
The Glowing Puppet: A Mirror of Personal and Collective Feelings

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Abstract

In this paper we describe the development and prototyping of an interactive puppet to be used by theater workshop participants to give feedback to the actors.

Keywords

Tangible User Interfaces, improvisational theater, puppet, migrant workers

ACM Classification Keywords

J5. Arts and Humanities: Performing arts (e.g., dance, music).

Introduction

As a group, we are all interested in theater workshops where everybody participates and interacts on a person-to-person basis. Our particular area of focus is "Playback Theater" where a participant tells her tale, and then a group of actors or other participants act it out [1]. With *The Glowing Puppet* we are exploring ways to encourage participants to express their collective feelings and opinions and to bring home a reminder of the workshop.

We have developed a TUI in the form of a hub-and-spoke system of interactive puppets; several "individual puppets" that each participant uses to input her opinions/feelings and one virtual "central puppet" that

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acts as a mediator and representative of the collective input. In addition to this 'collective' use, small puppets become property of the workshop participants, and can be used to express one's feeling through tactile input and to see them displayed on the puppet through light/sound output.

Background

To keep our project grounded, we have worked with a specific 'client' in mind for our puppets: a non-profit organization that runs playback theater workshops among migrant workers in Beijing. This organization uses theater to build the self-awareness and expression of low-skilled migrant workers. Our TUIs must be intuitive, and not require any familiarity with computers. The workshops are a way for participants to bring out and discuss different areas of their lives, from issues at work (discrimination, sexual harassment, contracts not respected, etc) to issues in their private lives (loneliness, but also friendship, courtship, love, etc). Therefore the puppets are intended to facilitate the communication of private thoughts and feelings in a public setting, and to build a bond among people who see each other rarely and who may be very lonely. The workshops are short and sometimes do not have long-lasting effects, so the puppets can enable participants to "bring something home" - both a physical object and a new way of expressing themselves.

Individual Puppets

The individual puppets are small, portable, and have a very generic appearance to discourage discomfort participants may have in "playing with dolls." When used by themselves, individual puppets can be squeezed, to express negative feelings, which will cause the puppet to "scream," or have their nose

stroked, to express positive feelings. The output is a faint glow of the puppet's nose, the brightness of which is determined by the forcefulness of the input.



figure 1. First working prototype of the individual puppet.

When used in a theater workshop, the puppets send their individual input (which, as outlined above, can express positive or negative feelings) to a central puppet, which in turn displays an average of all the puppets' inputs. Thus, if the majority of the puppets inputs positive feelings, the central puppet will output a positive expression, if the majority of the puppets inputs negative feelings, it will output a negative expression. If the audience is split, the central puppet will output a confused expression.

We went through several iterations of the individual puppets' design, trying to map accurately feelings people may express with tangible input and visual/sound output. We faced several challenges. In terms of inputs, we mapped the squeezing of the

puppet to negative feelings (anger, frustration), and observation and users tests with early prototypes confirmed our intuition, but also highlighted how squeezing is often done casually, as a sort of stress-reliever that is not necessarily associated with negative feelings. For positive feelings, we were planning to have a stroke-movement type of input, and did a number of tests on what kind of textiles evoked positive, comforting feelings. The response was unanimous: very soft wool like cashmere was associated exclusively with positive feelings. However, during the implementation phase we did not have the means to translate this finding into reality, as we did not have any sensor that could work in combination with a surface of cashmere. In terms of individual puppets output, we imagined that the puppet would make a noise when squeezed, and glow when stroked. We found the squeeze input-noise output mapping quite natural for users, but the color of the glow was more controversial – there did not seem to be an agreement on what kind of color was a more natural fit for positive feelings. We have not solved yet all these contradictions, as the first prototype of the puppet (described below) shows. However, having a working prototype will allow us to experiment different input-output combinations and adapt future versions of the puppet.

Central Puppet

In our original design, the central puppet was going to be a puppet similar to the individual ones, only bigger, so that it could be seen from afar. It would be positioned behind the actors, so that its output could be seen both by actors, who could take their clues from it, and by the audience, who could assess the collective feelings, and possibly react to them. The central puppet

takes its input from the individual puppets according to the same mapping that works for individual usage: individual puppet owners squeeze their puppet if they want to express negative feelings, and stroke its nose if they want to express positive feelings. The input is sent to the central puppet, which outputs an average of the inputs.

However, as we began to build the puppets, we decided that a central virtual puppet displayed on a computer screen would work better, as it would give us the opportunity to explore more nuanced expressions in the output. This is an important characteristic, since the central puppet is displaying an average of the audience's feelings, and therefore needs a wider variety of expressions than the individual puppets.



figure 2. Grid to map the expressions of the collective puppet.

We did several sessions of brainstorming to create a grid of expressions that would adequately capture different moods, without being too extensive and therefore confusing. The prototype of the central puppet will be discussed below.

