TOWARDS IMMERSIVE MOTION CAPTURE ACTING

Project Course: Housing Design of an Augmented
System Solution

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INDEX

1. WORKING CALENDAR

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
JANUARY	19	20	21	22	23	24	25
	26	27	28	29	30	31	1
FEBRUARY	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	1
MARCH	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31	1	2	3	4	5
APRIL	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	1	2	3
MAY	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31

1st PHASE
- Research part of the project. Knowledge about the issue.

2nd PHASE
- Different proposals of how could look the product.

3rd PHASE
- Development of the final idea.

2. PLANNING AND WORKING HOURS

	W1 (19/01/15)	W3 (02/02/15)	W5 (16/02/15)	W7 (02/03/15)	W9 (16/03/15)	
Planning	░░					--> 3 hours
Research		░░░░				--> 10 hours
New knowledge		░░				--> 7 hours
Market research			░░░░			--> 10 hours
Design factors				▓▓▓▓	▓	--> 32 hours
Proposals					▓▓	
Election						
Developing the idea						
Final presentation						

	W11 (30/03/15)	W13 (13/04/15)	W15 (27/04/15)	W17 (11/05/15)	W19 (25/05/15)	
Planning						
Research						
New knowledge						
Market research						
Design factors						
Proposals	▓▓					--> 32 hours
Election	▓▓					--> 16 hours
Developing the idea		▓▓▓▓▓▓▓▓				--> 85 hours
Final presentation					▓▓	--> 20 hours

Total hours of work:

- Phase 1 --> 30 hours
- Phase 2 --> 80 hours
- Phase 3 --> 105 hours

While the project draws on, the working hours that we have to use on it increase. It does not mean that the previous part of the project are less important, it just means that to reach the aim of developing a final product require to use more hours at the end to make a good design of it.
We need to make a really good research and planification at the begigining, to get the best solution at the end.

KPP307: Project Course Product and Process Development (7.5 Credits)

- 1 Credit is equal to 25 to 30 hours of work including:
    - Theoretical lessons
    - Personal study
    - Participation on seminars, practical lessons or projects
    - Preparation and realization of the exams

- To plan the project course we have to take into account all the hours that we have to been working on that. The amount of hours that we have to use on a course with 7.5 Credits should be around 188 and 225.

3. PROBLEM TO SOLVE

Today video games and animation films are becoming more and more realistic, not only because of the innovation in hardware and software but also because of the use of highly realistic animations of humans, animals, objects and environments.

However, actors´ performance for motion capture does not provide a totally realistic and believe motion and emotions. The reason of it is there are not provided a natural acting environment. The result is that the actors are not able to see and feel the virtual environment they act for while they are performing their action. In many cases this can result in unnatural motions such as stiff looking and emotionless movements.

The aim of this project was to give a solution to this problem. To get that goal, Daniel Kade started his research by focusing on the question:

> *What are the experiential qualities of immersion in an interactive system to create an immersive acting environment that supports motion capture actors?*

Daniel has developed an application which solves this problem. This tool provides flexibility to set up and modify digital assets and scenes quickly and with an easy use of its interface. On the other hand, Daniel has developed a prototype which helps to provide an understanding on which hardware and software can be used to build an immersive motion capture environment. This prototype will provide information about users' experiences from user tests as well as their satisfaction and effects on motion capture acting.

As he described in his Thesis, his motivation of this project results in a vision:

> *"Actors will perceive the virtual environment they are acting in, visually and emotionally, through the design of an immersive environment"*

In other words, actors will be able to perceive a virtual environment, visually and emotionally while acting without hindering them in their task to act for motion capture shoots.

4. USERS

To ensure the usability of the proposed solution and to identify helpful features within the process of a motion capture shoot, it is necessary to investigate the actors', directors' and motion capture operators' needs and wishes, as well as the current issues with the motion capture procedure and issues actors are currently facing.

However, actors´ performance for motion capture does not provide a totally realistic and believe motion and emotions. The reason of it is there are not provided a natural acting environment. The result is that the actors are not able to see and feel the virtual environment they act for while they are performing their action. In many cases this can result in unnatural motions such as stiff looking and emotionless movements.

Once actors have used the prototype, they have expressed their excitement to use new technology, but at the same time they create a distance to this new idea. Some of them think that it is not necessary to use technology because they are trained and experienced enought to provide a good job. Anyway, it is a way of development and for sure will be useful for that kind of motion capture acting jobs, it will be easier and more comfortable to work.
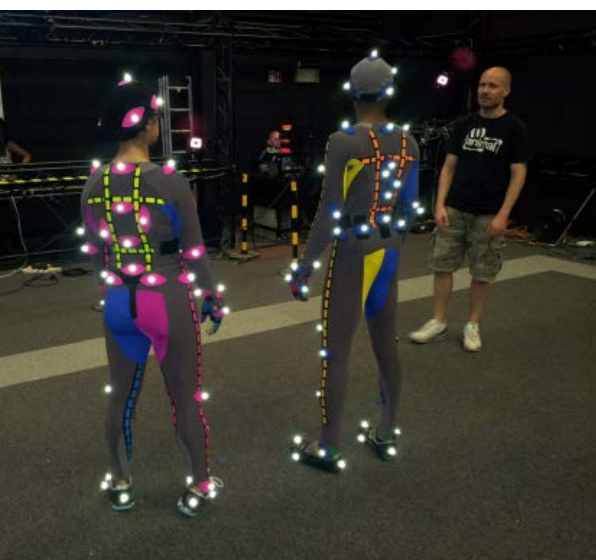
Related with the product that is being designing by Daniel, we have to consider some design solutions that do not limit the actors' freedom of movement or might be uncomfortable to wear.

To realize this application and to perform user tests, it is need a wearable, mobile projector solution, a retro-reflective foil placed around the actors and a game engine to show digital content.

To test the product it is useful both with experimented people on this task and with people who do not know so much about it. It is because a person who has been working with this kind of products will give more specific improvements and maybe more focus on the technological part. Instead of that, a person non experimented will give opinions about how comfortable or wearable is it.

5. NEEDS

- Motion capture actors need to **see, hear and feel** as well as to interact with the virtual environment they are acting for, while acting.

