Motivating Sustainable Behavior

Ian Oakley, Monchu Chen, Valentina Nisi
Lab:USE
University of Madeira, Funchal, Madeira, Portugal
ian@uma.pt, monchu@andrew.cmu.edu, valentina.nisi@gmail.com

ABSTRACT

Personal resource consumption is a major issue in sustainability. Consequently it has attracted a great deal of attention in the research community across domains including psychology, design and, more recently, HCI. Extending this body of work, this paper proposes the theoretical basis and general design of a system intended to enable users to understand the effect of their resource consumption practices and the direct influence that changes in their behavior patterns will have. The system has not yet been constructed. The design is motivated by the desire to enable users to experiment with, draw conclusions on and personally optimize their personal energy consumption. This vision is fundamentally one of citizen scientists, empowered to take responsibility for and reason about the consequences of their own actions. A further key element in this paper is to support communities of users as they develop, share and promote these sustainable conclusions and best practices, essentially aiding activists to spread their local message about this key global issue.

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Motivation, sustainability, resource consumption

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

In the face of environmental scares, rising costs for fuel and food and diminishing availability of these resources [14], sustainability and the environment have become prominent economic and political issues across the globe, literally becoming make or break issues in elections [e.g. 3]. In spite of this, the level of change individuals enact in their own behavior remains worryingly low. This matters: resource consumption in the home and commercial sector is reported to be almost 20% percent of overall consumption in the USA [15], and up to 20 times per head greater than that in the third world. Europe and developed Asia fare little better with multipliers of 12 and 10. This paper explores the issues underlying this discrepancy: why do vote green, but not act it? And, more importantly, it offers a theoretical understanding of how we as technologists and interaction designers can influence this trend.

It achieves by reviewing the literature on theories of motivation and linking the conclusions of this discussion into a framework of activism supported by technological systems and services which allow individuals to capture, understand and communicate not only the impact of their behaviors but also the impact of their changes in behavior. By designing infrastructures that facilitate citizens in understanding and acting in their everyday energy consumption practice, we hope to promote a positive vision of accepting personal responsibility for the resources we consume and foster the image (and reality) of achieving a better quality of life through the adoption of sustainable practices [9]. We also anticipate that providing users with these kinds of tool will support the grassroots development of products and service solutions [10] tackling sustainable issues.

MOTIVATING SUSTAINABILITY

This position paper suggests the fundamental factor underlying our unwillingness to integrate sustainable practices into our everyday lives is one of motivation. Introducing DOTT 2007, John Thackara illustrates this suggestion vividly [13]:

"The house is cold, someone keeps turning the lights off, and the grey water toilet is blocked again. As a way of life, sustainability often sounds grim. The media don't help: they tell us we have to consume our way to redemption. The shopping pages are filled with hideous hessian bags; and ads that used to be placed by double-glazing cowboys now feature wind turbines, and solar roofs. Adding mental discomfort to the mix, politicians scold our bad behavior as if we were children dropping litter. And preachy environmentalists expect us to feel guilty when we fail to embrace their hair-shirted future with joy. Could one planet living be made desirable, better than what we have now?"

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Indeed, this is a theme which has long been examined in the design community (in, for example, the SusHouse project in the late 90s [18]). It is concisely expressed by Manzini [9]:

"the action of consuming less has to be combined with a perception of living better".

However, how this objective can be realized remains a topic of some debate and this paper turns to psychological theories of motivation for insight. Although some of these have been explored in the context of computer science under the general banner of captology [5], this paper provides a brief review specifically focusing on how they can be used to explain the lack of adoption of sustainable practices in the developed world.

In particular, we highlight goal-setting theory [7]. This framework identifies three major factors of an end state that contribute to how motivated an individual is to attain it: proximity (the length of time it will take), difficulty (how hard it is) and specificity (how well defined success is). It suggests that people are most motivated to achieve goal states which are clearly defined and not too challenging or long-haul. Unfortunately, most goals in sustainability do not take this form. For example, reducing a home energy bill is a task which will take several months, may involve arduous efforts to enforce good practices on other family members and the influence of any given action (say using less of an appliance) does not have a clearly observable impact on the final result. Goal-setting theory predicts that motivating oneself to achieve a task of this nature would be extremely difficult.

Another key concept is the distinction between intrinsic and extrinsic motivations [11]. The latter term refers to motivations related to the achievement of external goals such as avoiding an unpleasant circumstance, impressing another person or attaining a particular prize or status. In contrast, intrinsic motivations (which have generally been studied by educational psychologists) lack obvious external incentives but are generally thought to be more powerful. They have been linked to an individual's belief that affecting the desired outcome is within their control and a high internal level of interest (as in the pursuit of a hobby). Although sustainability concerns are often couched exclusively in terms of extrinsic motivations such as saving money or attaining respect, combining these with appeals to intrinsic, self-driven motivations might make a more effective approach. Thackara hints at this issue in the quote given earlier: why is sustainability something we must be compelled to embrace? A better approach would surely be to make it more internally desirable, frame it as something people might actually want to do.

