Exploring the Role of Affect Recognition in Web-Capable Applications

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ABSTRACT

In this paper we present the results from a qualitative study exploring people's opinions and reactions to the possibility of emotion-aware adaptive web user interfaces, those which will have the capability to read users' emotions and adapt accordingly. The purpose of this work is to improve understanding of how people envision such emotion-aware interfaces may be a part of their computing experience, and to explore any concerns that people have relating to this technology. We expect that such information will be helpful for directing the development of new emotion-aware adaptive web interfaces.

Keywords: Adaptive interfaces, affective computing, qualitative evaluation.

Index Terms: Human-centered computing → Web-based interaction.

1 INTRODUCTION

Adaptive websites typically rely on user models constructed from interaction data (e.g., keystrokes and mouse movements or navigation history) or user-supplied questionnaire data to adapt their content according user interests, preferences or knowledge. While powerful, this type of interaction data ignores the importance of the user's affect or emotional state. People interacting with other people constantly adapt interaction strategies based on their interpretation of others' affective states, and thus some have argued that computers should likewise adapt their interaction to this information channel. [1]

Developing websites which adapt to affect involves many non-trivial challenges, including how to assess user emotions from biometric signals, facial expressions and/or body gestures. In addition, effective interface design will require answering questions of how affect can or should be used by adaptive web applications, and what sorts of applications will make sense.

There have been a number of proposals for emotionally intelligent websites (e.g., an e-commerce interface [2]) and suggestions (e.g., affective computing in collaborative networks [3]), however, there is limited end-user generated data and opinions on emotionally intelligent websites to inform such designs. As with any interaction design problem, having only a limited understanding of target tasks, end users, and their preferences increases the risk of application failure [4]. This is particularly risky for emotionally-aware applications given the difficulty of constructing them. Thus, we argue for the importance of having a solid user—expectation grounding for affect-aware web systems, for successful and efficient application development.

As an initial step, we take a user-centred design approach towards exploring the potential design space of affect-adaptive websites by conducting a set of semi-structured exploratory interviews. Through this brainstorming exercise we identified a number of promising directions and potential web-specific pitfalls for this type of technology. By describing users' attitudes toward emotion-aware possibilities our results help to inform the development of future applications.

2 EXPLORATORY STUDY OF USER OPINIONS ON EMOTION-AWARE ADAPTIVE WEB INTERFACES

We recruited 19 participants from our university population, aged from 18 to 57 (M=31.42, SD=7.67), 12 male / 7 female. Most (17/19) use the internet several times a day. The others (2/19) use the internet every day or two. They reported their internet/web skills as being fair (3 ppl.), good (6), or very good (10).

Each interview (15-20 minutes in duration) started by asking participants' opinions on emotion-aware systems. Then, we focused on their opinions of how emotion-aware adaptive web interfaces can be useful, where the interfaces can be applied, and what benefits people could expect to get.

We took an affinity diagram [5] analysis approach on the collected interview data to uncover emergent themes. While we asked participants to comment on web-specific uses of the emotion sensing, we note that our participants' ideas often extended beyond website tailoring.

2.1 Modify Users' Emotional States

Most participants (14/19) explicitly stated that they want emotion-aware intelligent systems to try and modify their emotional state, for example, to sense when they are unhappy or overwhelmed and perform actions to help mitigate their current emotional state:

> "Just came from University, so [I'm] very much (sic.) tired. Computer knows that we are very much tired. [Then] it will do something to cheer me up and make me relax … [because] if you are happier, it will get you more works [done]." [p12]

> "If computer knows my mood, computer should do something to adjust [my] mood. If you feel something really bad, you should not work, or [you will] make some mistake." [p15]

Above, P12 and P15 suggested that the computer should do something in response to their affective state to increase their productivity or to protect them for making errors. P19 suggested that under these circumstances the computer should simply prompt the person to take a break:

> "Maybe [the computer] prompts user [to] take a break." [p19]

Many participants (8/19) also expressed interest in having the computer take actions to help alter their affective state, such as automatically playing or suggesting music to help them relax:

> "If you feel sad, computer suggests there is a great music that can help you lift your mood." [p19]

> "[Mood] can be really affected by music. … Speaking from experience, I play different kinds of music; it tells me how I am feeling." [p16]

In addition to using music to alter affect, participants suggested adjusting screen brightness or switching user-interface themes, for example, modifying visual contrast of text.

