

Annotated Bibliography

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Problem Space: Food Sustainability

By now, the fact that global warming is an omnipresent and severe problem should be common knowledge and solving it requires everyone to be a part of the solution. Keeping your carbon footprint low can, however, be challenging and becomes increasingly difficult when you do not know what actions and activities are sustainable and which are not. We, as a species know that driving everywhere and burning fossil fuels hurts the environment, nevertheless we continue to do so. This tells us that even though we know that something has a negative impact on our planet, we are reluctant to change if the alternative is less convenient. Keeping up with the rapidly evolving sustainability movement can be challenging and can often feel like a massive endeavour. One area where each and every one of us has the opportunity to contribute to the environment is in changing our food consumption habits which we believe could be made a less daunting task for people and could be made easier through the use of technology. However, focusing on sustainability alone is not enough, we have to consider sustainability in correlation with maintaining a healthy and varied diet which becomes even more difficult for people with voluntary or involuntary dietary restrictions. Before considering solutions to these problems, we need first to see what foods are sustainable and how to effectively change users' food consumption patterns. We want to take a look at how social mobile computing can help people have a healthy and sustainable diet.

A. Aydin, A. Micallef, S. Lovelace, X. Li, V. Cheung, and A. Girouard, "Save the Kiwi: Encouraging Better Food Management through Behaviour Change and Persuasive Design Theories in a Mobile App," in *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '17*, Denver, Colorado, USA, 2017, pp. 2366–2372.

Abstract

Managing food waste is a means to improve our environmental and economic sustainability, and is achievable both societally and personally. We conceptualized "Save the Kiwi", a

personal mobile application that communicates food safety information to encourage better food management, primarily in consuming purchased food products before they expire. Instead of simply relaying food information to its user, the application combines elements of behaviour change and persuasive design theories, and uses personified icons to notify its user about the expiry conditions of the associated food items. In an exploratory study, we found that the application has the potential to help users reduce their food waste. We discuss our results and recommend future work to create a viable solution to address food waste issues.

Critique

In this paper, Aydin *et al.* explore how implementing persuasive design theories can be used to change human behaviour in terms of household food management. The team uses observations, interviews and audio recordings of students at Carleton University, Canada to evaluate how persuasive design affects human behaviour in terms of wasting less food. The study explores how positive reinforcement, negative reinforcement and punishment in combination with an achievement system promote behaviour change towards a desirable outcome. This paper is beneficial to our research as the study provide us with the most common causes of food waste that can be used to guide our design choices and they prove that persuasive design does impact users willingness to manage their food better.

Limitations of this study are how the selected participants are restricted to only campus students at one university, that the selection of participants is small in size in addition to that they did not explore the long term effects of participants using the application. The authors conclude that all three methods of persuasive design used are effective in promoting behavioural change and that the study will need further work in terms of longitudinal studies and benefit from a more extensive and varied group of participants. This study will benefit us most as a resource on how we can design a social aspect that also promotes behavioural change in terms of food waste and to understand the common causes of food waste. Thus, this paper will mainly be used as a supplementary resource.

R. Bohner, N. D'Adamo, A. Faeth, S. R. Kaplan, and W. E. Marsh, "Edible earth: dining on seasonal and local ingredients," in *Proceedings of the 27th international conference extended abstracts on Human factors in computing systems - CHI EA '09*, Boston, MA, USA, 2009, p. 2811.

Abstract

College students are primarily concerned with the price and convenience of the food they choose to eat. Environmental impact is not a consideration in their food decisions. We present a web-based solution that simplifies meal choices and addresses the perception that home-prepared meals are inconvenient and expensive. The solution provides a web service that suggests convenient recipes that use local and seasonal ingredients tailored to the user's location. This promotes sustainable food purchasing habits. The solution uses a location-aware mobile device as an example platform. The study presents the participatory design process that informed the development of this solution.

