

**POLITECNICO DI MILANO**  
Dipartimento di Design

Mater Degree – Integrated Product Design



**POLITECNICO**  
**MILANO 1863**

**OVERCOMING BOUNDARIES, EXTENDING SENSES**  
**Small design steps to face great social challenges.**

Advisor: Prof. Francesco Schianchi

Mastre Degree Thesis

Stefano Rombolà

Mat. 964562

Anno Accademico 2021/2022

# **ACCHIAPPARUMORI**

***a small solution thought for hearing impaired and gave to everyone.***

By Stefano Rombolà – mat. 965462

Advisor: Prof. Francesco Schianchi

MSc in Integrated Product Design – Politecnico di Milano, May 2023

## **ABSTRACT**

This project was born from an encounter and an idea. Getting closer to a deaf community opened my mind to new perspectives and points of view on a new reality, a new way of living life. I based my research on the latest design trends and practices to give my work not only a practical and technically precise connotation, but also an ethical one. Part of the studies were conducted along the supervision of Professor Francesco Schianchi, from whom I took the main modality that guided my choices in doing this project: Anthropodesign. After the design research followed the User analysis through questionnaires and interviews to the first users of the product; hearing impaired. The final part of the thesis completely focuses on the technological application and product development alongside its commercial background to settle the project in its complexity and entirety.

Keywords: Product Design, Hearing Impairment, Deafness, Sound Recognition.

# INDEX

<b>SECTION 1</b>	Pag. 12
<b>Chapter 1 – Disability</b>	Pag. 14
<b>Chapter 1.1 – Disability or eventuality?</b>	Pag. 16
<b>Chapter 1.2 – Reshaping</b>	Pag. 18
<b>Chapter 2 – Deafness</b>	Pag. 20
<b>Chapter 2.1 – The power of invisibility</b>	Pag. 21
<b>SECTION 2</b>	Pag. 22
<b>Chapter 3 – Actual Design Evolution</b>	Pag. 24
<b>Chapter 3.1 – Design Thinking</b>	Pag. 25
<b>Chapter 3.2 – Speculative Design</b>	Pag. 26
<b>Chapter 3.3 – Design for Sustainability</b>	Pag. 28
<b>Chapter 3.4 – Human Centered</b>	Pag. 30
<b>Chapter 4 – Anthropodesign</b>	Pag. 32
<b>Chapter 5 – Ethics</b>	Pag. 34
<b>SECTION 3</b>	Pag. 36
<b>Chapter 6 – Change of perspectives</b>	Pag. 38
<b>Chapter 6.1 – Kaizen</b>	Pag. 40
<b>Chapter 6.2 – Kairyo</b>	Pag. 41
<b>Chapter 7 – The Research</b>	Pag. 42
<b>Chapter 7.1 – Questionnaire results</b>	Pag. 43
<b>Chapter 7.1.1 – Personal data</b>	Pag. 43
<b>Chapter 7.1.2 – Product data</b>	Pag. 45
<b>Chapter 8 – Ideation</b>	Pag. 46
<b>Chapter 8.1 – Evaluation</b>	Pag. 49
<b>SECTION 4</b>	Pag. 50
<b>Chapter 9 – Extending senses</b>	Pag. 52
<b>Chapter 10 – Results</b>	Pag. 56
<b>Chapter 10.1 – mARTketing</b>	Pag. 57
<b>Chapter 11 – Acchiapparumori... and beyond</b>	Pag. 58
<b>Concepts</b>	Pag. 59
<b>RESOURCES</b>	Pag. 65

## INTRO

Since I was a kid, I was always driven by the desire to make and ideate new things. Drawing and design everything that passed through my mind was my favorite activity to boost and feed my creativity. When I started my career as Product Designer, I had the chance to dive deeper into this world, and I understood how to do it better and professionally. This made me move my scope from “creating objects” to “creating solutions”. The thesis you are now reading, was born after this need of mine, and a simple idea I had.

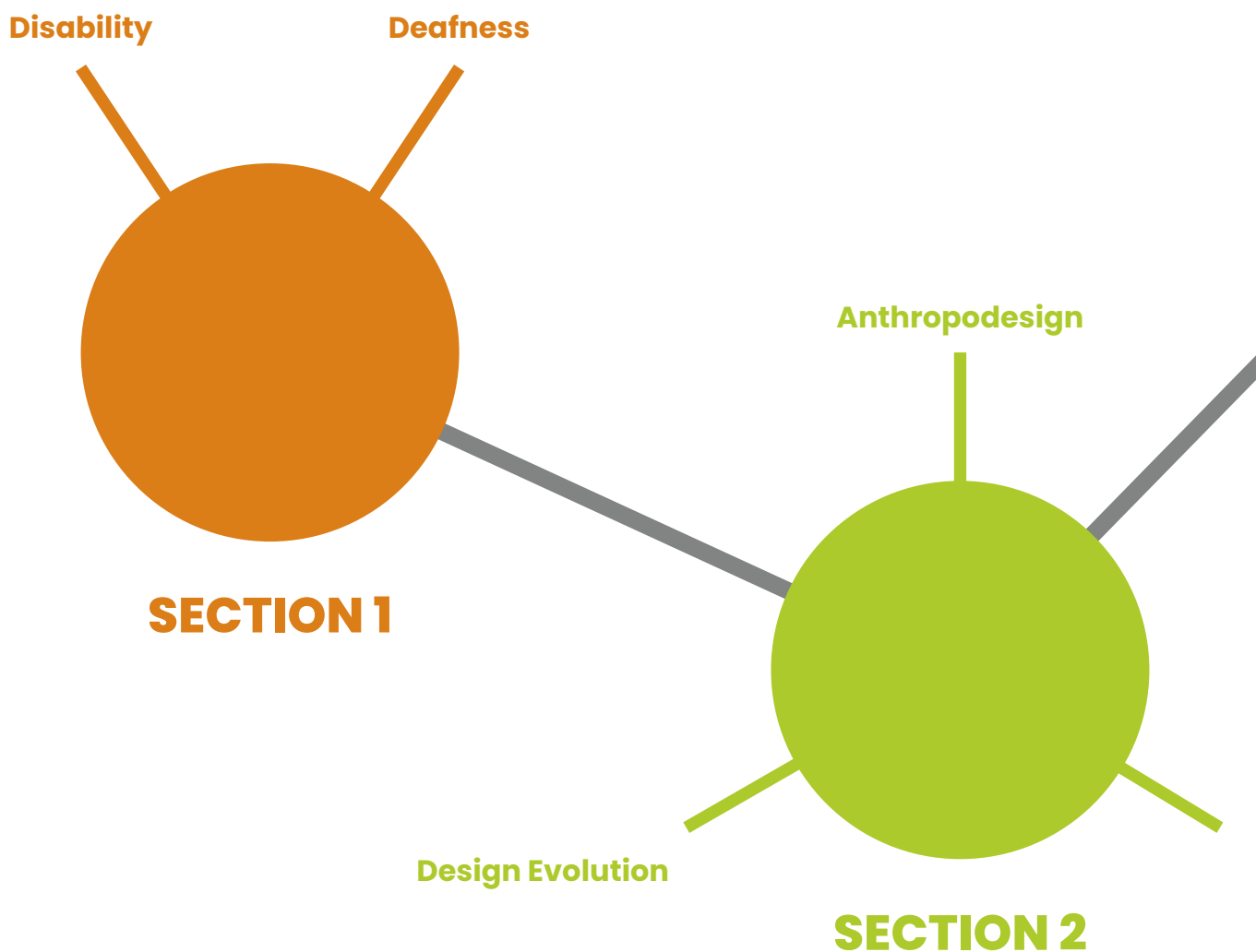
In my life, I met many people, did many experiences, and kept thinking to all the things surrounding me. On February 2022, I had the pleasure to meet a community of deaf people during an internship at an architectural firm, I learned a lot from them and about their condition. One day at the studio, distracted by the things I was doing, I tried to call a deaf person by his name, but he was not facing me, so he did not turn around. That made me think how sometimes we take for granted some actions which are not, and how I wanted to turn that weird feeling into something usual. Another time, I was at the airport when an intercom message called a passenger’s name, requesting his presence. Suddenly I said to myself that a deaf person with no escort would have never catch it, and who knows the consequences of missing that call! That was the last straw, so I started to write my thesis. From this little thought, an entire product bloomed, with a specific objective: to create an answer to a need, and more than that, to improve social relationships and enhance personal capabilities, to turn the “different” into a new normal. Disability is a very discussed theme; a lot has been made around it and a lot more is being made. But it is exactly for the reasons we just saw that much work is needed. I do not want to feel like yet another talking about it, I want to give my contribution to the cause, also because I am convinced that there will never be “a solution” but always small approaches to it. With this thesis I would like to take a step forward.

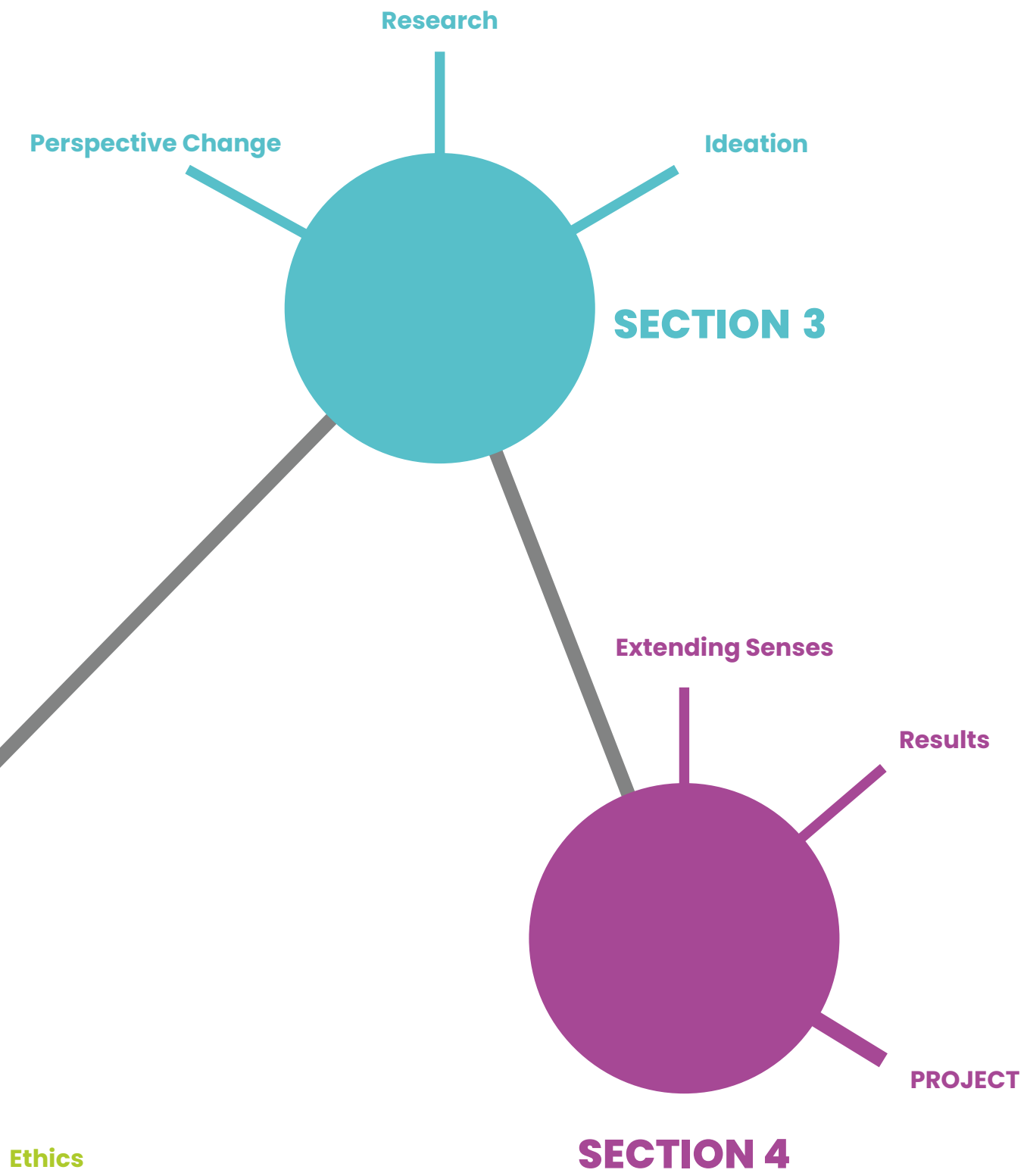
The more the research continued, the more possibilities it uncovered. These are the advantages of designing for humanity; that even a small solution can (partly) solve a big problem and turn a specific product into something else, something more, something with a greater meaning, a deeper purpose, a real value. So, an initial simple object I decided to call “Acchiapparumori” [literal: Noise-Catcher] was created and then evolved again, into a virtual network with the goal to connect in a better way, an even larger number of people, to services.

We can now begin.

## STRUCTURE

I decided to divide this thesis into four macro-sections in turn divided into subchapters. The first part focuses on the area of interest, its problems and where I would like to work on. The second part illustrates the methodology that stays at the core of my research, it analyzes the design trends, the approaches and the moral principles that pushed me. The third part will illustrate the user and products research through a questionnaire and benchmarking to prepare the field to the last part, that will be all about the solution, how it impacts on the problems found and how to best adapt it to us, with a complete overview in all its parts.