- When creating an immersive virtual environment for motion capture acting, one needs to consider designing solutions that **do not limit the actors' freedom of movement** or **might be uncomfortable to wear**, due to they have to interact with objects and people while they are acting.

- Make the **virtual content visible** to help actors to perform. Try to create an immersive acting environment that is still economic and usable in daily motion capture business.

- A wearable, mobile projector solution. A retor-reflective foil to show digital content.

- Important parts of the face, such as eyebrows, eyelids or forehead, **cannot be covered** due to if not, facial motion capture shoots is not possible.

- **No blocking the user's vision** and allow the user to move free.

- The equipment they have to wear during the performance has to be as much **confortable and ergonomic** as possible. The actors have to wear it during a big period of time, what means that if we do not take into account how important is to make the product ergonomic for the user, it will be hard for them to feel the product as if they were not wearing anything.

- When designing, we have to **distribute the weight** of the components around the "helmet". The camera that will project the images will have to be in the middle due to the images will have better qualitiy than if we locate it on one of the sides. The rest of the components will have to distribute with equal weights on the sides.

- By now, the prototype Daniel is using is just something simple where he can add all the components he needs by the moment. But there are some components that maybe he will be able to remove in the future, so we have to take that into account and think about the current prototype and the future possible one.

6. HOW DOES IT WORK?

The problem has been solved by using the best existing technological solution: a laser Pico projector. It permits to augment the actors vision by showing digital content from a game engine. The actor can see the scenery by looking at a reflective foil which is mounted on the walls and at important locations.

The laser projector sends the picture towards the foil which reflects it back to the source. As the projector is head-mounted on a wearable frame or strap, the reflected image can be seen clearly by the actors. This allows a hands free 360° degree view of the virtual environment and the real world at the same time without occluding the actors'vision.
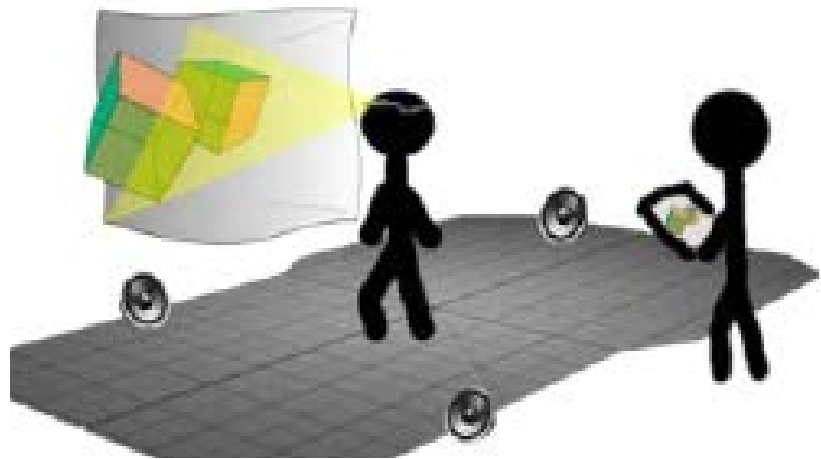
Figure 2.1: Future motion capture environment, showing an actor wearing a head-mounted projector, a retro-reflective foil reflecting the digital content and a director which controls the digital environment

The reflective material has to be stick all around the room to be able to project the images of the camera around the whole room where the actors are performing.
It is possible to have two different materials to make the projection possible. The difference between them is the price and how easy is to carry it with us. Although the reflective material that is a little bit more expensive reflects a brighter image, the difference between them is not so high. That means that it is not necessary to spend so much money with this part of the product.

By now, Daniel is using a phone with a programme inside that allows you to project in the walls the images of a game, that thanks to a sensor that capture our movements, it is possible to play. The game is controlled from the screen of the mobile phone, but this is a device that we would like to remove, so the programme will be controll from an external device.
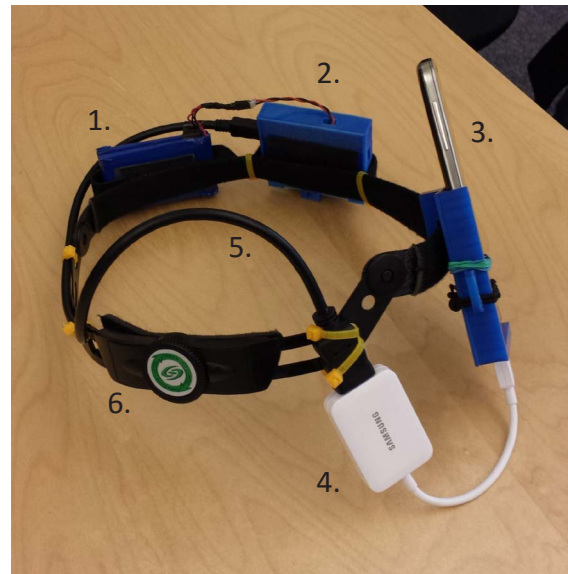
7. COMPONENTS

In this part of the report we will explain which components has the current prototype that Daniel is using to test all the improvements that he is doing day a day.

This is a very functional product, it is not the final one due to there are many things related with ergonomics that have to be developed still.

The total weight of the prototype is 400 gr. When designing we will have to distribute this weight around the whole product to make it confortable while the user is using it.

COMPONENTS

1. <u>Batery</u>: The size of the batery is 40x7x66 mm. It is what gives the energy to the whole product to make it work.

2. <u>Projector</u>: It has two different parts. The electronics part which has a size around 47x16x52 mm more or less, plus the projecting unit in front which dimensions are around 43x20x7 mm. (Look to the picture that is next to this paragraph to see both parts)
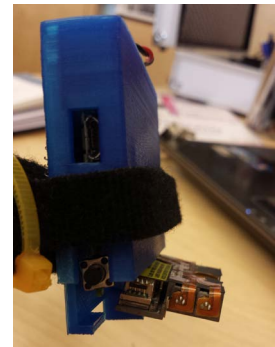
3. <u>Phone</u>: The phone that Daniel is using is a Samsung S4 +. The dimensions of it are more or less 7x13.5x8 mm. By now it is located in one of the sides of the head and it is the heaviest part of the product, what makes it a little bit unconfortable due to if you have to wear it for a long time, at the end you can realize that you are wearing something heavier in your head.

