and goes to the right on the buttons you would use the least.
    - The "connect" button is clever because you group both kinds of connections on one button. It's pretty easy to press once for bluetooth and press a few seconds for wifi or the other way around. A different light color is also discussed. The user confirms that this button is required, at home the user will say that he will use the wifi to have a better sound quality. Having a signal indicating what sources he is on should be required.
- This user test unveils new needs and insights for the non physical interaction between both speakers and both docking stations. The user asked: "What happens when I take the speaker out of the docking station, does the music stop on one of them or does it continue on both ? There should be a way to choose what I want because if I have guests or not it might change." This discussion also led to the following question: What the default setting should be ?
- To possibly answer this question a talk with the user is open and lead to the following conclusion:
    - Selecting if music is played on both speakers or only one will happen when the user pick-up the speaker and carries it around, therefore a button placed next to the thumb on the handle would make it easy to change. The user said that if he had to go in the app every time that would make it too difficult and not comfortable. It should be as flawless as possible.
    - Most users will have different habits depending if they live with their girlfriend/boyfriend, alone, commonly have guests having a default setting and always having to switch mode could be annoying. To make it as flawless as possible the speaker should keep in memory the last action of the user with the button. Example:
        - Both speakers keep playing music and the user presses the button to have only the speaker he carries playing music, then next time the user takes one speaker out, it will only be the speaker he is carrying that keeps playing.
    - This button can have two modes:
        - "pairing" to pair both speaker and have them working together
        - "isolate" to have only the speaker out of the docking station working
- There also was a discussion about what happens if the user wants to take both speakers out ? Therefore it can work the same way, the user will simply have to use the "pairing/isolate" button.
- What about the docking station ? How will it hold in position ?

Evaluation

User needs

- The buttons should be discreet enough not to trigger too much the attention of the user but still be intuitive when the user wants to use them.
- A visual signal indicating if the connected source is bluetooth of wifi
- A pairing/isolating button to manage non physical connection between both speakers.
- The pairing/isolating button should keep in memory the last action of the user.
- "pairing" to pair both speaker and have them working together
- "isolate" to have only the speaker out of the docking station working
- The docking station should stay in position when removing the speaker.

Reflection

Making the user test a 1:1 prototype with the physical working principles allowed to validate some of them and gave insights on the button for a new iteration and better development.

it also opened the discussion on the non physical interaction between both products and gave insights to develop a logical solution flawless enough for the user. The non physical interaction between both speakers lead to a solution where it is controlled physically by the user.

For this test the current Dynaudio app was used. A worksheet with the functioning of the app should be realized, it will be necessary to see if some modifications are required on the app.

The next step is to make iteration and develop solution for:

- Develop a solution for the button connecting to the wifi/bluetooth.
- Find the good balance between aesthetic and intuitive solution for the buttons.
- The pairing/isolating button placed on the handle.
- New iteration on the docking station
- Look at the Dynaudio app.

Important reflection: After this user test it is seen that the topic of the user charging device hasn't been mentioned in any test by the user. The development of the concept has been focused on the interaction between the user and the product. The user forgetting to charge the device can be integrated in the User interaction with the product, it will be integrated as a subtopic. This is not the main ax of research, therefore it is not the main priority but some basic function such as a difference of light color or a voice signal should still be considered.

The charging reminder will be developed in the same worksheet as "Find the good balance between aesthetic and intuitive solution for the buttons." In this worksheet the colors and shapes of the buttons should be developed.

Appendix 25: Tests on the docking station

Objective

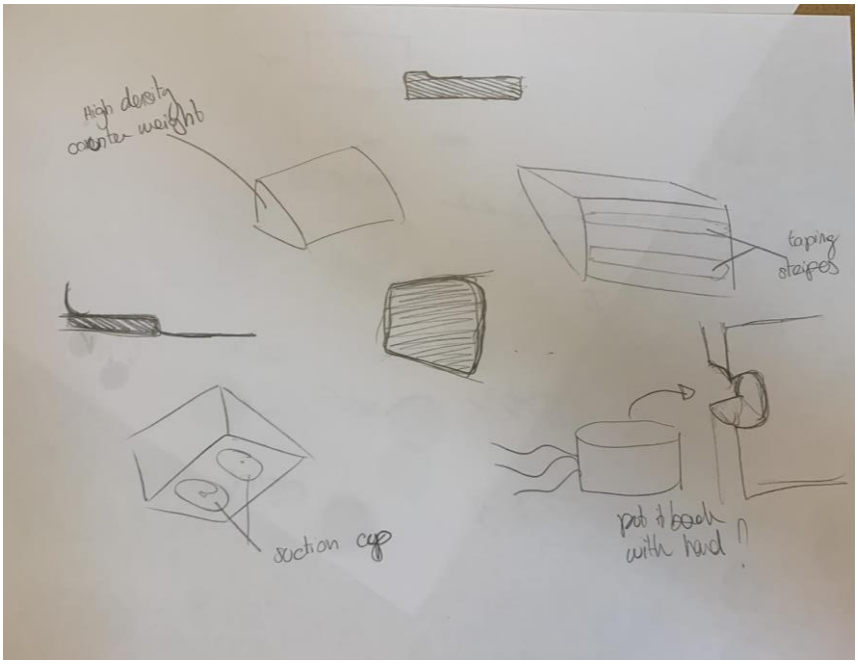
Define the way to counter weight the power of the magnet.

Experiment / Data

A/Brainstorming

As the model is right now the power of the magnet makes it not possible for the user to take the speaker off without taking the docking station with it.

Different solutions were thought about in a brainstorming.



Different possibilities arose:

- 1.suction cups placed under the docking station
- 2.taping stripes under the docking station
- 3.put the docking station back on manually
- 4.some weight in the docking station to balance the force

Putting some weights in the docking station is kept.

The ideas 1 and 2 would require adding an extra piece in the bottom to hold it in position, this could result in leaving some traces on the piece of furniture or the shelf where it is placed. In the idea with the stripes if the user wants to change the place where the speakers are it will have to buy some new stripes. The solution with the suction cups is not the most aesthetic one and could make it difficult for the user to take the docking station away.

The idea 3 would not be convenient if the user is taking it in and out everyday and asks extra steps every time.

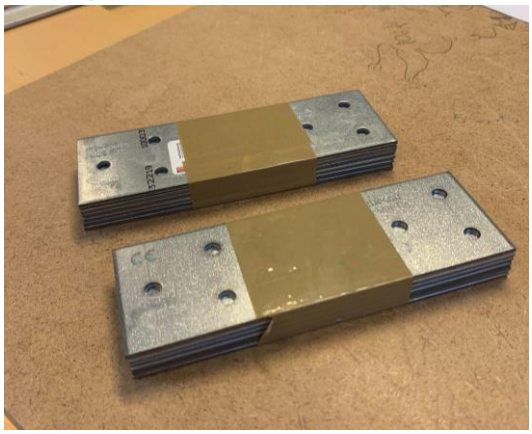
The idea 4 is kept, it is more discreet and elegant than the other ones while facilitating the use.

B/Presentation of the test

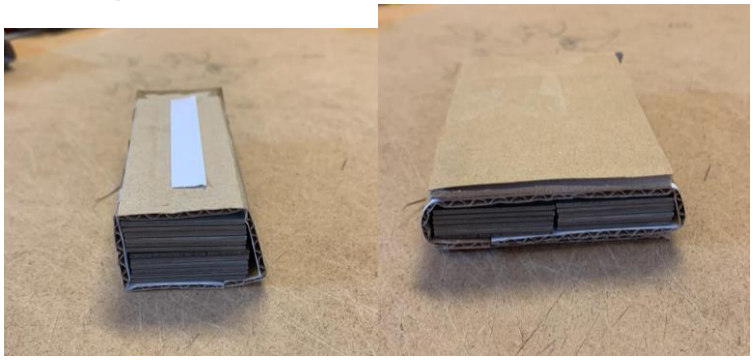
The solution with the counterweights in is then tested. It is quickly noticed that the docking station might tip on the side and not be really stable as it is right now.

Different configurations are then tested.

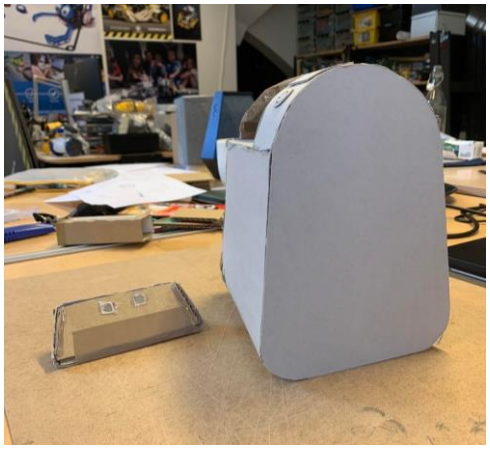
- Some metal sheets are bought to simulate to act as a counter weight.



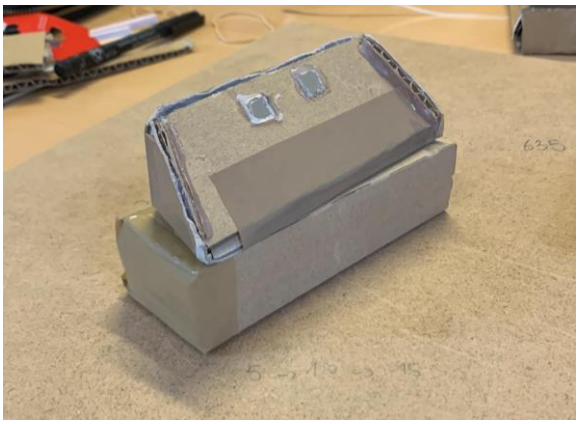
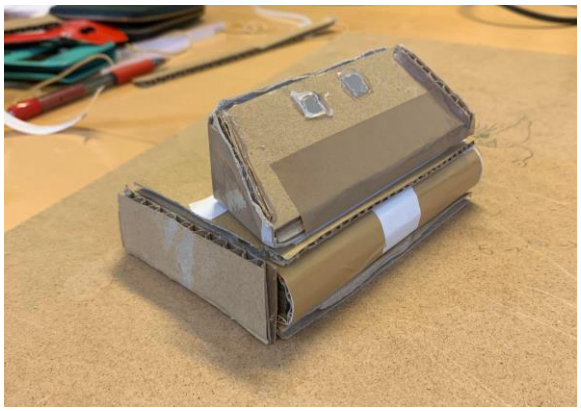
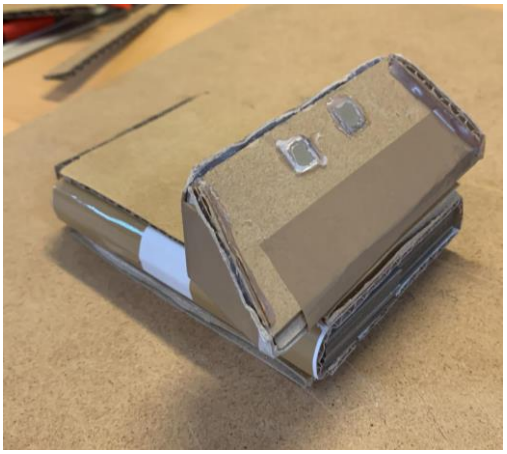
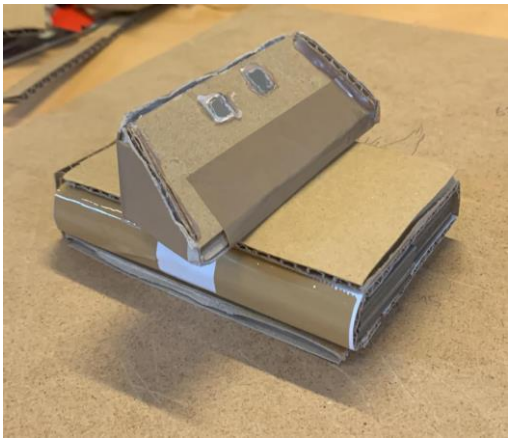
- Two different configurations for the balancing of the weight are tested. They are either stacked on top of each other or placed in two piles next to each other. The docking station should be discreet and as small as possible, if they are to be stacked in 3 different piles the size would be too big.



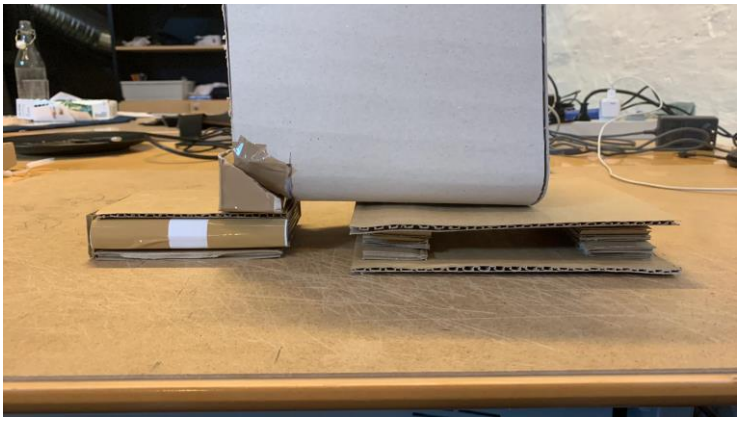
- Then the last prototype is used as it has the weight of the speaker and the magnets placed in.



- The docking station with the magnets is then tape with double face on the weights in different configurations. These 4 configurations test a different gravity center of the weights.

1. 	2. 
3. 	4. 

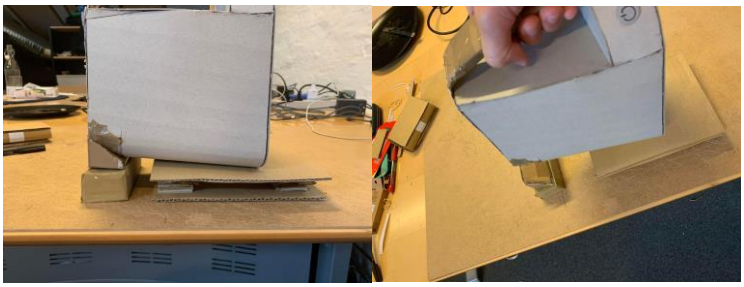
- The speaker is leveled up on a platform to simulate being at the same level as the docking station and laying on a flat surface. The docking station is placed a bit away from the platform, so that the platform does not block the docking station by removing the speaker and thus distort the results.



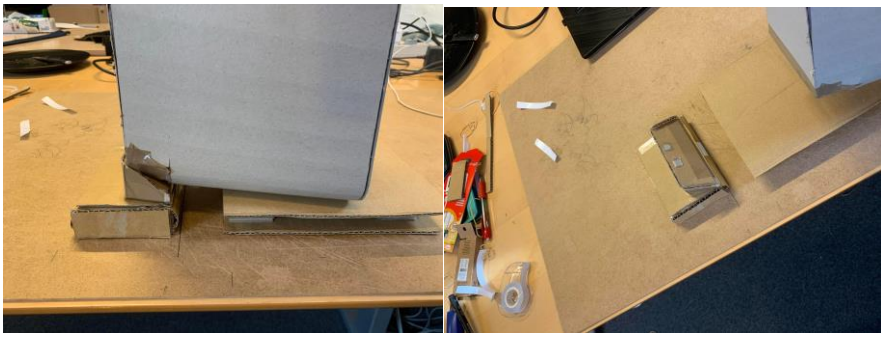
- Each one of the 4 concepts will be tested in the same conditions. The speaker will be taken away from the docking station and placed back on.
- A line will be drawn to mark a limit, if the docking station moves away from this line then it means that it is not balancing the strength of the magnets well enough.

C/Testing

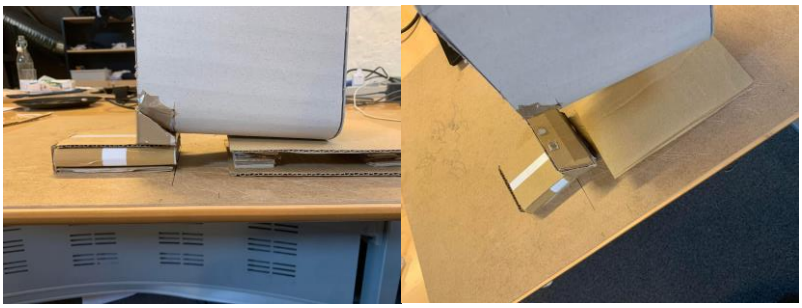
Concept 1



Concept 2



Concept 3



Concept 4

Conclusion

We can see that on concept 1 and 4 the docking station moves slightly above the line and is not stable enough.

