Towards the Creation of a Tactile Version of the Self-Assessment Manikin (T-SAM) for the Emotional Assessment of Visually Impaired People

Abstract:

The *Self-Assessment Manikin* (SAM) is one of the most extensively used instruments in the situational assessment of the emotional state in experimental or clinical contexts of emotional induction. However, there is no instrument of this kind adapted for blind or visually impaired people. In this paper, we present the results of the preliminary validation of a tactile adaptation of the SAM, the *Tactile Self-Assessment Manikin* (T-SAM). For this purpose, 5 people with visual disabilities participated in a focus group in which the usability of this adaptation was evaluated, as well as its usefulness in representing the valence and arousal subscales of the original instrument. The analysis of the content of this focus group suggests a pertinent content validity, while the participants correctly understood both the purpose of the instrument, and the tactile representations of valence and activation constructs created by the research team. However, the difficulty of blind people from birth to understand the graphic representation of an emotional facial expression was detected, which represents a limitation to control in future steps in the validation of T-SAM.

Keywords: emotion, emotional induction, assessment, cinema, audio subtitling

1. Introduction

1.1. What is an emotion?

We all experience emotions. We are happy when we reach our goals or when we receive good news, or we become sad when something that we think is negative for us happens. There is a consensus in considering that an emotion is a set of reactions (cognitive, physiological and behavioural) that are triggered as a reaction to a stimulus interpreted as novel or relevant (James, 1884; Plutchik, 1980). However, historically there has been a debate on what exactly an emotion is, what its components are, and how they interact with each other, to give rise to what we could call emotional experience. Kleinginna & Kleinginna (1981, p. 355) reviewed almost a hundred definitions of emotion available in the scientific literature, and proposed a combined definition that:

> 'Emotion is a complex set of interactions among subjective and objective factors, mediated by neural-hormonal systems, which can (a) give rise to affective experiences such as feelings of arousal, pleasure/displeasure; (b) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labelling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behavior that is often, but not always, expressive, goal directed, and adaptive.'

While there is a broad agreement on considering emotions as a reaction to external and/or internal stimuli as stated by Hilgard, Atkinson, & Atkinson (1979), some authors emphasize the somatic sensations associated with emotions as their main causal agent, while other theorists consider that the thoughts that accompany them are the main determinants of emotion. However, the current perspective is to integrate the components and dimensions of emotion into a complex vision, as postulated by Izard (1977, p. 4):

> 'A complete definition of emotion must take into account these three components or aspects: (a) the experience or feeling of emotion, (b) the processes that occur in the brain and the peripheral nervous system, and (c) the patterns of observable expressive behavior, particularly facial expression.'

1.2. The Model of Peter Lang in the Context of Emotional Assessment

The emotional model postulated by Peter Lang (1988) argues that emotional experience is composed of three fundamental dimensions: the emotional valence (the emotional value, more or less positive or negative that is attributed to the situation or stimulus that triggers the emotion), the arousal or perception of physiological activation induced by the emotion experienced (from not activating at all to extremely activating); and dominance, or feeling of control experienced over emotion (from no control to complete control). Lang & Vaitl (1988), in the context of the validation of a battery of images created to induce emotions called the International Affective Picture System (IAPS), developed an analogue-visual scale called Self-Assessment Manikin (hereinafter SAM), constituted by three subscales (see Figure 1), that evaluate each of the components of the emotions according to the model created by these authors. In these scales, an illustration represents different levels (from minimum to maximum) of emotional valence, arousal and dominance, accompanied by a numerical 9-point scale, that participants have to complete in real time by indicating their assessment in each one of these scales at the precise moment in which they answer the test. In the valence scale this concept is presented as a smiling to unhappy face corresponding the pleasant or unpleasant character of the emotion. In the arousal scale, the face of the avatar goes from very excited to very relaxed. Finally, in the dominance scale, the avatar is represented with a large figure (control) that progressively changes to a small figure (dominated).

