Designing Finger Movement On Mobile Phone Touch Screen For Rich Emotional Expression

Bin Zhu* and Haibo Li†
*KTH Royal Institute of Technology, Sweden / China Academy of Art
†KTH Royal Institute of Technology, Sweden
E-mail: binz@kth.se
E-mail: haiboli@kth.se

Abstract— Emotional expression is significant as an essential part in our daily life. Ubiquitous presence of mobile technology-mediated communication creates various affective occasions and affords rich emotional expressions with lower complexity of input. In this paper, we aim to design a simple way of emotional expression through finger movements on mobile phone touch screen allowing for richer affective expressivities. We categorize the visual representations into four types according to their properties of finger movement as a meaningful and corresponding properties of visual representation regarding to consistent with his theory on evolution, which is universal in emotional expression such as facial expression, physical across race and culture [7].

One of the most popular micro-blogging social networking services Twitter allows users to create free and open expressions within 140 words [10]. One reason of their popularities is the simplicity of users’ input and the richness of emotional expression and interaction [11]. As Geser indicates that the cost of communication has nonlinear relationships with the affective bandwidth of the channel and gain in reception. That is to say, lower complexity of making contact may cause richer expressivities. Inspired from the above research, a question is raised that if we can design a simple way of emotional expression through mobile media which allow for richer affective expressivities.

Goffman [12] describes gestures, and positioning as a performance. This kind of performance as a way of expressing ourselves can be read or sensed by technology as well as by other people. Especially, finger movements can express rich emotions in our daily communication. This leaves us with the potential to draw knowledge and innovation from designing finger movement data for rich affective expressivities. We focus on the finger movements that broadly used on mobile phone touch screens in order to explore the possibility of richer emotional expressions with lower complexity of input.

Designers today have access to finger movement data through readily available sensors, for instance, mobile phone touch screen. People get used to use finger gestures to manipulate on touch screen. Rich touch gestures are defined and commonly used. For instance, swipe one finger to move through photos or pinch fingers to zoom in and out of photos.
We use the richness of finger touch gestures more functionally to increase the ease of use. However, finger movements as means of emotional expression are not fully explored, interpreted and designed.

Jung and Stolterman [13] argued that the form of digital materials determined the way we generate, deliver and interpret experiential information. This paper explores how we approach finger movements data captured by mobile touch screen as digital materials to support rich experiences of emotional expression, and in particular how we may facilitate explorations of the visualization of the data for rich and expressive interaction on mobile communication. Inspired by the semantic properties of dynamic body-movement data by Hansen and Morrison [14] we raised a schema that including three core properties of touch-screen based finger movement dynamics. In our design process, we found the form and property of visual representation shapes people’s experience and the expression through their fingers. Kinesthetic representation with its dynamic property can reflect the core properties of finger movement and thus afford the rich expressivity in presenting emotional experience. Thus, we argue to design appropriate and corresponding properties of visual representation regarding to the properties of finger movement.

II. RELATED WORK

Fagerberg et al. [15] designed a mobile messaging service that users wrote a text message and then adjusted the emotional expression of the message through affective gestures based on the shape and effort of movement from Laban’s Movement Analysis as well as valence of emotion from the circumplex model of affect by Russell [16]. The gestures were based on different hand pressure and shaking movements which were captured by an additional interaction device. The emotional expressions were presented back to the user from the system by displaying the expressions in different colors, shapes and animations on the phone. The design indicated that affective systems should support interpretive flexibility, as stated by Boehner et al. [17].

Another finger touch based mobile phone application called CheekTouch [18]. The interaction technique aimed to facilitate more emotional communication while speaking on the mobile phone. CheekTouch used multi-touch finger input to deliver non-verbal cues in the form of vibro-tactile feedback on the cheek. While holding the phone against the cheek the user can provide multi-touch finger gestures on the back of the phone with the same hand holding the phone. These gesture inputs were then mapped by the phone to a predefined tactile pattern which was then delivered to the cheek of the other user. Six different touch patterns were used in CheekTouch for the multi-touch gesture-based communication: Patting, slapping, pinching, stroking, kissing and tickling. Each of these patterns corresponded to a group of emotional meaning.

Today researchers have access to movement-based digital interaction to explore interpersonal, emotional, non-verbal communication. Hansen and Morrison [14] argued the significance of materializing movement as a design material in practice. They developed a tool called Sync for identifying the semantic properties of dynamic body-movement data and visualizing in a readable interface. The movement data was revealed in corporeal and computational qualities. By materializing movement in such way that designers were enable to be aware of abstract data and shaped the movement as a material in a meaning making design process. Rather than static qualities such as location and postures, a movement schema was presented in their research for indicating multi-dimension of movement dynamics.

Focusing on small movement under fingertips, we aim to design through finger movements to help create rich experiences of emotional expression and assist our understanding of finger movement data on touch screen as a digital material in design practice.

