Designing Mobile Technology to Promote Sustainable Food Choices

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ABSTRACT
This paper is an experience report based on challenges encountered when designing scalable mobile persuasive HCI applications to help users make informed choices over their food consumption. We recently developed *Tagliatelle*, a social tagging system to help users to accurately monitor and assess their dietary behaviour and to promote healthier food choices. In this paper we propose a similar system in order to help users understand the sustainability of their food choices. We discuss the challenges inherent in doing so, and extrapolate some important issues that need to be addressed by technological developments that aim to persuade users to adopt more sustainable behaviours.

Categories and Subject Descriptors
H.5.3 [Group and Organization Interfaces]: *collaborative computing.*

General Terms
Design, Human Factors, Theory.

Keywords
Eco-feedback, sustainability, sustainable consumption, tagging, feedback, persuasive.

1. INTRODUCTION

1.1 Background
Recent studies have identified that topsoil erosion [17], depletion of fish stocks [13], tainting of meat products, depletion of oil reserves and climate change can all be linked to the method in which food is currently produced, distributed and consumed [17]. It is clear that reaching and understanding of, and improving the sustainability of, food that we purchase and consume is of growing interest [9]. As social computing researchers we are interested in how online mobile and social technology may facilitate these goals. In particular, we believe there is a need to directly engage the individual consumer in the process.

It is also clear, however, that, there is currently no all-encompassing measure of sustainability that we can use to deliver feedback to users. For instance, there are a number of different issues that the term 'sustainability' can refer to; these include *environmental* sustainability and *social* sustainability. Indeed, within environmental sustainability, there exist subtleties that make it hard to define how sustainable any given item is. For example, the question of whether it is preferable to grow fruit at a low carbon cost in the third world and air freight it to the UK, or to grow the fruit at a higher carbon cost in the UK, is a dilemma that currently appears to be a value judgment. Since the problem domain is so unclear, it is difficult at present to create meaningful applications that give judgement on an objective level. Complicating the issue further, there is currently no requirement for manufacturers to disclose where ingredients and components have been sourced (known as *supply chain transparency* [1]).

Nevertheless, in order to design mobile tools to encourage more sustainable consumption, we must have some useable definition of sustainability. As such, in our recent work, we have adopted the goals of the "Slow Food" movement, which emphasises the consumption of local and seasonal produce over that which is imported and/or out-of-season (see http://www.slowfood.com for more details). Hence, in the technology proposed here, users' food consumption will be evaluated in terms of how closely it adheres to the goals of the "Slow Food" movement.

Figure 1. In Winter the UK imports potatoes from Egypt, grown in the desert with seed from Scotland, water from 350m deep wells, and packed in peat from Ireland.

There are also a number of challenges facing any programme, technological or otherwise, that aims to change consumer habits. For example, although reports show that consumers are prepared to pay more for eco-friendly items [5], and rate sustainable items

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as of high importance, in fact they rarely purchase such items [14]. It appears that in order to bridge this attitude-behaviour gap, consumers need both access to sustainable produce and confidence in their ability to identify sustainable produce [11]. We believe that significant potential exists with existing mobile technology to develop tools that allow people to identify the overall sustainability of their personal food purchases and take action to improve it. Indeed, the inclusion of motivational tools such as visual feedback, goal-setting and mini-games may help persuade consumers to make more sustainable choices.

1.2 Tagliatelle

In previous work, we attempted to utilise the persuasive power of social media as a means of facilitating dietary behaviour change [7]. Specifically, we identified that the development of new and innovative methodologies aimed at helping people determine the nutritional content of their own food intake and motivating them to choose healthier options is an urgent goal. We proposed that exposing participants' eating habits to each other may act as triggers [6] for motivating both healthier food choices and the maintenance of those choices over an extended period of time. In order to examine this, we developed an application in which users uploaded digital photos of meals that they had eaten to a server, which anonymously distributed these photos to other users for tagging. Each user was required to tag one photo that had been previously uploaded by another user before they could upload a photo of their own. In addition, users were free to visit the website at any time in order to tag randomly selected images. Thus, each photo uploaded was tagged several times by different users, generating a rich history of tags for each photograph uploaded.

Figure 2. Screenshot of image tagging in the prototype tagliatelle application.

An evaluation of a basic prototype of Tagliatelle [7] suggested that although we encountered problems extrapolating valid nutritional information from the tags generated by participants, the activity of tagging fellow users' uploaded food photographs was very popular among participants. This finding is consistent with work in the field of human computation ([15][16]), where games are used to motivate users to tag digital images with relevant content labels that can later be used in text-based image retrieval. In effect, the players of these games function as a data analysis tool. It seems that this type of crowd-sourced image analysis may prove useful for a number of different tasks, including food sustainability.