Use Cases

Since the beginning of our project, we have tried to keep use cases and scenarios in mind, again in order to keep our project grounded. Many of these scenarios come from direct observation of theater workshops among migrant workers conducted by our client organization last summer, and observed by Elisa. We began with a rather large number of use cases, and in time have simplified them considerably.

The individual usage cases are the simplest: the puppets are an instant mirror of feeling, which responds to the input in real time. The puppets are small enough to be carried around at all times, and can be used as an outlet for feelings that often cannot be expressed in public. A typical scenario would be the following: Lili is a waitress, who has just started her break between the lunch and dinner work shift. Suddenly new clients arrive, and her boss calls her back to work. She tries to argue that she's on break, but her boss yells at her that if she is too lazy to work an extra two hours, she should just find another job. She goes back to work, and in her pocket she squeezes her puppet until it almost breaks. She hears the puppet's noise, which is soft enough to not be heard in the general chaos of other people chatting, but loud enough for her to hear and be comforted: there is someone who understand how she is feeling.

In collective use cases, the central puppet functions as a mirror of public opinion during playback theater performances, and as a Greek choir to the ongoing performance. It can collect anonymous feedback on whether and how to discuss topics that may be sensitive or embarrassing, or can tell actors how to direct their performances. For example, the actors are retelling the story of Lili, a migrant woman in the big city who wants to bring her boyfriend back home to meet the family. The family is against it, because they want her to come back to the village and marry someone local. The actors play the phone conversation between Lili and her father; while they do so, the audience can express their feelings about the performance. The actors can also ask for direct feedback from the audience at certain moments during the performance: "How would you feel if I did this?" asks Lili. This set-up allows a more involved participation of the audience, and a better targeted performance by the actors.

Testing and Prototyping

The puppets have gone through several iterations and we have created rough prototypes for testing. In order to build the individual puppets, we made a few arbitrary decisions regarding both input and output, that build partly on our user observation, partly on our decisions as designers.

The puppet was constructed with several goals in mind. First of all, we wanted to create it out of affordable materials, as these puppets would be used by migrant workers and sponsored by NPOs that rarely have large budgets.

Secondly, we wanted it to be highly tangible, so we thought about embodied feedback and the physicality of touch. The puppet is hand-sized so that it can fit well in one's grip, and was covered with a "gripping" rubber-polyester material such as is used in gloves. Finally, we wanted the puppet to be durable so that it can be squeezed very hard in a satisfying expression of anger without malfunctioning. Balancing this with the sensitivity we hoped to have in the FSRs was one of the primary challenges of construction.

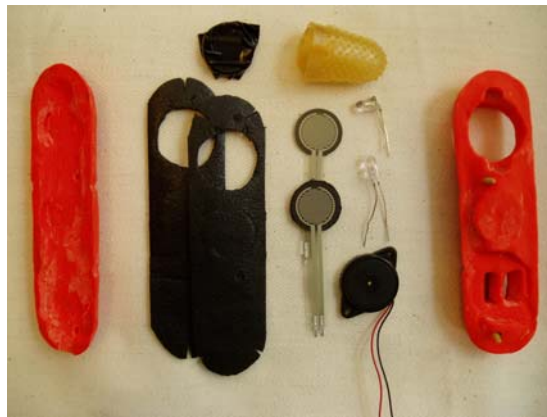


figure 3. Parts of the puppet including plastic body, insulation, "fingertip" , LEDs, FSRs, and Piezo Speaker.



figure 4. Assembly of component parts.



figure 5. Assembly of puppet "skin."

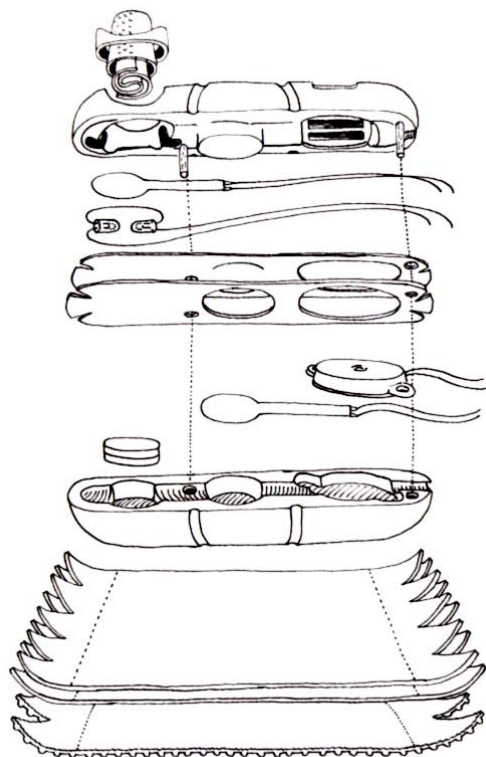


figure 6. A diagram of the puppet.

