REPORT CREATIVITY METHODS TRIZ

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4th December 2019

Introduction

Our objective is to study the glasses used to correct vision. The idea is to make a study on the object, know its essential parts (what makes us identify the object as a glass), identify its functioning system parts and analyse its evolution in time.

The chosen object: glasses

Our chosen object of study is the glass. Nowadays the glasses are used not only for correcting vision purpose but also for esthetic reasons.

In Figure 1 we can see the basic structure of a glass with its composing parts. The glasses can have many variations but nowadays they present always this same structure as a basis.

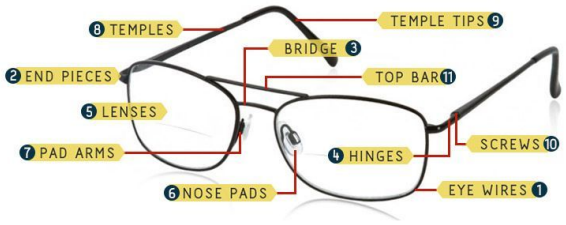

Figure 1: Essential parts that compose the glass system.

If we think on the glass as a system shown in Figure 2, we have the following parts:

- Energy: the light, which is input of the system. Its rays suffer reflexion and refraction when passing through the lenses to change the place where the image is formed in the ocular system.

- Motor: the lenses, they're the actuators that transform the energy into something useful to the system.

- Transmission: the lenses, they're responsible for transporting the energy from the external medium into the system.

- Organ of work: the temples, that establish the physical contact between the actuator (glass) and the target (human eye).

- Control: the human, who is the target of the action and reacts to variations of the system.

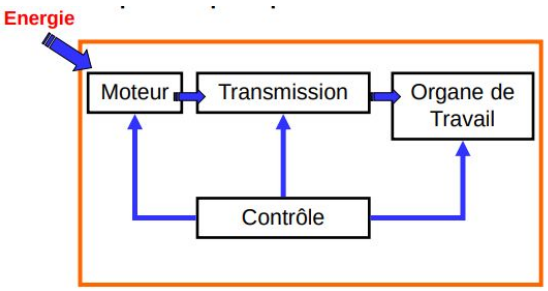

Figure 2: Relations between the parts of the system.

