Designing for a Rich Emotional Journey through a Game of Riddles Called EmRoll

Farnaz Zangouie, Mohammad Ali Babazadeh Gashti, Kristina Höök*, Tim Tijs, Gert-Jan de Vries**, and Joyce Westerink****

Royal Institute of Technology
Forum 100, 16440 Kista, Sweden
{zangouei,mabg}@kth.se

*Mobile Life @ Stockholm University
Forum 100, 16440 Kista, Sweden
kiah@mobilelifecentre.org

**Philips Research
5656, Eindhoven, The Netherlands
{ tim.tijs, gj.de.vries
joyce.westerink}@philips.com

ABSTRACT

During last few years we have designed several systems to involve users emotionally through physical movements.
In our recent work, we wanted to take the prior works one step further and make use of a combination of movement capture-sensors and bio-sensors, actively involving users' emotional experiences. We have designed a game named EmRoll stands for Emotional Rollercoaster that poses riddles to pairs of players. The riddles can only be solved if the players are, or at least pretend to be, moving according to different emotional states (happy dancing, relaxed breathing and scared reactions). We pick up on movement, breathing and sweat from the two players.

Author Keywords

Affective loop, designing for experience, full body interaction, body tracking, biological sensors

ACM Classification Keywords

H.5.2 Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Research in Neuroscience and Neuropsychology states that physical and cognitive assessment of a situation can aid modulate the emotions which turned out in a subconscious way [2]. Therefore for a powerful emotional experience, both physical and cognitive aspects of emotions need to be addressed [6].

Intense emotional experiences often involve our whole bodies [5]. The emotional involvement through physical movement, we have tried to capture by the idea of an affective loop. Affective Loop is an interaction process where user first expresses her emotion through body gestures or manipulation of an artifact. The system then gives feedback by generating affective expressions. The generated affective feedback of the system affects the user both physically and cognitively, and motivates her to respond affectively. Step by step this interaction feedback cycle amplifies the user's emotional states and makes her more and more involved with the system.

To design this game, we embarked on an iterative user-centered design journey where we created a game named *EmRoll* (Emotional Rollercoaster) that bases its interaction on bodily movement, respiration rate and spontaneous GSR frequency [1].

EMROLL

EmRoll is an affective multiplayer game mainly designed in Adobe Flash CS4 and programmed with Java and Action Script 3. EmRoll is played by pairs of kids, 8-12 years old. They dress up in the costumes that can be seen in (Figure 1, top).

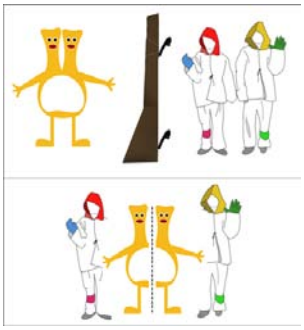

Figure1: (top) Players put on white costume with colored markers on their head, one hand and one leg. By means of two cameras their movements are captured. (Bottom) Each player has control over half of this two headed avatar.

To play EmRoll players stand in front of a big screen on which the game is displayed. There are also two cameras between players and the screen. By means of these two cameras we pick up the colored parts of these costumes and track their movements which in fact make us capable of tracking the movements of each player's head, one hand, and one leg (See figure1, top). During interaction with the game players have respiration sensor around their belly (over or under their costume). On their fingers (on the hand without the color marker) a GSR-sensor is placed. By this mean we can track their breathing rates and sweat reactions.

We use image processing to detect the movements of the mentioned colored markers. Two vision modules send the coordinates of colored markers to a central computer. The central computer also gathers information from sensor via Bluetooth and monitors all input data on screen. This is where we apply error correction and pattern recognition algorithms in order to detect shake, movement and position of markers as well as respiration rate, and derivative of GSR signal. After testing some bio-sensor solutions, we decided to use an off-the-shelf sensor named Nexus-10[1], and as an image processing solution we use a freely available software named CamSpace[2](See figure2).

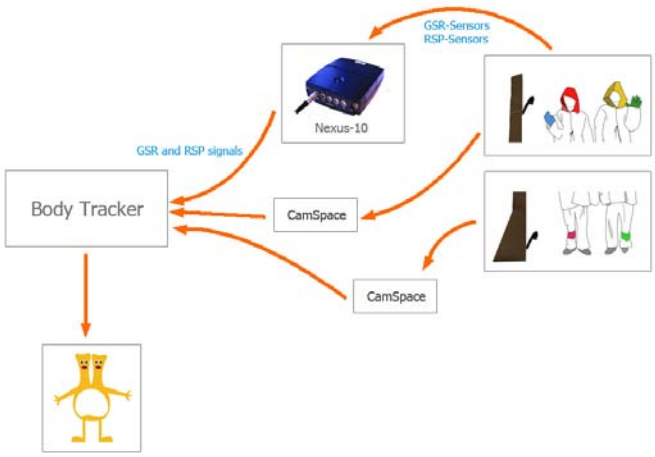

Figure2: We track players' body movements and the changes in their bio-signals

The pair of players share control of a two headed avatar named "Gamboo" on the big screen (See figure3). The avatar has two arms, two legs, but two heads.