The concept 3 is going far away from the line.

The concept 4 stays at the same place. Therefore this solution is kept.

It is also noticed that placing the speaker back on the docking station at exactly the right place can be a bit difficult due to the surface being open on the side. Therefore there should be a way to guide the speaker not only with magnets but also by the shape of the docking station.

Evaluation

The weight should be placed on the bottom of the docking station and in a lateral way with the magnets placed at the front.

Needs:

- A counter weight placed at the bottom
- The magnets should be placed in the middle of the docking station

Reflection

The position of the weight is now determined and the next step will be to include the different inputs in the docking station while developing its aesthetic to fit better with the current solution.

Appendix 26: Deconstructing a Music 1

Objective

During the meeting with the acoustic engineer Stephen at Dynaudio we had the opportunity to have a completely dismantled Music 1 to see all the components and have more precise measurements of these components

The objective was to know the exact size to have a 3D model as accurate as possible.

Experiment / Data

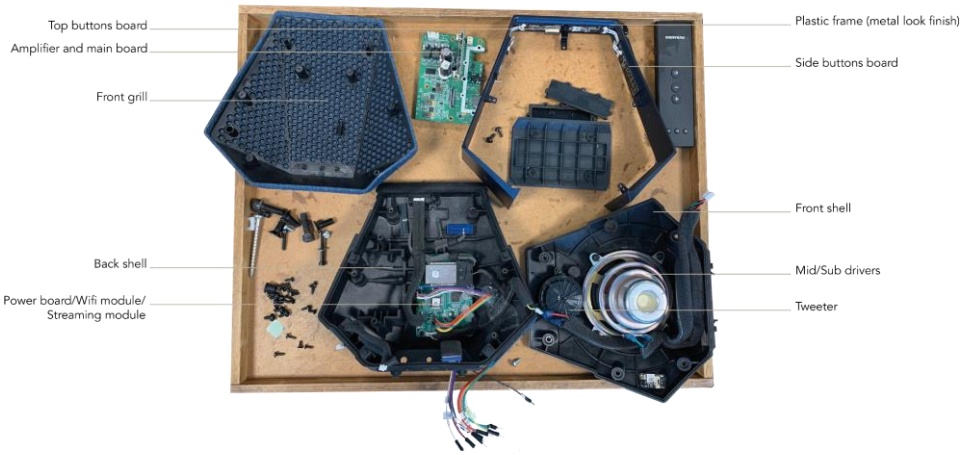
A/Dynaudio Music 1

229 x 220 x 142 mm

Status	Discontinued
Segment	Home
Range	Music
Type	All in one
Analog inputs (Primary)	Mini-jack
Digital inputs (Primary)	USB (iOS)
Network	Wi-Fi (2.4/5.0 GHz)
Bluetooth	4.0
Streaming	Apple Airplay, Spotify Connect, DLNA, Internet Radio, Bluetooth
Amplifier Power Woofer (Watt)	40
Amplifier Power Tweeter (Watt)	40
AC Power Input	100-240V 50/60Hz

Lower Cutoff (Hz @85 dB +/- 3 dB)	50
Upper Cutoff (kHz @ 85dB +/- 3 dB)	20
Box Principle	Sealed
Tweeter	1x 1in soft dome
Midrange/Woofer	4in
Weight kg	1,6
Weight lbs	3 4/8
Width mm	229
Height mm	220
Depth mm	142
Width inches	9
Height inches	8 5/8
Depth inches	5 5/8
Finishes	Light Grey, Dark Grey, Red, Blue

B/Components from the Dynaudio Music 1



Dimensions of used components:

- Amplifier and main board: 100 x 70 x 30 mm
- Power board/wifi/stream: 90 x 55 x 5 mm
- Battery: 70 x 45 x 45 mm
- Top buttons board: 120 x 15 x 2 mm
- 2 x side buttons board: 55 x 15 x 2 mm
- Tweeter: 50 mm diameter x 25 mm
- Mid/Sub: 104 mm diameter x 60 mm

Evaluation

Now the list of components for the speaker is more precise and accurate for the actual concept.

Reflection

The next step is to update the 3D model.

Appendix 27: Aesthetic of the buttons

Objective

In a previous user test (APPENDIX 24) some unser needs are unveiled:

- The buttons should be discreet enough not to trigger too much the attention of the user but still be intuitive when the user wants to use them.
- A change of color on the wifi/bluetooth button makes the user the speaker is connected in the desired way.

In a worksheet detailing the user journey (APPENDIX 14) a need is seen:

- Audiovisual signal indicating battery level

For the pairing button the aesthetic should be considered at the same time as the other buttons. In the APPENDIX 10 a need is seen:

- A solution for the feedback on the user should be developed.

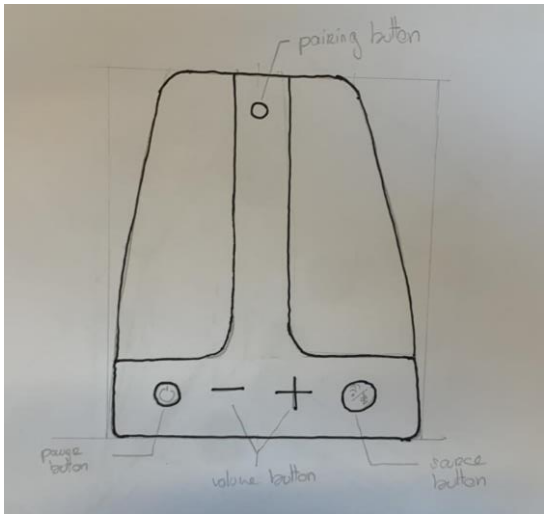
This worksheet aims to answer these needs with different iterations that will be presented to the users further on. It will answer

Experiment / Data

Here you put in a sketch, storyboard, diagrams, photos of mock-up or experiment, rendering of 3D model, interview, etc., including own explanatory comment, analysis, and perhaps evaluation

A/The different buttons, what is known

Position of the buttons



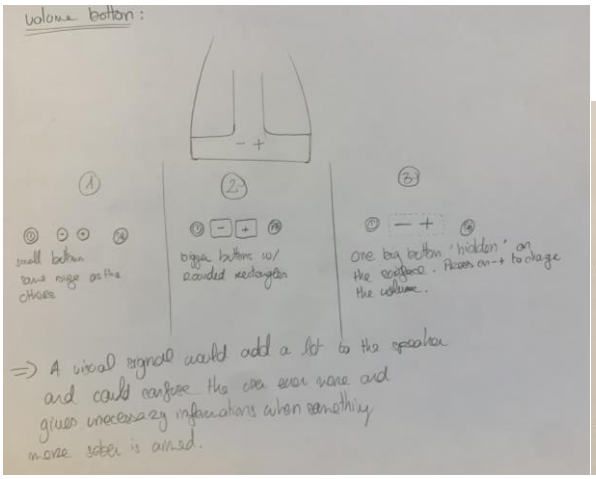
The buttons

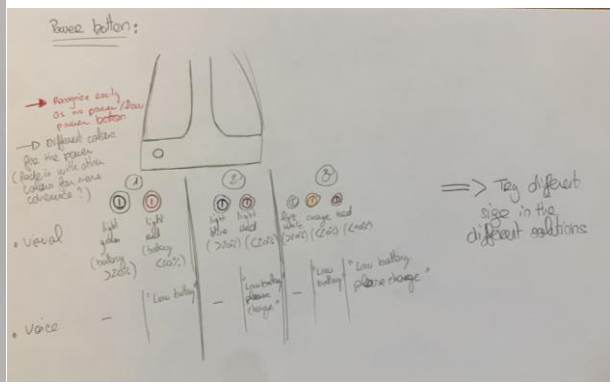
- The speaker should include a visual signal on the buttons for the source, the power and the pairing.

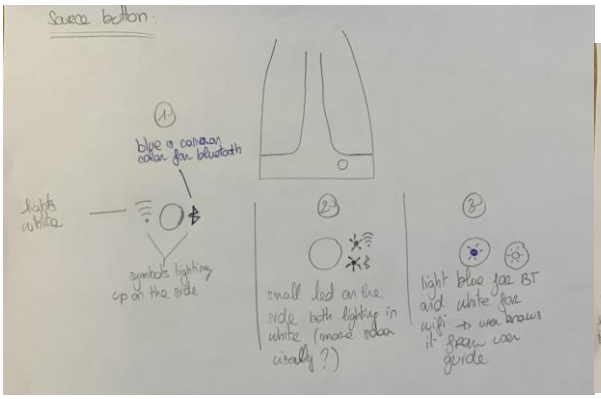
- Placement of the buttons is known
- The buttons should be discreet enough not to trigger too much the attention of the user but still be intuitive when the user wants to use them.

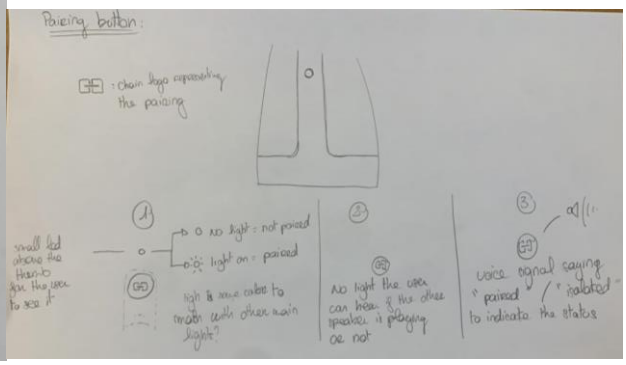
B/Iteration on the buttons

Some brainstorming is done for every button independently regarding its function and several solutions will later be combined to test different possibilities on the users:





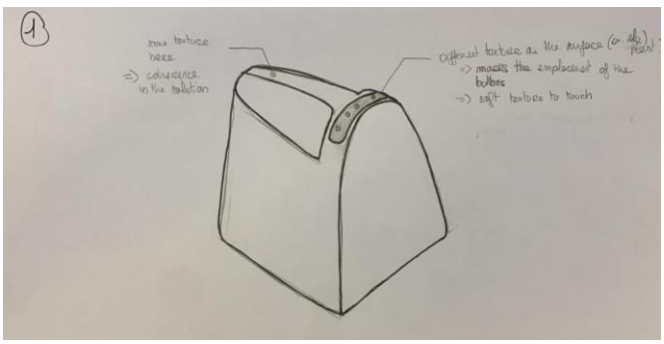


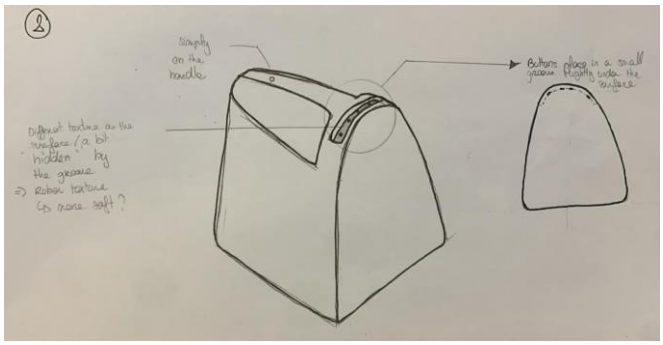


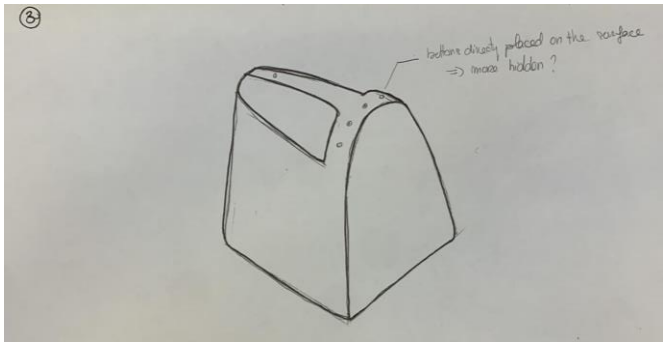
Remarks: To present these functions to the user design of the interfaces will be made in Adobe Illustrator and printed further on to have the right dimensions and colors.

C/Overall aesthetic of the buttons

Different concepts regarding the texture, the material and the size of the buttons will be made for further tests on the user:





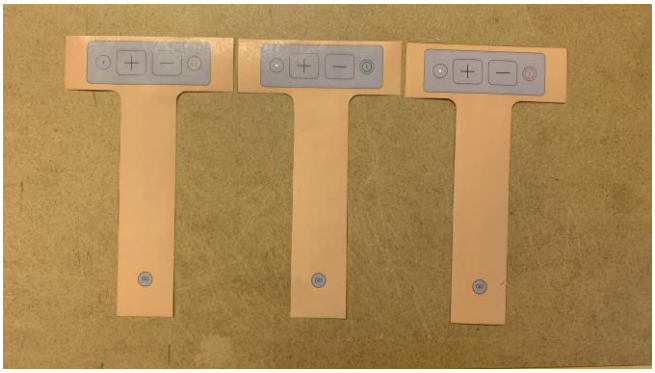


Remark: These concepts being meant for some aesthetic development some quick CAD models with quick renderings are going to be made to be presented to the user in order to give them a better feeling on the different solutions.

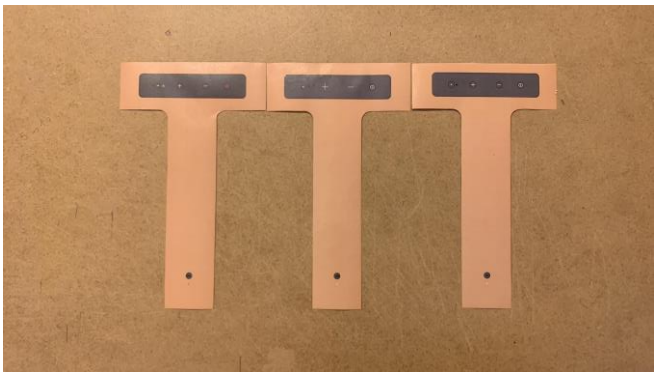
D/Combination

Different set-up combining the different concepts are made.

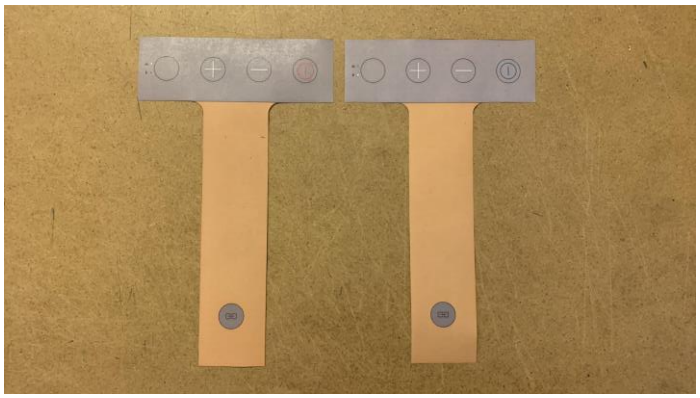
Combination 1



Combination 2



Combination 3



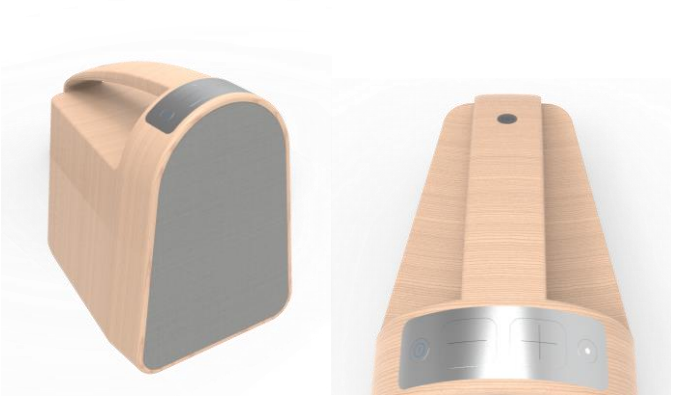
This different patterns can be placed on top of the last model to have a better view on how they are placed on the model.

Note: These combinations lead to different aesthetics that will change the overall aesthetic of the speaker. Some CAD models are realized with quick renderings.

Evaluation

3 iterations are made:

Concept 1



Concept 2

Concept 3

Reflection

Now that some iterations are made user tests should be realized to get some feedback on the solutions and test the different possibilities.

Appendix 28: User tests on the buttons

Objective

Test the buttons on the user in order to get some new user needs and feedback on the different configurations.