III. DESIGN APPROACH

Our design practice adopted a two-phase design methodology. In the first phase, a design workshop was conducted with HCI-experts and participants. We empower participants to create their own materials in user-centered design process. Together with researchers and designers, we came up with several design concepts and sketches during the workshop. In the second phase, current practices were investigated by using qualitative methods of interviews applied to the participants of the study. In semi-constructed interview, the experiences of a closer look at materials and emotional expressivities were discussed and shared. We sought to find parameters for visualization, which can reflect the properties of finger-based touch movement in a variety, rich and expressive ways.

In design workshop six people who were active on Facebook and experienced smartphone users were recruited. Four participants were female, three of them were Swedish and the others were Chinese. The age of participants ranged from 20’s to 40’s. Three participants were students at Royal Institute of Technology in Stockholm. The other three participants had full-time job in Stockholm. We used a small number of users in the study because what we aimed is to investigate in-depth the way people express through finger touch gestures on mobile touch screen.

Participants were required to interact with some of the posted content on Facebook that they found interesting, and express their emotional experiences by using finger touch movement of their own choice, with visual feedback from the smartphone. The visual effects were collected from several existing image processing applications. Alternatively, participants were allowed to sketch visualization on their own. The researchers and designers helped them to implement the visualization. They were asked to use think-aloud method to convey their intension and experience. The think-aloud method has participants continually verbalizing thoughts,
ideas, assumptions, expectations, hesitations and discoveries about the task they are performing. It is one of user-centered methods which utilizes direct participation from users. This method provides us useful insights into participant’s subjective experience during the whole process of design workshop.

IV. TYPES OF VISUAL REPRESENTATION FOR EMOTIONAL EXPRESSION

We classified the visual representation of emotional expression from our design practice into four types according to their form and modality:

Type 1. Static abstract form

Three participants used abstract graphics, for instance, color shape and texture, to represent the movement of fingertips and express the experience on the moment. When choosing the corresponding abstract graphics, they considered more about qualities of the emotion they want to convey. For example, P2 chose silky and soft texture as a background to represent comfort and care to her sick friend. P3 drew wave-like lines in blue and yellow. The color represented Sweden, and also his favorite colors.

“It looks smooth, beautiful and peaceful. Not too much meaning inside but just to match the content my friend posted.”

The way of choosing appropriate representations was mostly influenced by participants’ personal preferences and cultural background.

Some participants left trace of their finger movements on the top of photos by using different filters (Figure 1). Flow and space of the finger movement could be easily recognized through the visual effects.

“I don’t want to say anything, just like fingerprints, to tell my friend that I read it and then leave a mark on her image.”

Type 2. Hand-writing semantic representation

The typical case was one of the Chinese participants using brush and ink strokes to write “Like” (Figure 2). Compared to like button, he felt more expressive to use hand writing to express his admiration for posted content. From his point of view, communicating emotional experience was far more complex than pressing a simple “Like” button or commenting in words.

“Through the material of ink, the longer you hold your finger on the screen, the bigger the brush stroke grows. You can feel the rhythm and strength through the size of each stroke as well as the subtle emotion hidden behind during the whole process of writing.”

Ink calligraphy, in particular, the properties of brush and ink, helped the participant to represent his subtle and dynamic emotional experience. The participant mentioned about rhythm and strength, which were significant dimensions regarding to finger movements and related expressivity. Normal brush strokes cannot grow in size over time so the time dimension of finger movement was difficult to be visualized and perceived.

In this design case, the form of the handwriting not only expressed participant’s experience through rhythm and strength but also indicated the time of writing. From the perspective of the receiver, it was easy to “see” how much time the sender spent.

Five participants preferred the ink-handwritten style instead of typing on keyboard. One of the Swedish participants thought that handwriting was faster and more expressive than typing.

“Compared to a quick click on like button or typing, handwriting implies more care and thoughts. I prefer the way using finger if the screen can be bigger.”

Type 3. Kinesthetic representation

Participants used kinesthetic representation to convey the dynamic property of finger movement. Momentary emotion and ongoing experience was recorded through animation or kinetic avatars. For example, P3 triggered dynamic ripple on the top of texts and image by dragging the index finger (Figure 3). The ripple movement was mapped to finger movement by the repetition and frequency.

Fig. 1 Static abstract form

Fig. 2 Hand-writing semantic representation

Fig. 3 Kinesthetic representation
“The ripples represented my feeling. I don’t know how to describe what exact feeling I have on the moment. The visual effect of water evokes me a sense of flow. I enjoy the process of interacting with the ripple...Fun and beautiful...Feeling is slowly changing over time. And I would like to share the experience through the ripple animation with my friend...”

P6 dragged her index finger to move a virtual furry tail (Figure 4). The tail could express different emotion like an animal’s tail. For example, the tail swung back and forth quickly to express the emotion of happy and exciting. When asked why she designed a tail, she said,

“I used to have a tail-like mobile phone chain, when I use mobile phone I often involuntarily twist it and play with it. So I was thinking what if I have a virtual tail in my phone. It is fun to interact with it with my finger...”