The idea is to get a <u>external sensor</u> to replace the mobile phone and make the prototype more wearable and confortable. The dimesions of it will be 27.5x10x41 mm. but we cannot add it yet to the prototype.

4. <u>Adaptator</u>: It is an HDMI Adaptator that allows us to conect the phone with the rest of the structure of the product. Dimensions: 34.5x11x51 mm the big part. 10x27x14 mm the small one. The cable that connect both is 111 mm long (we can make it shorter) and the diameter is 4 mm.

5. <u>Cable</u>: The diameter of it is 5 mm. It is an HDMI - micro HDMI.

6. <u>Device to controll the size of the product</u>: Not everyone has the same size of head, so we need something to regulate it.

8. RELATED DEVICES

Virtual or augmented(VR/AR) glasses

CastAR-glasses

The castAR Glasses are a window into the 3D digital world. When looking through them, the digital world becomes a 3D reality.

CastAR Glasses achieve Mixed Reality by using two micro-projectors. These projectors cast a stereoscopic scene onto a retro-reflective surface, which in turn reflects the image back to the person. Located in the center of the glasses is a highly accurate tracking camera that is used to determine the absolute head position and orientation. By attaching the optional castAR/VR Clip-Ons, it is possible to turn castAR Glasses into a fully immersive Virtual Reality device.

Meta Augmented Reality Glasses

This concept is based on the idea of seeing the actual, natural world in front of you through transparent lenses, overlaid with virtual information with which you interact using your hands and voice.

It uses the real world as the focus of the interface , it means that the user is looking at the actual world around him/her in real-time and not looking at enclosed LED screens using cameras, like the *Oculus Rift* or *Gear VR.* Also, the AR content the user is seeing is in line with the task at hand instead of off in the corner of your vision like *Google Glass.*

8. RELATED DEVICES

Virtual or augmented(VR/AR) glasses

Oculus Rift is an upcoming virtual reality head-mounted display, being developed by Oculus VR. The the founder of Oculus, Palmer Luckey, developed the idea of creating a new head-mounted display that was both more effective than what was then on the market, and inexpensive for gamers.

The **Oculus developer kit** was an initial version which sought to get the initial Oculus Rift into the hands of developers to begin integration of the device into their games. Since then, four different iterations of the hardware have been revealed to the public. (Developer Kit 1, Developer Kit 2, Crescent Bay and finally, a consumer version)

A consumer-oriented version of the Rift is in development, which will be aimed at a general market and feature improved components. Improved head tracking, positional tracking, higher resolution, and wireless operation are some of the features under consideration for the consumer Rift. The consumer version of the Rift will have integrated audio. The headphones will use HRTF audio so that sounds can be better located in a three-dimensional space.

Jack-In Head

Jack-In Head is an immersive experience transmission architecture with a wearable omnidirectional camera for "Human to Human Telepresence". The first person wears a head gear with an omnidirectional camera and the omnidirectional video are stabilised to decouple ego-motion and transmitted to others. Other persons can virtually look around the immersive visual experience with his or her own head motion with HMD.

This can put a person in someone else's head and communicate each other without feeling dizzy, and even enable individual viewing interaction.

9. ALTERNATIVE USES

Motion capture technology is used for various applications from medical to training and entertaining purposes. This work is focused especially on motion capture for animations, mainly used in computer games.

Daniel found the necessity of this kind of application by discovering the act needs, observing the scenery changes, as well as the need to improve their motion capture procedures. So, all his work has focused on this problem and this environment.

However, as it is mentioned, it is possible to find many other uses for this application. It would be interesting find these new uses in order to be able to adapt the divide to new situations and activities. Besides, by discovering new uses it is possible to find new requirements for this device as well as improvements which could be use to improve the application in computer games.

CREATIVE SESSION

In order to find different and new uses for this device, we have decided to organize a creative session based on creative tecniques as Brainstorming.

Brainstorming

Brainstorming combines a relaxed, informal approach to problem solving with lateral thinking. It encourages people to come up with thoughts and ideas that can, at first, seem a bit crazy. Some of these ideas can be crafted into original, creative solutions to a problem, while others can spark even more ideas. This helps to get people unstuck by "jolting" them out of their normal ways of thinking.

Brainstorming provides a free and open environment that encourages everyone to participate. Quirky ideas are welcomed and built upon, and all participants are encouraged to contribute fully, helping them develop a rich array of creative solutions.

10. CREATIVE SESSION

Steps to run the Brainstorming session:

Step 1: Prepare the group

- Set up a comfortable meeting environment for the session. Make sure that the room is well-lit and that you have the tools, resources, and refreshments that you need.
- Consider who will attend the meeting. A room full of like-minded people won't generate as many creative ideas as a diverse group, so try to include people from a wide range of disciplines. If people aren't used to working together, consider using an appropriate warm-up exercise
- Appoint one person to record the ideas that come from the session. This persons has not to be necessary the same than the team manager of the session.

Step 2: Present the problem

- Clearly define the problem that you want to solve. Make it clear that that the meeting's objective is to generate as many ideas as possible.
- You can give people plenty of quiet time at the start of the session to write down as many of their own ideas as they can. Then, ask them to share their ideas, while giving everyone a fair opportunity to contribute.

Step 3: Guide the discussion

- Once everyone has their ideas, start a group discussion to share all the ideas and use them to create new ideas. Building on others' ideas is one of the most valuable aspects of group brainstorming.
- Encourage everyone to contribute and to develop ideas, including the quietest people, and discourage anyone from criticizing ideas.
- As the group facilitator, you should share ideas if you have them, but spend your time and energy supporting your team and guiding the discussion

The Next Step – Taking Action

After your individual or group brainstorming session, you'll have a lot of ideas. Although it might seem hard to sort through these ideas to find the best ones, analyzing these ideas is an important next step.

10. CREATIVE SESSION

Objective:

The main goals for this creativity session is to open new possibilities to the product and discover the way normal people understand it in order to start the definition of the shape and the housing of it.

