



Understand the Importance of Garments' Identification and Combination to Blind People

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Abstract. Throughout our lives, we are very dependent on the ability to see the “world”. Everyday our eyes capture images that enable us to describe our ideas, our tastes and influence our identity. How we dress up is determined by our personal taste, mainly fed through our own eyesight. Once esthetics are supported by our vision, blind people is limited while performing tasks such as purchasing, selecting and matching outfits. These are considered easy tasks for visually enabled people and difficult tasks for people that cannot see. Therefore, within this scope it has been developed and distributed a survey to all the departments of the Association of the Blind and Amblyopes of Portugal (ACAPO). The survey has two main objectives: to recognize the importance of identifying and combing garments and to assess the needs in the development of clothing identification and combination systems that support blind people.

Keywords: Survey · Blind people · Clothing recognition

1 Introduction

Visual impairment affects thousands of people worldwide. According to the 2011 census, in Portugal, there are about 900.000 persons with visual impairments, of which, around 28.000 are blind [1].

Our life is dominated by vision. Much of the information received by the brain reaches it through the eyes. It is through the sense of vision that we perceive everything around us, thus allowing to build ideas, tastes or identity. All of these concepts are reflected, among others, in the way we dress.

Currently, when purchasing or choosing clothes, blind people are dependent on their relatives, friends or support center professionals. These tasks are so easy for those who see but so difficult for those who have little or no vision. Dressing can be a difficult and stressful task in the daily life of blind people.

At the moment, there are some fashion apps to manage the clothes, create outfits, and plan what to wear that could be used for blind community also, even though they are

not focused on the blind [2–5]. Electronic devices such as ColorTest 2000 and Colorino has come to fill the difficulties of the blind in the distinction of colors. Both devices have voice feedback and can detect light source [6, 7].

In the literature, there are few projects focused on this area for the blind community. It was identified a project that recognize patterns of clothing being able to identify 11 clothing colors and recognize 4 categories of clothing patterns [8]. Other one that, suggests a form of clothing combinations of complex patterns for visually impaired people [9], as well as another project that allows to classify the type of pattern of garments through extracting their characteristics by a camera [10].

According to the research undertaken there are technological resources that, directly or indirectly, can help in the identification of colors, patterns, garments, but they do not focus on the aesthetic aspect of combining and identifying garments. So, within this scope a survey was designed and distributed to all the delegations of the Association of the Blind and Amblyopes of Portugal (ACAPO) in order to assess the need to develop a system to identify and combine the garments for blind people. Following the previous work [11–16], the main objective of the developed survey is to recognize the importance of identifying and combining garments by blind people and to identify the technologies and forms of assistance that have been used, or may be used if available, by this community.

This paper is organized in four sections: Sect. 2 explains the methods used to collect data; Sect. 3 analyses the results obtained; the conclusions and future work are addressed in Sect. 4.

2 Methodology

In order to fulfill with the proposed objectives, the perception of the importance of identifying and combining clothing for blind people survey was developed and applied. In this chapter it will be described the sample and survey methodology.

2.1 Sample

It was requested to the blind associates of the ACAPO to cooperate in the study filling the survey. The survey was delivered by email. The data was collected from July to September 2020 and the participation was voluntarily and anonymous. A total of 26 participants replied to the survey, in which 23 full responses fulfilled all the conditions set and only 3 did not satisfy the conditions set. In the present study, all the analyses were made considering the full responses.

2.2 Instrument: Survey - Perception of the Importance in Identifying and Combining Clothing for Blind People

The design of the preliminary version of the survey was developed according to a need identified by ACAPO, regarding the identification and combination of garments in blind people. The development of the survey has fulfilled the following stage process: (1) design of the preliminary version, (2) pretest of the preliminary version, (3) development

of the final version incorporating the suggested improvements, and (4) delivery of the survey.

The pretest of the preliminary version consisted of validating the questionnaire prepared by the research team to the representatives of ACAPO, including a blind member. Afterwards, the development of the final version incorporated the suggested improvements detected during validation. These improvements consist in reorganize the method of response for determined questions in order to be more user-friendly to answer. Finally, the survey was distributed to all the delegations of the ACAPO in Portugal. These delegations have sent the survey by email to the associates.

The final version of the survey consisted of a total of 25 questions divided into 5 main parts: (1) Personal identification, (2) Identification of the type of disability, (3) Clothing, (4) Technology and (5) Research and development.

The part of the Personal identification included questions in order to gather information regarding the characterization of the participant, like age, gender, academic qualifications and current occupation.

