Tailored Scenarios: A Low-Cost Online Method to Elicit Perceptions of Home Technologies Using Participant-Specific Contextual Information

# Abstract

The introduction of new ubiquitous computing technologies has the capacity to greatly affect the home, a space that is core to human experience, yet remains understudied owing to its sensitive, semi-private nature. Scenario based methods have previously been used to collect home technology design responses but they have tended to over-simplify the social contexts involved, and have not taken into account the unique circumstances of the respondents. Technology probes have also been used but suffer from increased costs in research time and effort and a corresponding reduction in participation, as well as decreased acceptance owing to their invasiveness. We present ‘Tailored Scenarios’, a new method for eliciting participant responses involving home-based technologies that dynamically presents participants with scenarios, based on their home contexts, into which new technologies are installed. ‘Tailored Scenarios’ use self-reported contextual data to customise each scenario. We present the method, and report findings from a case study in which we compared responses to ‘Tailored Scenarios’ with those from traditional scenarios and technology probes. Our findings suggest that ‘Tailored Scenarios’ is an improvement over standard scenario methods in terms of eliciting attitudes towards technology and are easier to implement at scale than technology probes.

# Keywords

Home, Technology Design, Scenarios, Method Development, Activity Monitoring

# Research Highlights

* Development of a novel ‘Tailored Scenarios’ method for eliciting responses to in-home technologies.
* ‘Tailored Scenarios’ involve presenting a fictional scenario dynamically created to be situated in the context of each respondent’s home.
* Validation study explored differences in responses to a technology presented via a ‘Tailored Scenarios’ method, a traditional static scenario and a technology probe installation.
* Results suggest that the use of’ Tailored Scenarios’ helps to overcome some of the shortcomings of traditional static scenario methods.

# Introduction

Many of the challenges key to the widespread adoption of ubiquitous computing, such as understanding the ambiguous boundaries of group and individual privacy remain under-evaluated, and the potential benefits therefore are underexploited. More generally, it is increasingly recognised that as ubiquitous computing becomes more integrated into everyday life, issues of sensitivity to social context are an increasingly important part of modern HCI practice (Harper et al., 2008).

Homes can be difficult settings to study, primarily because the intrusion that study typically entails is at odds with the home’s role as a personal, private place. Commonly, these places are shaped by a multitude of complex human relationships defining notions of personal and shared space (Brown et al., 2013). Traditional study methods face a variety of challenges: laboratory studies in artificial locations may not replicate the lived experience of being at home, field studies can be intrusive, and the infrastructure and resources required to turn technology probe design concepts into working prototypes are not conducive to exploring or comparing a wide range of ideas.

In the HCI community and elsewhere, various alternate methods are being developed to overcome difficulties in studying technologies in the home. These take different approaches to the representation of events and relationships, the uncovering of implicit or mundane (yet essential) issues in home life, and speak to the general concern of conducting ethical and less intrusive research in the domestic context (Coughlan et al., 2013a).

In this paper, we present a new method ‘Tailored Scenarios’ that combines scenario-based surveys with details of each respondent’s own household situation, and make two subsequent contributions. First, we provide a methodological analysis of the potential to advance survey-based approaches to better address socio-technical issues through the development of scenarios sensitive to the household social context of each individual participant. Second, we experimentally contrast this technique with both a standard scenario-based approach and a field-based technology probe to evaluate their relative strengths and weaknesses in terms of the results produced.

## Background

In this section we review literature that presents a case for further analysis and innovation in the way that scenarios are used in research, particularly with respect to areas such as the home where research must endeavour to take account of complex socio-contextual topographies.

### Scenarios and Narrative

A scenario is traditionally a narrative description in text or storyboard form of activities, background information and assumptions about the environment, actors’ goals and objectives, and sequences of actions and events (Collett & Childs, 2011). Due to their simplicity and flexibility, scenarios can be used to conduct research in which responses to a wider range of designs are collected from a larger number of respondents than would be feasible within a field trial (Carroll, 2000). However, amongst other distinctions, scenarios lack the specificity of respondents’ actual household relationships – the very thing that gives the home setting much of its structure. Characters in scenarios are often little more than cyphers with limited goals, and tend to conform to simplistic stereotypes (Chapman & Milham, 2006). Nielsen (2002) argues for the importance of narratives driven by characters with multiple traits and interpersonal desires.