Experiment / Data

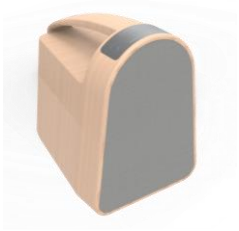
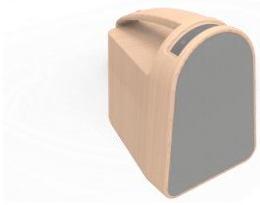
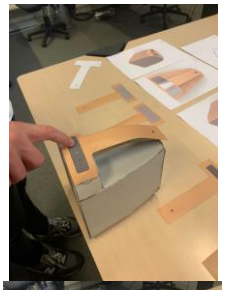
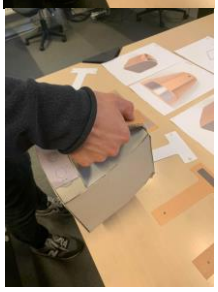
The three concepts are presented in the previous worksheet (APPENDIX 28).

A/The test procedur

What I want to test ? → In the APPENDIX 24 an user insight about a clash between the overall look/ aesthetic of the speaker in stereo mode against the buttons being intuitive enough is noticed. This test aims to find the good configuration to answer the expressed needs.

Different steps in the testing:

1. Present the 3 concepts to the user with the renders printed out to show the aesthetic and visualization for a better understanding of the solutions. Explain the solutions at the same time.
2. Test each concept one after another.
3. The solutions are printed on paper to have real life sizings.
4. Each paper will be placed on the current prototype.
5. Explain the different colors and how it works with the right order (from battery high to low).
6. The user will have to figure out the placement of the buttons by itself and different actions will be asked in the following order:
    a. Turn the speaker on.
    b. Connect the speaker to the source.
    c. Turn the volume up and down.
    d. Take the speaker off the docking station and press on the pairing button to pair or isolate the speaker.
7. Repeat that for the 3 concepts
8. Make the user touch 2 samples to feel the materials
9. Get feedback from the user and discuss the different solutions.

Observations:

On all three solutions the user figures out quickly what button to use and where it is placed. Having the buttons on the top makes it easy for the user to see which one to press without having to search for the right one. The different sizes are okay and the user sees where to place its fingers.

The only difficulty that the user faced was to see the difference between wifi and bluetooth in the solution 2.

It is also noted that having the buttons following the round shape results in having the user looking around to find the right buttons to make sure he is pressing the right one, to avoid that on the product having a flat surface for all the buttons would make it easier for the user to quickly identify the right button.

Feedback:	Feedback:	Feedback:
- Having the small frame for the buttons like that is taking a lot of space and makes a big deal out of the buttons. It takes a lot of attention when	- Like the rubber because it's quite discrete, having it placed under the surface makes it more hidden. - Like the tactile feeling	- Like this solution because the distinction between the buttons being a feature or hidden is a good mix. Having the buttons integrated to the

passing by. - Having only the light blue or white for the wifi makes it a bit confusing, the user is not sure and a logo would help better. - Having the voice indicating when the battery is low is nice because the user might not look at the speaker all the time or see when the light color is changing.	with the rubber, it's more warm and less sterile than something in metal. - Compared to the other solution the user likes the simple colors on the power button, when it's on it's white and it feels less artificial than green or blue. When the speaker is on the docking station if the light is white it will not be shocking to look at it. - Having the black rubber and the rubber takes a lot of attention to it and also makes a big deal out of the buttons. - Regarding the pairing button the user likes this solution better, it is quite small and doesn't draw too much attention in comparison to the others. The user prefers to have the light to indicate what is the status because if he is in another room he might not hear what's happening and a voice signal would draw attention away from the music.	frame they are hidden but the user also easily knows where to find them. - Nice to have the frame going all the way around, it emphasizes where the buttons are and doesn't overpower the all aesthetic of it like in the solution 1. - Regarding the pairing button it feels like it's a bit alone there and it looks a bit funny to have it there only on the wood. - For the source button the user prefers this solution, the solution 1 is too confusing without a logo. On solution 2 the logos are really difficult to read because they are small, to see them better with light on it would look too big and be a bit weird. This solution looks more elegant.

Evaluation

Different guidelines are taken from the user research for further development:

Overall aesthetic:

- Having the frame going all the way around emphasizes where the buttons are and doesn't overpower the all aesthetic of it. It doesn't make a big deal out of it for the buttons.
- Make it consistent for all the buttons by having the metal frame going on the handle to hide the pairing button.
- Regarding the size of the buttons this will depend on the aesthetic, a fine balance should be found in the size regarding the aesthetic as the size of all the buttons was clear enough for the user to identify the buttons.

Some more precise needs are taken for the different buttons:

Power button:

- Have a white light when there is battery
- Red when power is low
- A voice signal indicating when the battery is low

Volume buttons

- Classic push buttons in the middle that don't draw too much attention

Source button

- Small white light on the side with a pictogram on the side indicating what source it is connected to

Pairing button

- Button placed on the handle with a small light

Buttons in general:

- Have the buttons next to each other on a flat surface.

Reflection

The user test showed the direction to take in further development of the concept, the next step is to gather the needs and the guidelines for a new iteration on the product.

Appendix 29: Functioning of the Dynaudio application/Signal transmission

Objective

Get more knowledge of the Dynaudio application and see how it can work with the speaker. What are the connectivity possibilities ?

What are the different controls via the app ?

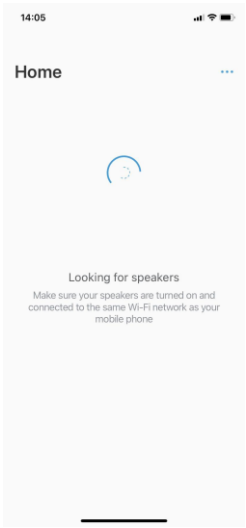
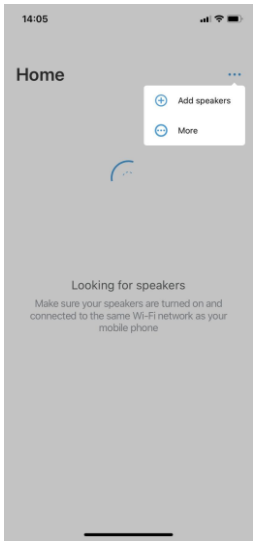
Suggestions for improvements ?

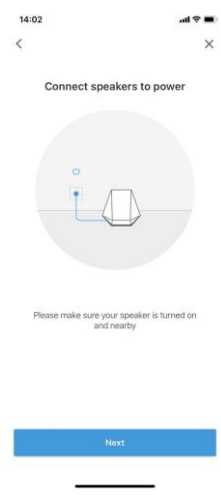
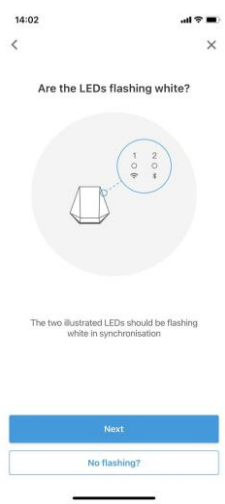
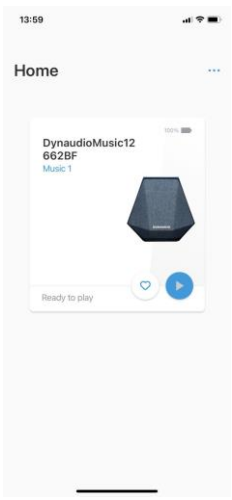
link needs evolve in multiroom and control device from a smartphone

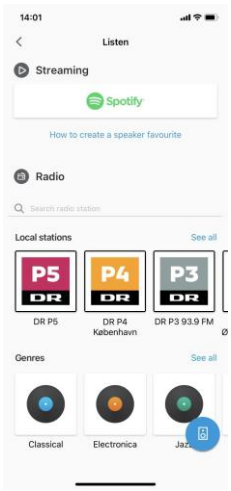
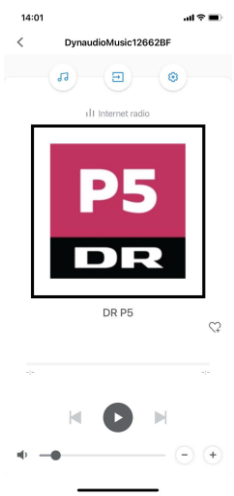
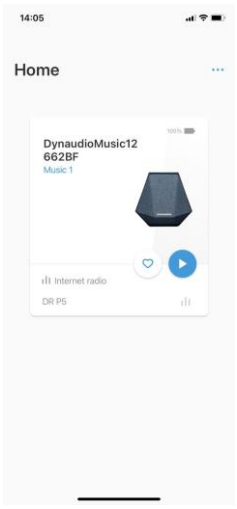
Experiment / Data

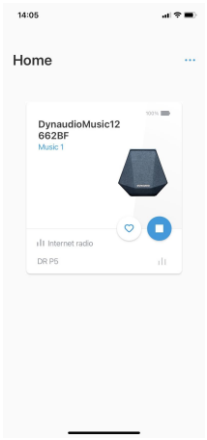
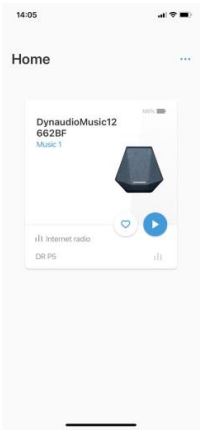
A/The Dynaudio application on smartphone

Set-up and control the speaker in a chronological order.

		
When opening it the application is first searching for previously paired speakers.	To add a speaker the user needs to press on the 3 dots on the top right of the screen and select “add speakers”.	Then the app asks the user which Dynaudio product to pair. The user simply have to click on the desired one.

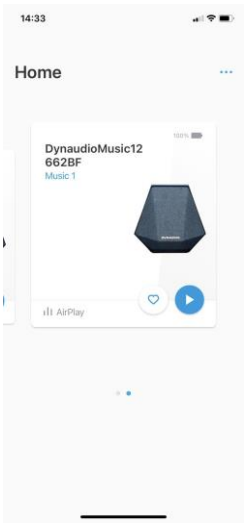
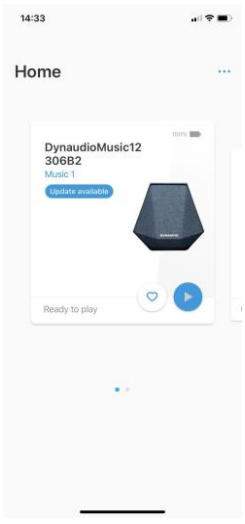
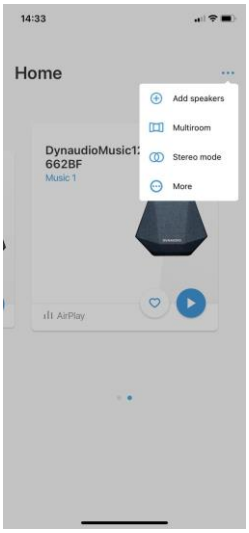
		
Then it asks if the speaker is turned on.	The user simply has to follow the instructions to have the 2 lights blinking to be ready for pairing.	The speaker now connects to the app and appears in the home screen.

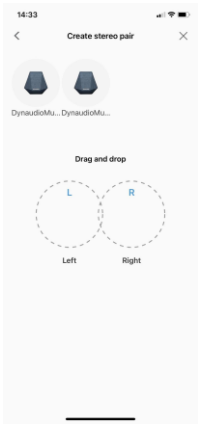
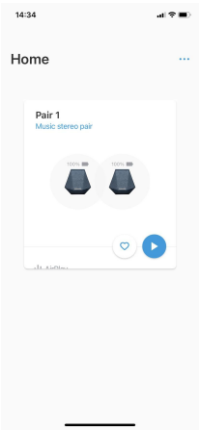
		
The user can click on the speaker in the home and is directed to this page to choose what to listen to. Streaming services and radio stations are proposed.	The user clicks on one and it starts playing.	Users can go back to the home screen to see the status of the speakers, change some parameters or settings.

	
The user can press “stop” to stop the music. After 5 min without playing the speaker will automatically turn off.	The speaker is now registered in the app. Once it is recognized and the wifi is on in the house the user can press play in the app and the last sound sources played will start again. The user doesn’t have to touch the speaker anymore.

<u>B/ The new solution and the application</u>

The solution will require connecting two speakers to the application. The process is the same to connect the other speaker but the user will be asked to select a left and a right speaker.

		
The first speaker is already connected.	The user needs to repeat the steps to connect a second speaker.	Once it’s done the user can click on the 3 dots and select to connect them in multiroom or as we are interested in stereo mode.

		
It is then asked to drag and drop the speakers to assign a left and a right speaker.	The user can now click on create a stereo pair.	The user can now enjoy its sound in stereo and control both speakers from the app.

Remark:

To stop the music on only one speaker the user can turn the volume down as the volume can be changed independently on each speaker from the application. But there is no real convenience or direct access. It asks to go in the app and search for the volume. **This confirms that the use of a "pairing button" on the speaker will make it easier for the user to control.**

Evaluation

The app is developed to work with any Dynaudio product and allow the Dynaudio users that have multiple products to create different groups of speakers. Some stereo pairs or connect everything into a multiroom. This offers some possibilities of evolution for the user, if they buy more active Dynaudio products they can have everything in the palm of their hand and easily access all their products. Regarding the solution itself there is no specific change to bring to the application. The actual concept can easily fit in and adding a pairing button will allow it to make it faster to control the sound and avoid the user going into the app.

Even though it is possible to fully control the speaker via the app some direct control is needed on nomad speakers as the user might not always have its phone in hand. It could be sitting in another room for example and would make it annoying to have to get on the phone and change parameters from it.

Reflection

The Dynaudio application is intuitive to use and makes it easy to connect the speakers together. The app itself will not impact the development of the product.

The product can directly be integrated into the app before going on the market.

Appendix 30: Iteration on the buttons

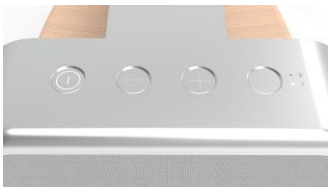
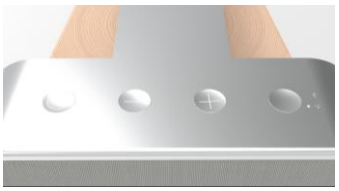
Objective

test different iterations on the shape of the buttons to see what solution is the best match between intuitive and aesthetic.

Experiment / Data

A/The concepts

3 concepts are considered:

Concept 1	Concept 2	Concept 3
		
The hole for the button has a little chamfer and the button a small filet. This solution is really intuitive and the user can quickly feel where the button is placed.	The surface of the button is perfectly flushed with the surface and has a small filet to see the demarcation line. This solution is less intuitive but more aesthetic.	The edge of the button is flushed with the surface and the button's surface is curved for the user to feel where to place its fingers. This solution aims to be a mix between being intuitive and aesthetically pleasing.

The objective is to test what is the good combination and if it's possible to quickly identify where to place the finger.

To test that a prototype for each kind of button is realized. It will then be asked to the user to place its finger on it and see if they can press on it without searching for it.

As seen from the designer the Concept 2 is the most pleasing visually, then the concept 3 and finally the concept 1 but it has to stay intuitive for the user.

B/Prototypes

On concept **1** it is easy to feel where the button is placed, the feeling is not really smooth as we can feel the edge. On **concept 2** it is really difficult to identify where the button is. We can feel a little bit but it is necessary to search for it while looking at it. For concept **3** it is also easy to feel the position of the button and the feeling is smoother than on concept 1. The curved button englobes the finger.

The **concept 3** is a good mix between aesthetic and a practical solution, it is also more pleasing to touch than the other concepts. Therefore this concept is chosen.

These concepts are tried with a diameter of 12mm. It gives more space for the finger than 10mm and is seen as a good size to adapt more fingers.

Evaluation

The **concept 3** is chosen.

<u>User needs:</u>

- The buttons should be curved
- The diameter of the button should be 12mm

Reflection

This activity allowed us to confirm the initial thoughts on the button size and shape. It will be implemented in the CAD model and helped to figure out the final shape and size for the buttons.

Appendix 31: Test on the docking station

Objective

Try two different concepts for the docking station with 2 different working principles. The magnets will also be implemented to try the counterweight.

Talk about why usb-c, aux and HDMI. Link to APPENDIX 19 meeting with DYnaudio engineer

Experiment / Data

A/The model

In the precedent iteration on the CAD model (APPENDIX 18) 2 solutions are considered for the docking station.

The two models are 3D printed for better testing and try it with the right dimensions. 2 models are printed and some counterweights are put in with some magnets.

In concept **1** the speaker goes around the docking station and in concept **2** it's the docking station that goes around the speaker.

In order to have quicker models and save some time on the process some quick models are made, they are only trying the working principles.

