Fishualization: a group feedback display

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Abstract

In this contribution[1] we present a novel psychological intervention that maps human computer activity to a group feedback device on the basis of a combination of various types of unobtrusive, low-level sensors. The goal is to enable employees to gain insights into their working habits, to reduce stress levels and increase productivity. The unique approach taken is a social feedback board (*fishualization*), which gives collective feedback to employees of an entire department to stimulate social interactions, group awareness and openness, which are all beneficial for well-being at work. Fishualization is set up with a reconfigurable and modular approach to visualization and reasoning components to allow future additions and improvements.

Introduction

In our connected workplaces it can be hard to work in a calm and focused way. Ruff [5] speaks of 'plugged in compulsion' as "the strong need to check mail and the internet to stay in touch", and 'hurry sickness' as "the belief that one must constantly rush to keep pace with time". Stress can either directly lead to illness through its physiological effects or indirectly, through maladaptive health behavior, like smoking, poor eating habits or lack of sleep [1]. Certainly, some amount of stress is not harmful and might even be beneficial to gain concentration and focus, but extended periods of stress can be dangerous for health, e.g. causing burn-out.

Recent TNO research (2013) indicates that out of the Dutch workforce of 7.4 million people, 1 million have burn-out complaints and that stress and workload are identified as the main reasons for at least 7% of reported sick leaves with an estimated cost of roughly 900 million euro per year.

The goal of the Fishualization system is to enable employees to gain insights into their working habits to reduce stress levels, prevent burnout and increase productivity. The social feedback board increases awareness and stimulates discussion between employees and their differences in ways of working, which contributes to reduced stress and burnout prevention. Besides the feedback board for the whole department, an extension is provided with a personal feedback tool that provides personal feedback on working behavior, based on computer logging and input of subjective experience (energy level).

Related work

The SWELL fishualization system bears some similarity in function with the Hello.Wall from Fraunhofer [4], see Figure 1 (left). However, the Hello.Wall is considered to be 'informative art' and more abstract and futuristic without an explicit goal or application. When compared with the Hello.Wall, SWELL fishualization does not sense the vicinity of people for personalized feedback but it shares the concept of visualizing working patterns in a friendly and anonymous way without judgment. Both approaches also share the idea of using a reconfigurable and modular approach: the Fishualization system can easily be extended with new sensors, reasoning and mapping between data/information and visualized fish behavior.

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Figure 1. (left) Hello.Wall from Fraunhofer, (right) SWELL fishualization.

System description

The Fishualization system includes basic sensing using key logging (uLog [9]), a data storage and messaging framework (CommonSense [10] or RabbitMQ [11], both frameworks are possible), central aggregation and analysis of sensor data, and visualization of data at a central place (like the coffee corner) as feedback strategy. See Figure 2 (left) for a system architecture overview. The primary sensor is the key-logging software uLog, installed locally at each individual's PC, that captures key strokes, mouse movements and clicks together with information provided by the operating system: window titles, active applications, application switches, etc. Other sensors and sensor processing may add other modalities like heart rate, dominant facial expression (from FaceReader [12]), and for example e-mail sentiments [7].

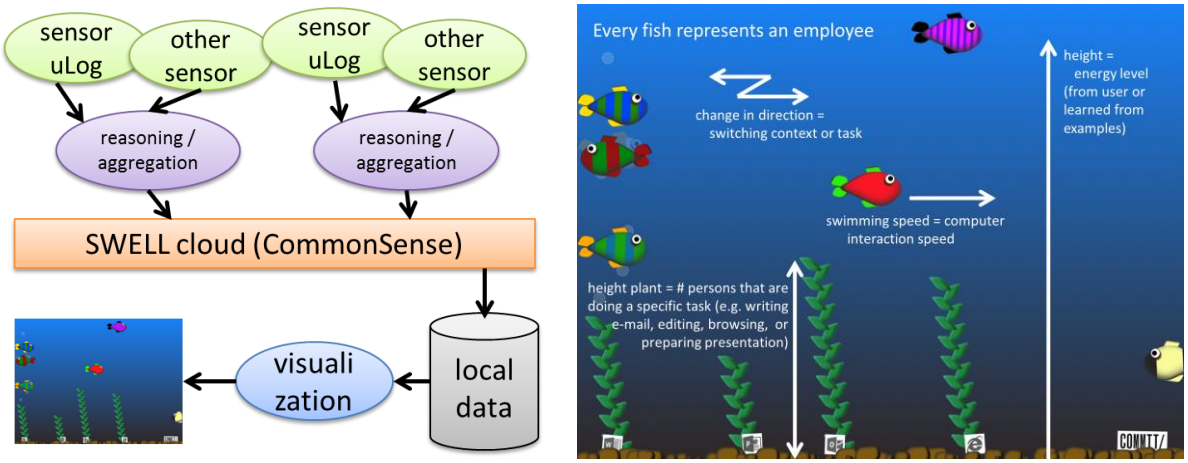

Figure 2. (left) Fishualization architecture (right) Fishualization legend.

