Perceptions of reality

by Tom Vincent

« The knowledge comes to the human being through the door of the senses »

Heraclitus

Debut

Throughout history, philosophy has been the main lens through which we studied our sensorial apparatus. Senses have always been the way in which we perceive our reality. This understanding has been essential for us to be able to navigate in our surroundings. Starting with the different senses we have, everything we knew about them is changing. Aristotelian views tell us there are only five external senses; Smell, Taste, Hearing, Touch, and Vision. This has, by many counts, been extended to include internal senses, such as balance, proprioception, and kinesthesis. Science and technology are redefining our senses and how we access this reality.

With the desire to discover new perspectives within creativity, the goal of this text is to understand the work of scientists who research the possibilities and limits of our perception. In order to reveal more creative potentials, this thesis will also help to bridge gaps between the scientists and the artists, architects and designers, and everyone else who is trying to make unexpected experiences accessible to the general public. By finding connections between these persons, I want to highlight the influence of scientific discoveries and the understanding of reality has on creative minds.

Starting by understanding our senses, I will then explore their limits and discover the relativity of what we consider as real. By getting an idea of their functions, roles and restrictions, I will then go deeper into our brain, our memories and expectations, with the aim of questioning our awareness. Along this scientific

journey about perception, speculations on the possibilities that can open up to us and the changes they bring to our everyday lives will be made, in attempting to better acknowledge these discoveries. This text can be a tool for creating new experiences, questioning the rules, and transforming the way we perceive our reality.

Make sense

We are using our senses every day, they are playing an essential role in our perception of reality, and yet most of us are not well aware of how they work. Let's unwrap how senses function so we can understand the different theories about them.

Our senses are sending information to the higher association cortices[1], this is where the brain will decode them. Before being translated, these pieces of information are the materials that will define what we conceive as real. Once received by the brain, the data is gathered, then ordered and finally translated so we can understand it. This system is happening constantly without us being always aware of it. Even if this process includes a lot of steps between the outside world and what we feel like is reality, it is going so fast that we can't grasp it. Our five senses are often triggered simultaneously, we see, hear, taste, smell and touch continuously during our day, so sometimes we cannot feel our tongue or the taste it has when there is no food on it, but it does have a taste by itself, everything has a taste, a shape, a texture or a sound, even the air. By constantly sensing, we start to conceive this perception as the norm and stop paying attention at it. It is by directing our attention toward a specific aspect of our sense that we can fight against our habits and reveal those light sensations. The huge amount of materials being converted by our brain help us to make decisions on what we like, what we do and

1. The association cortices include most of the cerebral surface of the human brain and are largely responsible for the complex processing that goes on between the arrival of input in the primary sensory. Larry Squire Darwin Berg Floyd E. Bloom Sascha du Lac Anirvan Ghosh Nicholas C. Spitzer, "Fundamental Neuroscience 4th edition" 2012, chapter 26.

what we think. For example, what we think of survival reflexes are a consequence of our senses sending information to our brain (feeling pain causes us to react). Connecting this sensation to other experiences and through our senses, we can tell where it comes from. Thanks to its ability to create connections, the brain tells us what to do in order to make the pain stop. However, we need that "something" to connect within order to learn/react. To be burned only once, does one understand that fire is always burning.

Our brain works as a translator of our senses, it is within ourselves, inside our brain, catering to how we conceive the outside world. Senses are here to make the bridge between our surroundings and our perception. In other words, our eyes don't really see anything, they are simply transforming the light into electrical chemical pulses and then the brain translates these pulses into visuals that we can "see". Our eyes are more or less open doors that let the information pass to the brain so we can process it and add it to our big library of knowledge. And yet senses are essential to our perception, they are the first thing that touches reality, and perception is the moment the brain takes over the relay baton for us to understand and to be able to connect it to other experiences.