Structure of the session:

Before the session we met Daniel to decide together the objectives to reach, the procedure for it, the methods we were going to use and the details. For this session we consider very interesting to invite people who had no previous knowledge about the product in order to get new perspectives and to find ideas and solution. Our guests for this session were:

- Alina Baberuxki, international student of Economics
- Toni Alarcón Mesquida, international student of Computer Sciences.
- Asier Etxairgendwas, student of Master in Logistics
- Samuel Lei, international student of Master in Economics

We structured the session into three different parts:

1. Warming up part. Open part.

The first part consisted in an individual brainstorming technique. We aim of this first part was to let the participant know what we expected from them and how a creative session works because for almost all of them it was the first time they participated in one.
For this first technique we introduced ourselves and we show them a picture of the product. We did not give them more information about the topic and we asked them to answer the following questions:

- What can it be?
- What does it remind you to?

They had to write all their ideas in different post-it papers and finally show them to the others. Without knowing the real use, the components or the technology this product uses they got several interesting ideas like:

- Medical uses: pulse meter, sleeping helper, practice sports mentally, temperature
- Helmet to play "Who am I?"
- Dreams recorder
- Playing music

All these ideas are interesting in order to see how the user sees the product and how he or she tends to use it.

10. CREATIVE SESSION

2.   General part. New uses.

What we expected from this second part was to discover new uses for this product. To do that we gave them more information about it: how does it work, which are the components… After that, by using the same technique that in the last part we asked them to ask them the following questions:

- What can you do with it?
- What could it be use for?

By doing it we got many solutions and ideas. Most of them were similar to the real use of this device but many other were completely new and unsuspected. Among the ideas we got are:

- Device to watch films
- Personal, adaptive computer
- GPS uses
- Communication and connection applications
- Computer games, entertaining
- Change the environment (different times, present, past, future), possible use in museums.
- Medical uses: surgery, help for old people with dementia
- Translator
- To see what other people see
- Virtual reality
- Discovering new places with robots
- Construction map viewer
- Rescuing people in difficult places
- Cooking, projection of the receipt book
- Sightseeing
- To recognize plants and animals that are not discovered

Fig. All the ideas generated after the session.

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10. CREATIVE SESSION

3.   Specific part. Finding the perfect shape.

For the final phase we had a specific goal, to know how to imagine the shape in order to use it as a started point for our Second Phase in our project. We gave them a little more of information, we told them the real use for what it had been designed and we showed them a video with the performance of the actors who would use it.

After that we divided the group into two different groups, we participated on it by acting as a couch for each group. The task for them was to get the shape of the product, to reach that they could use many types of resources as paper, pens, and materials in order to explore with the shapes and to create a simple model.

By doing that we found out with many different shapes and alternatives for the housing. And the most interesting thing, we started to think in the difficulties and questions we will have to deal with in the process of designing it.

Conclusion:

The results of this session were satisfactory for Daniel and for us. The amount of ideas generated was bigger than what we expected as well as the participation of the participants who are not familiar with product development and creative techniques.

They gave us new perspectives and points from were start to work and many things to consider in the design process.

