

Digital Kick in the Shin: On-body communication tools for couples trapped in face-to-face group conversations

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ABSTRACT

In this paper we explore ensembles of on-body devices designed to support private, intimate, communication in public settings. We introduce a mobile system design concept entitled “Digital Kick in the Shin” (Digikits) that enables individuals in an intimate relationship to subtly send alerts to their partner with the intent of prompting action in a face-to-face conversation. We present a brief survey of intimate technology design literature and conclude with several conceptual designs that explore a range of different input and output configurations in this space.

Keywords

Mobile input, input devices, intimacy, collocated use

Categories and Subject Descriptors

H.5.2 [User Interfaces]: Input devices and strategies

1. INTRODUCTION

We are currently exploring the use of ensembles of mobile technology to augment face-to-face communication for collocated groups of on-the-go users [2, 3, 18]. As part of this research initiative we have been examining within (as opposed to between) group communication in which every member of a collocated group has access to communication technologies used by the group. In this paper we break from the assumption that everyone has the same technology to explore a more common situation where only a subset of the members of a group have access to a particular communications platform. In this case, we are investigating the use of communication technologies by two persons in an intimate relationship (partners, husband/wife, girlfriend/boyfriend, etc.) who are engaged in a face-to-face conversation with a larger group of collocated individuals. We are in the early stages of designing systems to enable couples to more easily communicate with each other while engaged in larger face-to-face group communications. This paper presents preliminary ideas on how to think about the use of distributed ensembles of communication technologies for transmitting intimate communications between couples.

In this paper, we present a brief survey of intimate technology design literature and then discuss several con-

ceptual designs that explore a range of different input and output configurations that can be used to explore intimate communication between couples in larger collocated groups.

2. RELATED WORK

The field of intimate technologies is an emerging area of HCI research. In an early paper on the topic of intimate technologies entitled “Mediating Intimacy: Designing Technologies to Support Strong-Tie Relationships” Vetere *et al.* state:

“Studying intimacy is challenging because intimate acts are ephemeral and transient yet ubiquitous and crucial to the ongoing life of an intimate relationship. They form the material and background of close personal relationships, yet occur in the doing and then often vanish unremarked. While the informational content of intimate acts may be low and seemingly trivial to outsiders, the act itself can be laden with emotional significance for those involved...Much of what passes between intimates is unsaid and premised on deep knowledge and understanding of one another and occurs in the context of a rich, shared and sometimes idiosyncratic view of the world that may be difficult for others to fathom and comprehend.” [20].

This work along with the works of Kaye *et al.* [11, 12] has introduced the concept of intimacy as a valid subject of study to the HCI community. Though there has been much recent work investigating intimacy in mediated communication [6, 7, 14, 17, 21], most of this work has explored communication over a distance. We are unaware of any work that has examined technologically mediated intimacy in face-to-face communication.

In this paper we explore ensembles of on-body devices designed to support private intimate communication in public settings and introduce a mobile system design concept entitled “Digital Kick in the Shin” (Digikits) that enables individuals in an intimate relationship to subtly send alerts to their partner with the intent of prompting explicit action in a face-to-face conversation.

3. DIGITAL KICK IN THE SHIN

The “Digital Kick in the Shin” system (Digikits) is designed to be a light-weight, subtle, mobile communication system capable of delivering low-level communications

between intimate partners when they are engaged in face-to-face conversations in a group of collocated individuals. The system is designed to carry a message from one member of a couple to their partner with the intent of signaling the partner to take an action of some sort in the conversation. Messages of this sort are often currently communicated between partners when one partner physically sends a signal via semi-private facial expression, gesture, or physical interaction such as squeezing hands or kicking the partner under a table. These subtle signals for action usually are intended to request cessation of a conversation, moderation of a conversation, or are a prompt to initiate a prearranged activity.

3.1 Unmediated Scenario

The following scenario illustrates an unmediated interaction as it might occur today: Bob and Alice are out for the evening taking their new dog for a walk in the neighborhood. From a distance they see a group of neighbors engaged in conversation and realize that their walk will take them directly passed these neighbors. Knowing that Bob has a paper deadline that evening, Alice and Bob make hasty arrangements to enter into the conversation with the intention of excusing themselves at the earliest possible moment that would be socially acceptable. They engage in conversation with their neighbors and have a pleasant chat. After a while, Bob is thoroughly engrossed in the conversation and appears to have forgotten his paper deadline. Concerned for his wellbeing, Alice begins to subtly squeeze Bob's hand. She does this to remind him that they had agreed to exit the conversation early so that he could get back to work. Unfortunately, Bob does not immediately notice Alice's subtle signal. This presents Alice with the choice of either continuing to try to prompt Bob to excuse himself from the conversation or interrupting the conversation to announce their need to excuse themselves. Opting to not interrupt the conversation, Alice next decides to subtly step on Bob's foot and squeeze his hand again. This time Bob gets the message and at the next possible opportunity makes an excuse to disengage the couple from the conversation.

