‘Not Too Much, Not Too Little’ Wearables For Group Discussions

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Abstract
Here we present a social wearables prototype, i.e. a wearable that augments collocated social interaction: the Lågom. This design is meant to support people to be aware of and better regulate their verbal participation in group discussions. Lågom takes the shape of a colorful, bulky and funny looking flower that senses the wearer’s speaking and responds with haptic and visual feedback. We ran a pilot study with nine people participating in a class discussion. Preliminary results show potential of the haptic feedback to increase self awareness of participation, and to help people better regulate their participation in group discussions.

Author Keywords
lågom; social wearables; collocated interactions; group discussion; RtD; prototyping.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous;

Introduction
Wearables by their nature have the potential to impact in-person social interactions [7]. But how can they be designed to positively impact collocated social experiences? Research in the area of play and games are inspiring (e.g. [4, 5, 7, 8, 12, 13]). Our research extends these works by looking at an everyday

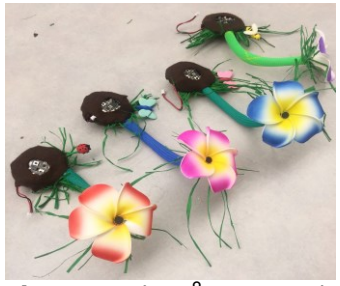

Figure 1: The Lågom social wearables prototypes.

situation: collocated discussions, and the end goal of playfully balancing conversations. This design goal is motivated by observed participation differences among individuals in conversations. Some are explained by hierarchical positioning, personality traits, values, abilities and gender (E.g. males tend to dominate conversations over females [17]).

Here, we take up the challenge of increasing awareness of and regulating individual participation in group discussions with wearable technology. Following a Research through Design approach [18], we created the Lågom social wearable, named after the ancient Swedish ideal and word without a direct English translation that means "not too much and not too little" or "just enough" [15]. Our Lågom social wearable is a playful flower/plant-like technology that senses the wearer's voice and provides haptic feedback to them, as well as visual feedback to collocated others to increase awareness of self-and others' participation, towards more balance group discussions (See Figure 1). Here we present the Lågom design concept and preliminary results from its deployment in a (semi-)natural setting: group discussions during a class. Initial results show that such devices have the potential of affecting self awareness of one's own participation in discussion and of helping regulate one's participation.

Related Work

Providing peripheral visual feedback on participation balance can influence individual speaker-participation rates, especially of those "part of the extremes of over and under participation" [10]. Based on data collected through microphones [10] or sociometric badges [6] there are systems that provide real-time feedback on group dynamics by visualizing participation-rates on a personal or shared screen, directed to participants' peripheral view, to encourage overall positive changes of communication patterns. Web and mobile applications have also addressed the need of balancing participation, e.g. [2, 3], which measures gender participation imbalances. Smart objects, such as furniture, have also been created to balance social situations. E.g. Terken and Sturm [14] used a table as a surface on which to project a visualization of social dynamics (based on speaking-participation rates and each participant's gaze); Mitchells' interactive table to help balance conservation and eating during social dining experiences [9]; or [11]'s smart table for group discussions, which records "what topics were talked about, in what order, and by whom" [11]. The Lågom prototypes were also designed to augment group discussions by providing feedback with the intention of supporting balanced conversation. We took a different approach to the design and implementation of the real-time feedback mechanism. The Lågom social wearable provides haptic feedback to speakers *as they speak* as well as visual feedback to others in the group. The devices don't show the overall participation rates until the end of the session, and in that way provide more subtle and personal feedback during the discussion time. Further we designed the wearables as playful objects to make engaging with them more joyful and to ease potential related social-pressure stress.

Concept Prototype

The Lågom prototype picks up the sound of wearer's voice and provides haptic feedback to the wearer, and visual feedback also to collocated others about amount of verbal participation. We worked with Adafruit's *Circuit Playground* (CP) [1] for its prototyping flexibility, and used its 10 built-in LEDs for visual feedback. We added an external microphone for improved audio recognition, and a single vibration motor for the haptic feedback.