One player has control over one arm, one leg and one head. The other player controls the other arm, leg, and head (See figure1, bottom). There is a one to one mapping between the movements of colored markers on the costumes and the movements of the avatar's different parts of body. In fact each player controls the game with those parts of his body that have colored markers on.

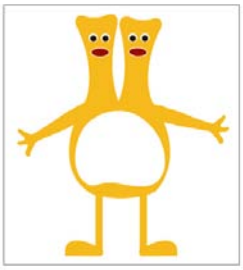

Figure3: Gamboo (The two-headed avatar)

To come up with the challenges of the game, the two players should perform physical actions in a synchronized fashion. At the beginning of the game after wearing the costumes and attaching the sensors, the pair of players is introduced to the whole story of the game through a narrative as follows:

"On a sunny day, Gamboo and his friend were playing in the garden. Suddenly, however, a hungry eagle attacked them and took Gamboo into the sky! The eagle wanted to take Gamboo to his nest to make a delicious meal for his babies!!! Fortunately, Gamboo managed to release himself. But now he is far away from his home (See figure4).

Can you help Gamboo return home to his friends?"

Figure4: Gamboo captured by eagle

The players' first challenge is to find out how to move this avatar and how to make him walk to return home to his friends. They have to move one leg each in turn and in a synchronized fashion to make the avatar move across the scene.

In their way home, Gamboo faces with a sulky purple guy with a spear in his hand standing next to a gate (See figure5). The purple guy prevents Gamboo of passing the gate and continuing his way.

By means of narration we give the players a clue of how to pass through the gate:

"Wow! Look at this purple guy! He looks so sad. I wonder if he lets you pass the door with such a sad face..."

[1] http://www.mindmedia.nl/english/nexus10.php

[2] http://www.camspace.com/

To make the purple guy happy, players should start a happy dancing (from now on we refer to this scene as the Happy Dance Scene).

Figure5: The sulky guy who needs cheering up in order to open the gate.

Their movements are mapped to Gamboo's movements. By moving their heads, arm and legs, each player can make their half of the avatar jump up and down, which in turn makes the sulky guy less grumpy, even starting to dance and finally becoming happy. Then he drops his spear, opens the door and the two players can move on to the next riddle.

The second riddle, involves a spider slowly approaching the avatar (from now on named the Spider scene). The players have to shake it off their body and stomp on it in order to get out of this scary situation. But to succeed and not have yet another spider arriving on the scene, their GSR has to go up – that is their emotional arousal needs to rise (See figure6).

Figure6: Scary spiders attack Gamboo

While approaching the avatar, the spider starts a scary laugh to increase the sense of fear. To make the players even more scared, the spider approaches the avatar in a high speed and climbs up his legs and starts walking over his whole body.

Finally the third riddle happens when Gamboo accidentally falls into the water (The Underwater Scene) (See figure7).

To reach the surface, the two players have to breathe deep, slow, and synchronized with one another. Shallow breathing of both the two players makes Gamboo going up and down under water. If one breathes deeply and the other shallowly Gamboo looses his balance and turns left or right.

The intention behind these three riddles is to take the pair of players from an intense, aroused, happy peak in the Happy Dance scene, through a scary experience in the Spider scene, into a relaxed, deep breath-experience in the Underwater scene.

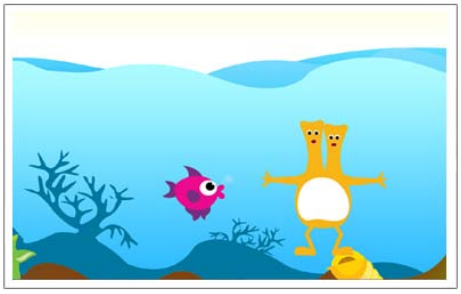

Figure7: Gamboo falls into the water. A helpful fish gives hints on how to breathe to rise out of the water.

EMOTIONAL EXPERIENCE IN EMROLL

Our challenge in Happy dance scene is to distinguish happy movements from other body movements, and to provide affective feedbacks to motivate players in intense expression of happiness. Our final goal is to make players to be involved in an affective loop which may results to experience a warm feeling of happiness that slowly grows inside them.

Inspired by the analysis of shape, effort, and valence [7] we look at the shape of movements and the level of effort to distinguish happy gestures among other movements.

Based on this analysis [7], shape of the movements related to excitement and happiness is extremely spreading, rising and advancing. Waving with hands and making faster movements in the whole parts of body result into higher level of effort and therefore higher arousal. However in this scenario, valence is always positive as the players are trying to express their happiness to the purple guy.

In this case, in order to recognize happy movements among other movements, we should look for the fast movements with spreading, rising and advancing shape.

