Breakbot: A Social Motivator for the Workplace

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ABSTRACT

Workplace injuries commonly result from long periods of inactivity during computer use. Software exists to help remind people to take breaks but is often ineffective. On the basis of design research performed in an office environment, we propose an emotionally expressive companion robot to encourage employees to take breaks and socialize more regularly. Initial reactions to our design were positive, and encourage further investigation.

ACM Classification Keywords

H.5.2 Information interfaces and presentation: Prototyping

Keywords

Interpretation, Human-robot interaction, Emotional design, Ubiquitous computing, Assistive technology

INTRODUCTION

People all over the world work in offices, and sit all day at a desk using a computer. Imagine Anna, a typical office worker. Anna chats briefly with coworkers while getting her morning coffee, then sits down at her cubicle to work. In the four hours until lunchtime, she gets up once to use the bathroom. Anna enjoys a packed lunch at her desk and an afternoon walk if the weather is nice. Throughout the day, she communicates with coworkers via email or instant messenger, and greets them on her way out of the office.

In an 8-hour day, Anna typically gets up and walks only three or four times and spends the rest of the workday sitting. Years of such a routine can lead to repetitive strain injuries. The lack of face-to-face contact with coworkers also reduces the opportunity for socialization, leaving Anna feeling isolated at work. Even though she knows she should be more physically active during the day she has trouble motivating herself to get up and walk around when there is so much work to do. She has tried time-management software, but hasn't stuck with any of them for long.

In this paper, we propose that a socially interactive robot could assist office workers in pacing their work, and managing break cycles throughout the day. We describe our methodology for designing Breakbot: a robot to help motivate individuals to take active, social breaks from computer work. Initial reactions to our prototype are discussed, and we consider implications for future work.

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BACKGROUND

Relevant literature identifies three general categories of needs that prompt individuals to take breaks: physical, cognitive, and social. Below we discuss the benefits of breaks from computer work as they pertain to these needs.

Physical

According to research conducted by Blatter & Bongers (2002), there are three major risk factors for pain or injuries associated with computer use: neck flexion, wrist flexion, and prolonged static posture. The first two can be addressed through ergonomic equipment and good posture habits, but even ergonomically sound postures, when maintained for hours at a time over long periods, can lead to pain and injury. Prolonged static posture is the result of a person's overall work organization, and not directly addressable through artifacts that change how a person sits or moves. It is up to the individual to take preventive measures such as shifting postures, stretching or walking around.

Cognitive

As well as helping to moderate risk for physical pain and injury, breaks can also help prevent or alleviate boredom and fatigue that negatively affect job performance. Mild physical activity in particular seems more beneficial than just a "mental" break. For example, data entry workers who take breaks that involve physical stretching during short breaks have better job performance than workers whose breaks do not include much physical movement (Henning, Jacues, Kissel & Sullivan 1997, as cited in Jett & George 2003). Finally, breaks offer time for reflection, creative thought, and similar activities that are important for psychological wellbeing (Jett & George 2003).

Social

Part of being a healthy and productive employee also involves having good workplace relationships. A relaxed and open social atmosphere contributes to worker satisfaction, while having contacts with a wide variety of coworkers helps employees gain the information and resources they need to do their jobs effectively. On an individual level, forming in-depth ties with people in positions of authority related to the individual's place within the organization (not just an immediate supervisor, but anyone who is involved in giving feedback or in some way evaluating that individual's performance), helps predict promotions (Podolny & Baron 1997).

PROBLEM SPACE

We address the need for physical activity and social interaction in the workplace by designing a robot that will promote healthy computing habits and facilitate workplace interactions. These robots could be used in an office where work is primarily computer-based to encourage people to get up from their computers and talk with one another face-to-face, requiring both physical activity and interaction with coworkers.

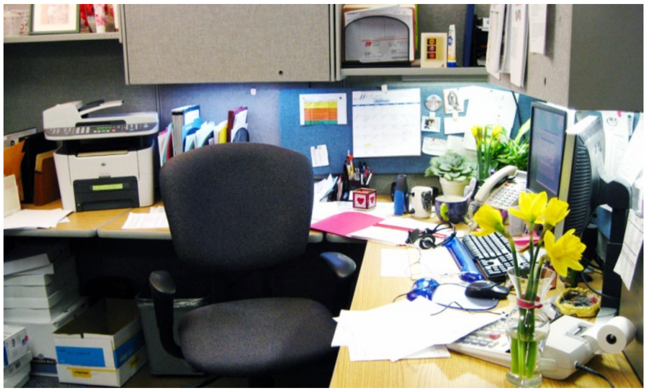

Figure 1 – A typical workspace in the target office environment.