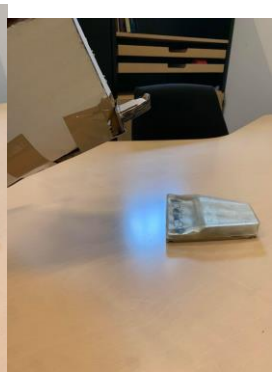

The model is taped to an old iteration of the model with the right weight in and the right position for the handle. On **concept 1** the magnets are placed on the top part of the docking station where the end of the speaker comes to meet the magnets, if they are placed at the beginning it might make it difficult to slide it in. On **concept 2** the magnets are placed where the end of the speaker meets the docking station.


B/Testing

To test the 2 different models they are placed on the docking station, taken out and placed back in. The objective is to see which solution is easier to place back on the docking station and which one feels better.








It is easy to take the speaker out of the docking station but when placing it back the edges are going over the docking station and makes it difficult to place it back correctly every time, it is necessary to look at when to place the speaker. The magnets are also less useful and don't guide the speaker really well.	For this solution it is easy to place the speaker back on the docking station without paying too much attention on where to place it back, the magnets allow it to guide the speaker easily in the right position.
In both solutions the counterweights work really well and the docking station is not moving when taking the speaker in and out. The **concept 1** makes it difficult to place the speaker back, it is not really intuitive and aesthetically pleasing therefore it is abandoned and the **concept 2** is kept and will be implemented in a new iteration of the speaker. For both concepts it is also observed that there is tendency for the docking station and the speaker to "slide" on the table top, it was tested on wood with lacquer and could annoy the user therefore some rubber could be added to avoid this.	

Evaluation

This test allowed to validate a new iteration on the docking station and confirm the different working principles:

- the counter weight
- the magnets
- the shape of the docking station going around the back of the speaker unit

User need:

- The docking station should go around the back of the speaker.
- Some rubber pads should be added to the docking station and the speaker.

Reflection

This test allowed us to confirm the main working principles of the docking station. While realizing it a question arose regarding the magnets.

How to put precise user needs on the kind of magnets to be used and what force should they be ?

With the magnets currently used the feeling is right and the counterweight is heavy enough to avoid the docking station to move. In order to give better indication for further manufacturing some desktop research should be made on the different types of magnets and which ones to choose for the product.

Appendix 32: Magnets

Objective

Justify the use of this type of magnets and define more precise needs regarding the magnets.

Experiment / Data

A/Different types of magnets

Magnets can be made with different materials resulting in various forces of attraction, different types of magnets can be commonly found on the market:

The neodymium magnets which are the strongest magnets that are commonly available on the market. They have a maximum operating temperature of 80°C.

The alnico magnets are less strong than neodymium magnets but also commonly used and can operate until 500°C.

Ferrite magnets are the most common ones, they are pretty cheap and have a high resistance to corrosion. They can operate up to 200°C.

https://www.magnetexpert.com/technical-advice-for-every-application-magnet-expert-i685/materials-information-i682#:~:text=There%20are%20five%20main%20types,%2C%20ferrite%2C%20and%20flexible%20rubber.

https://www.duramag.com/alnico-magnets/temperature-effects-on-alnico-magnets/#:~:text=Alnico%20magnets%20can%20be%20used,be%20recovered%20by%20reheat%20treating.

It is seen that when magnets are exposed to high temperature their longevity and their magnetic properties can be impacted. For most common chargers available on the market the maximum temperature can reach a maximum of 65°C and therefore will not affect the magnetic properties of the different kinds of magnets.

Different types of magnets are searched in shops to try their pulling force and their size. Neodymium and ferrite magnets are found to be used.

The neodymium magnet is on the left and the ferrite one on the right. The size of the ferrite magnets is a big disadvantage, it is way bigger than the neodymium one but the pulling force is way lower and would result in a bad user experience (APPENDIX 23). They are not guiding the speaker unit in a precise position as well. Therefore the ferrite magnets are abandoned.

The neodymium magnet by its size and its pulling force is a good solution to answer the different user needs for the docking station:

- Magnets to guide the user when placing the speaker
- The magnet should be strong enough to allow the user placing the speaker back without searching for the direction.

<u>B/Pulling force</u>

Different set-ups are tried with the magnets and the right weight in the speaker:

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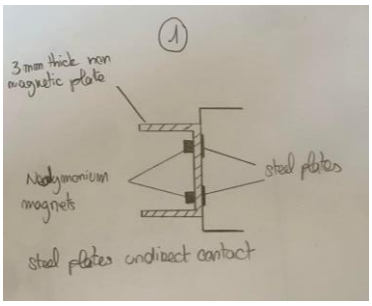
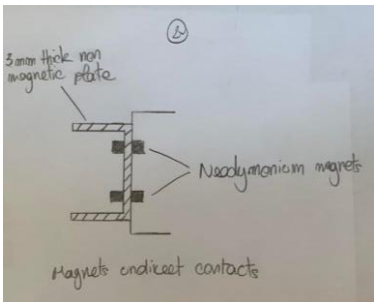
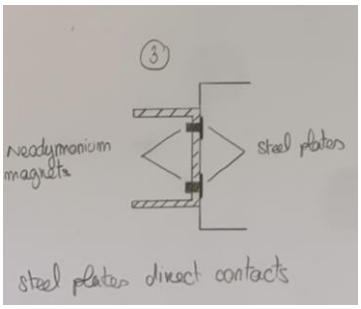
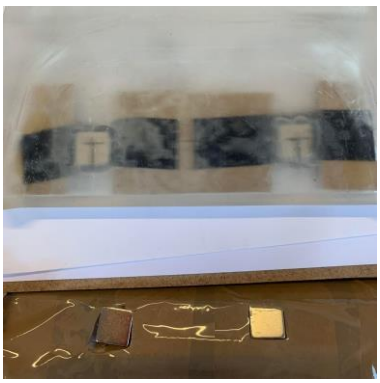
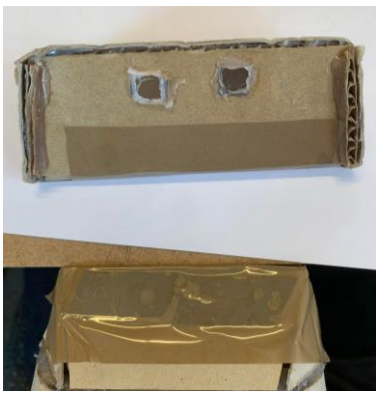
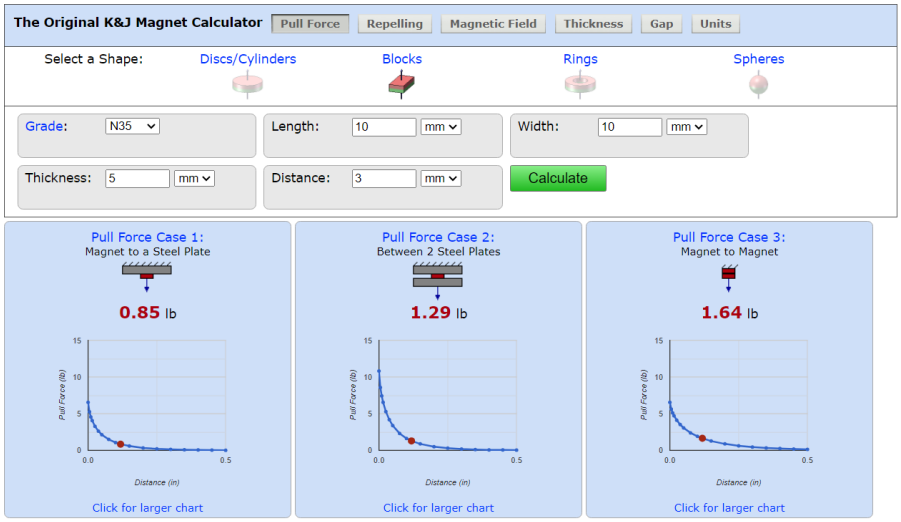
<td> 
</td>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>  </td>
<td>  </td>
<td>  </td>
</tr>
<tr>
<td colspan="3">The solution 2 as a force of attraction way too high for the speaker, it is difficult to take it off the docking station. The solution 3 has a high force of attraction but is pleasant to use, but that results in putting a lot of weight in the docking station to counter the force. The solution 1 has a really nice feeling when taking the speaker on and off, it guides it in the right position and it’s easy to take it off while offering a small resistance. The weight in the docking station will also be lower.</td>
</tr>
</table>

Calculating the pulling force:

The pulling force is calculated with https://www.kjmagnetics.com/calculator.asp?calcType=block



We are in the case of the pull force case 1 with a distance of 3 mm from a steel plate.

Pull force = 0.85 lb = 0.39kg.

2 magnets are used therefore the total pull force is: **Tpf = 0.78kg.**

In order to counter the pulling force of the magnet the total weight of the docking station should be a minimum of 0.78kg.

In order to make sure the docking station will not move a total weight of 1kg can be used.

C/Test

In the WS72 a test is performed with the magnets in the case 1 with a steel plate separated from the magnets with a 3mm non magnetic plate.

978 grams of counterweights are placed in the docking station

Combined with the weight of the 3D printed docking station it reaches a total of 1kg.

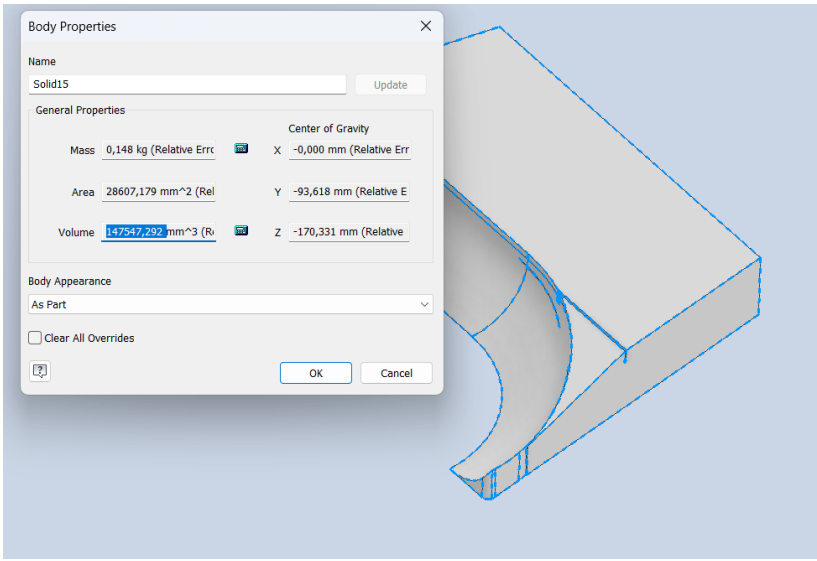
The test showed that the docking station is not moving and that pulling force makes it comfortable to use and matches all the requirements.

Evaluation

The selected solution is to have two neodymium magnets placed on both sides of the connectors on the docking station. They are separated from a steel plate placed on the speaker unit with a 3mm thick non magnetic wall.

- The total attraction force for the magnets should be 0.78kg
- The total weight of the docking station should be 1kg
- Steel plates should be added at the back of the speaker and be separated from the magnets by 3mm.

The current CAD model for the counterweight:



VOLcounterweight = 147,5 cm3

According to : https://amesweb.info/Materials/Density_of_Steel.aspx the density of steel is 7.8 g/cm3.

The use of lead is not considered due to its toxicity.

With the actual model and the actual size of the counterweight its total mass is:

Tm_counterweight = 7.8 x 147,5 = 1150 g = 1,150 kg.

Therefore there is enough space for the counter weight in the docking station.

Reflection

This activity allowed us to set some precise parameters for the weight of the docking station and the required attraction force for the magnet. This was reversed engineering and allowed to confirm the assumptions previously made, the parameters are now ready for a more precise development and to be implemented in the final solution.

Appendix 33: FEA analysis

Objective

Ensure the structural integrity of the speaker cabinet through a Finite Element Analysis.

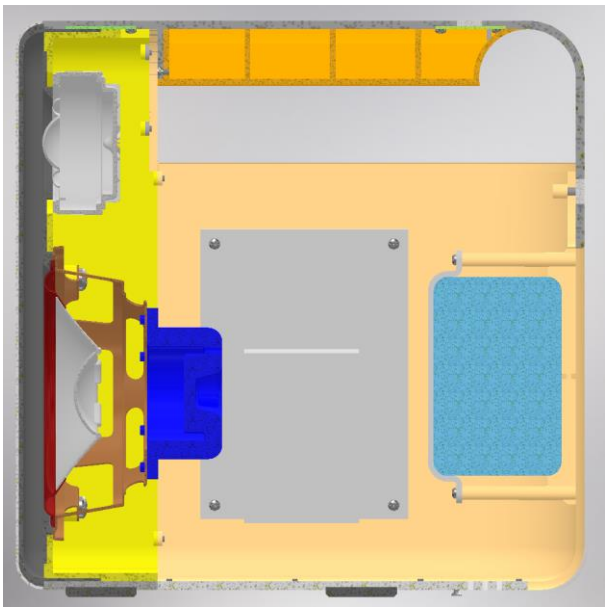
What is tested:

When the speaker is laying on a table the cabinet is subject to the forces occurring by the shell and the components but it is way lower than when the user will grab the speaker to move it around. This simulation aims to calculate what are the stresses when the speaker is moved around, it is the use phase where there are the most risks for it.

Experiment / Data

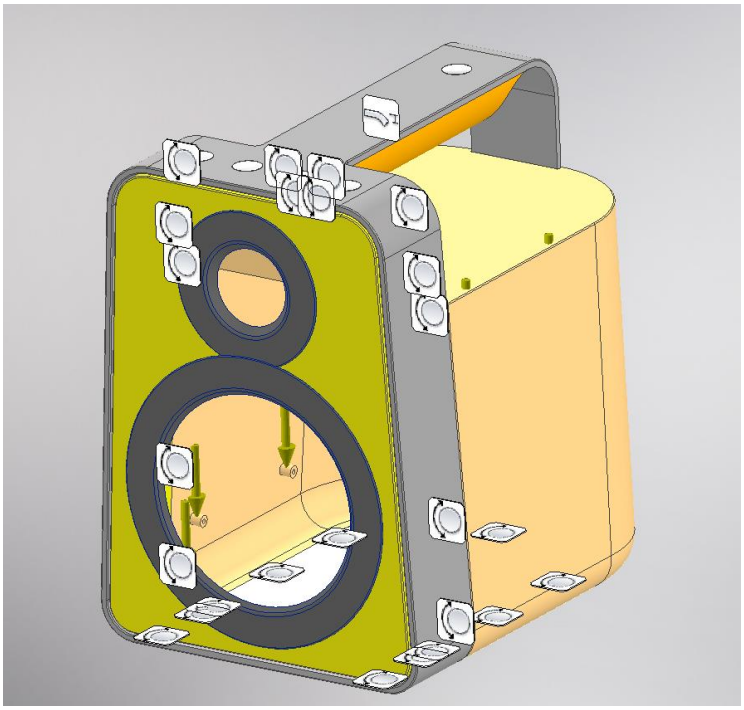
A/Set-up for the analysis

Brackets and constraints



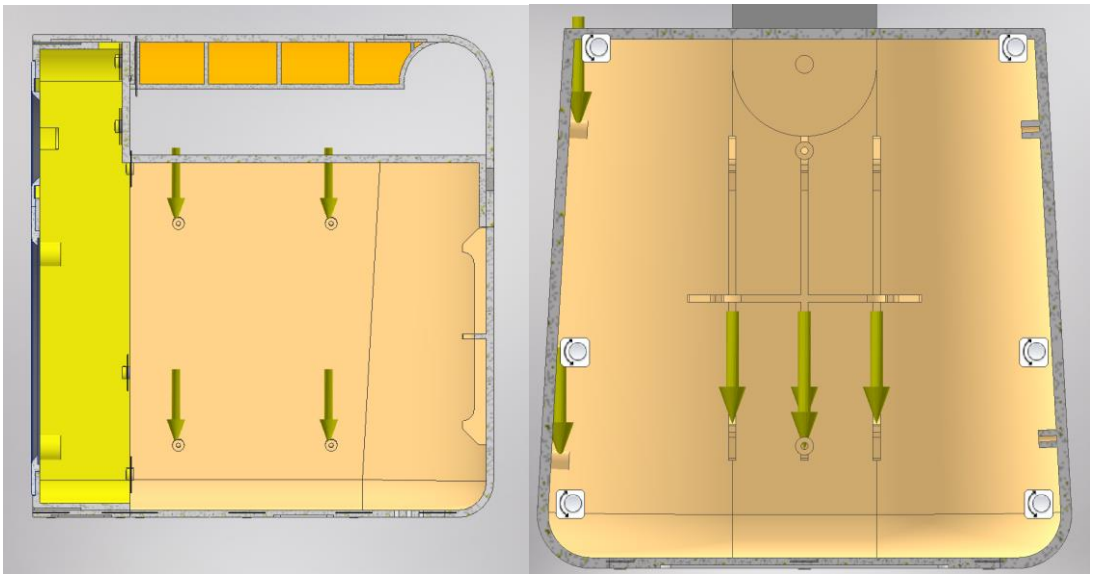
A final CAD model is realized including all the latest findings from the speaker development. All the components are placed in the speaker and some brackets are put to connect the different parts and components together.

