Conductive Chat:
Instant Messaging With a Skin Conductivity Channel

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ABSTRACT
Conductive Chat is an instant messaging interface which incorporates users' fluctuating skin conductivity levels into the dialogue interface. By including an indication of users' arousal within a text chat interaction, Conductive Chat augments the written communication with situated affective content. We hypothesize that this additional contextual channel increases the quality and effectiveness of the computer-mediated communication.

Keywords
Affective computing, skin conductivity, instant messenger, emotion communication.

INTRODUCTION
Media richness, according to Daft and Lengel [1], is a function of a communication medium's capacity for immediate feedback, the degree to which intent is focused on the recipient, the language variety, and finally, the amount of cues and communication channels available. The essence of this theory is that the greater the number of channels of communication within a medium, the greater the immediacy and warmth of the communication.

While instant messaging clients are frequently and widely used for interpersonal communication, they lack the richness of face-to-face conversations. Without the benefit of eye contact and other non-verbal 'back-channel feedback,' text-based chat users frequently resort to typing 'emoticons' and extraneous punctuation in an attempt to incorporate contextual affect information in the text communication [4].

Based on the theory of media richness, we have built an instant messenger client that adds a new information channel to a common text-based communication interface. Our application, Conductive Chat, integrates the changing skin conductivity levels of the application's users into their typewritten dialogue. Skin conductivity level (also referred to as galvanic skin response) is frequently used as a measure of emotional arousal, and high levels are correlated with cognitive states such as high stress, excitement, and attentiveness.

Our goal in building this interface was two-fold. On an expressive level, we strove to build an interface which communicated information about each user's arousal in a consistent, intuitive manner, without needing explicit controls or explanations. On a communication-theory level, we hoped this new communication channel would allow for more "media rich" conversations without requiring more from the users. To understand how arousal and affective information influence computer-mediated communication, we plan to use Conductive Chat as a platform for studying how a display of arousal level influences users' abilities to communicate intent and feelings within a text-based medium.

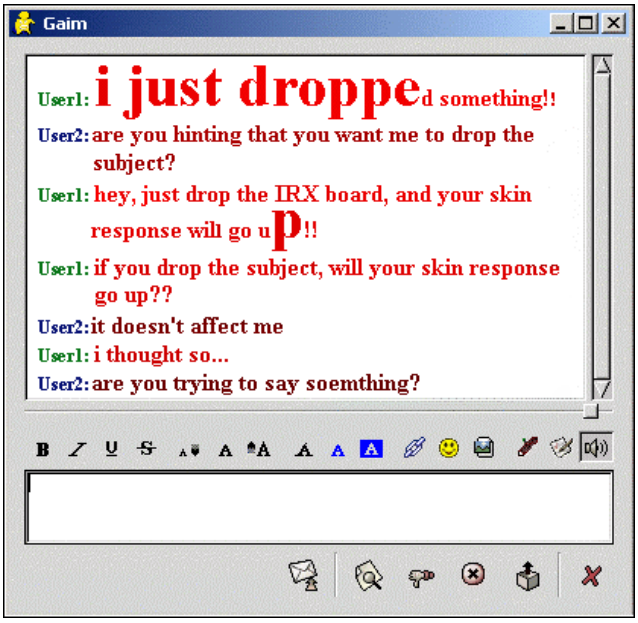

Figure 1: The Conductive Chat Interface. Depending on current arousal level, the color of the chat text ranges from black to bright red and the font size ranges from 8 to 14 point.

THE APPLICATION
The Conductive Chat application is a modification of the open-source AOL Instant Messenger client GAIM 0.55, which runs on Linux using GTK. Skin conductivity is measured using the Galvactivator [5], a specialized glove designed at the MIT Media Lab for measuring and displaying skin conductivity. The Galvactivator apparatus sends the skin conductivity level as a digital signal to the user's desktop through the serial port. The client software then reads the incoming data and adjusts the size and color

of the typed text on a per-letter basis just before sending the text to both the sender and recipient's dialogue windows.

