e-Seesaw: A Tangible, Ludic, Parent-child, Awareness System

e-Seesaw: A Tangible, Ludic, Parent-child, Awareness System

Yingze Sun
Design Informatics
University of Edinburgh
Edinburgh, UK.
itstefan217@163.com

Matthew P. Aylett
University of Edinburgh and
CereProc Ltd.
Edinburgh, UK.
matthewa@inf.ed.ac.uk

Yolanda Vazquez-Alvarez
University of Glasgow
Lilybank Gardens
Glasgow, UK.
Yolanda.Vazquez-Alvarez@glasgow.ac.uk

CHI'16 Extended Abstracts, May 07-12, 2016, San Jose, CA, USA
ACM 978-1-4503-4082-3/16/05.
http://dx.doi.org/10.1145/2851581.2892349

Abstract
In modern China, the pace of life is becoming faster and working pressure is increasing often leading to pressure on families and family interaction. 23 pairs of working parents and their children were asked what they saw as their main communication challenges and how they currently used communication technology to stay in touch. The mobile phone was the dominant form of communication despite being poorly rated by children as a way of enhancing a sense of connection and love. Parents and children were presented with a series of design probes to investigate how current communication technology might be supported or enhanced with a tangible and playful awareness system. One of the designs, the e-Seesaw, was selected and evaluated in a lab and home setting. Participant reaction was positive with the design provoking a novel perspective on remote parent-child interaction allowing even very young children to both initiate and control communication.

Author Keywords
Tangible Interface; Interaction Design for Children; Computer-Mediated Communication; Awareness Systems

ACM Classification Keywords
H.5.2. [Information Interfaces and Presentation]: Asynchronous interaction

Introduction

The hope that technology can support and enhance social interactions and improve users' quality of life has been a constant thread within modern human computer interaction (HCI). Changes in society and culture offers the opportunity for both revisiting previous approaches, and generating novel designs to help support new ways of living and working. In China, economic growth and cultural change is occurring at a startling pace. As in the West this has led to families coming under pressure from long working hours, from the need and desire for both parents to work, and often with remote working becoming a requirement. The traditional extended family infrastructure that helped care and support children has also, as in the West, become challenged by the need for parents to work far from their original family home. A constant concern for working parents is maintaining a positive connection with their children and the use of phone, SMS and video chat has become a core asset in dealing with long working hours and remote working [16]. The project presented here is pragmatic in nature and driven by the desire to help support working couples in their social interaction with their young children.

In order to achieve this, first a survey was carried out with 23 working parents, and their 31 children, together with an in-depth interviews of 5 pairs of parents and children. Results from these surveys and interviews were used to inform a set of design provocations. These designs were presented to parents and children and the one receiving the most positive response was then produced as a prototype and evaluated in a lab setting and home environment.

The contribution made by this work is threefold:

1. No previous research we are aware of has explored the issue of remote parent-child communication in China. Exploring user needs in a non-Western culture adds to our broader understanding of the issues and requirements for supporting family connectedness.
2. This work extends Yarosh and Abowd's work [16] which focused on remote parent-child communication where parents were absent for many months. However, we focus instead on separation for more frequent but shorter periods of time.
3. As Massung *et al.* highlight *"little work has been carried out on technology that young children can use on their own, without supervision or the need for adult mediation."* [10]. In this work we focus on a tangible, playful solution, that supports children's needs in preference to an adult requirement of controlling and organising family life.

In this paper, we first consider the background literature on child-parent awareness systems. We then present the results from our parent and child surveys and interviews, the design process, and a ludic, tangible, awareness system - the *e-Seesaw*. Finally, we conclude by considering the e-Seesaw as a pervasive system, a technological probe, and a means of enhancing reciprocal communication between parent and child.

Background

Yarosh and Abowd [16] examined how parents and children respond to work separation and the strategies used by families to stay in touch. They conclude that systems supporting this kind of interaction need to account for the differing needs of parents and children, and support existing communication practises. Two central strategies have been applied to the design space of supporting family communication. On the one hand, awareness systems, (See [9] for a review) which strip down communication, often allowing for asynchronous communication; and on the other, computer

mediated communication (CMC), where current communication systems (for example video chat) are enhanced or augmented with additional technology. In this work we consider only the awareness system approach, for a detailed review of CMC (see [5]). Systems designed for family communication have often emphasised the tangible nature of the design to aid interaction and to enhance a playful or ludic aspect (e.g [6, 2, 11, 10]).