This scenario demonstrates the need for the type of system we are proposing. If Alice and Bob had access to a Digikits system, then it would have been easy for Alice to remind Bob that they had agreed to quickly exit the conversation. Without Digikits, Alice was put in the stressful position of discretely alerting Bob that it was time to leave. Failing to successfully alert him initially, she then had to decide whether or not to "be the bad guy" and interrupt the conversation so that they could continue on their way.

3.2 Digikits design goals

Costanza *et al.* introduced the notion of "Intimate Interfaces" as a new class of interfaces that enable interaction with mobile devices in a subtle, discreet and unobtrusive manner [5]. "Intimate Interfaces are designed to enable very personal and private interaction with mobile devices, require minimal attention and, cause the least distraction and disruption, both to users and to those around them" [4]. Inspired by Costanza's notion of intimate interfaces we formulated a set of design goals.

Our goal with Digikits is to design and deliver an intimate, minimal-communication system that allows a sender to

subtly push a message to a receiver who is discretely alerted to the incoming message. Both the sending and receiving of the message should be explicit to the couple but completely invisible to other members of the collocated group. In order to successfully deploy such a system we need to address several design goals. These design goals are separated into two categories: technological and social. Important issues to consider when designing technology for the use on-the-go include:

- the amount of attention a user can devote to the interface
- the type of input that can be performed while the user is on the move
- the size constraints of mobile displays and
- the social acceptance of devices and interaction techniques

Additionally, using a mobile device in a social context should not cause embarrassment and disruption to the people in the immediate environment. Our system needs to fluidly fit into the existing conversational context. As such, our social design goals were fairly straight forward The system must support:

- the ability to send a message in plain sight of a group of collocated individuals without their knowledge
- the ability to deliver a message in such a way as to not visibly interrupt the receiver

3.3 Message sending

In Table 1, we present a list of subtle input techniques that could be employed in Digikits. These techniques include but are not limited to Dual Purpose Speech [16], gesture [8], and a wide variety of button pressing techniques such as groping buttons sewn into clothing [1], tapping on the body [10] or explicitly executing a button press on a piece of mobile technology already on the body such as a cellphone, watch, or piece of electronic jewelry. Each technique has pros and cons, some of which are outlined in the table below.

3.4 Message receiving

Just as there is a need for discretion when sending a message with Digikits, messages should be received in a way that is unnoticeable to anyone but the receiver. To accomplish this we have investigated a variety of discrete notification methods including wearable tactile displays [13], mobile phone vibration [15], subtle visual queueing systems such as eye-q [7], or discrete audio queueing via a bluetooth headset [19]. Table 2 has a list of techniques and some of their pros and cons.

3.5 Mediated Scenario

We now return to the scenario presented above only this time Bob and Alice are using a version of Digikits:

Bob and Alice are out for the evening taking their new dog for a walk in the neighborhood. From a distance they see a group of neighbors engaged in conversation and realize that their walk will take them directly passed these neighbors. Knowing that Bob has a paper deadline that evening Alice and Bob make hasty arrangements to enter into the conversation with the intention of excusing themselves at

Input Technique	Pros	Cons
Dual Purpose Speech gesture	easy to use while on-the-go socially appropriate gestures are ubiquitous	not always socially appropriate hard to segment, difficult to capture, cognitively demanding to not create false positives requires lots of on-body hardware
tap on body button press on phone	invisible to bystanders explicit activation	requires phone to always listen for button press, even when locked
button press/gesture on watch	subtle but allows explicit control	visible to group, if popularized, Digikits gestures will be easily recognized
button press/gesture on jewelry	same as watch	same as watch

Table 1: A list of potential input techniques and the reasons for and against using them for Digikits.