Critique

Bohner *et al.* looks into the gap between college students' desire to make sustainable food choices, their actual food habits, and how the authors use local produce and recipes to promote sustainable habits. The study uses a combination of a survey and interviews of college students at the Iowa State University, Iowa USA to understand purchase prioritisation and barriers of home cooking. In terms of scope, the authors focus on how information availability and convenience of local produce and meal preparation promotes sustainable food choices. This paper is useful to our research in how it tackles sustainability from a different viewpoint and how it elaborates on key obstacles that hinder people who want to make sustainable choices from doing so. Due to the paper's intended user group, this study is limited to only researching the purchasing habits of college students and does not include habits of other people with similar issues in terms of wanting to make sustainable food choices, but who seldom do so. Another limitation is the lack of details in the walkthrough of specific feedback to each prototype and what factors led to the authors' conclusion. The authors state that their current solution received positive responses, but that further research into local food markets and stakeholders in addition to further work on the application is needed to create a holistic solution. This paper will be used as a supplement for our research to provide another perspective on how to tackle sustainability and to inform about the gap between purchasing habits and sustainable food choices.

G. Farr-Wharton, J. H.-J. Choi, and M. Foth, "Food talks back: exploring the role of mobile applications in reducing domestic food wastage," in *Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures the Future of Design - OzCHI '14*, Sydney, New South Wales, Australia, 2014, pp. 352–361.

Abstract

Mitigating domestic food waste reduces its environmental and economic impacts. In our study, we have identified the use of mobile technology to support behaviour change as a key tool to assist the process of reducing food waste. This paper reports on three mobile applications designed to reduce domestic food waste: Fridge Pal, LeftoverSwap and EatChaFood. The paper examines how each app can influence consumer knowledge of domestic food supply, location, and literacy. We discuss our findings with respect to three considerations: (i) assisting with the user's food supply and location knowledge; (ii) improving the user's food literacy; (iii) facilitating social food sharing of excess food. We present new insights for mobile interventions that encourage changes towards more sustainable behaviours to reduce food waste.

Critique

Farr-Wharton *et al.* look into to what degree three different mobile applications support users in changing their behaviour around food waste and food sharing. The researchers interviewed the participants after they had used the application for some time while simultaneously collecting data on the frequency the participants used the applications and how they used it. The researchers' main goals were to find out to what degree the applications helped the user with their food supply, food literacy, facilitate food sharing and reduce food waste. The researchers focused on specific features that helped the users with the abovementioned goals, and any other functions and features are ignored. This paper gives a clear overview of the performance of previous solutions in this problem space, creating a foundation on which to build. The researchers have, however, used a small sample size with little diversity, all but two participants are either students or lecturers, and most of these are PhD students. Also, during the trials, two users did not use the application, and the researchers elected to remove these users' statistics from the final result, decreasing the validity of their results. The researchers concluded that all applications helped the users change their behaviour to some degree and revealed three different stages of food sharing based on how well the users know each other that they affect the users' willingness to participate in food sharing. This paper is the basis of our research that has valuable information on previous products in our problem area that can guide future design by clearly presenting what solution and features worked well and those that did not.

K. Henriksen and S. Viller, 'Design of software to support families with food-allergic and food-intolerant children', in *Proceedings of the 24th Australian Computer-Human Interaction Conference on - OzCHI '12*, Melbourne, Australia, 2012, pp. 194–203.

Abstract

Childhood food allergies and intolerances are increasing in prevalence and can impact heavily on the health-related quality of life of children, in addition to placing a significant burden on parents and other caregivers. This paper reports on a multi-part research study in which we examined current use and future opportunities for software to support families dealing with childhood food allergies and intolerances. In the first part of our study, we conducted an online parent questionnaire and interviews with clinicians, in order to understand the challenges faced by families with food-allergic and food-intolerant children, as well as the current levels of technology use by these families. Based on the outcomes, we focused our subsequent attention on the design of food diary software to support the care of children with non-IgE adverse food reactions, which are extremely challenging to diagnose and monitor. We conducted a week-long food diary study and follow-up design workshop, in order to evaluate food diary compliance and to elicit design inspiration for a new food diary application.

