Hug Me – A tangible interactive multimedia installation that explores human sentience

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Abstract. Sentience is one of the singularities that distinguish us as humans, and hugging is one of the gestures that may have several feelings behind it. A hug may be associated with feelings of love, happiness, joy or just be a social behavior, among others. This paper describes the concept, validation and implementation of "Hug Me", a tangible interactive multimedia installation that explores human emotions and participants feelings, based on how they hug. The installation consists of a mannequin with sensors that detects when a participant hugs it. According to the characteristics of the hug, it perceives what the participant is feeling and creates an audiovisual ambience in consonance with that feeling. The paper describes also the scientific investigations and validation of the installation.

Keywords: hug, sentience, human, feelings, interaction, tangible, installation.

1 Introduction

Sentience is one of the singularities that distinguish us as humans, and hugging is one of the gestures that may have several feelings behind it. A hug may be associated with feelings of love, happiness, joy or just be a social behavior, among others. Hugging is also an intimate form of touch. In fact, several studies suggest that ever since we are born, the human touch and human hug is essential for our personal development (Stack 2009). Nevertheless, our society now faces a challenge of human touch scarcity, in much due to the social isolation that came along with the widespread adoption of technological communication (Turkle 2011). This social isolation makes us less prone to accept others and ourselves as physical beings, makes us believe that the sense of friendship and belonging is achieved by likes, followers and virtual friends. As an antithetical approach to this new inhibition of touching and hugging, we sought to create an artwork that explores human sentience based on a return to the human hugging, highlighting this tangible act as an initiator of collective memories and social culture.

This paper describes Hug Me, a tangible interactive multimedia installation that further explores human sentience, by inviting participants to hug an anthropomorphized interface which creates a digital ambience representing their sentiments during that hug.

2 Contextualizing

Several realms of digital media and interactive art are significant to trace the area of focus and groundings of Hug Me, namely:

a) Projects that explore the act of hugging as a way of reconnecting people to one another (throughout remote communication). The concept of digital systems recognizing hugs or

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producing the sensation of being hugged is explored in several works, mainly aiming at improving the communication experience between people over long distance. Under these, we should refer Hugvie (Nakanishi et al. 2013), a cushion with a minimalistic human form, meant to be hugged while people are communicating with each other. A microcontroller receiving data from a mobile phone will make the dolly vibrate to recreate the heartbeat, creating a richer communication experience between them. Also, the Like-A-Hug (Wills 2012) project, which is a "wearable social media vest", designed to inflate like a lifejacket when friends "like" a photo, video, or status update on the wearer's Facebook wall. Besides these projects regarding remote connections between people, there are also projects that intend to foster interpersonal social touch. In Hugginess (Angelini et al. 2014), a wearable system based on smart t-shirts with conductive fabric, the hugs are recognized and used to reciprocally exchange digital information during the touch, encouraging people to have physical contact.

b) Projects that explore the act of hugging as a metaphor (a conceptual reflection of connecting people to the artwork). In fact, several approaches have applied the physical act of hugging to create proximity between the participant and the artwork, namely as a metaphor of the symbiotic relationship between humans and the concept that grounds that artwork. We find it on projects such as "oneHug" (Praschak 2010) and "hug@ree" (Mendes, Ângelo and Correia 2011), which seek to amplify the bond between participants and the environment, specifically through the act of hugging.

c) Projects that explore human sentience and sentiments through digital interactive systems. On this field, We Feel Fine is "an emotional search engine and web-based artwork whose mission is to collect the world's emotions to help people better understand themselves and others" (Kamvar and Harris 2011, 117). It searches throughout user-generated content (specifically from blogs, micro-blogs, and social networking sites) for sentences that express user's sentiments and presents them in an interface that allow users to search or browse about these sentiments. It should be noticed that we do not directly address the academic field of sentiment analysis as research in this area has its main focus on algorithms for opinion extraction and categorization (Kamvar and Harris 2011), which is not the focus of our work.

Also worth to call to the context is the field of surrogate human interaction, with affective humanoid social robots that "extend the realm of communication to the machine world by playing the role of humans" and of which some "are designed to trigger human emotions" (Zhao 2006). Although this is not the central focus of Hug Me, it might be an area for future developments, as the act of hugging itself substantially increases oxytocin levels, even when using surrogates, and the oxytocin hormone has an important role in social bonding (Lee et al. 2009).