Output Technique	Pros	Cons
Wearable tactile display	easily recognized by wearer	vibrators are not silent sound may be detected by others
mobile phone vibration	current notification system, easy to build	hard to distinguish signal from noise easy to miss incoming alerts if phone is in bag or pocket
visual queues	silent	can be obviously distracting requires hardware on the face
audio queues	conveys richer information	can be obviously distracting requires hardware on the face

Table 2: A list of potential output techniques and the reasons for and against using them for Digikits.

the earliest possible socially acceptable moment. They engage in conversation with their neighbors and have a pleasant chat. After a while, Bob is thoroughly engrossed in the conversation and appears to have forgotten his paper deadline. Concerned for his wellbeing, Alice decides that it is time to send Bob a reminder that they need to go home so that he can write. She does this by twisting her wedding ring around her finger three times in a counter clockwise direction. Making this explicit gesture with her wedding ring turns it into mobile input device. Her innocuous gesture alerts Digikits to send a signal to Bob’s Digikits output device of choice. Digikits sends a signal to Bob that is output using the vibrotactile display embedded in the band of his watch. The wristband of Bob’s watch contains three small vibrators that are situated on this underside of his wrist. They vibrate in a specific pattern whenever Alice sends him a message. So Alice twists her ring and Bob’s watch subtly vibrates prompting him to excuse himself from the conversation. Bob gets the message and at the next possible opportunity makes an excuse to disengage the couple from the conversation. The Digikits system has enabled Alice to send a message in a way that goes unnoticed by members of the collocated group and that requires a minimal amount of her attention. Digikits allows Bob to receive a message in a manner that does not interrupt his face-to-face conversation but is easily distinguishable by him and is not easily overlooked (as was Alice’s hand squeeze in the unmediated scenario).

3.6 Conclusion

In this paper, we propose a lightweight, subtle, mobile communication system, Digikits, that delivers simple messages between intimate partners when they are engaged in face-to-face conversations with a group of collocated individuals. We are in the early stages of designing this system and have described the goals of the system as well as several possible input and output mechanisms. Future work includes building the actual system and then testing it in the wild. We conclude with a humorous poem by Edgar

A. Guest [9] that illustrates several examples of a physical notification system employed by a couple when engaged in group conversation:

After a man has been married awhile,
And his wife has grown used to his manner and style,
When she knows from the twinkle that lights up his eye
The thoughts he is thinking, the wherefore and why,
And just what he’ll say, and just what he’ll do,
And is sure that he’ll make a bad break ere he’s through,
She has one little trick that she’ll work when she’s able
She takes a sly kick at him under the table.

He may fancy the story he’s telling is true,
Or he’s doing the thing which is proper to do;
He may fancy he’s holding his own with the rest,
The life of the party and right at his best,
When quickly he learns to his utter dismay,
That he mustn’t say what he’s just started to say.
He is stopped at the place where he hoped to begin,
By his wife, who has taken at kick at his shin.

If he picks the wrong fork for the salad, he knows,
That fact by the feel of his wife’s slipped toes.
If he’s started a bit of untellable news,
On the calf of his leg there is planted a bruise.
Oh, I wonder sometimes what would happen to me
If the wife were not seated just where she could be
On guard every minute to watch every trick,
And keep me in line all the time with her kick.

4. REFERENCES

- [1] J. Clawson, N. Komor, S. Gilliland, M. Bhardwaj, M. Garg, C. Zeagler, and T. Starner. Is it grovable? - assessing the impact of mobility on textile interfaces. In *ISWC ’09: Proceedings of the 2009 International Symposium on Wearable Computers*, pages 71–74, Washington, DC, USA, 2009. IEEE Computer Society.