The evolution of the glass: S-Curve

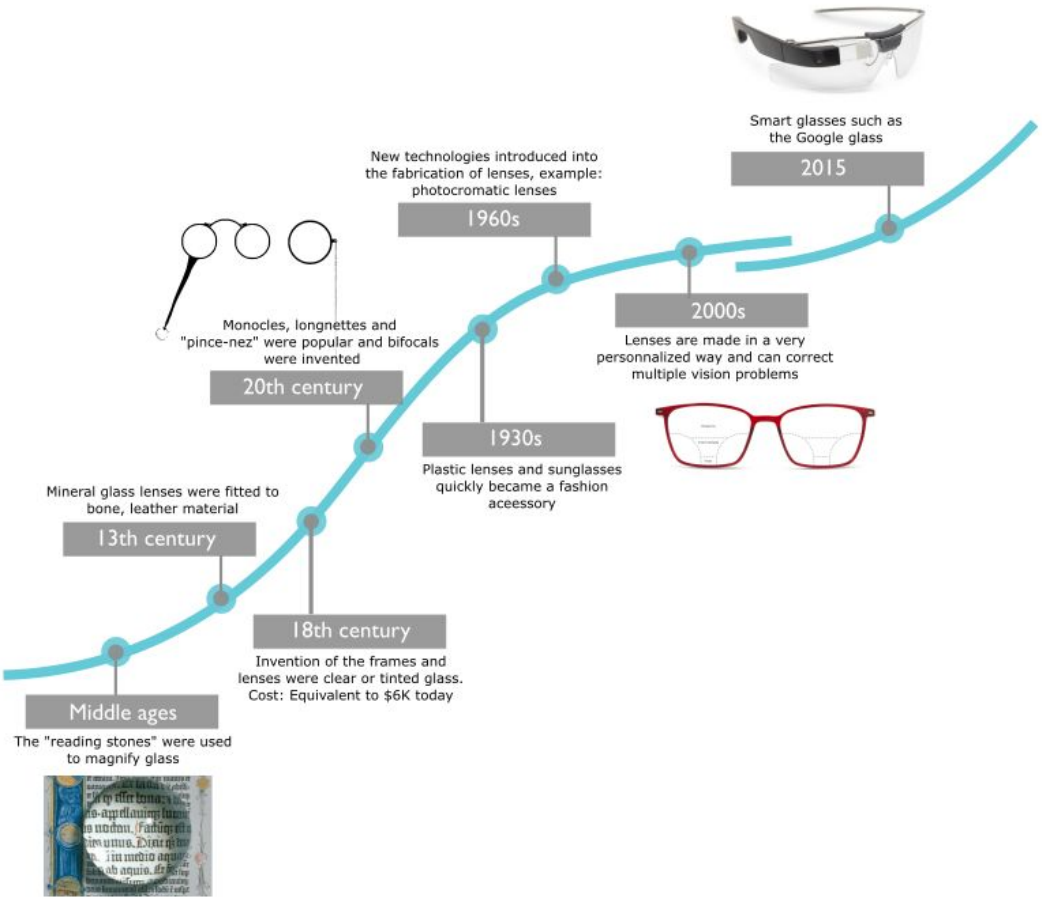

Figure 3: S-Curve of the glass.

To study the evolution of the glasses we'll investigate its evolution through the S-Curve. The first use of an object that resembled the functions of a glass comes from the Middle Ages. Some paintures dated from the 1400 ac show the use of "reading stones". These stones made of glass were used to facilitate reading, but they didn't have any kind of structure to attach it to the body.

In the 13th century, the lenses were made of mineral glass and they had a structure with leather and bone to support the lenses. Also at this same time, there are artifacts as proof that the Inuits used walrus ivory to create goggles with small slits to peer through and dim the light (those would be the first sunglasses) - see Figure 4.

Figure 4: Inuits goggles to protect vision from sun in 13th century.

In the 18th century, the frames were invented and the lenses were made of clear or tinted glass. But in that time, the glasses were a luxurious item costing the equivalent of $6K today.

In the 19th century glasses became more accessible. Because of the culture of theater and spectacles rising, more simple models (monocles, pince nez, longnettes) became very popular. Following this tendency, in the 1930s, glasses became a symbol of culture, of belonging to a certain social status, so they gained the function of fashion accessories. And the structure of the frame could be made easily out of plastic which reduced the price of the glasses making them more accessible.

Since the 1960s, many technologies were made for the lenses to adapt to the plurality of vision problems. This is a response to a need from the population. From the 1940s the estimated myopia rate in 20 year-olds rose to almost 75%.

Now we have lenses that can adapt to multiple vision problems in only one lens. But since then the evolution of the glass did not change much. As it is possible to see from the curve, from the 13th century until the 1960s, the glasses suffered big transformations but now it is more stable. The big break in this S-Curve is the explosion of the Industry 4.0 that exploits the IoT and the connectivity. That's why Google launched in 2017 a smart glass that can connect to mobile phones, make calls, see calendar, etc.

Study of the evolution laws around the glasses

We have to give a grade for our object to each evolution law. The grade is given between 0 and 1, 1 being the best and meaning we do not want to improve the object to fit that law better, also meaning that according to us, the glasses are respecting this law as much as possible.
A lot of laws have a grades inferior than 1, we are therefore going to explain our choice and why the glasses did not get the maximal grade regarding these laws.

Law 1: Integrality of the parts : 1
There is nothing in the integrability that would really need to be done to improve the visual help of the patient. The device is already highly integrated in all its parts.

