Emily Lo
15-300, Fall 2018
<div align="center">Research Project Proposal</div>

Project Title: Embodying Expressive Biosignals through Social Support

Project Web Page: All documents related to my 15-400 proposal will be hosted on
https://hiemilylo.github.io/research/.

Project Description

For my 15-400 project, I will be making a mobile communication system that helps people
express and respond to biosignals through phone gestures as a way of experiencing social
support.

Faculty and Mentors

I will be working with Professor Laura Dabbish (http://www.lauradabbish.com/) and PhD
student Fannie Liu (http://www.fannieliu.com/), who both work in the CoEx Lab (Connected
Experiences Lab, http://coexlab.com/) in CMU's Human-Computer Interaction Institute. I will
be working closely with Fannie, whose research area focuses on expressive biosignals.

Context and Background

This project extends on the field of exploring how biosignals can be expressive and taken as
social cues in order to increase interpersonal communication.

Biosignals are patterns exhibited by the human body that we can monitor. The biosignals that
HCI researchers are particularly interested in are skin conductivity, heart rate, and brain activity
based on region. There have been many physiological studies[1] that correlate these biosignals to
the intensity of an emotion.

The results from these papers have led to many HCI researchers experimenting with displaying
these biosignals to others to see how effective it is as a secondary social cue. In previous
research, biosignals are detected through some kind of hardware that users must wear: for studies
looking specifically at skin conductivity, users wore sensors on their fingers to test for the
amount of electricity conducted by the user's skin[2]; other sensors include a large band attached
above a user's abdomen to monitor respiratory rate and heartrate[3].

Current research focuses more on the social meaning of displaying biosignals, and how others
can correctly identify these expressive biosignals through a natural and intuitive way. For
example, researchers have played with displaying warm colors through ambient light when
higher levels of intense emotion are detected[4]. Others have tried showing light signals through a
special kind of t-shirt with built in sensors and subtle designs that increase in brightness with
intensity.

All of the research we have seen so far targets only one direction in the conversation between a detected user and the observing participant. We have now seen many ways of displaying these biosignals and researched what kinds of social implications and privacy concerns may arise from displaying these signals; now, we want to explore how to make these biosignals more easily actionable for observers. Our project will attempt to help make biosignals more approachable by creating fixed actions associated with biosignal readings, making the conversation flow in both directions.

Project Goals

For this project, I will assist Fannie in making a mobile application that detects a user's biosignals and uses phone activity to sense memorable or stressful moments. We aim to promote positive well-being by allowing users to express these stressful moments through small gestures they can perform on their phones (shaking the phone, tapping vigorously for a few sections, etc.), and be given the option to send these emotions to another user, who is prompted to respond through another gesture (raising the phone above their head to show support).

75%: If the project is 75% complete at the end of the spring semester, it will have a working prototype of the mobile application complete with gestures and the user scenarios. However, no user tests will have been made.

100%: A successful project will include the full mobile application complete along with some user testing in action before the summer starts. Hopefully the experiment will last at least a couple of weeks, so data collection can happen throughout the summer with minor tweaks to do multiple rounds.

125%: Exceeding the target goal includes performing a full user study before the semester ends and we analyze the data completely.

Milestones:

1st Technical Milestone for 15-300: Decide what mobile OS we will be developing for and make a simple mobile application that allows for user feedback, asks for permission for phone activity, and learning possible gestures and push notifications to other users who have downloaded the app. Explore what options for phone activity are available as a part of the mobile application creation, and brainstorm ideas for gestures.

Bi-weekly Milestones for 15-400:
- 2/1: Have a preliminary plan for all gestures. We are aiming for 3 total gestures, each which target a different kind of emotion—by this point, it would be best to have documentation for each gesture describing the criteria for the triggering of the gesture, and a story board for each gesture. These first two weeks will be mostly brainstorming and iterating on possible ideas, and the plans will remain flexible.
- 2/15: Implement at least one of the three gestures, try user testing locally (have at least 2 others within the lab use my app). Make adjustments to plans if necessary, and ensure that sending notifications to users works properly.

- 3/1: Finish the second out of the three gestures; continue iterating on the designs and story boards according to technical challenges. Implement any changes necessary to the first gesture.
- 3/22: Complete all planned gestures; spend time to debug and iterate based on feedback from local testers. Start thinking about how the experiment would work, and how the application will record this data (storing in a database, saving to a spreadsheet, etc.).
- 4/5: Document experiment proposal (what to measure, how to measure it), getting feedback for experimental design and signing off with Professor Dabbish. Time to debug the application if necessary. Include how to deploy the app to research participants.
- 5/3: Recruit pairs of friends and/or couples for user testing.

Literature Search:

To prepare for this project, I have read multiple papers that explore the one direction of expressing biosignals to others. Their research methods are described in the background section and are helpful in learning about how to detect different kinds of emotions given just biosignals.

Resources Needed:

Depending on what kind of mobile system we decide to make the application on, we might need to buy a phone to test on. The software used to build mobile applications is available.

Citations:

[1] Boehner, K., Depaula, R., Dourish, P., and Sengers, P., 2007. How emotion is made and measured. IJHCS, 65, 4, 275-291.

[2] Howell, N., Devendorf, et al. Biosignals as social cues: ambiguity and emotional interpretation in social displays of skin conductance. In Proc. Of DIS `16, 856-870.

[3] Tan, C., Schoning, J., Luyten, K, and Coninx, K. Investigating the effects of using biofeedback as visual stress indicator during video-mediated collaboration. In Proc. Of SIGCHI 2014, 71-80.