The idea of using technology to increase this awareness of others and to promote cooperative work and social bonding is rooted in early work at Xerox Parc [1]. Previous research has examined how such systems might enhance or support the formation or strengthening of social ties [8], provide affective support [12], or increase intimacy [15], where the concept of *connectedness* is formulated as a contrast to *social presence* or *social communication*. van Bel et al present a potential framework for measuring connectedness [14] where social connectedness at the individual level could be split into *sense of sharing and involvement* and *dissatisfaction with contact quality*. However, as Schmidt [13] points out, the concept of *awareness* can be ambiguous and the motivation for a system can be very varied. In a family context, the affective and practical requirements of systems are often conflated. For example, Brown et al's *Whereabouts Clock*[2], which displayed the approximate location of family members, strove to improve connectedness but also to make available the practical information of where everyone was. The *Presence Light* [6] made elders aware that a family carer was available to offer a sense of connectedness but also to relieve the anxiety of calling when communication was unwelcome.

User Requirements

Cultural differences between the West and China can have a major impact on research methods p.196 [4]. Participants were recruited in Shenyan (the capital of Liaoning province), through personal connections. Two surveys, one for parents and one for children, were created to gauge attitudes to communication technology and the needs and challenges for remote communication.

Surveys

23 parents and their 31 children filled in two surveys. In contrast to van Bel et al [14], which offers a general framework, questions were focused directly on the child parent relationship, for example *Is the time you spend with your parent enough?*. Online presentation (using www.sojump.com) and paper presentation were used depending on user constraints. We present only the key results.

Child Survey (31 child participants, aged 5-10): Results showed that a large proportion, though not the majority, of children feel a degree of loneliness and would like to spend more time with their parents. (*Do you feel alone? Never - 3, not really - 6, a little - 13, often - 7, very much - 2* and *Is the time you spend with your parent enough? yes - 17, no - 14*. When asked *What would you most like to have from your parents?* Talking to parents was rated low (5 responses) compared to material items (Pocket Money - 17), physical demonstrations of love (Hug or Kiss Me - 12), or just spending more time together (21). When asked *What is the best way for parents to show their love?*, over two thirds of the children surveyed felt knowing their parents were thinking about them was important. (*Let me know they are thinking about me - 21, Spend more time with me - 16, A kiss or a hug - 14, Good care when they are not there - 6, Frequent phone calls 6, Heart to heart chat 5*).

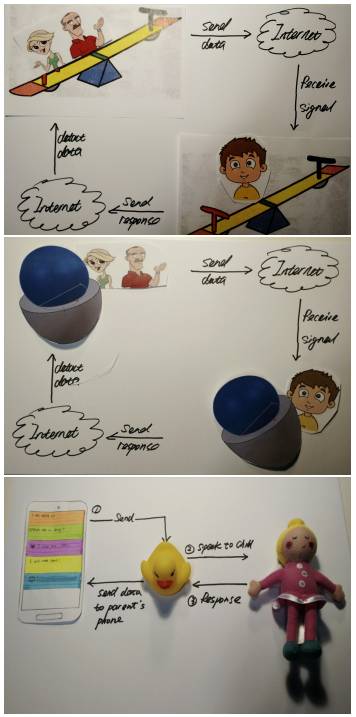

Figure 1: Initial six design ideas in order of preference: Designs 1-3

Parents survey (23 Parents participants, aged between 27-49): Results showed that a smaller proportion of parents to children, but still over a quarter, felt the time they spent with their children was not enough (*Is the time you spend with your children enough? Yes - 9, I'm not sure - 8, No - 6*). Of particular interest when considering results from both surveys is that parents' main means of communication with children when they are not present is by phone (*What is your main means of communication with your children when you are not present? Phone - 14, Video chat - 4, Text message - 3, Social networks - 2*), and yet children scored talking to their parent as low, either as something they desired or as a way of showing a loving connection with them.

Interviews

In depth interviews were then carried out with 5 parents and their children from this original group in the family home with parents and children being interviewed separately.