Besides, this session was especially useful and interesting for us because we learnt how to lead a creative session and how to manage the people and encourage them to come up with ideas and feel motivated to participate on it.
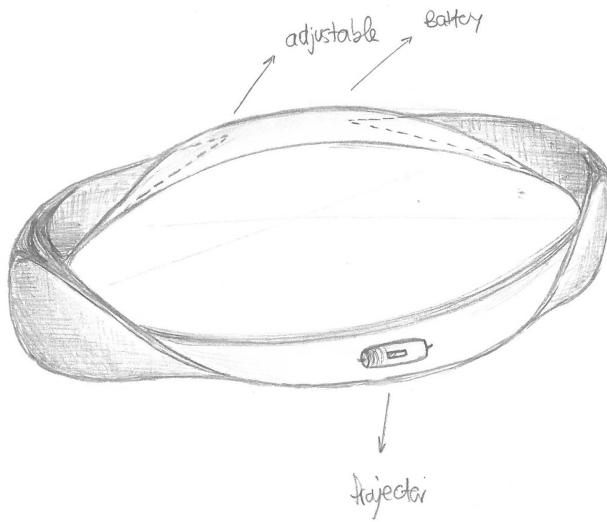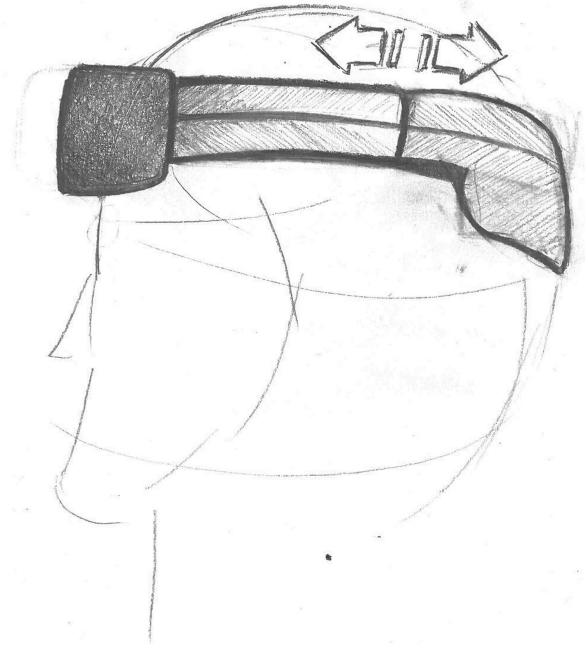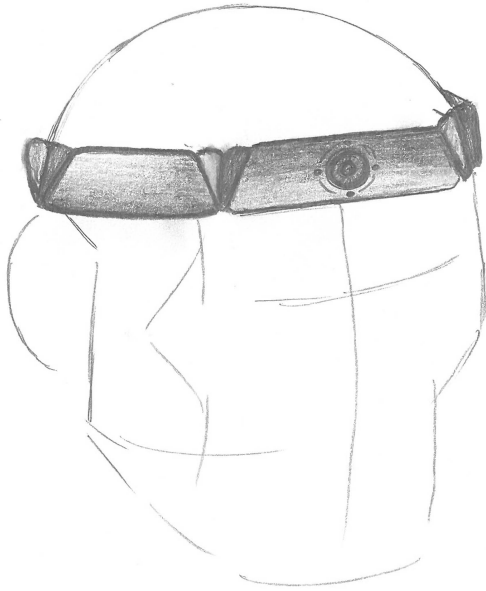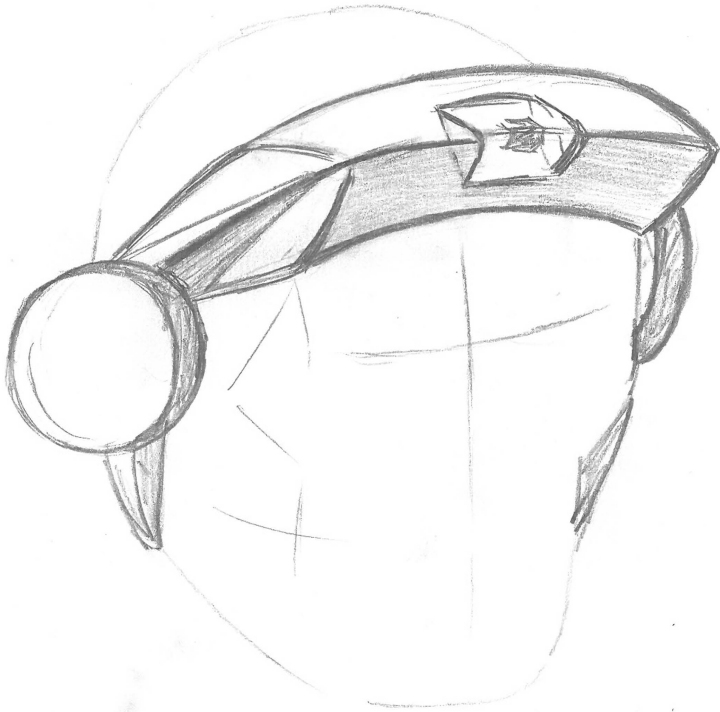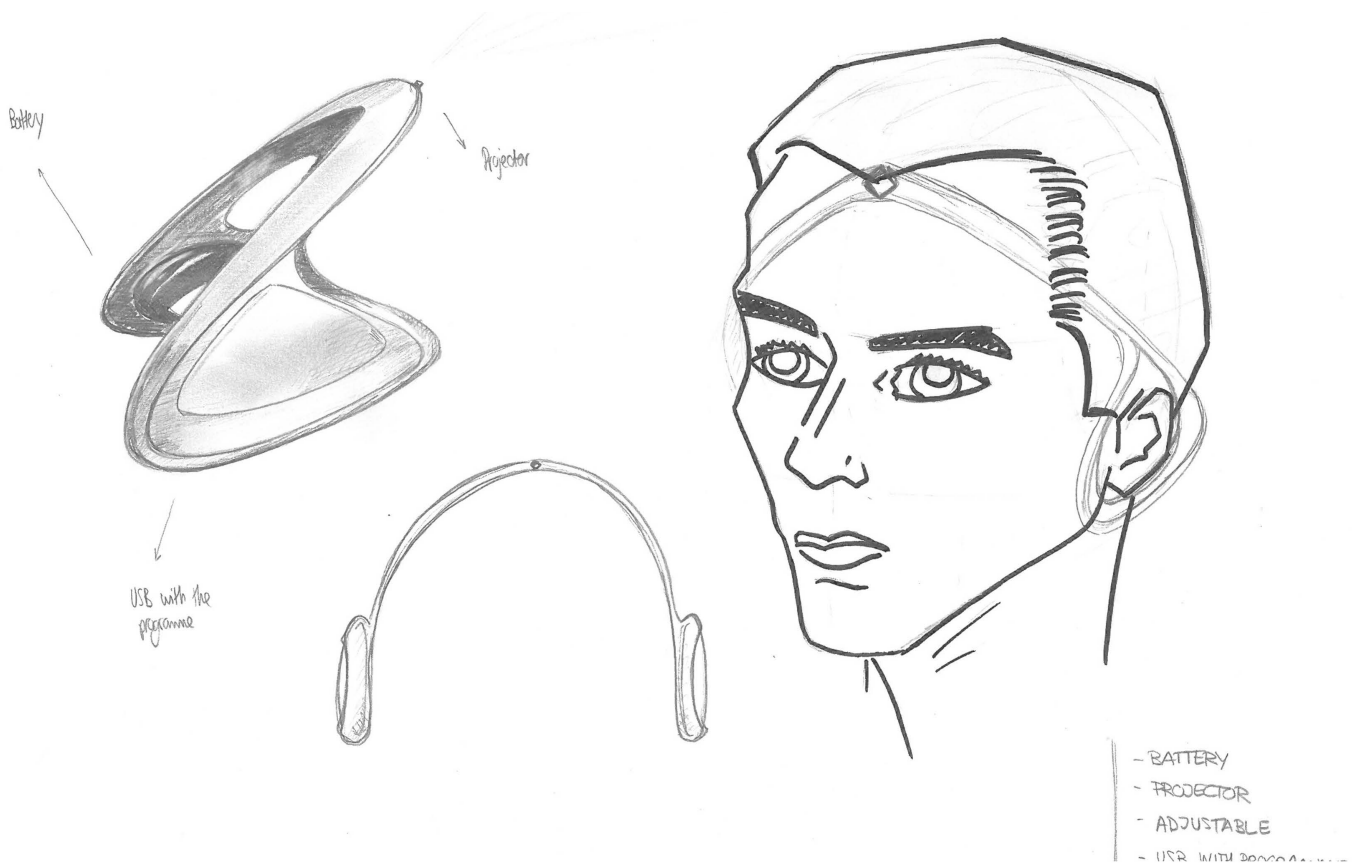

