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# ‘STEPS’: Walking on the Music, Moving with Light Breathing

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**Abstract**

Recently calm technology has been widely applied. Many cases help to enhance social intimacy among close people. Particularly, the area of family members has opportunities to support feeling of connectedness. We aim to investigate of implication through case study of calm technology to support social interaction. We suggested a mutual communication system; Steps, it supports emotional communion in short time separation. It consists of an attachable device for parents and shoes for children. It helps remote and non-verbal communication in a shopping context. We achieved to solve the worry of safety and fear, curiosity issues by sharing their steps. It is also sublimated from daily activities to pleasurable interaction. It suggested a possibility to extend the application of calm technology.

**Keywords**

Calm technology, Social interaction, Connectivity, Wearable Computing, Ambient Intelligence, Aesthetic User Experience, Interactive Music System

**ACM Classification Keywords**

H.5.2 User Interfaces: Interaction styles (e.g., commands, menus, forms, direct manipulation)

**General Terms**

Design, Human Factors, Performance, Experimentation

### Introduction

As a calm technology has been widely applied to our life, its importance for social interaction among intimate people is also increased. Many HCI technology development cases are investigated for enhancing the intimacy of close relationships such as friends, lovers or family members.

There is a particular opportunity to investigate the new technology for application of social interaction. It is the field of supporting the feeling of connectedness between parents and their children. When they are separated in a distant place, it is important to provide satisfied user experience through constant connectedness and less concerning of safety.

Parents commonly spend enough time with their children to be emotionally closer and to share their feelings together. Despite of this effort, sometimes separating from each other is unavoidable. Families in urban society tend to spend relatively less time with each other. Nevertheless, overcoming this difficulty is not a simple issue.

The moment when parents and children are in a distant place makes stronger feeling of connectedness and concern. Children who need more affection and care miss their parents a lot. On the other hand, it is hard for parents to compromise the safety issue and children's independence issue. In this situation, a useful and appropriate tool for supporting interaction with family members is necessary.

There have not been diverse technologies for social interaction, but many direct ways of communicate are widely spread to our life. Some examples may include

voice message, text message via mobile phone or instant message tool. The direct communication system suggests examining safety issue. However it is not ambient and convenient to connect every time. Also it has difficulty to obtain emotional communed interaction.

The aim of this research understands implication through developing case study that is supporting calm technology for social interaction. To address this issue, we suggest emotional communication system for short time separation between parents and children. Steps is a mutual interaction system to use in mall environment. It consists of a device attaching to cart and shoes for children. It helps to communication of remote and non-verbal between family members.

### Related work

There is some research related to the topic of this paper such as investigation of calm technology, implementation structure and the product's nonverbal expression.

In terms of calm technology, investigations of social connectivity for remote communication have been described by many researchers. When joggers want to jog together, Jogging over a distance [1] helps to connect other joggers by the audio headset which optimizes sound spatialization. Joggers can feel their partner's presence even in distant place. SyncDecor [2] has been developed for the remote couples who want to know partner's condition in routine life. Danielle [3] has explored the design space for supporting the sharing of empty moments by designing *MissU* technology probe. It supports the necessity of designing remote communication tool between couples. Lover's cup [3] has a similar issue of sharing the time

through certain channels in different places. Unlike the couples as a target, some researches explore the curiosity between parents and children like our paper. Safe & sound [5] is a location-aware system to keep their children inside a secure zone. WatchMe [6] is a personal communicator with context awareness in a wristwatch form, in order to keep family always connected via awareness cues and text. These papers explain the importance of social connectedness and concerning each other among family members.

Another issue is the implementation structure, particularly sensing from the shoes. The technical structure of Nike+ iPod [7] has been applied to widely-available commercial shoes; however it was rather personal sensing device than concerning others' presence. In addition, commercialized baby shoes which have the auditory or lighting alarm are not aimed for remote computing for presence awareness.

The issue for nonverbal expression to show one's presence is also related to our paper. Generally, mobile phone, CCTV, Walkie-talkie are tools for direct expression, as they support to communicate verbally. Jogging over a distance [1] and WatchMe [6] can be also supporting tools for ordinary verbal communication. On the other hand, GameLunch [8] is the musical expression that responds to the certain input of ordinary behaviors with simple technology. The aspect of expressing interactive and pleasurable music can be related to our research, as our defined walking pattern changes the musical expression. Besides, our paper also concerns about light expression. Although light is the common expression nowadays, changing light by sensors can be found in MissU [3], Lumitouch [9] or Lover's cup [4].