The puppet's body is made of two forms created with "Sculpey" oven-bake plasticine. The convex and concave inner surfaces direct the force of a squeeze onto the fhrs, even if the squeeze is not directed perpendicular to the surface. However, the curved inner surface was not acceptable for the FSRs, so these lie in flat-bottomed wells. Additionally, the potential of a

sideways squeeze to pull the body apart was countered by two small guide posts. Other internal features include a well and sounding-holes for the Piezo speaker, sockets for the LEDs, and a hole in the bottom through which the wires protruded. The nose was made of modified "fingertips" - rubber tubes available in office supply stores, which were cut to function both as a force-distributor and a light-diffuser. Finally, two layers of insulation were put between the two sides. The shape and thickness of these were carefully adjusted through trial and error to apply the right level of force to the FSRs. The whole body assembly was wrapped in rubber bands, two layers of compressible foam, and a layer of the "gripping" fabric mentioned above.

The Arduino code processed input and sent output to actuators and Processing. The FSRs triggered LEDs and the Piezo (which was custom-tuned to produce an "angry sound") for the embodied feedback portion of our TUI. The most challenging functional part of the code was the relationship between the input gathered by the FSRs and the output variable sent to processing through the serial port. In order to do this we programmed a matrix of different values determined by the correlation of two FSR inputs. We used trial and error to balance the values of the matrix so that the virtual puppet's reactions would be smooth. The Processing code simply received a variable, which mapped directly to the display of a specific image.

The ten facial expressions of the central puppet are based on the combinations of shapes of eyebrows and mouth as to Paul Ekman's facial expression theory [2]. These facial expressions are modeled and rendered by 3DS Max 8.0, then animated by the Processing code according to the puppet's input.



figure 7. Virtual puppet.

Work Distribution and Preliminary Evaluation

The project has evolved from an initial proposal in mid-October to a full-functioning prototype in December. The group work has been very productive and stimulating: we found that our individual strengths were a good complement to each other's, allowing us to be quite productive. We all participated to all the brainstorming that have led to the prototypes presented in class in December. In addition to this, Farley has been particularly involved with the physical construction of the puppet (and its previous mock-ups) and coding, Seung-wan with the central puppet visualization and expressive mapping using processing, and Elisa with users and material testing and write-ups.

The TUI class open house was the first actual test of the puppet. The central puppet output seemed to work

very well: its expressions were very clear, and people would understand immediately the mapping between body and negative expressions, nose and positive expression, mixed input (squeezing and stroking at the same time) and confused expression. Technical problems with the individual puppets prevented a more thorough testing. FSR proved to be very delicate and easy to break, especially when working with the clay we used to create the core of the puppet, so we ended up with only 2 working ones, sufficient for one puppet but not a second one. This prevented us from testing with actual users the averaging of emotions for the central puppet output (which we had tested earlier, using only FSRs without a puppet built around them), and this function was not well understood by testers.



figure 8. User testing the puppet at the open house.

Overall, we are very satisfied with this first prototype. The puppet proved to be quite sturdy and responded well to rough handling. The FSR embedded in its body responded well and in a nuanced-enough way to

different levels of pressure. They were a bit hard to reach, which makes on-the-spot repairs cumbersome, but on the other hand they are well protected and shouldn't be broken easily once they are fixed in place. The nose-pushing input instead of stroking overall worked well, especially because with the very clear central puppet output, it proved quite easy for users to figure out the mapping. Still, we would like to trim the design, and perhaps cover the nose with a soft material, or change the position of the FSR underneath so that it is more responsive to movements from side to side rather than straight-forward pushing. The noise level in the room was such that we could not really evaluate the individual puppets output – the puppet did make a noise when it was squeezed, but it was very hard to

hear, and likewise, the embedded LED blinked, but it was obscured by all else that was going on. The central puppet animation seemed to be very clear and intuitive, and responded well to confusing and contradictory outputs. We might trim the number of expressions, to achieve an even more straightforward mapping between input and collective output.

Again, because of the rather loud and unstructured atmosphere, we are not sure that the usage of the puppet in improvisational theater was clear to our visitors. However, it is in a way a secondary consideration: if the input/output – individual/collective puppet dynamics are clear, the puppet can be used in different situations.

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Citations

[1] "Playback theatre is created through a unique collaboration between performers and audience. Someone tells a story or moment from their life, chooses actors to play the different roles, then watches as their story is immediately recreated and given artistic shape and coherence. Playback Theatre creates a ritual space where any story - however ordinary,

extraordinary, hidden or difficult - might be told, and immediately made into theatre. And where each person's uniqueness is honoured and affirmed while at the same time building and strengthening our connections to each other as a community of people." from the International Playback Theatre Network website, <http://playbacknet.org/about>.

[2] Chapter 5, *Sadness and Anger*, and chapter 9, *Enjoyable Emotions*, in Paul Ekman, *Emotions Revealed*. Times Books: 2003, pp110-147, pp190-212.