Font color is used to convey the user's arousal level and font size relates to the rate of change in arousal level within the previous two seconds. The color of the text ranges from black to red on an RGB scale and the text size ranges from 8 to 14 points. As shown in Figure 1, when there is a spike in arousal, the aroused individual's chat text will jump in size and become more red. A user with a lower, more steady arousal state will type darker, more consistently sized text.

Design Considerations

We sought to incorporate the skin conductivity signal into the chat interface in an unobtrusive, but readily useful way. To parallel the LED display on the Galvactivator, we decided to color each letter of the text to convey the skin conductivity of the user as she types the letter. This encodes the temporal progression of the conductivity relative to the message as it is typed. Additionally, because the information lives in the text itself, the user need not look for or try to understand a separate display. In this way, the text provides the user an immediate context for the arousal reading.

The value of the skin conductivity signal provides an important conversational cue, but sharp rises and declines in its value also have meaning. To punctuate such occurrences, we used the size of the characters in each message to encode the rate of change of the conductivity signal. Quickly increasing conductivity causes larger letters; quick decreases make smaller letters.

On average there is a few second delay between when a person experiences an arousing emotion and when their skin conductivity rises. Initially we were concerned about how to align the users' emotions with their words. Our pilot testing indicates that the time delay between an emotion and the user typing out a statement relating to that emotion roughly corresponds to the delay in skin conductivity.

INITIAL FINDINGS AND HYPOTHESES

Our preliminary observations have uncovered interesting areas for future experimentation. Based on our observations of several users, it appears that the additional richness provided by skin conductivity does enable the recipient of the data to make more informed assumptions about the emotional state of the message sender. As a result of this, sudden and extreme modulations in text appearance frequently provoke recipients to inquire about the emotional state of their chat partner. Additionally, we have seen that the expressive nature of the text tends to increase the sender's willingness to disclose information about her own emotional state. A third intriguing observation is that over extended chat conversations, the arousal levels of two chatting users changes in sync, rising and falling in color as the content of the conversation changes. This mirroring of arousal may be an outcome of being able to see each user's current arousal state. This will be the subject of further study.

Prior research on mediated communication has compared different communication methods and their intrinsic communication channels [2,3]. Our approach to understanding how individuals interact over mediated technology will be to examine one medium (instant messaging) with different numbers and types of communication channels (skin conductivity being the initial channel). Our research goal is to understand how interfaces, enriched with new types of communication channels, influence individuals in decision-making and communication situations.

CONCLUSION

While Conductive Chat is an entertaining tool for chatting in informal scenarios, we are interested in providing an interface which assists people in conveying affective channels to improve online communication within the constrained environment of a text-based interaction. Whether skin conductivity and another physiological signals can be used to intuitively communicate emotional state is yet to be determined. This continuing area of research aims to understand how affective information can enrich the sharing of desires and intent over computer-mediated environments.

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REFERENCES

1. R. Daft and R. Lengel. 'Organizational Information Requirements, Media Richness and Structural Design,' *Management Science* Vol. 32, No. 5, 1986, pp. 554 - 571.
2. S. Kiesler and L. Sproull. 'Group Decision Making and Communication Technology,' *Organizational Behavior and Human Decision Processes* Vol. 52, 1992, pp. 96-123.
3. R. B. Ochsman and A. Chapanis. 'The Effects of 10 Communication Modes on the Behavior of Teams During Co-operative Problem-Solving,' *International Journal of Man-Machine Studies* Vol. 6, 1974, pp. 579-619.
4. K. Rivera, N. Cooke and J. Bauhs. 'The Effects of Emotional Icons on Remote Communication,' *Interactive Poster, Proceedings of the Conference on Human Factors in Computer Systems (CHI 96)*, 1996.
5. J. Scheirer and R. W. Picard. 'The Galvactivator: A Glove that Senses and Communicates Skin Conductivity.' *Proceedings of the 9th International Conference on Human-Computer Interaction*, New Orleans, 2001.