Scenarios are a low cost method of communicating designs, considered a means to consistently engage designers with a user-centred approach without the costs of constant communication between designers and users (Carroll, 2000). While they cannot be expected to provide the same insights found through richer methods of study such as ethnography or technology probes, they are flexible and productive in developing understanding and directing design. Rather than merely presenting attempts at the best possible design, multiple contrasting scenarios can also be used to prompt creative engagement from users, such as using alternate ‘light’ and ‘dark’ scenarios to open up a discussion space (Mancini et al., 2010). At the same time these technologies are intended to integrate with complex social environments which are poorly understood (Davidoff et al., 2007)

Interfaces, visualisations, and contexts lend themselves well to visual representation, and so storyboards have often been used to communicate designs to users. Walsh et al. (2011) explored differences in storyboard interpretation based on the background of participants. They reported that some male respondents had difficulty identifying themselves with a female character presented, and that cultural differences in areas such as transport provoked inconsistencies, e.g., where the use of airplanes and buses held different cultural connotations. Through empirical study of designers and students, Truong et al. (2006) developed guidelines for storyboard presentation that suggest using only the minimum level of detail to highlight essential features, just three to five panels, small amounts of text for explanation, and including renderings of people only where absolutely necessary.

### Vignette-Based Methods

Looking beyond HCI and design, narratives in the form of vignettes are commonly used in surveys, focus groups, and interviews. Vignettes “prompt respondents to consider a hypothetical situation or scenario” (Jenkins et al., 2010) and take the form of a short piece of text and/or images that describe a scenario. Vignettes and scenarios are put to very diverse uses in research, often being applied to phenomena that are sensitive or difficult to study in situ. O’Conner et al. (2003) found evidence that responses to vignettes were predictive of later behaviours. Vignettes are more broadly agreed to be useful in eliciting data on beliefs, knowledge and attitudes. Reviewing previous research, Hughes (1998) states that vignette methods “recognise the socially situated nature of individual behaviour and provide participants with an opportunity to discuss aspects of their own lives”. However, there is a clear detachment from the events described. Collett and Childs (2011) found that participants were more emotionally engaged in lab studies than in vignette studies, and that this affected interpretations and subsequent actions.

In light of this, Jenkins et al. (2010) argue that a phenomenological approach is needed to understand how the act of responding to a vignette is qualitatively different to more embodied activities. The method can uncover otherwise hidden interpretation processes, but discrepancies suggest differences between how people believe they should act, as opposed to how they act under the conditions of a lab or field study. They find that the common use of a fictional protagonist can lead participants to adopt a character unlike themselves, and to make choices according to their perception of this adopted character. Van den Hende et al. (2012) also explore the significance of the choice of protagonist in narratives presenting novel products, finding evidence that technologies are more positively received when the viewer has a positive view of the protagonist, but also that this effect may be mitigated by explicitly asking the viewer to imagine themselves in the role of the protagonist. In a further step, Jenkins et al. (2010) begin to explore the potential for interactive vignettes, in which respondents make choices leading to different narrative paths. Utilising this in interviews, they argue that interactivity can make vignettes more plausible to participants, and that this helps to maintain participant engagement.

**Researching in the Home**

Various factors such as household composition, including familial and extra-familial relationships, can impact upon responses towards new in-home technologies. Such factors can also affect study design, e.g., interventions such as encouraging competition can work as an incentive to change behaviour in residential contexts such as shared student housing, but a deeper understanding of the varied, nuanced motivations and values of dwellers may be necessary to initiate change in other settings (Pierce et al., 2008). Ethnographic studies of behaviour in the home have shown that once ‘abstracted’ from the environment considerable complexity arises, even in issues as apparently straight forward as the handling of mail (Crabtree & Rodden, 2004). The liquidity of relationships over time, particularly notable in the changing boundaries between adults and children, is a further element requiring consideration. In a similar vein, Toscos et al. (2012) argue that pervasive technologies for monitoring diabetes need to be designed to be sensitive to how child-parent relationships evolve during adolescence, with relation to control of data and surveillance.