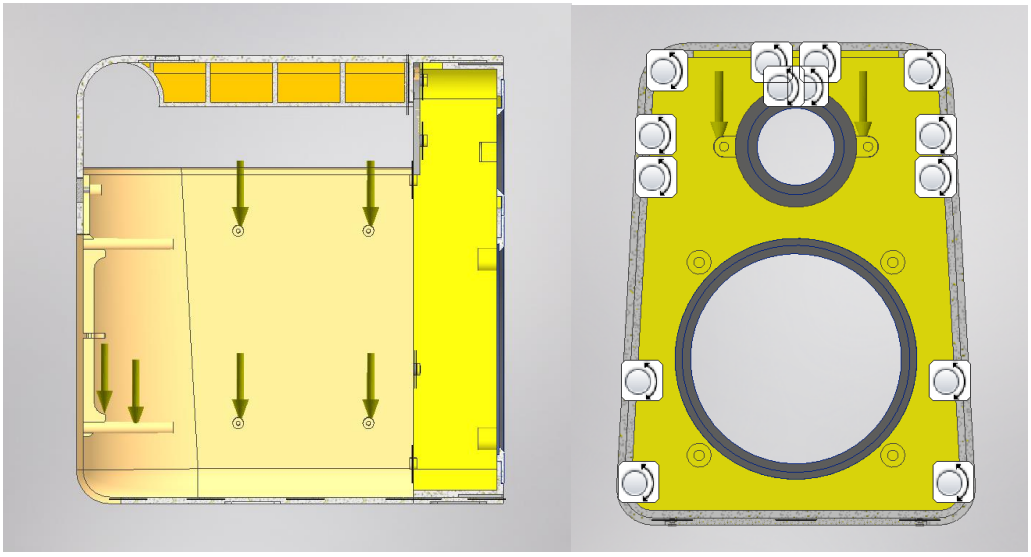
In the FEA analysis the "pin" constraint is used for the screws simulating the thread. A "fixed" constraint is placed on the handle to simulate where the user is grabbing the speaker cabinet.

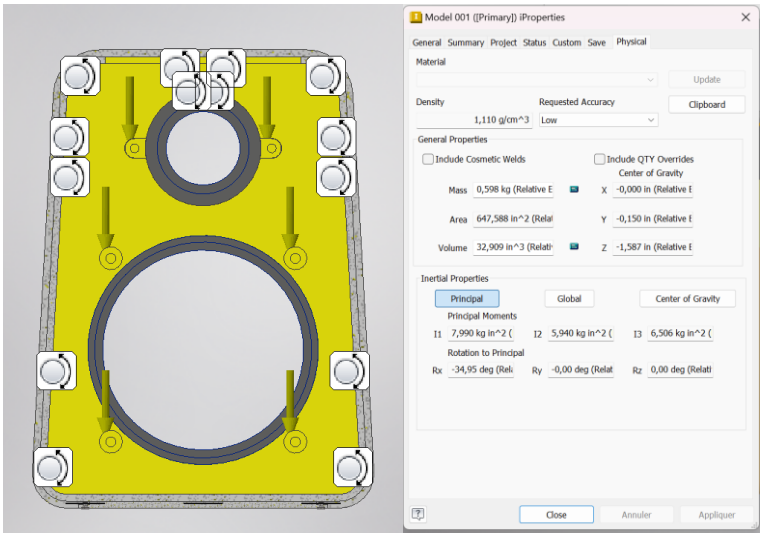


Forces applied

Component	Weight (g)	Force (N)	Number of brackets	Force applied on each bracket (N)
Amplifier board	280	2,76	4	0,69
Battery	300	2,94	4	0,735
Main board	200	1,96	4	0,49
Tweeter	120	1,18	2	0,59
Mid/Sub	100	0,96	4	0,24
Speaker shell	600	5,89	-	-
Total	1600	15,69		

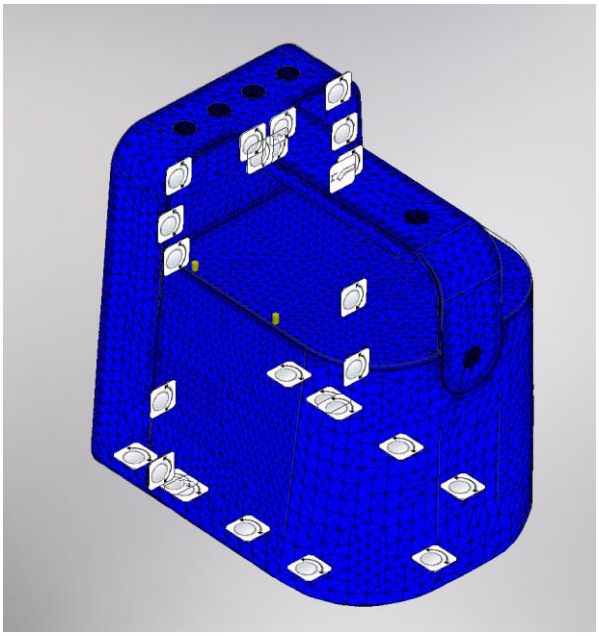





Model 001 ([Primary]) iProperties
General Summary Project Status Custom Save Physical
Material
Update
Density
Requested Accuracy
Clipboard
1,110 g/cm^3
Low
General Properties
Include Cosmetic Welds
Include QTY Overrides
Center of Gravity
Mass 0,598 kg (Relative E
X -0,000 in (Relative E
Area 647,588 in^2 (Relat
Y -0,150 in (Relative E
Volume 32,909 in^3 (Relati
Z -1,587 in (Relative E
Inertial Properties
Principal
Global
Center of Gravity
Principal Moments
I1 7,990 kg in^2 (
I2 5,940 kg in^2 (
I3 6,506 kg in^2 (
Rotation to Principal
Rx -34,95 deg (Rel
Ry -0,00 deg (Relat
Rz 0,00 deg (Relati
Close
Annuler
Appliquer

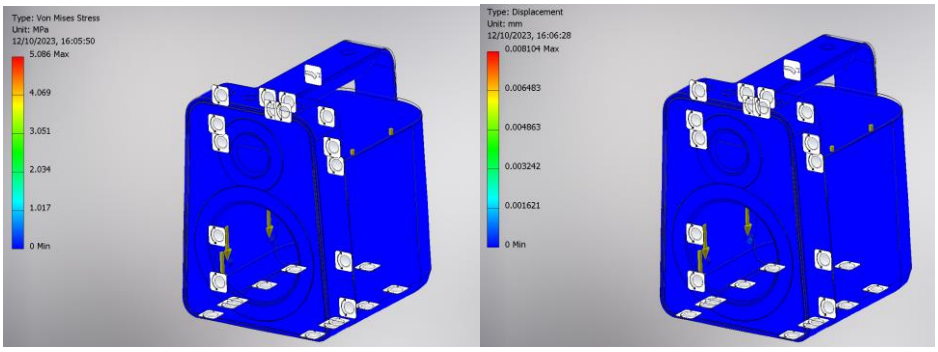
The mesh

Then the mesh is generated to prepare the analysis, the mesh is thinner around the edges and the brackets to have a better calculation around the spots where there is a concentration of constraints.



B/The analysis

Once the setting up is done the analysis can be launched giving the following results:



The maximum Von Misses stress is: 5,9 Mpa

The maximum displacement is: 0,0081 mm

These results are then compared to the mechanical properties of ABS which is the main material for the speaker cabinet.

Mechanical Properties of ABS

Elongation at Break	10 - 50 %
Elongation at Yield	1.7 - 6 %
Flexibility (Flexural Modulus)	1.6 - 2.4 GPa
Hardness Shore D	100
Stiffness (Flexural Modulus)	1.6 - 2.4 GPa
Strength at Break (Tensile)	29.8 - 43 MPa
Strength at Yield (Tensile)	29.6 - 48 MPa
Toughness (Notched Izod Impact at Room Temperature)	200 - 215 J/m
Toughness at Low Temperature (Notched Izod Impact at Low Temperature)	20 - 160 J/m
Young Modulus	1.79 - 3.2 GPa

https://omnexus.specialchem.com/selection-guide/acrylonitrile-butadiene-styrene-abs-plastic

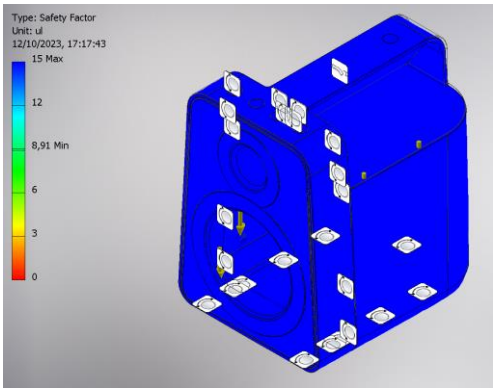
We can see that the maximum Von Misses stress of 5,9 MPa is way under the maximum tensile stress of 29Mpa the material can accept.

Evaluation

The FEA analysis shows that the integrity of the speaker cabinet is respected when being carried around. The maximum safety factor is 15 and the minimum one is 8,91.

The risk for the speaker is to be dropped from a human height while being carried around, a test that requires a fully functional product and to do some repetitive simulations to see how many times the speaker can be dropped before breaking. The software used doesn't allow this kind of testing, a physical test should be done. Due to the available resources (time and no final products yet) it is not possible to realize it in a physical way.

With a minimum safety factor of 8,91 it is assumed that the speaker should resist shocks, the selected material also has some good properties for shocks, it is often used for working tools.



Reflection

The analysis shows good results for the structural analysis of the speaker cabinet. The analysis is made in order to respect the placement of the different components and the force they apply to each screws and brackets. The computer analysis shouldn't be the only one to do before launching the product for manufacturing, to further validate a 1:1 prototype with all the components should be realized.

Appendix 34: BOM and business

Objective

Estimate the cost of the components to establish the BOM

Experiment / Data

The following informations come from Dynaudio:

The issue is that Dynaudio wasn't producing the Music series in-house - So the only thing I have available at the moment are these quotes:

Pcs	Component	Price CNY	Price DKK
1	1" Cockatoo Tweeter	¥33.32	31.99 kr.
3	3" midrange	¥114.00	109.44 kr.
1	Wifi module	¥120.00	115.20 kr.
1	DSP unit	¥33.66	32.31 kr.
1	MCU	¥22.10	21.22 kr.
1	M3 AMP	¥15.95	15.31 kr.
1	M3 Mainboard	¥7.82	7.51 kr.
1	M3 PSU	¥10.00	9.60 kr.
1	misc	¥37.57	36.07 kr.

Wrong midwoofer – so you can use the below instead:

ML quote 20201020			ML quote 20201014		
Item	USD		Item	USD	
Woofer x 2 (plastic basket)	12.39		Woofer x 2 (plastic basket)	12.39	
Mid-range x 2 (plastic basket)	7.17		Mid-range x 2 (plastic basket)	7.17	
Tweeter x 2	5.46		Tweeter x 2	5.46	
Amp	51.98		Amp	51.98	
Stream 1832 module	22.93	24.90	Stream 1832 module	24.60	24.9
Power cable x 2 (UK & Euro plugs)	0.00		Power cable x 2 (UK & Euro plugs)	1.00	
Optical cable	0.00		Optical cable	0.00	
3.5mm audio signal cable	0.00		3.5mm audio signal cable	0.00	
Y logo light pipe	0.10		Y logo light pipe	0.10	
Y logo	0.31		Y logo	0.31	
Key kits 1	0.71		Key kits 1	0.69	
Key kits 2	1.21		Key kits 2	1.18	
Key kits 3	1.69		Key kits 3	1.64	
Light pipe 1	0.00		Light pipe 1	0.00	
Light pipe 2	0.07		Light pipe 2	0.07	
Front baffle	10.65		Front baffle	10.65	
Front grille + fabric (Gabriel's fabric)	15.82		Front grille + fabric (Gabriel's fabric)	15.82	
Rear baffle	15.92		Rear baffle	15.92	
Rear baffle + fabric (Gabriel's fabric)	16.97		Rear baffle + fabric (Gabriel's fabric)	16.97	
Chassis	6.66		Chassis	6.66	
Frame plug x 2	0.13		Frame plug x 2	0.13	
PCB plastic box	0.34		PCB plastic box	0.34	
Airtight enclosure	0.17		Airtight enclosure	0.17	
Silicone parts	4.06		Silicone parts	4.06	
EVA	0.02		EVA	0.02	
Terminal strip x 6	1.09		Terminal strip x 6	1.09	
Al trim strap (Wisefull)	39.38		Al trim strap	35.60	
Heatsink (IC)	0.23		Threaded spacer	0.42	
Threaded spacer	0.42		Screws	1.79	
Screws	1.79		EVA mylar	1.97	
EVA mylar	1.97		Desiccant bag	0.19	
Desiccant bag	0.19		Absorbant sponges/damping material	1.26	
Absorbant sponges/damping material	1.26		EPE top left, top right and bottom	3.98	
EPE top left, top right and bottom	3.98		Giftbox	3.48	
Giftbox	3.48		Master carton	1.12	
Master carton	1.12		PE bag	0.00	
PE bag	0.00		Non-woven fabric bag	1.15	
Non-woven fabric bag	1.15		Pallet & edgeboard	0.37	
Pallet & edgeboard	0.36		Labels	0.59	
Labels	0.59		Manual	2.66	
Manual	2.66		Labor cost + manufacture cost + overhe	101.98	
Labor cost + manufacture cost + overhead	103.01		Total	334.98	
Total	337.44				
嘶美隆下次更正SUE模组价格；需美隆更新按键/铝片/铝框价格					

The M1 AMP, Mainboard and PSU might be a littlebit cheaper – but not much.

Regarding the weight I would use the weights from page 85 in the Ambient 1 report (Appendix).

The cost of the component is found according to the data gathered from Dynaudio and data from the Ambient 1 project.

It is difficult to find the cost of some smaller and more specific components. They will not have a big impact on the total production cost and are therefore not taken into account.

Manufacturing method:

R-ABS

For the R-ABS the chosen method is injection molding because it is cheaper for large production scales and allows to make the product with the desired shape. To estimate the cost "www.costumpartnet.com" website is used. It is possible to enter the parameters of the pieces and make an estimation of the cost of injection molding for a given amount of units. It was discussed with Dynaudio (APPENDIX 19) a good objective for them is to sell around 5000 pieces/year, therefore the cost estimation is done with 5000 pieces. In the NPV 2 cases are taken to be compared.

- slow sales start at the beginning (2500 pcs) and progressively raising
- strong start (5000 pcs)

The tooling and mold costs are included in the cost/pieces.

Cost of ABS/kg on the website is higher than some R-ABS found on computer research. Therefore it will be slightly overestimated and it can be projected to reduce costs on it.

Dimensional Tolerances ± mm

	Commercial Tolerance			
Dimension	1 to 20 (+/-mm)	21 to 100 (+/-mm)	101 to 160 (+/-mm)	for each 20mm over 160 add
ABS	0.100	0.150	0.325	0.080
ABS/PC Blend	0.100	0.150	0.325	0.080
GPS	0.075	0.150	0.305	0.100
HDPE	0.125	0.170	0.375	0.100
LDPE	0.125	0.170	0.375	0.100
Mod PPO/PPE	0.100	0.150	0.325	0.080

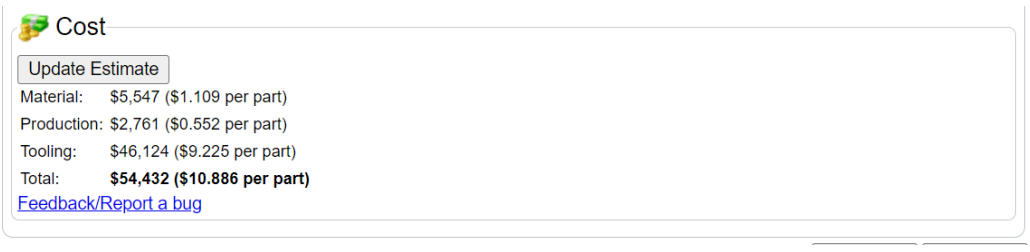
Tolerance of +/- 0,325mm for ABS

(https://www.starrapid.com/wp-content/uploads/2016/11/Star-Rapid-Plastic-Injection-Molding-Tolerance-Guide.pdf)

https://www.erieri.com/salaryreport/researcher

Machine operator are paid an average of 7,10USD/hour in China, mother company of Dynaudio is in China and for lifestyle product the production is outsourced in China.