For example, the SAM was used to evaluate the affective response elicited by a battery of images that evocated different types of emotions, both positive and negative, from the *International Affective Picture System* (Lang, Bradley, & Cuthbert , 1999), and is a widely accepted test and has been used in studies of emotional induction of various types (Bradley & Lang, 1994; Cuthbert, Schupp, Bradley, Birbaumer, & Lang, 2000; McManis, Bradley, Berg, Cuthbert, & Lang, 2001)

Figure 1. *Self-Assessment Manikin* (Lang & Bradley, 1998).

It is precisely because of its brevity, simplicity and transcultural character (its dimensions are universal, and are not susceptible to being contaminated by cultural values and patterns), that the SAM represents one of the *gold standards* in emotional evaluation, especially in experimental situations of emotional induction, and has been employed prolifically in many studies (Bradley, Codispoti, Cuthbert, & Lang, 2001; Bradley, Codispoti, Sabatinelli, & Lang, 2001; McManis, Bradley, Berg, Cuthbert, & Lang, 2001).

1.3. The Emotional Assessment of Visually Impaired People

Several studies argue that visual impairment has a negative impact on psychological and emotional well-being (Barr, Hodge, Leeven, Bowen, & Knox, 2012), which is manifested in a greater presence of depressive symptomatology (Burmedi, Becker, Heyl, Wahl, & Himmelsbach, 2002), suicidal ideation (Lam, Christ, Lee, Zheng, & Arheart, 2008; Mitchell & Bradley, 2006) and feelings of loneliness (Verstraten, Brinkmann, Stevens, & Schouten, 2005). Essentially, the same psychometric tests used with sighted people are used in the emotional assessment of visually impaired people, but they are presented in braille language, or orally.

In this sense, the psychometric instruments for assessing the emotional state most frequently used in the study of the psychological impact caused by visual disability consist in tests that measure emotional constructs such as depression, loneliness or social support, but do not focus on the assessment of the specific emotion which is experienced by the person in a particular situation. Some of these widely used tests are the Scale of the Centre for Epidemiological Studies of Depression (CES-D), created by Radloff in 1977, and revised in 2004 by Eaton et al. (used, for example, in studies by Rovner, & Ganguli, 1998, or Rovner, & Shmuely-Dulitzk, 1997); the Social Support Questionnaire (Horowitz, & Reinhardt, 2000), or the UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980).

Méndez-Ulrich, Prats-Basset, Yagüe, & Sanz (2016) reported evidence regarding the reliability of this administration modality for several psychometric instruments, due to the fact that Cronbach alfa scores in this modality were very similar to self-administered modality normative values, which is why it can be considered an acceptable procedure for psychological assessment.

On the other hand, the *Nottingham Adjustment Scale (NAS,* Dodds, Bailey, Pearson, & Yates, 1991), which represents the most commonly used instrument to assess quality of life and psychological adjustment to disability, was specifically developed for visually impaired people. The 7 subscales that make up the NAS centre on aspects such as the general emotional state of respondents or their depressive symptomatology. However, in the emotional assessment of people with visual impairment, there is a tendency to use tests that measure the emotional state over an extensive period, and not in a situational way, at the same moment that the evaluation is made, as the SAM test does.

In the same vein, there are several adaptations of the IAPS that could be useful for the emotional induction of blind people, like the one developed by Bradley & Lang in 2000, for emotional induction through auditory stimuli, the *International Affective Digitized Sounds*, *IADS*. These authors had previously also created a list of validated words to induce emotions, the *Affective Norms for English Words*, *ANEW* (Bradley & Lang, 2000). In addition, despite the scarce volume of existing literature on emotional induction through video fragments, Schaefer, Nils, Philippot, & Sanchez (2010) validated a series of movie fragments to induce emotions that could be the basis for designing strategies to improve the adaptation of films for blind people, for example, through audio narration.

However, given the obvious difficulties, and probably because people with visual impairment are a minority, no scale adapted to these people has been created with similar characteristics to the SAM in terms of simplicity and situational nature to evaluate emotional states immediately. It is for this reason that we have proceeded to create a tactile version of the SAM. In this paper we present the preliminary results of the validation of this adaptation, to be used in contexts of emotional induction in people with visual impairment (for example, through sounds, words, or narrated audio video fragments, etc.), which was submitted to the critical analysis of a sample of people with visual disabilities in the context of a focus group.