There is then a fundamental difference between our senses and our perception. When our brain works to translate the information, it leaves room for mistakes, short cuts or misinterpretations. This is where illusions come to life. In the field of optical art, we can perceive movement, even though our gaze is fixed on a still painting. In the artwork, "Nora Dell" by Victor Vasarely[2], the shape he created has several perspectives connected with each other, sending contradictory information to our brain. The brain, in turn, tries to make sense of this shape,

2. Victor Vasarely, «Nora Dell», painted in 1974, 200x200cm, acrylic on canvas

connecting it to previous perceptions, but in doing so, begins to morph the shape, looking for a more coherent visual, but cannot find anything similar to connect to.

Constantly learning from the input, the brain always tries to relate to what it already knows. That is why it can override the information that actually is there and make us feel movement that is not there. While the brain is looking for connections a lot can happen and the information can change from what it actually is.

Cross-modal sensory

While the brain works to understand what's happening around us, it can be fooled by incoherent information, but it also can create new experiences or have trouble to deal with information when some of them are simultaneously overlapping with others.

Every new perception starts by directing our attention toward an experience, someone can be talking to us for an hour, and we can still not understand anything of what this person saying, if our mind is somewhere else. This gives us an example of how important attention is in order to perceive the outside world, the same goes for discovering new realities, which I have found to be everywhere!

An experience that comes to mind most vividly is the sensation I felt by mixing hot coffee and chocolate ice cream. The taste of both dishes overlapped with each other and created a new impression on those well-known sensations. Having a combination of cold and warm in my mouth within the same exact moment seemed unreal, as my preconceived assumptions told me cold and warm would just make for a tepid flavor. But the opposite happened, the two complementary sensations went through my brain at the same time and end up creating a new appreciation. There was a confusion of perception, even if it was not the first time I mixed these two dishes, I never felt this confusion before I really started paying attention to it. From this experience, I started to believe new ways of using our senses are still there to discover, even though I thought that I knew all of my

senses by using them since I'm born, a simple experience never lived before can completely change ones point of view. During this moment my brain manages to get two different sensations from one sense, and somehow it blended them together and created a new sensation.

The German Psychologist, Marc O Ernst[3], & Irish Neuroscientist, Fiona N Newell[4], have both worked on the multisensory perception, which studies the connections happening in our brain between different senses. Compared to the previous experience, this theory is asking if senses can actually have a connection with each other and if they can influence one another, a theory called "cross-modal sensory"[5]. Following the concept of this theory, it should be possible to change the perception of one sense through the use of another one simultaneously.

This is also an example of how fragile and not fixed our perception of reality is. During our daily lives, we are not often questioning what we sense, we accept it and conceive it as reality. Mainly due to the fact that we cannot miss what we have not experienced and that everything seems logical once we perceive it. One experiment already shows an alteration of our perception, that we can be aware of once it has been explained to us. However, it is still hard to know what actually is the alteration, is the senses, or the brain who create the confusion. Our senses are not always right, and cannot always be a perfect reflection of reality.

3. Marc O Ernst, professor of pshycology at Ulm university,Ulm, Baden-Württemberg, Germany, he worked on "Human multisensory perception" and "interactive coaching in virtual reality".
4. Fiona N Newell, professor of neuroscience at the Trinity College, Dublin, Ireland, she worked on "Using principles of human multisensory perception to endow virtual agents with maximum social appeal
5. Cross-modal sensory is a perception that involves interactions between two or more different sensory modalities.

This experiment is called "The McGurk effect"[6], and its main focus is to highlight the influence that sight can have on hearing. The experiment works by combining visual and audio content simultaneously. In the short video, we see Harry McGurk, the founder of this experiment, facing the camera and exaggeratedly saying "BABA" three times. This scene fades to black, only momentarily, before he returns again to the frame, repeating the same audio, "BABA", but this time changing the visual mouth movements to show more of a "V" sound, tricking us to hear "VAVA". Even though the audio doesn't change ("BABA"), when the lip movement is exaggerated to such a degree, visual changes from movement "B" to "V" or "D", our brain will change what we then hear ("VAVA" / "DADA" / etc.). So in the experiment, what we hear is influenced by what we see, even though we know that the audio is "BABA" whereas the lips are doing a "V" it is impossible to not hear "VAVA". Even after experiencing this effect a few times, it is still impossible for us not to be tricked.

