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## THE CONCEPT OF COMFORT APPLIED IN THE ANALYZES ON THE BEHAVIOR OF PEOPLE WITH LOW VISION - CURRENT STAGE

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**Abstract:** *The comfort of people with disabilities is one of the current problems that we try to find as many solutions as possible. These devices improve the mobility of people with visual disabilities and facilitate daily life. Due to their properties and innovative design, they are easy to use and offer safety to people who need help. In a world where technology is evolving towards flat surfaces, which means nothing to a blind person, these devices come to their aid in order to ensure their contact, in other sensory ways, with the world around them.*

**Keywords:** *low-vision, comfort, behavior, analyzes.*

### 1. INTRODUCTION

In essence, comfort is a category of relative but especially subjective aspects. As defined by Hatch (1993) [11] "comfort is the release of pain, the release of discomfort. The physical aspects of comfort are related to human perception and subjective feelings of discomfort and / or pain." These definitions emphasize that this, comfort is a multifaceted construct influenced by several factors and that it is not just the opposite of a state of discomfort, of any kind.

Knowing and understanding the different categories of visual dysfunctions that a human subject can manifest involves, in addition to their study (causes, manifestations-symptoms, recovery, etc.) and an approach in terms of how human behavior changes and can amplify sensory dysfunction, respectively the perception of the environment.

For example, the US Social Security Administration (SSA) defines legal blindness as follows:

- Reducing the central visual acuity to values of 20/200 or lower, in the best eye, with the use of the best glasses lens to correct vision;
- Limiting the field of view so that the largest diameter of the field of view in the best eye has an angle of no more than 20°. [2]

Eye pathologies or conditions can cause vision problems, the most common of which include the following categories: [12]

*A. Macular degeneration* is a disorder that affects the retina, the area where images are focused. The most common form of age-related macular degeneration is known as the non-exudative or "dry" form, in which vision loss progresses slowly. Faster and more severe vision loss comes from the exudative or "wet" form of macular degeneration.

*B. Diabetic retinopathy.* People with diabetes may experience changes in their vision and / or visual functioning, noticeable on a daily basis, as a result of the disease. Diabetes can alter the blood vessels that feed the retina by developing small abnormal branches that show blood leaking. This can interfere with vision function and over time can severely affect the structure and function of the retina.

*C. Retinitis pigmentosa.* Retinitis pigmentosa is the term given to a group of hereditary retinal diseases that result in the degeneration of photoreceptors (cones and rods). Night blindness is an early symptom of retinitis pigmentosa, followed by a constriction of the peripheral visual field. Loss of central vision usually occurs late in the pathology.

*D. Retinal detachment.* In this pathology, the retina separates from the lower layer (pigment epithelium, Bruch membrane and choroid). This can be described as loss of visual abilities ("covering with a curtain") on one side of the visual field. Without intervention with a specialized treatment prescribed by the ophthalmologist, over time, a permanent loss of vision function may occur. If diagnosed early, most forms of retinal detachment can be surgically reattached to partially or completely restored visual capacity.

*E. Cataract.* This pathological form manifested in the eyeball is an opacification of the lens of the eye - the lens, a degeneration that prevents light from reaching the retina. Cataracts can be due to a variety of causes, some congenital, hereditary, others due to the natural aging process, or other particular causes (trauma, nutrition). The presence of a cataract can interfere with the functioning of the human visual system, by decreasing acuity, sensitivity to contrast, decreased color perception and decreased visual field.

*F. Glaucoma.* Glaucoma pathology is characterized by increasing and exceeding normal values of intraocular pressure that can lead to damage to the optic nerve, having as final effect the installation of blindness (blindness). Types of glaucoma include primary, secondary, congenital and total glaucoma.

*G. Amblyopia.* In amblyopia, the visual system fails to develop normally during childhood and the evolution of visual function. This form of visual dysfunction results in blurred vision in one or both eyes, which is not easy to correct with normal glasses or contact lenses, with amblyopia being a form of cortical suppression.

