IdleWars: a Pervasive Game to Promote Sustainable Behaviour in the Workplace

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Abstract. Energy reduction is one of the main challenges that countries around the world currently face, and there is potential to contribute to this by raising awareness towards sustainability in the workplace. We introduce IdleWars, a pervasive game played using smartphones and computers. In the game, workers' pro-environmental or wasteful behaviour is reflected in their game score, and displayed through eco-feedback visualisations to try and call attention to energy wastage and potentially reduce it. We conducted an initial deployment for two weeks in an open plan office, and observed that the game dynamics works in terms of engaging participants and drawing their attention to the pro-environmental behaviour.

1 Introduction

Sustainability, both in the workplace and at home, has gained increasing attention in the HCI community [2, 10]. Indeed, reducing energy consumption is one of the main challenges that countries around the world are currently facing, and it has been pointed out that raising awareness towards sustainability in the work environment may contribute to this [5]. A large part of this potential is related to energy wastage [4, 13], i.e. equipment being left on when not in use. For example, 9% of workers in the UK reported to never shut the computers down[1]. This energy wastage results not only in additional cost for the industry, but, more importantly, in unnecessary carbon emissions.

We refer to the time that a computer is left on while not in use as "idle time", and we argue that idle time reduction offers a rich opportunity to study interventions to promote energy awareness and behaviour change in the workplace. It is worth emphasising that the aim of our work is researching

[1] http://www.1e.com/energycampaign/downloads/PC_EnergyReport2009-US.pdf

interactive interventions to promote environmental awareness and behaviour change, rather than directly addressing reduction of computer energy consumption. Indeed, the potential energy savings related to computer usage can be considered relatively small (but not miniscule [9] in the context of computer-based work environment) compared to other sources of consumption, e.g. climate control, and there are already commercial solutions available on the market to reduce computer idle time by automatically switching computers off at predefined times (e.g. 1E NightWatchman[2], Cisco EnergyWise Suite[3]). Instead we adopt computer idle time as a *symbol* and as a convenient *research vehicle*, not only because it is easy to recognise as an example of wasteful behaviour, but also because it greatly simplifies the prototyping and evaluation of interactive interventions (as discussed later in the paper). Moreover, idle time is a rather *direct* measure of wasteful behaviour: while increases in energy consumption may be related to increases in productivity [6], idle time is always undesirable.

In this paper we introduce *IdleWars*, a pervasive, competitive game played using smartphones and desktop computers. In our game, workers' pro-environmental or wasteful behaviour is reflected in their game score.

A reduction of wasteful behaviour could be either the result of individual behaviour change, or the result of communal policies, whether at company level or at larger scale. Recently, researchers in sustainable HCI started to question whether eco-feedback visualisations that target individual behaviour change, are an appropriate mean to address sustainability issues [8]. While we largely share such doubts, we argue that when integrated within the broader context of a game for the workplace, feedback visualizations can be instrumental in raising awareness and promoting the proposal and implementation of pro-environmental policies.

2 Related Work

Froehlich et al. provide a review of eco-feedback technology and interventions, discussing the potential benefits of cooperation between the academic fields of HCI and environmental psychology [2]. To date, research related to eco-feedback is mostly focused on the domestic environment [2]. Few papers have addressed eco-feedback in the work environment. Siero et al. [13] investigated behaviour change related to energy conservation in two units of a metallurgical company.

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2 http://www.1e.com/it-efficiency/software/nightwatchman-enterprise-pc-power-management/

3 http://www.cisco.com/en/US/products/ps10195/

Pousman et al. [10] proposed *Imprint*, a system that tracks the documents people print in the work environment, and provides a visualisation of the resources consumed in this way on a semi-public display. Schwartz et al. [12] installed plug-level energy meters in a few offices of a research organisation and observed the reactions of employees through business ethnography. Jentsch et al. [5] presented an energy-saving support system for work environments that leverages a variety of sensors (temperature, electricity, light, contact) to provide workers suggestions about how to act in an environmentally friendly way, however, no real-world evaluation is reported.

Games have also been used with the aim of promoting pro-environmental behaviour, mostly in the domestic context, and targeting children and teenagers [1, 3, 11]. In contrast to this prior work, IdleWars, the game we present here, is a pervasive game designed for adults in the work environment.

The only two games designed to encourage pro-environmental behaviour in the work environment are *Climate Race* [14] and the *Energy Chickens* [9]. Climate Race tracks players' activity in the real world at the room level, through environmental sensors (e.g., switching off lights when not in the office); based on this activity players gain positive or negative points. In the Energy Chickens game, animated characters are used to represent the energy consumed by individual devices in an office (through device level current sensors). Our approach is different from Climate Race and Energy Chickens in three ways: first, it does not require sensors, as activity detection takes place in software on existing office IT infrastructure. Second, in IdleWars the game score is related directly to wasteful behaviour (energy consumed when devices are not in use), rather than the more generic energy consumption. Third, as a pervasive game IdleWars introduces an element of physical action in the real world, beyond screen-based gameplay, with an aim to increase engagement.

The idea of using computer idle time as a proxy for energy wasteful behaviour was originally proposed by Kim et al. [7], who used this measure to investigate two persuasive ambient displays. While their work focussed on individual users, IdleWars uses computer idle time in the context of a game and the online nature of it provides not only personal feedback, but also comparative feedback.

3 Game Design and its Rationale

We started the design process by taking into account the main contrasts between the workplace and domestic environments, to try and best apply lessons from prior work. The first important difference is the lack of incentives: employees generally do not share financial benefits coming from lower energy bills [4].

Another key difference is that workplaces often have a richer social dimension than in a domestic context, not only because generally there are more people in an office than a home, but also because these multiple social groups and layers (e.g. friends, teams, divisions, departments, cross-cutting projects, etc.) may co-exist among workers.