This experiment serves as a link to understand synesthesia[7], because the viewer was hearing the lips and seeing the voice. For people who experience life as a synesthete, senses are overlapping always, and core concepts of reality are progressively changing. Nevertheless, we know for a fact what McGurk is saying even if we hear something else, but in order to accept this reality, we have to not listen to our senses. This is then an example that reality is not always what we sense, even if we cannot grasp it. Everything we consider as real relies on our senses, so when sometimes they get tricked by each other, our reality itself get modified. So our senses are not always trustable when they send us information, the absolute reality is then invisible to us.

6. "The Mc Gurk effect", published in 1976, is a perceptual illusory phenomenon which shows an interference between hearing and vision when perceiving speech, Harry McGurk and John MacDonald are the co-creators of this experiment.
7. Synesthesia is a perceptual phenomenon in which stimulation of one sensory or cognitive pathway leads to involuntary experiences in a second sensory or cognitive pathway.

From this experiment we can clearly observe the brain trying to find the most logical connection at all costs, even if it has to modify our senses input. Whatever the connection it's trying to create or the origin of the information, the brain will process in the quicker and most coherent way. We don't know yet if this alteration is an interconnection of our senses or a misinterpretation of our brain. Nevertheless, you are always going to have the same sensation, one thing is sure our sight can override other senses. And that's what interest me, the fact that senses can make mistakes opens up a door for possible realities that we have never experienced before.

The sight also influences how we create the meaning and how much attention we will give to a situation. The photographer Richard Mosse[8] documented the conflict going on in Congo by using an infrared photographic lens. The use of this specific lens transforms the color and turns most part of the landscape into pink. It is still showing the hard truth of war, but once confronted with these pink landscapes the message is becoming incoherent, we then start wondering what is happening, is this true or just another photoshopped image illustrating a made-up story. We have to make choices when interpreting these visual, we cannot always just accept them at face value. Understanding the senses and how they function help us to decide, as creators, what to work on, what to change in order to stimulate a reaction.

In this picture, we can observe how the perception of unexpected colors can take over the logic of the meaning behind it. In this context, the first thing that takes over my mind is the struggle of my logical brain trying to make sense of what I am looking at, especially since war picture themselves are

8. Richard Mosse, born in 1980, is an Irish conceptual documentary photographer, exhibited in solo exhibition for his work on the war in the Republic Democratic of Congo, and won the Deutsche Börse Photography Prize in 2014

hard to accept. It does not seem logical to see the war in a pink background. We need to spend more time to reflect on it in order to process all the information. In this way, the photograph manages to hold the audience facing an image related to war longer than what they would normally do. Here also is a form of manipulation using one of the most influential senses that humans have, the sight.

Another example called the "mirror box"[9] also uses the sight to change the perception of touch or the sensation of a movement. It has been invented to help people with no response coming from one of their arms to recreate a sensation of touch and mobility in their unusable limbs. The simplicity of this device compared to its effect is astonishing. Composed only from a box where the patient can place his disable arm/leg, on the side of the box a mirror is placed to reflect the other arm which is fully functional. By moving the functional arm and looking into the mirror the patient has the optical illusion to move both arms, by seeing both arms moving, the brain has the sensation of having the possibility to move both of them. After a few practicing times, the hidden arm in the box starts moving, the brain can then recreate a connection which enables the arm to respond.

Relating to these examples, fooling our perception with sight is definitely a part of our reality. It has been used for sharing information, creating scientific experiments and also curing diseases. And yet there are way more possible uses to make out of this brain characteristic.

9. The Mirror Box experiment has been invented by Vilayanur S. Ramachandran in 2000 to help alleviate phantom limb pain, in which patients feel they still have a limb after having it amputated. The wider use of mirrors in this way is known as mirror therapy or mirror visual feedback.