The key-logging data is aggregated over time (1 minute) by the (local) reasoning/aggregation component. The aggregation keeps track of the keyboard and mouse activity as well as open applications and switches between them. Every minute the aggregation components post a data message to the SWELL cloud: CommonSense or a combination of RabbitMQ and an SQL database (in the experiments the RabbitMQ/SQL framework is used). The 'fishualization' shows visualizations of the state or mood of the group or individual people working in that specific group. Each fish represents an individual employee, see Figure 2 (right). The y-position of each fish represents the energy level of the corresponding employee on a scale of 0% (no energy) to 100% (full energy) and that is asked every 20 minutes by means of a pop-up dialog. The speed of horizontal movement of a fish is determined by how fast the corresponding employee is interacting with their computer (number of clicks and keystrokes) and the number of changes in direction per time unit represents the number of task or context switches per time unit. In this way a distinction can be made visible between fish (aka employees) that are in 'the flow' (no switches, high

speed) and employees that work fragmented (many switches, low speed). Fish that leave the display at one side appear shortly thereafter at the opposite side with the same swimming direction. 'Plants' at the bottom of the screen represent active applications, for example, e-mail client, document editor, browser, or presentation editor. The more people work with a specific application, the larger the plant. In order to see your own fish behavior at the corner visualization works with a delay of seconds and an aggregation time of minutes.

Future additions will include real-time reasoning components to extract information to intelligently detect context switches (from one project to another) [6,8] and classify interaction patterns into pre-categorized task labels like 'writing e-mail', 'editing document', 'browsing', or 'preparing presentation', etc. [2,3]

Experiments

We are currently experimenting with the Fishualization group feedback device in our own working group with approval of management. A second and third deployment at other companies is anticipated in the near future.

Figure 3. Feedback device (PC and computer display) and camera and microphone for data collection.

The feedback device (a large computer display) has been placed in our coffee corner; a computer runs the web-based fishualization on the display, see Figure 3. In order to measure the effects of the deployment of Fishualization data collection was started 3 weeks before the official start. Using a webcam and a microphone, data was collected to measure activity at the coffee corner. Camera and microphone automatically deduce the number of detected faces, the amount of video motion and the average sound level. In order to warrant privacy of participants, images and sound are not stored but per minute aggregated values of number of detected faces, motion and sound volume are stored. The data collection is continued to compare activity statistics before and after deployment of fishualization. Figure 4 shows a typical day pattern at the coffee corner.

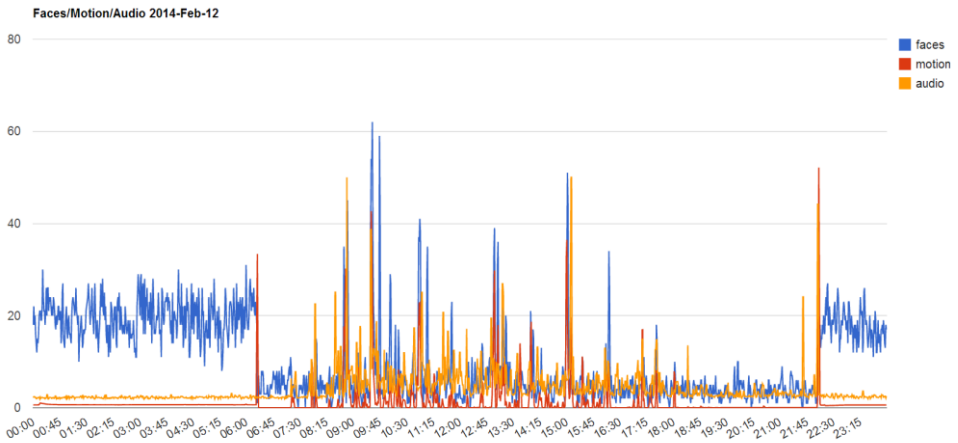

Figure 4. A typical day pattern at the coffee corner (the high number of detected faces between 22:30pm and 6:00am occur because the face detector is sensitive to noise when the lights are turned off in that period).

Evaluation

For future evaluation of the experiments we will use pre- and post-test questionnaires to measure several dependent variables that relate to the following claims:

C1: Collective department feedback stimulates social interactions, group awareness and openness, which are all beneficial for well-being at work.
C2: The feedback data is visualized in an intuitive, easily interpretable and appealing way so that it is most effective for gaining insights.
C3: The user's privacy is warranted, no detailed content information is shared (user's 'sensed' level of privacy is a key factor for acceptance of employees).
C4: Including a subjective variable (energy level) improves the personal awareness of well-being at work and its relations to working patterns.

Conclusions

In this paper we have introduced our fishualization concept. At the moment we are conducting experiments with this group display at one company and have plans for roll out at two other companies. Future additions will include reasoning methods for (semantic) interpretation of heterogeneous multi-scale sensor data providing information on context switches and task recognition (writing e-mail, editing document, browsing, or preparing presentation). The activity representations that are used can be easily extended with affect aspects as well; for example using analysis of facial expressions or analysis of e-mail sentiments (SWELL e-mail plugin).

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