2. A MOBILE APPLICATION TO ENCOURAGE SUSTAINABILITY IN FOOD CONSUMPTION

We are interested in exploring the possibility of harnessing the apparently intrinsically motivating activity of tagging images as a means of creating mobile applications that allow users to accurately monitor, assess and change the sustainability of food they consume. We believe that this type of approach may prove very effective in helping users to gain an overall picture of the sustainability of their own food choices. The main advantages of designing a system with a social tagging architecture are both the lack of need for expert involvement and huge potential for scalability.

Thus, we propose a system based on our experiences in the design, development and evaluation of the Tagliatelle project. However, instead of taking photographs of prepared meals, participants will photograph their food at the point of purchase. In addition, as mentioned above food consumption will be evaluated in terms of how closely it adheres to the goals of the "Slow Food" movement.

The system will be composed of a mobile phone application and a server-side database. Users will interact with the database primarily through the mobile application, although it is envisioned that a standalone website will also be created. The application will allow three interactive experiences: uploading of photos, tagging of photos and presenting of feedback. These are now discussed in turn.

2.1 Photo Uploading

The mobile phone application will allow users to take photographs of their purchases and to easily upload these photos to their personal profile on the server with one button click. The server will anonymously assign all uploaded photos to other users for later tagging.

One particular challenge lies in motivating users to photograph each individual item that they purchase and upload these items to the server. Failure to report a significant proportion of food items, or the selective uploading of only 'good' items would lead to inappropriate feedback. Exactly which tools are most effective at motivating honest participation is an empirical question that we intend to pursue over the course of this and related work.

2.2 Photo Tagging

Users will have the option of tagging photographs either through the mobile phone application itself, or through a standalone website. Specifically, a mini-game, inspired by [15] and [16] will be created in which users rate the food content of the photos presented in terms of sustainability. As in [16], ratings will only be accepted if agreement is reached between independent raters. Exactly what form these ratings will take is, at this time, an empirical question. There is no obviously superior option between numerical, visual or other methodologies. However, we do recognize that a vital part of this research will involve educating

users on how closely items do or do not adhere to the goals of "Slow Food."

2.3 Providing Feedback

Each user will receive feedback on the overall sustainability of their food choices through a number of possible methods such as graphs and mini-games. This feedback will be reported both in terms of personal goals and in comparison to the mean results for other users.

3. DESIGNING USEFUL FEEDBACK FOR PERSUASIVE APPLICATIONS

Apart from the very specific problems of ensuring that food is tagged validly and reliably, and that participants photograph and upload appropriate quantities of their food, there are some basic issues that need to be dealt with when setting out to design any technology that promotes sustainable consumption.

One criticism that can be leveled at the vast majority of persuasive tools, mobile or otherwise, is that although these technologies are designed with the specific aim of effecting change in user behaviour, very few have implemented empirically established methods for doing so (see [8]). Indeed, very little of the published work on persuasive technology gives any specific insights into the processes involved in behaviour change, nor specific examples on how to apply these processes. Fortunately, however, there is an entire academic discipline that sets out to examine precisely these questions.

Behaviour analysis is the scientific study of learning [3]. It is, by definition, practical and pragmatic, as it presumes that all behaviour is determined by interactions with and feedback from the surrounding environment [12]. Successful behaviour is maintained, while unsuccessful behaviour is not. Crucially, behavioural psychologists suggest that because behaviour is determined by the environment, it can be changed readily by analysis and manipulation of that environment (see [10] for an excellent introduction to behavioural interventions; [4] for an in-depth analysis). Hence, the field of behaviour analysis has spent decades investigating exactly how to deliver feedback in order to generate real and lasting behaviour change. We believe that, regardless of the target behaviour, in order to create effective persuasive technologies, the science and methodologies of behaviour analysis must be employed as an integral design phase. Indeed, assuming that the principles of behaviour don't apply when a person is interacting with a computing device is a stance that is uninformed, and will lead to a large amount of duplication of effort in addressing questions that have already been comprehensively answered.

In the application introduced in section 2, the way in which feedback is delivered to participants will be informed by the methods of behaviour analysis. Specifically, we will endeavour to provide consistent, regular and specific feedback, regardless of whether participants reach their goals or not. This will, at times, necessitate the considered use of aversive feedback [8]. We will also design the system so that there is a range of available reward structures, such as mini-games, social networking and competitive leader boards, and will ensure that the system is adaptive enough to recognize and utilize the types of rewards that are most effective for each participant.

4. CONCLUSION

A discussion addressing the problems facing any mobile application that attempts to promote sustainable food choices has been presented. We have proposed the design of a system based around the popular activity of photograph tagging that may help users to gain an overall picture of the sustainability of their own food choices. We have also discussed how behaviour analysis can help HCI researchers design the way in which feedback is delivered to users, in order to create applications that are both engaging and useful.

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