The second part of the questionnaire, regarding the Identification of the type of disability enables the analysis of diseases that caused blindness in the participants, as well as the age group in which the diseases occurred.

The third part, Clothing, includes 6 questions to identify the importance and concerns that blind people has around what do they do to get dressed, choose and how they shop their clothes. In this subject, some questions were presented as statements. The answers were based on a 5-point Likert scale of agreement, importance or frequency.

The fourth part, Technology, includes 3 questions that aim to assess the knowledge, usability and satisfaction that blind community has in relation to the available supportive technologies. However, it is also possible to assess the proximity that this community has within this technology.

The fifth and last part, Research and development, includes 3 main questions and other 2 complementary. In this section, it is intended to assess the availability and the interest in developing a technology that supports the blind community identifying and combining clothes. Moreover, we also are interested in knowing how blind people would like this technology to be available. The suggestions and opinions of the participants were taken into consideration in the final version.

3 Results and Analysis

The data collected using google forms were stored in a table and analyzed using the statistical software SPSS (Statistical Package for the Social Sciences) version 22. At this initial stage of analysis of the collected data, a descriptive statistics with data represented and summarized as percentages was considered.

3.1 Participants Characterization

In order to obtain the characterization of the participants in this survey, 4 variables were defined: age, gender, academic qualifications and profession.

The age of the participants denotes that there is no uniformity between the age groups, with the age between 45 and 54 years old, representing 52.2% of the answers, the youngest being 18 years old, and the oldest 65 years old.

Due to the wide range of participant's age, during the analysis of the survey, the variable age was grouped into two groups, one for the age less than or equal to 44 years and the second to values equal or greater than 45 years.

The majority of the participants were female (73.9%).

Most of the participants have higher education (43.5%) and 26.1% have at least nine years of secondary education.

In the analysis of the professions, most of them are unemployed (30.4%), which may represent a hindrance to integration of this population in the labor market. Restaurant and administrative services were the following areas with 13% each. Other category include all retired people and students, representing 17%.

3.2 Identification of the Type of Disability

The second part of the questionnaire contains two questions enabling each participant to identify the causes and types of disease that caused to the participants' loss of vision:

QII.1: Since what age are you visually impaired?

QII.2: What caused your disability?

On the basis of the responses received, the majority (69.6%) were blinded during the first year of life. This shows that they do not have basic notions about the "world" around them.

Identical value was obtained regarding the reason for the loss of vision, that is, 65.2% had lost their vision due to congenital disease, and 8.7% as a result of an accident. The remaining 26.1% refers acquired disease as cause of vision loss.

Congenital disease occurs during pregnancy, which explains the high number of vision losses before reaching one year of age. The participants characterized their type of disease with regard to congenital disease and acquired disease, with glaucoma and retinopathy being the main causes of vision loss, respectively.

3.3 Aesthetics and Clothing

More and more, aesthetics is present in our lives. The way we dress has a big impact on our daily lives and is crucial to our well-being. From the importance that society gives to the way we dress to the importance of choosing clothing for the workplace in order to help convey the right and appropriate image for the context in which we are inserted. So, in the third part of the questionnaire, three statements were considered:

QIII.1: Vision is one of the senses that dominates the life of human beings. It allows them to know and perceive the world around them, while giving meaning to objects, concepts, ideas and tastes.

QIII.2: How to dress and the style we prefer for different occasions is part of someone's identity. Blind people do not have this sense, and dressing can be a difficult and stressful task. With the advancement of technology, it is important to minimize all the limitations of a blind person whilst organizing their own clothing.

QIII.3: The lack of knowledge about the colors, the type of pattern or the condition of the garments makes this a daily challenge, in which the current resources are not the best.

And the following three questions:

QIII.4: Are you worried about matching garments?

QIII.5: How often do you need help buying clothing?

QIII.6: Where do you buy your clothes?

Due to the size of the sample, for all statements, the scale was recoded so that only two groups were possible: “agree” and “disagree”, showing a positive or negative response for each statement. Figure 1 shows the distribution of results in the different statements.