## **SECTION 1**

*Not problems, but opportunities to grow as humans.*

Our society is a complexity of individuals, shades of characters and personalities. In this mixture of diversities, it is inevitable to see some get wiped away, confused, misunderstood, or even forgot, for lack of interest, or simply because human nature is sometimes selfish and selfless. Our society has a complexity of problems as well, of various natures, and, just like us, problems tend to get different attentions. Even though we should face all of them – paraphrasing George Orwell – all problems are equal, but some problems are more equal than others. Design is the bridge that links all these different spheres of the human existence and constantly keeps on generating solutions or proposals, to improve life in all its forms. This section will address to some problems related to disability and it will focus on the most common errors we make when we relate to it, uncovering many stereotypes and dropping some masks that prissiness and superficiality have put on.





# Chapter 1 – Disability

Generally intended as a physical or mental condition that limits a person's movements, senses, or activities. Even though we cannot give a precise definition to disability since we cannot even comprehend the vastness of it. Both forms (mental and physical) present too many shades, scales of intensity and perception. As shown by LANC-UK, just by looking at the autistic spectrum for example, we can have subjects with mild disorders – like repeated actions or slight discomfort – or others who cannot even eat alone. To be more direct; depression, OCD, anxiety, developmental coordination disorder or “intellectually gifted” are all different spheres of the autistic spectrum (alongside many others) [1]. All of them have such divergent traits and could manifest combined and have diverse intensities, making autism a labyrinth of varieties that just a single word has the presumption to describe, making cares and support difficult and not always properly addressed. Now imagine the difficulties of design to approach this already messed up environment. Without a decisive and clear change of perspectives we will keep on creating products that are just the reflection of our standards and our desires to only “upgrade them” and not a way to grow together.

As state by Deborah Kaplan, even today some populations treat disability as a sin, or a punishment, others apply forms of isolation, segregation or even annihilation towards disabled people. More socially advanced cultures still treat disability as a sort of illness, are confused in front of it and sometimes do not really know how to act. There is a lot of confusion, also because amongst all the clinical conditions, the ones related to disability are also the ones we tend to treat in the most introspective and personal way. It is very hard to detach from stereotypes, to fears, to judgments and generalization when we cannot look at disability without prejudices or the presumption of knowing it better than the ones who lives it. The border between the need of a medical intervention and the simple human condition to accept and welcome just as it is its very difficult to tell, even a small detail can make a huge difference. A person on a wheelchair can be perfectly autonomous if the social aspect in which he is into, is respectful of his state, as well as another in the same situation – but for different causes – may need continuous assistance. A blind person can live a perfectly normal life, its situation is way more less constraining than we think, especially if we consider that it is often placed in a context that is disadvantageous to it, and so on... [2].



*Figure 1: Nico Acampora, PizzAut founder*

“On the 19th of November 2017, a group of dreamers – initially informal and formed by parents of autistic children – transformed into the PizzAut Onlus association with the aim of raising awareness of the employability of autistic people among institutions and civil society” [3]. Nico Acampora, its founder, gave everyone a beautiful life lesson by creating a pizzeria completely run by autistic people, and today they are opening their third restaurant. PizzAut is not only a restaurant, but also an association that helps and supports people and families.

## Chapter 1.1 – Disability or eventuality?

We must stop thinking about disability the old way like it is some sort of sickness, we must start treating it as a “human eventuality”. It is a very difficult thing to do since when we have to face it, it forces us to step out our comfort zone, it gives us a distorted perception of a body. Freud in 1919 theorized the theme of the “perturbing”: in front of a disability, people are scared, pitying, or even disgusted. Our subconscious projects the disability, the distortion, onto ourselves, and this happens because we are looking at something that is not part of what we consider normal, and yet, it could happen to us too, it is an **eventuality** since it is so strongly linked to a human. But instead of treating it like it should be, we prefer to avoid it, do not even imagine a life with a burden so heavy, in some cases we prefer death over it. These thoughts are what really kills a human, the thought that there is nothing to do, but to survive. The people who find themselves in such situations are usually considered like fighters, but they are not, they are just adapting their unusual, or new life condition to ours. And that’s why we consider disability so uncomfortable, because we always measure it with our standards, instead of creating new ones, to adapt all kind of lives to a big complex reality, and not the one that only the majority experience [4].

Another great barrier consists also in how disability is perceived, not only to others, but to disabled people themselves. Nowadays it is fortunately emerging a new trend about body positivity. Initially it came from people who had bodies which shapes and weights were not in compliance to “the standards” as analysed by Céline Leboeuf in her *What Is Body Positivity? The Path from Shame to Pride* [5]. It was born to boost confidence and (in some specific cases) to start a healing process, since it was mostly addressed to obese or overweighted people. After a while it split into three main currents: one still close to the initial principles, another more “extremist” that pushed **body positivity** even in some extreme situations where, instead, a medical treatment was needed, and a last one, that extended body positivity not just to look, but also to function. We can look at this movement as the opposed current to what, up to ten years ago, was standardization and idealization of a perfect body, or like medias and public opinion know better as “body shaming”. That led to the spreading of mental illnesses like anorexia, anxiety and the extreme use of plastic surgery, diets, and gyms. This process has also inevitably affected even more the already distorted vision we had of disability. It was not just a matter of perturbing now, but there was also the belief that “defections” could be corrected in some ways, without even caring about the disabled people point of view, they were just broken humans that needed a repair. But today, little by little, this new positivity is bringing us into a new era of relationship with our

body. Disabled people are no more afraid or ashamed of their condition but on the contrary are proud of who they are and how they live. But still, a lot more has to be done. Disability should not become a wall or a mean to increase differences. "It is part of a person's experience. Even though it is hard to face diversity when it is problematic and does not generate a social value" [6]. It is not a matter of empathizing or – even worse – compassion, disability is a condition in which a human being is. Just like someone is allergic to something, or afraid of height, or sensible to weather changes, disability is something that should not have that negative connotation already inside its name, disability is just state. Being not able to do something "the common way", does not make anyone less than the other, and the conception on which we have – as designers – to help disabled people is "wrong". We just need to answer to their needs as well, as we do with everything else. It's not helping, it's good design. To look at disability as a condition, will radically change the way we confront it. I wanted to quote Ilaria Soranzio, a Politecnico di Bologna student who did a very interesting thesis about a UX interface that helps disabled and elder people better interact with a smartphone. She wrote "Would it surprise you to think that a Frenchman in Japan might be much more limited than a blind man struggling with a smartphone? True disability is something that does not only depend on physical limitations but is context-dependent" [7]. If we look at disability this new way, we could finally break the barrier that divides physical and mental problems to contextual ones. Doing so in a project will make it universally usable, no need to create a tailored solution for a category, two birds with one stone. Still, we should never forget that disability has its own identity to consider when designing something. Create a design so clear that the phrase "even a child can do that" becomes needless to say, not because it is easy, but because it is easily accessible.

## Chapter 1.2 – Reshaping

*“To undertake or promote research and development of goods, services, equipment and appliances designed universally” [8].*

This is the most important statement of the United Nations Convention on The Rights Of Persons With Disabilities, as well as the most fundamental document ever made around the theme. A document everyone should take into account whenever doing something related to this world. It is also considered as the key point of **Inclusive Design**. Although, we should forget this term “inclusive” because there is nothing more categorizing and even more classist than this. Of course, I am not against it, nor I am implying that the ideal is wrong, I just would like to question the meaning of it. Like the word disability, also inclusivity has – in its own way – a negative aspect. To include someone means to let that individual become part of a society and let him enjoy all the rights and opportunities it can offer. But this can be achieved in two ways: or by adapting that individual to the society in question, or vice versa. Still, it is not sufficient. The person that needs to be included, **has to be** part of the environment surrounding him. The passive approach to create just a tool, or a mean solely made “for them” is already an outdated concept, we must think bigger, we must design a new society in which there is no inclusion, but just an intelligent project identity, something that does not “need” to think about differences but embraces them with no hesitation, and models them to be surpassed or exploited by everyone, we need to design **with values**. Also, because this is what we have always done in our history: not adapting but reshaping. We created utensils, we have tamed fire, cured illnesses, conquered lands and seas, we shaped the world on us, we can shape it for everyone as well. The number of people with disabilities is radically increasing in these last years, it covers up to the 15% of the global population (almost one billion people), while just in the 80’s it was less than 10%. Disability is no longer a minority; we must start treating it like a human condition. We have sent a man on the moon and sometimes we can’t even let a wheelchair reach the end of a stair. From research by Rob Imrie and Peter Hall, in the United Kingdom most primate homes are not accessible to many typologies of disability [4]. I am sure that one day, the words disability and inclusion will cease to exist, because already inside our mental processes. We will not see what a person cannot do, but how does everything. But to do so, we need to start this, through small changes at first. Small solutions, to big problems.



[rwi.lu.se](http://rwi.lu.se)

## Chapter 2 – Deafness

From this maze I decided to choose one small piece, a little fragment of what we now understand no more as an illness, but as a condition: Deafness. But before getting into the matter, let us first analyze what this curious human trait is. Deafness (or hearing impairment) is a condition that prevents an individual from receiving sound in all or most of its forms [9]. Note this last part “most of it”. Like all other disabilities (as we said before), is a word that describes a multitude of states, more or less significant. It can occur at almost every stage of life, due to infections, genetical problems, accidents or just age. So, deafness, to reiterate, is not THE sickness, the problem, but a side effect, a consequence, an eventuality. From a detection made by Del Bo – Tecnologia per l’ascolto (a Milan audiology center) there are three main different levels of hearing impairing; the most superficial one, cannot let the individual hear faint sounds like whispers (20/40dB). An intermediate level where even normal conversations are difficult to hear (40/70dB). A severe state where only intense sounds are perceived (70/90dB), and last, deep deafness (in turn divided into three levels) where all sounds from 90dB above are not heard at all. The very last level of deafness makes impossible to people affected by it to ever learn to speak, while for the others can be possible even through labial lecture and cochlear implants where necessary. One interesting common trait that unites all these levels, and normo-typed people is the capacity to hear (or perceive) extremely grave sounds, with a strong vibratory component, like a roaring engine, or a slamming door [9]. This can be one interesting starting point to begin with. The connecting link for making something useful, not for deaf only, but useful in general.

## Chapter 2.1 – The power of invisibility

But why deafness? Blind people can be recognized from their white sticks, people with motor disabilities have different means of support (like a wheelchair), others with genetic diseases can also have marks of it on their bodies, or specific types of behavior that make their condition evident. But deaf people (with no other condition) are a bit different. Deafness is defined as the “invisible disability” [9] since you cannot tell if someone is deaf until you directly interact with them. This condition makes it particularly easy for them to adapt to “normal standards”, to the point they do not consider themselves impaired, or in need, but – on the contrary – are genuinely happy of what they are, to the point that some of them refuse to use spoken language (even if they could) and rightly demand others to learn sign language. This is my ideal scenario of a **multi-able society**. A place where there are no constraining differences, but eventualities that are naturally faced. Like we had to learn English at school, to uniform to the most used language in the world, we should learn how to interact with people even closer to us and our own culture but with different ways of communication. I got close to this world not because I physically met a deaf community on my path and got curious or felt the need to give them something (they do not want). But because I wanted to learn from them and treasure their critics towards the reality of “normal people”. To grow as a person and as a designer.





## **SECTION 2**

*How and why.*

Design is the bridge, but to build a solid bridge we need the finest materials to make it. Design is in continuous evolution and improvement, and so it is important to know the best practices and methodologies to start every project. In this section will be analyzed today's main design trends, approaches and ethics at the base of the final product of this thesis. It is important to define them as they originally started and got intended, since with the passing of time, there can be some misleading changes, usually operated by those entities that have particularly large presences on the global market. Never lose faith in a good principle only because few decided to adopt it in a distorted way to benefit only themselves.



mbanotesworld.com

## Chapter 3 – Actual Design Evolution

Nowadays, product design is radically changing from its past self. Technology is becoming more and more part of our lives, not only on the physical plane, but also on a more “abstract” one. The **digitization** of society is the next step of human evolution. As research from Lambèr Royackers also shows, there are a lot of factors both social and ethical that can have a strong impact on our reality as we know it. Products are passing through a process of **hybridization** to become more performative than just their prime function, and to let us evolve faster, with them (sometimes). This new trend is almost necessary to keep up the pace, and it is adopted by designers like Giulio Iacchetti – two times Compasso d’Oro Award winner – who showed already in 2016 at a WOW! Roundtable, the advantages of hybridization [10]. But which are today’s Design challenges? To become a SUPPORT for technology, or to keep a social and ethical value to it? The answer can vary from case to case, but for sure its purpose must be always one: to make life better. “Traditional design often aims for an abstraction: the standard man. Doing so penalizes real people with their diverse skills, competencies, desires, and aspirations.” Design for All is design for human diversity, social inclusion, and equality. [From the Stockholm Declaration of EIDD©, 2004] [11]. But still, Design for All is a confusing term, since sometimes we tend to use it to indicate just Inclusive Design (it should not mean to “help those poor people”) and even products with such high purposes, if not properly projected, can fail to reach their objectives, becoming just empty objects. The real goal of design is to create a solution for a specific request or problem, that can solve a greater range of related problems for a bigger number of people, with a universal vocation.

Before getting into the matter, to better understand how to design something for today, let us quickly analyze the current situation in which we are, with a focus on the main themes and sectors that are having more impact on this transition of our design mentality.