As the parent's survey showed, the phone was the main form of parent-child communication. However, it became apparent during the in-depth interviews that the primary purpose of the phone was to coordinate family business and was typically not reciprocal in that parents would initiate most calls. (Note: all quotes translated from Mandarin). *"I like to call my daughter to talk to her and sometimes I also send her a instant messages as a reminder of important events."* The use of the phone for reciprocal phatic communication (social communication) can be hampered by context: *"I really enjoy communicating with my son and often want to know all his news from school. But he is only 8 and does not have a phone. So I cannot contact him until I return home form work."*, *"My Father bought me a smart phone as a birthday gift last year, but it is the school rule that phones are prohibited. I cannot take it into class."*, *"My parents are often worried that I'm addicted to mobile games and I'm not allowed to go to school with my mobile phone."*, and by time constraints: *"I have two children and both of them are in primary school. I'm the product manager of my company, I always have a lot of meetings every day and have hardly any time to speak to my sons by phone when I am in the office."* Children value time spent with parents and miss direct contact: *"My Father and Mother are both doctors and very busy, I'm always at home alone playing with my toys."*, *"I really hope we can play together at the weekend or just read to me before I go to sleep every night."*, *"I always look forward to my mother's hugs and kisses. These all make me feel loved."*.

Survey Discussion

Compared to parents included in Yarosh and Abowd's study [16], participants in this study spent less time separated from their children with typical periodic separation being 1-2 days a week in contrast to 1 week a month to entire years. Thus, scheduled synchronous contact with the home (e.g. calling home while on an extended visit) was less common than unscheduled synchronous contact (calling to arrange a pick up time). As with Yarosh and Abowd, there was a lack of consensus between parent and child about what sort of communication was required (e.g. the parental use of the phone despite children regarding phone conversation as a less preferred means of feeling connected and loved). However, there is a big difference between communication required during long work hours, and communication required due to traveling. In Yarosh and Abowd, frequent contact with a traveling parent could be disruptive for the child, hindering their ability to cope with the separation, while in our study the desire to feel close and in communication with a parent working long hours was a common theme supported both by interview and survey data. The most common theme was that children wanted parents to be there and to interact with them. No novel design tech-

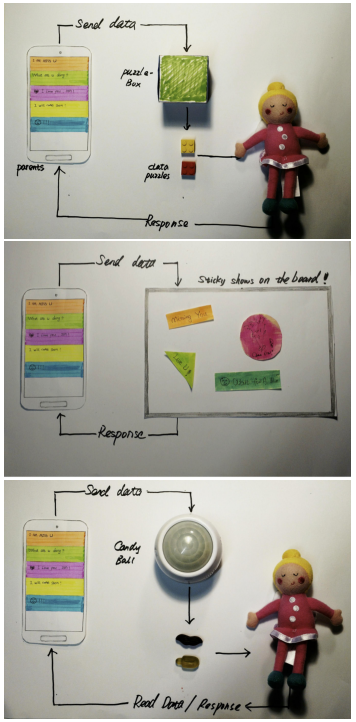

Figure 2: Initial six design ideas in order of preference: Designs 4-6

nology is likely to replace the importance of time together. The challenge is rather to design something that can alleviate a child's sense of isolation while complementing current means of communication using the phone or video chat. Rather than investigating means of extending conventional methods of communication (and taking a computer mediated communication route), the design process we followed focused strongly on the high score *"Let me know they are thinking about me"* was given by children for good ways for parents to show love and affection.

Brainstorming, Design and Implementation

Based on survey and interview results, idea development was driven by a desire for playfulness in order to appeal to children and parents and an attractive tangible interface to offer an alternative to traditional means of communication which is easy for young children to use and supports asynchronous communication for busy parents. The authors brainstormed six design ideas (see Figure 1 and 2). The e-Seesaw (1) and communication ball (2), are simple tangible games that parents and child can play remotely. The smart toy (3) was a talking device that could be partially controlled by the parent. The puzzle box allowed parents to dispense a piece of a puzzle game remotely. The e-Sticky Note (4) acted as a remote notice board (similar to the Scanboard from [6]). The candy dispensar allowed parents to dispense candy remotely. They rated each design out of 100. The e-Seesaw was rated with the highest average of 90.8, the candy dispenser with the lowest average of 69.2.

Design sketches for the e-Seesaw were discussed with two other designers and the final design for the prototype was agreed. The prototype system was based on an Arduino board with an Internet Shield, a 3-Axis Digital Gyro, and a mechanical system that changes the centre of gravity of the e-Seesaw to cause movement. Figure 3 shows the prototype system and an example of its operation. Both e-Seesaws start in the same configuration with one side down and the other up. They are connected across the Internet via internal Arduino boards using a ThingSpeak Channel[3] which allows them to be remote to each other. If a user pushes down his e-Seesaw, the ball bearing rolls to the end of the seesaw keeping it in that position, weights within the device move to match this position, and a signal is sent to the remote device giving the new position. The remote device alters the internal weights which causes the remote e-Seesaw to mirror the movement of the local device. In this way two players can play seesaw with the devices at remote locations. Figure 4a shows the internal mechanics, the controlling Arduino together with the weight mechanism used to tip the e-Seesaw remotely.

