“Smiles, Kids, Happy Songs!”: How to Collect Metaphors with Older Adults

Sabrina Panëels
CEA LIST, Sensorial and Ambient Interfaces Laboratory
91191 Gif-sur-Yvette, FRANCE
Sabrina.paneels@cea.fr

Fanny Le Morellec
CEA LIST, Sensorial and Ambient Interfaces Laboratory
91191 Gif-sur-Yvette, FRANCE
Fanny.lemorellec@cea.fr

Margarita Anastassova
CEA LIST, Sensorial and Ambient Interfaces Laboratory
91191 Gif-sur-Yvette, FRANCE
Margarita.anastassova@cea.fr

CHI 2014, April 26–May 1, 2014, Toronto, Ontario, Canada.
ACM 978-1-4503-2474-8/14/04.
http://dx.doi.org/10.1145/2559206.2581308

Abstract
In the context of an ageing society, vibrotactile wearable devices can open up new avenues for assisting older adults in their daily lives. They can provide information and yet free the hands, ears and eyes, which can be crucial to safety. However, designing intuitive informational vibrotactile messages for and with the older adults has seldom been investigated. This paper describes an initial study involving older adults in the design of vibrotactile messages for a pedestrian navigation application. The design is based on metaphors or everyday analogies in an attempt to strengthen the link between the pattern and its associated meaning. The study presents the method to collect these metaphors, focusing on the difficulties encountered with such an ‘abstract’ task and the steps taken to adapt it to the audience. As a result, a number of metaphors were collected, in line with what matters for older adults (e.g. kids, health).

Author Keywords
Sensory metaphors; haptic pattern design; older adults; navigation.

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces (D.2.2, H.1.2, I.3.6) – Evaluation / methodology, Haptic I/O.

Introduction

As the visual and auditory senses are getting overloaded with information, haptics is increasingly being proposed as an alternative modality to convey information in an ear-, eyes- and hands-free manner. A number of application using vibrotactile feedback and targeting older adults are being developed, in particular in the medical domain. For example, haptics has proven effective in the rehabilitation area, with augmented shoes for alerting users about a potential fall hazard [9] or balance belts to convey gait and posture information [11, 7]. In the navigation field, Grierson et al. [5] demonstrated that healthy older adults could discriminate and follow tactile cueing through a vibrotactile directional belt.

For most haptic applications older adults are not involved in the design of the vibrotactile feedback from the beginning of the design cycle but rather solely in the last stages through evaluations of the final prototype [9, 6, 5]. However, older adults present different challenges than younger people that can impact the design and the perception of the vibrotactile cues such as different attitudes to new technology, sensory impairments, difficulties in extracting information [1], and difficulties in abstract thinking [2]. In the navigation area, most applications have focused on conveying directions [6] using simple intuitive mapping and thus the lack of involvement of the target users was not an issue. However, it can be problematic for other potentially useful non-directional information, often omitted, such as alerts for problems, leisure-related or social information, as it is more challenging to encode into vibrations. In this case the mapping is less straightforward than mapping directions and choosing the right mapping, suitable to the target audience, can impact the learning and recall.

Different approaches have been used in the literature to design complex haptic patterns: perceptually-based design and metaphor-based design. For the perceptually-based design, patterns are chosen depending on their discriminability using multidimensional scaling or musical techniques [8, 3]. Even though these techniques are perceptually efficient, they do not promote the creation of intuitive and original patterns. Moreover, the patterns created are often arbitrarily assigned to the messages they are meant to convey, without any semantic link. In order to ensure the effective integration of haptic patterns into daily life applications, it is important to use stimuli that can assist in their interpretation and recall. One solution could be to strengthen this semantic link between the pattern and its corresponding message, as often done with visual icons. For example, the visual trash icon is based on the real life analogy of "removing" something by throwing it in the trash and can thus be easily recognized.

This is why the other trend is to ground the design on semantic analogies or metaphors, which hold more potential for intuitiveness. In this case, the design of tactile patterns is supported by a symbolic representation shared by a wide range of people (e.g. danger is assimilated to screams, fire, sirens, etc.). As Pirhonen et al. [10] underline, the design success relies on the choice of metaphors. In their study, even though they were then validated with users, the metaphors were chosen by the authors. The choice of metaphors is often arbitrary and not defined by the target users themselves. Therefore, Brunet et al. [4] have proposed an approach where the users are involved as co-designers not only

Study 1	6 [4f/2m]
Study 2	5 [2f/3m]
Study 3	15 [13f/2m]
Occupation	2 working 24 retired
Age range	60 - 92

Table 1. Number of participants per questionnaire and their profile.