## Chapter 3.1 – Design Thinking (or the art of Problem Solving)

A way to explain the design process to everyone. The importance to have the right approach when doing something, the right mindset, and the right intentions. Design thinking is becoming more and more popular among companies, because it has the best way to identify problems not just coming from a single point of view, but through the analysis of the whole processes and all the actors involved in a determined sector. “Among other things, design thinking calls for **reframing** problems (how it is described) to find solutions that others have overlooked” [12].

- In 1950, to speed up transoceanic shipping, companies spent a lot of money improving ship’s engines, but all they could save was just hours or few days. Malcolm McLean, owner of a trucking company, recast the problem on the time spent to move cargo on and off the ships: container shipping. This new system saved weeks, instead of hours or days [12].

*“Thinking through the process of serving a meal is the difference between cooking and designing an experience”* [13]. Design thinking means to impact on a whole procedure, from every aspect and point of view, to have a complete vision over it. Because when we design something, we are not just creating an object or a service, we are creating a network of actions and reactions, linked together. The key to reframe and solve problems can be easily grasped if we don’t look at them like isolated phenomena, but consequences of a chain of decisions and investments in resources and time. To think like a designer means to be interested in everything surrounding us, to “think outside of the box” is a misleading term since we are not “imprisoned” in a concept or in a certain situation, but we are looking at it too closely. We don’t have to hop out of a self-imposed mind border, we just need to take a step back and look around us, look up and down and even **inside ourselves**, the problem could be everywhere. There is no box, just a complexity of things that can be understood only if methodically studied and observed.

- Oral-B, a well-known oral hygiene brand, was conducting a study on what could be the ideal electric toothbrush. They wanted to add many functions like tracking brushing frequency, observing gum sensitivity, and even playing music. Unfortunately, they did not do the first thing they should have done: ask their clients. Thanks to Kim Colin and Sam Hecht’s design studio, the company was able to understand that users did not want more functions, but better performances [14].

These concepts and examples are for sure extremely interesting, but only from an economic point of view. Americans (mostly) described

design thinking as a mere instrument to make money. They only brought it to us in a business logic, putting time and money saving as its main objective. Today the real values of design thinking start from the individual, the single person's needs and demands, and only after that, they reach for other purposes. A great example is the new logics of UX/UI design. It does not focus on giving the customer what the company wants, but on letting the customer reach everything he needs in the easiest and fastest way possible. Design thinking, as Tim Brown from IDEO [15] explains, is a human-centered approach to innovation. It draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success. Design thinking is the balance between needs, desires, feasibility, and viability. [16]

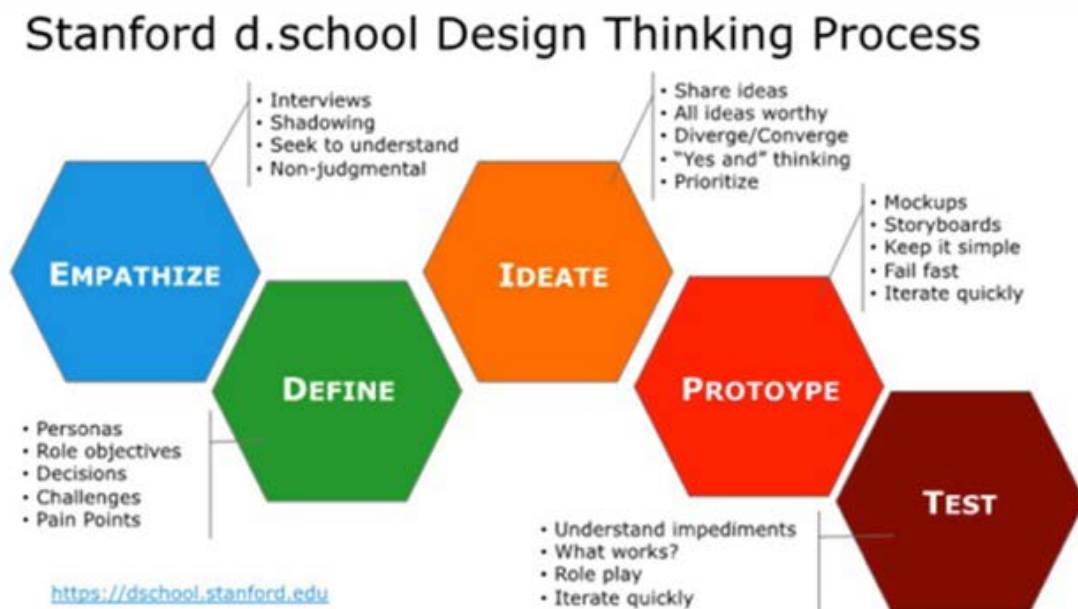


Figure 2: Stanford D.school's Design Thinking Process

## Chapter 3.2 – Speculative Design (Design for the future)

"An activity where conjecture is as good as knowledge, where futuristic and alternative scenarios convey ideas, and where the goal is to emphasize implications of mindless decisions for mankind." [Anthony Dunne and Fiona Raby] [17]. Design for the future, to anticipate it, not to create it. Closely look at every aspect of what is surrounding us, grasp the **weak signals**, the new emerging trends, but not only from a social point of view, but even political, environmental, economical. To design for the future means to have a complete and total overview of the

complexity of a place, community, or entire society or ensembles of them. It is one of the most important instruments for a designer to have. It is perfectly described in an intervention by Debora Bottà from Medium [18] with all the positives aspects this practice can bring. Even though many blogs and some designers are skeptic towards it, saying it is no more like when it started. Speculative design was in fact born as a critic towards modern design, an invitation to rethink its methods. But it does not matter if some big brands use it with a different meaning (as they always do with anything they touch), its original ideals will not change. Always go to the roots to really understand something (Francesco Schianchi) [19].

Speculative design does not aim for a possible future, but for a desirable one. The difference is subtle but crucial. As already stated, designing for a possible future, will drive design to become just a mean of exploitation, while a desirable future can be made only by listening – once again – to humans, not users. It is not a matter of consumerism, but a matter of citizens and people. To go through a realistic future, and not a constructed one. The research of trends and silent needs only to anticipate competitors on the shelves is now considered unethical. Yet, all these data are extremely important if used for the right purpose; to anticipate a possible future and make it better. Mike Monteiro in his book “Ruined by Design” urges designers to consider the consequences of our actions before the brilliance of our ideas, and with the advent of mass media and socials, now almost everyone is aware of the side effects of unethical design. The key is not to predict times to dictate new fashions, but to improve possible situations even before they happen, to come prepared, to improve the quality of life.

( a )	( b )
affirmative	critical
problem solving	problem finding
design as process	design as medium
provides answers	asks questions
in the service of industry	in the service of society
for how the world is	for how the world could be
science fiction	social fiction
futures	parallel worlds
fictional functions	functional fictions
change the world to suit us	change us to suit the world
narratives of production	narratives of consumption
anti-art	applied art
research for design	research through design
applications	implications
design for production	design for debate
fun	satire
concept design	conceptual design
consumer	citizen
user	person
training	education
makes us buy	makes us think
innovation	provocation
ergonomics	rhetoric

*Figure 3: differences of traditional (a) and speculative design (b)*

### Chapter3.3 – Design for Sustainability

To take care of the environment and having respect for nature means to take care and respect humans too. Sustainability is a word we are only listening a lot lately. Problems related to climate change, pollution, wars, famine, are creating a growing desire for action, especially in young people. To encounter these needs and go along with them, Design for Sustainability was born. In her research, Virginia Tassinari from Politecnico DESIS lab, says that we are currently dealing in many parts of the world with the consequences of anthropocentric design practices, that have not considered the interrelationship between human and non-human natural agents [20]. Design for Sustainability opposes anthropocentrism as its original meaning and embraces this new concept of humanity as part of an ecosystem. “It moves the focus from a technical and product-centric way of designing to a large-scale system change in which sustainability is understood as a socio-technical challenge” (Evolution of Design) [21]. This period of sensitization and information around this theme – among other things – has started a golden era on material research. It surely gave positivity and new purposes to product design, enriching it with more values and new visions. Material District [22] is a pioneer in this field, with one of the richest collections of materials, and a great panorama of meetings and events to boost the research and inspire the change in a very original way.



*Figure 4: bricks made of construction waste by Kenoteq*

But it is not just the products that will move us towards the green transition, but a radical change of mentality and habits, starting from understanding what and where we are. The best example to provide for this, is the 2030 Agenda for Sustainability, launched by ONU in 2015 [22] and signed by more than 193 countries. It enounced the 17 points (Figure 5) everyone – hopefully – should follow for a sustainable development.



*Figure 5: The 17 points for Sustainable Development in the 2030 Agenda by ONU.*



## Chapter 3.4 – Human-Centered... More or less

HCD – as the name states – places human beings at the center of its focus. Today, as we previously saw, it is comprehended in every design process. Even for this reason it is sometimes misused, or even confused. It is full of design websites that boast over-performative products as human-centered, or companies using it to increase selling. This extremely good practice needs once again to be resized to its original meaning. Affirmations like “Spotify, Netflix or Apple are human centered” [23] will not be taken into consideration since it is not sufficient to place just an ideal of person at the center of a product development to make it human-centered, this is just extremely superficial and reductive. To simplify, there are two main brand-new practices that mainly involve human participation in its design process but do not actually valorize humanity at its fullest: User-Centered Design and Interaction Design. They have a strong economic component since (also starting from their names as well) even if they consider the individual as a being with a variety of emotions and dreams, it is still a user, whose main goal is to have the best experience possible, and eventually pay money, on the platform that is hosting it. Again, the ideals they bring are more than valuable, only if used in the right way. We can consider also Inclusive Design (see Section 1 – Chapter 1.2) as a branch of HCD, but this one is closer to its prime principles than the other two.

**User-Centered Design** means to directly involve people into the decisional process. For years we have been told that “the user is stupid” and we need to create a simple product to be understood. Nothing could be more wrong than that. The user is the key to understand how to best fit a product, not just to its direct expectations, but to its deeper desires, its real needs and eventually its dreams. “To create direct involvement of the end user at all stages of the design process. Build an iterative flow (prototyping, evaluation, modification, continuous verification of user needs and requirements). Set up a multidisciplinary team” (D. Norman – the Design of everyday things) [24]. These are only the needed basics to achieve what UCD aims for. To synthesize these concepts, we can just say that; to obtain a meaningful product, you must observe, talk, and listen to what its potential end users do, ask, and say about it and its surroundings. It seems certainly a logical thing to do, but not every time it is used ethically. As we just said, the user is human, and the complexity that characterize it equals a gold mine for the times we are in. The habits, the interests, ideas, tastes, political orientation, gives developers a large reservoir from which to draw inspirations and insights for the products of the future. It is almost a detour from speculative design. But all this cloud of information has also many potentials in so much more areas. If not correctly handled, this could trigger the infamous problem of the

privacy violation. To know too much about someone can become a powerful weapon both for and against that person. To involve humans in a product/service development have its risks, but it can be extremely worthy.

For **Interaction design** (IXD) instead is the perfect ally of digitization. Quoting Alan Cooper, it is “the practice of designing interactive digital products, environments, systems, and services.” [25] Born from extremely recent trends, it has its peak application on virtual interfaces. UX/UI (User Experience and User Interaction) are the two cardinal points around which revolves almost every application, program, and site online. It is fundamental to have a good UX design to have a functional and appreciated product. For sure it can make things easier, but it is extremely tied to the digital world; it cannot exist alone. As UCD, even interaction design limits users to just its area of action, it does not let them express themselves. Fictionally, it is a technology at our service, but realistically speaking is more like a guide dog, that pushes us to the right directions.



*Figure 6: A smartwatch*

In Figure 6 is depicted a smartwatch, one of the newest yet extremely diffused tools of our society. Research from the Nottingham Trent University and Beijing Institute of Technology [26] [27] show how **smart wearables** has quickly become a huge trend among young and adults. Everyone is already accepting to become part of the hybridization. Wearing technology, something that seemed so futuristic until just ten years ago is now becoming a reality. Smartwatches are the best example of UCD and IXD since they embody both in a perfect dialog between them. It can assist its user during the whole day while monitoring his health, all this sided by a simple yet extremely practical interface. The potentials of a smartwatch are a lot and can still be improved.

## Chapter 4 – Anthropodesign (The value of values)

We reached the real mind of the project, the mentality to have while creating something which main goal is to help others. What we have just seen in Section 1 is an overview of the situation in which we are operating, while in the first part of this one, we passed through the evolution of design, an analysis of the cornerstones this research is based on, and an evaluation on today's trends, misunderstandings, risks, and potentials this field has to offer. Anthropodesign embodies all the notions analyzed before (it has the objective to solve problems, prevents them, it respects the environment and puts users' real needs and desires at the center of its research) in addition to one according to which humans, in their complexity, are the real end-users of its products. To be mentioned too, notions such as **anthropometry** and **ergonomics**, and all the ones related to physical and mental wellbeing. Anthropodesign incorporates the principles of Human-Centered Design (HCD) and surpasses them by introducing a true parameter capable of perceiving how much a certain product/service contributes to improving people's lives, for every man has a right to well-being, happiness, and freedom [Dal design all'antropodesign – Serena Grattagliano] [28]. As described by Francesco Schianchi in the book that illustrates its main concepts [19] Anthropodesign has no boundaries, according to it, a product can freely evolve in many ways and shapes as long as its purpose is to help humanity (on every level). It is a way of doing design that acts on social innovation through projects, territories, and startups. Anthropodesign means to put **life at the center**.