Cabinet



Front panel

Cost

Update Estimate

Material:	$391 ($0.078 per part)
Production:	$1,882 ($0.376 per part)
Tooling:	$20,870 ($4.174 per part)
Total:	**$23,143 ($4.629 per part)**

Feedback/Report a bug

Frame

Cost

Update Estimate

Material:	$2,289 ($0.458 per part)
Production:	$2,398 ($0.480 per part)
Tooling:	$38,860 ($7.772 per part)
Total:	**$43,547 ($8.709 per part)**

Feedback/Report a bug

Bottom handle

Cost

Update Estimate

Material:	$328 ($0.066 per part)
Production:	$1,850 ($0.370 per part)
Tooling:	$16,468 ($3.294 per part)
Total:	**$18,646 ($3.729 per part)**

Feedback/Report a bug

Front grill

Cost

Update Estimate

Material:	$391 ($0.078 per part)
Production:	$2,197 ($0.439 per part)
Tooling:	$19,801 ($3.960 per part)
Total:	**$22,389 ($4.478 per part)**

Feedback/Report a bug

Cover frame

Cost

Update Estimate

Material:	$296 ($0.059 per part)
Production:	$1,539 ($0.308 per part)
Tooling:	$12,762 ($2.552 per part)
Total:	**$14,597 ($2.919 per part)**

Feedback/Report a bug

Cover cabinet

Cost

Update Estimate

Material: $862 ($0.172 per part)
Production: $1,867 ($0.373 per part)
Tooling: $19,380 ($3.876 per part)
Total: **$22,109 ($4.422 per part)**

Feedback/Report a bug

Docking shell

Cost

Update Estimate

Material: $631 ($0.126 per part)
Production: $844 ($0.169 per part)
Tooling: $31,882 ($6.376 per part)
Total: **$33,357 ($6.671 per part)**

Feedback/Report a bug

Dock cover

Cost

Update Estimate

Material: $372 ($0.074 per part)
Production: $822 ($0.164 per part)
Tooling: $18,325 ($3.665 per part)
Total: **$19,519 ($3.904 per part)**

Feedback/Report a bug

Dock input cover

Cost

Update Estimate

Material: $77 ($0.015 per part)
Production: $583 ($0.117 per part)
Tooling: $13,470 ($2.694 per part)
Total: **$14,131 ($2.826 per part)**

Feedback/Report a bug

Pad cabinet

rubber is not in the calculator, a material with a similar price is chosen

Cost

Update Estimate

Material: $149 ($0.030 per part)
Production: $928 ($0.186 per part)
Tooling: $13,036 ($2.607 per part)
Total: **$14,112 ($2.822 per part)**

Feedback/Report a bug

pad dock

Cost

Update Estimate

Material: $26 ($0.005 per part)

Production: $450 ($0.090 per part)

Tooling: $12,242 ($2.448 per part)

Total: **$12,718 ($2.544 per part)**

Feedback/Report a bug

Counerweight

Cost

Update Estimate

Material: $22,791 ($4.558 per part)

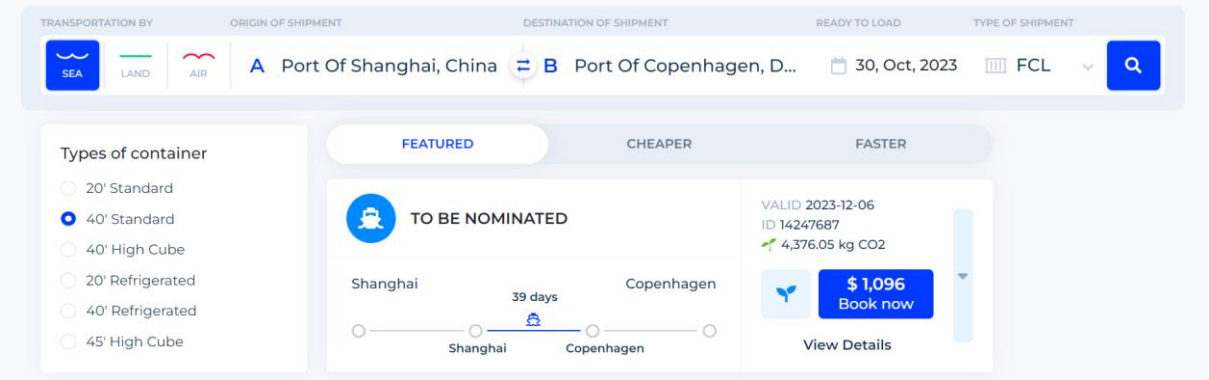
Production: $2,811 ($0.562 per part)

Tooling: $0 ($0.000 per part)

Total: **$25,602 ($5.120 per part)**

Feedback/Report a bug

Shipping cost



shipping cost/product	0,48

https://www.searates.com/freight/from-shanghai-to-copenhagen/?from=ChIJMzz1sUBwsjURoWTDI5QSlQI&fromPortId=706&codeFrom=CN&typeFrom=locality&to=ChIJIz2AXDxTUkYRuGeU5t1-3QQ&toPortId=21146&codeTo=DK&typeTo=locality&date=2023-10-30&type=fcl&cont%5B40st%5D=1

Total cost and investment for 5000 pcs:

For 1 unit

Component	COST (USD)
MCU	2,85
Power board	1,29
DSP unit	4,34
Amplifier	2,06
Mother board	1,01
Power cable	0,5
Wifi module	15,46
Tweeter	2,73
Mid range	3,58
Wood veneer	15,44
TOTAL COMPONENTS	49,26
Cabinet	10,866
Front panel	4,629
Frame	8,709
Bottom handle	3,729
Front grill	4,478
Cover frame	2,919
Cover cabinet	4,422
Docking shell	6,671
Docking cover	3,904
Docking inputs	2,826
Pads cabinet x 2	2,822
Pads docking x 4	2,544
TOTAL INJECTION MOULDING	58,519
Counter weight	5,12
TOTAL CNC MILLING	5,12
TOTAL PRODUCTION COST	63,639
Assembly	0,955
TOTAL (1unit)	113,854
Manufacturing cost 2 units	227,708
shipping cost/product	0,48

Initial investment	USD
Product	1 140 940,00
2 Danish Acoustic engineers	28 640,00
Tooling (outsourced)	-
total	1 169 580,00

Retail price:

Retail price	USD	
Manufacturing cost	227,71	
Constribution margin (Dynaudio)	148,01	65%
Sales price (at Dynaudio)	375,72	
Constribution retail	187,86	50%
Retail price	563,58	
VAT	140,89	25%
Retail price (incl. VAT) (USD)	704,47	
Retail price (incl. VAT) (DKK)	4874,94	

The retail price is under the maximum limit of 7000 dkk fixed.

Evaluation

Slow start business case:

Business case	year 1	Year2	Year3
units sold	2500	3500	5000
sales price (Dynaudio)	376,51	376,51	376,51
manufacturing cost	228,19	228,19	228,19
Turnover	941275,5	519127,7	741611
Investment	- 1 169 580,00	- 228 304,50	290 823,20
Benefit	- 228 304,50	290 823,20	1 032 434,20

ıth 13	month 14	month 15	month 16	month 17	r
291	291	291	291	291	
376,51	376,51	376,51	376,51	376,51	
228,19	228,19	228,19	228,19	228,19	
)9564,4682	109564,4682	109564,4682	109564,4682	109564,4682	
29 810,54	- 120 246,07	- 10 681,60	98 882,86	208 447,33	
20 246,07	- 10 681,60	98 882,86	208 447,33	318 011,80	

Strong start business case:

	month 6	month 7	month 8	month 9	month 10
416	416	416	416	416	
76,51	376,51	376,51	376,51	376,51	
28,19	228,19	228,19	228,19	228,19	
,2432	156628,2432	156628,2432	156628,2432	156628,2432	15662
',03	- 386 438,78	- 229 810,54	- 73 182,30	83 445,95	240 0
3,78	- 229 810,54	- 73 182,30	83 445,95	240 074,19	396 7

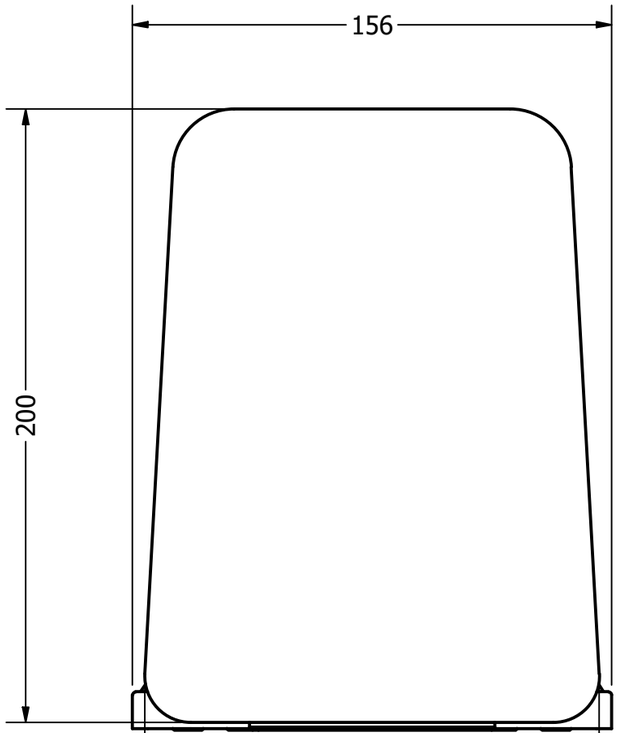
Business case	year 1	Year2	Year3
units sold	5000	5000	5000
sales price (Dynaudio)	376,51	376,51	376,51
manufacturing cost	228,19	228,19	228,19
Turnover	1882551	741611	741611
Investment	- 1 169 580,00	712 971,00	1 454 582,00
Benefit	712 971,00	1 454 582,00	2 196 193,00

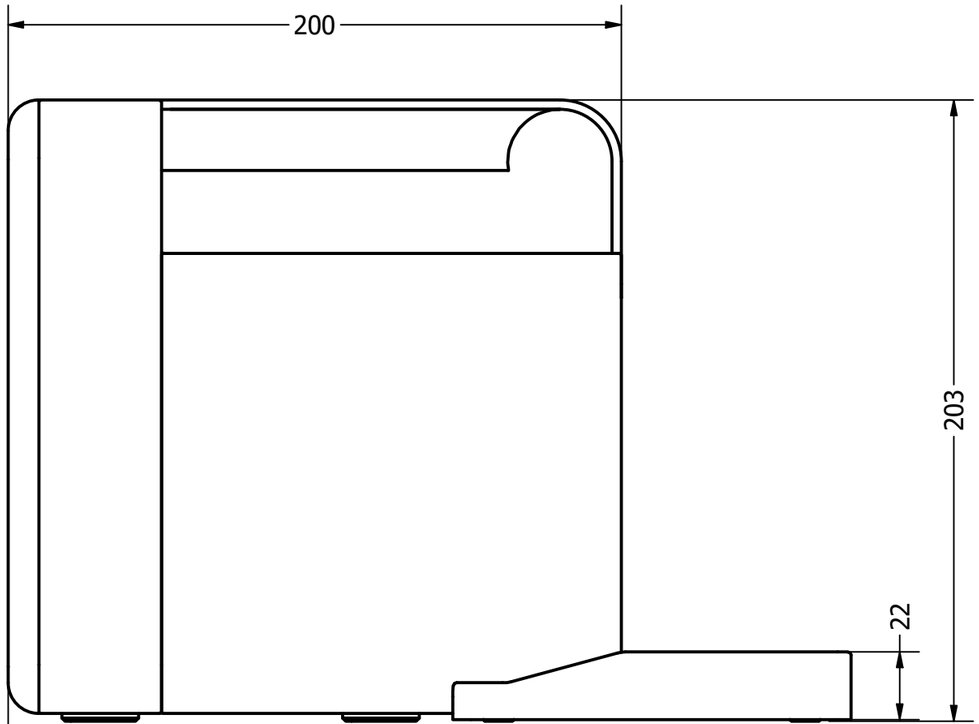
A HOME HARMONY

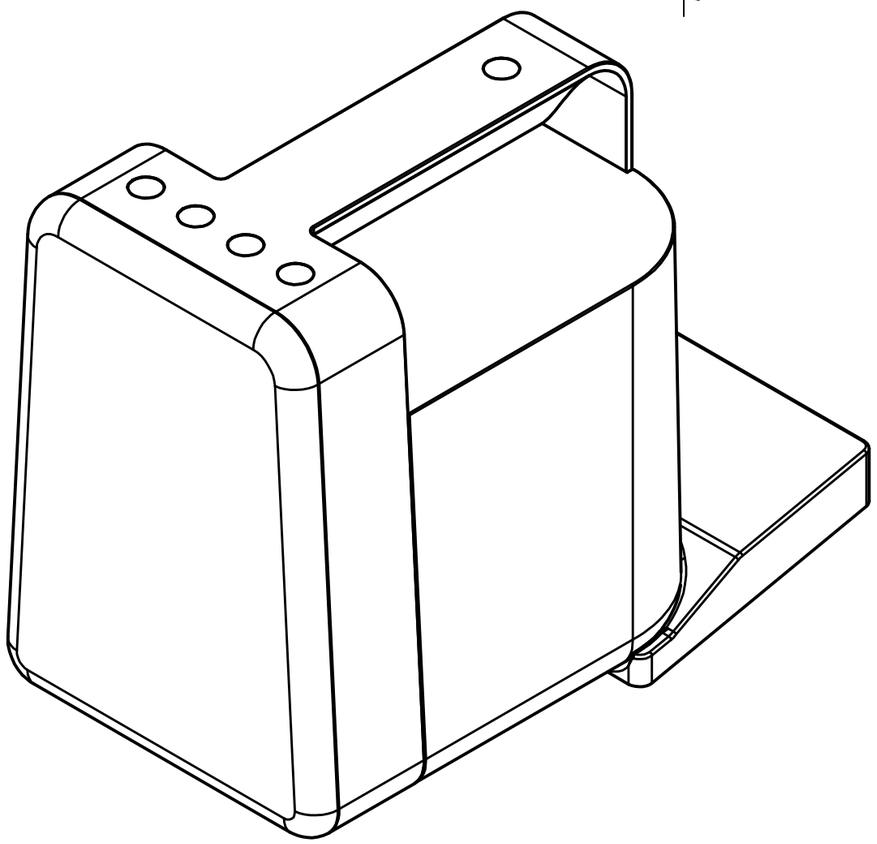
Technical Drawings - Harmony 10
MSc04 - ID16 - November 2023
Antoine François Louis André Rouaud