Virtual (can be) reality

Our brain is being fooled the same way when we use Virtual Reality glasses. Surroundings become a different universe than the one we live in and it still can feel real. When our head moves, in reality, our VR point of view changes as well. Finding this connection completely logical, the brain doesn't find the necessity of going further into questioning this perception, therefore it will think it is real. Often, when using this device, people lose all perception of the space they are in when their eyes are seeing something different. When I tried it something really perturbing happened, at one point I was falling in the game and it made me believe and feel that I was actually falling in reality, so I lost my sense of stability, all my muscles started to faint and I fell on the floor. Then I started to pay more attention about how influenceable we can be when we trick our sight, and what will be the outcomes of using such knowledge.

Looking at this observation from a designer's point of view, I started to imagine using the sight to cure claustrophobia, how to help these people to take the elevator or just being able to stay in small rooms using videos or optical illusion. By fooling the sight with augmented reality, it becomes possible to make a space feel bigger or at least give the sensation of a wide landscape in a small/narrow space. Also, VR has a role in helping individuals with agoraphobia to get over their fear of public spaces, to virtually place this person in a situation of stress, being surrounded by people. Like a vaccine, the person would slowly fight their fear until the moment they would feel strong enough to face it for real. There is then a lot of fears that virtual reality could help to fight.

We can already observe how fooling the sight can be used in order to help efficiency in the food industry. In Moscow, the Russian Embassy of Agriculture and Food made public their research on using virtual reality on cows[10] in order to improve their milk production. Projecting the visual of a wild and spacious field to the cow's virtual glasses helps them to reduce their anxiety, by a chain reaction when the cows feel more comfortable they start to produce more milk.

This has just been an experiment but we can imagine that their aim is clearly not to change the treatment of cows. Just like any other discoveries, there is a wide range of possible applications, and with it bears a load of responsibility, deciding how/where to use it belongs to each of us. Up until now, VR has mainly been used in video games in order to make the experience seem more real and immersive. Not too harmful for the planet, let's hope the future will give this device a more profitable use for humans than adapting it for cows to make them produce more milk. Many different types of uses can be discovered and tried, understanding the functions of our perceptions helps us to give an application a new concept.

The environments in which we evolve influence our behavior, virtual reality is mimicking how we experience a situation, so our body reacts the same way in daily life. In the work "Visiona II"[11], made in 1970, by the designer Verner Panton[12], our behavior is directed by physical shapes. The organic shape of the walls, pillars, and floor leads us to lean, jump and play in the space.

10. The experiment took place at RusMoloko farm in Moscow's Ramensky district. Examples of dairy farms from different countries show that in a calm atmosphere, the quantity, and sometimes the quality, of milk increases markedly

11. "Visiona II", made in 1970, is a holistic dreamy environment, consisting of organically unfolding, untraditional megastructures made suitable for sitting and lying, exhibited at the Cologne furniture fair.

12. Verner Panton, 1926-1998, is a Danish designer, he created objects with an innovative and avant-garde design.

Also, the primary colors of the room linked to the organic shapes create a desire for experimenting like a child would do. So this room is working on us the same way virtual reality does, but this time in our physical space which is way more immersive since we can touch it, go through it, using all our senses to experience his work.

These examples clearly show a natural order between our senses, the view often has the most impact on our perception. I can then suppose our sight, being used constantly, gives us the most influential feedback on reality by serving how senses and how the brain is translating them, changes in perception of reality, and making it look more subjective. Therefore, in relation to their point of view, everyone has a different reality, and we will never share the same since our memory library is composed of different books. One way of changing reality is to communicate with each other and share our experiences. Being aware of the existence of several realities helps us to question ours and not to be fully sure of how we are acting, leaving some space for changing our beliefs and improving our behaviors thanks to others.

Collecting our perceptions

0Souvenirs can be seen as tracks of a connection in our brain made by what we sensed and experienced during our life. Every connection made in our brain creates a path between neurons using synapses as a bridge. In order to remember a souvenir, we have to reactivate these paths when we are not connecting enough to a souvenir, otherwise it starts to fade away and before finally disappear, leaving the place for other memories to be hosted by the brain. This process is happening in the same time that we sense and perceive our surroundings, in the same way that we sense the outside world, we are constantly creating, remembering and forgetting experiences during our conscious day.