Figure 7A: Minekafon



Figure 7B: Minekafon Drone

MineKafon (Figure 7A), created by the Afghan designer Massoud Hassani [29] inspired by a kid's toy moved by the wind. It can save people from mines in all those forgotten lands left scarred and lost after big conflicts. It is an extremely simple product and is made with low-cost materials. The concept is to make it buildable on site and get thrown into an abandoned minefield to sweep mines. Its constitution and weight make this object capable of moving with the wind and swipe up to four landmines before becoming incapacitated to roll. Beside it (Figure 7B) the upgraded version, with technological implementation. It evolved into a completely new system. The drone now can detect mine, create a map of the minefield and release small charges over each located mine to detonate them. Same function, different technology, different approach, same results: saving and improving life. Not only a child has not lost a leg, an arm, his sight, or his life, but it is now free of running and playing outside with no fear. This is the peak of ethical and human-centered design. That's what every product should do. Exit the borders of mere functionality and embrace the possibility to "become anything" even a hero.

Another case of design that aims to save lives is the Samsung Safety Truck (Figure 8) [30] has a built-in camera at the front that can let who is behind to see other approaching vehicles through a big screen. But aside from its high purpose, it still lacks "perfection". Some people found the screen to be distracting, while in other conditions (with fog, or in the dark) it will not work as well as it usually should do. Something more is needed, something that technology can achieve better than a human eye. Now we have sensors that can spot vehicles in almost every condition, from way further than what we can do [US Dept. of Transportation] [31]. Design should not be ashamed of advanced innovation if it is reasoned and done to save lives.



*Figure 8: Samsung Safety Truck*

## Chapter 5 – Ethics

The link between all the methodologies discussed earlier is more than clear: humans must be the center of the design process. This affirmation can be declined into two main ways; the project is designed to help, or it directly involves humans to better adapt to them. These two approaches (that can also come together as one) are not to be taken lightly. Emblematic is the case of Nestlé boycott during 1984. The New York Times, and many other newspapers, described it as one of the worst acts ever made by a multinational corporation [32]. In brief, Nestlé during the late 60's did a large and pressing campaign to encourage the use of powdered milk amongst African and South American mothers, saying it could be a good solution to toddlers' malnutrition. The effects of this sponsorship came few years later with an even higher rate of premature deaths due to polluted water (used to prepare the milk) and increase in poverty, because after the free samples, to buy a milk carton costed almost half of the salary of one of those mothers. For this reason, Nestlé is still today one of the most hated multinationals worldwide, rightly. Actions have consequences (citing again Monteiro), as we said before, in some cases good intentions are just a facade to hide other interests. Even when it comes to the digital world. As seen in chapter 3.4 personal data is extremely important, a wrong use of it can make extremely serious damages not only to individuals but to whole countries as well. How many times have we heard about data breach, or privacy violation. The potentials of knowing all this are very high, it is the most important resource to speculative design, but becomes instrument of manipulation in the wrong hands. See the 2020 FBI report about how Russia manipulated through internet and public opinion 2016 USA elections in favor of Trump [33].

These are not isolated cases, and it is hard to tell if they will ever stop. Examples like these are so important to sensitize and let all of us understand what bad consequences can occur if life itself is not respected on every scale, even the smaller ones. Luckily, in this new era of hyper-connectivity, even though it could be scary sometimes, we can get many points of view on reality. Doing research got easier as well as talking to people. We have to set our objectives from designing for profit to designing for humans. And not just because it is socially expected (like bad design and consumerism do), but because it should be logical. Forget empty and soulless creations done to boost personal ego, and embrace the courage of doing for others, without expecting nothing in return but the human wellness, like Renato Favero (former hospital chief), Cristian Fracassi and Alessandro Romaioli (from Isinnova company) did in 2020 during COVID pandemic, by creating “Charlotte” (Figure 9) a valve capable of converting snorkeling masks into ventilators, helping thousands, all for free [34]. My project wants to be a gift too, and this is my ethic.



*Figure 9: Charlotte valve (in yellow)*

## **SECTION 3**

*The Research.*

After analyzing the partial context of action (Section 1) and in which ways we intend to operate in it (Section 2) we can now move onto the actual realization of the product-service system. In this section we will retake some previous concepts, deepen others, and finalize with a practical application of what could become a potential solution to part of the problems analyzed at the start of this thesis. Always following the good design practices and principles that will turn a simple product into a value.



[www.marketingweek.com](http://www.marketingweek.com)



## Chapter 6 – Change of perspectives

My initial sparkle about helping deaf people was for sure a good start to me, but still it was not everything, it was just a beginning. The “problem” found (the impossibility for deaf people to interact with all the stimuli our society takes for granted) cannot be completely considered as such. First of all because deaf people are used to it, they are not bothered, because they are more than conscious of their limits. For sure it can be annoying sometimes, or even dangerous, but it will not surely stop them. We can consider this matter more like a necessity, a right. Everyone has the right of knowing, everyone (in its own way) has **the right to listen**. And so, what I believed was a problem, immediately became an emblem. The project was not just a solution for a category, but it was a symbol of an ideal inspired by the willing of equity. Like stated in the first chapter, we must stop looking at difficulties with negativity and change them into opportunities or design challenges. This can be possible only through a change of perspectives, nothing too extreme, just avoid thinking on standard terms. I would like to bring a very small example of this: the vertical mouse (Figure 10A). Today, computer-related jobs are becoming more and more popular, “Italian It companies expect hiring growth of +14% for the last quarter of the year.” [35], some people spend the entire day in front of a screen, typing, scrolling pages. The problems related to such behavior are multiple, from eye fatigue or backache to mental stress or even cardiac failures. The most obvious solutions came right away, like ergonomic chairs, posture studies, special computer-glasses, specific screen settings, exercises to get the body back on track. This is very superficial – they help of course – but still, I personally see them like methods to keep us doing our job. Not products that only serve the user, but products that serve the company too. Can you imagine a chair that “forces” us to get up, or a computer that stops working for a while after some time of usage. Without going too further into the theme, let us take a step back and talk about the product that mostly struck me. The vertical mouse is the real change of perspective, though it has a minimal impact on the problem, but still its effects are positive on a larger scale of actions. The vertical mouse distorted the perception of the standard object by changing its shape, this way we can hold it in a more natural way without stressing the carpal tunnel (Figure 10B), avoiding pain and disturbs on our forearm, another setback of too much computer usage.



Figure 10A: A vertical mouse



Figure 10B: Benefits of a vertical mouse

## Chapter 6.1 – Kaizen

From the Japanese “to change for better” the Kaizen methodology is another valuable instrument to use. Coined in 1988 by Masaki Imai to describe the success of the Japan industries in those years and mostly used by Toyota company as society belief [36]. This work philosophy is (in brief) divided into ten main points:

1. Let go of assumptions.
2. Be proactive about solving problems.
3. Don't accept the status quo.
4. Let go of perfectionism and take an attitude of iterative, adaptive change.
5. Look for solutions as you find mistakes.
6. Create an environment in which everyone feels empowered to contribute.
7. Don't accept the obvious issue; instead, ask “why” five times to get to the root cause.
8. Cull information and opinions from multiple people.
9. Use creativity to find low-cost, small improvements.
10. Never stop improving.

Since in Section 2 we discussed about the importance of not bending good design processes to solely economic purposes, now we will do the opposite, by extrapolating these ideals from their industrial environment to place them into a context of community of persons. The last point in particular better marks what I would like to be one of the points of my research and results; there is no such thing as a definitive solution, or a product that will benefit everyone, there is no design for all, there are only good and bad ways of doing it, and both can be always improved.

改善

# 改良

## Chapter 6.2 – Kairyo

In Japanese culture, as previously indicated, Kaizen, as continuous quality enhancement, occurs through a structured and prioritized set of specific improvement projects, that simultaneously optimize different aspects of product, service, and process. Kaizen culture is essentially a managerial, and therefore project-based culture and behavior that focuses on efficiency. In Japanese culture there is another term for improvement: Kairyo. And it “occurs through innovation” and focuses on the “deep transformation” of a specific performance and/or artifact through creative techniques. Inside the diffuse improvement that connotes “project work”, Kairyo represents the interpretation of innovation. Marked on one hand by elements of discontinuity and change of perspective (within reference contexts) and on the other, by triggering solutions that are often unexpected and surprising. Kairyo could be defined as “a leap innovation” and finds in Italian design perhaps its most relevant interpretation. If we think about the innovation of the coffee machine – represented by the Moka Bialetti – we have the most evident testimony of this cultural approach to design. My project aimed to merge both Kaizen and Kairyo, combined with the specificity of being an Italian and cosmopolitan designer.

## Chapter 7 – The research

Symbolic or not, the idea was born into a precise environment, so I decided to deepen it for two reasons; develop a valuable answer, find details, and change perspectives. This last point occurred quite deeply, in the beginning my research tried to focalize on a vaster range of deaf persons, mostly the ones also belonging to the autistic spectrum. I have contacted a support teacher specialized in dealing with deaf-autistic children, and with her I developed her own personal table for augmented communication (Figure 11) [37].

I discovered a lot about that world, new ways of interacting, also got close to sign language, but I felt I was not yet ready for a challenge that big, I wanted to start from the basis before getting into such a delicate and complex matter. So, I decided to resize me and my ambitions, got a bit undecided, took a lot of time until I got the right inspiration, and that little idea born from a simple action. I started talking about it with my new deaf friends at first, then I moved on the next stage creating a form with a set of questions regarding the product and, more importantly, the feelings of the first directly interested users towards the theme. Many things emerged. I managed to reach around forty people, sadly not as much as I expected, but aside from the twelve I got to know during my stage, it was very difficult to find more. Not to mention the sadly poor communication system of the competent institutions, but I am not here to move a critic.



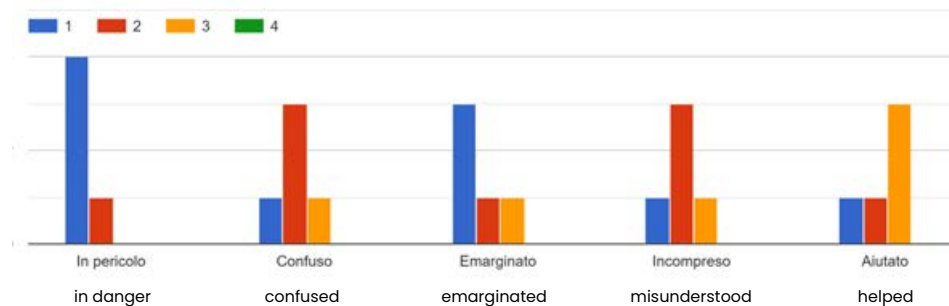
Image 11: Augmented communication table

## Chapter 7.1 – Questionnaire results

### Chapter 7.1.1 – Personal data

Of the forty individuals who responded, the 40% is aged between 40 and 50 years old (the other 60% equally divided between 20–30yo, 30–40yo and 50–60yo) and the 60% of the total are women. All of the participants are completely deaf (no light cases of hearing impairing), 20% became so during the first years of life due to illnesses, while the other 80 was deaf since birth. All of them can sign, but the 60% of the total can speak.

I asked them if they felt: in danger (80% no 20% a little), confused (80% a little, 20% enough), emarginated (60% no, 40% enough), misunderstood (20% no, 60% a little, 20% enough), helped (40% no, 60% enough). There was also the option to put “a lot” but has never been used (see stats on Graphic 1 below).



Graphic 1

To the question “tell me an aspect of deafness you would like to change” some of them answered:

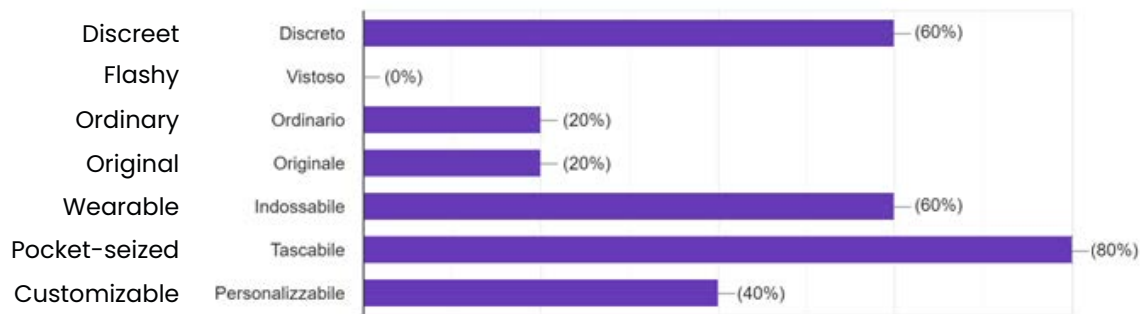
- “Since it is not visible, every time I have to declare it.”
- “I would trade misunderstanding for normal interpersonal relationship, which helps in no small part in the various aspects of daily life...”
- “In some situations, you are still not fully independent because there is still little accessibility.”
- “Understanding others without lip-reading.”
- To the request of pointing out some aspects misperceived by others, some of them answered:
  - “When I ask them to repeat something because I didn’t hear correctly, they get very impatient.”
  - “I am not evaluated for my qualities at work, and one is shallow in evaluating and/or have little patience in pursuing a goal.”
- General complaints about incomprehension, inclusion, communication, and repetitions.