Evaluation

Lab Prototype Testing

A second set of ten parents and 6 children were recruited and one-to-one sessions were conducted in a lab environment. Participants were invited to interact with the e-Seesaw, and informally comment on the design and concept. Participants interacted with a pair of connected prototypes for 10 to 30 minutes, with both parents and children interacting for similar durations. Functionality was tested with a series of predetermined actions (e.g. pressing left end of the e-Seesaw, pressing right end of the e-Seesaw). The design was shown to be robust with only one fault occurring when one child shook the prototype somewhat violently. All 10 parents gave positive comments on the interactivity, entertainment and usability of the system commenting that the e-Seesaw offered a novel and simple way to link parents and children together. One parent reported: *"I think that the seesaw idea is amazing. Its physical design is nice and interaction is very interesting. I can even take a mini one anywhere to play with my little child remotely."*

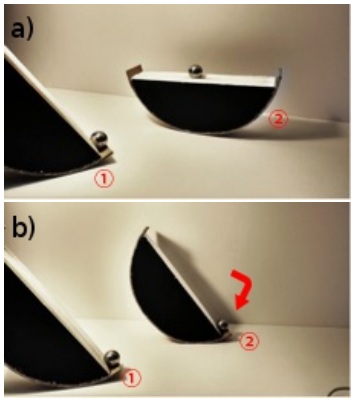

Figure 3: a) (1) The e-Seesaw is pressed down by a user. b) (2) The remote e-Seesaw mirrors the movement of the first device.

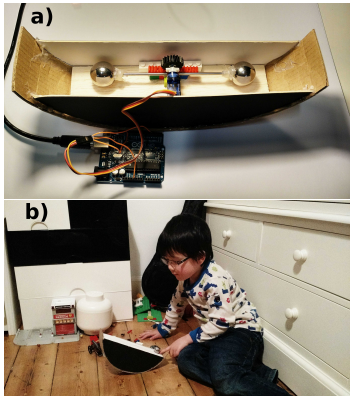

Figure 4: a) The e-Seesaw mechanical system. The . b) The e-Seesaw deployed with a 6 year old participant.

Only one of the 6 children experienced difficulty playing with the e-Seesaw, with some initial confusion. But after a short explanation and demonstration played happily and effectively. One child reported: *"It is just like a toy. I like toys very much."* and another child remarked: *"It is so interesting to play a seesaw with my mother at any time and any place."*

Small Scale Deployment

A field study with two connected e-Seesaws was carried out with two families over a 5 day period. One system was deployed on an 8 year old's desk and the parent's desk in the family home, the other on the floor next to a 6 year old's toys (See Figure 4b) and on the parent's desk in the office. No faults were reported with the underlying mechanics and communication protocol. Both sets of parent-child participants responded positively to the design and deployment of the e-Seesaw. Parents reported: *"I used the e-Seesaw these days, it is an interesting idea of making parent-child communication more playful. Just One finger and a pressing will tell my son I am think about him."*; *"Its mode is very simple. I do not need to hear a phone or see a screen of computer, I just put it on the table of my office, I can play with my son even in my office through simple interaction with the e-Seesaw."* and children reported: *"My mother talks more to me after using e-Seesaw. I play with it and look forward to a response from my mother."*; *"It feels like I am playing a seesaw with my father, but he is working. I enjoy waiting my father for swinging my e-Seesaw."*

Conclusion and Future Work

Our initial survey of parent-child communication showed the mobile phone was the mainstay of communication between parent and child in busy Chinese families where the parents are required to work long hours and be separated from their families. However, results from child interviews suggest the phone does not perform the same function for children as for parents. For children, talking to their parents on the phone is a less preferred way to feel loved and cared for. Overall, the dominant requirement is more time spent with parents. However, knowing their parent is thinking about them is also valued. Based on the results from our study, the e-Seesaw successfully fulfills this requirement.

