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Reducing temporal tensions as a strategy to promote sustainable behaviours

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ABSTRACT

This research proposes that it is possible to deliberately reduce temporal tensions in order to promote energy saving behaviours. People may not dedicate enough time to planning their tasks that consume energy, rushing into them without much deliberation. They may also use more energy than necessary in an attempt to accelerate processes that seem to be taking too long, to reduce the boredom of waiting. Persuasive technology provided the tools to manipulate the perception of time and therefore elicit changes in the specific behaviours that result in unnecessary energy usage. Cooking tasks were used as the scenario to test behaviour change strategies delivered via a smartphone application. Results showed that these strategies facilitated the performance of sustainable behaviours. Participants reported that the app made (1) them more likely to follow the steps needed to use less energy, (2) the activity more enjoyable and (3) the time appear to pass more quickly compared to a control version.

1. Introduction

The potential of technological interventions to bring about sustainability has gained attention over the past few decades. This research field has diverse labels such as Sustainable Interaction Design (Blevis, 2007), Environmental Human-Computer Interaction (HCI) (Goodman, 2009), Sustainable HCI (DiSalvo, Sengers, & Brynjarsdóttir, 2010; Huang, 2011; Silberman & Tomlinson, 2010) or Information and Communication Technologies for Sustainability (ICT4S) (Hilty & Lohmann, 2013). However, there is ongoing demand for increased research in the area, the development of new innovative strategies to motivate sustainable behaviours, and success evaluation (Huang, 2011; Silberman & Tomlinson, 2010; Steg & Vlek, 2009).

Human behaviours are generally complex and are determined by diverse factors such as demographic variables, personality characteristics, and situational and domain-specific factors related to the behaviour under investigation (Fishbein & Ajzen, 2010). There is a large number of theories attempting to explain behaviours and to provide the mechanisms for change (Davis, Campbell, Hildon, Hobbs, & Michie, 2014). An individual's attitudes, social norms and the level of control they have can partially explain the performance of behaviours (Fishbein & Ajzen, 2010). Other theories include social learning and more individual aspects such as self-efficacy (Bandura, 2001). Studies intending to evaluate behaviour change may be more effective when starting from the identification of the specific behaviours to be changed and an examination of the main factors underlying this behaviour (Abrahamse, Steg, Vlek, & Rothengatter, 2005). Upon identifying these determinants, the chosen theory should inform the adequate intervention methods to attempt to change the consequent behaviours.

Persuasive technology describes a field where computational systems induce transformation of either attitudes or behaviours (Oinas-Kukkonen, 2013; Oinas-Kukkonen & Harjumaa, 2009). Persuasive technologies can be used to increase energy use awareness, change people's behaviour and motivate them to commit to more environmentally friendly actions (Fogg, 2003). There has already been substantial work performed on strategies that can be implemented to change individual behaviours towards energy conservation. Research often investigates the use of technology designed specifically to change people's attitudes and behaviours, and these studies report different levels of success in promoting energy conservation in various forms of domestic energy use, from heating (Wilson, Bhamra, & Lilley, 2015) to cold appliances (Tang & Bhamra, 2012). The design of products and

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services can influence how we behave and ultimately contribute to minimising the negative environmental impact of energy consumption (Lockton, Harrison, & Stanton, 2010).

One of the reasons for people wasting energy is that they do not want to wait nor put effort into energy saving behaviours. Chetty, Brush, Meyers, and Johns (2009) exemplify this with the classic example of how people use computers. Devices are frequently left on because they do not want to experience the frustration of long boot up times. Previous studies with individuals who act pro-environmentally indicate that "efforts to be environmentally responsible typically required significant dedication of time, attention, and other resources" (Woodruff, Hasbrouck, & Augustin, 2008, p. 313).

Cooking activities present special challenges for time management, and they can affect energy use. One study found that when acting patiently, participants used the least energy to complete the preparation of a menu (DeMerchant, 1997). Users in a hurry generally exhibited the highest energy consumption due to pre-heating saucepans, using high heat and not matching the diameter of heat source and cookware. These examples of previous research indicate that unnecessary energy use is caused by the unwillingness of people to dedicate enough time or pay the required attention to an optimised procedure that could save energy. In addition, individuals may want to accelerate the activities, resulting in extra energy use.