The 70% thinks that it would be useful for others to immediately know they are hearing impaired even though the 40% thinks that this could create them problems, mostly for reasons linked to ignorance of the interlocutor, bullying and, again, misunderstandings. To remark the fact that the other 60% would not care about the other's point of view as problematic since deafness is "part of themselves" and so there is no shame in it, or nothing to worry about. **100% of them, met at least once someone who associated their deafness with lower intelligence.** Some of the final free comments said:

- "Point out deafness is helpful because one feels more integrated if one is aware of the deafness and finds ways to interact, to have accessible communication and to avoid embarrassment on their part."
- "I would rather not say I'm deaf because of their racism and a lot of stupidity because of their complete ignorance. If I'm in extreme dangerous situation I have to necessarily make it clear to someone close to get comprehensive info on what to do."
- "Deafness is not an abnormal aspect but is simply due to the failure to develop hearing with repercussions that in various ways may or may not be severe. It depends on the degree of deafness, the earliness of the prosthesis, and who chose to have the cochlear implant. The ones who have never encounter deaf people, in most cases, if they are not interested, ignore them without involving them in discussions. And it always comes back to the lack of patience in meeting the needs of deaf people. It is more useful for them to catch up, as if they were their relatives or children, with a serious project of professional trainings dedicated and relevant to the qualification obtained. The criticism goes especially to people from the working world who should be doing more... but unfortunately they are not."

## Chapter 7.1.2 – Product data

After a social analysis the questionnaire focused on a more product related part. The results showed that the 80% of the participants know many sound detection devices, but just the 50% of them actually uses one (themselves again divided into 80% for necessity purposes only and 20% for personal safety) both for difficulties in finding “the right product” or because too specific for an everyday use. The most known products of this category are: IntendiMe [38] (a sound detection device we will deepen further on), and cry detector for deaf parents. While the product used by almost everyone (but does not belong to sound detection devices) is a vibrating alarm clock to place under the pillow. Many other necessities get solved through phone’s applications (e.g., word to text converter). Only the 10% of users who know sound detection devices declared to also use specific products for personal security in public. **The 90% of all participants think that a sound detecting device could be a valid ally in a social context**, and when asked which characteristics it should have, they answered the following (see Graphic 2 below):



Graphic 2

From all these data, it clearly emerged that hearing impaired suffer first of all the ignorance around their condition, and sometimes the difficulties of communication. It is not a matter of marginalization, but incomprehension. The “invisibility” of their condition (chapter 2.1) made invisible also some of their needs, desires, and expectations. To try to solve this situation it would be useful to give them a distinctive sign of who they are, not as a mark, but as a relational tool, a symbol related to a certain awareness of their being. It is kind to make room when a wheelchair passes by or be more careful when a “white stick” crosses the road. But not everyone understands what to do in front of a deaf person. I bet that the first thing that comes to mind is to speak louder.



## Chapter 8 – Ideation

Now that we understood part of the context, we can move on to the next phase: the creation of a physical solution. **The ideal outcome is to simplify interpersonal relationships by making interactions more natural and direct** assuming to be in a context of lack of knowledge from others about deafness (since for the formation of a different mentality towards the disability another path – but not too different though – must be followed). A benchmarking analysis was then conducted to find ideas with a similar purpose and look out for tools and technologies that could help hearing impaired do the first step in this process. The research resulted in four products quite fundamental to reach a first result.

### **SignAloud** (Figure 12)

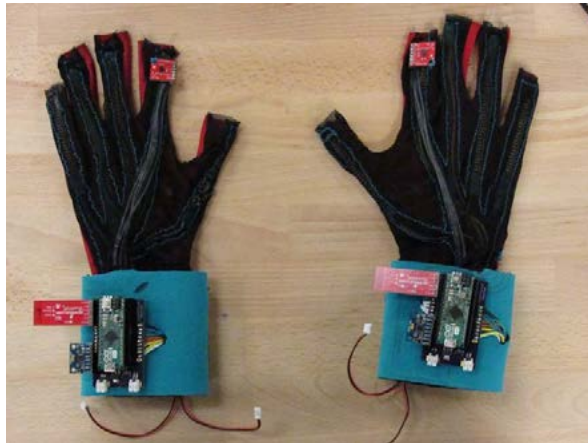
Navid Azodi and Thomas Pryor, two University of Washington undergraduates, made a glove that is capable of converting gesture into speech. They calibrated a pair of gloves so that they could recognize hands movement from ASL (American Sign Language) and translate them into words through a computer [39].

### **IntendiMe and Vibering** (Figure 13 and 14)

The first one, created by Giorgia Ambu, Antonio Pinese and Alessandra Farris, all from Cagliari University is a sound detector device composed of magnetic numbered sensors and a digital wristwatch [38]. The sensors must be located next to a potential sound source (like an intercom or oven timer) and, once they catch a high-volume sound, they make the wristwatch (or the owner's phone or tablet) vibrates, showing the corresponding number of the plate. The second product was created by Jeong Kwang-Seok, Kim Min-Hee and Kim Hyun-Joong, it is very similar to the first one, but it is still a concept. It extends the idea of IntendiMe but concentrated into a smartwatch connected to a ring. The ring captures and recognizes certain sounds, also which direction they come from, and sends everything to the smartwatch, that converts them into vibrations to alert and pictures of the recognized sound e.g., a car horn will be displayed with a car icon [40].

### **Smart Glasses** (Figure 15)

The name already explains it. Made by multiple societies like Google (retired in 2015), Apple, Xiaomi, RayBan and others, smart glasses are still a product under development, but still very promising as an indispensable gadget of the next future (like what smartwatches). A smart glass is an almost normal pair of glasses which can show a small digital/AR screen on its lenses, like having a computer in your eyes [41].



*Figure 12: SignAloud*



*Figure 13 – IntendiMe*



*Figure 14 – Vibering*



*Figure 15 – Smart Glasses*

## Chapter 8.1 – Evaluation

These products all have extremely similar or identical characteristics in common: they are all **smart wearables**; they work with recognition and have a secondary interface to translate the inputs received. Except for the goggles, they all serve a very specific purpose, and, except for IntendiMe, they are still in a developing phase and have not been fully launched on the market yet. Also, they all have quite high production costs due to the complex technology used, that – in addition – is still not precise enough for the function it will serve. The gloves are extremely useful especially for deeper hearing impaired who are unable to speak, but they still need to be attached to a computer and its technology is still a bit too intrusive and bulky. While for IntendiMe the product is way more complete (but limited by its specific field of use) for Vibering there are more problematics linked to it, since it is also still a prototype; first the interface makes it too slow to give a quick reaction when needed, the fact that the user must check the watch to know what the sound is and look at the ring to know where it is coming from can waste precious time, for example when crossing a street. But a good point it provides is the attention to details and the willing to become also a “fashion accessory” and not just a tool. Anyway (for both devices) recognizing a specific sound amongst many others is still a big challenge even though thanks to modern AI Sound and Image Recognition [42] [43] great strides are being made. Societies like Apple, Tesla, or Google use these means in some of their products, it could be a more concrete reality in the immediate future. Same as it concerns smart glasses. This product could bypass the need of a “detached” interface (like a swatch) since they would provide an immediate response in front of our eyes. I am confident this object will be part of our new digitized normality, both because of the advent of the **Metaverse** [44]. where Augmented Reality and digital world will merge with ours, and because big companies like the ones cited before alongside with digital giants as Meta (Facebook, WhatsApp and Instagram) or Microsoft, are making large investments in the advent of the Metaverse and thus, the development of these technologies – as also shown in research conducted by Nokia [45].



Figure 16A – Tesla computer

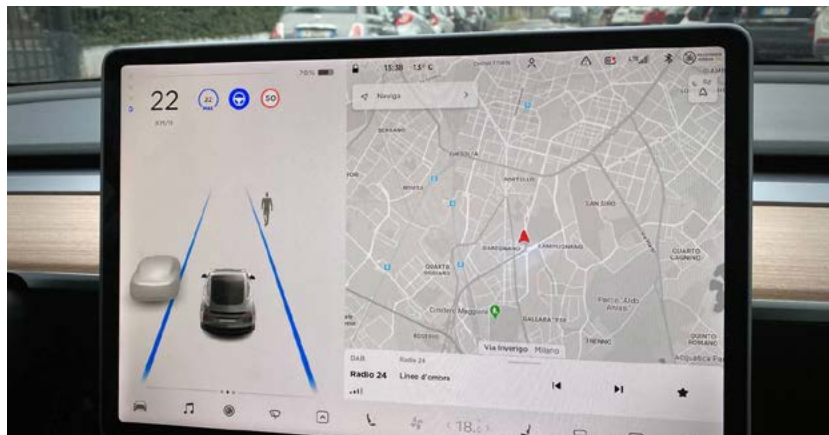


Figure 16B – Tesla UI

In the first picture on the left we can see how the computer interface of a tesla looks like; a series of codes and data. When translated to the user interface (Figure 16B) it gives a clearer impression of all the processes, recognition of other vehicles (also by their dimensions), speed limits and signals awareness and most importantly, attention to pedestrians. Imagine this type of technology combined with sound recognition devices like a smartphone's Vocal Assistant but applied to everyday life situations, not only on the road.

## SECTION 4

### *The Project.*

We are now entering the last part of this journey. As final act, along with the definition of the product-service, we need to adapt it even more to its user, always remember that all this technology must be at human's service, and not vice versa. It must not be just an object, but become a **personal object**, something that bonds with its owner as a **relational object**. It is not just a matter of customization, it must be part of the product itself, like for Vibering before (chapter 8.1), make it evolve into something more than a mere tool, let it be both useful and beautiful. To achieve this, we must put inside it a "human factor" that can be obtained outside of the boundaries of technology and embrace the desire to create art. While discussing with my professor, he brought me an example of a leather bag manufacturer (that I will not be able to cite since we could not find the name, I beg their pardon) who in a very clever advertising said, "we can only sell you bags that are new, it is up to you to make it your own, we are sorry". This amused me but also inspired me to follow a logic of product's personality along with the usual one of functionality.

DISCLAIMER: from now on, when referring to the "user" (if not differently specified) we are referring to an hearing impaired individual with no other serious conditions such as deep visive impairments (since part of the solution is based on that too) or other severe disabilities that would require constant assistance. I am truly sorry to have to specify this, but to build a solid house you need solid foundations, so starting from the "most basic" needs I hope will lead the way to go even further.



## Chapter 9 – Extending senses

The product should be a dialogue between all the ones analyzed in Chapter 8. As stated, it is really complicated to obtain a prototype, so we will mostly move from a theoretical point of view, even though from the research it is more than clear that a product like this is feasible, useful, and possible (not just desirable). The project can be divided into two main outcomes: one more immediate and another more effective in the long run. This last one would be the simplification of the other. When smart goggles will become advanced enough to become a precise and diffused reality, they could easily synthesize the concept we will address shortly into just an interface, a function tailored to directly show what a deaf person cannot hear. But since we can limit this aspect to UX, let us get into a more physical solution, as a sort of precursor, another symbol, that will hopefully dictate the base for this to happen, and maybe become even better than just a virtual screen. Also, I would prefer avoiding an interface that forces to look away, since sight is the most important instrument for a deaf person to receive the primary signals of the environment surrounding it.

Let us then forget for a moment about the interface and concentrate on the practical result. A study conducted by University of Geneva's (UNIGE) neuroscientists [46] revealed that the most sensitive parts to vibrations in our body are mostly three: the jaw and the skull bones, the soft tissues of the belly, and especially the fingers. So, the idea of operating around the hand (wristwatch, glove, and ring) can be considered optimal. To maximize the stimuli instead of giving out just a vibration, I decided to operate on all the fingers, following the Tactile Sign Language (TSL) principles [47]. As you can see on Figure 17 to each phalanx is assigned a letter. If in the same way we assign a set of vibrations to each finger, we can create a new methodology of communication between the user and the product instead of the digital interface. I came up with an extremely simple pattern (assuming it would be worn on the left hand since I would like to make it discreet and avoid entangling the wearer):



Figure 17 – TSL scheme

1. Soft left: pinky vibration / Hard left: pinky and ring finger vibration
2. Soft front: middle finger vibration / Hard front: index, ring, and middle finger vibration
3. Soft right: thumb vibration / Hard right: index finger and thumb vibration
4. Soft back: pinky and thumb vibration / Hard back: all fingers vibration

I decided to use the following fingers for the communication code because – as shown by anthropometry studies [48] – in a relaxed standing position, the orientation of the left hand's fingers corresponds to the directions chosen (pinky facing our left and thumb our right) hoping to make this mechanism easier to grasp. Same goes for the right hand but in this case, left and right vibrations should be inverted. I also decided to give two different intensities of vibration; soft and hard, basing it on the crescent intensity of a sound, to let the user better deduce the proximity of it. So, we can see that the user needs to understand this object, it is not 100% intuitive, it has a code. I wanted to create this relationship between person and product both to create a stronger bond, to avoid (for now) an interface, and because I got inspired by Neil Harbisson (Figure 18), colorblind artist who in 2003 created a device that lets him **hear colors**.



Harbisson's creation is composed by an electronic eye that synthesize a different sound for each color it registers and, through bone conduction, transfers these sounds directly to Neil's hears. To a TED talk where he presented his device he said "I have been hearing colors for 8 years all the time so I find it completely normal now, at start I had to memorize the notes associated to the names you give to colors, but **after some time all this information became a perception and after some time, this perception became a feeling**, and is when I started to dream in colors that I realized that my brain and the device became one, and I became a **cyborg**. Perceptions has changed, in an art gallery I listen to a Picasso. I stopped dressing to look good, but to sound good. I started to eat songs, my favorite sounds first, and my concept of beauty changed as well. I decided to expand my color vision since there are **some colors the human eye can't see, but the machine does**. Hearing UV tells me immediately if there are motion sensors in a room, or if it is time to sunbathe, since UV are dangerous and when there is too much is better to avoid them." [49] Neil also created the Cyborg Foundation, where he encourages people to use wearable technology to expand their senses by becoming cyborgs.