The device was designed to be worn like a brooch around the lapel area for several reasons: technically, the microphone required direct orientation towards, and close distance from, the mouth; the haptic feedback was intended to be felt close to the shoulder to emulate a tap-on-the-shoulder-style reminder; and the visual

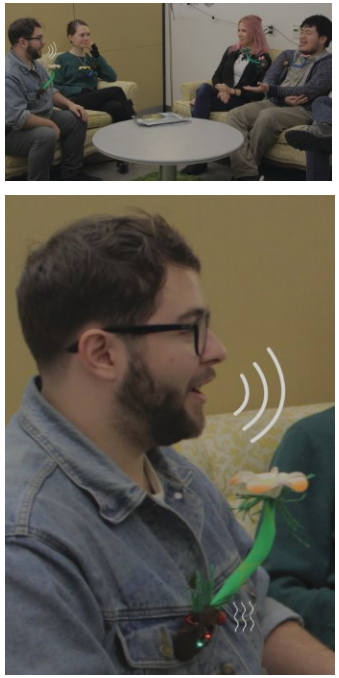

Figure 2: Demonstration of Lågom is use.

output needed to be in proximity to the speaker's face/chest area so that others' focus on the device would not impede simultaneous monitoring of the speaker's gestures while speaking. This shoulder and higher chest area is an appropriate location for wearable feedback [16], and for external attention (e.g. frequent area for jewels and fashion adornments, such as shoulder pads) (see Figure 2).

The look of the prototype is inspired by the water-squirting flowers clowns sometimes wear, to infuse playfulness and increase acceptability. The microphone was placed at the center of a flower, as its carpel; the petals would act as a screen to improve the filtering of other noise. The stem of the flower was flexible to allow directing the microphone to the mouth. The vibration motor was covered by a little ladybug/bee/butterfly detail. The LED lights would shine through brown felt that covers the CP. We used clips and safety pins on the back side of the devices to attach the wearable to one's clothes.

We programmed the CP to record amount of time when the wearer talks: i) with a volume over a certain threshold, to avoid capturing others' sounds, and ii) for over 500 milliseconds, to avoid minimal intended and unintended verbal sounds. Real time feedback was provided with two modalities to the wearers and the rest of the group: i) Visual, mainly designed for others' awareness of the wearers' participation, using the 10 LED on the CP. They would light up gradually based on the length of one's verbal participation; ii) Haptic, mainly designed as a gentle reminder of one's verbal participation, using an external vibrating motor. Vibrations (500 milliseconds each) would be felt more and more frequently during speaking time. The first LED and vibration would appear after one spoke for three seconds nonstop. Subsequent LEDs and vibrations output would occur as the speaking continued in increments of three seconds. When silent for more than two seconds, the LEDs and vibrations would decrement at a similar pace. Last, to allow the wearer to guess and reflect on their participation, we programmed the CP to display the percentage of the wearer's participation at the end of the discussion session. This was done programming a counter in the CP that would be activated with the CP's built-in toggle switch when the discussion started. At the end of it, each participant could display their participation percentage pressing the two CP's built-in buttons, which would light the corresponding number of LEDs[1] (each two LEDs would be approx. 20%).

Method

We follow a Research through Design [17] approach to explore how wearable technology can better support collocated social participation in discussions. We made seven functioning wearable prototypes with only slight formal changes (e.g. color of the flowers, and bug that camouflaged the vibrating motor). We iterated the initial prototypes several times, exploring different feedback modalities, vibration patterns, and input sensibility. Variations of the Lågom prototype were tested during in-lab group discussions by lab members and invited guests.

Here we report on a pilot study where we studied the potential value of a wearable device like Lågom. We collected feedback from nine external users on our current prototype. We were interested in people's opinion about having their verbal participation monitored, displayed, and represented to them, and about the feedback modalities chosen. We wanted to know if this feedback impacted their and others'

[1] Solution to avoid implementing networked communication between devices in this early design exploration phase.