Although there are many intriguing topics, they commonly propose direct and verbal communication for reducing parents and children's concerns or enhancing social connectivity. Furthermore, the topic of nonverbal expression hardly faces the challenge of safety and curiosity issue, but focuses on the amusement purpose. Our paper can be differentiated as focusing on the emotional communication through the creatively interpreted ordinary behavior. We expect users can naturally acquire the aesthetic experience throughout this process.

### **Design Solution; Steps**

#### *Design Concept Description*

Steps [figure1] is a mutual communication system that can feel steps of parents and children. This system has a non-verbal interaction and remote communication based on walking steps. It supports not only parents' worry of security issue, but curiosity of children so that they obtain playful shopping experience at mall.

The target context is a shopping mall which has a playhouse inside. Going to mall with family members are common occurrence lately. In this situation, sometimes, they spend time separately and the complex place allows remembering as a better experience. Particularly, parents leave their children into the playhouse to avoid a difficult situation that caring children and shopping at the same time.

The core needs of Steps are to solve the children's safety issues of parents as well as curiosity of children while spending time alone. To achieve this, we chose to design new interactive product applied calm technology. To make them feel together, we provide remote communication tool. The feeling of existence share in



**figure 1.** Logo of Steps



figure 2. Shoes for children



figure 3. Speaker for parents

company with each other, thereby they reserved new and imaginative experience in empty moment.

Steps consists of two devices those are available mutual interaction as a set. One device is shoes for children [figure2], they can using that in the playhouse. Another one is a speaker which can be attached to the grip of cart [figure3].

*Value of Steps*

Steps enables various expression of audio-visual, therefore it guarantees pleasurable shopping experience and feel relieved. It offers non-verbal and non-directive communication according to the context, thus unaffected communion is practicable.

The dynamic movement of parents and children unobtrusively perform functions through ambient information. The interfaces are embodied into the product, it is available the natural interaction. Specially, the step movement to make an interactive music, light, and cart movement is mapped. Those mapping is indirect, but it becoming elements to support aesthetic user experience.

On the other hand, it serves the worries of children safety and fear of being alone by display feedbacks of parents and children.

*Usage Scenario*

First, when parents and children arrive at mall, they go to the playhouse. At the playhouse, they gain a paired product set. Children wear the shoes and go into the playhouse, and then parents attach the device and go shopping.

We selected 3 representative movements in the playhouse and mall. The movements of parents are going straight for moving, turn left or right, and not moving for examining an item. The movements of children are walking, running, and sit on the floor for taking a break. More detail movements are as follow [figure4];

Behavior of playing children	<input type="radio"/> How is the music interactively played?
	Music 1
	Music 2: slow tempo
	Music 2: medium tempo
	Music 2: medium tempo + additional musical sound
	Music 2: fast tempo + other type of musical sound

Movement of shopping cart	<input checked="" type="radio"/> How is the light interactively displayed?
	Green blinking LED >> represents the direction
	Blue blinking LED >> represents the speed
going straight	faster  slower
turning	right  left
not moving	speed = 0

figure 4. Instruction of parents' and children' movements

The Steps shoes present children's conditions through the music expression based on the speed of steps. In the walking situation, the speed is expressed as the tempo of a melody. That is, if the children run fast, the music will play at a fast tempo. Also, if children walk



figure 5. Circuit for shoes

slowly, the music will play at a slow tempo. If the children sprint, another musical instrument is added while playing the same song. When the children sit on the floor, another song is played that is recognizable to parents.

The speaker embodied sensor data is transformed into the lights breathing of shoes. The lights consist of center section that is representation of breathing and peripheral section which shows the direction of movement. When parents go straight, the center and peripheral lights are starting. The center light displays the speed of walk. On the other hand, if parents walk fast the, lights turn on and off rapidly. If parents turn left of right, the peripheral lights turn on like a circle so that children are able to recognize their parents' movement. When parents are not moving, only the center light is working silently.

### Implementation

Steps is an audio-visual interaction system with wireless communication. In reality, Wi-Fi system is available to use, however, for this prototype we use a PC and Arduino board to demonstrate.

Arduino mini for shoes is responsible for controlling data of accelerometer, digital sensor, LED, and Xbee is helping to wireless communication to PC [figure5]. Accelerometer and digital sensor examine patterns of movement. For instance, if Z data gap is increasing highly, it means children jump high. In order to reduce errors, digital a sensor was added. If the frequency of data input is fast, the children are moving actively.

Meanwhile, the parents' device undertakes measuring direction and speed of cart movement. It consists of a

Wiimote and Bluetooth speaker. Through the acceleration embodied in Wiimote, the data is collected and send directly to PC.