*H. Trauma.* Pathologies due to domestic, work, road or other accidents that destroy the structures of the eyeball and have as final effect the partial or total loss of vision. By positioning it, the eyeball is subject to an increased risk of trauma. The massive facial bone defends the eyeball, but only to one side; but even in the protected parts it sometimes suffers due to traumatic injuries of the cephalic extremity. These injuries can be insignificant to other organs, but they can cause serious eye damage to the eyes.

## 2. ANALYSIS OF VISUAL AID SYSTEMS TO ACHIEVE COMFORT IN LOW VISION

For people with low vision there are some impediments in having a normal life. I believe that the most important aspects for them would be travel, reading, and we will assign all the other problems to a single category called "everyday life".

### 2.1. Support systems for movement

One of the biggest obstacles in the life of a person with visual disabilities is the movement between different points in the environment in which they act. Because these people do not have a good overview, there are two important issues that need attention:

1. Avoiding obstacles
2. Traveling on a known or unknown route.

Regarding the movement and avoidance of obstacles, we will analyze several devices, depending on the ease of use and created especially for people with visual disabilities.

#### 2.1.1. The classic cane - the white cane

This is the most distinctive sign of a person with "low vision" or blindness. It is used for travel and is a very important tool when traveling in the pedestrian area, in crossing streets (a blind person can cross the street through unmarked or unmarked places just by lifting this cane), in access to various locations of general interest (train station, hospital, shop, cultural institution, etc.).

As constructive forms, even this classic cane can have the following variants:



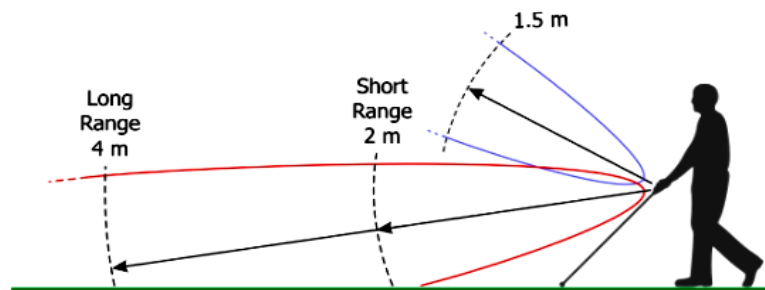
**Figure 1:** Cane for the blind [1]

- *Bastonul lung:* Aceasta varianta este conceputa în primul rând ca un instrument de mobilitate folosit pentru a detecta obiectele din calea unui utilizator. Lungimea bastonului depinde de înălțimea unui utilizator și se extinde în mod tradițional de la podea pînă la sternul utilizatorului.
- *Bastonul de ghidaj:* Acesta este un baston mai scurt care se extinde, în general, de la podea pînă la talia utilizatorului - cu o funcție de mobilitate mai limitată. Se utilizează pentru a "scana" prin lovire bordurile, diferitele denivelări sau obstacole din calea sa.

- *Bastonul pentru suport*: Aceasta variant este de culoare alba și este proiectat în primul rând pentru a oferi stabilitate fizică unui utilizator cu deficiențe de vedere sau/si de mobilitate. Prin culoarea sa, bastonul funcționează și ca mijloc de identificare a situației în care se afla utilizatorul.
- *Long cane*: This variant is primarily designed as a mobility tool used to detect objects in a user's path. The length of the tub depends on a user's height and traditionally extends from the floor to the user's sternum.
- *Guide cane*: This is a shorter cane that generally extends from the floor to the user's waist - with a more limited mobility function. It is used to "scan" by hitting the curbs, various bumps or obstacles in its path.
- *Support cane*: This variant is white in color and is primarily designed to provide physical stability to a visually impaired user and / or mobility. Through its color, the stick also functions as a means of identifying the situation of the user.

### 2.1.2. Ultrasound stick - Ultracane

Incorporating "narrow beam technology", UltraCane stick-type equipment [4] detects road obstacles within two or four meters (depending on the setting used) and does so by emitting ultrasonic waves from two sensors with which it is equipped. It also detects up to 1.5 meters in front at chest / head height, providing tactile feedback to the user via two vibrating buttons on the handle on which the user places his thumb.