Critique

In this Conference paper, Hendricksen and Viller attempt to ascertain whether a software can be created to help families that include children with some form of allergies. The primary goal was to decrease the different burdens on the parents, including but not limited to financial and increase the quality of life for the children, such as a reduction in potential social isolation. The authors gathered data through three different methods throughout their research, an online questionnaire, an open-ended interview and a week-long diary followed up by a workshop. The researchers focused on families with children that had non-IgE allergies; however, they did not exclude those that have IgE allergies. Although our primary research area is not children, this article is still immensely useful because these issues, although likely more prominent in families with allergic children, is not limited to them. The results from their test can be adapted to guide our research, testing and potential designs going forward. This article does have some limitations. Firstly the researchers used an online questionnaire which limits the usability of the results created, however, since the online questionnaire was mainly used during the beginning stage of the research it does not have a significant impact on the overall results. Also, they have used specific channels to recruit participants, which has potentially limited the variety and diversity of the testers. The

researchers conclude the paper acknowledging that creating such an app is inherently challenging and that further development and testing is required. Although children with allergies is not our primary research target since we aim to focus more on the general public, this paper will still give us a basis to work on and guide our design decisions based on it.

M. Jones and G. Marsden, "Products for People" in *Mobile Interaction Design*. Chichester, UNITED KINGDOM: Wiley, 2006, ch. 2, sec. 1, pp. 39-66.

Abstract

Key Points:

- Successful mobile products are ones that are useful and usable, and provide a coherent, comprehensive user experience.
- If a mobile does not provide highly valued functionality, it will not be used, no matter how well designed the interface is.
- A mobile's usability is affected by two factors: its intrinsic ease of use – the way it presents its functionality, the feedback given to users and more; and how well it fits in with other resources at the user's disposal.
- A user's perception of a mobile's usability is affected by far more than just the device's quality. The customer support provided, its interaction with network services and even the explanation of pricing plans matter too.
- Research from business schools and information science departments on technology acceptance has provided useful tools to assess the reasons for success and failure of mobile products.

Critique

In this chapter, Jones and Marsden take a look at the user, how we, as designers should think about our designs regarding the users, what makes an application or device useful and usable. When talking about Usefulness, the authors bring up two main points, the fact that function precedes form and that as technology and humanity evolve, design must follow. The authors present a set of rules and guidelines to help make sense of what makes a design Usable, there among the Golden Rules of Design. Although a solution to some of the problems found in the food waste and allergy domain can likely be solved with the help of technology, it is not a guarantee. This chapter, as well as the rest of the book, is a helpful tool to help understand the user through guidelines and method, as well as help design a solution for those users. The authors conclude that making a design attractive to the target audience is needed and that the methods and factors presented are a potential guide

towards that goal. Although some of these rules and methods are relatively old, they still have the potential to be very helpful when designing a solution. Using these should help guide our design process in the future as well as getting to the core of the issue instead of assuming to know what the real issue is. That said, it is still important to not simply follow old traditions blindly and remain critical to their usability and evolve when necessary.

G. Masset, F. Vieux, and N. Darmon, "Which functional unit to identify sustainable foods?," *Public Health Nutrition*, vol. 18, no. 13, pp. 2488–2497, Sep. 2015.

Abstract

Objective: In life-cycle assessment, the functional unit defines the unit for calculation of environmental indicators. The objective of the present study was to assess the influence of two functional units, 100 g and 100 kcal (420 kJ), on the associations between three dimensions for identifying sustainable foods, namely environmental impact (via greenhouse gas emissions (GHGE)), nutritional quality (using two distinct nutrient profiling systems) and price.

Design: GHGE and price data were collected for individual foods, and were each expressed per 100 g and per 100 kcal. Two nutrient profiling models, SAIN,LIM and UK Ofcom, were used to assess foods' nutritional quality. Spearman correlations were used to assess associations between variables. Sustainable foods were identified as those having more favourable values for all three dimensions.