In summary, narratives are an important tool for the technology researcher. Their low cost supports the exploration of concepts with users through multiple designs. While responses given to narratives cannot be considered directly equivalent to those given to embodied actions in the home, they offer insights into an individual’s beliefs, knowledge, and perceptions about actions and consequences. Crucially, these types of low cost methods commonly direct decisions about which prototypes to build and which field-based studies to conduct, but the importance of specific social relationships to each individual’s experience of home life is not well accounted for through such approaches. It is also troubling, both ethically and in terms of research validity, if personas and scenarios fail to represent minority groups, or ask people to engage with ‘dominant’ or ‘normative’ representations of user groups that do not relate to their own situation or requirements.

# Method Development

In this section we present our work on ‘Tailored Scenarios’, a HCI method to provide a medium through which narratives can be tailored to the person viewing them, populated with the rich characters that that person already knows. Reflecting on the prior use of a static scenario-based online survey method by Brown et al. (2013), we identified the need to further explore issues around the interpretation of in-home technology scenarios by respondents. It is difficult to present the use of social technologies without presenting specific people interacting with them, but we had no sense of whether respondents were able to relate the fictional characters we used to their lives. These were fundamental issues, as we wanted to gain an understanding of how distinctions between respondents related to their own household relationships. The following is an approach to automatically deliver ‘Tailored Scenarios’ through software.

## Implementation

The implementation of ‘Tailored Scenarios’ (see Figure 1) begins by asking for information about the respondent and each member of their household. Respondents are only asked for first names, and can use pseudonyms if they wish. A household member is then selected to be the ‘focus’ or protagonist. Selection is random with the stipulation that the participant themselves is not selected, nor any household members under the age of 12, as they may not be appropriate as a focus for some scenarios. A scenario and a condition are then selected randomly and shown to the respondent, with the information from the respondent used to include the name of the focus person and other members of the household in visualisations as appropriate. The example presented in Figures 2 and 3 shows the physical activity of the focus person to be relatively low.

Figure 1 HERE

The system has been implemented as a plugin for the Wordpress blogging platform, allowing us to easily create scenarios, use other plugins to generate visualisations using household members on the fly, and use forms for responses.

Figure 2 HERE

Figure 3 HERE

An initial study of this method was performed by Coughlan et al. (2013b), exploring participants’ responses to a range of different in-home Internet of Things (IoT) technologies. This study suggested the potential value of ‘Tailored Scenarios’ to elicit more nuanced and reflective responses to in-home technologies, but did not go far enough to draw comparisons with alternative approaches. Thus we have performed and will now next describe results from a case study exploring the relative strengths and weaknesses of ‘Tailored Scenarios’ compared to both traditional or static scenarios and technology probes installed into homes.

## Experiment – Comparison of methods

To explore the research implications of adopting the ‘Tailored Scenarios’ method we performed a validation study in which three different methods were employed to obtain feedback about a single proposed technology: ‘Tailored Scenarios’, traditional scenarios and a technology probe that involved the installation into participants’ homes of a system analogous to that presented in the scenario. The technology used was an in-home display for sharing fitness data, collected via personal activity monitoring devices. The probe approach provided an interesting comparison, as it represented a similar set of goals as we hoped to achieve through the ‘Tailored Scenarios’ approach: understanding needs and desires of users, and inspiring users and researchers to think about design (Hutchinson et al. 2003). In addition to this, the technology probe is a field test of the technology, with the associated costs and richness of interactions that distinguish it from a scenario-based approach, making a comparative study useful.

## Study Method

The nature of the study meant that two different methods had to be employed in order to operationalise the three conditions: a technology probe, and surveys presenting participants with a either a traditional/static scenario or a scenario tailored to their home context. In order to explore the practical differences between the methods, deployment of each condition was allocated a comparable amount of effort. Practically, this means that a total of 80 hours of researcher time was used in the deployment of each method in homes or online. For the technology probe much of this time was spend installing and maintaining technologies, while for the surveys time was mostly spent recruiting participants.