**Figure 2:** Ultracane stick - obstacle detection distance [4]

The two buttons, when vibrating, indicate the direction of the obstacle; in addition the frequency of vibrations allows the user to know the approach of the obstacle. [5]

### 2.1.3. Infrared stick

Designed for the visually impaired, this type of support system goes beyond traditional models because it uses a network of positioned checkpoints as landmarks, such as at bus stops and intersections to help users navigate safely and more efficiently.

The design is based on RIAS (Remote Infrared Auditory Signage) technology and through systems installed at the reference points. These systems communicate with the staff and signal an auditory message to the user, with details about their location as they approach a checkpoint. For night use and for extra safety, a red light is used that provides a form of signaling by alerting drivers to the user's location.



**Figure 3:** The Infrared Walking Cane [13]

The two devices (Ultracane and Infrared walking cane) are based on the oldest aid system for the visually impaired, namely the cane. To make life easier for those with visual impairments, they have undergone various changes to improve them. Thus, the Ultracane is used to be able to detect obstacles from distances of one meter to five meters and in addition it detects obstacles from the chest, while an ordinary cane can detect obstacles up to two meters, only at ground level. The infrared walking Cane is also an adaptation of the usual stick but it, unlike Ultracane, connects to the environment through RIAS technology, which interconnects the device with a

variety of sensors that can provide more detailed information about obstacles, GPS position and about nearby public transport. For people with disabilities there are GPS devices adapted for traveling on unknown routes, these devices are easy to use because they do not have too many buttons and have a special design.[13]

#### 2.1.4. Trekker talker GPS - GPS vocal

This device is a voice GPS that can be used with one hand, especially by the visually impaired. It verbally announces the names of streets, intersections and landmarks while walking, at the touch of a button, doing all this even while traveling with a vehicle carrying a person with a disability. It can record routes and announce what kind of institutions are in the vicinity (shops, banks, hospitals, etc.).



Figure 4: Trekker talker GPS [9]

This *Trakker talker system* based on GPS technology has an intuitive design, with direct function buttons, fast volume adjustment, a built-in speaker and an 8-hour battery life. If the visually impaired person does not recognize where he is, there is a special button that once pressed, says exactly where he is. The required location maps can be stored on SD cards. [9]

#### 2.1.5 Victor Reader Trek Talking GPS

*Victor Reader Trek Talking* is a device that combines the help offered by a high-performance GPS with playing audio files outdoors. This is a small 114 x 62 x 24 mm device with a stereo headphone jack, a built-in omnidirectional microphone and a speaker for playing sound without using headphones. This device provides information about the nearest current address, the cardinal direction in which the person is traveling, the description of the next intersection or the instruction for the route followed. It provides a complete route for a voice-announced address. [10]

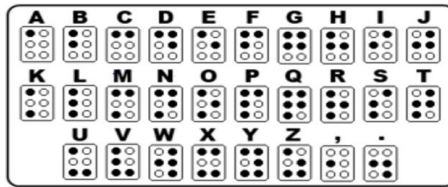


Figure 5: Victor Reader Trek Talking GPS [10]

The two devices (Trekker talker GPS and Victor Reader Trek Talking GPS) frequently used for traveling on external routes, by people with visual disabilities have an intuitive design and can be maneuvered with great ease, both due to small size and predefined buttons. They get anyone out of trouble because they can indicate exactly the position in space, by the name of the street on which the subject is and the distance to the next intersection and what it looks like. The first device can also provide names of important landmarks (banks, museums, shops, hospitals, etc.) while the second does not provide as much detail about the environment but can be useful in playing audio files while also providing GPS coordinates.

## 2.2. Reading aid systems

**2.2.1. The Braille alphabet** is a writing and printing system for the blind or partially sighted in which letters and numbers are identified by various dot arrangements made in relief. Each "cell" consists of six points, which are placed on 2 columns and 3 rows. This is a technique by which those with low vision or blindness can read and write.



**Figure 6:** Braille alphabet in translation with the Latin alphabet [3]

### 2.2.2. Top Braille –Optoelectronic reading system

This system (Top Braille) allows a visually impaired person to read a printed text at any time. The user positions Top-Braille on the text he wants to read, places his finger on the Braille matrix above the device, then moves the device from left to right as if reading normal text, while reading the letters on the matrix. When the device finishes reading the word, it is read aloud by the voice module and is heard in the speakers or headphones.