The research areas exemplified by these works express the wide representation of hugs and sentiments within digital and interactive media. Maybe the extensive exploration of these topics is due to the high significance they have for us as both individuals and social beings. But those technologies are the same setting us apart from the human touch, as supported by Turkle (2014). So, following the statement of Steffen and Bluestone, "the way artists use and misuse emerging technologies in their work can prompt deeper reflection about our society than a two hundred page report written by eminent sociologists can" (2011, 96), Hug Me seeks to engage participants in a deeper reflection about the human sentience that resides in the real interpersonal human relationships.

3 Hug Me

3.1 Concept, pitch and project overview

Hug Me further explores the fusion between the participants and the act of human touch, by creating a virtual representation of participants' feelings based on

Fig. 1. General view of the installation

their hugs. Using sensors on a mannequin, the system understands different hugs and the feelings associated with each of them, based on participants' arms position, the hugging strength and duration. When it senses that a hug is given, audiovisuals with memories associated with the feeling detected are projected around the place where the person and the mannequin are (Fig.1).

3.2 Scientific validation of the concept and contents

The first thing necessary for the project was the scientific validation of the concept, the contents, and user interaction, specifically in four topics, each guiding a research stage (RS):

RS.01 – Understanding which feelings may be implied in a hug;
RS.02 - Understanding how does the human body express each of those feelings.
RS.03 - Understanding how should those feelings be represented (this RS is divided by several others, one for each feeling, following results of RS.01).
RS.04 – Understanding how can a digital system recognize those feelings.

RS.01 – Understand which feelings may be implied in a hug.

During this RS, we sought to understand some basic concepts about the act of hugging, specifically why do people hug, what can a hug mean and which feelings may be implied on a hug.

It might not seem difficult to define a hug. On a basic description, a hug is a form of physical contact between two (or more) living beings, where one put their arms around another and hold him / her closely. This physical contact is usually executed when a person has feelings towards another, or done as a social behavior. The act itself will trigger feelings on both (or all) the persons involved in the act.

Despite the importance of the act of hugging (*e.g.* Bloom 1995, 239), we realized that the correlation between this gesture and human sentiments is sparsely scientifically studied. In fact, an extensive search in all major scientific databases[1] returned very few results related with the act of human hugging and its relation with emotions and feelings, and none that would provide us valuable insights for a comprehensive understanding of the human sentiments implied in a hug. Accordingly, we needed an approach that would allow us to validate a concept of the act of hugging and, more specifically, what may this gesture mean in terms of human feelings. To do that, we conducted a semi-structured interview to a medical doctorate in psychiatry, specialized in human relations[2]. To structure this interview, we previously performed a broad search about the act of hugging in user generated content. Two trained students searched for questions, opinions, sentences and reflections about the act of hugging that people usually make in generalist online platforms, such as blogs and social networks. Our purpose with this search was to assess how the act of "hugging" is expressed and understood in popular culture, and then use the results of that assessment as a base for the interview. As stressed by Hannula, Suoranta and Vadén, "t*he value of studying (popular culture) lies in the fact that (it is) perceived as representing and presenting that reality in which people live and which they produce through their own actions*" (2005, 72.)

The analysis of the interview resulted on a list of broad settings for people to hug:

Setting 1. People hug because they feel in love for each other;
Setting 2. People hug when they share some reason to feel joy or happiness;
Setting 3. People hug when one (or more) of them is leaving or arriving back;
Setting 4. People hug for protection or comforting someone;
Setting 5. People hug in social situations;

Each of these settings has one or more feelings implied. Settings 1 and 2 are directly connected with the feelings implied, namely love for setting 1 and happiness for setting 2. In setting 3, the feeling

1 - *e.g.* Scopus, EBSCO, Web of Science, Science Direct, Google Scholar, Microsoft Academic.

2 - We will keep the anonymity of the interviewed, as sustained by the Statement of Ethical Practice for the British Sociological Association (Britsoc.co.uk 2012), "the anonymity and privacy of (participants) should be respected".

implied is a deep emotional state of nostalgia or profound melancholic longing. It should be noted that this feeling occurs when people are departing, not when they get back together. When people are getting back together, the feeling is of joy and happiness (setting 2). In fact, people do not say "I miss you so much" to someone that is arriving, people rather say "I have missed you so much", which means that the feeling of longing is actually gone by then. Setting 4 (hugging for protection or comforting someone) cannot be considered a feeling. The act is usually done between two persons who have feelings towards each other, but is not a feeling *per se*. For instance, when a mother hugs a child for protection, the feeling implied is (usually) love. Setting 5 may happen for several reasons, but generally implies one of three situations: a) people don't have any feeling, and the hug is only a social behavior; b) people are happy for some reason (for instance, a great notice at the workplace), in which case we have feelings of joy or happiness (setting 2); or c) the hug is not expected or "not welcome" – which creates a situation where one or both parts feel uncomfortable.