- [2] J. Clawson, N. Patel, and T. Starner. Exploring computer augmented communication through an examination of the collocated use of multiple mobile displays. In *Beyond the Laboratory: Supporting Authentic Collaboration with Multiple Displays*. CSCW '08: Proceedings of the 2008 Conference on Computer Supported Cooperative Work, 2008.
- [3] J. Clawson, A. Volda, N. Patel, and K. Lyons. Mobiphos: a collocated-synchronous mobile photo sharing application. In *MobileHCI '08: Proceedings of the 10th international conference on Human computer interaction with mobile devices and services*, pages 187–195, New York, NY, USA, 2008. ACM.
- [4] E. Costanza. Subtle, intimate interfaces for mobile human computer interaction. Master's thesis, Massachusetts Institute of Technology, 2006.
- [5] E. Costanza, S. A. Inverso, and R. Allen. Toward subtle intimate interfaces for mobile devices using an emg controller. In *CHI '05: Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 481–489, New York, NY, USA, 2005. ACM.
- [6] E. Costanza, S. A. Inverso, R. Allen, and P. Maes. Intimate interfaces in action: assessing the usability and subtlety of emg-based motionless gestures. In *CHI '07: Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 819–828, New York, NY, USA, 2007. ACM.
- [7] E. Costanza, S. A. Inverso, E. Pavlov, R. Allen, and P. Maes. eye-q: eyeglass peripheral display for subtle intimate notifications. In *MobileHCI '06: Proceedings of the 8th conference on Human-computer interaction with mobile devices and services*, pages 211–218, New York, NY, USA, 2006. ACM.
- [8] T. Deyle, S. Palinko, E. S. Poole, and T. Starner. Hambone: A bio-acoustic gesture interface. *Wearable Computers, IEEE International Symposium*, 0:1–8, 2007.
- [9] E. A. Guest. *When Day is Done*, chapter The Kick Under the Table, page 69. The Reilly & Lee co., Chicago, 1921.
- [10] C. Harrison, D. Tan, and D. Morris. Skinput: appropriating the body as an input surface. In *CHI '10: Proceedings of the 28th international conference on Human factors in computing systems*, pages 453–462, New York, NY, USA, 2010. ACM.
- [11] J. J. Kaye and L. Goulding. Intimate objects. In *DIS '04: Proceedings of the 5th conference on Designing interactive systems*, pages 341–344, New York, NY, USA, 2004. ACM.
- [12] J. J. Kaye, M. K. Levitt, J. Nevins, J. Golden, and V. Schmidt. Communicating intimacy one bit at a time. In *CHI '05: CHI '05 extended abstracts on Human factors in computing systems*, pages 1529–1532, New York, NY, USA, 2005. ACM.
- [13] S. C. Lee and T. Starner. Buzzwear: alert perception in wearable tactile displays on the wrist. In *CHI '10: Proceedings of the 28th international conference on Human factors in computing systems*, pages 433–442, New York, NY, USA, 2010. ACM.
- [14] D. Lottridge, N. Masson, and W. Mackay. Sharing empty moments: design for remote couples. In *CHI '09: Proceedings of the 27th international conference on Human factors in computing systems*, pages 2329–2338, New York, NY, USA, 2009. ACM.
- [15] J. Luk, J. Pasquero, S. Little, K. MacLean, V. Levesque, and V. Hayward. A role for haptics in mobile interaction: initial design using a handheld tactile display prototype. In *CHI '06: Proceedings of the SIGCHI conference on Human Factors in computing systems*, pages 171–180, New York, NY, USA, 2006. ACM Press.
- [16] K. Lyons, C. Skeels, T. Starner, C. M. Snoeck, B. A. Wong, and D. Ashbrook. Augmenting conversations using dual-purpose speech. In *UIST '04: Proceedings of the 17th annual ACM symposium on User interface software and technology*, pages 237–246, New York, NY, USA, 2004. ACM Press.
- [17] S. O'Brien and F. F. Mueller. Holding hands over a distance: technology probes in an intimate, mobile context. In *OZCHI '06: Proceedings of the 18th Australia conference on Computer-Human Interaction*, pages 293–296, New York, NY, USA, 2006. ACM.
- [18] N. Patel, J. Clawson, A. Volda, and K. Lyons. Mobiphos: A study of user engagement with a mobile collocated-synchronous photo sharing application. *Int. J. Hum.-Comput. Stud.*, 67(12):1048–1059, 2009.
- [19] N. Sawhney and C. Schmandt. Nomadic radio: speech and audio interaction for contextual messaging in nomadic environments. *ACM Trans. Comput.-Hum. Interact.*, 7(3):353–383, 2000.
- [20] F. Vetere, M. R. Gibbs, J. Kjeldskov, S. Howard, F. F. Mueller, S. Pedell, K. Mecoles, and M. Bunyan. Mediating intimacy: designing technologies to support strong-tie relationships. In *CHI '05: Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 471–480, New York, NY, USA, 2005. ACM.
- [21] J. Werner, R. Wettach, and E. Hornecker. United-pulse: feeling your partner's pulse. In *MobileHCI '08: Proceedings of the 10th international conference on Human computer interaction with mobile devices and services*, pages 535–538, New York, NY, USA, 2008. ACM.