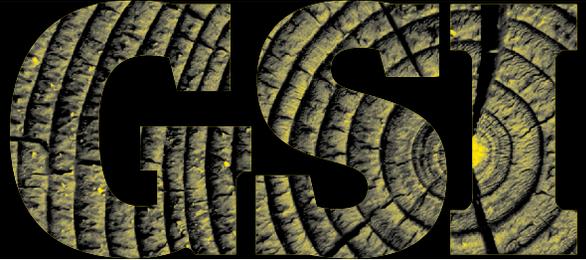




Briefing Notes

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Technologies and sustainability: How developers account for the end-user

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This GSI Note investigates the technology design process and in particular the relationship between developers and end-users, and what this relationship means for sustainability. On the basis of interviews with technology developers, we give an overview of how they construct fictive (imagined) visions of end-users, detailing the specific role of two elements: clients and metrics.

Introduction

It is vital that society reduces its consumption of resources, due to their finite nature and (in the case of fossil fuels) their contribution to climate change. Recent policy targets aim to reduce consumption and lower carbon emissions [e.g. 1]. All resource consumption, from housebuilding or farming to phone manufacture, involves designers or developers at some stage in the process. In this study we focussed on household and industrial product design within the engineering services; engineering companies represent 25% of all UK turnover [2] and play a key role in delivering reduced carbon emissions.

In exploring ways to reduce consumption, the active role of materiality (tangible objects, including technologies) is under accounted for [cf. 3]. If materiality is considered, it is typically assumed that if (lower carbon) technologies are rigorously tested and demonstrably proven, if market forces are undisturbed and non-technical barriers overcome, then technology uptake and behaviour change (and lower consumption) will ensue [4]. Research has also focussed more on 'end-users', i.e. people operating the technologies post-purchase and/or installation. Less research has been conducted with regard to those designing technologies, although Science and Technology Studies does have a track record of work in this area [e.g. 5], including research into 'scripts' (structural characteristics of technologies that encourage/discourage certain user actions [6]).

There are several characteristics of the boundary between developers and end-users. In this Briefing Note we focus on 'fictive visions' (images and perceptions) of the end-user [6]. No developer can ever *know* perfectly what an end-user does and wants, so must imagine to some degree what form the user, and the use, will take. Even though the end-user can only ever be fictive to the developer, these visions shape the present and future actions of the developers (and thus the exact form that 'scripts' will take). It is interesting to reflect on how developers, consciously or not, construct these fictive end-users through studying the sociology of their expectations [7].

We aim to investigate how fictive visions of end-users are created by technology developers and what that could mean for sustainability.

Methodology

Five interviews (19-75 mins; avg. = 44 mins) were undertaken in July 2015 with technology developers (labelled A-E in this Note) from three engineering consultancies. These companies work with clients to develop technologies across consumer and industrial products, software, hardware, and military devices. All interviewees were male, had a mechanical/electronics engineering background, and represented a range of experience in the sector (8 months-17 years). The interviews focussed on duties, company and client expectations, end-user engagement, and sustainability. The interviews also involved a drawing exercise of the design process. Interviews were recorded, transcribed, and thematically coded using NVivo software.

Findings and discussion

We now give an overview of how fictive visions of end-users are broadly constructed during the design process, before discussing two emergent themes: clients and metrics.

Overview: fictive visions during design

End-user needs are considered at the start of each project during a highly detailed "*defining*" (E) phase. Developers take a list of end-user needs identified by their clients, and seek to 'complete' this list via focus groups, questionnaires or ethnographic studies, the extent of which usually depends on budget. These data are then used to produce the design concept (and 'script'), from which everything else follows. Unsurprisingly then, two interviewees highlighted this as the optimal time to consider sustainability: "*there is no point in trying to talk about sustainability when you are part way through a design*" (D).

The prototyping phase next allows developers to test the product, through formal in-home trials, focus groups, questionnaires and ethnographic studies. Fictive visions are often also, interestingly, based on developers' own household use, by gathering feedback from taking the product home. This gives the developers an additional opportunity to explore how the technology's script is 'described' (end-users translate the script as part of taking action [6]).

Developers do not tend to explore end-user experience after the final product has been released onto the market "because we don't manufacture and sell products, so it will be the client organisation who does that sort of post-market surveillance" (B). Receiving post-market feedback is rarely conducted directly, and is only likely to be introduced if a client returns to undertake a future project with the company.

The role of clients

Since developers work with a variety of different sectors, their clients were seen to be the ones who "understand their [end-] users really well" (A). Technology consultancies aspire to maintain long running relationships with clients; the personal skills needed for the job were a recurring theme in all five interviews. Although interviewees clearly enjoyed seeing their products become available commercially, their main professional priority was making sure their clients were happy, which could involve recommending *not* to pursue a new technology or business area. They are "providing a service in the end" (C) and so the client's needs and wishes take priority. In line with this, developers allow the client's fictive vision of the end-user to dominate, especially during initial brainstorming.

Although the developers noted sustainability as an important environmental issue, it was not always a priority for their clients, and hence became a secondary concern: "it's rare to find a client who is prepared to use fewer resources, less energy, do less shipping just because it makes them feel good" (E). Thus environmental impact was typically only considered in the context of cost, regulatory demand, risk reduction and/or brand promotion. It is then no surprise that "the percentage of product development in the world that is based around just being greener is small" (C). However, developers did recognise their key role in informing clients of updated regulations, including environmental or resource consumption considerations. Although outside of the scope of this GSI Note, this poses numerous further questions, such as: how do clients construct their fictive end-user visions? And, how are clients' fictive visions translated into those of developers and is there a mismatch between the two?

The role of metrics

The opening defining stage produces large numbers of possible designs, which must be narrowed down for the prototyping stage. Developers use metrics (systems/standards of measurement) to aid this process, where data are often quantified into a single indicator for comparison: "there is a lot of scoring and weighting of scores and matrices at this point" (C). The use of metrics also helps communicate the progress of the project to, and thereby manage the relationship with, the client: "we say 'we are going to be working with this number', and he [the client] is saying 'okay that's an acceptable number'" (A).

Metrics therefore help funnel the design and fictive visions in certain directions. This can be seen, for example, in the practical application of sustainability, where action was often seen to be about compliance with particular standards: "our board level says we must reduce our EI99 score, the environmental impact score, by 10% for each new product" (E). Therefore those needs and priorities of clients and end-users that align with sustainability, but are *not* easily quantifiable, could potentially be backgrounded.

Materials efficiency – discussed in the interviews as the metrics-assessed use of raw materials and production – was also raised as a profit indicator and an environmental issue. One interviewee explicitly argued that materials efficiency was "often forgotten" (A). Yet we argue that it can never be truly forgotten because, as well as being independently raised by some of the interviewees, significant efforts are made to improve "the efficiency of production lines" (E). We wonder what happens to sustainability concerns that are artificially forgotten due to how metrics-based assessments are created. For example, "intergenerational equity" (B) was discussed as a sustainability concern that could not be easily (and 'objectively') measured, which led to it not featuring in developers' metrics-based assessments and thereby not becoming a design priority.

Summary

- Fictive visions of end-users are inevitable because developers have to imagine the user.
- The opening defining stage of the design process commits developers to a certain design concept. This is a critical stage for sustainability to be potentially considered.
- Client perceptions of the end-user, and their sustainability concerns, are pivotal. Developers felt more comfortable advising on sustainability issues where regulation was concerned.
- Metrics are used to focus the design; by their nature they prioritise 'measurable' concerns whilst potentially overlooking others, e.g. intergenerational equity.

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