Accordingly, with results from the interview, we defined four major feelings that might be implied on a hug: love, happiness, longing and discomfort. Thus, these were the feelings we selected to include in the project.

RS.02 - Understanding how does the human body express each of those feelings.

To understand how human body reacts when giving (and receiving) each kind of hugging, we made a semi-structured interview to a theatre choreographer and teacher in a theatre school. Along with this, two of the participants on the project attended to lessons on a workshop of body language and emotions expression, specifically organized by the same theatre school. The entire interview and the classes were recorded in video for subsequent analysis. From the analysis of the interview and the workshop classes, we reached some outcomes about how the body expresses each of the feelings defined during RS.01. Next, we briefly expound some of the more relevant.

Hugs that are related with feelings of love have a lot of body contact, are strong and durable hugs and the touching area is on the lower back, near the waist. In a hug of happiness or joy, the most important factor is the starting velocity. The bodies embrace and attach to each other very strongly, almost like they are seeking to merge. This is a very intense and strong hug, where the stronger contact is made by the arms and not by the body. Longing hugs are long and with gradually decreasing strength. The areas commonly touched are the shoulders. Uncomfortable hugs are slow, without rhythm, without strength, with the minimum possible contact. Only the upper parts of the torso are slightly in contact, as people try to keep as much distance from each other as they can.

RS.03 - Understanding how should those feelings be represented.

To comprehend how should those feelings be represented, we pursued to assess the popular understanding and imaginary for each feeling, again valuing the inclusion of popular culture. Accordingly, an online questionnaire asking about which memories the respondents associate to each feeling was sent to about 8230 people, of which we received 282 answers. The questionnaire comprised 4 open questions, one for each of the aforementioned feelings, each of them asking "Which memory or situation first comes to your mind if you think about [*the feeling*]". We chose to make only open questions as the objective was for each person to share their personal experience, memories or imaginary. The analysis of responses focused on memories more connected to specific images, possible and real situations, and that were not redundant on feelings. For example, we would not consider an answer like "being in love is to feel the happiest person ever for being with someone" for the love feeling, as it expressed the feeling of love with another sentiment. Also, we excluded images directly connected to hugs, as it would not convey any distinctive view about that feeling (for example, for the love memories, if someone answered "two people hugging"). From this analysis, a total of 111 memories or images were selected: 34 for happiness, 24 for love, 29 for longing and 24 for discomfort.

RS.04 – Understanding how can a digital system recognize those feelings.

From the results of the research made during RS.01 and RS.02, we realized that the main characteristics of the different kinds of hugs are the strength, time and body positions (arms and torso). Accordingly, a digital system is able to understand humans' feelings based on these

parameters of each hug. Hence, the basic system to recognize participants' feelings based on their hugs includes pressure sensors attached to a mannequin (as it will be more natural to participants to embrace an anthropomorphized form) that delivers data to a computational system that decodes the feeling and plays audiovisual contents in the surroundings.

Fig. 2. User hugging

Fig. 3. Room with visuals

3.3 Describing the installation and the participants' experience

Hug Me is an interactive multimedia installation that creates virtual environments according to how people hug. The installation consists of a mannequin, placed on an empty dark room, with a low glowing light and an inscription with the sentence "hug me" written on it, on the top of the mannequin. In the room, there is ambiance music playing all the time, along with voices that call the participant to hug the mannequin.
When the participant reaches the mannequin and hugs it (Fig.2), the system immediately triggers a blinking red LED in the mannequin's chest (the place of the heart) along with the sound of a heartbeat. This feature has a dual purpose:

- it seeks to simulate a heartbeat to create a more realistic experience;
- it provides real-time feedback to the participant. As time (duration) is one of the metrics the system uses to understand the feeling behind each hug, it could not trigger the audiovisual feedback immediately. According to Krueger (1977), "Response is the medium", meaning that interactive systems need to give immediate feedback to users' interactions, otherwise it may become either uncomfortable or confusing to the participant if he/she performs some action without any feedback from the system.