CITIZEN SCIENCE AS SELF STUDY

This paper proposes to embody the motivational factors reviewed above into a framework of citizen science. To ground this discussion, it deals with a specific example of the use of electricity in the home, although we believe the concepts discussed can apply more generally: to water, fuel use and transportation. One key component of this system is a diverse set of devices to measure, display and control resource usage and the efficiency of that usage. In the electrical domain, this includes a network of power meters attached to individual sockets, room activity sensors, ambient displays and on/off device controllers. Although numerous, these kinds of device are generally small and consume relatively little power. They have been studied in the context of sustainability by many previous researchers (see [2] or [12] for brief reviews) and some commercial products are already available.

The novel aspect of the approach proposed in this paper is to focus on collating data from these devices with more normal diary and activity logs in an on-line social networking site. The main goal of this site will be to allow users to visualize and understand their own resource usage over time through encouraging and supporting them in asking meaningful questions about it. These questions might relate to the current state of their energy consumption, to some change they have enacted in their habits, to outcomes of future changes they might adopt or to a comparison between their usage data and that of one or more other users of the system. By supporting this kind of sophisticated hypothesis generation and test, people will be able to better understand the consequences of their own actions and therefore to adjust their behavior in full knowledge of its effects.

This represents a fundamental shift in motivational strategy with the objective of demonstrating to users how small changes in their behavior can have clear significant effects in their consumption. For example, many people may find it hard to connect the use of the lights in their kitchen and restroom with their monthly electricity bill. Rephrasing this as a percentage change in usage based on improved behavior acted out over the course of a single day or week and then projecting that forward on to a period of weeks or months will make the impact clearer. Goal setting theory predicts this simpler, more immediate and precise expression of goal states will increase people's levels of motivation. Similarly, by empowering users with the ability to understand the impact of their actions, we can appeal to intrinsic internal motivators. The value of setting achievable goals has been stated previously in this domain [e.g. 16]. The system proposed in this paper extends this concept with its focus on user experimentation in goal setting and goal achievement strategies.

This approach also appeals to the concepts outlined in Democratizing Innovation [6] which suggest that users themselves represent the most informed and aware experts and innovators in many domains. This kind of tool we propose in this paper will act to leverage this contextual knowledge and insight, and may lead to user generation of novel products, services and sustainable solutions tailored to their specific context. Such outcomes could be used to promote local community change, start businesses or in

dialog with policy makers and service providers. This concept is expanded upon in the following section discussing activism.

However, practically realizing such a system will be a challenging task. Bridging the gap between the kinds of questions and answers that otherwise untrained users might make and understand and those which an essentially analytic computational system might reason on and resolve is a formidable problem. This paper indentifies developing such systems as a key research challenge and suggests that the solution will lie in harnessing the power of a community of users. By enabling the sharing, searching and exploration of data, questions and results from many users, the knowledge and expertise available throughout the community will be made available. Although there will never be a one size fits all solution, many users in a given physical location will face common problems and difficulties but some will be more able and willing to tackle these than others. By leveraging the enthusiasm and skills of these essentially activist users, a community system could promote their results and best-practices widely.

Another key aspect of the system would be to enable users to control and configure the infrastructure installed in their homes. This is a key element in the model of community problem solving: if one citizen solves a problem, another must be easily able to replicate that same fix in their own lives and homes, including automatically configuring any equipment installed there. Furthermore, customizable input, control and display infrastructure is essential to the concept of the citizen scientist asking and answering questions about the impact of his or her own behaviors, practices and environment on resource consumption. For example, noting a high level of usage from a home entertainment system, a user might choose to connect up an ambient display to show this information live and later explore whether this had any effect. Alternatively, a user might experiment with how his or her behavior (and overall usage) changes when deploying automatically controlled lights linked to an activity sensor in the kitchen.

A final benefit of this kind of community system has been highlighted by other authors, in particular Mankoff et al. [8] on the topic of sustainability. Grounded on a thorough review of the literature they propose exploring whether social networking technologies can enable behavior change relating to resource consumption by tapping into factors such as group goal setting and competition. Mankoff's approach is clearly relevant to the one put forward in this paper.

ACTIVISM

Generally, activism is used to refer to directed action to instigate social or political change in relation to controversial issues. Activists are often motivated by intrinsic factors, reinforcing the importance of rephrasing sustainability in these terms. Borshuk [1] enumerates motivating factors as: self-concept, socialization, the search for meaning and identity, values, personality attributes, political consciousness, a quest to join community life and a need for status. On-line activism has also received attention. Vegh [17] describes three distinct categories: awareness/advocacy, organization/mobilization and action/reaction. Respectively, these refer to the use of information technology to distribute or promote a message, to organize events in the real world and to engage in "hackivism", a term for virtual attacks such as denial of service.