1.4. Tactile Adaptation of Graphic Contents

People who are blind or visually impaired have to rely on other senses different from sight to relate to the environment surrounding them. In fact, touch is not only a sense common to all but has also been the way people with a sight disability obtain literacy since Louis Braille created his system for writing and reading in the 1820s. However, new technologies that allow written text to be read aloud in the form of audiobooks narrated by a human-voice or with the aid of synthetic voices have given rise to a debate on the importance of this tactile system. While some users defend the use of braille as an access to literacy for the blind and visually impaired and highlight that new technologies, such as refreshable braille readers or screen readers, should improve and support the diffusion and use of braille (World Blind Union, 2017). Others, however, underpin the role of new technologies as facilitators of communication in all kinds of people regardless of the way they interact with information (Brannan, 2013), in the sense that new technologies are also substituting print materials used by sighted users and this has an impact on literacy levels in the sighted population.

However, whereas the written message can be adapted into an aural or tactile form delivering the same content, drawings, images and graphs are items with much more visual content. Proof of that is the implementation and introduction of new systems and gadgets that allow blind and visually impaired users a more autonomous and faithful way to understand such contents. Many researchers have focused on the development of new technologies for the representation of graphs, elements that embrace great amount of information in a small space. For instance, Fritz, Way, & Barner (1996), proposed two different systems that allow for the better comprehension of scientific data combining aural and tactile information; Vidal-Verdu & Hafez (2007) emphasise the elevated cost and quick deterioration of shapeable sheets for the representation of tactile graphs and refreshable displays able to connect to a computer and portray both text and images.

The representation of graphic elements other than graphs has also drawn some attention in academia. Systems that allow for a 3D representation of visual graphic elements have been invented (Shinohara, Shimizu, & Mochizuki, 1998) based on tactor-pins. Similarly, another system is targeted at students for the representation of graphic items in schoolbooks (Petit, Dufresne, Levesque, Hayward, & Trudeau, 2008), which makes use of the STReSS (Stimulator for Tactile Receptors by Skin Stretch) tactile display device (Pasquero & Hayward, 2003). Some years later, other technological systems were created, such as the one proposed in Rotard, Knodler, & Ertl (2005), which connects with web pages and allows zooming and combination with voice-readers, even though some scholars more recently express their concerns about these new tactile technologies and present more simple and straight-forward solutions for tactile representation of graphic content, such as plastic touch plates (Kane, Morris, & Wobbrock, 2013).

From the information found in previous paragraphs, studies on the tactile translation of graphic content have focused on devices, systems and, in general, different ways to portray visual content in haptic adaptations. However, there are few guidelines or recommendations devoted to how these representations should be shown specifically in printed documents. Examples of this are the guidelines provided by the *American Printing House for the Blind Inc.* (1997) and *The Braille Authority of North America* (2011). These two documents aim to shed a light on how graphic elements must be represented in their haptic version. Although they may focus especially on the representation of maps or graphs, there is some information about illustrations or similar representations of reality. Related to the latter, the document issued by the *Tactile Book*

Advancement Group (2006) on the representation of graphical information for young visually impaired readers, which centres chiefly on illustrations and drawings, related to the images shown in the SAM questionnaire is of great interest. Therefore, for the purposes of the present study, the recommendations and instructions related to maps and graphs where they are of secondary relevance, focuses attention on those sections devoted to the general issuance of haptic adaptations and specifically illustrations. From the guidelines here, the following points were observed in the adaptation of the SAM questionnaire:

Elimination: only relevant components are to be portrayed in a haptic adaptation. Stylistic and decorative elements must be removed if no helpful information is provided.

Simplification: very complicated images and graphic elements are difficult to convey in a tactile representation. The main purpose is for the user of the material to comprehend the element shown.

Space. Avoiding clutter: it is very important to leave enough space between elements in order to avoid clutter. The user must easily identify all the elements found in a graphical representation.

2D: all elements in 3D should, where possible, be reduced to 2D. In this regard, The Braille Authority of North America (2011) provides special instructions on the representation of basic shapes in 3D by means of lines with different textures.