Fig. Participants

11. FIRST IDEAS

INSPIRATION
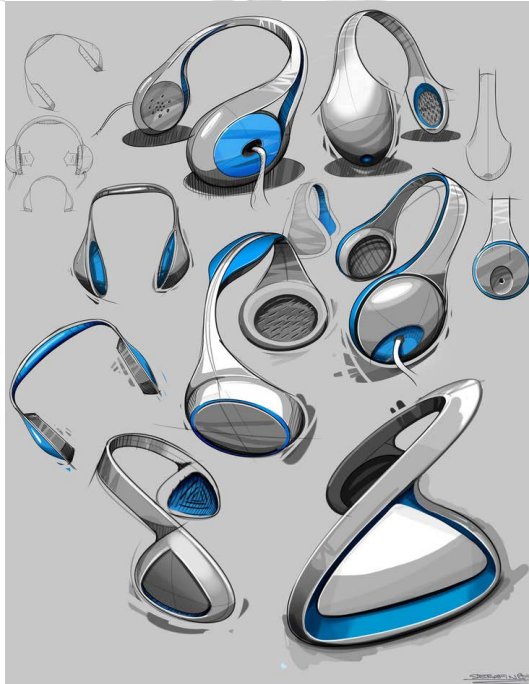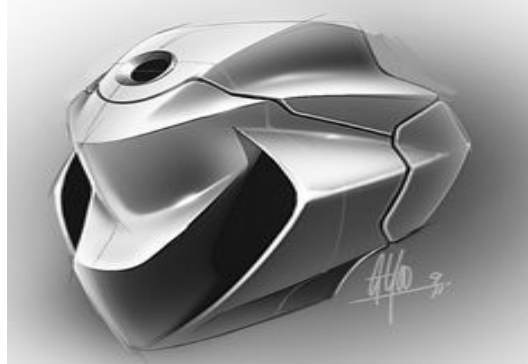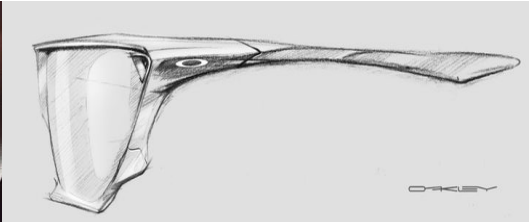
11. FIRST IDEAS

adjustable → battey

Trajector

11. FIRST IDEAS

PROJECTOR

PROGRAMME

BATTERY

ADAPTABLE (ELASTIC)