M.1	**Reassurance** it is the right way
M.2	Alert of a **problem**
M.3	Alert of the **arrival at destination**
M.4	Inform of a cultural or leisure-related or user-defined **point of interest (POI)**
M.5	Inform of **friends or relatives** nearby
M.6	Inform of **promotions** nearby
M.7	Alert the device is **connected** and functioning

Table 2. List of messages the haptic device could provide.

for the definition of metaphors but also their associated patterns. The process consists roughly of two stages. First, metaphors corresponding to the different elicited messages are collected during face-to-face interviews. Second, patterns corresponding to each message are designed by users based on the collected metaphors and subsequently refined for a final set. However the users they recruited were mostly excluding the 60+ age range. Questions that naturally arise include (1) whether this potential method is replicable with the older adults and (2) whether the older adults share the same metaphors as the younger adults. This paper investigates issue (2) and issue (1) in the early stages.

In a nutshell, the initial work presented here pursues Brunet et al.'s [4] effort in applying the principles of participatory design to the design of haptic patterns, using the metaphor-based technique. In this way, we hope to design meaningful and intuitive messages that can consequently be easily learnt, recalled and accepted by older adults. This paper describes the results of the first phase to collect meaningful metaphors. Our main contribution lies in the analysis of the approaches that did and did not work with the older adults. This feedback can be useful for other researchers in the same field. The remaining sections describe the study and its results.

Evaluation

Objectives

The goal of this study was to collect sensory metaphors for the 7 messages chosen for a pedestrian navigation application (see Table 2).

Participants

In total, 26 participants (19f/7m) took part in the metaphor collection experiment (see Table 1 for their repartition). They were recruited through senior clubs or acquaintances. The average age was 73.54 (60-92). They had a wide range of occupations, from bank employees, cemetery caretaker to head of an advertising agency. 7 participants had experience with navigation systems. Only 6 participants owned a smartphone; 17 had a "standard" mobile phone, mostly to enable their families to reach them or for emergencies, while 3 had none at all. 11 out 26 participants have used the vibration mode of their mobile phones to guarantee discretion.

Procedure

Three interview guides for semi-structured interviews were subsequently employed to collect the metaphors, until the right one was found to gather meaningful results. We further describe them and report on the limitations of the first two as they can help in the design of interview guides targeting the older adults.

STUDY 1 (6 PARTICIPANTS)

It followed the protocol proposed by Brunet et al. [4]. First, the participants were trained, through examples, to associate quickly a metaphor to messages presented verbally by the experimenter. For example, for the message "I feel good", they could propose: "a bubble bath" or "the sound of waves crashing on the beach". They were then presented with the 7 messages the device should convey (see Table 2) with a context describing the situation of future use of the message. The participant was asked to verbalize the metaphors (such as objects, melodies, etc.) that s/he spontaneously associated to the given message. The 7 messages were given in random order. The experiment lasted about 20 minutes.

STUDY 2 (5 PARTICIPANTS)
The training was the same, but the context was removed and solely the message with its description was provided (as in Table 2). The participant was asked: "what spontaneously comes to your mind for this message? It can be sensations, sounds, images, smells or else".

STUDY 3 (15 PARTICIPANTS)
It concretely asked for metaphors for each sensory modality. The new instruction was to provide as quickly as possible which analogies came to mind in relation to the messages for each sense. For each message and for each modality, the following question was asked: "To indicate the message [*message*], what would you like to [feel; see; hear; smell or taste] or what would you associate [tactually, at the body level; as images, signs; as melodies, sounds, noises, music; as smells or at the gustatory level]. A training phase provided examples for three messages ("feeling good", "hurrying up" and "beware of danger").

Results: general tendencies
STUDY 1
In most cases, participants were focused on the context and did not give answers that were generic enough. For instance, for the message concerning a problem (M.2), the context given presented the unavailability of the escalators, so an answer was "stairs". In other cases, participants were not concrete or specific enough, for example for the message "arrival at destination" (M.3), a participant replied "caution", while for "friends/family nearby" (M.4) a participant replied "trust, reassurance". Therefore out of the 39 replies collected, 11 were unsuitable metaphors (~28%). In the remaining cases, participants gave mostly auditory or visual metaphors. This showed that the collection protocol used by Brunet et al. [4] was rather unsuitable for the older adults and needed to be adapted.

STUDY 2
Consequently, the context was removed. However, this method led to even more general and abstract answers, due to the lack of any indications on the types of answer expected. Out of the 34 replies collected, only 6 were suitable metaphors (~18%). Moreover, participants would often provide personal replies, which was also observed with the first interview guide but was more exacerbated in this case. For instance for the message "friends nearby", participants would often answer they currently have no friends or they would provide the name of an actual friend or relative (e.g. "my wife"). Participants were centered on their feelings (loneliness, disease) and behavior (e.g. reasoning and action for problems). These results, though interesting as they provide insights about what preoccupies them, were not really usable for the collection of metaphors.