Law 2 : Energetic conductibility : 0.8
The energy comes from the light. The transmission works normally well, however it can be less good due to dirty lenses. As well, the energy that comes from the light is lost, even though it could be possible to gather it. For example, light ray collection is a way to make fire. In our case, it could be interesting to focus the light in a little battery that could power some invention on the glasses (like a light to read in the dark).

Law 3 : Coordination : 0.9
The glasses are well coordinated, the place of the lenses is calculated for the correction to be coordinated between the two eyes. However, it is still perfectible, since progressive lenses are long to adapt to, for example. As well for the progressive lenses, there are some areas of the lense that is not well adapted to the distance when the glance goes from up to down. In that case, the glasses are badly coordinated with the patient.

Law 4 : Perfectibility : 0.7
It is already very adapted in shape, design, and quality to nowadays need. However, it would adapt itself to the luminosity, the humidity, and the environment.

Law 5 : Unequal development of the parts: 0.5
The development is very unequal between the lenses, their support, the temples, and the other components of the shape of the glasses. Some support cannot handle some type of lenses. Or some support require nose pads that people do not desire in the product.

Law 6: Super system : 0.6
The super system existing nowadays is the google glass. It adds a lot of functionality, but it does not improve the correction. In this study, another approach related to the improvement of health is studied.

In that case, the google glass are not adapted. One can think about a super system like glasses composed of sensors cameras and an emitter, that would transmit information to the brain of a blind person, aiming at reconstructing an image as if he was seeing it.

Law 7 : Transition to the micro level : 0.2
The glasses are not treated with other particles to apply the correction. Except some filters that are put on top of the curved lenses, a new material could be used to improve the vision. The glasses could also interact with the brain through waves for the case of blind people.

Law 8: Dynamisation and control : 0.4
Even though the glasses are nowadays adapted to ones need in general, they are not responding to a dynamic environment. They are very fragile regarding to choc and scratches. The glass is not designed to adapt and resist to chocs. As well, glasses could adapt the amount of light to protect the eyes from UV, and react toward humidity and rain.

