

A wearable technology to induce and support emotional awareness

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ABSTRACT

This paper focuses on designing a wearable technology that will support the metaphor for a focused meditation exercise (i.e. 'Wheel of Awareness') to induce emotional awareness. We focused on applying the User-Centered Design process, including the phases of *understanding*, *specify*, and *create design solutions*. The methods used are semi-structured interviews, storyboarding, interactive prototyping, and video prototyping. Based on these methods new design iterations, a persona and a formalization of our final design named 'Watch of Awareness' were developed. The 'Watch of Awareness' is described as an interactive watch that facilitates a more regulated state of mind through three main components. Firstly, reflection and emotion regulation using the 'Wheel of Awareness' practice. Secondly, using an integrated form of a 'psychophysiological emotional map' as a form of journal therapy. Lastly, physiological user data (i.e. heart rate, SCR, location) as a means to track and check for reliable user-input and provide necessary feedback over time to induce better performance. The design is suitable for people between 20 and 35 years old.

CCS CONCEPTS

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KEYWORDS

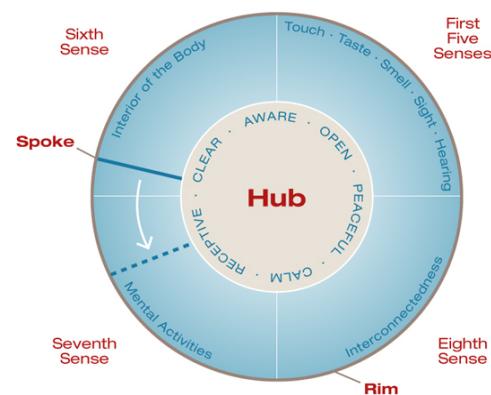
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1 Introduction

Based on the Positive Design framework developed by Pieter Desmet and Anna Pohlmeier (2013) we broke down the over coupling the idea of happiness into more tangible and concise components. This offered great insights in our ideation towards the idea of meditation and handling stress related situations. The ingredients that brought us to the core idea of our context space were accordingly: transcendence, relaxation, tranquility, confidence, happiness and self-regulation. Within these elements, we combined the ideas of 'transcendence', 'relaxation', 'tranquility' and 'confidence' into one merged outcome variable for our design that would be substituted and guided by a thought

out self-regulation method. The next two paragraphs will go into more depth on how we managed to use meditation and self-regulation into forming the context for our project.

As for the meditation, we chose to focus on "The Wheel of Awareness" technique developed by Dan Siegel (2018). In his book "Aware: The Science and Practice of Presence--The Groundbreaking Meditation Practice" he describes how (see figure 1) the 'hub' provides a representation of the awareness/experience itself (i.e. knowing) and how the 'rim' contains all the elements of which we can become aware of (i.e. that is 'known' to us). Mentally, we can send out a spoke to the rim to be able to focus our attention (i.e. spoke) on one point on the rim, which could be accordingly: the first five senses, our internal bodily sensations, our mental activities and our interconnectedness with other people. The wheel becomes seems to be a concise metaphor for the idea of emotion regulation as we differentiate between the 'rim' and 'hub' part and our related focus of attention. For our process, this conceptualization of focused attention and emotion regulation forms a coherent basis for understanding and ideation.



© 2007, 2014 Mind Your Brain, Inc.

Figure 1: Wheel of Awareness, Siegel, D. (2007, 2014).
Retrieved from Retrieved from
https://www.drdansiegel.com/resources/wheel_of_awareness/

Within this analogy, we considered the opportunity of making a wearable technology that would embody this metaphor in an optional design solution. Personal growth is one of the six symbolic meanings that can be used to inspire a meaningful user experience. Designing a wearable technology that would support this goal and facilitate personal development through reflection became our ambition. Wearable technologies have become more and more prevalent in today's society. Fitness trackers, smart glasses, smart clothing and most notably smartwatches are being worn in great numbers (Costello, 2018). Although a portion of the wearable devices are focused on entertainment and information, a great number is related to personal health. The idea behind health related wearables is that by gathering information about behaviors such as physical activity or sleep patterns, these devices can educate and motivate individuals toward better habits and therefore better health (Patel, Asch & Volpp, 2015). Although the gap between merely recording information and behavior change is substantial, wearable devices can be facilitators of behavior change when designed correctly.