STUDY 3
Overall, we realized that abstract concepts (i.e. providing generic yet concrete metaphors) were difficult to grasp, and that the task should be made as explicit and easy as possible while still avoiding bias. Furthermore, context should only be provided when answers directly related to this context are needed. Therefore in the final interview guide, metaphors were directly asked for each sensory modality, while the message and context provided remained generic to avoid influencing the answers (as in Table 2). In this case, we obtained much more targeted answers, and it enabled the collection of metaphors for every dominant modality. The olfactory and gustatory metaphors raised more difficulty as they were often not appropriate to the message. In total, 354 answers were

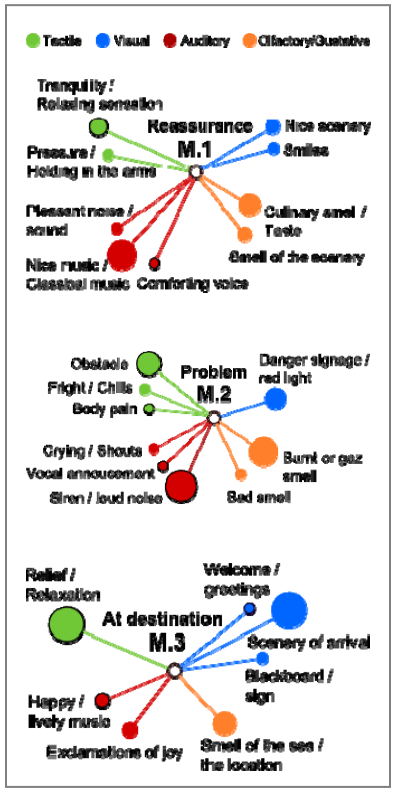

Figure 1: Summary of metaphors given by at least 3 participants. The circles proportionally represent the count of participants for that metaphor. A circle with a black contour indicates the answers from the other groups that were also included. The upper left quadrant shows the tactile metaphors, the upper right the visual ones, the lower left the auditory ones and the lower right the olfactory and gustative ones

collected, of which only 11 were unsuitable metaphors (~3%).

RESULTS: METAPHORS COLLECTED

In total 139 different metaphors were gathered. Figure 1 and Figure 2 depict the answers common to at least 3 people (i.e. same word or idea) and their proportion for each message and for each sensory modality through the size of the circles. We used an ad-hoc similarity analysis which allowed us to combine metaphors according to their similar meaning. The results integrate the results from all the groups. Overall, auditory and visual metaphors are the dominant modalities for common metaphors, not surprisingly as most of the world cues are based on these modalities. Except for M.6 (Promotions) (see Figure 2), all the messages could be related to some tactile metaphors, meaning these messages can be associated to tactile or body sensations. Apart from the gustatory/olfactory modality, the rest of the metaphors can be used in any application using these messages: for example for M.5 (friends/family nearby), the presence of friends (like in Foursquare[1]) could be indicated visually by smiles, auditory with happy songs and tactually with a pattern mimicking the sensation of joy (see Figure 2). For M.2 (problem), a problem could be indicated by a loud noise, a blocking sensation, a burnt or gas smell or a danger sign (see Figure 1). The collection of metaphors for each modality ensures a consistent design of cues for a given message within one or a set of applications.

Compared to Brunet et al.'s results [4], for similar messages, similar metaphors were obtained, further validating commonly shared cultural metaphors.

[1] https://foursquare.com/

Future work

We are currently involving older adults as co-designers for designing the vibrotactile patterns using the collected metaphors. To fully check the repeatability of Brunet et al.'s method [4] and for comparison as well as assessing whether the older adults can be used as co-designers for vibrotactile patterns, the same protocol for pattern creation will be followed and tested. Participants will be first familiarized with the haptic device and the prototyping interface. They will then choose one metaphor per message amongst the metaphors from Figures 1 and 2, shown through text and visuals on slides. Finally they will produce the corresponding pattern with the help of the experimenter who will manipulate the interface. The choice of metaphors will be done amongst the tactile, auditory and visual metaphors collected. Indeed, olfactory and gustative metaphors were removed as they are difficult to transcribe into vibrotactile patterns. Metaphors that are tactile can be rather easily transferred to vibrotactile patterns; so can auditory metaphors [3] mostly through rhythm and intensity. Though it could seem that visual metaphors are not transferrable to haptic patterns, initial results show that users reproduce either the movement from the visual metaphor (e.g. smiling for M1 or greetings for M3) or the action provoked by the visual metaphor (e.g. stopping in front of a sign board to read it for M4).