### Method 1: Technology Probe Installation

Technology probes are simple, flexible, and adaptable technologies that can be installed in real world settings to gain insights for design, engineering and social science. In contrast to technology prototypes, which are relatively faithful implementations of the proposed technology deployed to answer specific questions concerning its efficacy, technology probes can be technically rather simple and should be deployed in an open ended manner, so as to encourage users to adopt, adapt and be creative with forms of technology that were previously unfamiliar (Hutchinson et al, 2003). The aim of our instillations was to explore acceptance and appropriation of communally displayed activity monitoring information. After an initial pilot to test the technology and method, studies were conducted in four homes. Each trial lasted for one week. We recruited a diverse range of households in order to see different behaviours.

Figure 4 HERE

Each participant was given a Fitbit device,[[1]](#footnote-1) a small, clip-on pedometer-type unit that collects data on the steps taken by the individual during each day. Participants were given an instruction sheet along with a verbal introduction to the technology and asked to wear the device for a week. Participants were asked to find a space in a commonly visited communal area in which a display could be installed. Kitchens, dining areas, and lounges were used for this purpose. Data from the Fitbit was synchronised whenever the device was within a ~10 metre range of a base station situated next to the display. The display simultaneously showed a graph of the activity on the current day for each individual, and a chart of the cumulative total steps so far in the week, allowing comparison among all participants (see figure 4). For simplicity, the system did not support any interaction, instead consistently provided the same information as an ambient display.

After the week was completed, researchers arranged a suitable time to meet all the participants in the home. Each participant was asked to fill in a survey, featuring the same open and closed questions used in the survey conditions (see Tables 1 and 2). In addition a focus group was conducted with each household in order to gain a richer understanding of the perceptions of the technology, and the participant’s experiences during the week.

### Method 2: Static Scenarios

Participants were initially asked for information about themselves and each member of their household. Respondents were only asked for first names, and were told they could use pseudonyms if they preferred.

A scenario was then developed for these two conditions, describing the installation of and interactions with a technology probe. Each scenario was developed with three frames describing the installation/use of the technology and a fourth frame presenting fictitious information displayed on the shared display. The scenario was written in the third person, describing a fictional family and presenting the data they produced on the communal display. One member of the household described in the scenario was shown to have had considerably less physical activity during the daytime, in order to provoke discussion.

After viewing the scenario, respondents were presented with a set of open and closed questions derived from those used by Brown et al. (2013) for the elicitation of attitudes towards Internet of Things technologies (see tables 1 and 2).

### Method 3: Tailored Scenarios

This method followed an identical procedure to Static Scenarios with the exception that the scenario was written in the second person, the fictional data was associated with members of their household and in the fourth frame of the scenario was modified dynamically as described above.

Tables 1 and 2 HERE

## Participants

### Method 1: Technology Probe Installation

A total of five families were recruited though personal contacts and social media. One family withdrew before completion, leaving 4 families and a total of 16 participants. The age of participants ranged from 13 to 48 (mean 27.8, SD 12.7). Two of the homes were traditional family homes with two parents and two children. One home was a shared student house and the last a shared house of working professionals. All members of each household took part in the study, with the exception of the student house, in which 4 of 7 residents took part.

### Method 2 & 3: Static and Tailored Scenarios

A total of 75 participants were recruited via social media and personal contracts, and randomly assigned to either a static scenario or ‘Tailored Scenarios’. For the static scenarios 38 participants completed the survey and ranged in age from 18 to 59 (mean 32.3, SD 8.6). For ‘Tailored Scenarios’, 37 completed the survey and ranged in age from 18 to 49 (mean 31.4, SD 9.2). All participants were pre-screened to ensure they lived in a household with at least one other person over the age of 16 to remove the potential for sole occupancy households to confound responses. Number of co-occupants ranged from 1 to 7 in number and 4 to 85 in age with comparable variation between methods.

None of the participants from any of the methods reported previous experience of ‘fitbits’ specifically or digital pedometers in general. While we adopted a between subjects design the partialities of method 1 required an independent recruitment and thus convince based allocation to this method.