In the "McGurk" experiment we can find out how our brain has been tricked when we go deeper into how memory works. When we experience something our neurons connect with each other in a specific way and they are creating a pattern. When we remember the same thing we are actually asking our neurons to recreate the connection in the exact same way. In order to remember something, you have to trigger this connection with something similar. When I have to locate myself on my way back home, I'm trying to reconnect with the path I took when I left my place, the moment I manage to actually remember where my goal is located, it's when I finally recognize a building or object that I can relate with, so at this moment I can tell where my house is and which path to take. It is also up to this exact mechanism to help with our developing skills, since remembering also creates

a comparison between the past and the present that allows us to continue the development rather than starting over again. For example, when we try to solve a Rubik Cube our brain has to work hard to find the best way to solve it. It has to go through a billion of different patterns before finding the right one and that for every step. But for the fastest person on earth to solve a Rubik Cube, it is completely different. This individual brain knows which path to take and it doesn't have to work hard for it, the pattern has already been created during his practice, therefore he just has to reactivate them instead of creating new ones.

I supposed that what is happening in the McGurk effect is that a connection in our brain is established and then reactivated by the visual of the moving lips. Seeing the lips movements makes our brain guess what the audio output will be, therefore we hear something that is logical to us even if it is not real. What we remember and how we remember it also influences what we are going to perceive, the relation between past and present experiences is omnipresent in our lives and in our understanding of our reality.

In art we can also see the importance memories has in relation to our perception, sometimes our sensation of space completely relies on what we already know. During the time of experiencing the work "Aural"[13] by the American conceptual artist James Turrell[14], we can see how lost we are getting when nothing is relating to our library of knowledge. When we enter this space, free of corners, with lights coming from nowhere, we cannot define the depth and space we are standing in. Not having anything clear to see in order to help us define what's around us makes our brain work harder to find a connection to make.

13. "Aural" is a light art space that reveals neither its light source nor its dimensions, by James Turrell, exhibited in the Jewish Museum, Berlin, 2018.
14. James Turrell, born in 1943, is an American conceptual artist working with light and space.

Then, the other senses start to fade away as well, focusing on our sight and not being able to understand what we are seeing can cause the individual viewer to begin hallucinating, searching for something to rely on. Our brain starts to apply some memories into our surroundings, thinking it would help us to assimilate what is happening during this disorienting experience. When what we are experiencing does not link to anything known, it starts perturbing our perception, that is where we can experience a completely new sensation.

Memories, with the information gathered by our senses, are the material our brain is using to come up with our own reality. So depending on your life and your previous experiences, you will experience the same situation as your neighbor in a completely different way. That's when our personality rises, and that is how it becomes interesting to express a point of view, to communicate and to debate with each other.

Expectation shapes our experience

Other than which sense overrides which, there is another essential element that comes into consideration when we talk about reality: our expectations. It also changes the perception we create from an experience. The psychologist Charles Spence[15] is in his research about the perfect meal, focusing on the impact atmosphere can have on the taste of our food. In relation to the example of the chocolate ice cream & hot coffee taste referred to earlier, the expectation I had happened to be completely wrong. In reaction, I experienced a memorable sensation of an unexpected mix. Through examples and tryouts, Charles Spence is looking to understand the impact of our expectations on what we sense, and also how to influence them in order to change our perception.

Charles Spence does not see a perfect meal into a pill, he considers the perfect meal is the right balance between all the components during the experience of a dish. For him, the tasty experience of a meal start by the name of the ingredients that we use, a study made around restaurants in Australia shows how influential a name can be on sales. A fish called the "Patagonian toothfish" is one of the least sold fish in the country, and by simply changing its name to "Chilean sea bass" the sales tripled in a year. This is the effect that expectation has on the consumer, expectation is the idea that we create in our brain before

15. Charles Spence, born in 1969, is psychologist and professor at the Oxford university, Autor of the books "Perfect meal" 2014 and "The handbook of multi-sensory processes" 2004.

experiencing something. From the first sensation, we already create an idea of what is going to follow. One of Spence's goals is to share with the world chef's the influence that the brain has on our sensations.

