The Health Bar: A Persuasive Ambient Display to improve the office worker's well being

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ABSTRACT
Recent research studies have shown the serious health risks associated with prolonged sitting. Standing up and walking on a regular basis has been proved to improve an office worker's well-being. Small behavioral changes like the aforementioned are the basis of preventive medicine and even though they appear easy to follow, in practice are difficult to apply. Advances in technology miniaturization and smart sensors are paving the way for the development of devices that empower preventive medicine. These devices use the power of persuasion to help people change behavior and maintain well-being. They act as an ambient personal 'coach' that monitors and intervenes at the right time. In this paper we present the *HealthBar*, an ambient persuasive device that helps users break up their prolonged sitting habits.

Author Keywords
Human Augmentics; Ambient Displays; Persuasive Technologies; Calm Technologies; Context-Awareness; Preventive Healthcare

ACM Classification Keywords
H.5.1 Multimedia Information Systems: Multimedia Information Systems—*Artificial, augmented, and virtual realities*; H.5.2 User Interfaces: Haptic I/O

INTRODUCTION
Information, when it is available in real time and presented in a personal, interactive, and engaging way, can have transformative impact on human behavior. For example, hybrid cars have dashboards that give people real-time information about fuel consumption in order to motivate and teach drivers how to improve their driving to conserve fuel. If such motivational and educational capabilities were available in the field of healthcare, people would have the necessary feedback to maintain their well-being. The technologies that aim to motivate people in behavior change are known as Persuasive Technologies (PT) [1, 2]

New healthcare paradigms emphasize the importance of preventative medicine and healthy lifestyles, but often provide little patient support. For example, doctors counsel patients to live healthier and make health-conscious decisions, but patients are then left alone to achieve these goals, often with little success. However, if individuals had the ability to easily monitor their health status 24/7 and receive personally tailored, persuasive, and actionable feedback and suggestions at the right times, they would be continuously coached towards healthier living. Intille identifies two ubiquitous computing trends that are converging to create this new preventive healthcare opportunity [4]: the rapid adoption of powerful mobile computing devices that convey motivational health messages at an appropriate time, and the emergence of real-time context-aware computing that use smart sensors. These smart sensors can sense the user's activity and persuade him/her to change potentially unhealthy behavior and can be used in favor of developing new ways of practicing preventive medicine [3].

The typical office worker spends most of his day at work on a chair. Unfortunately this sedentary lifestyle is not only limited to the office environment: television, computers and game consoles are just a few of the entertainment options that perpetuate this unhealthy lifestyle. Research has shown that people who perform physical activity but fail to break up prolonged sitting periods have higher mortality rates [5].

To address this problem, we designed the *HealthBar* (See Figure 1), a persuasive ambient display that aims to inform office workers about their sitting habits, and persuade them to take short, regular breaks (Henceforth, we define a "break" as taking a short walk after a sitting period).

THE HEALTHBAR
Human Augmentics (HA) refers to technologies for expanding the capabilities, and characteristics of humans [6]. The *HealthBar* is a HA ambient persuasive device that reflects the office workers' health status. It is constructed in the shape of a light-tube which changes color from green to red, depending on the length of the user's sitting period and was inspired by video games, where the color-coding and length of the "Life Bar" reflects the player's status. Initially the *HealthBar* is green when it is fully charged. While the user is sitting at his/her desk, the bar slowly discharges to indicate when he/she needs to take a break. A complete discharge will take forty five minutes of sitting, will lerp the color of the *HealthBar* to red and change the indicator width to about

Figure 1. The *HealthBar* installed below the monitor of an office worker.

four inches. The bar will remain into this state until the user takes a break. However, if no break is taken, the bar will start pulsing twice every 5 minutes as a reminder for breaking up the prolonged sitting. A picture with the *HealthBar* at 50% charge can be seen in Figure 2 and at 25% in Figure 3.

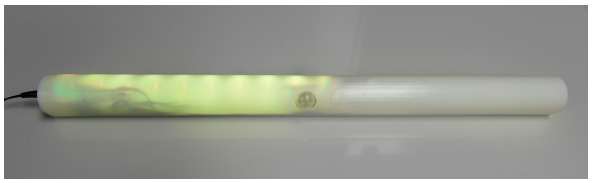

Figure 2. The *HealthBar* at 50% charge.

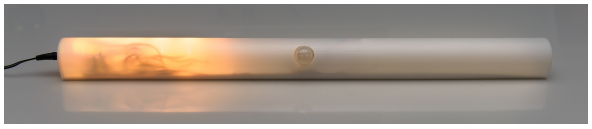

Figure 3. The *HealthBar* at 25% charge. Worker needs to take a break soon.

When the user decides to take a break, the bar will start recharging. The recharging is proportional to the time that the user is away from his desk. A full recharge can be accomplished with a five minutes break. For example, if the bar is at 25% a 2.5-minutes break will recharge the bar to 75%.

IMPLEMENTATION

For the prototyping phase we used the Arduino Uno. Scaling down the electronics to fit in the tube was achieved by using the Arduino Pro mini and a custom breadboard. The exterior of the Health Bar is a 3-feet plastic diffuser lighttube. An individually programmable RGB 18-LED strip was used to light the tube. We detect the presence or absence of a user from his/her disk using a passive infrared motion sensor, which is capable of detecting motion from a distance of 20 feet within a 120-degree sensing cone.

PRELIMINARY USER STUDY

To evaluate the *HealthBar* we conducted a preliminary user study on 8 office workers. Each subject used the *HealthBar* for 5 working days and answered a pre and post study questionnaire. All the subjects agreed that the color representation was easy to understand and made sense. Three subjects responded that the *HealthBar* was not a distraction at all, while half rated it as a very light distraction. Six subjects reported that the *HealthBar* made them more aware of their unhealthy sitting habits and five that they were taking a break because they were concerned of their health. To the question whether they would like to continue using the *HealthBar*, all the subjects responded positively. Finally seven subjects characterized the *HealthBar* as "helpful", while six as "interesting".

CONCLUSIONS AND FUTURE WORK

In the future, we would like to perform an extended evaluation of the *HealthBar* on a longer time period. We would also like to investigate whether users continue to be motivated and take breaks over an extended period of time and see how the motivation curve changes as they get used to the device. A longitudinal user study may also reveal interesting patterns in the breaking habits (i.e. users taking more breaks after holidays, or New Year's resolution).

It would also be interesting to evaluate how the user behavior changes when multiple public *HealthBars* are installed in an office environment. In this scenario the *HealthBars* create a local ambient health network where users can see the health status of their co-workers and consequently can challenge and persuade each other to become healthier. Moreover if the *HealthBars* are interconnected through a network, it would be extremely interesting to perform social network analysis and identify friends, groups of friends, etc.

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