Conclusion

With the goal of ensuring acceptability of a haptic wristband communicating informational messages, a user-centered approach was adopted for the design of the haptic language in the context of a navigation application targeting older adults. This paper presented the initial work undertaken to involve the older adults in the design of these vibrotactile patterns by collecting the

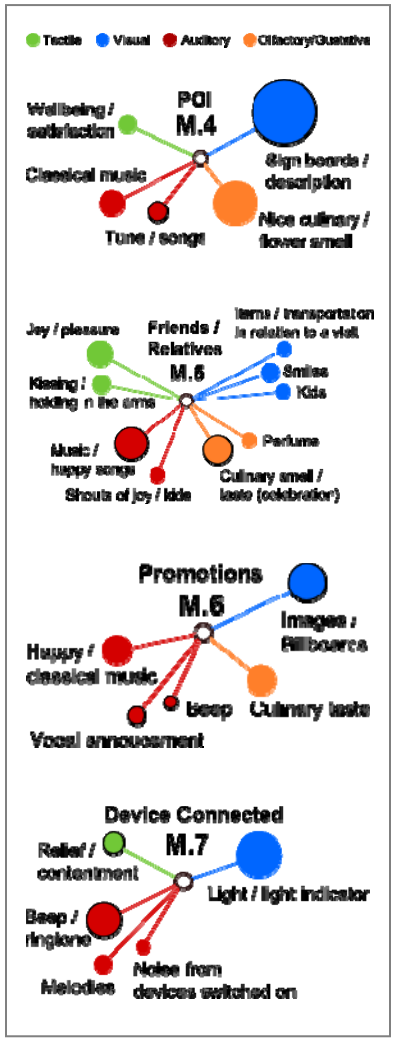

Figure 2: Part 2 of Figure 1.

most common user-elicited metaphors for their definition. The different steps undertaken until reaching a suitable methodology in the study highlighted the difficulties encountered with such an abstract notion to collect meaningful results. In particular, devising the protocol should carefully take into account the impact of introducing "example" contexts and should try being as explicit as possible in the task without introducing bias. The most common metaphors enabled to gather representations in every sensory modality for each message and could be used to create feedback in other modalities. The collected metaphors were also mostly similar to the metaphors gathered with younger adults for similar messages by Brunet et al. [4], thus supporting the existence of commonly shared cultural metaphors. Future work will attempt to further replicate the approach to create a set of patterns suitable for the elderly.

References

[1] J. Allan, C.W. Khong, B. Gilhaum, S. Hall, J. Kerwood, A. Macdonald, N. McNally, D. Nelson, S. Page, S. Stewart, and D. Stovell. The Challenge of Age. Glasgow School of Art, The Foulis Press, Glasgow, 1996.

[2] Paul B. Baltes and Margret M. Baltes. Psychological perspectives on successful aging: The model of selective optimization with compensation. Successful aging: Perspectives from the behavioral sciences, 1:1–34, 1990.

[3] Lorna M. Brown, Stephen A. Brewster, and Helen C. Purchase. Multidimensional tactons for non-visual information presentation in mobile devices. In Proc. MobileHCI 2006, pages 231–238, New York, NY, USA, 2006. ACM Press.

[4] Lucie Brunet, Christine Megard, Sabrina Panëels, Gwenael Changeon, Jose Lozada, Marie P. Daniel, and Francoise Darses. "invitation to the voyage": The design of tactile metaphors to fulfill occasional travelers' needs in transportation networks. In Proc. WorldHaptics 2013, pages 259–264. IEEE Press, 2013.

[5] Lawrence Grierson, John Zelek, and Heather Carnahan. The application of a tactile way-finding belt to facilitate navigation in older persons. Ageing International, 34(4):203–215, 2009.

[6] Lars Knudsen, Ann Morrison, and Hans Jørgen Andersen. Design of vibrotactile navigation displays for elderly with memory disorders. Online at: vbn.aau.dk/en/publications/design-of-vibrotactile-navigation-displays-for-elderly-with-memory-disorders(24b64bac-13d1-4642-b553-f68113821199).html, September 2011. Workshop paper.

[7] Beom Chan Lee. Design and assessment of Vibrotactile biofeedback and instructional systems for balance rehabilitation applications. PhD thesis, University of Michigan, 2012.

[8] K. E. MacLean and M. Enriquez. Perceptual Design of Haptic Icons. In Proc. Eurohaptics 2003, pages 351–363. IEEE, 2003.

[9] B.-A.J. Menelas and M.J.-D. Otis. Design of a serious game for learning vibrotactile messages. In Proc. HAVE 2012, pages 124–129, 2012.

[10] A. Pirhonen, S. Brewster, and C. Holguin. Gestural and audio metaphors as a means of control for mobile devices. In Proc. CHI 2002, pages 291–298. ACM Press, 2002.

[11] III Wall, C., N. D. Lyford, K.H. Sienko, and M. D. Balkwill. The design and development of a production prototype balance belt. In Proc. Engineering in Medicine and Biology Society (EMBC) 2011, pages 3524–3528. IEEE Press, 2011.