Relevant reference based on experience: this applies especially for illustrations based on real objects or concepts. Particularly for children but common to the whole population, a part of the object or concept will provide more understanding than the whole image of that object or concept (Tactile Book Advancement Group, 2006: p. 12)

Consistency: the tactile representations read by the users should be consistent throughout the whole product. That applies to dimensions and textures, as well as to keys and other instructions.

2. Methods

2.1. The Adaptation of the **Self-Assessment Manikin** *Questionnaire*

The original form of the SAM questionnaire has been presented in the introduction of this article. The questionnaire is based on three 1-9 scales that include graphic representations of different dimensions of emotions that support the grades in the scales. It is worth mentioning that the original images are not very complex and that they are portrayed in 2D. Secondly, the different images in each series are correctly separated one from the other, which will avoid clutter, as mentioned in the previous section. Furthermore, the structure of the questionnaire is consistent across the whole questionnaire. The questionnaire, then, already presented qualities that could be suitable for tactile adaptation.

Before talking about the adaptation for a tactile version of the questionnaire it has to be said that for the purposes of the experiments in which such questionnaire would be used, the last scale and corresponding series of images corresponding to dominance were removed. In fact, Lang himself and other scholars do not make use of this dimension in more recent works (J. P. Lang, Bradley, & Cuthbert, 2008; Montefinese, Ambrosini, Fairfield, & Mammarella, 2014). More precisely, the experiments in which the questionnaire was used included a combination with psychophysiological measures that find correspondence in the two first scales, in particular the second one. Therefore, removing the third series was a decision taken based on previous experience that allowed for a quicker understanding of the questionnaire by the participants, thus, reducing the time of the experiment.

2.1.1. Elimination and Simplification

The first step towards the adaptation of the SAM questionnaire (see the questionnaire in Figure 1) was identification of the relevant aspects in the graphic elements of the questionnaire that will convey the meaning of the scale they referred to. The first drafts were done by hand; the main intention was to maintain the essence of the original questionnaire but eliminating redundant and useless information and simplifying that which was useful and meaningful. As it can be seen in Figures 2 and 3, for the first two drafts, in the first two dimensions the body of the avatar was removed, as it is repeated and does not change the meaning of the images. For the third dimension (to be removed in the future) size was the key factor, so the body was kept. The other characteristic common to both drafts was the very clear delimitation between one image and the following using lines. Similarly, the implementation of braille numbers was kept in mind from the very beginning of the adaptation process.

Figure 2. First hand-drafted T-SAM.

Figure 3. Second hand-drafted T-SAM.

Both drafts were to be presented in the focus group. The main differences between the two were the following:

Shape of the faces: for the first dimension it was unclear whether or not the shape of the human faces would be of help when enhancing the comprehension of the scales. The decision to provide this feature in only one of the questionnaires aimed to clarify this issue.

Eyes, eyebrows, nose and mouth: for the second dimension, the body of the avatar in the original questionnaire is repeated with no changes along all the scale. However, changes in the facial gestures of the avatar, albeit small, do change along the scale. It was unclear whether or not including such a feature would be of help to the user of the T-SAM. Again, the removal of this feature was only performed in one of the drafts, so the feature could be clarified during the focus group.

The last scale maintained the same idea since the main concept was the size of the avatar in relation to the framework of each image. Whether to portray a more schematic or real interpretation of a human body was also an issue in the first stages. However, this question was never corroborated empirically since this dimension was removed before the materialization of the questionnaires in their tactile form.

2.1.2. Vectorisation and Digitalisation

Once the ideas were portrayed by hand on paper, they had to be transformed into digitised computer files that could be processed by the printer. The drawings in the sketches were image traced using Adobe Illustrator CS6. The numbers in braille were included replacing the numbers in the original SAM questionnaire. The result of this was the production of two PNG files: Figure 4 corresponds to the sketch in Figure 2 and Figure 5 below corresponds to the sketch in Figure 3.

Figure 4. Vectorised version of the sketch in Figure 2.

Figure 5. Vectorised version of the sketch in Figure 3.

When the last dimension was removed from the original vectorized sketches the results were the following (Figure 6 and Figure 7).

Figure 6. First draft of the questionnaire T-SAM after removal of the third dimension.

Figure 7. Second draft of the questionnaire T-SAM after removal of the third dimension.

