Teenagers Talking about Technologies: Designing Technology to Reduce Teen Energy Use

Beth T Bell
PaCT Lab
Northumbria University
Newcastle, NE1 8ST
beth.bell@northumbria.ac.uk

Nicola Toth
PaCT Lab
Northumbria University
Newcastle, NE1 8ST
nicola.toth@northumbria.ac.uk

Janet C Read
ChiCI
University of Central Lancashire
Preston, P1 2HE
jcread.horton@uclan.ac.uk

Matthew Horton
ChiCI
University of Central Lancashire
Preston, P1 2HE
mplhorton@uclan.ac.uk

Dan Fitton
ChiCI
University of Central Lancashire
Preston, P1 2HE
dbfitton@uclan.ac.uk

Linda Little
PaCT Lab
Northumbria University
Newcastle, NE1 8ST
l.little@northumbria.ac.uk

Russell Beale
School of Computer Science
University of Birmingham
Birmingham, B5 2TT
r.beale@cs.bham.ac.uk

Yukang Guo
Department of Computer Sciences
Swansea University
Swansea, SA2 8PP
y.guo@swansea.ac.uk

CHI 2013 Extended Abstracts, April 27–May 2, 2013, Paris, France.
ACM 978-1-4503-1952-2/13/04.

Abstract
This paper describes the methodology through which a set of guidelines that inform the design and development of energy-use reduction technologies for teenagers were created. The presented research forms part of a wider project that aims to design, develop and evaluate mobile solutions to change teen attitudes and behavior to energy consumption. In order to understand how to approach the design of technologies that reduce teen electricity consumption, researchers engaged teenagers in a comprehensive user-centered evaluation of relevant existing prototypes. The evaluation feedback was used to generate a set of seven guidelines that will inform the design and development of future energy-reduction devices for teenagers as part of the final stages of this overall research project.

Author Keywords
Teenagers; energy; design; requirements

ACM Classification Keywords
H.5.m. Information interfaces and presentation: Miscellaneous

General Terms
Design

Introduction

Energy consumption continues to increase world-wide [1] despite the well-documented deleterious consequences of this to the global environment [2]. In addition to negative environmental outcomes, high energy consumption has serious financial ramifications for consumers, as energy prices continue to soar in the face of rising demand [3]. It is no surprise therefore that reducing energy consumption ranks high on government agenda worldwide.

Reduction of household electricity consumption is one way in which individuals are being encouraged to contribute to the global reduction of energy consumption. Teenagers may be a particularly effective population to target with such strategies as it is estimated that the average teenager uses approximately 20% more electricity than the average adult [4].High teen electricity use may be attributable to their high general consumption of media and technology, which play a crucial role in teen lifestyle and development [5].

In light of teen preoccupation with technology, developing innovative technology-based solutions may present a novel way of reducing energy consumption amongst this population. However, teenagers are a highly unique user group and little research has explored how designers should design with and for this distinctive population [6]. Designing technologies that teenagers will adopt and use in everyday life therefore can be challenging.

To overcome the potential challenges associated with designing technologies that aim to encourage a reduction in energy consumption for teenagers, the present research engages teenagers in the user-centered evaluation of two relevant existing prototypes in order to derive guidelines that may inform the design of future devices. The research forms part of a wider RCUK-funded project that aims to design, develop and evaluate mobile solutions to change teen attitudes and behavior to energy consumption.

Study

The method employed for this work was to initially engage with teenagers in two events in order to gather rich data about their attitudes and opinions of technology.

The first event was an energy awareness day hosted by Northumbria University that was attended by 101 teenagers (*Mean age* = 13.65) from four local secondary schools in the North-East of England.

At the energy awareness day, eight stalls were set up, each featuring an energy-themed activity. In groups of 20, teenagers participated in a "hot-table" session wherein they spent thirty minutes engaging in each activity, before moving onto the next.