Figure 3: Graduate students in Group A and B during in class pilot test of Lågom social wearables.

participation in the discussion, and if they thought a wearable device like Lågom could potentially increase their awareness of participation and help them modify it. We used a master's program class where students would be discussing two research papers to explore these questions. The class was attended by 9 students that we divided in two groups, A and B, following a within type of study: Group A would discuss paper 1 with the devices and 2 without them, while group B would discuss paper 1 without the devices and paper 2 with them. Group A was composed of 2 female- and 2 male-seeming participants, and group B of 2 male-and 3 female-seeming participants. Both groups had a male discussion facilitator and two female researchers observing participation (see Figure 3).

Before wearing the devices, the groups were introduced to a backstory: Lågom were a flower species that fed upon their voice and thrive with balanced conversations. Participants were shown how to wear the device and were helped to affix them when necessary. We also explained the feedback Lågom would provide.

Both groups discussed the two papers following the same protocol: a summary of the paper was read out loud by all group participants (a segment each), followed by a discussion. We used the summary phase to check that all devices were functioning correctly. After that, the devices were reset to start recording participation time. Discussion time with the devices was five minutes long. Then, we asked participant to estimate their participation time before pressing on the CP's buttons to display it. At the end of the sessions, we asked participants to fill in a short survey with questions such as: "How did you perceive your participation during the two discussion sessions?" "What were the main noticeable differences between the two the discussion sessions?". We conducted follow-up interviews with 7 students on the following days. Here we report on results from a preliminary analysis of both.

Preliminary Findings

Participants liked the flower backstory ("I liked the idea of having a little plant to 'care for' in that way"). The flowers were considered aesthetically 'cute' by some but also 'distracting' at times by others. In general there was a split in fondness. Five participants mentioned that the proximity of the devices to their face bothered them.

The devices worked very well to increase self-awareness of participation of all participants and it changed habitual participation patterns of some participants. Those who usually tended to shy away from contributing to group discussion reported finding the wearables useful. They said it helped them to notice their participation more, and encouraged them to put more effort into making their voices heard. One participant commented: "I liked that it brought ordinary invisible social patterns into focus. It made me more aware of something I do all the time and this made me want to do it better (be more confident, loud, assertive - which I often have trouble doing, especially as a feminine - socialized person)".

However, users' appreciation and the impact of this feedback was varied: one male participant found it distracting, although something he could get accustomed to, like a cell phone's vibrations. One male participant decided and managed to ignore the feedback almost entirely. One participant really liked it and mentioned how it invited her to participate more: "I wanted to talk more and louder, because I wanted to feel the vibration". One, usually participative, female participant disliked the haptic feedback, which she interpreted as a signal to stop talking - she commented how she was probably influenced by the use of other wearables, whose vibrations she interprets as a call for action. Another person did not feel comfortable with the

haptics altogether and preferred to participate with gestures rather than words. The visual feedback also elicited diverse responses, but not such strong reactions: seven participants responded that they did not notice others' devices and participation patterns. One mentioned she "wanted to look at people while they spoke more, because I wanted to see the LEDs light up". Another person said she was watching the LEDs light up but that distracted her from the discussion topic. One participant commented how she thought the device contributed positively to the group's togetherness: "it felt like we were more connected due to shared simultaneous experience. I would like my lab to use it, for the togetherness and playfulness". Finally, participants reported they would consider using such a device in the future.

Future Work

We are planning to continue testing and evaluating the Lågom social wearable in diverse contexts (e.g. lab meetings, work critique sessions, brainstorming sessions etc.), with more participants, and for longer periods of time (to better understand their impact after the novelty effect). We would also like to study them in contexts where people take socially agreed upon roles, like a presenter in a presentation. In future iterations of the prototype, we will explore allowing end-users to tune the device's intensity of haptic feedback, as well as new device forms that will make wearing it simpler and easier to use.

Conclusion

We have presented the Lågom social wearable, a prototype to increase awareness of self- and others' verbal participation towards supporting balanced discussions. We conducted a pilot study with nine participants divided into two discussion groups during a class session. Preliminary analysis show promising results: the device works to increase awareness of self-participation and impact participation patterns. The wearable devices also elicited strong affective responses. We plan to conduct further studies with longer discussion and testing times (the limited time of the one reported here was imposed by external factors), which will allow us to investigate the impact of these devices past the initial novelty effect. In addition, it will allow us to better understand the design features that provoke negative reactions. We take it as important feedback that some people feel strongly about vibration, and we will explore different vibration patterns and intensities.