AALBORG UNIVERSITY

DYNAUDIO







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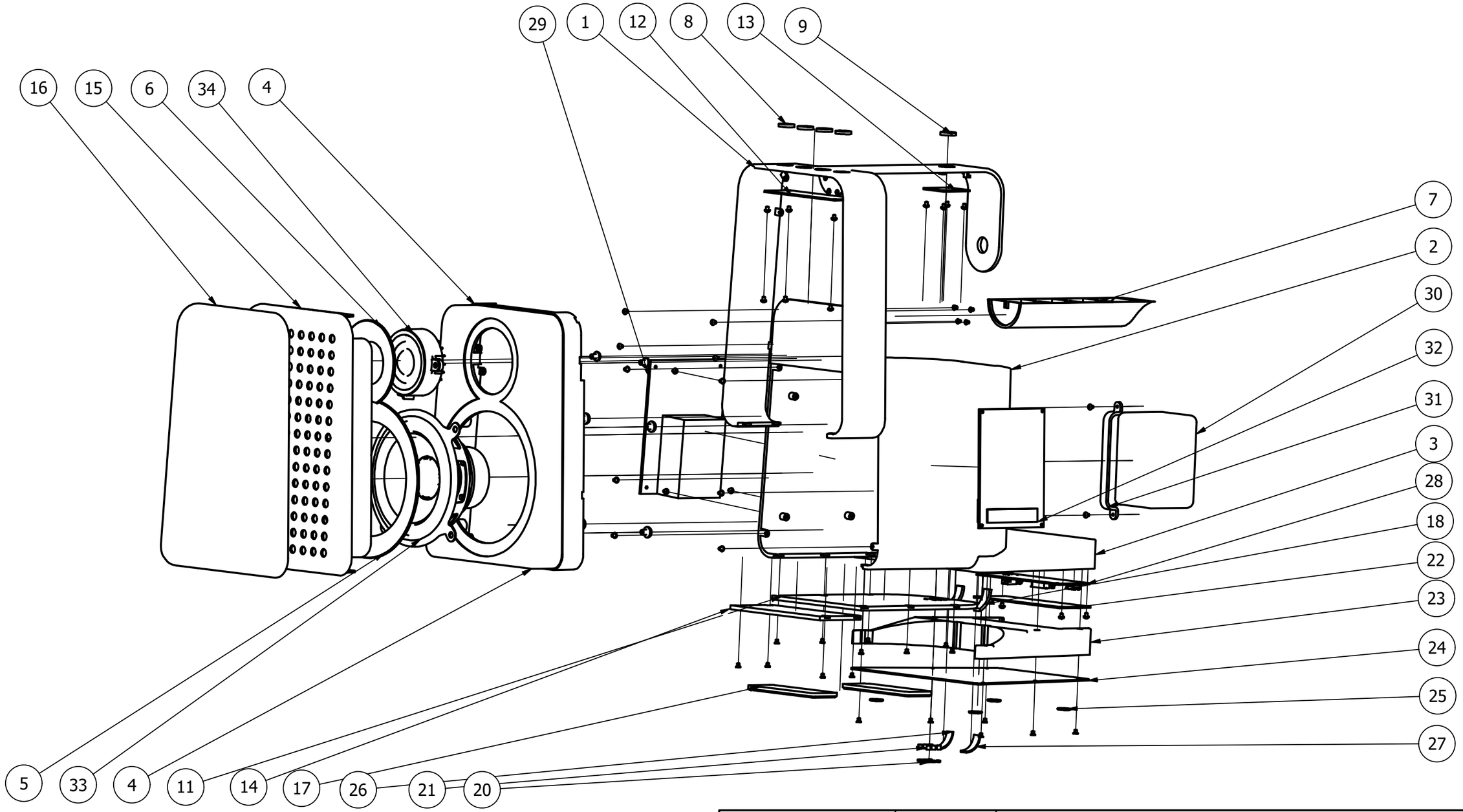
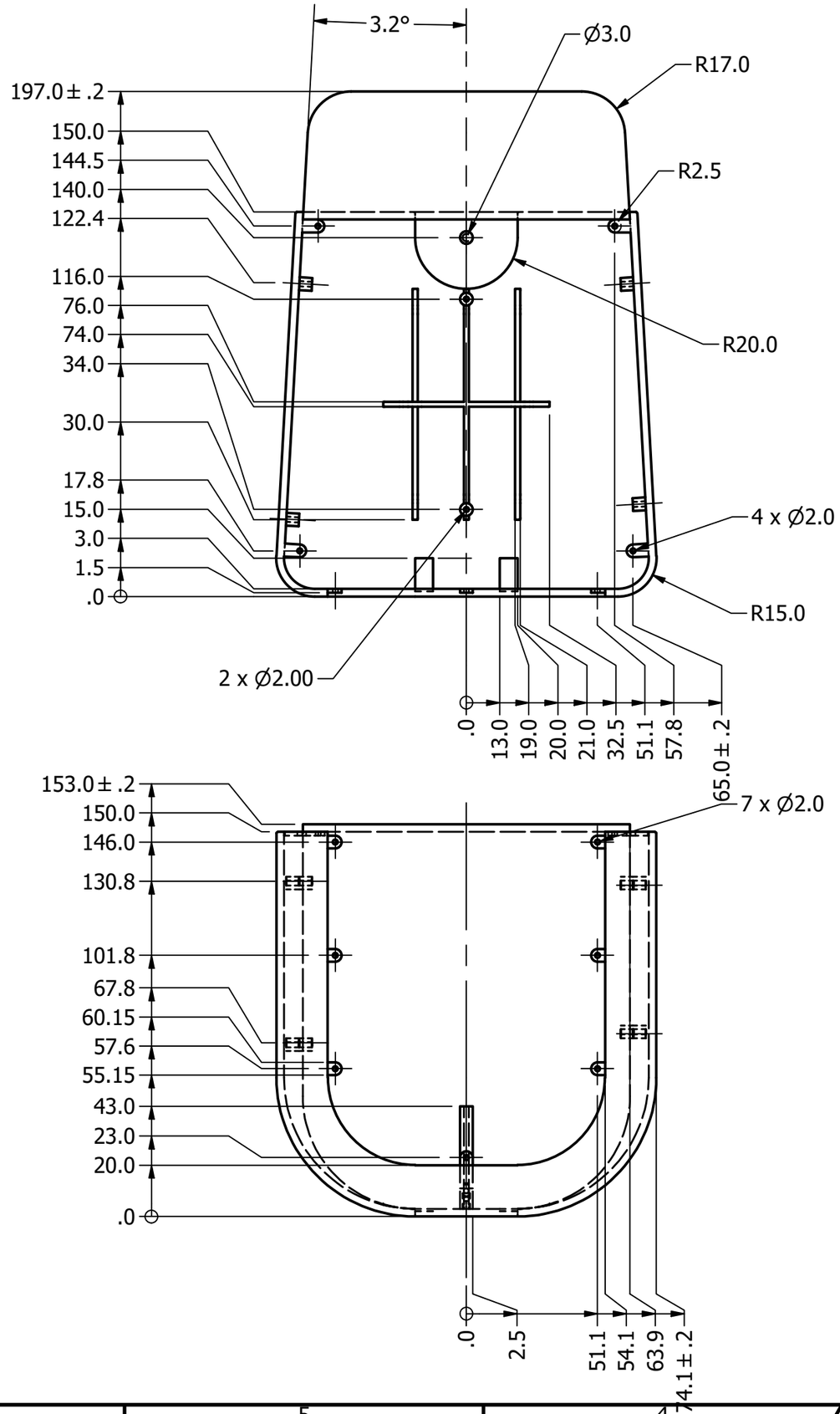
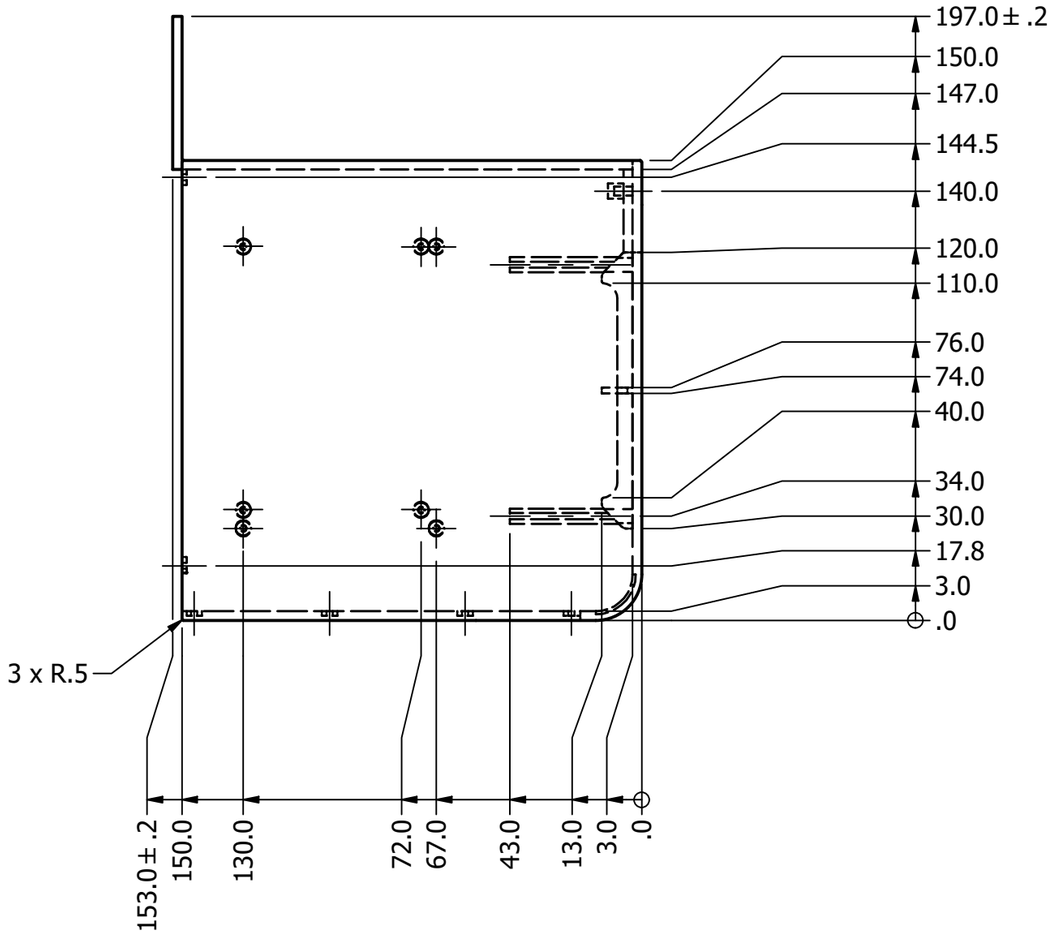
		SIZE A3	DWG NO 1/6 REV
		SCALE 1 / 2	SHEET 1 OF 1



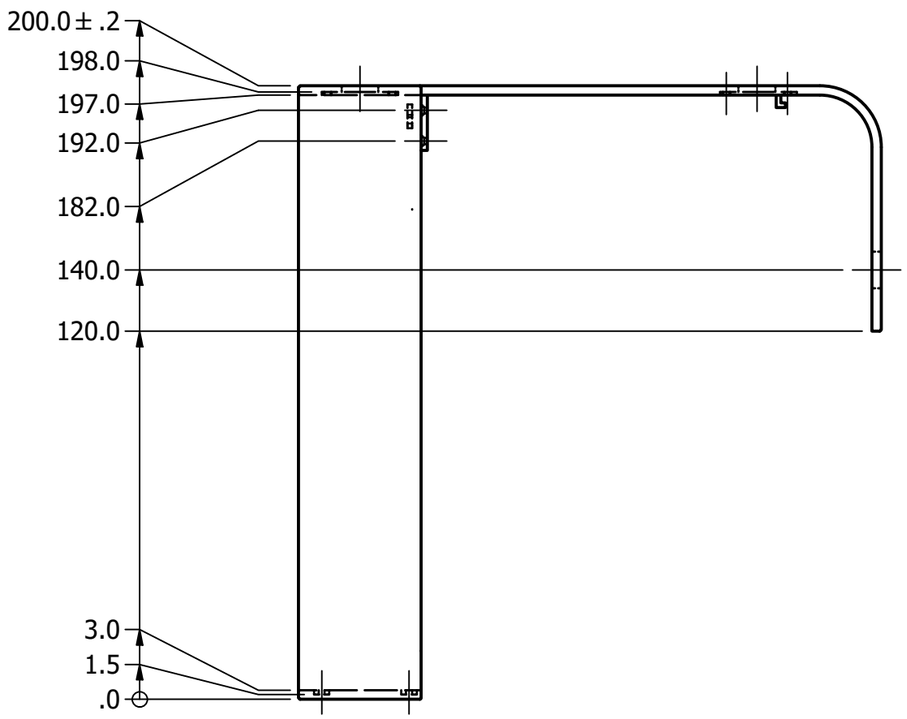
DRAWN Antoine Rouaud	31/10/2023	AAU	
		TITLE Harmony 10 - Exploded view	
		SIZE A3	DWG NO 2/6 REV
		SCALE 1 / 3	SHEET 1 OF 1

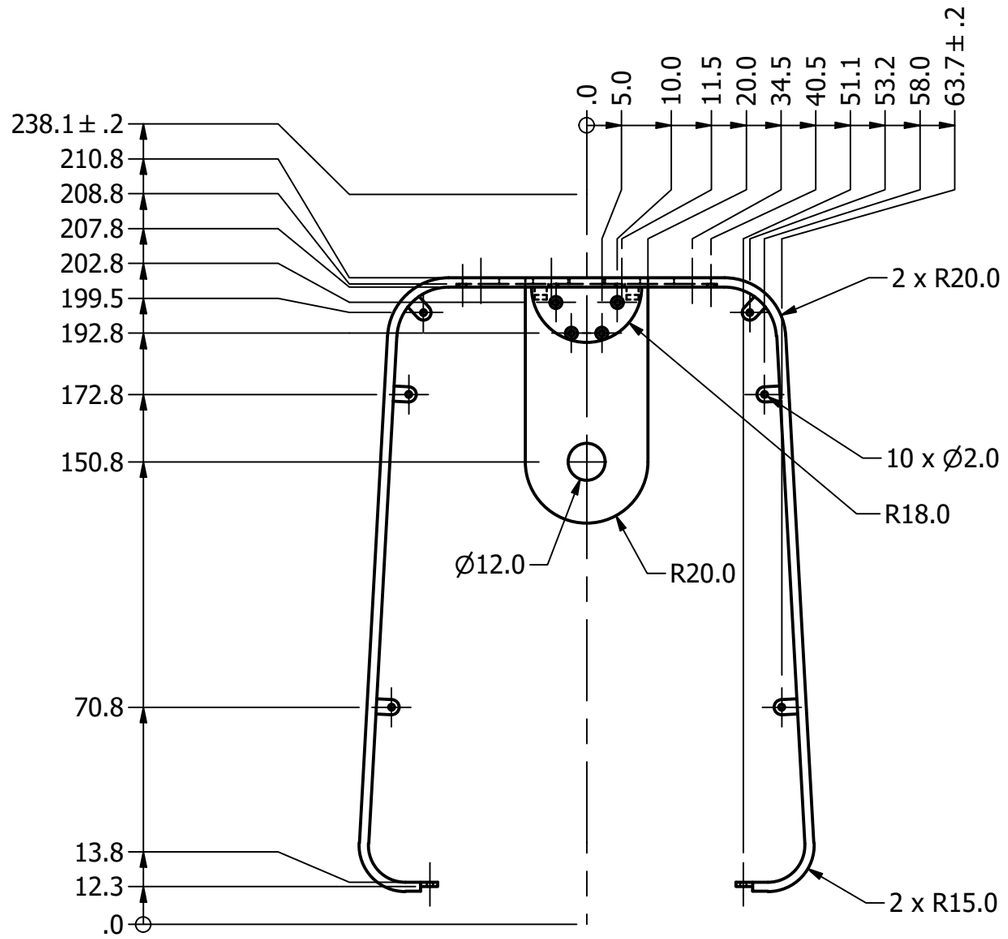
PARTS LIST			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	Frame	ABS
2	1	Cabinet	ABS
3	1	Docking station shell	ABS
4	1	Front panel	ABS
5	1	Round woofer	Aluminum
6	1	Round tweeter	Aluminum
7	1	Handle bottom	ABS
8	1	Top buttons	ABS
9	1	Button handle	ABS
10	1	Screw handle	Stell
11	1	Cover cabinet	ABS
12	1	Top buttons board	Standard
13	1	Button handle board	Standard
14	1	Cover frame	ABS
15	1	Front grill frame	ABS
16	1	Front grill mesh	Xpress fabric
17	1	Rubber pads	Rubber
18	1	Magnet 1	Neodymium
19	1	Magnet 2	Neodymium
20	1	Connectors docking	Standard
21	1	Connectors cabinet	Standard
22	1	Cap docking station board	ABS
23	1	Counterweight	Iron
24	1	Docking station cap	ABS
25	1	Rubber pad docking station	Rubber
26	1	steel plate 1	Steel
27	1	Steel plate 2	Steel
28	1	Board docking	Standard
29	1	Model Amp board	Standard
30	1	Battery	Standard
31	1	Battery holder	Aluminum
32	1	Model Main board	Standard
33	1	Music 1 midwoofer	Standard
34	1	Music tweeter	Standard
35	2	ANSI B18.6.7M - M3,5x0,6 x 5, CRPHMSTIM	Standard
36	4	ANSI B18.6.7M - M4x0,7 x 5, CRPHMSTIM	Standard
37	21	IFI 513 - M2x0,4 x 3, CRFCHMSTIM	Standard
38	32	ANSI B18.6.7M - M2x0,4 x 2,5, CRPHMSTIM	Standard