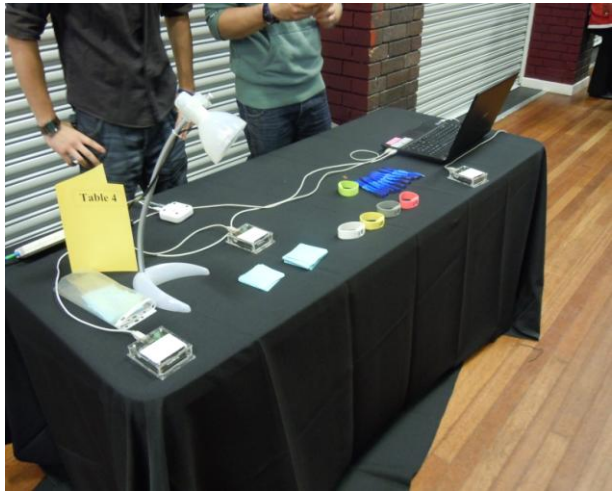
Two of the stalls showcased two high-fidelity prototypes that aimed to reduce users' energy consumption, chosen by the researchers who felt that the devices would be of interest to teen populations. The first device, the '*stroppy kettle'* aimed to reduce electricity consumption by preventing individuals from over-filling the kettle. Should overfill occur, the kettle would still boil the water, but would make them undertake a repetitive, boring task as a negative reinforcement for the undesirable behavior. The second device, the '*electricity tag*' used RFID technology, an energy sensor

and a smart phone to track and monitor individual energy consumption in a shared context. It therefore aimed to reduce individuals' energy consumption by increasing their awareness of the energy they used. The RFID tag was embedded within a wristwatch.

For each prototype, teens watched a demonstration of the prototype by researchers. They then engaged in an exploratory use session wherein they were permitted to test the device and ask questions about it. They were then invited to provide written feedback to the designers of the devices. Showcases thus employed a range of widely-used product evaluation techniques including exploratory use, peer discussion and critique with the designer present, in order to provide a holistic understanding of the populations wants and desires in this domain.

The 'stroppy kettle'

The second event occurred three months later. Teenagers were invited to participate in focus group sessions that aimed to evaluate the energy-awareness day. During the focus groups, teenagers provided more in-depth feedback on the devices. Focus groups lasted between 30 and 45 minutes and there were between 3 and 8 teenagers in each session. Overall 37 teenagers participated in this phase of the research.



The '*electricity tag*'

Findings

Written and verbal feedback provided at the energy-awareness day and transcripts from the focus groups were analyzed using thematic analysis [7], wherein all excerpts pertinent to device design and development were derived from the data. Over 200 individual excerpts were extracted and these were subsequently arranged into themes. Themes were reviewed and revised by two members of the research team, resulting in seven final themes. These seven themes

were construed as representing a set of guidelines that may inform the future design and development of devices that aim to reduce electricity consumption amongst teenagers.

Guidelines

Energy Reduction Technologies for teenagers need to be:

1. *Convenient*
   Teenagers reported that saving energy often interfered with their lifestyle, as electricity was required to fuel many of their out-of-school pastimes, e.g. computers. Consequently, teens expressed an interest in devices for energy reduction that caused minimal disruption to their lifestyle. Many disliked the *stroppy kettle* for this reason, claiming that the purposeful inconvenience caused by the kettle to save energy, would lead them to try and "cheat the system" and thus the kettle would be ineffective.

2. *Personalized*
   Many teens expressed the desire for an individualist product that was unique to them. This may reflect a desire for self-expression that is psychologically central to teen development. For example, many teens felt that the wristband component of the *electricity tag* would benefit from a different design, whereas others felt that the tag should be incorporated into a necklace or bracelet instead. Having a standard design that can be customized to reflect the individual desires of the teen is therefore recommended.

3. *Age Appropriate*
   Technologies that are frequently used by teens may not be the same as those that are frequently used by adults, and this must be taken into consideration when designing energy reduction technologies for teens. This is demonstrable in the case of the *stroppy kettle* where teens claimed that "teenagers don't make the tea", and as such it is likely device would have minimum impact amongst this age group.