2.1.1 Tailor the Quantity of Information Delivered

Other participants (4/19) also wanted the computer to react based on their mood, but to do so by tailoring the quantity of information delivered. For example, P18 discussed limiting notifications when the person should not be disturbed, while P19 suggested simplifying the contents of a webpage:

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"Maybe someone calls me, (sic.) and if I am really, if [the interfaces] know I don't want to be disturbed; [the phone call popups] won't show up, something like that." [p18]

"If someone feels confused, he comes to website and can't navigate, right? If the browser can sense it … then, the web browser can suggest, for example, 'would you like me to simplify this page for you?'" [p19]

2.1.2 Feedback on One's Own Emotional State

Apart from proactive emotion-tailored support, some participants (3/19) expressed a desire for an emotion-aware system to simply provide them with feedback on their changing emotional state:

"You are going to be done your day; you suddenly realize, 'oh, this [emotion] reading means I am sad.' It makes you explore what's making you sad and how you can deal with that." [p16]

While P16's quote above indicates a desire to learn about one's emotions through self-reflection, one participant was hopeful that the computer could also explain the causes:

"Maybe, computer can try to explain why this emotion was caused … When I am looking at the interface, tell me why I am sad." [p4]

2.1.3 Feedback on Others' Emotional States

Discussions on adapting to one's emotions also sometimes included a desire to have feedback of others' emotional states (2/19). There was a focus on children who could benefit, such as autistic children who have difficulty expressing emotions or socially isolated children, a theme already in the field [6]:

"They [autistic children] are not being able to express themselves. Having that [displaying children's emotion] might help you as a caregiver or as a parent." [p16]

"Good for the kids … [who] are not able to group for the studies … For them this study [exploring emotion-aware interfaces] can be used. And what's more, this study can be used for those who are abused." [p6]

2.1.4 Expressing One's Emotions to Others Online

In addition to applications which may work well for off-line general computer use, a few participants (2/19) wanted an emotion-aware computer to serve online social purposes by sharing their emotional states to family and friends:

"I am going to share why I am happy and what I am feeling." [p4]

For others, any emotion sharing was viewed as a potential downside. For example, some (4/19) expressed hesitance as they felt computer-generated emotion representation was no substitute for direct interaction with people:

"Relationship is based on communication. But, if I didn't talk to my friend; I just saw their emotion on computer, then that is not good. Because I just know they are angry or happy, but I don't know why." [p18]

"I am super happy, so … all I am going to do is sitting on my chair and seeing 'I am happy,' then computer senses it and share to my friends. I don't feel too involved; it's taking out the level of social interaction." [p19]

2.1.5 Privacy Concerns

In addition to worry over negative impact on social interactions, many participants (9/19) expressed a range of privacy concerns inherent to this type of technology:

"No! I don't want, I don't want computer to read my emotion to adjust interfaces. I like my privacy." [p1]

Others did not mind their emotions being read and used for user-specific tailoring, but expressed worry about the technology exposing or sharing their emotions:

"Emotion has to be within you. This must be private. One will never prefer sharing their emotion." [p6]

"If computer reads someone else's emotion, changes whatever [interfaces], and exposes the information automatically, it might be really dangerous to others. But if it is just between the monitor, like the computer, and me, it wouldn't be that bad." [p10]

3 DISCUSSION

Our results unveil several potential application domains for affective-aware web systems, and highlight key areas of concern.

Many participants focused on the idea that an affect-aware interface can be an emotion reflector, displaying one's own or others' emotions. This approach is already commonly used in many scenarios, for example, for biofeedback therapy, where a machine informs a person of their state to help them correct behaviour. A benefit of integrating this approach into daily computing would be that it could improve accessibility to this therapy technique, and more people could gain from the positive advantages. One integral challenge with this approach is the question of how to communicate, or perhaps visualize, users' affective states, for example, as interruptive notifications, through ambient displays, or as dedicated applications.

On a similar note, many people were interested in having computers that could leverage knowledge of their affective state to improve their interaction experience, e.g., by trying to improve their mood (such as through playing music) or by improving productivity by recognizing when they are confused or do not want to be disturbed; these fall along the lines of arguments for how positive affect in computing can improve experience and productivity [1], [7]. While all of these applications themselves will require careful technical and interaction design consideration, our results show that, at the very least, some people are open to the idea of productivity tools that leverage their emotional state.

4 SUMMARY AND FUTURE WORK

In this paper we presented results from a set of semi-structured interviews that elicited end-user opinions and preferences regarding emotion-aware interfaces. Our results indicate that people are interested in a diverse range of applications including mood improving recommendations, tailoring information content and interruption frequency based on cognitive load and allowing people to reflect on and share their emotional states. In the long run, we hope to continue this investigation with both more targeted inquiry (e.g., focusing on privacy concerns) and the development of prototype interfaces to test many of the ideas presented in this paper. Ultimately we aim to formulate a framework to help adaptive web designers and developers to be aware of user-needs.

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