## Results

### Quantitative Results

Responses to the closed questions was reversed as appropriate (see table 2) and scored from 0 (strongly disagree) to 4 (strongly agree), with mean scores for each question shown in figure 5. In order to explore the impact the method of technology presentation had on the response to Likert style items, a multivariate independent subjects ANOVA[[2]](#footnote-2) using Wiks’ Lambda was then performed with “method of technology presentation” as the independent variable and “responses to individual items” as dependant variable. This test was followed by post hoc analysis of individual questions with Šidák(1967) correction for multiple tests, to explore the effect on individual item responses.

Figure 5 HERE

This testing revealed significant effects for method of technology representation at p<0.05 for the overall construct (treatment df=22.0, error df=152.0, F=3.445, df=152.0, P<0.001) and five of the individual questions (1,4,6,7 and 10, see table 4 for details).

Finally, between conditions post hoc t-tests with Šidák correction revealed a number of significant effects, as show in table 5.

Tables 3 and 4 HERE

### Conclusions from Quantitative Findings

Descriptive statistics suggest that for several questions, responses to the ‘Tailored Scenario’ version of the survey are more similar to responses from the technology probe than those elicited by the static scenario.

The initial inferential results show that the way in which a technology is presented influences attitudes towards that technology. Examining individual questions we provide evidence (tested at P<0.05) that that the specific conditions presented influence reported attitudes in terms of (see table 4):

* Acting on the information presented by the technology (Q1)
* Likelihood to share with commercial organisations (Q4)
* Subjective usefulness (Q6)
* Potential of the technology to violate privacy (Q7)
* Perceived value of the technology as a communication tool (Q10)

More specifically we can see that those who experienced the technology probe were (see table 5):

* more likely to be happy to share the system data with commercial organisations, compared to those who saw the static scenario.
* more likely to feel that the technology would violate their privacy compared to those who saw the static scenarios
* more likely to think that the technology would be useful for communicating with members of their family than those who saw the static or tailored scenario.

### Qualitative Results

The free text responses to questions 1-4 were analysed through a process of thematic coding. This referred to a coding scheme developed in previous scenario-based studies in the home technology domain (Coughlan et al. 2013b, Brown et al. 2013). The coding process focused on both the content of the responses, and the ways in which the respondents contextualised and framed what they said. The results were then compared across the ‘Tailored Scenarios’ and static scenarios conditions, by comparing the number of instances of a code and looking for differences in the ways this content was expressed. A total of 358 instances were identified between 41 codes, as show in table 5. CHI squared analysis revealed differences in code frequency between conditions was significant at p<0.05 (CHI2=65.44656, df=81, P=0.0068).

Table 5 HERE

In many cases, codes reflecting themes in the content occur to a similar degree across the two conditions. For example 21 respondents in the static scenario condition expected forms of competition or comparison behaviour to occur as a result of the system being installed and 15 expressed similar sentiments in the ‘Tailored Scenarios’ condition. 18 respondents in the ‘Tailored Scenarios’ condition expressed an expectation that positive behaviour changes would occur if the system was installed, and 14 expected this in the static scenario condition. There was a distinction around privacy concerns, which were more commonly expressed in the static scenario responses, forming part of 15 responses, and were only mentioned 8 times in the ‘Tailored Scenarios’ responses.

Interestingly, participants were similarly capable of making inferences about the behaviour of fictional characters (in 30 responses) as they were at making such inferences about the behaviour of people they knew (in 24 responses). For example, stating in the ‘Tailored Scenario’ that the person “would have college to attend and might play in the evening”, or that when the monitoring of the fictional household member in the static scenario shows little exercise, it is because s/he “works from home or is unemployed, therefore doesn’t walk around as much”. As the last example shows, these inferences in the static scenario could be more speculative since the respondents were not given any detailed information about the people in the fictional household.

Eight respondents in the static scenario condition explicitly qualified how they interpreted their role in their responses, a qualification that did not appear in the ‘Tailored Scenarios’ responses. For example: “It depends on my relationship to this household, I would think that Bob should do more walking”, or “If I were Bob I would try to be more active”. One respondent in the static condition stated that it was “not clear who I am”. This confusion or need for qualification suggests that there is some level of dissonance between presenting a fictional household in a scenario and then asking for an individual’s response on it.