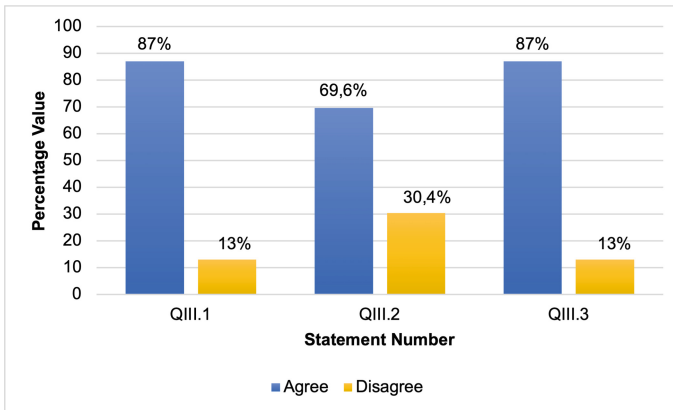


Fig. 1. Positive and negative response distribution for each statement.

The majority of participants recognize the sense of vision as the key to the attribution of meanings and recognition of everything that surrounds us. The importance of aesthetics as a definition of our identity is also in agreement among the participants, as well as the daily difficulties experienced by participants due to the lack of resources.

As expected, all participants have reinforced their importance in combine clothing, the majority of which (73.9%) say that they frequently seek help to shop their clothes, mainly from family members, support center professionals and CAVI (Support Center for Independent Living).

When asked where they buy their clothes, all participants referred physical stores, with 39.1% of them also referring to do shopping online.

3.4 Technology

Certainly, the technology in this field has evolved considerably; however, it is necessary to understand whether there is enough technology to minimize the obstacles faced by these people in their daily lives.

So, in the fourth part of the questionnaire, after the identification of the device and system used, two questions were considered:

QIV.1: Are you aware of any technology for clothing identification?

QIV.2: How satisfied are you with the technology available on this topic?

The participants, in their majority (65.2%), demonstrate to have a knowledge of clothing identification technologies. They identified apps on their smartphones as their main source of aid to detect colors. As an alternative, the same users opt for Colorino. However, only 26.1% demonstrate being satisfied with the existing technology resources. This result, in a way, is important and motivating for the continuity of the work.

Around 89% mentioned to use smartphones, 72% a laptop, 33% uses mobile phones and 11% tablet devices. Most smartphone users have the IOS operating system.

3.5 Research and Development

Aesthetics not only characterize the image and appearance of our body, but also our well-being, self-esteem and optimism in "day-to-day" life. The research and development of a solution in this project seeks these characteristics.

Finally, in the fifth part of the questionnaire, three main questions were considered:

QV.1: Would it be important to develop *something* that would make it possible to identify and combine clothing?

QV.2: How likely is it to use a technology that includes the act of identifying and combining clothing?

QV.3: Did you need help in completing this survey?

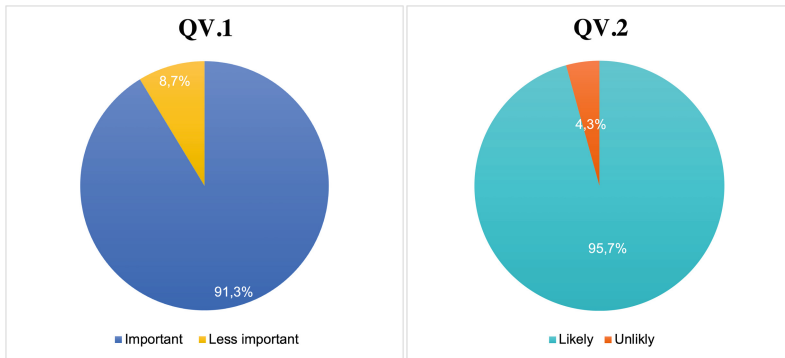


Fig. 2. Results distribution for QV.1 and QV.2.

According to Fig. 2, most participants (91.3%) agree that a framework should be developed to help identifying and matching garments.

According with the previous answer, almost all participants (95.7%) are willing to use technology that helps them to identify and combine clothes. When choosing the platform to use the technology, the smartphone and the laptop were the main choices with 43.2% and 35.1%, respectively.

Lastly, and in order to answer the survey only 17.4% states that sought some help to fill out the questionnaire.

4 Final Remarks

Based on the information collected and analyzed to this stage, the results on the first application of the survey to the blind associates of the ACAPO population show a positive attitude that reinforces the importance to develop tools that allow the identification and combination of garments. Moreover, about 95.5% of the respondents are available to use technology that helps them in this task.

Although the sample dimension used in the analysis can be considered small ($n = 23$) to be representative for the national blind people population, it is authors believe that the results so far collected reinforce that the aesthetics of clothing is of central importance in the life of blind people, who are increasingly inserted in the labor market, following the major global and European directives of inclusion.