The aim of this study was to design a wearable technology that would support the metaphor for the Wheel of Awareness to induce emotional awareness. In the following section we will introduce the different user centered design process to specify and understand the user context, their requirements and how these apply to the context of our design focus. Furthermore, we will present a mockup video prototype, an interactive prototype and give a reflective evaluation of our finalized design. We start with introducing the methods we used.

2 Method

To answer the research question, whether the new media tools can enhance emotions awareness and control, stimulate behavioral change and help to create a state of mindfulness, selected activities and methods from User-Centered design approach have been used. We specified the context of use of the potential product by identifying the target group, which will use the product, specified its requirements and created possible design solution. For these activities four different methods have been employed, which are semi-structured interviews (understand), storyboard (define/ideate), interactive prototyping (prototype), video prototyping (prototype).

2.1 Interviews

2.1.1 Participants. To understand the user, their behavior towards emotions awareness and meditation, their problems and needs, interviews with four potential users have been conducted. We selected four different users with different occupations and from different age groups, namely the research university student, the applied science university student, the employee and the parent. The age of participants ranged from 20 to 51. This sample represents different types of people, and was essential to identify the target group of users.

2.1.2 Materials. We used semi-structured interviews with a set of predefined questions. The participants have been asked whether emotions affect their life and whether they track them and aware of them, what do they know about meditation, whether they use it or if they use any other technique to cope with the emotions. We also asked what the participants think of owning a technology to better track and deal with negative emotions. The interviews have been executed orally and have been recorded in text notes.

2.1.3 Procedure. The interviews have been conducted in non-lab convenient settings to increase ecological validity. Before the interviews the participants have been informed about the aim of the study and how their answers will be used. All the interviews lasted for no longer than 30 minutes. After the interviews it was communicated to the participants that they had the opportunity to be debriefed and ask questions whenever they felt like (for example to get to know the results of the study).

2.1.4 Analysis. For the reason that the semi-structured interview was used in the study, all the questions were pre-defined in advance, and only four people participated, the coding schema was not needed. The interviews have been analyzed according to the answers the participants gave. All the answers concerned the specific set of questions and will be reported accordingly. The full set of questions and answers can be found in Appendix 1.

2.2 Storyboard

To define the problem and show the context of potential use of the product the storyboard as one of the methods has been selected. This method was prioritized because the stories are the most powerful in delivering information and visualizing users' problems. The storyboard shows, how the designed product will approach the users' problems and needs and how it will be used. This method was selected because storyboards easy to create on the initial stages, and are possible to make quick iterations when needed.

2.3 Interactive prototyping

To quickly gather feedback from users, a high-fidelity, interactive prototype has been created. An interactive prototype gives the look and feel of the final product, although the back-end of the product is not yet completed and fully working (Still & Crane, 2017). Therefore, the user can only perform predefined actions. This means that when the user, for example, click on a button that is not linked to a predefined location, nothing will happen. However, with high-fidelity prototyping changes that should be made in order to improve the product will come to light (Still & Morris, 2010).

The tool that is used to create the interactive prototype is *InVision* (<http://invisionapp.com>). This online design and prototyping tool allows you to create high-fidelity, interactive prototypes of different devices, including smartwatches (Orsow, 2015). First, the static graphic interfaces were designed. Afterward, these interfaces of the application were uploaded to

InVision and made clickable within the online tool. In this way, users were allowed to interact with look and feel of the product.

2.4 Video prototyping

Complementary to interactive prototyping, the last method in this research also focuses on producing design solutions: video prototyping. Video prototyping enables the researcher to combine elements of mock-ups, scenarios, and prototyping and therefore create real-life virtual mockups. With this method, the designer is forced to pay attention to the physical, real-world constraints and the interaction between the technology and the user. New design issues will come to the surface before the video can be made (Bardram, Bossen, Lykke-Olesen, Nielsen, & Madsen, 2002). The video created in this research, shows the interaction between a prototype of the product and the user, in a real-life setting.

3 Results

3.1 Interviews

The results of the interviews revealed the difference between participants, representing different age groups.

The research university student. This participant doesn't really use any techniques to deal with emotions and considers meditation as something spiritual and think that it does not believe it actually works.

"I personally wouldn't like to be constantly thinking about how I'm feeling [...]"

The applied science university student. This participant often consciously aware of internal experiences, however, only meditated once. Often feels stressed when there are lots of things to do or when the deadlines are coming.

"Emotions are something natural. I think it's important that you can regulate it yourself."