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References

1. Circuit Playground Express ID: 3333 - $24.95 : Adafruit Industries, Unique & fun DIY electronics and kits. Retrieved January 15, 2018 from https://www.adafruit.com/product/3333.
2. Cathy Deng. Are men talking too much? *Are men talking too much?* Retrieved December 15, 2017 from http://arementalkingtoomuch.com/.
3. 2016. What is GenderTimer. *GenderTimer*. Retrieved December 15, 2017 from http://se.gendertimer.com/en/what-is-gendertimer/.
4. Katherine Isbister, Kaho Abe, and Michael Karlesky. 2017. Interdependent Wearables (for Play): A Strong Concept for Design. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, ACM, 465–471.
5. Katherine Isbister and Elena Márquez Segura. In press. Social Affordances at Play: Game Design Toward Socio-Technical Innovation. *In Proceedings*

of the SIGCHI Conference on Human Factors in Computing Systems (CHI '18).

6. Taemie Kim, Agnes Chang, Lindsey Holland, and Alex (Sandy) Pentland. 2008. Meeting Mediator: Enhancing Group Collaboration with Sociometric Feedback. *CHI '08 Extended Abstracts on Human Factors in Computing Systems*, ACM, 3183–3188.
7. Elena Márquez Segura, James Fey, Ella Dagan, Jared Pettitt, Samvid Jhaveri, Miguel Flores, and Katherine Isbister. In press. Designing Future Social Wearables with Live Action Role Play (Larp) Designers. *In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '18).*
8. Robb Mitchell and Thomas Olsson. 2017. Barriers for Bridging Interpersonal Gaps: Three Inspirational Design Patterns for Increasing Collocated Social Interaction. *Proceedings of the 8th International Conference on Communities and Technologies*, ACM, 2–11.
9. Robb Mitchell, Alexandra Papadimitriou, Youran You, and Laurens Boer. 2015. Really Eating Together: A Kinetic Table to Synchronise Social Dining Experiences. *Proceedings of the 6th Augmented Human International Conference*, ACM, 173–174.
10. Joan Morris DiMicco, Anna Pandolfo, and Walter Bender. 2004. Influencing Group Participation with a Shared Display. *Proceedings of the 2004 ACM Conference on Computer Supported Cooperative Work*, ACM, 614–623.
11. nytlabs. Retrieved December 14, 2017 from http://nytlabs.com/projects/table.html.
12. Joshua Tanenbaum, Karen Tanenbaum, Katherine Isbister, Kaho Abe, Anne Sullivan, and Luigi Anzivino. 2015. Costumes and Wearables As Game Controllers. *Proceedings of the Ninth International Conference on Tangible, Embedded, and Embodied Interaction*, ACM, 477–480.
13. Tanenbaum, J. and Tanenbaum, K., 2015. Envisioning the Future of Wearable Play: Conceptual Models for Props and Costumes as Game Controllers. In *FDG*.
14. Jacques Terken and Janienke Sturm. 2010. Multimodal Support for Social Dynamics in Co-located Meetings. *Personal Ubiquitous Comput.* 14, 8: 703–714.
15. 2017. Why is Sweden's "lagom" leadership taking the world by storm? Retrieved December 3, 2017 from https://www.thelocal.se/20171127/why-is-swedens-lagom-leadership-taking-the-world-by-storm-sseexecutiveeducation-tlccu.
16. Clint Zeagler. 2017. Where to Wear It: Functional, Technical, and Social Considerations in On-body Location for Wearable Technology 20 Years of Designing for Wearability. *Proceedings of the 2017 ACM International Symposium on Wearable Computers*, ACM, 150–157.
17. Don H. Zimmermann and Candace West. 1996. Sex roles, interruptions and silences in conversation. *AMSTERDAM STUDIES IN THE THEORY AND HISTORY OF LINGUISTIC SCIENCE SERIES 4*: 211–236.
18. John Zimmerman, Jodi Forlizzi, and Shelley Evenson. 2007. Research Through Design As a Method for Interaction Design Research in HCI. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, ACM, 493–502.