The concept of the activist as someone who engages in direct action, in the form of asking and answering questions about behavior and consumption in order to determine best practices, is central to the vision proposed in this paper. Equally, Vegh's concept of using the internet as a means to spread awareness of issues and advocate for change is central. Highly motivated activists are a critical component of how the system proposed here might work in an actual community. Realistically, not all individuals will want to undertake the kind of hands-on investigations outlined in this paper. So by providing enhanced tools to support those who do to communicate to and influence those who do not, we may be able to increase the rate at which new, sustainable practices are adopted. Furthermore, the empirical, numerical data that the system we propose can capture may be able to create compelling, supported arguments which citizens can present to other energy stakeholders such as providers, policy makers and regulatory bodies. This kind of lobbying is a core part of activism and this proposed system has the potential to enhance it.

EVALUATION APPROACH

A multi-faceted evaluation of the approach outlined in this paper is important. The simplest metric would be to assess the ability of the system to effect changes in an individual's behavior. This is relatively easy to achieve by empirically logging resources consumed and qualitatively observing how habits and practices develop. However, the social context in which activism and community change takes place calls for a broader mandate. The overall goal of the framework described in this paper is to promote best practices of resource consumption and energy efficiency more effectively across a whole community. Correspondingly, any comprehensive evaluation needs to answer the question of whether the approach described here accelerates the rate of social change compared to that achieved with existing activist and top-down policy structures. This can only be realized by detailed, post-project comparative case studies contrasting the overall social and physical environment of a community which has been using the system against one which has not. Although ambitious and large scale, only through such in depth qualitative study can the true worth of the approach proposed in this paper be validated.

CONCLUSIONS

This position paper has proposed a vision of motivated citizen scientists equipped with specialized tools which enable them to capture and understand their resource consumption practices and in the role of activists, seamlessly communicate the most optimal ones to other system users and large-scale policy makers. These concepts are in the preliminary stage of development, but we firmly believe they represent an empowering way in which citizens can take concrete action to generate novel solutions on sustainability issues and communicate these to their peers. It has been suggested that to achieve a sustainable level of resource consumption, a reduction of up to 90% from current levels may be called for [9]. Supporting users in the generation of grass-roots solutions to their local problems will be an important mechanism by which such radical change can be achieved and this paper outlines one way this activity can be supported.

MADEIRA AND MUSE 2008

This position paper is one result of MUSE 2008, a two week brainstorming workshop held in early July by Lab:USE, a research group at the University of Madeira in Portugal. The theme of the workshop was "Interaction for Sustainability". Madeira is an isolated island (Morocco is the closest continental country) with an increasingly affluent local population (of 270,000) and a large tourist industry. It has developed very rapidly in recent years. Beyond the common moral imperative to behave sustainably, these factors combine to place heavy demands on existing resource infrastructures. Sustainability is a critical issue for Madeira and the goal of this workshop was to generate research proposals to address how interactive technologies could serve this need. Although its work on this topic is at an early stage, Lab:USE is committed to pursuing innovative research in the area of interaction for sustainability.

Other concepts explored at MUSE 2008 included the generation of new services for tourism, a series of awareness, educational and motivational games related to recycling and rubbish disposal and the requirements for a community and social networking site which would offer citizens a canvas on which to express their concerns relating to environmental issues and development projects.

AUTHOR BIOGRAPHIES

Ian Oakley is an assistant professor at the University of Madeira and an adjunct assistant professor at CMU under the CMU|Portugal agreement. His research interests are in the psychology of interaction: the perceptual and cognitive human issues that underlie and affect how people adopt, use and relate to computational systems. Under this broad banner, sustainability is an emerging topic of interest and he sees attending this Ubicomp workshop as an important opportunity to get in touch with the community which is forming around this topic. He has recently spent two years doing R&D in Korea (split between positions at GIST in Gwangju and ETRI in Daejeon) and as a Scot shares Paul Dourish's affection for haggis.

Monchu Chen is an Assistant Professor at the University of Madeira teaching Interface and Interaction Design. He holds a both a Masters and PhD in Human-Computer Interaction from Carnegie Mellon University. He also has an MA in Design from the National Chiao-Tung University and a BS in Computer Science from the National Chiao-Tung University. He has lectured in the Dept. of Arts and Design, University of Science and Technology Beijing and has been a research associate at the ACT-R Group, in the Department of Psychology at Carnegie Mellon University. Previously he has been a Research Assistant at the Lab of Brain and Behavioral Science, Dept. of Psychiatry, Chang-Gung Memorial and a Hospital System Developer at Dayi.com. Monchu has also worked as a Multimedia Designer at EduPlus.com and a Software Engineering Officer, Combined Service Force Web Designer at the National Museum of Natural Science and at National Center for High-Performance Computing and Taipei National University of the Arts.

Valentina Nisi is an Assistant Professor at the University of Madeira under the CMU|Portugal agreement where she teaches Designing for Service. She holds PhD on Location Aware Narratives and an MSc in Multimedia Systems from Trinity College Dublin (TCD). Between 2006 and 2008 Valentina worked as a designer and producer of Location Based Mobile Stories in Ireland and Holland. Previously she worked at MediaLabEurope in the StoryNetworks group and in the Distributed Systems research group at TCD researching the potential of wireless mobile technologies and audiovisual non-linear narratives.

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