The employee. The participant experiences lots of emotions throughout the day, which can affect the whole day, his/her productivity and concentration. There is no technique for tracking the emotions or dealing with mood swings. However, the participant is experienced with yoga and tried Headspace app. The participant is eager to experience new things but is tired of computer and cell phone.

"Meditation is mostly not about gadgets. It would be nice to have something more real, tangible."

The parent. This participant reported as not expressing emotions that much, however, keeps track of them because they can affect the daily rhythm and actions being performed. The participant does not consciously try to regulate or alter emotions.

"It might not be something that could become crucial in someone's daily life, but it could potentially be something that would be nice to keep track of."

Based on the interview findings, we identified the target group, which are students and employees aged from 25 to 35 years old. The last participant declared to not being interested in such technology, therefore, we do not consider this age group as a target one for us.

3.2 Storyboarding

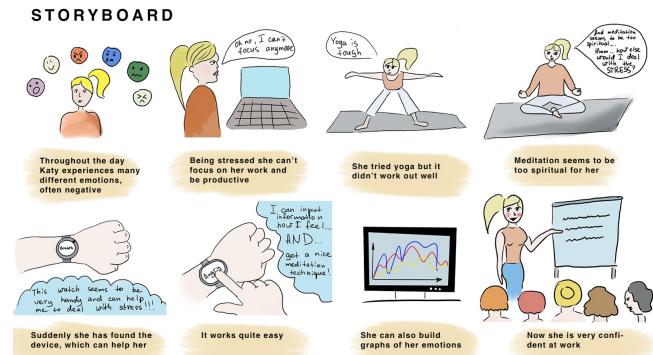


Figure 2: Shows a member of the target group - Katy. She works in the office and experiences lots of emotions throughout the day, often negative. It causes stress and decreases her productivity at work. She tried yoga and meditation but it did not work for her. Yoga seems to be too complicated, and meditation seems to be too spiritual. Suddenly, she finds the device that can help her. This device is the watch, which can track her emotions and give a simple meditation technique. Using the watch, she is less stressed and more confident at work.

3.3 Proposed design and prototypes

Based on the findings of the theory, interviews, and storyboards, we made some crucial design decisions that led us to our final design. First we will introduce our persona named Tania (23 years old) who will be our hypothetical user of the final product. The characteristics and personality traits are based on the semi-structured interviews and the storyboards. According to the interviews, negative emotions experienced by the users overrule their lives and lead to stress and productivity loss. Meditation is considered to be something spiritual and not for everyone. People do not know how to track their emotions and how to deal with stress. The participants experiencing these problems fall in the category of students and young employees. Therefore, we came up with an interactive watch for people between 20 and 35 years old.



Figure 3: Persona.

Furthermore, during active group discussions in our storyboard and interactive prototyping phase, as well as based on the feedback received from the first feedback session, we found that tracking emotions as an emotion diary, often encountered in 'journal therapy' and can be useful to heal a writer's emotional or physical problems, work through a trauma and facilitate more emotional awareness (Allison, 1999). Because of this, we argued that this watch would facilitate a more regulated state of mind through reflections and emotion regulations using the practice of the 'Wheel of Awareness' as well as the 'Psychophysiological Emotional Map'. Mood tracking is a psychological technique for improving mental health by reporting your moods and emotions in order to identify how they vary. Mood tracking helps users increase their awareness and self-regulation of their emotional well-being (Church, Hoggan & Oliver, 2010). A recent study analyzed 32 mood tracking applications and found that most have features supporting the collection and reflection stages of self-tracking (data collection and visualization for example), but lacked support for the preparation and action stages (Caldeira et al., 2018). This project wants to incorporate functions that enable the users to actually act based on the insights gained through reflection, compared to merely tracking their emotions. The mood tracking interface will be based on the psychophysiological emotional map by Villon & Lisetti (2007). This visual representation of 12 emotions is based on the valence and arousal of the emotions (See Figure 2). Because of its circular shape, it can be easily adapted in the design together with the "Wheel of awareness".