The 9 Windows diagram for the glass

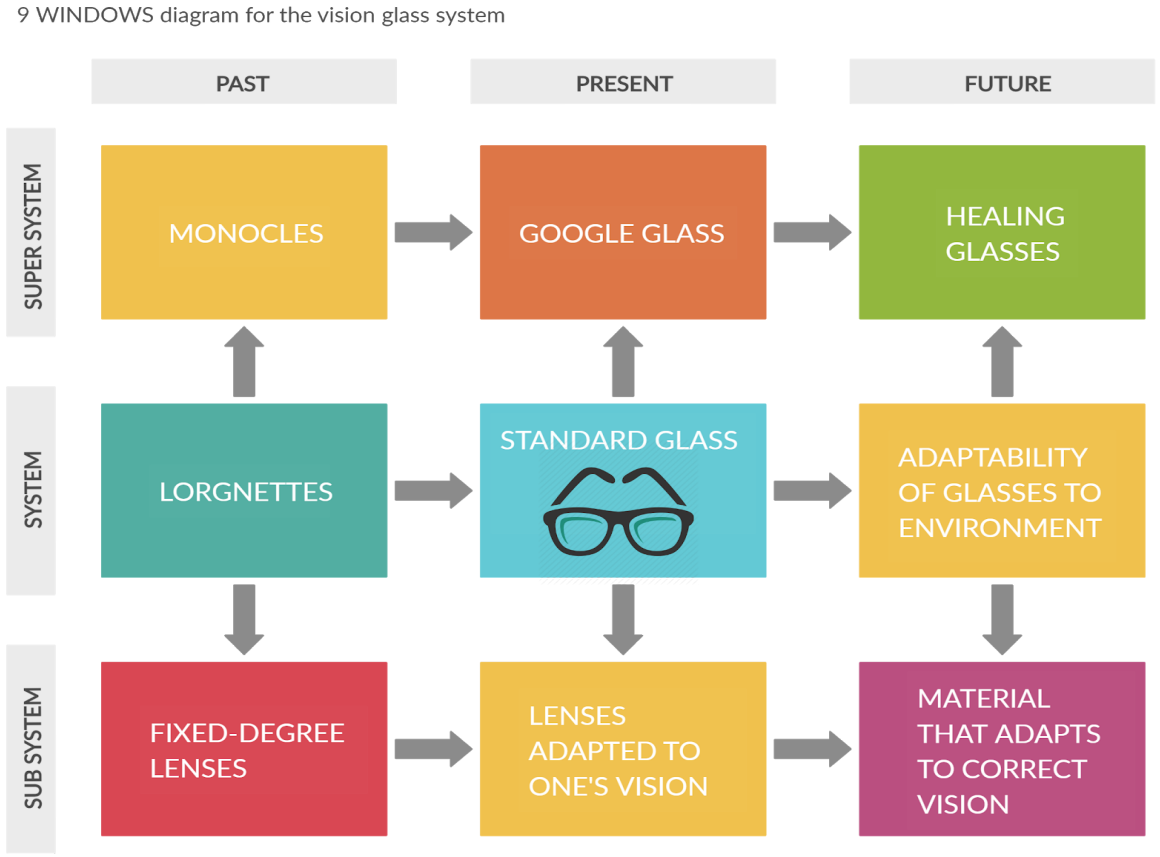

Figure 5: 9 Windows diagram for the glass.

The 9 Windows diagram is a method that allows us to explore issues and ameliorations that could be made in a system by analysing the past, present and future in 3-levels: macro (super system), the system itself and in micro level (sub system).

We applied this technique to analyse our system, the regular glass that corrects vision. In the present, the standard glass already has an upgraded version, the Google glass, that started being commercialized in 2017. The Google glass adds functions to the glass other than the simple correction of the vision, with this Google product the user is able to access the mobile internet browser, camera, maps, calendar, and other apps by voice commands.

As a subsystem to the the standard glass, there are the lenses, which are the actuators of the correction of the vision. Nowadays the lenses can be adapted to correct different degrees of correction and problems (miopie, astigmatism, etc).

In the past, the lenses were only available to sell in stores in a limited range of degrees. So the correction of the vision wasn't adapted to the user. In the 19th century, the glasses in monocle format did the correction of the vision on only one eye. After a while the lorgnettes were invented to make the correction in both eyes.

In the future, the tendency is to have glasses that are more and more adaptable to the environment. And possibly have a technology that allows the glass not only to correct the vision but also to work on healing the origin of the problem itself. For the subsystem would have to change its technology to a different material.

Tools of resolution

We first thought about one improvement to do but it is too much in rupture with current product. The idea was to pass to some glasses that are equipped with cameras and sensors and that would send information to the brain of blind people, through waves or through through some device put in the brain of the patient. The problem with this idea is that it depends too much on medicine, and is too much in rupture with the current idea of glasses. To go on with this exercise, we chose to illustrate glasses that would adapt to humidity, in a way that the lenses would not get blurred.

To address our problem we chose to improve the adaptability/versatility of our glass and preserve the easiness of manufacturing. For this, the TRIZ Matrix 40 (for more information, consult: http://www.triz40.com/TRIZ_GB.php) proposed the following principle to solve this contradiction: the segmentation.

The idea is to divide the project in independent parts, so they can function separately. So to ameliorate our glass we would add a layer over the normal lenses that has the capacity to adapt to humidity conditions. Instead of chemically changing the composition of the lenses, this part is separated from the system and becomes an additional feature. However, in the TRIZ 40 matrix, the segmentation states that the object has to be easy to disassemble. In our case, we want the filter to be on the lense permanently, so that if the lense fall the person does not lose it. It raises here a contradiction.

The solution found with the help of the matrix is to stick a filter on the lense. The best thing would be some very cheap filters that can be placed on humid days so that they are easy to disassemble as well and their loss would not be a problem. However, this would probably have a big environmental cost.