The use of technology to facilitate and support remote communication can play an important role in maintaining important family bonds. However, many systems perform many roles at once. The phone, for example, can be used to organise family life, for informal communication, or like the e-Seesaw, just to let the child know the parent is thinking about them. The e-Seesaw is a novel technological probe [7] that, by allowing only a very simple communication, can help understand the underlying nature of *connectedness*. Furthermore it shows the importance of reciprocal communication for children. Very often communication technology is controlled and communication is initiated by the adult. Allowing children equal power in the control and initiation of remote communication can facilitate a less formal and potentially more intimate sense of connection.

Acknowledgments

This research was carried out at the Centre for Design Informatics, University of Edinburgh, with additional funding from the Royal Society through a Royal Society Industrial Fellowship.

References

[1] Sara A Bly, Steve R Harrison, and Susan Irwin. 1993. Media spaces: bringing people together in a video, audio, and computing environment. *Comm. of the ACM* 36, 1 (1993), 28–46.

[2] Barry Brown, Alex S Taylor, Shahram Izadi, Abigail Sellen, Joseph JofishâĂŹKaye, and Rachel Eardley. 2007. *Locating family values: A field trial of the Whereabouts Clock*. Springer.

[3] Abel Avitesh Chandra, Yeonwoo Lee, Beom Mu Kim, Se Yeong Maeng, Sang Hyeok Park, and Seong Ro Lee. 2013. Review on sensor cloud and its integration with arduino based sensor network. In *ICITCS*. IEEE, 1–4.

[4] Catherine Courage and Kathy Baxter. 2005. *Understanding your users: a practical guide to user requirements: methods, tools, and techniques*. Gulf Professional Publishing.

[5] Alexandra Georgakopoulou. 2011. Computer-mediated communication. *Pragmatics in practice* 9 (2011), 93.

[6] Debby Hindus, Scott D Mainwaring, Nicole Leduc, Anna Elizabeth Hagström, and Oliver Bayley. 2001. Casablanca: designing social communication devices for the home. In *CHI*. ACM, 325–332.

[7] Hilary Hutchinson, Wendy Mackay, Bo Westerlund, Benjamin B Bederson, Allison Druin, Catherine Plaisant, Michel Beaudouin-Lafon, Stéphane Conversy, Helen Evans, Heiko Hansen, and others. 2003. Technology probes: inspiring design for and with families. In *CHI*. ACM, 17–24.

[8] Panos Markopoulos, Wijnand IJsselsteijn, Claire Huijnen, and Boris De Ruyter. 2005. Sharing experiences through awareness systems in the home. *Interacting with computers* 17, 5 (2005), 506–521.

[9] Panos Markopoulos and Wendy Mackay. 2009. *Awareness systems: Advances in theory, methodology and design*. Springer Science & Business Media.

[10] Elaine Massung, Sarah Dickins, James Torbett, James Holmes, Kirsten Cater, and Victoria Bates. 2015. InTouch Tactile Tales: Haptic Feedback and Long-Distance Storytelling. In *CHI*. ACM, 1289–1294.

[11] Hayes Raffle, Rafael Ballagas, Glenda Revelle, Hiroshi Horii, Sean Follmer, Janet Go, Emily Reardon, Koichi Mori, Joseph Kaye, and Mirjana Spasojevic. 2010. Family story play: reading with young children (and elmo) over a distance. In *CHI*. ACM, 1583–1592.

[12] Natalia Romero, Panos Markopoulos, Joy Van Baren, Boris De Ruyter, Wijnand Ijsselsteijn, and Babak Farshchian. 2007. Connecting the family with awareness systems. *Personal and Ubiq. Comp.* 11, 4 (2007), 299–312.

[13] Kjeld Schmidt. 2002. The problem with awareness': Introductory remarks on awareness in CSCW'. *CSCW* 11, 3-4 (2002), 285–298.

[14] Daniel T van Bel, KCHJ Smolders, Wijnand A IJsselsteijn, and Yvonne de Kort. 2009. Social connectedness: concept and measurement.. In *Intelligent Environments 2009-Proceedings of the 5th International Conference on Intelligent Environments-Barcelona, Spain 2009*. 67–74.

[15] Frank Vetere, Martin R Gibbs, Jesper Kjeldskov, Steve Howard, Florian'Floyd' Mueller, Sonja Pedell, Karen Mecoles, and Marcus Bunyan. 2005. Mediating intimacy: designing technologies to support strong-tie relationships. In *Proceedings of the SIGCHI conference on Human factors in computing systems*. ACM, 471–480.

[16] Svetlana Yarosh and Gregory D Abowd. 2011. Mediated parent-child contact in work-separated families. In *CHI*. ACM, 1185–1194.