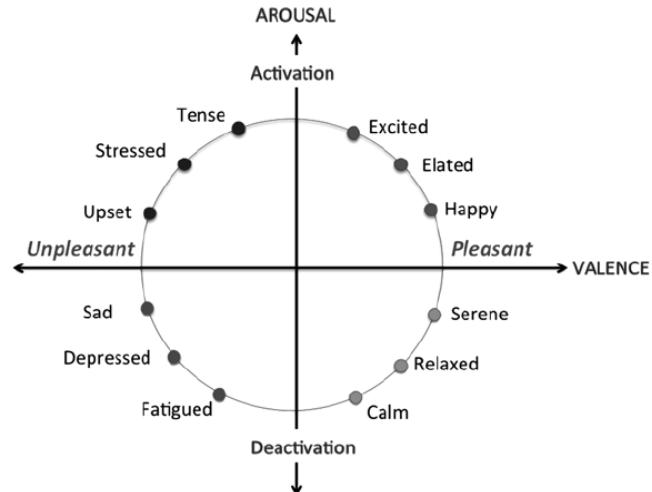


Figure 4: The psychophysiological emotional map (Villon & Lisetti, 2007).

3.3.1 Interactive prototyping. To see the interaction between the user and the product, an interactive prototype has been created. First, the different graphic interfaces that will be used in the watch were designed. They can be found in Figure X and consist of the following screens (described from top left to bottom right):

1. *Clock.* At first sight the watch just seems like a normal clock, so other people will not look at you funny or ask questions.
2. *Starting the Wheel of Awareness.* By tapping the clock screen twice, this screen will appear. It shows the Wheel of Awareness. All four 'pie parts' are colored neutral. The user can start doing their exercises based on the segment the spoke is currently placed.
3. *Completed part of Wheel of Awareness.* After one is done with the exercise corresponding to the segment, the spoke moves on to the next section. The user will continue with another exercise. When the screen is touched once, it will move to the next phase.
4. *Completion of the wheel.* After the user has gone through all four phases, the watch gives the feedback that the Wheel of Awareness is now completed.
5. *Emotion regulation.* The user is asked to pick their emotion.
6. *Emotion regulation picker.* The user will use the visual mapping to assess his or her state of mind at that point in time using the analogy of the emotion axes from the 'Psychophysiological emotional map'. It works similar to a color picker and is easily accessible; the user does not have to spent 15 minutes writing down an actual diary.
7. *Pick emotion.* The user picks an emotion by dragging the circle on the map.
8. *Emotion tracker.* Your emotion will be tracked overtime. After a certain time, the watch gives you feedback about

which emotions you picked overtime. This data will be presented as a heatmap and serves as a reflection part for the users. It might be the case that your overall level is still unpleasant.

9. *Improve emotions overtime.* The system gives you feedback on what to do in the future. After one month, the user might be more relaxed or happy, as shown in this graph.



Figure 5: Screen design for the interactive prototype, placed in a mockup of a smartwatch. All the visuals can also be found in Appendix 2.

The interactive prototyping can be visited via the following links:

- For laptop or smartphone: <https://invis.io/32S7QO3DRKJ>
- For Android watch: <https://invis.io/FUS7QGXAR4P>.

3.3.2 Video prototyping. To use the interactive prototype in a real-world mockup, a video has been created. In this video, a potential scenario is presented regarding the interaction between a user and the product. The video not only shows the scenario, it also shows the designed screens complementary to the actions of the actors in the video. The video can be found at <https://youtu.be/xjos-Mwbu4c>.

4 Discussion & Conclusion

The aim of this study was to design a wearable technology that would support the metaphor for the Wheel of Awareness to induce emotional awareness taking into consideration the findings of our study.

With this in mind, we thought of an interactive watch that will facilitate a more regulated state of mind through reflection and emotion regulation using the ‘Wheel of Awareness’ practice for people between 20 and 35 years old.

Through the methods used for this study, we came up with a final design for the watch of awareness. However, there are some limitations, for instance, additional features can be added to

improve the product overall. First and foremost, the product should be able to make more use of the fact that it is a wearable device. By using features that are exclusive to this watch, it will set itself apart from other meditation related phone or tablet applications. One of these features is a heart rate monitor. With this monitor the watch can keep track of the user’s heart rate and support the process of detecting stress. Another feature that this watch could have, is a skin conductance monitor. Similarly to the heart rate monitor, this could measure body reactions of the user in certain situations, which would lead to a higher accuracy for keeping track of the user’s moods. The user should still give input themselves on how they are feeling at certain moments, but a heart rate and skin conductance monitor can see if the user input is in line with the reactions of their body and provide insights based on a combination of these inputs. The monitors can also make it clear in which of the four phases of the wheel of awareness the inaccurate input would potentially lie. This way it could let users know that their input in that phase is not similar to the readings of the monitor. Other minor features that could potentially improve the product are GPS and voice memos. GPS can have the product keep track of locations to see where the user was when they were in certain moods, while the voice memos could help users remember what situation they were in when they felt that mood. An additional point is that the watch of awareness was never tested with users. Testing it with users might have led to more practical feedback which could have improved the product.