Setting: The French Individual and National Dietary Survey (INCA2), 2006–2007.

Subjects: Three hundred and seventy-three foods highly consumed in INCA2, covering 65 % of total energy intake of adult participants.

Results: When GHGE and price were expressed per 100 g, low-GHGE foods had a lower price and higher SAIN,LIM and Ofcom scores ($r=0.59$, -0.34 and -0.43 , respectively), suggesting a compatibility between the three dimensions; 101 and 100 sustainable foods were identified with SAIN,LIM and Ofcom, respectively. When GHGE and price were expressed per 100 kcal, low-GHGE foods had a lower price but also lower SAIN,LIM and Ofcom scores ($r=0.67$, 0.51 and 0.47 , respectively), suggesting that more environment-friendly foods were less expensive but also less healthy; thirty-four sustainable foods were identified with both SAIN,LIM and Ofcom.

Conclusions: The choice of functional unit strongly influenced the compatibility between the sustainability dimensions and the identification of sustainable foods.

Critique

This work of Masset *et al.* explores a combination of food measurements in the pursuit of a formula to best determine which foods are most sustainable. The authors present data on greenhouse gas emissions from a wide selection of foods based on French consumption patterns gathered from the INCA2 database in combination with the food's price from Kantar World-panel purchase database and nutritional values calculated using SAIN, LIM and UK Ofcom profiling models. The study uses this data to explore whether a calculated sustainability per 100g or sustainability per 100kcal would be the optimal function of determining sustainable food choices. This study is of particular interest to our research as it specific food groups and why they are- or are not deemed a sustainable source of food. This data will aid in creating a solution around sustainable food based on facts. Limitations of this research include the geographical scope of the study and by not considering the whole lifecycle of the product, such as land and water usage, packaging, transportation in addition to how different foods are used in different regions, cultures and religions. The authors conclude with neither methods tested are optimal in determining a sustainable diet; however, that both functions were useful to attain a better assess food options across the selected sustainability criteria. This paper will be used to inform the team on how different foods are to be deemed sustainable or not and what criteria should be taken into consideration when designing in the space of sustainability and food.

Overview Statement

The core link between the articles is through different viewpoints on food, whereas most of the articles focus on food in terms of sustainability, and one looks at food allergies and intolerances. The last source, the book, does not link directly to the design space but does function as guidelines which are important to consider in designing a solution.

Throughout the different papers, there have been several attempts to create new or test existing solutions to help users become more sustainable or to keep track of food consumption to help with allergy management. Aydin *et al.* created the application Save the Kiwi that according to the designers, was effective in performing its task where most testers showed interest in using the application if it were to be released. The implementation of gamification factors seemed to be useful; the users not only wanted to progress and level up their profile but also redoubled their efforts to improve whenever they were punished for underperforming. Other applications did not make it clear exactly what made the application successful or unsuccessful. Farr-Wharton *et al.* talk about the fact that colour schemes within

the fridge itself helped with the organisation and that the design of the fridge itself was a hurdle to overcome, which proved difficult for them to do anything about without getting involved with fridge companies directly. In addition to this, the same authors found that people had some difficulty trusting strangers enough to conduct in food sharing outside of their immediate social circle. This presents a significant challenge, where further research is needed to find out what would make this experience easier for people. Lastly, when looking at designing a food diary application for families Hendricksen and Viller found that this was a substantial challenge since every family has different needs. Although this creates a challenge, a possible solution could be a high level of customisation on the user end so that they can personalise their experience as much as possible. One theme that was seen across most solutions was the fact that manual logging was a big hurdle; this is possibly the most important takeaway from all previous solution and should be considered in future designs.

From the selected readings, one can see a wide range of approaches being tested in the design space. Among these approaches were suggesting recipes based on inventory, persuasive design to influence decisions, food management, food sharing, utilising local produce, adapting existing solutions to cater to people with allergies and looking to calculate what food is most and least sustainable. This goes to show that a lot has been tested in the design space, but there are still many aspects left to research.