We imagine the ideal environment for this type of intervention is one in which employees are free to determine their own break schedules, are encouraged by their managers to engage in healthy break-taking practices, and where work is done primarily at a personal desktop computer for six or more hours per day. Even offices that share these three features, however, may still pose very different challenges to our design. We situated our study and design in one particular office with the aim of creating a robot that fits well in this environment. In the future, we plan to test the prototype in other offices.

In the office we studied, workers have personal cubicles arranged so that coworkers with similar job responsibilities are nearby. Each workstation has dual monitors, a printer-scanner, and is as ergonomically furnished as possible [Figure 1]. Study participants were predominantly women, and the average number of years in their current position was over ten, ranging from less than one year to over 20.

DESIGN STUDIES

We conducted interviews, a diary study, and an informal survey to gain insight into the ecology to which our design will belong. We worked with managers to recruit participants from an office that shares the three characteristics of our target problem space. For the purpose of our studies, we define break as a period of one minute or more during which the worker is physically away from their immediate work area.

Interviews

We interviewed six coworkers from the selected office about their break-taking practices. The goal of the interviews was to learn about the coworkers' current break practices, such as how often they take breaks, how they decide to take breaks, and what they typically do during their breaks. This information allowed us to understand some of the environmental constraints for our robot design.

We found that participants' break-taking habits varied and although they were aware that taking breaks is important, none felt they were taking breaks frequently enough. When they did move away from their computer, it was most often motivated by a sense of need to get up and do something in the physical world, like retrieve a printed document. For those whose work rarely included physical activity, breaks were taken less frequently. Several interviewees reported that they were more conscious of their break-taking and got more often because of our study, but participant reports of similar reminders indicate the effect fades quickly.

Diary Study

In addition to understanding how, why, and when computer users take breaks, we also needed to understand the implications of the physicality of our design. Our robot will convey curiosity and react to changing environments, to encourage owners to get up and move it around. The purpose of the diary study was to understand individuals' willingness to take a robot with them on breaks. We recruited three participants from the same office in which we conducted the interviews and gave them a small memo pad to carry for a day. The participants were asked to log their breaks, and include the purpose and need that prompted each using a coded notation we provided based on the responses from the interviews [Figure 2]. Most breaks were taken to address work-related needs, such as getting up to pull a file, or physical needs, such as going to the bathroom or getting a drink of water. These tended to be short breaks of two to five minutes taken sporadically. Participants showed very different patterns in their willingness to take the notebooks with them on breaks, so the robot will need to recognize that a break has occurred even when it is left behind.

Activity: [t] talk [w] walk [f] food/drink [o] other
Purpose: [1] work [2] physical [3] mental [4] social

Figure 2 - Activity and purpose codes used in diary study.

Survey

While the design of the behavior and function of the robot was based on the situated environment of use, we took liberty in imagining possible forms for the robot. In a group brainstorming session, we created and photographed around two dozen possible forms. After narrowing the selection to nine forms representing a range from starkly minimal to creature-like, we surveyed 16 members of the greater university community to find out which they preferred and why. Interestingly, the top three forms [Figure 3] spanned the range of minimal to creature-like. We noticed a tendency for older adults and males to prefer the more minimal forms, while children and young women tended to prefer the creature-like forms, but this finding was not statistically significant.

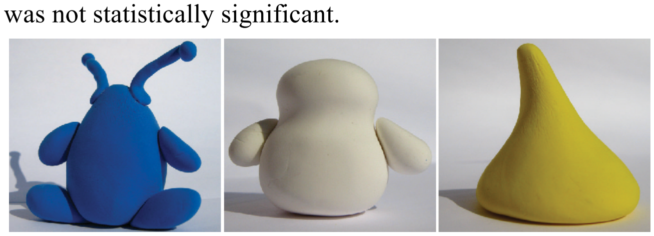

Figure 3 – Three possible forms.

DESIGN

We envision a tool for promoting healthy workplace habits that would be at least partly under employee control and in which they could feel personally invested. Our proposal for Breakbot, a small robot that sits on the worker's desk as a reminder to take breaks, is based on our analysis of the relevant literature, user studies, and the office ecology.