*Figure 18 – Neil Harbisson and his cyborg eye*

So why not doing the same with vibrations? With the right sensors of sound detection, we could obtain similar results. Like colors, also sounds and vibrations have different frequencies, so after following the example of Neil, we could stop trying to focalize on isolating sounds, but take all of them and categorize them into different vibrating outputs. The user will then slowly learn to associate to a certain sound the respective feedback. Almost the opposite of what Harbisson did but with the same results. To achieve this, I thought about exploiting the advantages of **sound detection** and **Haptic technology**. The first one is becoming extremely common nowadays thanks to the voice recognition softwares present in almost every digital product like smart TVs, smartphones, vocal assistants (like Amazon Echo or Alexa), smartwatches and so on. On the other hand, haptic technology (also kinesthetic communication or 3D touch), as stated by Gabriel Robles-De-La-Torre in his article [50], is a technology that can create an experience of touch by applying forces, vibrations, or motions to the user. One of the pioneers of haptic feedback was Nintendo, with Wii controllers then, and Switch controllers now, where haptic sensors can mimic different vibrating experiences, like a purring cat, a car wheel shaking on a dirt road, or even a precise number of marbles rolling inside a box. Today there are some examples of haptic technology adapted to humans; Tomosuke Maeda and other four researchers from Toyota Central R&D Labs created a prototype for enhancing human perceptions of touch [51]. But still, this is not enough, to really take the next step towards impaired of any kind, it is not sufficient to upgrade, but to extend. Extend the capacity to perceive something in an extraordinary way.

*“Knowledge comes from our senses, so if we extend our senses, we extend our knowledge.”*

– Neil Harbisson

## Chapter 10 – Results

A sound detector (Figure 19), a haptic sensor (Figure 20), and a battery to keep everything running. Augment communicational capabilities, extend our senses, and improve life conditions. These are the three physical and ideological pillars on which my product is based on. Not just icons on a screen, but real interactions. The technologies used are no bigger than the tip of a finger, just to think that we carry all of them with us constantly, inside a pocket. Exactly, smartphones can detect sounds, give haptic feedbacks through the touchscreen and, of course, have a built-in battery. Fulvio Bambusi, Chief Technology Officer at Wiseair, and a dear friend, wrote for me in few hours a program capable of calibrating a smartphone to vibrate to sudden noise changes in every environment (e.g., if someone starts talking in a silent room, or if a glass breaks on the floor in a noisy place). Few hours to make a great part of the job on a device which is not even designed to do it. Simplify processes and parts to have more freedom in combining them.

The detector listens to the sounds and send all the audio signals to the haptic sensor which translates them into vibrations. There are many categories of these two sensors, but the ones find in our phones are even enough for a right programming and calibration for a basic functioning. All that remains is to make this extremely small assembly of microchips a good-looking assembly. A product with a personality that can live in tune with its user, to upgrade it to the point that can even surpass the standards through the help of technology. A product that can be immediately recognized by everyone for its function, and its appearance. Thanks to an already cited study of the hand's movements and ergonomics [48], it will not be a hindrance, like a thick glove or a tight bracelet. Become a refined object and not an engineering medical implant.

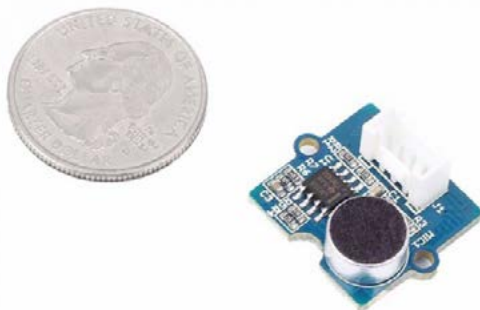


Figure 19 – Sound detector

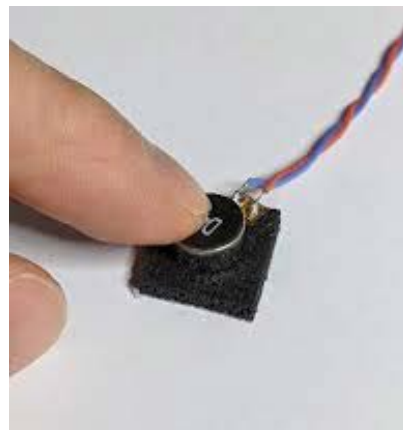
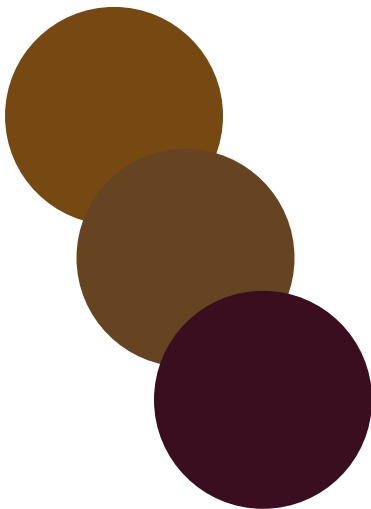


Figure 20 – Haptic sensor

## Chapter 10.1 – mARTketing

Today, **colors shapes and materials** are what characterize an object even more than its actual function, appearance means a lot. It is not a matter of selling; it is a matter of “normalizing”. But still it is not just the look alone, also a coordinated image is needed as part of its complexity, as a whole product. It is important to not forget this point. What usually a product designed to help lacks, is a captivating shape and a catchy advertising campaign. It could not seem like much, but to the eyes of the public it is everything. For example, on two children wearing glasses, you can directly tell who is the one wearing corrective glasses and who is wearing “normal” ones. This immediately puts a label on that child: he has a problem. I would like to create a product so beautiful that becomes normal. In much research conducted by WGSN [52], the **first impression** is what really makes the difference. You can design the best product ever created, but without a proper campaign behind, it will not stand a chance. Themes like **gender neutrality** are a very important point to be kept into account too. It is suggested to use muted colors such as dark brown or pastel tones, very much in vogue now. Use materials “for all”, antiallergic, like latex or silicon, or even better highly recyclable materials like some metals or new plastics to also pander the new demands to lower environmental impact (chapter 3.3). As also requested in graphic 2 the three main characteristics I would like to give to my product are: being discrete, wearable, and pocket-sized. It will adhere to the hand like a second skin, also to give the possibility to wear jewelry, but it will be visible enough to make others wonder what could be, and after some time around, to let others immediately know what it does.

Dark Brown variations



Gender neutral



*familyindustries.com*

Gender fluid



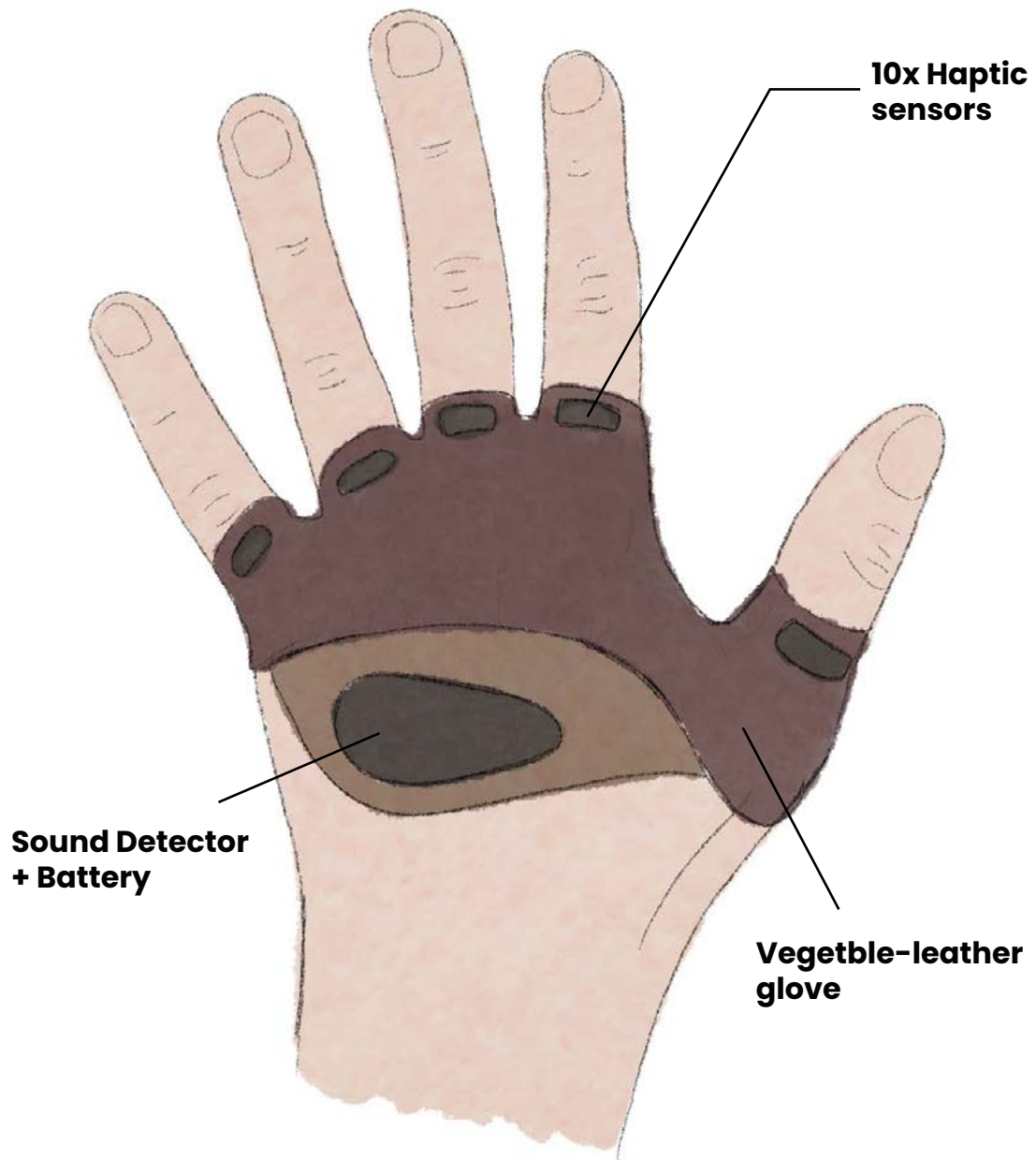
*confidentials.com*

## Chapter 11 – Acchiapparumori... and beyond

In 1913, Luigi Russolo, member of the Futurist movement, invents the Intonarumori (literal: Intone noises), a family of instruments that – on the wave of industrialization and urbanization – had the function to recreate the sounds of the city. Exactly 110 years later, I create the Acchiapparumori (Literal: Noise Catcher) which has the function to recognize them. And here we have it, a little glove that could help many hearing-impaired persons to increase their perception about that part of our society they are not too familiar with. But this product is not just for them, or at least for deaf people as we imagine. Hearing impairing manifests in many other ways; with old age for example, or also in many more subtle forms; an extremely loud place (like a concert or a heavy-machinery industry), in a car with music playing at a very high volume, or even when we are concentrated on a certain activity (like when talking to the phone with someone), we tend to isolate the others, as proven by a study on selective attention, in which “auditory objects” can be differently perceived [53]. And that’s how Acchiapparumori extends its possibilities too. When thinking about an example for this, I always like to say that a potential approach would be installing sensors on cars, directly connected to the wearable technology, and let them warn us about an approaching ambulance for example, pointing the right direction where it is coming from. A study from ACI (Automobil Club Italia) for example shows that in Italy the first cause of car accidents is distraction while driving (15,7%) followed by failure to respect the right of way (14,5%). But this figure is the same on a global scale. In the same article it is also stated that “90% of accidents occur due to causes attributable to the human factor”. Of course, ACI invites to become more aware and responsible, through sensitization campaigns (sometimes brutal), but it is also true that these types of campaigns have been going on for more than thirty years. Are we really capable of changing our nature? Security devices like brake assist and proximity sensors have truly helped reduce this sad number. What if we also impacted on the human factor and not just the car technology?

I believe that this product can become for everyone for real since it could convert all outside inputs (with the right settings) into vibrations, and tactile stimuli are universally perceived by everyone. The impairing or the disability are not important, if you are alive you can feel, not necessarily in your hands, it’s all a matter of adapting the product to the human who’s wearing it. Possibilities are infinite, never stop improving.