The brain always tries to imagine what would happen next, and what it comes up with will change the following perception. The brain wants to create connections the same way it does when it deals with souvenirs. Heston Blumenthal, a famous chef, created an ice cream that unfortunately nobody really liked. The appearance of the ice cream was its main issue, it has a pinkish color looking like a strawberry ice cream, therefore the consumer already imagines having the sweet frozen fruit taste in his mouth. Unfortunately for him, the taste was not strawberry but salmon. This dish is a famous type of salty ice cream from England a century ago, the chef was sure of his recipe the only problem is the disconnection between what the client tastes and what he was expecting.

When an experience matches the expectation, to some extent, it creates a positive sensation. On the other hand, when the sensation felt does not link in any way to the expectation, it ends up in an unpleasant but memorable experience. Charles Spence had the desire to direct the expectation in order to emphasize the taste of a dish, as we saw during the chapter on the cross-modal sensory, senses can be affected by a lot of different factors, therefore influencing a sensation using people's expectation must be possible. During a collaboration with the scientist Katsu Kojima, they tried to change the taste of sushi by changing the visual, using virtual glasses they are projecting an image on the actual dish, they manage to change the color of the sushi, making it more appealing to the client. Other ways to direct expectation, more practical, are already in use in some restaurant, such as at chef Denis Martin's restaurant, where laughter is used to direct

his client's expectations. The mood in which we are, also changes what we feel. The chef decided that only placing a "moo box" on the table, before bringing the menu, causes the guest to use the box at least once in order to be served. The surprise "MOO!" helps people to forget their previous mood that they build up throughout the day and start the dinner with a happy mood.

The conceptual artist Anish Kapoor[16] is one of the artists who work with people's expectations in order to create a memorable experience, similar to what we saw with the salmon ice cream, that an expectation fulfilled creates a pleasant feeling. For an unexpected situation, the feedback is not always positive but it has another effect, they create a new connection in our memory which makes the experience more memorable. When the artist decided to work with the color "vanta black"[17] his aim was to disturb people's ideas of color. When he created his art piece "Descent into Limbo", he made for people the possibility to discover this color and the whole concept of no light bouncing back from an object to us in a well-lit space. Using an empty room as a host of an endless or inexistent black hole, he wanted to direct people's attention toward the central piece. He knew that people always relate to physicality through volumes, and volumes exist with perspective and through shadows, therefore when the audience was confronted with the art piece, they would not know what to believe. This experience is actually seeing darkness in light, a notion which is deeply unrealistic and yet it still exists. There, Anish Kapoor shows that art can be the bridge between science and the public, by using this endlessly black in "color works", and how we understand space. By experiencing the installation, we can see how our reality depends on our senses, then by linking this art piece to how our senses operate, we can

16. Anish Kapoor, born in 1954, is a british conceptual artist born in india.
17. Vantablack, developed in 2012, is a new material made of carbon nanotubes. Deposited on the surface of an object, it gives it the deepest black color ever obtained, with a light absorption coefficient of 99.965%.

understand what is actually happening and speculate on new possibilities. Our eyes can only see if there are light waves passing through it when these waves are being absorbed by the vanta-black, our eyes are being overruled and can't perceive anything else than darkness. As an example being able to perceive radio waves would make it possible to understand space by looking at where the radio wave is bouncing into and we would not need light anymore to understand our environment. This is a way of trying to imagine new realities.

When it comes to understanding a sensation, the research and experiments made by scientists show the need of paying attention to the whole picture. In the continuity of the others works made by Charles Spence, even the cutlery has an impact on people taste. One chef created a restaurant in Japan called "The Ultraviolet", where not one single detail is left behind, making everything part of the meal experience. Walls, tables, and cutlery are linked to a projector or screen that project visuals in relation to the served food. He also was the first using audio to change the taste. By experimenting on a few thousand people, he created a range of sounds that create specific tastes. He called this effect "Audio Seasoning", some of his sounds make a dish feel more bitter, or salty, even if it is actually not the case. Since its opening, Ultraviolet is always booked and if we would like to experience this in real, you would have to wait at least six month before having a seat at his table.