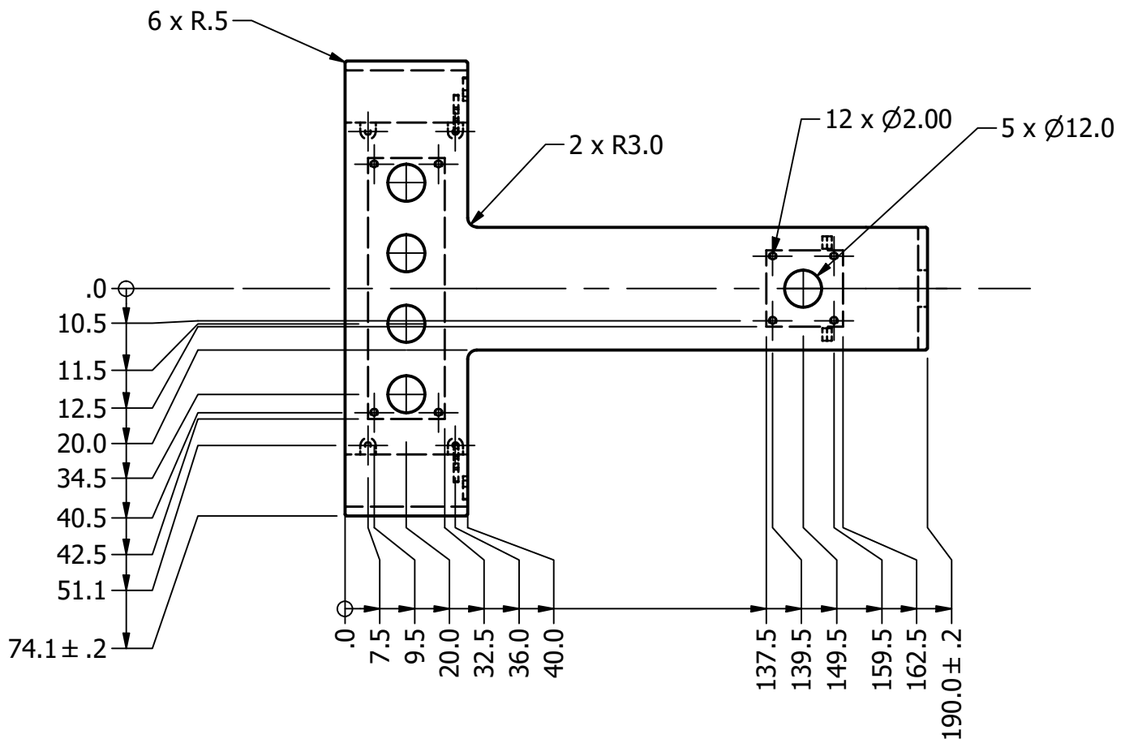




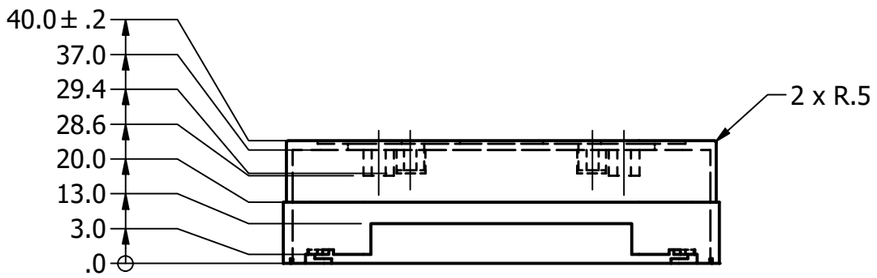
DRAWN Antoine Rouaud	31/10/2023	AAU	
		TITLE Cabinet	
		SIZE A3	DWG NO 3/6
		SCALE 1 / 2	SHEET 1 OF 1

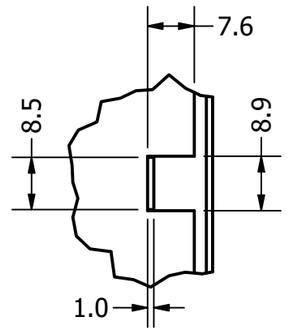




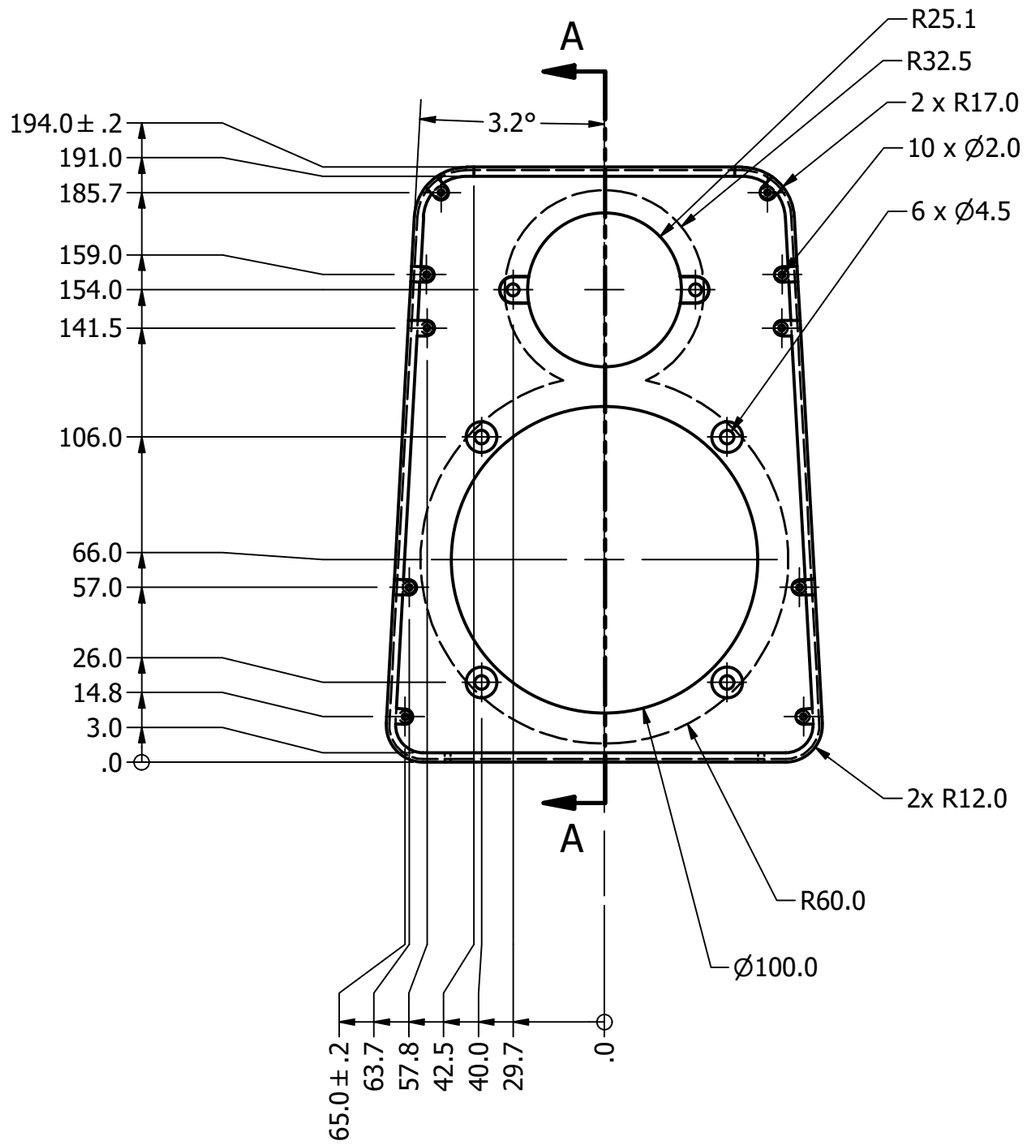


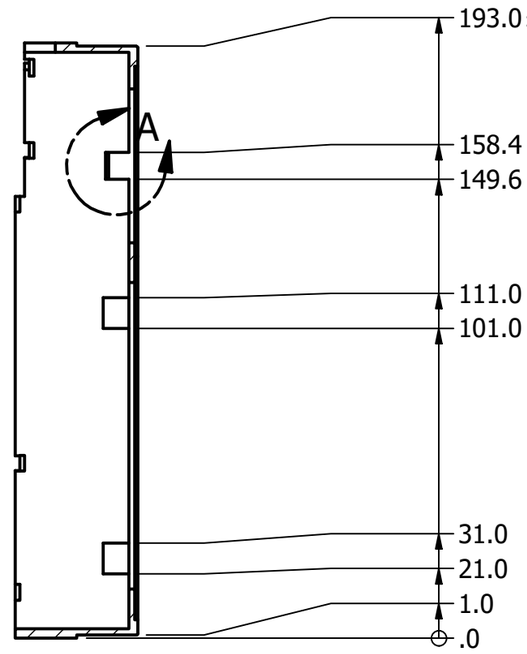
DRAWN Antoine Rouaud	31/10/2023	AAU
		TITLE: Frame
		SIZE A3 | DWG NO 4/6 | REV
		SCALE 1 / 2 | SHEET 1 OF 1





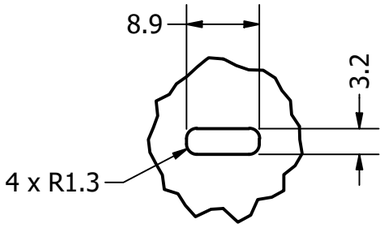
DETAIL A
SCALE 1 : 1



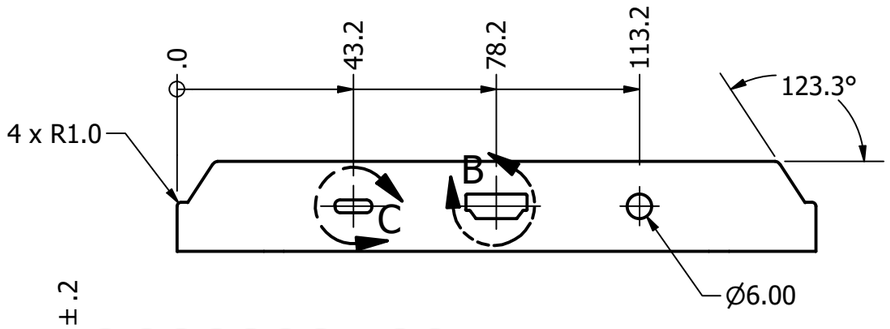


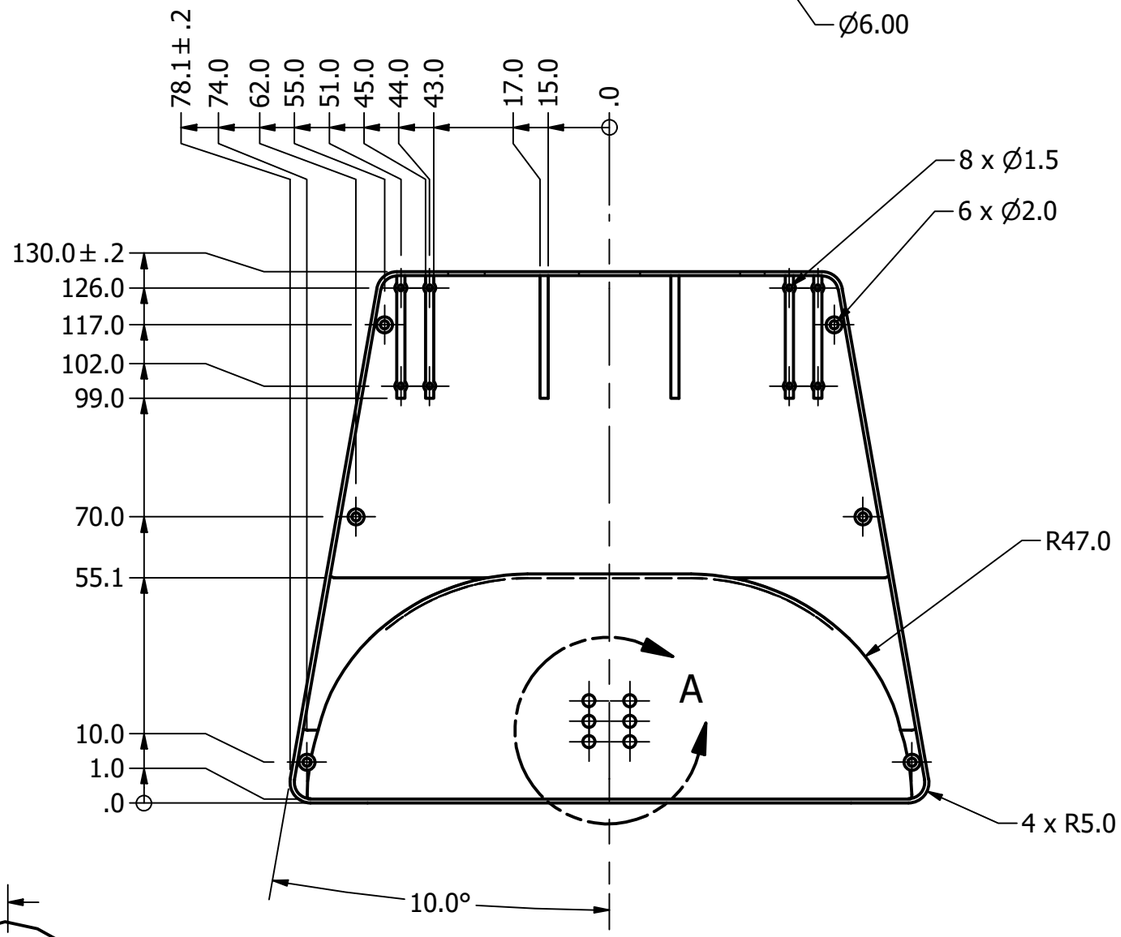
SECTION A-A
SCALE 1 / 2

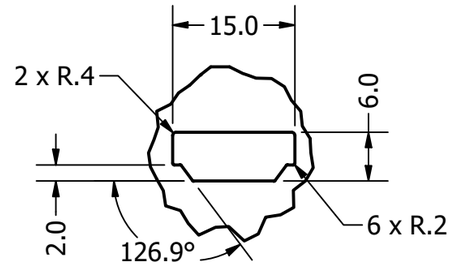
DRAWN Antoine Rouaud	01/11/2023	AAU
		TITLE: Front panel
		SIZE A3 | DWG NO 5/6 | REV
		SCALE 1 / 2 | SHEET 1 OF 1



DETAIL C
SCALE 1,33 : 1







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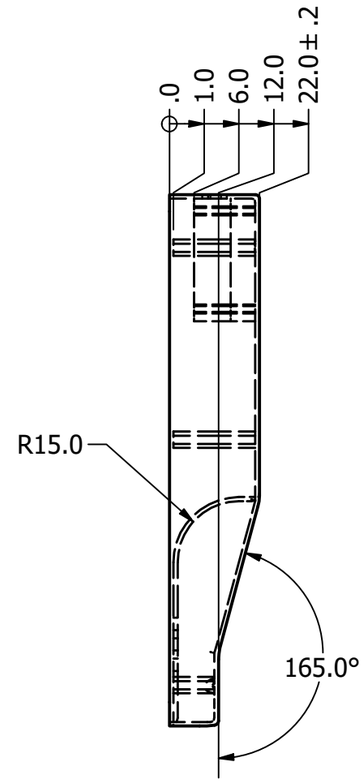

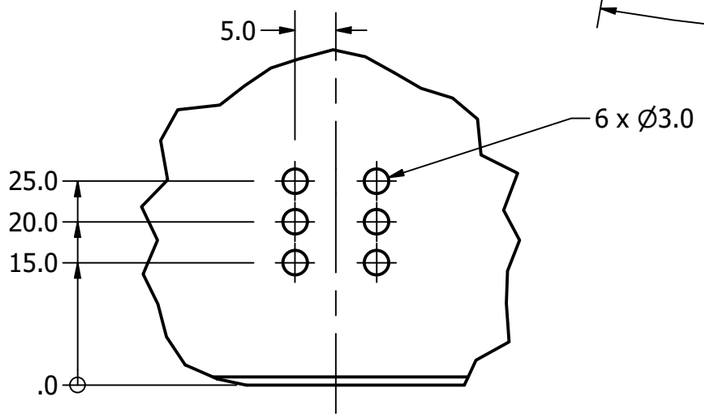

DETAIL A
SCALE 1,33 : 1

DRAWN Antoine Rouaud	01/11/2023	AAU	
		TITLE Docking station shell	
		SIZE A3	DWG NO 6/6 REV
		SCALE 2/3	SHEET 1 OF 1