Form

Based on insights from our design studies, we chose a minimal design approach for this project. A minimally-designed robot offers only what is essential to its function, leaving out potentially distracting or confusing features that may lead users to expect more from the robot than it can offer. As we still cannot make robots truly like living creatures, the more a robot tries to be like an existing creature, the more obvious its deficiencies become (Matsumoto, Fuji & Okada 2006). We also chose to avoid emulating familiar animal forms or behaviors to minimize preconceived expectations. By leaving the exact meaning of the robot's form and behavior open to interpretation, users have the opportunity to construct their own meaning.

Results from the survey study suggested some creature-like features were desirable, while the unfamiliar aspects of minimal design were intriguing. We chose to explore the "snowman" form, changing the arms for insect-like ear tufts on the top of its head.

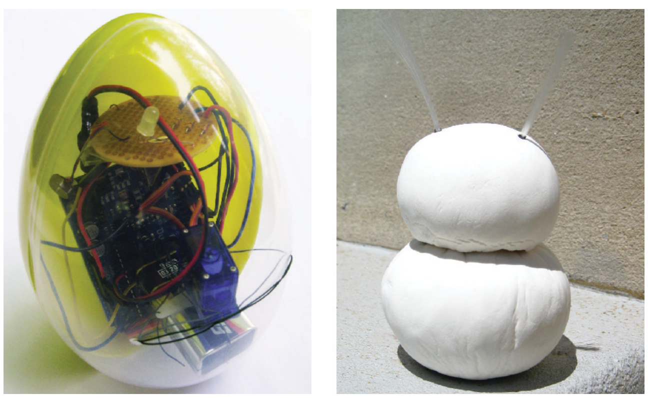

Figure 4 – (a) The working prototype and (b) Breakbot form

Behavior

The robot will employ emotional behavior as a mechanism to communicate with users, to encourage attachment, and to motivate them to care for it. Emotional states are affected by the user's behaviors, and ideally users will value the robot's well being and act in ways that make the robot "happy," in the process taking more active and social breaks.

Bethel and Murphy's (2006, 2007) work on emotional expression in robots without speech or anthropomorphic features offers a vocabulary of behaviors to communicate emotion. Body movement, posture, orientation, sound, and color all offer potential cues for affective expression. For example, jerky motions can express pain, and gentle, aimless motions may express relaxation or contentment. Kozima's Keepon (2009) uses joint-attention and affective cues to inspire users to relate to the robot socially. The robot Mung uses the suggestion of injuring the robot, expressed with blue and red LEDs, to motivate interaction partners not to use profanity (Kim et al 2009).

In addition to existing robot designs, we also drew inspiration from the animal kingdom in designing Breakbot's behaviors. We particularly focused on bioluminescent light shows displayed by organisms such as fireflies, deep-sea creatures, and jellyfish. The strangeness of such expressions may enable social interaction by drawing users together to discuss and interpret the robot's unfamiliar behavior.

Our chosen behaviors mimic bioluminescent qualities of color and changes in light intensity, as well as other modes of expression as outlined by Bethel and Murphy (2006). To express a feeling of comfort, the fiber optic tufts slowly pulse a calm blue; however, if the robot is displeased it can rapidly blink red. The tufts would also have a range of motions to express attention and awareness. If they are retracted Breakbot is gloomy and tired, and if fully extended it is energetic. They would also orient towards sound or people to show attentiveness. The robot expresses further affective cues by vibrating and rocking side to side.

Interaction

Breakbot responds to the physical presence of humans and other breakbots and senses changes in temperature and the amount of light in its environment. Owners can "snooze" by patting the breakbot on the head to soothe it, and pick it up to carry it with them when they take a break.

Use Scenario

When our typical office worker, Anna, comes into work in the morning, she would greet her coworkers and wake Breakbot up. After 45 minutes, the Breakbot becomes restless. Its fiber optic ear tufts blink red and retract into its head. As Anna continues to work, Breakbot vibrates, which catches her attention, and she realizes she has been working for an hour without getting up. Breakbot displays behavior that Anna interprets as curiosity. She thinks that it wants to explore, so she picks it up and carries it to visit another employee's Breakbot. Anna's Breakbot senses changes in its environment and becomes happy again. When it notices the other Breakbot, they wave their tufts and blink at each other. Anna and her coworker have a short conversation, during which they observe their Breakbots interacting. Anna returns to her desk and works until Breakbot becomes restless again. Sometimes she is too busy to stop right away, so she pets it to soothe it. At the end of the day, Anna feels less tired and more productive now that she is using Breakbot.