REFERENCES

- [1] Allison, N. (1999). *The illustrated encyclopedia of body-mind disciplines*. Taylor & Francis.
- [2] Bardram, J., Bossen, C., Lykke-Olesen, A., Nielsen, R., & Madsen, K. H. (2002). Virtual video prototyping of pervasive healthcare systems. *Proceedings of the Conference on Designing Interactive Systems Processes, Practices, Methods, and Techniques - DIS 02*. doi:10.1145/778712.778738.
- [3] Caldeira, C., Chen, Y., Chan, L., Pham, V., Chen, Y., & Zheng, K. (2018). Mobile apps for mood tracking: an analysis of features and user reviews. *AMIA Annual Symposium proceedings. AMIA Symposium*, 495–504.
- [4] Church, K., Hoggan, E., & Oliver, N. (2010). A study of mobile mood awareness and communication through MobiMood. *InProceedings of the 6th Nordic Conference on Human-Computer Interaction: Extending Boundaries*, 128–137.
- [5] Costello, K. (2018). Gartner says worldwide wearable device sales to grow 26 percent in 2019. Retrieved from <https://www.gartner.com/en/newsroom/press-releases/2018-11-29-gartner-says-worldwide-wearable-device-sales-to-grow->.
- [6] Desmet, P. M., & Pohlmeier, A. E. (2013). Positive design: An introduction to design for subjective well-being. *International journal of design*, 7(3).
- [7] McCoy K., Palioras G. (eds) User Modeling 2007. UM 2007. Lecture Notes in Computer Science, vol 4511. Springer, Berlin, Heidelberg.
- [8] Orsow, A. (2015, April 24). Apple Watch and Android Wear prototyping is here. Retrieved May 18, 2019, from <https://www.invisionapp.com/inside-design/apple-watch-and-android-wear-prototyping-is-here/>.
- [9] Patel, M. S., Asch, D. A., & Volpp, K. G. (2015). Wearable Devices as Facilitators, Not Drivers, of Health Behaviour Change. *Jama*, 313(5), 459–460.
- [10] Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, 39(6), 1161–1178. <http://dx.doi.org/10.1037/h007714>.
- [11] Siegel, D. (2007,2014). Wheel of Awareness. Retrieved from https://www.drdansiegel.com/resources/wheel_of_awareness/.
- [12] Siegel, D. (2018). *Aware: The Science and Practice of Presence--The Groundbreaking Meditation Practice*. Penguin.
- [13] Still B., & J. Morris. 2010. “The Blank-Page Technique: Reinvigorating Paper Prototyping in Usability Testing.” *IEEE Transactions on Professional Communication* 53, no. 2 (2010): 144–157.
- [14] Still, B., & Crane, K. (2017). *Fundamentals of user-centered design: A practical approach*. Boca Raton, Fla.: CRC press.
- [15] Villon O., Lisetti C. (2007) A User Model of Psycho-physiological Measure of Emotion. In: Conati C.