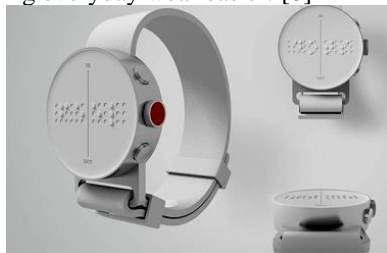


**Figure 7:** System Top-Braille [6]

The device also recognizes colors when placed on a colored surface, it displays the color in Braille, but also expresses it sound. If it is connected to a computer it can also read messages or e-mails. It has a power button on one side, two volume buttons, a USB port and a charging port, on top of it a 6-point Braille cell and two extra points for navigation, and on the opposite side a menu button and secondary menu and a headphone jack. [7]

### 2.2.3. Dot Wach - Smart Watch

This smartwatch displays the time and not only in real time in the Braille alphabet. This watch can also display notifications received via the built-in Bluetooth module and a touch sensor with a vibration motor. The watch works in a fairly simple way, under the dial there are four motorized modules, each with six possible points, and each point can be raised or lowered individually, so that the watch can display up to four Braille characters at a time. The wearer then reads the watch as if it were printed in Braille. The dial is concave to provide a protective edge around the Braille modules, making everyday wear easier. [8]



**Figure 8:** Smart Watch DOT [8]

Based on the Braille alphabet, the two devices (Top Braille and Dot Wach) help people with visual disabilities to adapt to everyday life by giving them the ability to read documents in real time without the need for a special printer. read notifications received on your mobile phone or the current time and date

## 2.3. Help for everyday life

In the age of electronic devices, there are applications for the phone and the visually impaired, regardless of the phone's operating system. These applications, which can offer multiple facilities, include:

- *Be My Eyes*- Helping the Blind which is an application that connects a person with disabilities with a normal-sighted volunteer. The person with "low vision" can ask for help from a volunteer who will receive a notification. When the volunteer accepts the request, an audio-video connection will be established in order to

solve the problem, from identifying the products in the store to reading the street names. The average response to a notification is 30 seconds.

- *Tandem Navigator* is an application in Romanian that uses GPS coordinates and the phone's internet connection to guide a blind person. The application registers landmarks (shops, banks, traffic signs, etc.) on the first road, so that on the following roads the user announces vocally. The application can call a taxi for easier transport, can guide the user to an address or communicate to him on which street it is. This application can be implemented on any phone.

- *Capti Voice* is an application that allows you to read documents, news, books by audio signal, so simply opening the application and a document makes it read with sound.

- *Color ID Free* is an application that uses the phone's camera to identify the color the camera is aimed at in real time and to communicate it with sound to the low-vision person.

All these applications bring considerable improvements in the life of each person who uses them because they can adapt much easier, can get increased comfort and confidence in adapting to the environment when they have to perform various tasks, such as: color identification, listening audio books, using a GPS smartphone or identifying the types of cans on a shelf in the store.

### 3. CONCLUSION

In conclusion, these devices increase the comfort of people with disabilities by making everyday life easier. In addition, their behavior is greatly improved by the facilities offered by visual aid devices, an improvement observed by increasing the degree of confidence in movement or in straightening the number of activities that low vision subjects can perform. These devices are accessible to a wide variety of people with disabilities, whether visual or postural or even for the elderly who can no longer cope with daily tasks.

The Ultracane and The Infrared Walking Cane devices increase the mobility of visually impaired people because they offer much more safety in avoiding obstacles and greater stability due to the large coverage area of the stick sensors. The devices incorporate state-of-the-art technology and offer several types of response, tactile or audio, in the event of an obstacle.

Moving on a new route to a new objective can cause problems for a visually impaired person, and Trekker talker GPS and Victor Reader Trek Talking GPS facilitate movement both by providing accurate position details and detailed descriptions of the surroundings to be met.

For a life as close to normal as possible and for finding out the information, these Top Braille and Dot watch devices combine technology with a simple writing and reading language dedicated to the visually impaired. They meet the desire to read as normally as possible a text or a notification coming on the mobile phone, in any circumstance, without the need for a special form or a person to read the desired information.

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