Mixing multisensorial experiences and everyday routine creates a new way of living. Chefs and scientists have focused on linking food and neuroscience, but every aspect of our day could be improved using this system. Let's imagine what is a day where everything that we know and do, can be perceived differently. It makes me believe that every aspect of our perception can be designed in order to create our next reality.

Brain plasticity

The reality, as we know it, is a complex mix between our senses, our environment, our expectations, our memories. All of it happens in our brain and yet every part of this mixture can be influenced, modified by each other and by many other elements. In order to see the possibilities that we have, let us now turn our focus on our brain functions and its hidden capacities.

Since high school, we have been told the basics of brain functions, but there is a lot more to know, so let's go through a selected part of these functions focusing on how we understand reality. As a starter, we will go back to what we have been told and link this information with some more uncommon research in neuroscience. All of us have two hemispheres within our brains, the right one controls the right side of our bodies and the opposite works for the left hemisphere. The right hemisphere handles the logic tasks such as science or problem-solving. The left one is more the creative part, dealing with art and sensitive content. Further, inside these different hemispheres, we have 4 lobes and the cerebellum. The frontal lobe is hosting the sense of smell, the motor control and helping us to concentrate, plan and solve problems. For the Partial lobe, there are the senses of touch and taste, even our bodies awareness. Then there is the Temporal lobe, for hearing, facial recognition, but sharing with the Parietal/Occipital lobe, the capacity of reading and writing. The last lobe is the Occipital, which is mainly used for the vision. Your cerebellum takes care of coordination in brain activity but also of your whole body functions.

From this, it is clear that everything has its own place within the brain structure, at least to start with. Each capacity hosted by our brain has its own place independent from each other, that is why it's possible to stay alive even with a missing sense, or a nonfunctioning part. As a big computer, our brain is a receiver and a transmitter. But compared to a computer, it doesn't work with codes but with electrochemical pulses. Similar to electrical currents, the main difference is that they are being created by our senses and our brain, also they use our nervous system to go through our body.

Even if we start to understand the basics of how a brain operates, we will soon see that nothing is as easy and structured as we thought. Everything about our minds is more malleable and adaptable than what we expect. Thanks to the latest studies of the neuroscientist David Eagleman[18], we now can say that the brain can understand any type of electrochemical current ,even if they are not coming from one of our senses. In other words, it means that the visual information coming from your eyes could come from another sense. Depending on the electrochemical pattern, the brain would still translate it into visual data. So our brain could adapt to any type of information if there is an electrochemical current. In 2019, it was made possible to proceed with a cochlear implant for deaf people. It consists of linking a microphone directly to the internal ear using electrodes. Also, the microphone is transforming the sound wave it is receiving into an electrochemical current. They have a specific pattern that allows the brain to translate them just as if it came from our ear. No matter the origin, no matter the information, any type of electrochemical pulses can be translated by our brain. We can host any type of sense and still our brain will manage to make sense of their information.

18. David Eagleman, born in 1971, is a neuroscientist and a New York Times bestselling author. He heads the Center for Science and Law, a national non-profit institute, and serves as an adjunct professor at Stanford University.

Discovering this research, I was convinced we will all be cyborgs in the next 50 years, but yet, I couldn't understand what makes this possible and how we can know that it is really true. I started looking into the origin of this discovery, the first step within this research was made with an experiment made in 1976, by the American neuroscientist Paul Bach Y Rita[19]. Blind people could perceive their environment through their touch without actually touching they surroundings. To explain his theory, he built up a chair with a grid of mechanical sensors hooked on the backrest which was linked to a camera. An image was translated into impulses working like pixels. The sensors were being activated when the camera was detecting a white object, then the blind person was feeling the image of the object through their back. It worked the same as if someone draws something on your back and you had to guess what is. From this point, Dr. Rita was able to say that it is possible to see what surrounds you without using your view and without physically touching it, the brain will still consider this information as an element of our surroundings even if it does not use the eye.