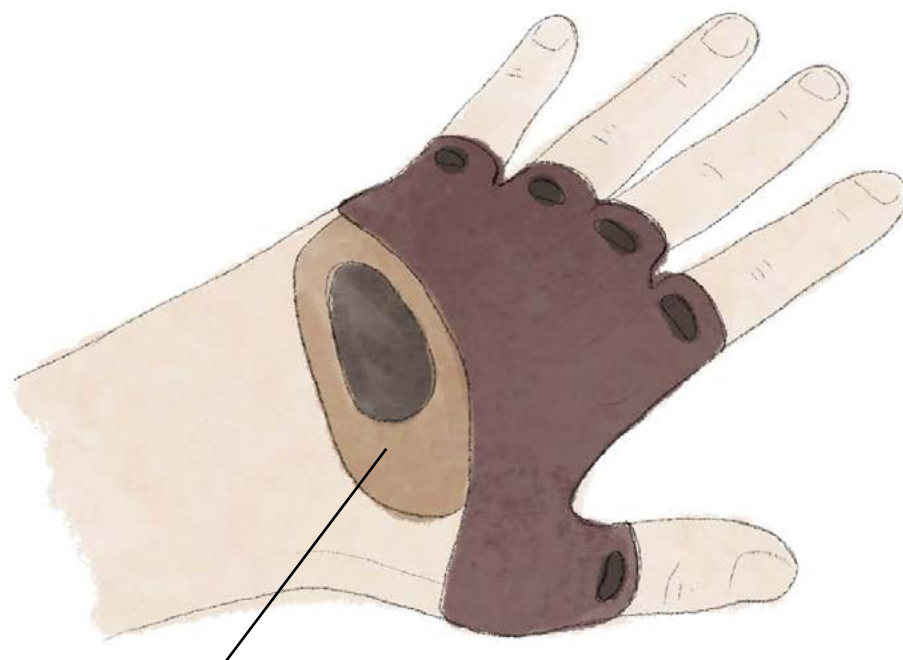
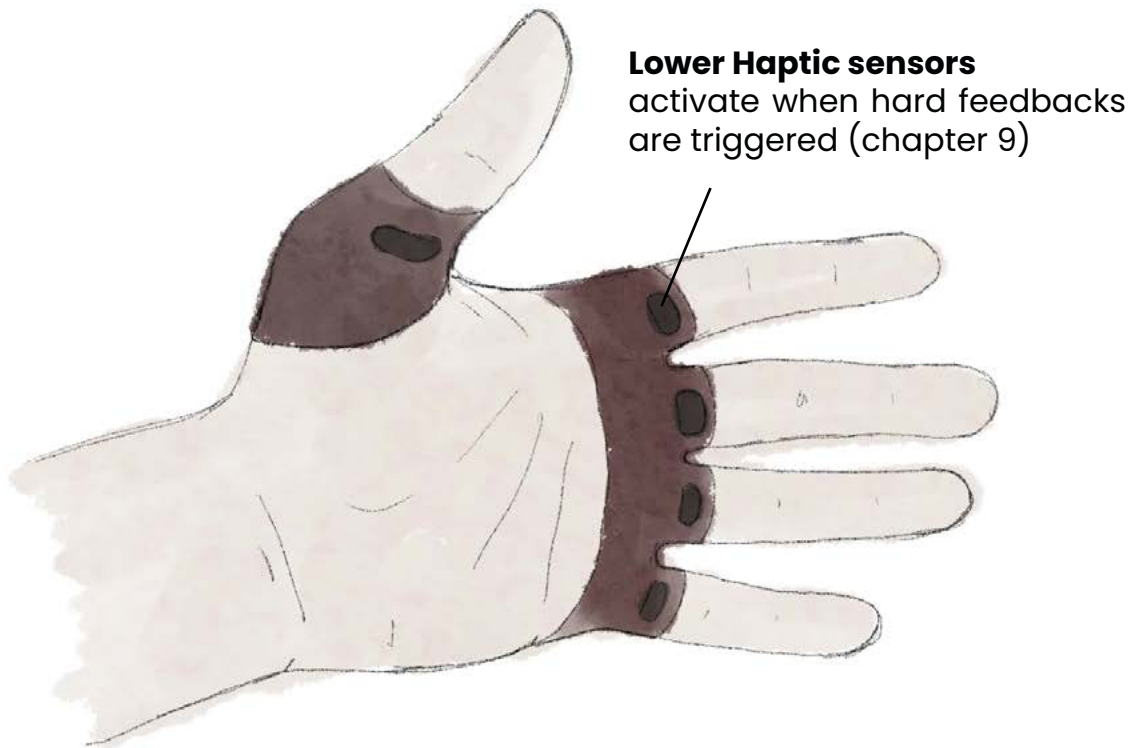
## Concepts

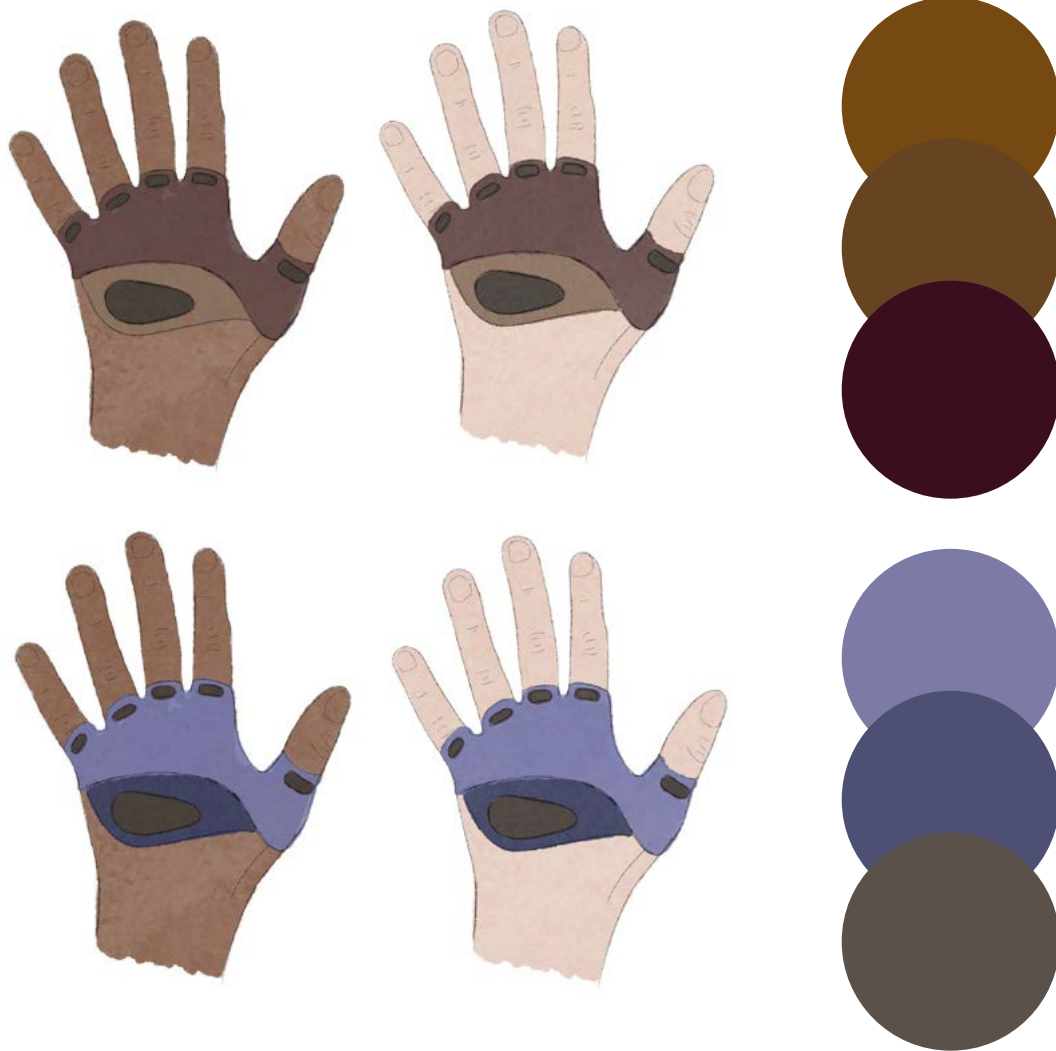


*"I think life would be way more exciting if we stop creating applications for our mobile phones and start creating applications for our own bodies."*

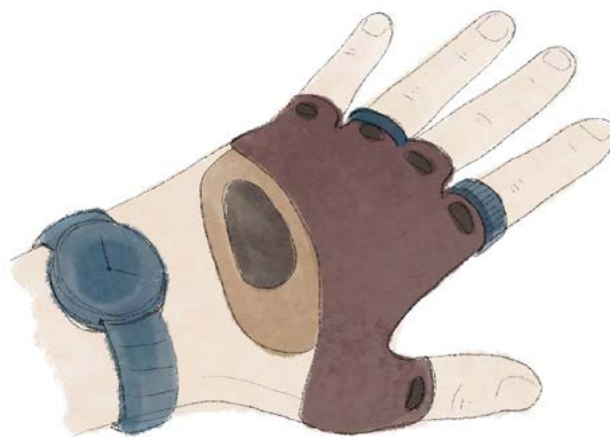
– Neil Harbisson

Hands are the most important part for hearing-impaired to communicate, they need to be free to move and clearly visible.





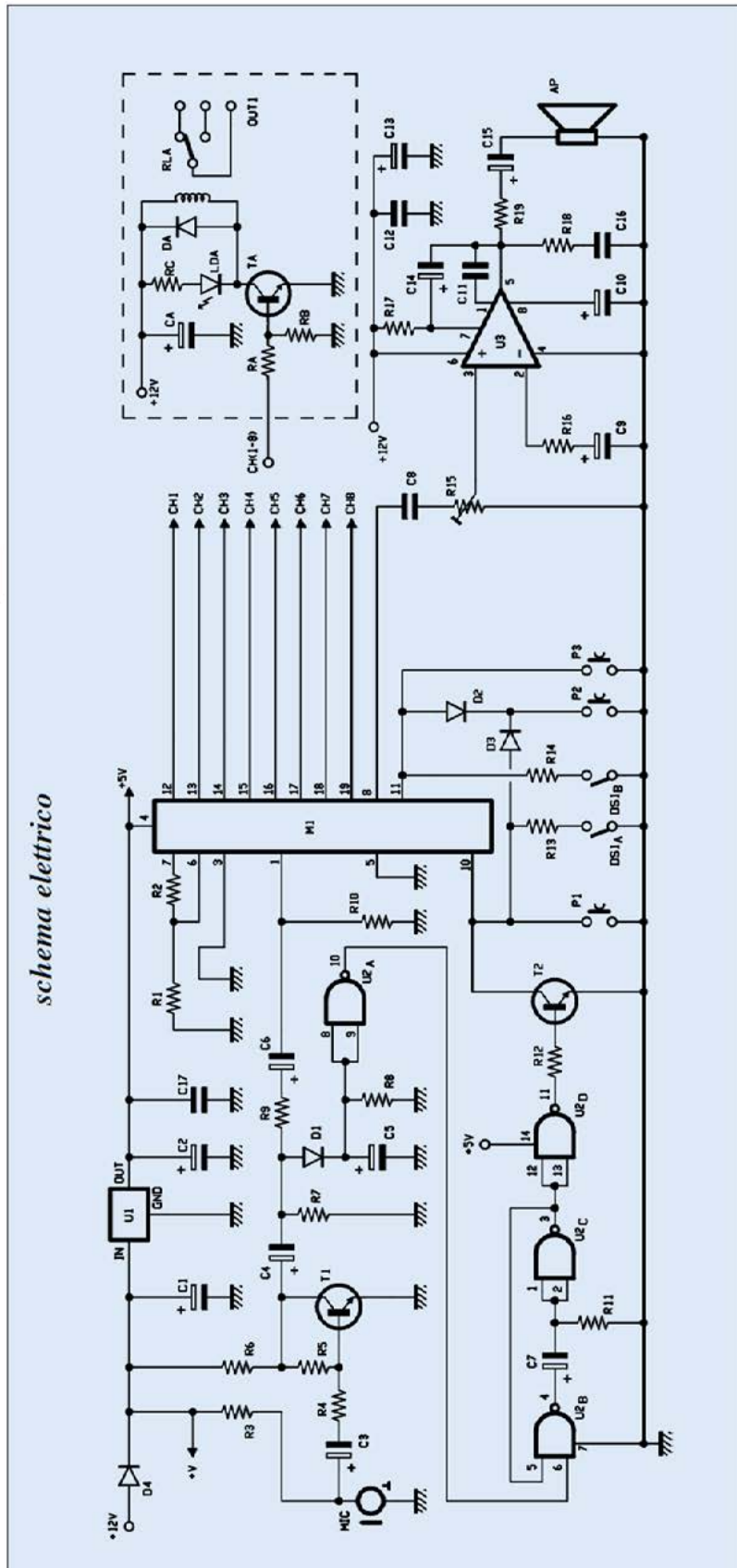
Soft natural colors to match every type of skin  
Organic shapes to fit every user