1.1. Temporal tensions

A group of researchers in Finland (Oulasvirta, Tamminen, Roto, & Kuorelahti, 2005; Tamminen, Oulasvirta, Toiskallio, & Kankainen, 2004) observed the concept of temporal tensions and defined it as the psychological construct based on assessing the availability of temporal, mental, physical and social resources. Sometimes it is necessary to fit more actions into a given time frame. In other situations the relationship between time and action is stretched – for example when individuals are just anticipating outcomes that are imminent.

This research proposes that it might be possible to promote energy saving behaviours via the implementation of strategies to reduce temporal tensions. Having the right information on how to act efficiently may not be sufficient to motivate sustainable behaviours. Temporal tensions can make it more difficult for people to perform certain behaviours, especially those believed to increase time to complete tasks. Therefore, the introduction of an intervention that reduces temporal tensions appears to be one way to motivate sustainable behaviours. Designing systems that change the involvement of the individual with the tasks has the potential to alter the sense of duration, make time appear to pass quickly and consequently reduce temporal tensions during specific activities. To date, no studies were found investigating how manipulating time perceptions could ultimately promote sustainability.

1.2. Perceptions of time and duration

Humans have subjective mental timers that affect the focus on the passage of time, therefore events may be perceived as having shorter or longer duration than clock time (Zakay & Block, 1997). This phenomenon is usually dependent on the density of the experience (Flaherty, 2000; Holubar, 1961). Having few acts in a timeframe will make the temporal distance appear relatively longer (Fig. 1b), and people then perceive time to 'drag' or be prolonged. Conversely, a higher number of events between points in time indicates that the distance between these two points appears relatively shorter (Fig. 1a), making time seemingly 'fly' or be accelerated (Lewis & Weigert, 1981). It is common to say that 'a watched pot doesn't boil', in reference to the "situation in which there is the perception that time is passing slowly" (Flaherty, 2000, p. 149). Individuals notice that the time is passing through changes in the environment. In periods of waiting and boredom, there is the impression that time lasts longer than expected or usual: there is not much happening to fill the units of time. The notion of time can be more painfully vivid during expectation and when we have to endure delay (Fraisse, 1963).

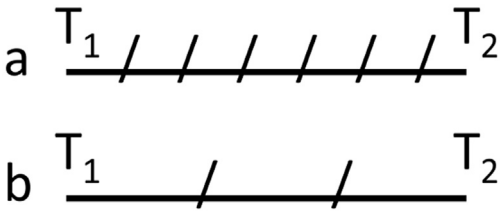

Fig. 1. Time and events (Lewis & Weigert, 1981).

Fig. 2 illustrates a paradox of time: Situations with extremely high stimulus complexity, such as those involving danger (a car crash, an assault) will demand high attention to self and situation, thus will be perceived as passing slowly. On the other extreme, situations with low stimulus complexity, such as when simply waiting during periods of boredom or when in stimulus depriving environments (empty waiting rooms, prisons) can also be perceived as passing slowly (Flaherty, 2000). Therefore, to make time appear to pass quickly, the situation must present neither high nor low stimulus complexity. Temporal compression can occur with low complexity of routines or habits involving low conscious deliberation. Between unusually slack times and extremely eventful circumstances sits the usual comfortable situation, when people experience routines and habitual times, which can make time pass relatively easily (Flaherty, 2000).

The optimal relationship between the challenges of the environment and one's skills determines an ideal state that is referred as *Flow* (Csikszentmihalyi, 2000). Fig. 3 illustrates this optimal state, when an individual's skills match the challenges of the environment. However, if one's level of skill is high and there is not much challenge, this individual feels bored. If the challenges are higher and there are not enough skills to cope with these challenges, anxiety builds up. In a state of flow people's attention is entirely focused on the task at hand, they tend to lose track of time and start doing things spontaneously and automatically without

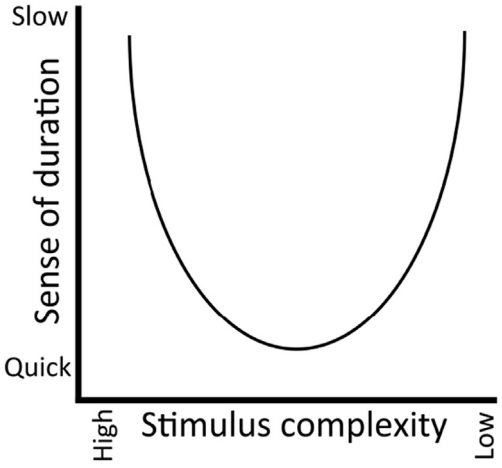

Fig. 2. Sense of duration of time versus stimulus complexity (based on Flaherty, 2000).