The story of this discovery is also relevant in order to understand the plasticity of our brain, the capacity it has to adapt depending on its state. Paul Bach Y Rita started his researches when his father had a stroke and couldn't walk anymore since the part of his brain dealing with balance was damaged. Doctors at that time thought his father would never walk again.

Nevertheless, when Paul took his father home, he was sure that by practicing, he would be able to walk again. After three years of hard training, his father started to walk on his own, leaving Paul to think that his father's brain finally made a full

19. Paul Bach Y Rita, 1934-2006, was an American neuroscientist he is the first to seriously study the idea of neuroplasticity and to introduce sensory substitution as a tool to treat patients suffering from neurological disorders.

recovery. It wasn't until after his father death that Paul asked to see his brain autopsies. What he discovered, was in fact, that the brain area linked to the sense of balance was still 98% damaged. He was able to draw the following conclusion: if the area linked to the balance is still damaged even if he could walk again, it means that his father's brain hosted the sense of balance somewhere else. Therefore, the brain is not fixed to a predefined organization, through its life it can reorganize itself, using new areas to host new senses.

From this moment, I understood that our brain has endless potential. Neuroscientist David Eagleman knew that our brain can adapt to new senses. He then took the research of Paul Bach Y Rita to another level. With the same principle, he built a vest with some electrical transmitters and for an example connect it to the stock market data. So through his skin, he was able to understand the state of the stock market in real-time. After some practicing, he got used to this new device and it became a must quicker way of analyzing the data.

Exactly like learning a new language, the brain is capable of learning any type of electrochemical pulses and make sense out of it, after an adaptation time. As a practical example of this fact, an artist called Neil Harbisson[20] became a cyborg, hooking up to his skull a camera that reads the light wave. It transforms the light wave into audio waves, and just like a synesthete, the artist is now able to hear color using bone conduction. Using the device for a few years now, the artist is having a new sense that we don't have. He made an orchestra using colors as partition, and like John Cage, he tried to change the relationship we have with music and sound in general. With the idea of sharing to everyone his experience, he also created an app that reads through our camera the colors and creates sound from it.

20. Neil Harbisson, born in 1984, is a Catalan artist known for his ability to hear colors. In 2004, he became the first person in the world to have an antenna implanted in his head.

Neil Harbisson perceives reality completely differently than we do, by sharing his experience he makes it possible for us to understand the reality his living in. He is also the first example of cyborg, it makes it easier to understand the plasticity of the brain and the studies of Paul Bach Y Rita. From this example, I can also imagine that one day the rest of the population might have the desire of experiencing new realities, and therefore deciding to upgrade their senses.

Conclusion

Every year, humankind manages to broaden our understanding of reality, even if our senses are not developed enough to let us access all of it. We now can build tools that make it more "readable". Taking in consideration all the possibilities that our brain offers us, we now know that we could sense the hidden part of reality. Nature already has all the information we need in order to change our reality, we just need to spend the time and the energy needed to adapt it to humankind. As an example, we only see the light waves but we know some species such as bees can see ultraviolet and snakes can see infrared, also one of the most advanced eyes on earth is the mantis shrimp, it has twelves different types of photoreceptors when we only have four. With this attribute, they can perceive ultraviolet and infrared and also see the light polarisation, which is the direction the light waves are evolving into. Let's imagine for a moment how our world would be having the eye of this shrimp, it would be like walking on another planet, maybe we won't even have the sensation of walking because the floor will not look as stiff as it does now. Anyway changing our perception opens up new perspectives and possibilities, also adding new input into our library of knowledge will always end up creating new connections and therefore finding new creative ideas. In order to do so, we don't only have the option of adding a new artificial sense to our body, being a cyborg is not the only way to evolve our understanding of our surroundings. Directing our expectations, stimulating our brain activity and just sharing with one another are already keys to alter our daily reality. Artists and designers

have the potential to guide people through new experiences, giving them the opportunity to change our point of view on what we know. Even if it seems that we are being shaped by our reality, in fact, it is the opposite, we are the ones shaping reality. It is malleable, flexible, we can change it, alter it, upgrade it, we just need to be aware of the possibilities and have the desire to do so, let's see what are we going to do with our reality.

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