Against this background, we decided to design a game. We believe that through a balance of competition and collaboration games have potential to leverage and influence social dynamics, in a way that can be steered towards pro-environmental behaviour. We decided to focus on wastage around personal *computer usage* for several reasons: first, in the work environment the computer is mostly a personal tool and only its owner has the responsibility of switching it on and off, so it is possible and easy to track *individual behaviour*, in contrast to shared equipment (e.g. from shared printers to coffee machines to corridor lights), for which apportionment would be more difficult or even impossible. Second, in the context of in a midsized office, monitors and computers influence significantly the overall energy consumption [9]. Third, monitoring computers can be achieved *purely in software*, without any additional hardware, therefore keeping deployment costs and installation complexity low and making the system easily scalable.

Figure 1. (a) A participant busting the idle computer of another player by scanning the QRCode on the IdleWars screen saver. (b) A busted computer showing the profile picture of the player.

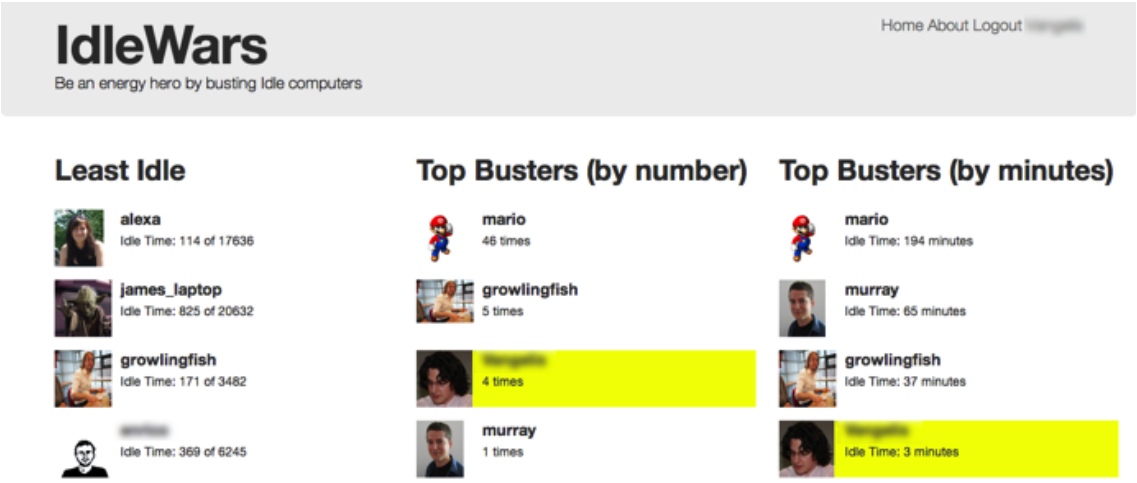

Figure 2. The leaderboard visualisation

IdleWars, the game we designed, tracks the computer status for each player. When no mouse movements or key strokes are detected for more than 5 minutes, the computer is considered inactive, or "idle". In such case, a screensaver appears on the computer screen, showing a QR code, a short url, and an additional alphanumeric code, as illustrated in Figure 1 (a). Any player (other than the computer owner), can then "bust" the idle computer by scanning the QR code with a smartphone, or by manually typing the short url or the alphanumeric code in any web browser (in case a smart phone is not available). Following the busting action, the screensaver of the idle computer changes to show the profile picture of the person who busted the computer, as illustrated in Figure 1 (b). At any point the "owner" of an idle computer, whether busted or not, can close the screensaver and resume the normal operation by moving the mouse or pressing any key. If the idle computer is busted, the owner will see a full-screen profile picture of the player who busted them when they return to their desk. Once a computer has been busted by one player, it cannot be busted by anyone else. The computer based idle time and bust count is presented in aggregate form on the game leaderboard (see Figure 2) via a public display, so our participants were exposed to it throughout the duration of the trial.

4 Initial Evaluation

We report a two-week deployment "in the wild": a medium size organisation, where 20 employees volunteered to participate. Interaction logs were automatically collected by the system, including: idle and active time, bust attempts. Moreover, participants were invited to comment on the trial via an online shared document, and we kept track of emails received from participants. In total 16 comments were recorded by 11 participants and 9 emails were received from 4 participants. Comments and emails were treated as qualitative data. In total, 14 participants out of 20 busted a computer at least once. We found

that the total 37 busting actions took place on just 9 computers, which got busted from 2 to 11 times.

Beside interaction logs, engagement with the game was demonstrated through the choice of profile pictures and emails. During the registration process we described to the participants how the picture would be used. Only six of the participants used an actual photograph as profile pictures, the rest used images of animals, cartoon characters, flowers. One of the participants used an image of a kitten corned with a hand pointing at it, with a message Figure 1 (b). After seeing the game in action, 2 participants emailed us because they decided to change their profile picture to humorous images that included messages for the players they busted (e.g. "I busted you").

We observed that the game sparked discussion within the organisation with regards to computer based energy conservation. The main topic was the trade offs between sleep and hibernation power-saving states in terms of consumption and workflow impact. A few participants commented on technical issues related to the computer power-off, hibernation or sleep, not only in terms of time required to resume work, but also in relation to some specific software applications, which because of interrupted network connection would stop working after resuming.

5 Conclusion and Future Work

In this paper we introduced IdleWars, a pervasive game designed to promote energy conservation in the workplace, in terms of computer idle time. An initial evaluation revealed that the game design works in terms of engaging participants, and raising awareness on energy conservation. It opens the way for further research to investigate the impact of a similar game dynamic other environments such as the home environment. We believe that computer idle time as a measure of pro-environmental behaviour has potential for larger scale, remote deployments, and engagement through online social networks.

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