2.1.3. Materials and Printing

The two adaptations of the SAM questionnaire were duly prepared for printing out. Printing for haptic purposes normally means elevated costs. The technique used for the printout on paper or paper-related materials is based on the use of moulds that shape the material. The creation of such moulds is expensive and they are not used for the creation of only one or two final products but whole amounts produced in series.

Among the possible solutions considered that could be affordable and practical, the following techniques and materials were considered: negative relief with laser on a hard support, such as methacrylate or wood; positive relief also with laser on a hard support; and the use of resins specifically for braille writing; and finally, the technique used in the final adaptation, the use of UV gloss.

The negative relief was discarded automatically as all guidelines for the creation of reading materials for the blind and visually impaired suggest using some sort of relief, in particular, minimum 1 mm (*The Braille Authority of North America*, 2011). The second object was considered the least affordable option and it may not convey all the tiny details found in the original SAM questionnaire. Resins for Braille purposes were not easy to find and their application was done by specialists in printing houses specialising in haptic printouts for the blind and visually impaired. The final solution and the most suitable to the situation was the use of UV gloss. This material is common in the production of visiting cards and book covers and creates a bright thin layer that highlights the component printed with it. Moreover, it can be used on different materials. In fact, a previous test was carried out on regular paper and relief was also obtained. Printing with UV gloss is widespread.

In order to achieve the desired volume a support which would not absorb the gloss was needed. The material used was foam board that has a plastic surface. The gloss printer was prepared so it had to print the same exact pattern as many times as desired. After printing it with four layers of gloss and checking that the relief was not high enough the final questionnaire was done with seven layers. The gloss is applied right after the printing in black ink, required for those participants who have low vision or are sighted as well (for the future experiments).

3. The Focus Group

The focus group was defined as a preparatory section in the whole development of the experiments which were presented before the Ethics Committee of the Universitat Autònoma de Barcelona and was approved. Participants were contacted by means of an association for young people with disabilities in Barcelona (*Assemblea per la Diversitat*[1]).

3.1. Participants

The focus group was carried out with the collaboration of five participants (n=5) (4

[1]http://www.diversitat.cat/

females and 1 male). Participants were aged between 26 and 51 (mean age 36.4). Three of the participants identified as completely blind, one of them had lost her sight early in life and had university studies (28 years old) and two of them had been blind since birth, and had finished secondary education (47 and 51 years old, respectively). The two other participants identified as having low vision, they could move around without the help of a white cane and could perceive shapes and colours. In this latter group, one had had full vision early in his life (26 years old) whereas the other had had low vision since birth (27 years old). Both had university studies.

3.2. Development

The focus group was prepared to have a duration of around one hour. It was held in a private space in the centre of the city of Barcelona. After receiving the participants, they were introduced with the objective of the focus group and were presented with the informed consent that was both printed and read aloud. The participants were informed that the focus group was going to be recorded and they all gave their consent orally. Afterwards, the moderator (n=1) presented the two tactile versions of the questionnaires and allowed the participants to interact with the material in order to familiarise themselves with it.

After that, a series of questions were asked which were aimed at the assessment of, first, (1) the comprehension of the objective of each one of the two subscales. Later, the questions touched upon each of the scales and the tactile graphic items portrayed. For the first scale corresponding to the dimension of valence the questions concerned (2) the comprehension of the tactile representation of a simplified human face, (3) the difficulty to detect facial features related to emotional gestures (particularly lips and eyebrows), (4) the familiarity of each of the participants with the use of emoticons, since the face represented is an artificial representation of a face very similar to today's emoticons and finally, (5) the understanding of the shape of the face and the usefulness of tiny details as such as eyebrows, eyes and nose for understanding emotional gestures.

Secondly, questions were asked about the second series of images devoted to the dimension of arousal. The first question (1) focused on the understanding of the shapes and the faces found inside the shapes of one of the two versions of the T-SAM, later (2) the interest was placed on the relation between the shapes and the emotional activation translated into the ever-changing edges of the shapes. Since this representation of arousal goes from less to more, an open question about different ways of portraying such gradation (3) was asked.