Appendix 1. Interviews & Answers

	Student (AS)	Student (UNI)	Employee	Parent
Do you use any wearables (activity trackers, step trackers, sleep trackers etc.)?	Telephone counts steps	Iphone's step counter once in a while, after a citytrip for example	No	No actual wearables but the phone keeps track of steps and other physical activities
Do emotions affect your life a lot?	Of course.	Yes I think so, you could say I'm an emotional person so yes.	Yes, they are. In general, emotions for me form the whole day. If something good happens during the day, probably the whole day will be good. But if something bad happens, it affects my day, my concentration, I will be less productive.	It influences my everyday life, all day long. Almost everything I do is somehow affected to emotions.
Do you track your emotions throughout the day, both positive and negative?	No	No not really, only if i'm really stressed or mad about something. Then I try to reflect on it.	I don't track it on paper or with any device but I make myself aware about the emotions I experience. If my emotions jump the whole day, then I feel that I need to sleep or something. So I perform kind of actions. Or sometimes I share how I feel with my partner, it also helps to slow down and fixate my emotions.	Not really.
Are you often consciously aware of your internal experiences (e.g. state of mind / emotions)?	Yes. Because I wonder why I feel this way (why I feel bad or good)	No not really, only if someone else says something about it to me or asks if I'm ok	Not always, for women it is a bit harder I think than for a men. My emotions sometimes overrule many things in my life.	Yes, because it affects my daily rhythm and the actions I perform during a day.
Do you actively seek out to regulate or alter current emotional states?	Well, depends on whether I feel bad. If I feel good I do not tend to alter it. I only do it when I feel bad. So not more than usual.	Only, if other people notice something, then I think to myself "ok get it together". But I'm not thinking about how I feel every day.	I would say yes, especially recently. Before I didn't care a lot. I am an extravert so for me it is important because I experience lots of emotions throughout the day.	I am quite introverted so I do not openly express my emotions all that much. Therefore I also don't really try to alter it very often.
Do you feel stressed sometimes? In what situations? If yes, how you	Yes. Sometimes. Especially when I have a lot to do on a day or when I'm in a rush. Or deadlines. Not only work	Yes, not that often. But of course, I'm stressed sometimes. When a deadline is approaching for example, or I have a lot of things to do	Yes, I feel stressed when I am scared. So fear brings a lot of stress to me. Fear can be caused by unexpected situations or by something	Yes, but not really very intense stress. It's more just slight healthy stress during some situations. This happens for example

deal with this?	related. It's always temporally related.	or something unplanned comes up that changes the schedule. I try to deal with it by making a planning, when looking at stress related to school. It depends on the moment, I don't have one specific thing I do to calm down.	happening in my family. I don't really find the way to deal with stress. Sometimes I cry..or talk to people..it helps. I try to calm myself down but I can not really control myself.	when I travel by plane. Going through security, etc. Or when doing something new for the first time. The way I deal with it is just breathing normally and telling myself it is nothing to be stressed about. Relativating the situation works well for me.
What do you know about meditation?	It helps with feeling rested or getting things in order. That it's from the east of the world. Asia.	Not that much actually. Eumh... No. It's something to calm down. I don't really believe in it. How come? It's related to spirituality and stuff, I don't really think it works, it's all in your head.	I have average knowledge about that. It helps to bring the attention to yourself, to your body.	I know that they are exercises, sometimes by breathing or other calming exercises, that make you feel relaxed and stress-free.
Do you use any meditation techniques in your daily life?	Not much. I've done it once. Then I was very aware of every part of my body. Being aware of yourself.	No, I sometimes just try to calm down and think about everything after a fight or something and try to reflect on it. But that's not really meditation is it?	I used to, but not anymore. I had this app Headspace, so I meditated using it. I also do yoga classes.	Consciously breathing is something I do pretty regularly. Other than that, not really. Just regular ways to relax, like watching a series or having a nap.
What are your thoughts on owning a technology to better track and deal with a negative state of mind (e.g. stress, negative emotions, insecurity, mood)?	Well, if it's a device that does that. No, I think emotions are something natural. I think it's important that you can regulate it yourself. I think it's good if you can regulate your emotions with meditations, because then you're aware and making an effort at getting better. I think it's two sided. You can't be happy if you never experienced sadness.	I think it would be interesting to see like, I was angry on last Tuesday at 15:00 for example. I think it could be useful to notice like, hey I'm stressed more often than I thought. So you can maybe do something about it you know. But it can go 2 ways, if the app says that I'm depressed, but I don't feel depressed, you maybe start to doubt yourself. That's not really how it would work, you would put in how you feel yourself, the watch doesn't measure things to determine itself how you're feeling (explaining our idea and how it would work) Would you be interested in that?	Yes, I would like to do that. However, having too many gadgets is sometimes difficult, there are lots of them in our life already. In the office I work with a computer, I am always staring at the screen. I use cellphone quite often as well, too much to my opinion. Meditation is mostly not about gadgets. It would be nice to have something more real, tangible.	It might not be something that could become crucial in someone's daily life. But like a step tracker on a phone, it could potentially be something that would be nice to keep track of. Just checking your negative emotions and keeping you aware of them. Even if you would also know it without the technology, it could still be something that could be nice to keep track of.

		Like I said, I would use it once or twice to test it and find out about it. But I don't think it's good to be thinking too much about your emotions. I think it can go two ways. I personally wouldn't like to be constantly thinking about how I'm feeling and start comparing my emotions to before and stuff. I can think of people that would definitely be interested in something like that, my aunts for example, but it's not for me		
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Appendix 2. Visuals