The data from Wiimote is send to Arduino through Xbee, and it affects the LED light. The accelerometer and digital data is controlled on MAXMSP and the sound is send to the Bluetooth speaker.

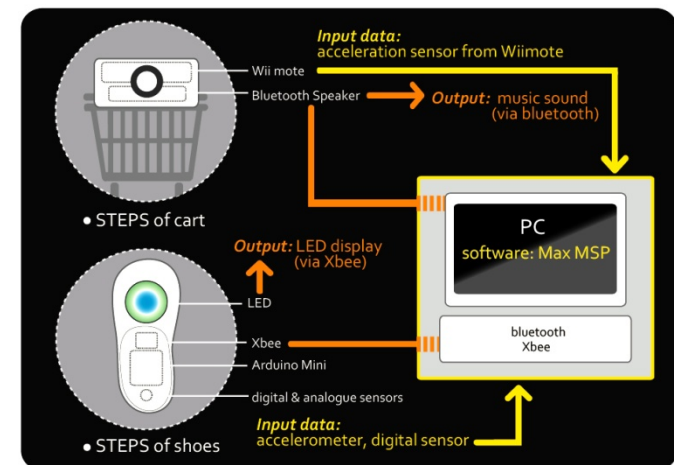


figure 6. System diagram of Steps hardware and software

### Discussion

This research is expected to enhance a new type of communication between family members. The possibility of extending the application is positive.

However, to understand the implications of this system, it is necessary that preliminary feedbacks from users. User study for measuring effectiveness of non-verbal communication is crucial. Also it needs to verify the

usability such as appropriate volume level or the needs of sending message function.

### Conclusion

This research supports to enhance intimacy between parents and children, by developing a new, interactive communication system. In the Steps case, we presented new needs, approach, and product through non-verbal interaction.

We achieved to solve the worries of safety from parents, and also curiosity issues from children who spend time alone in a new place. By sharing their step movement, they feel emotionally connected while spending time separately.

It is sublimated from daily shopping activities to pleasurable interaction. Therefore, family members are able to commune their emotional status without inconvenient activities. It is productive result that discovering emotional disconnects context and designing application applying notion of calm technology.

For future work, applying this mutual communication system to other context expected to discover new pleasurable solution. And also as the possibility of applying calm technology is extended, thus it is a forte to researching this area.

### Reference

[1] F. F. Mueller, S. O'Brien, and A. Thorogood. Jogging over a distance: supporting a "jogging together" experience although being apart. In *CHI '07: extended abstracts on Human factors in computing systems*, ACM Press (2007), pages 2579–2584.

[2] Tsujita, H., Siio, I., and Tsukada, K., SyncDecor: appliances for sharing mutual awareness between lovers separated by distance. In *CHI '07 Extended Abstracts on Human Factors in Computing Systems. CHI '07*. ACM, New York, NY (2007), 2699–2704.

[3] Lottridge, D., Masson, N., Mackay, W., Sharing empty moments: design for remote couples, Human factors in computing systems. In *Proc. CHI 2009*, ACM Press (2009).

[4] Chung, H. Lee, C. H., Selker, T., Lover's Cups: Drinking Interfaces as New Communication Channels. In *CHI '06 extended abstracts on Human factors in computing systems, alt.CHI session (2006)*, pp. 375 – 380.

[5] Marmasse, N., Schmandt, C., Safe & Sound: a wireless leash, *Extended abstracts of CHI 2003 (2003)*, pp.726 -727.

[6] Marmasse, N., C. Schmandt, and D. Spectre. Watchme: Communication and Awareness between Members of a Closely-Knit Group. In *Proceedings of UbiComp (2004)*.

[7] T. Saponas, J. Lester, C. Hartung, and T. Kohno, "Devices that tell on you: The nike+ipod sport kit," Dept. of Computer Science and Engineering, University of Washington, Tech. Rep., November 2006, <http://www.cs.washington.edu/research/systems/privacy.html>.

[8] P. Polotti, S. Delle Monache, S. Papetti and D. Rocchesso, "Gamelunch: Forging a Dining Experience through Sound", *Proc. Conf. on Human Factors in Computing Systems (CHI)*, Florence, Italy (2008). <http://www.vimeo.com/874774>

[9] Chang, A., Resner, B., Koerner, B., Wang, X., and Ishii, H., LumiTouch: an emotional communication device. In *Ext. Abstracts of CHI 2001*. ACM Press, New York, NY (2001). 313-314.