The rich movement of finger touch was easily mapped to the tail movement. Meanwhile, the tail movement reflected the way of finger moves and recorded the dynamic process of interaction experience.

For example, P2 selected a newly born plant to a sick friend. The plant was considered as a symbolic representation of life and hope. P4 selected a kiss pictures to her friend as she described that her friend needs a hug and kiss at that moment. P5 and P6 tapped their fingers several times to generate a bunch of roses and sunflowers on the screen. Visualized flowers had the same meaning of love and blessing as in real life. Symbolic representation triggered meaning from established routines and behaviors. However, the rich qualities of finger movement were not fully mapped for conveying emotional experience. The reason might be that the symbolic visualizations were mostly static.

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V. ANALYSIS

From the design practice, we find that the form and property of visualized representation shaped the way of finger moves. For the purpose of reflecting the rich expressivity of finger touch movement, we argue to design appropriate and corresponding properties of visual representation for immersive experience of emotional expression.

Table 1 A schema for identifying semantic properties of touch-screen based finger movement dynamics

<table>
<thead>
<tr>
<th>Finger movements</th>
<th>Core properties</th>
<th>Description of properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Location in space</td>
<td></td>
</tr>
<tr>
<td>Velocity</td>
<td>The speed of movement in space</td>
<td></td>
</tr>
<tr>
<td>Time duration</td>
<td>Continuation of movement</td>
<td></td>
</tr>
</tbody>
</table>

Inspired by the semantic properties of dynamic body-movement data by Hansen and Morrison [14], we raise a schema (Table 1) that including three core properties of touch-screen based finger movement dynamics: position, velocity and time duration. Position refers to the location of finger touch on the screen. When the visual representation is generated by fingertip and followed the path where the finger moves, it is clear to see the position data from the interface. Velocity refers to the speed of finger movement in space, in particular, the two-dimensional surface on mobile touch screen. This requires us to visualize the rate of change in the position of fingertip rather than the position finger starts or ends to move. Type 2 semantic representation and type 3 kinesthetic representation can present the velocity of finger movement by the change of form regarding to their properties. Time duration indicates the continuation of finger movements.
VI. DISCUSSION

Designing for finger movement-based interactions on mobile phones introduces new notions of materials other than conventional materials for designers. The shift is influenced by software [19,20,21] and screens [22]. From our design approach, we focus on the dynamic, finger touch as a material. In other words, we try to explore how finger movement data captured by mobile touch screen can be experienced, displayed and interacted in order to gain more immersive experience. However, visualization on mobile touch screen is not like the physical material that people can get the tactile feedback and physically play with it. The interaction behavior is restricted by the limited touch gestures recognized by mobile phone screen and the properties of visualized objects.

Thus, when working with finger movement data, it is very important to consider how to map the data and present it in such a way that can visualize the rich properties of finger movement, in order to better convey immersive and dynamic experience.

In the design practice our findings indicate that compared to other types of representations, kinesthetic representation can fully present the core properties of finger movement in a dynamic process. The velocity, position, time and rhythm of finger touch are fully mapped to animation or the movement of avatars. For instance, the animation of ripple indicates how fingers move like the effect of real water touched by fingers. The center of the ripple represents the position of the finger touch. The size of the ripple represents the time duration of the finger holds on the screen. The velocity and frequency of waves are synchronized with the finger movement. We read and feel the finger movement in the similar properties of kinesthetic representations, in particular, velocity, position, time and rhythm. Meanwhile, the dynamic changes in visualized representation provides corresponding dynamic feedback to people that evoke them with various experience over time. And then the experience of interaction influences the way of finger movement later on. It is summarized as “affective loop”[23, 24], which indicates that the system presents the user’s emotional interaction back to the user as feedback, and so further affects the user’s emotional experience. In this sense, making appropriate use of the experiential qualities of visual representation determines finger movement as a meaningful and expressive material. As Fernaeus and Sundström [25] argued in that “from an interaction design perspective, a central challenge is often to make appropriate use of the experiential qualities of the design materials available.”

VII. CONCLUSION

In this paper, we explore the possibility of richer emotional expressions with lower complexity of input in mobile technology-mediated communication. We design a simple way of emotional expression through finger movements on mobile phone touch screen allowing for richer affective expressivities. In addition, we categorize the visual representations into four types according to their modality and then raised a schema that including three core properties of touch-screen based finger movement dynamics. From our design practice, we find the form and property of visual representation shapes the experience of expression and the way finger moves. Kinesthetic representation with its dynamic property can reflect the core properties of finger movement and thus afford the rich expressivity in presenting emotional experience. Thus, we indicate that simple finger movements on mobile phone touch screen can express rich emotional experience. Moreover, we suggest designing appropriate and corresponding properties of visual representation regarding to the properties of finger movement as a meaningful and expressive material.

REFERENCES