When the system recognizes a given feeling, it triggers the audiovisual contents related with that specific feeling (Fig.3). Also, the system records data from that hug on a database.

Fig. 4. "The room's mood" projection

The data from all the hugs will then feed an application that shows the prevailing sentiments of all participants through data visualization. This application, called "The Room's Mood" (Fig.4) got inspiration from "We feel fine" (Kamvar and Harris 2011). It consists in glowing patterns of different color, created and modified in real time, according to data from the hugs given so far. For each of the feelings, a color has been attributed, according to the colors usually related with it in color psychology literature: pink for love, yellow for happiness, blue for longing, as it has been associated with tenderness and sadness, and grey for discomfort, as it is associated with negative emotions. These options were grounded on finding and recommendations of (Cherry n.d.), (Brave and Nass 2002) and (Hemphill 1996). The patterns are blurry and change slowly in random directions. However, the degree of each color on the canvas is always directly proportional to the

data received from the hugs given by participants. This application is used to change the color of the walls outside the installation location, according to the predominant feelings at each moment. This way, the installation explores the feeling of each participant as an individual (whenever it is hugged and triggers the audiovisuals related with the feeling it senses) but also the feelings of the participants as social humans, whose feelings are interdependent of people around them.

3.4 Audiovisual contents creation

The audiovisual content to be played by the installation was created based on the analysis of the responses to the questionnaires done during RS.03. We filmed 122 scenes for the 111 memories chosen from that research. We also used some clips from YouTube and Vimeo because we wanted to enrich participants' experience with content derived from spontaneous and free online sharing from anonymous users to the (virtual online) world. The few selected clips were under a Creative Commons license and therefore with permission for non-commercial use.

For the editing of the video, we searched in specific web-forums for guidelines for the use of effects on video adequate for each feeling. The final concept for the editing was:

- *Love:* Black and White images, slow movements;
- *Happiness:* use of a yellow glare, with a slightly blurring filter;
- *Longing:* Sepia toned colors, with '8mm camera' effect;
- *Discomfort:* cold toned colors, sharp images, and high contrast;

Fig. 5. Examples of visual aspect of footage after edition for each sentiment

All the videos were edited according to these visual effects (Fig.5). A fact about this editing is that some footage was used for more than one feeling (as the same memory was referred to more than one feeling on the questionnaire answers) and it did actually provided a different sensation (feeling) depending on the effect used (as reported by participants – see point *4. Results on participants' experience*).

The audio for each film sequence was selected from the Mobigratis.com website, a website that provides free music from the catalog of the musician Moby for independent, non-profit videos, films or shorts, via a simple online application system. Two trained students selected music tracks that would fit the video sequences for the representation of each feeling, which were edited (cut) to fit the time of each sequence.

When a sentiment is detected by the installation, it randomly triggers one of these audiovisual sequences, according to the detected feeling (per example, if the sentiment of love was detected for the given hug, it would trigger a random audiovisual sequence about love).

3.5 Implementation and technical overview

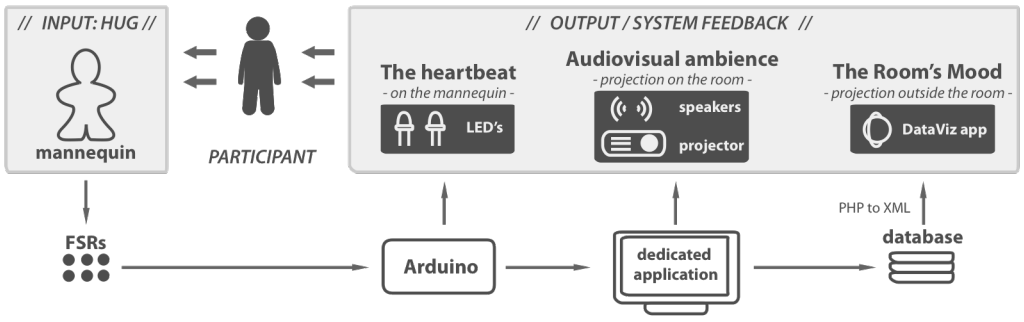

Fig. 6. System technical overview

The technological requisites for the system summarized in Fig. 6 were defined during RS.04.