Through the survey undertaken by the participants, it is possible to conclude that not knowing colors, patterns and clothes' overall condition is a challenge that blind people faces every day. This comes to emphasize the need to identify and combine clothing.

Despite of all the difficulties, the offer of different technologies and support is still very limited to this community. So far, mobile phone applications and Colorino remain the leading sources of support used by blind people.

The participants recognise the importance in identifying and matching clothes. They are willing to make use of technology, available in smartphones and laptops, to enhance their ability in identifying and combining clothes.

In the comments, the participants demonstrated their enthusiasm and willingness to collaborate in this research.

This paper highlights the need to overcome a problem already identified in previous researchs, showing it's importance. Also, it shows how much the people is willing to make use of technology to support them with the presented challenge.

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References

1. Quantas pessoas com deficiência visual existem em Portugal? | Associação dos Cegos e Amblíopes de Portugal. <http://www.acapo.pt/deficiencia-visual/perguntas-e-respostas/deficiencia-visual/quantas-pessoas-com-deficiencia-visual>. (in Portuguese)
2. ClosetSpace - Closet & Outfits on the App Store. <https://apps.apple.com/us/app/closetspace-closet-outfits/id549724282>
3. Virtual closet, fashion app, Fashion, Virtual Closet Apps. <http://www.purple.com/>
4. Smart Closet App | Closet Organizer | Shop Fashion & Style. <https://smartcloset.me/app>
5. Stylebook Closet App: a closet and wardrobe fashion app for the iPhone and iPad. <https://www.stylebookapp.com/>
6. Colortest Standard - Computer Room Services. <https://www.comproom.co.uk/product/colortest-classic/>
7. Colorino Color Identifier - Light Detector - Assistive Technology at Easter Seals Crossroads. <https://www.eastersealtech.com/2016/07/05/colorinos-color-identifier-light-detector/>

8. Yang, X., Yuan, S., Tian, Y.: Assistive clothing pattern recognition for visually impaired people. *IEEE Trans. Hum. Mach. Syst.* **44**, 234–243 (2014). <https://doi.org/10.1109/THMS.2014.2302814>
9. Yuan, S., Tian, Y.: Rotation and illumination invariant texture analysis: matching clothes with complex patterns for blind people. In: 2010 3rd International Congress on Image and Signal Processing, pp. 2643–2647. IEEE (2010)
10. Jarin Joe Rini, J., Thilagavathi, B.: Recognizing clothes patterns and colours for blind people using neural network. In: *ICIIECS 2015 - 2015 IEEE International Conference on Innovations in Information, Embedded and Communication Systems* (2015)
11. Rocha, D., Carvalho, V., Oliveira, E., et al.: MyEyes-automatic combination system of clothing parts to blind people: first insights. In: 2017 IEEE 5th International Conference on Serious Games Applications of Health (SeGAH), pp. 1–5 (2017)
12. Rocha, D., Carvalho, V., Oliveira, E.: MyEyes - automatic combination system of clothing parts to blind people: prototype validation. *SENSORDEVICES' 2017 Conference, Rome, Italy*, 10–14 September 2017 (2017)
13. Rocha, D., Carvalho, V., Gonçalves, J., et al.: Development of an automatic combination system of clothing parts for blind people: MyEyes. *Sens. Transducers* **219**, 26–33 (2018)
14. Rocha, D., Carvalho, V., Soares, F., Oliveira, E.: Extracting clothing features for blind people using image processing and machine learning techniques: first insights. In: Tavares, J.M.R.S., Natal Jorge, R.M. (eds.) *VipIMAGE 2019. LNCVB*, vol. 34, pp. 411–418. Springer, Cham (2019). https://doi.org/10.1007/978-3-030-32040-9_42
15. Rocha, D., Carvalho, V., Soares, F., Oliveira, E.: A model approach for an automatic clothing combination system for blind people. In: Brooks, E.I., Brooks, A., Sylla, C., Møller, A.K. (eds.) *DLI 2020. LNICSSITE*, vol. 366, pp. 74–85. Springer, Cham (2021). https://doi.org/10.1007/978-3-030-78448-5_6
16. Rocha, D., Carvalho, V., Soares, F., Oliveira, E.: Design of a smart mechatronic system to combine garments for blind people: first insights. In: Garcia, N.M., Pires, I.M., Goleva, R. (eds.) *HealthyIoT 2019. LNICSSITE*, vol. 314, pp. 52–63. Springer, Cham (2020). https://doi.org/10.1007/978-3-030-42029-1_4