PROTOTYPE

We programmed an Arduino microcontroller wired to a tricolor LED, a vibration and a servo motor to exhibit Breakbot's simpler behaviors. We constructed the outer form with Model Magic to house the internal mechanisms, but various constraints made implementing the behavior of the fiber optic tufts overly challenging. Instead, we chose to house the prototype in a plastic egg-shaped container and used the form prototype to illustrate the behavior of the tufts manually. The working prototype [Figure 4 (a)] uses the weight of the battery to rock from side to side. The tricolor LED will change colors slowly or rapidly, and the vibration motor will rattle inside the egg to create noise.

Evaluation

After creating our prototype we returned to the office where we conducted the interviews and diary studies to present our design. Audience members included employees both familiar and unfamiliar with the design, and the discussion following the presentation was lively. The form of the prototype [Figure 4 (b)] was met with enthusiasm, but with concern for its size and portability. Having sized the prototype to house an Arduino board, it is larger than we intend the finished product to be. One participant presented a 3” tall figurine she had in her workspace as a preferred size, and others agreed enthusiastically.

Employees were quite interested in personalization, and suggested that the robot should be customizable according to the owner's mood, or that it should somehow be more individual, and distinct from others in the office. When asked whether they personally would use the robot, most thought they would find it helpful at first, "until the novelty wore off," so designing for long term interest will be important. Comments such as "What if I lose it? Will it help me find it?" and "Mine would die," indicated a concern for the robot's welfare as well as concerns about being responsible for one more thing at work.

Implications for Redesign

Our interviewees expressed concern at the thought of needing to carry the robot every time they left their desks, so the final design includes mobile sensors that clip to clothing or ID badges, and communicate with the Breakbot wirelessly, so it knows whenever a user moves. Concerns that the robot might cause workers to become distracted while on break, extending breaks longer than intended, led us to think about the need for Breakbot to signal the end of a break as well.

DISCUSSION AND FUTURE WORK

Our research confirmed that break scheduling in an office environment is erratic. Participants did not take regularly scheduled breaks, but did take opportunities to briefly leave their workspaces. Habits did not seem to depend on type of position or length of time employed; however, we did observe that personality differences affected break habits and patterns of interaction that took place within an established social ecology. We should be aware of the effects of personality differences on how individuals use and interact with the Breakbot, and future work should explore strategies for responding to these differences. Breakbot may be one part of a system of devices and policies intended to encourage healthy computing and improve working conditions.

It is also important to note that our study focused on a single small office within a large academic institution. The people who work in this office, and their work setting, may not be representative of the larger population of office workers. Different environments such as a legal firm or doctor's office might have varying patterns of workflow and interaction, and concerns about interrupting sensitive work. Additionally, particular professions may be more or less enthusiastic about incorporating a new technological device into their workplace.

The responses to our prototype were positive, and comments from the participants revealed a sense of the Breakbot as a creature needing human care for its own well being, with appeal as a playful office accessory. We are hopeful that for people with the knowledge and the desire to take healthy breaks, an extra external factor such as a social robot will provide the needed support for long-term behavior changes, turning a temporary increase in physical breaks into a habitual part of the workflow.

REFERENCES

1. Arnold, M.B. (1960). Emotion and personality. New York: Columbia University Press.
2. Bethel, C. L. & Murphy, R. R. (2006). Affective expression in appearance-constrained robots. Proceedings of HRI ’06, 327-328.
3. Bethel, C. L. & Murphy, R. R. (2007). Non-facial/non-verbal methods of affective expression as applied to robot-assisted victim assessment. Proceedings of HRI ’07, 287-294.
4. Blatter, B. M. & Bongers, P. M. (2002). Duration of computer use and mouse use in relation to musculoskeletal disorders of neck or upper limb. International Journal of Industrial Ergonomics, 30, 295-306.
5. Demirbilek, O. & Sener, B. (2003). Product design, semantics, and emotional response. Ergonomics, 46, 1346-1360.
6. Desmet, P. M. A., Overbeeke, C. J. & Tax, S. J. E. T. (2001). Designing products with added emotional value: development and application of an approach for research through design. The Design Journal, 4, 32-47.
7. Kim, E. H., Kwak, S. S., Han, J. & Kwak, Y. K. (2009). Evaluation of the expressions of robotic emotions of the emotional robot, “Mung.” Proceedings of ICUIMC ’09, 362-365.
8. Kozima, H., Michalowski, M., Nakagawa, C. (2009). Keepon: A playful robot for research, therapy, and entertainment. International Journal of Social Robotics, 1, 3-18.
9. Podolny, J. M. & Baron, J. N. (1997). Resources and relationships: Social networks and mobility in the workplace. American Sociological Review, 62, 673-693.