To find the shape of movements we measure the distance between the colored marker over hand and those over head and leg in each player's costume. The minimum distance between the two shows the position of hands in the space. If the colored markers over hand and head have the minimum distance from each other then the shape of movement is rising. And if those over hand and leg have the minimum distance then the shape of movement is descending.

Based on the speed and the domain of movements in hand, head, torso and leg we categorize effort into three different levels: low, medium and high. The expression of happiness in both of the players should be high in order make the purple guy start a happy dancing along with them.

Otherwise he only smiles or waves his head but the door would not get open.

Our challenge in Spider scene is to check if players are experiencing fear.

Lisetti's and Nasoz's experiments showed that emotions such as fear and stress can increase the skin conductance [3]. Due to this fact, in the system we implemented so far, the GSR measurements are analyzed into level of arousal, simplified into a 5-grade scale, where the extremes on the scale represent a fast change (up or down) in arousal. An extremely fast increase is interpreted as getting enormously scared and fast decrease as getting highly relaxed.

Players' GSR has to go up, and they should experience fear in order not to have another spider arriving on the scene.

We designed Underwater scene for players to get relaxed through deep breathing. Traditional Chinese holistic medicine considers a mutual relationship between emotions and breathing[3] [4]. While some one is anxious, nervous or upset her breathing rate rises and may also becomes erratic. On the other hand, a slow, calm and rhythmical breathing is the result of being relaxed and composed. There is specific breathing technique named "Anxiety breathing technique" which helps people to still their mind and emotions by controlling their breath.

In this technique all inhalations are done through nose; all exhalations through mouth. Inhaling should be commenced slowly, smoothly and deeply to a mental count of 4 seconds. For a mental count of 7 seconds breath should be held. And slowly and smoothly exhaling should be done for a mental count of 8 seconds. This is also called "Four-Seven-Eight Breath Technique".

Inspired by this technique we stage the interaction to motivate players to breathe deep and slow in order to get relax. Using respiration sensor we track players' breathing rate and the extraction of their chest. We categorized their breathing rate into three different levels:

1. Shallow and quick
2. Medium
3. Deep and slow

We map each player's breathing rate to the expansion and contraction of half of Gamboo's torso. The more deeply the player breathes, the more expansion is displayed in the half of Gamboo's torso under her control. Moreover a deep breathing sound is heard while players breathe deeply.

In Underwater scene, in order to come out of water, both players should try to near their breathing rate to "Four-Seven-Eight". In order to motivate them to do so, we benefited from different graphical objects, animations and sound. For instance we added a fish to this scene which follows the "Four-Seven-Eight" rule in breathing. We displayed its breathing through expansion and contraction of its body and some bubbles come out of its mouth (See figure 8).

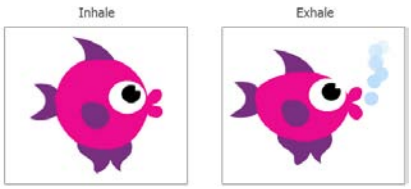

Figure 8: The guide fish in Underwater scene which follows the "Four-Seven-Eight" breathing rule

RESEARCH STATEMENT

The workshop authors have identified five main topics for submissions. EmRoll as a game with affective input for interaction fits in the first topic which is "Related biometric or affective input gaming prototypes".

Our EmRoll design process and iterative testing with users show how bodily expressions can be used to involve players in intense experiences with games. In particular, physical movement and breathing, helped start emotional processes that created for a stronger experience of the narrative in the game. The overall story in EmRoll was a simple, quite naïve, and still our players, got very involved.

REFERENCES

1. Backs, R.W., Boucsein, W. (2000). Engineering Psychophysiology: Issues and Applications, Lawrence Erlbaum, Mahwah, NJ.
2. Banich, M. (2004), Cognitive Neuroscience and Neuropsychology, Houghton Mifflin, Boston.
3. Lisetti C. L., Nasoz F. 2004 "Using Noninvasive Wearable Computers to Recognize Human Emotions from Physiological Signals", EURASIP Journal on Applied Signal Processing 2004:11, pp. 1672-1687
4. Manzoni GM, Pagnini F, Castelnuovo G, Molinari E. 'Relaxation training for anxiety: a ten-years systematic review with meta-analysis.' BMC Psychiatry. 2008 Jun 2;8:41.
5. Sheets-Johnstone, M. (1999). Emotion and Movement: A beginning Empirical-Phenomenological Analysis of Their Relationship, J. of Consciousness Studies, 6,No. 11-12, pp. 259-277.
6. Sundström, P. (2005), 'Exploring the affective loop'.
7. Sundström, P., Ståhl, A., and Höök, K. (2005). eMoto - Affectively Involving both Body and Mind, In Extended abstract CHI2005, Portland, Oregon, USA.

[3] http://www.chinese-holistic-health-exercises.com/anxiety-breathing-techniques.html
http://www.umm.edu/sleep/relax_tech.htm#c