Finally, the final section of questions embraced the whole questionnaire in general. The first question (1) asked the participants whether the questionnaires could be understood and answered only with the introductory explanation. The second (2) posed a question about which of the two questionnaires was easy to follow and related directly with the third and last one (3) invited the participants to provide their opinion on which characteristics of one or the other questionnaires made the comprehension and completion of the questionnaire easier. It should be remembered that some of the features were unclear so different nuances of them were portrayed in one or the other questionnaire.

The moderator clarified those questions that were not clear with examples or by guiding the participants through the questionnaires in order to highlight the specific feature the question was concerned with. The questions that were initially planned for the focus group were also expanded regarding certain topics, so secondary questions arose during the process. The moderator took notes of everything the participants suggested and at the same time the session was recorded so the researcher could come back to it when required.

4. Results

4.1. Comprehension of the questionnaire and its subscales

Due to the specific needs of people who are blind or visually impaired, it was necessary to provide information not only about the functioning and meaning of each of the two subscales of the questionnaire (as is the case for sighted participants) but also about the physical characteristics of the material. Participants understood the whole questionnaire as well as any other person who is presented the standard SAM questionnaire.

4.2. First Dimension: Valence

Comprehension of the tactile representation of a simplified human face proved to be somewhat problematic. This first question related directly to the familiarity of participants with the meaning and form of emoticons. Whereas younger participants who had low vision or had been sighted in the past quickly recognised the faces and their gestures and their meaning was supported by their comprehension on the 1-9 scale, participants who were completely blind from birth had trouble understanding the faces. Two blind female participants (aged 47 and 51) suggested that for them such images were no support and that they preferred to only have a braille numerical scale and an explanation from the researcher. However, since this questionnaire is designed for all kinds of user, whether blind or with low vision, having both options was the better solution. In fact, the T-SAM questionnaire is also suitable for sighted audiences since its simplification provided a quicker understanding of the tasks.

People with low vision also made some comments. Even if they could perceive the augmented and simplified lines of the faces represented, the relief helped them to understand the images, as well as the frame delimiting each face. They also preferred having the profile of the faces. As far as numbers in the scale are concerned, people with low vision suggested that they could benefit from the inclusion of augmented graphic numbers apart from braille (not all of them understand braille, or at least do not understand it with ease).

Even if blind participants, who were not familiar with emoticons, suggested that they could not understand such representations, they could understand faces and gestures with the guidance of the researcher. However, they made significant recommendations about the artificial representation of facial features:

(1) The profile of the face helped understand the image.
(2) The nose was represented as a tiny horizontal curve and this is very artificial. Blind participants understood the nose as a straight vertical line that separates a face in the middle.
(3) The tears were understood as a sign for negativity.
(4) The mouth, that was shaped as a single line that curved depending on the valence of the emotion brought some problems. Blind participants understood the mouth as two different lines corresponding to the two lips, not to the line formed by this two, which is much visual.

In general, it could be argued that a proper explanation and some guidance around the tactile elements of the questionnaire were the key factor for the understanding of the whole questionnaire. All participants understood their task in this first series of images. It was confirmed that the community embracing blind and visually impaired people is very varied, and that different solutions and options must be included in the T-SAM questionnaire to fulfil all the different needs.

4.3. Second Dimension: Arousal

The first two questions asked in relation to the second dimension were related to abstract representation in the form of changing shapes. Once the meaning of the scale was explained to the participants, those with low vision clearly understood the relationship. Those accessing the subscale solely through touch, required a more focused explanation and some guidance which highlighted the changing feature: the edges of the shapes. Since the images found on this scale are a metaphor of emotional intensities that are based on an abstract concept, it was understood relatively quickly. As far as the faces inside the shapes are concerned, even if participants with low vision perceived no interference for the understanding of the shapes, blind participants required additional information and all participants coincided in the fact that such faces did not carry meaningful information. The participants also showed some confusion with the size of the shapes in the frames. Since in the second version of the T-SAM the size increases progressively, similar shapes could be easier to relate. Participants with low vision pointed out the inclusion of augmented numbers apart from the numbers in braille.