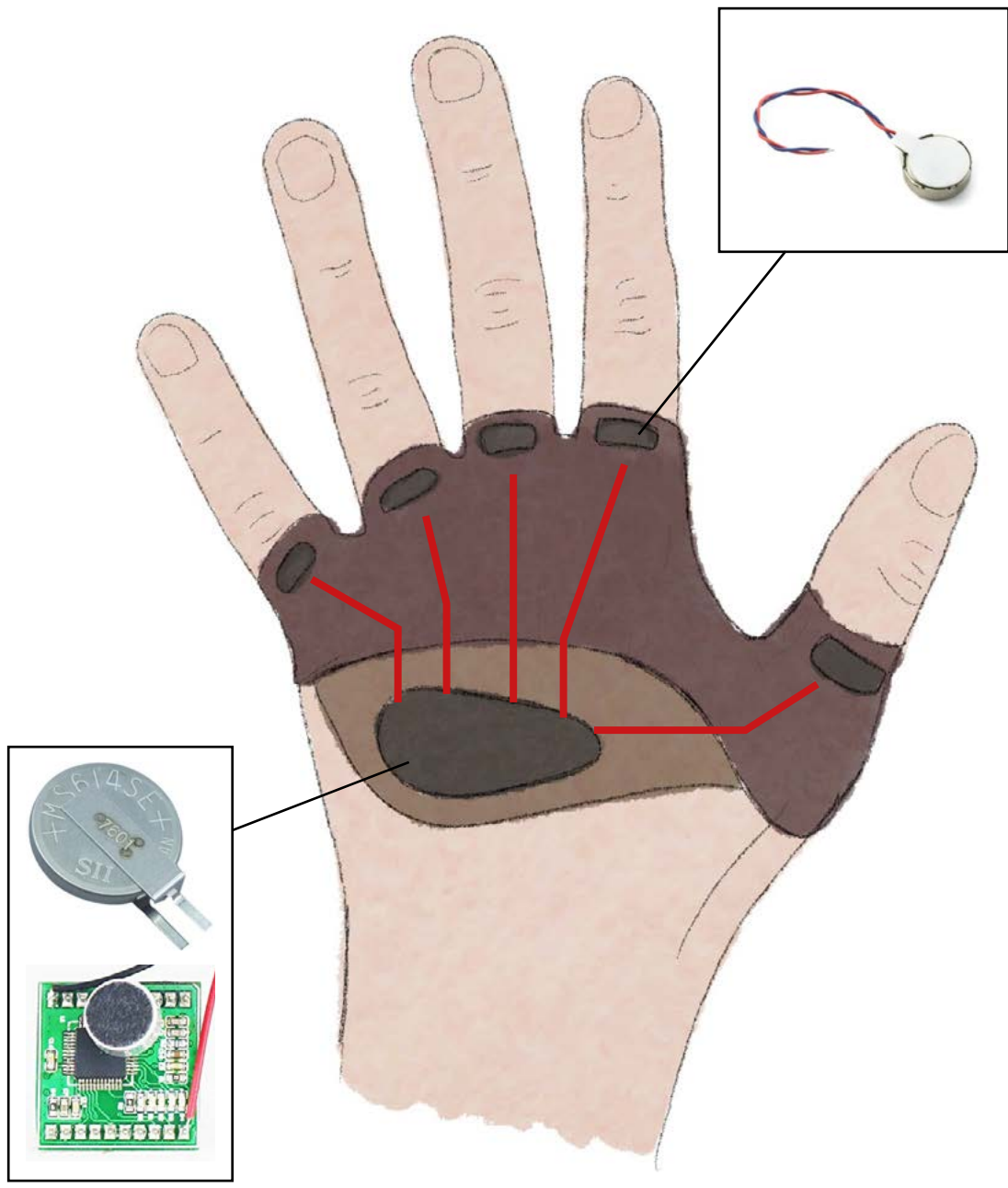
Possibility to wear jewels or accessories



Example of wiring diagram 8-channel voice recognizer [55]



Micro-technology applied directly inside the wearable product, rechargeable and easy to replace.



## RESOURCES

1. (1) [Autistic Spectrum Disorder - Lanc UK](#)
2. (2) Deborah Kaplan, The Definition of Disability: Perspective of the Disability Community, 3 J. Health Care L. & Pol'y 352 (2000).
3. (3) [PizzAut Onlus | Nutriamo l'inclusione](#)
4. (4) Inclusive Design: Designing and Developing Accessible Environments. Rob Imrie, Peter Hall – Taylor & Francis, 2 set 2003.
5. (5) What Is Body Positivity? The Path from Shame to Pride – Céline Leboeuf | Philosophical Topics Vol. 47, No. 2 (FALL 2019), pp. 113-128 (16 pages) – Published By: University of Arkansas Press
6. (6) Matteo Schianchi – Disabilità e relazioni sociali. Temi e sfide per l'azione educativa | Carocci editore, 26 maggio 2021
7. (7) [Oppa! Nella tesi di Ilaria Soranzio un'app per persone anziane e disabili - Frizzifrizzi](#)
8. (8) UN Convention – (Italy) LEGGE 3 marzo 2009, n. 18
9. (9) [Sordità, conoscerla per curarla. Tipi e gradi | Sordita.it](#)
10. (10) [Ways of Designing e ibridazione: Giulio Iacchetti. | WOW! \(Ways Of Working\) webmagazine \(wow-webmagazine.com\)](#)
  - Royackers, L., Timmer, J., Kool, L. et al. Societal and ethical issues of digitization. Ethics Inf Technol 20, 127-142 (2018). <https://doi.org/10.1007/s10676-018-9452-x>
11. (11) [The EIDD Stockholm Declaration 2004 - EIDD - DfA Europe](#)
12. (12) ['Design thinking': Does it live up to the hype? | Financial Times \(ft.com\)](#)
13. (13) Brown, Tim. 2009. Change by Design. New York, NY: HarperBusiness.
14. (14) Esther Han – 22 FEB 2022 Harvard Business School | [5 Examples of Design Thinking in Business | HBS Online](#)

15. (15) [Design Thinking Frequently Asked Questions... | IDEO | Design Thinking](#)
16. (16) [Stanford d.school](#)
17. (17) Dunne, A., & Raby, F. (2013). *Speculative everything: design, fiction, and social dreaming*. Cambridge, Massachusetts, The MIT Press.
18. (18) Debora Bottà – Jul 6, 2020 | [Speculative design: inclusivo, partecipativo e tangibile | by Debora Bottà | UXlab.it | Medium](#)
19. (19) Francesco Schianchi – Il design salverà il mondo ISBN: 8833831310, Biblion 30-11-2020
20. (20) Virginia Tassinari – January 2020 Conference: 16th Participatory Design Conference “Participation(s) Otherwise” (PDC2020) At: Universidad de Caldas | <https://hdl.handle.net/11311/1151302>
21. (21) Fabrizio Ceschin, Idil Gaziulusoy, *Evolution of design for sustainability: From product design to design for system innovations and transitions*, Design Studies, Volume 47, 2016, Pages 118-163, ISSN 0142-694X, <https://doi.org/10.1016/j.destud.2016.09.002>
22. (22) [ONU Italia La nuova Agenda 2030 per lo Sviluppo Sostenibile \(unric.org\)](#)
23. (23) [8 Outstanding Examples of Human-Centered Design Every Business Needs to See \(userguiding.com\)](#)
24. (24) Norman, Donald A. 2013. *The Design of Everyday Things*. The MIT Press. Cambridge, Mass.: MIT Press.
25. (25) Alan Cooper, *About Face 3: The Essentials of Interaction Design*. Indianapolis, Indiana: Wiley. ISBN 978-0-470-08411-3. Retrieved 18 July 2011.
26. (26) Dehghani, Milad. (2016). *An assessment towards adoption and diffusion of smart wearable technologies by consumers: the cases of smart watch and fitness wristband products*. 10.13140/RG.2.2.31366.37449.

- 27.(27) Tianyu Zhang, Peiwu Dong, Yongchao Zeng, Yanbing Ju, Analyzing the diffusion of competitive smart wearable devices: An agent-based multi-dimensional relative agreement model, Journal of Business Research, Volume 139, 2022, Pages 90-105, ISSN 0148-2963, <https://doi.org/10.1016/j.jbusres.2021.09.027>.
- 28.(28) Grattagliano Serena, PoliMi, 2018: <http://hdl.handle.net/10589/143623>
- 29.(29) [awareness – Mine Kafon](#)
- [Massoud Hassani, il designer che combatte le mine antiuomo con l'arte | Wired Italia](#)
  - <https://www.falga.com/it/news-aziendali/mine-kafon/>
- 30.(30) [The Safety Truck Could Revolutionize Road Safety – Samsung Global Newsroom](#)
31. (31) [Advanced Technologies | NHTSA](#)
- [Automated Vehicle Safety | NHTSA](#)
32. (32) Jan. 27, 1984, Section A, Page 1 of the National edition with the headline: [NESTLE BOYCOTT BEING SUSPENDED. NESTLE BOYCOTT BEING SUSPENDED - The New York Times \(nytimes.com\)](#)
- Il pasticcio della multinazionale DI ARMANDO ZENI, 23 Novembre 2005 – [Il pasticcio della multinazionale - La Stampa](#)
- 33.(33) [RUSSIAN INTERFERENCE IN 2016 U.S. ELECTIONS – FBI](#)
- 34.(34) Andrea Federica de Cesco, [Coronavirus, l'azienda bresciana che ha trasformato una maschera da snorkeling in un respiratore - Corriere.it](#)
- 35.(35) Maurizio Carucci martedì 8 novembre 2022, [Professioni digitali in crescita \(avvenire.it\)](#)
- 36.(36) Imai, Masaaki, 1930-. Kaizen (Ky'Zen), the Key to Japan's Competitive Success.
- 37.(37) Aurelia Rivarola, Comunicazione Aumentativa e Alternativa, Milano, Centro Benedetta D'Intino Onlus, 2009.
- 38.(38) [Homepage IntendiMe - IntendiMe](#)

- 39.(39) [College Students Invent Gloves that Speak Sign Language Out Loud - Good News Network](#)
- 40.(40) Aditi Simlai Tiwari, [Vibering Sensor: For The Deaf \(inventorspot.com\)](#)
41. (41) IEEE Spectrum, "Vision 2.0" IEEE Spectrum, Volume 50, Issue 3, Digital Object Identifier: 10.1109/MSPEC.2013.6471058, pp42-47
- Wearable Computing: A First Step Toward Personal Imaging, IEEE Computer, Vol. 30, Iss. 2 Feb. 1997, pp. 25-32
- 42.(42) Iryna Sydorenko, Editor-at-Large, on November 26, 2021: [AI Sound Recognition: Do the Machines Dream of Electric Music? \(labelyourdata.com\)](#)
- 43.(43) Kinza Yasar, [What is Image Recognition? | Definition from TechTarget](#)
- 44.(44) A. B. C. News, EXPLAINER: What is the metaverse and how will it work? on ABC News.
- Doug Antin, The Technology of the Metaverse, It's Not Just VR, su The Startup, 5 maggio 2020 – [The Technology of the Metaverse, It's Not Just VR | by Doug Antin | The Startup | Medium](#)
- 45.(45) [Six use cases for the metaverse in business | Nokia](#)
- 46.(46) Daniel Huber - How our body «listens» to vibrations - Department of Basic Neurosciences UNIGE Faculty of Medicine published in Nature DOI: 10.1038/s41586-019-1015-8. [How our body «listens» to vibrations - Press Release - UNIGE](#)
- 47.(47) Handbook of Pragmatics / Verschueren, Jef.; Östman, Jan-Ola - Amsterdam: John Benjamins Publishing Company, 2018 - 297 p. - Handbook of Pragmatics - ISBN: 9789027263070 - Permalink: <http://digital.casalini.it/9789027263070> - Casalini id: 5002497
- 48.(48) The effect of hand preference on hand anthropometric measurements in healthy individuals Gülnihal Kulaksiz 1, Rabet Gözil PMID: 12056757 DOI: 10.1016/S0940-9602(02)80119-4
- 49.(49) [Neil Harbisson: I listen to color | TED Talk](#)

- 50.(50) Gabriel Robles-De-La-Torre. "International Society for Haptics: Haptic technology, an animated explanation". Isfh.org. Archived from the original on 2010-03-07. Retrieved 2010-02-26.
51. (51) Wearable haptic augmentation system using skin vibration sensor. Tomosuke Maeda, R. Peiris, K. Minamizawa – Published 23 March 2016 Computer Science Proceedings of the 2016 Virtual Reality International Conference | DOI:10.1145/2927929.2927946 Corpus ID: 16853399
- 52.(52) [WGSN | Trend Forecasting & Analytics 2023-2031](#)
- 53.(53) Shinn-Cunningham BG, Best V. Selective attention in normal and impaired hearing. Trends Amplif. 2008 Dec;12(4):283-99. doi: 10.1177/1084713808325306. Epub 2008 Oct 30. PMID: 18974202; PMCID: PMC2700845.
- Adrian K.C. Lee, Eric Larson, Ross K. Maddox, Barbara G. Shinn-Cunningham, Using neuroimaging to understand the cortical mechanisms of auditory selective attention, Hearing Research, Volume 307, 2014, Pages 111-120, ISSN 0378-5955, <https://doi.org/10.1016/j.heares.2013.06.010>
- 54.(54) <https://trieste.aci.it/La-distrazione-alla-guida-al-top-delle-cause-degli-incidenti>
- 55.[Riconoscimento Vocale.qxd \(furanet.it\)](#)





## **Thanks**

Thanks to everyone who helped me get through it. Even though I do not consider this project as finished.

Thanks to professor Schianchi for the great advice and inspirations, and to have endured my slow climb, always taking an interest in how everything was going, truly believing in the project (increasingly rare gift among professors nowadays), also for this I would like to go on with it.

Thanks to Fulvio for loving so much my idea and creating the first little real part of it. And thanks to all the friends who shared a thought and a laugh.

Thanks to the hearing-impaired guys from T12Lab and all the ones who contributed to give credibility to the research and gave me new points of view on life.

Thanks to my parents for letting me become the man I am now, through all the love they had for me. And to my family for all the interest and affection in what I was doing.

Thanks to Isabella for supporting and helping me nurture and express all the colors and joy I have in my heart.

Thanks to the beautiful diversities, experiences, and unexpected surprises (the good ones and the bad ones) life gave me as inspiration.

Dedicato a nonna Rosina, nonno Partigiano e zia Rosa che sarebbero stati fieri di me.  
Dedicato a Franco e a zio Lino, che avrei tanto voluto abbracciare.  
Dedicato a Claudio. Ora che ne ho presa un'altra, la prima posso darla a Gianluca nel caso.