4. *Discreet*
   Psychological research indicates that the teenagers experience a heightened susceptibility to social/peer influence. In the present research, many teenagers reported that saving energy was regarded as 'un-cool' and so they were reluctant to be seen engaging in energy-saving behavior, despite inwardly supporting such behavior and advocating its importance. Energy-saving devices for teenagers should therefore aim to be discreet and personal.

5. *Logical*
   Many teenagers adopted a logical approach to the evaluation of the energy reduction devices. Some teenagers expressed concerns about the potential financial costs of the devices and also the personal input they would be expected to give. They also wanted to know how effective devices were in terms of electricity they could save. As such it would appear that they were engaging in a conscious cost-benefit analysis wherein personal and financial expenditure were weighed up against the perceived "greater good" of the device. As such teen logic should not be underestimated.

6. *Based on Teen Ideas*
   In focus groups, teens generated many new ideas for energy-saving devices. One particularly common idea, across all focus groups, was that of an energy-saving phone charger that would disconnect energy supply to the phone once it was fully charged. Designers should always endeavor to listen to teens and further research could explore the plausibility of teen ideas for technologies that hope to reduce energy consumption.

7. *Designed with Teenagers*
   Feedback from focus groups indicated that teens had extremely enjoyed being involved in the design process, with some even reporting that they had felt inspired through working closely the designers. In the showcases, a variety of techniques were utilized to engage teenagers in the design process, including exploratory use, peer discussions, critique with designers present, and reflective post play sessions. The holistic use of such methodologies enabled a rich understanding of the wants and needs of this unique user group, with regard to energy-reduction technologies, to be derived. However teen input in the design process should not end here, and should instead continue throughout. See [5] for further suggestions by the authors of other methodologies that may also help sustain teen engagement in the design process.

Discussion & Conclusion

The guidelines derived from the present research will be utilized to inform the design and development of an energy-saving device for use with teen populations, as part of the final stages of the overall research project. Though the guidelines presented in this paper are explicitly tailored for the design of energy-saving devices, they may also be applicable as more generic guidelines for designing technologies with teenagers. Previous work by the authors on understanding the importance of cool when designing for teenagers supports this view with factors such as convenience (guideline 1), appropriation (guideline 2) and adoption (guideline 4) being an integral part of designing with this age group alongside the need to, and benefit of, involving teenagers in the design process (guidelines 3, 6, 7).

From a methodological perspective, inviting teenagers to work with prototypes fits with the participatory and user-centered design approaches advocated by researchers within the child computer interaction field.

Acknowledgements

The project is joint-funded by the Research Councils UK Digital Economy and Energy Programmes. We would like to thank all the teenage participants in the energy-awareness day for their enthusiasm, honesty and robust discussions.

References

[1] BP Statistical Review of World Energy http://www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2012.pdf

[2] Climate Change: How do we know? http://climate.nasa.gov/evidence/

[3] Why are energy prices rises?

http://www.ofgem.gov.uk/Media/FactSheets/Documents1/Why%20are%20energy%20prices%20rising_factsheet_108.pdf

[4] Gram-Hanssen, K. Teenage consumption of information and communication technology. *Proc.2005 European Council for and Energy Efficient Economy,* (2005).

[5] Toth, N., Little, L., Read, J. C., Guo, Y., Fitton, D., & Horton, M. Teenagers talking about energy: Using narrative methods to inform design. *Proc. 2012 CHI* (2012)

[6] Fitton, D., Read, J. C., Beale, R., Cowan, B., & Guo, Y. Creating 'cool' mobile technologies to reduce teen energy use. *Proc. 2009 CHI* (2009)

[7] Braun, V., & Clark, V. Using thematic analysis in psychology. *Qualitative research in Psychology, 3, 2,* (2006), 77-101.