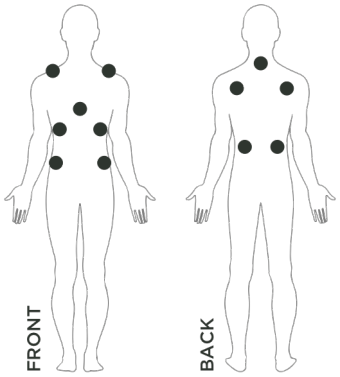

Fig. 7. FSR's positions on the mannequin

Participant's hugs are translated into digital data using Force Sensing Resistors (FSR) connected to an Arduino board microcontroller. The data is forwarded to a computer where an algorithm detects the type of hug based on the pressed areas, the strength and the duration of the pressure. Then, the system plays related audiovisuals and saves the result sentiment in a database that might be used for future analyses and developments. The 12 sensors were placed according to data gathered during RS.02, as seen on Fig.7. According to data acquired during that research, this would be the number and places we needed to measure the three aforementioned characteristics for each hug. During the interaction, the microcontroller also triggers a "heartbeat" on the mannequin (high intensity red LEDs blinking along with sound) with the dual purpose of creating a more realistic experience and delivering immediate feedback to participants.

Using previously saved database data, "The Room's Mood" application generates data visualization with the percentage of hugs for each feeling that is projected outside the room. This application (developed in Actionscript 3) queries the database through a PHP bridge that processes and delivers data in the form of an XML file.

4. Results on participants' experience

The analysis of participants' reactions during exhibitions was made through observation and open questionnaires, and focused mainly on three points: the overall experience (in terms of individual appreciation); the personal perception of the system accuracy; and perceived suitability of contents to represent each feeling.

Results suggest that most of the times the system accurately recognizes the feelings when a hug is given. We say "most of the times", as it should be noted that some participants could not specify the feeling they were having. Many of them answered with sentences that began with "I don't know, maybe it was (…)". Also, these results are prone to bias: if participants were asked after the experience what each of them was feeling whilst hugging the mannequin, chances are that at the time they would be influenced by the experience they just had. On the other hand, if the participants were asked before the experience, it would influence their behavior during the experience and therefore, the way they hug. One future development would be to develop a more reliable measurement instrument to help with the system accuracy.

Fig. 8. Participant embracing and kissing his partner after hugging the mannequin (hug recognized as "love").

Results concerning participants' perceived suitability of contents to represent each feeling are more reliable and suggest that most participants and viewers recognized each digitally created ambience (according to the chosen memories for each feeling) as a correct representation of that sentiment. These results are suggested by both the answers to questionnaires and observation of general bystanders. In fact, participants had a lot of people around them, usually people waiting for their time to hug the mannequin or after that, with curiosity to see others' participation. These viewers would often express or comment with sentences such as "wow, it's happiness" (or any other sentiment) when the audiovisuals were triggered. During our observation time, all these sentences correctly told

the emotion the system was recreating. Thus, we may affirm that people's imagery of sentiments (gathered by self-administered questionnaires – see RS.03) may be considered a reliable source of information for a commonly recognized representation of those specific sentiments.

Last, but not least, one commonly observed behavior of participants after the experience was to go and hug bystanders they were with (Fig. 8). It might be that, in fact, the act of hugging did increased participants' oxytocin levels, developing their pursuing for social bonding, as we have postulated earlier. Or maybe seeing those images of sentiments projected reminded them of what really matters: the importance of physical connection with people they love. Either way, this suggests that the installation did influenced people to go from interact with a digital system to personal human-to-human interaction.

5. Concluding thoughts

Hug Me further explores a connection between participants and what makes us humans: our ability to develop feelings, along with the need for physical contact with the dual purpose of nourish and express them. The anthropomorphized interface of Hug Me, along with the act of embracing it in order to experience the artwork, becomes a metaphor of human sentience. In fact, the way to interact with the installation also becomes part of the piece: when each participant embraces the mannequin, he bonds and merges with the artwork itself. The audiovisual feedback is an expression of the participants' feelings, actively interpreted by the system. The artwork is that feedback: the representation of the participant's feelings (not the physical installation itself). Van Dam said: "I think, therefore the computer gives me what I thought about" (1997, 64). Hug me expands this concept towards the realm of human feelings: I feel, therefore the computer gives me back what I am feeling about. But we agree with Turkle when she says, "*robots can't empathize. They don't face death or know life*" (2014). Digital systems might be able to understand, represent or even mimic sentiments, but we are the ones who really feels them, and that is what makes us humans.

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