In terms of the manner of framing or contextualising responses, 13 of the respondents from the ‘Tailored Scenarios’ used specific information about those they lived with in their responses. Three of the respondents to the static scenario referred to members of their household by name, even though their household was not used in the scenario they were given. However, their names were asked for at the preliminary stage, which could explain why they felt that mentioning their household members by name made sense.

Given that the scenario and data used remain fictional, even where the names are real, a further identifiable phenomenon is that the scenario appears unrealistic to the respondent given their knowledge of the person. For example: “This would be a very atypical scenario in our household. Usually I would be the one who was less active because I have a desk job while (the other household members) would be active all day”. However, the respondent goes on to suggest a possible reason for the data, that it is a weekend and there is a sports event on the television that the (usually more active) household member is watching.

Compared to either of the scenario based conditions, the technology probe resulted in more detailed response to individual questions, but also fewer overall responses, due to the work effort restriction put in place (as described above). This difference results in a deeper understanding of individuals experience/expectations of the installed technology but limits the ability to generalise findings from the relatively small sample size.

## Conclusions

The quantitative results reveal that method of presentation has an effect on reported attitudes towards technology presented. In some cases this data suggests that ‘Tailored Scenarios’ elicits responses that fall between those created by traditional static scenarios and installing technology Probes.

The qualitative analysis suggests that both types of scenario produce similar themes in responses, although there may be some differences in social phenomena such as privacy. ‘Tailored scenarios’ appears to support respondents to describe complex social phenomena with reference to their household, which is not always well supported by the traditional scenario based methods.

# Discussion

In general our findings suggest that ‘Tailored Scenarios’ as a means to elicit attitudinal feedback about in-home technologies, provides a compromise between traditional static scenarios and technology probes,. Our results suggest that tailored scenarios can provide a clearer instruction to respondents about the way in which they should approach their response, as there is no longer a disconnect between them viewing a fictional household and being asked for their opinion about their own household. At the same time, Tailored Scenarios’ is nearly as easy to implement and just as scalable as traditional scenarios, as it can be applied remotely and is not dependant on the deployment of a working technology.

These findings are in line with Jenkins et al.’s (2010) exploration of interactive vignettes utilised during interviews, which revealed that participants find dynamic narratives more plausible and engaging. Our study suggest that a similar effect can be obtained in a more scalable manner by presenting customised vignettes, rather than dynamically adjusting vignettes during elicitation. Furthermore, while personas or other types of biography can be created to provide a background to the fictional characters used in scenarios, the ‘Tailored Scenarios’ approach removes the need to include such characterisation. Instead, each participant already has a rich understanding of the people that they live with, grounded in real life experience. This work also provides evidence of and a potential solution to the issue on inconstancies between narrative and reality impacting participants’ responses to fictional scenarios (Walsh et al., 2011).

Within the home setting this type of scalable but contextually sensitive method is especially valuable, as studies in this area have historically tended to lack generalisability due to scale or be naïve to the complex social, physical and psychological nature of home environments.

## Future Work

Future work in this area should further explore the value of this and other methods in eliciting feedback about in-home technologies. In addition to using the names of actual household members, there may be further potential to create scenarios that are automatically tailored to provide a suitable context for the respondent to envisage a novel technology in their home.

The possibility also exist for building on this technique in order to tackle the issues of inclusiveness and cross-cultural meaning making in interaction design, as highlighted by Bardzell et al (2011). In this domain, scenarios could be tailored in order to allow for cultural or gender issues in addition to those of social context.

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# Figure Legends

Figure 1: The Tailored Scenario process .

Figure 2: Example Tailored Scenario. Sections 1-3: Generic Narrative.

Figure 3: Example Tailored Scenario. Section 4: Tailored Visualisation.

Figure 4: Shared display as presented with live information in technology probe installations.

Figure 5: Mean responses to closed questions from 0 (strongly Disagree) to 4 (strongly Agree) for each condition.

1. http://www.fitbit.com [↑](#footnote-ref-1)
2. The authors feel ANOVA is sufficiently robust to deal with individual Likert type items and that this is the most appropriate testing given rank best methods would be unsuitable, due to the prevalence of tied ranks. [↑](#footnote-ref-2)