The final task concerning the representation of the dimension of arousal invited participants to provide other ways to represent the grading. A solution was offered based on the use of different materials to convey different textures, from low arousal, related to the state of being calmed, to a high arousal, related to the state of being excited. A scale could be portrayed from a silkier texture, using materials such as cotton or linen, to a coarser texture, such as that of the rope or the sandpaper. The application of such a strategy for the representation of scales presented to blind and visually impaired participants need to be further investigated in research. It was also suggested by participants that touch is also subjective and that not every person would relate a texture with the same meaning.

To sum up, the main recommendation acknowledged in this phase was the removal of the facial features inside the shapes and the inclusion of more textured surface in the final image of this series, as well as the representation of all the shapes with the same size rather that in a progression. Such recommendations were implemented in the last version of the T-SAM (Figure 8).

4.4. The T-SAM and its Two Versions

The initial part of this last phase of the focus group aimed to invite the participants to discuss their whole understanding of the questionnaire when comparing the two versions they were presented with. In general, all participants agreed that once the explanation was given to them and they could interact with the questionnaire, they understood their task and the structure of the two dimensions.

All coincided in the latter version. The explanation can be found in the physical characteristics of the relief between one and the other. The first version of the questionnaire T-SAM (Figure 6) was made with fewer layers of gloss for the relief, while the second (Figure 7) had a better-defined relief. This was appreciated by all the participants whether low-vision or blind. Apart from the more technical characteristics, they preferred the outline of the faces and the removal of the faces inside the shapes in the second dimension.

The changes suggested by the participants in the focus groups were then implemented in the second version of the T-SAM (Figure 7) which was the preferred option. This was the version that was to be used in the experiments. The final result is shown in Figure 8 below.

Figure 8. Final version of the T-SAM.

Finally, all participants acknowledged that even if some of the characteristics were less useful for people with certain specific needs (emoticon-like features of the faces for blind participants), the questionnaire could be used by people with different visual conditions, with the incorporation of the augmented numbers for people with low vision as well.

5. Discussion

Despite the limitations of this work, such as the lack of participants to organise more focus groups and thereby obtain a greater volume of information, the results in this focus group suggest that the adaptation of the SAM to a tactile version is particularly useful, understandable and usable for participants who have low vision or who became blind later in life and have had sight before. This is a step forward the situational emotional assessment of people with visual disabilities, given that to date, there is no instrument with such characteristics targeted at persons with specific visual needs, and emotional assessment is limited to the administration of tests that measure emotional constructs, global and complex, such as loneliness or depression, but not the particular emotion that may be elicited by an emotional stimulus or situation.

The adaptation of the SAM would be less useful, or at least it would take more time to understand, for those who have been blind since birth, particularly when it comes to the identification of facial gestures related to different emotions. This could be explained by the unfamiliarity with the artificiality of the representation of emoticon faces and corresponding emotional gestures.

The previous fact may clash with the validity of the T-SAM and could be conceived as one of the main limitations of the adaptation proposed here, thus having an effect on the responses of blind participants. However, the T-SAM proved to be effective with the inclusion of different tools for the vast panoply of needs the participants may have. Therefore, when participants cannot understand the form of the faces by touch, they can rely solely on the braille numbers and an accurate description by the researcher. For this reason, it is especially important to provide a clear oral explanation of the dimensions of the SAM to the people to whom it is administered, and to ensure it has been correctly understood before use.

As a result of the aspects mentioned in the previous paragraphs and following the present validation of the content of the adaptation some remarks for future research can be made. It would be advisable to continue with the validation of the self-report instrument by means of psychometric validations applying both the classic version and the tactile version of the SAM questionnaire in an emotional evocative context (for example, by means of sounds of video excerpts with emotional content). This could lead to a comparison of the data obtained to test its reliability in people with and without vision disability.

In further research, it also could be interesting to further investigate the validation of the T-SAM in participants who are blind, by using the sound stimuli of the IADS, and thus be able to make a comparison of the emotional assessment obtained through the classic original SAM format, with those obtained in our tactile version presented in this article, which would provide a greater level of validity to this new instrument.

Finally, another relevant aspect for the future development of the T-SAM, is the inclusion of a tactile version of the dominance scale of the SAM questionnaire, in order to have a tactile version analogous to the original test, despite the difficulties that this construct may cause in their validation process.

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