STICKY

adjustable

Battery

Projector

USB with the programme

- BATTERY
- PROJECTOR
- ADJUSTABLE
- USB WITH PROGRAMME

12. CONCEPT 1

BATTERY

12. CONCEPT 2

PHONE

BATTERY

40 mm

66 mm

10 mm

43 mm

7mm

39mm

PROJECTOR

20 mm

– weight distribution in
your head
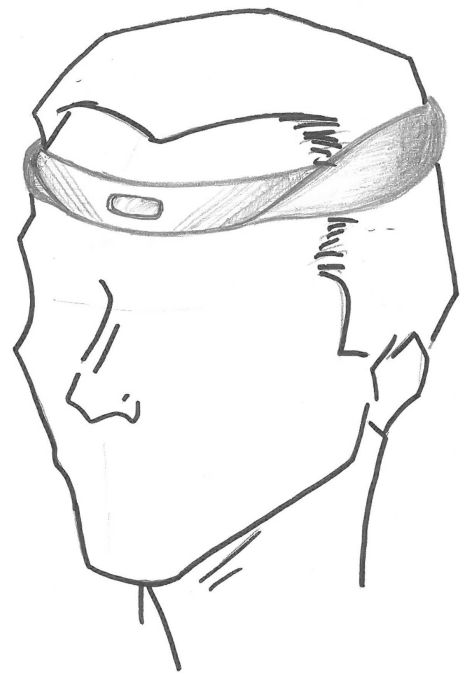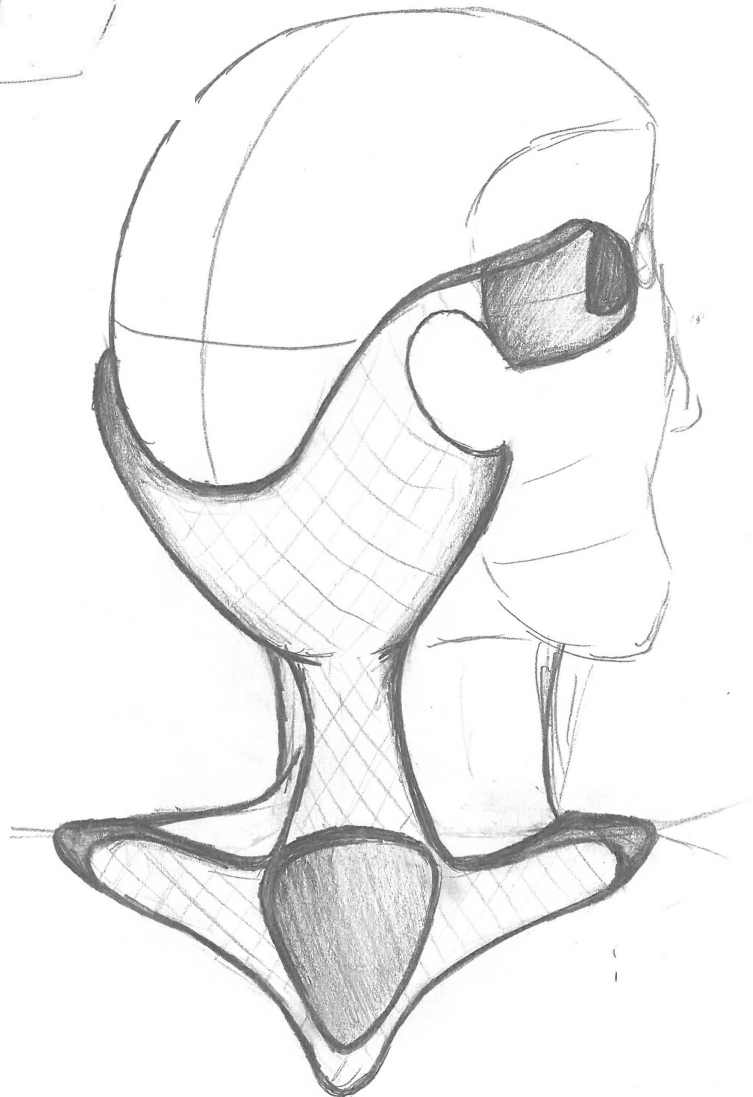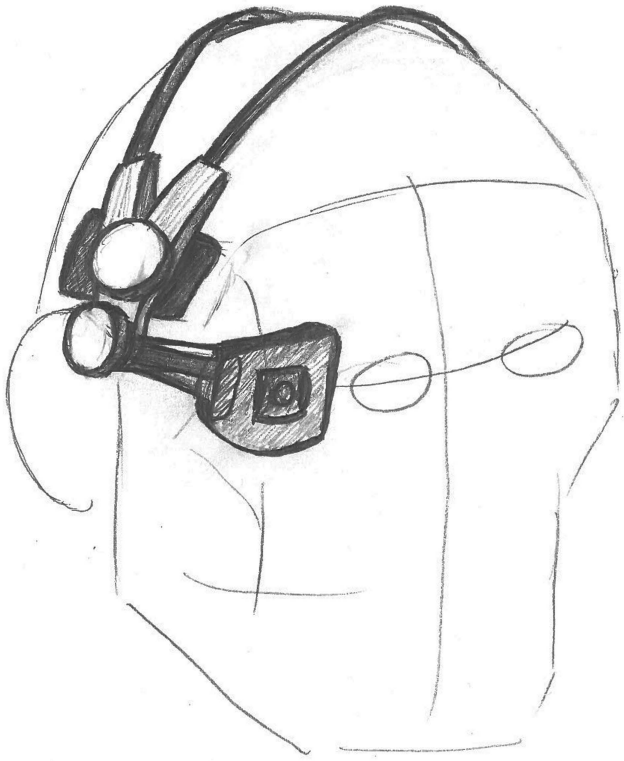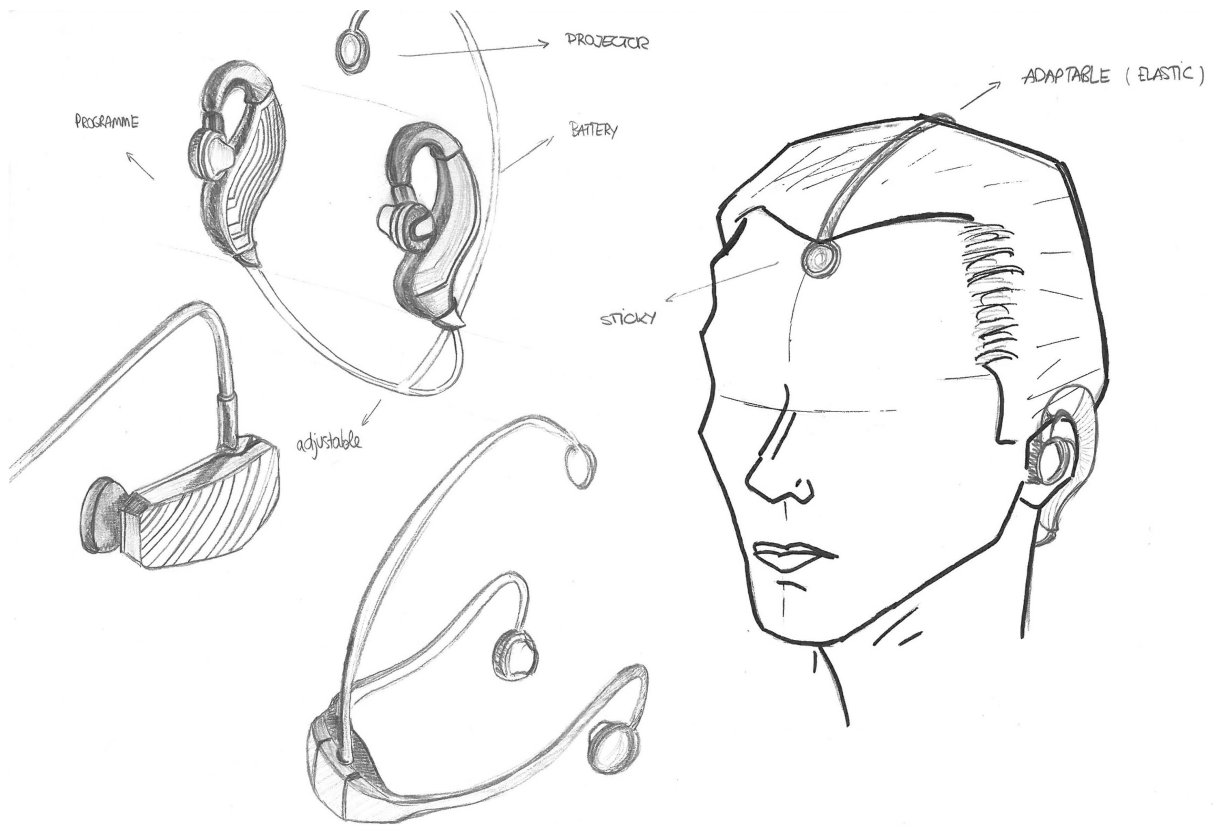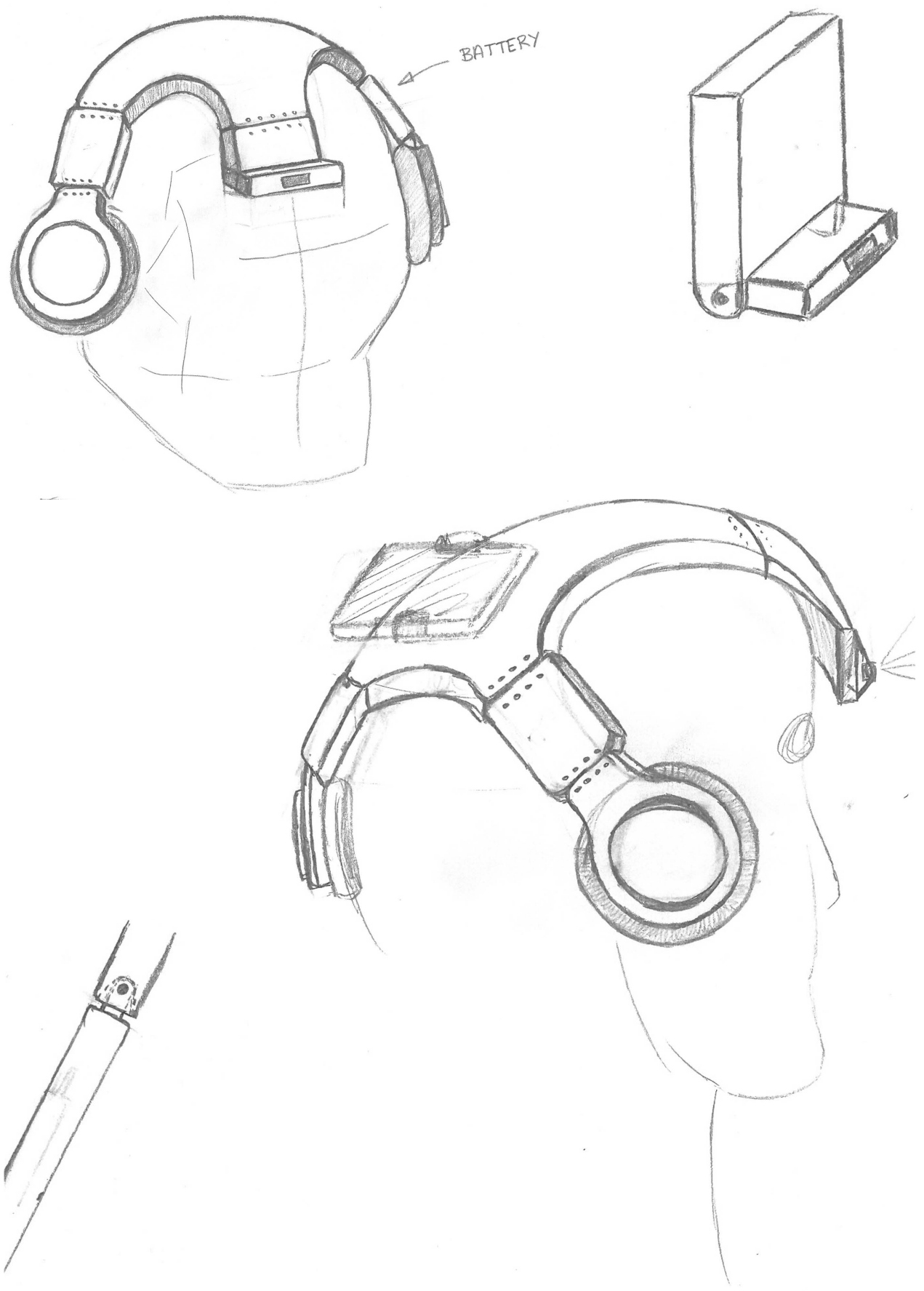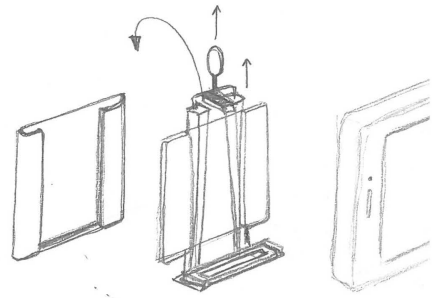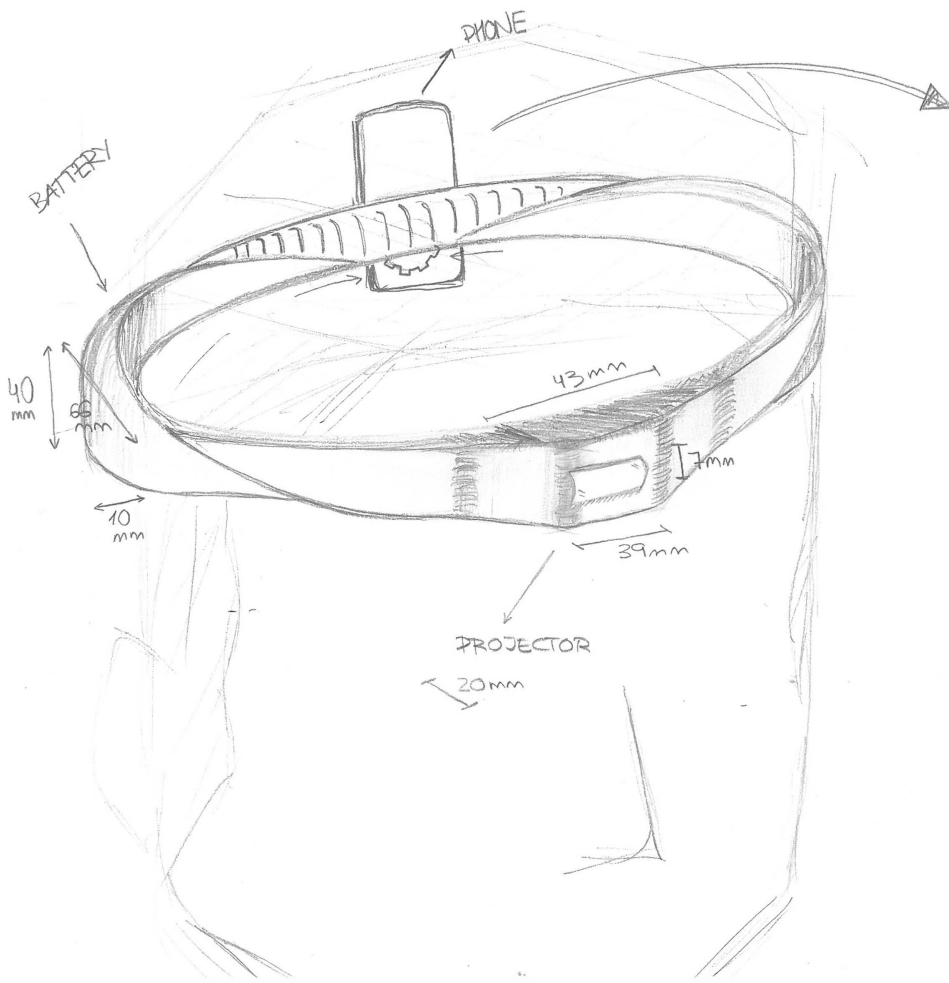
12. CONCEPT 1.2

12. CONCEPT 2.2

PHONE