Changing the change
DESIGN VISIONS PROPOSALS AND TOOLS

Is design the answer to cultural acceptability of waterless toilets?

A collaborative approach to design research

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Abstract

The adoption of waterless toilets could potentially reduce domestic water consumption in many western countries by approximately 20% (ABS, 2001) but this reduction, and the environmental gain it represents, is strongly dependant on the cultural acceptance of this technology by the end-user (and openness to the behavioural changes its operation would require). As Verbeek et al have noted, *"The environmental crisis is not only a technological problem, but a cultural problem as well" (Verbeek & Kockelkoren 1998)*, which suggests the need to redefine the role of the designer beyond the development of technical considerations and finite solutions to the facilitation of more systemic social change (Morelli 2007) where users and stakeholders are considered important collaborators in the design research and development process.

Introduction

The traditional focus of design research has been product oriented, market driven and focused on finite technical solutions to problems. As Papanek has noted, design emerged as a profession in the early 20th century with the primary purpose of analysing, creating and developing products for mass production (Papanek 1984). So it is no surprise that one way design has responded to sustainability has been to 'commodify the environment' as seen by the proliferation of 'green products and technical solutions' on the market (Shove 2003). Consumer-oriented product design is centred around a narrow set of economic concerns and although it may be politically sensible

to promote green consumption of products and services and 'green' ways of living, the question is whether consumer choice is the best way of encouraging behavioural change (Shove 2003).[1]

Behavioural change strategies are increasingly being linked to product marketing campaigns that do not require engagement which directly challenge a consumer's values about consumption. Rather 'green' behaviour is built into technology or products such as water efficient toilet cisterns, low flow shower heads and energy efficient light bulbs (Crompton 2008). The benefits of 'behaviour steering technology' is not being discounted here as a means of reducing resource consumption. As Jelsma has noted, technical devices have the potential to script and enforce the user in environmentally positive ways (Shove 2003). But the benefit of scripting behaviour through technology fails to engage users in the need for significantly reducing consumption[2] and the broader issues of sustainability required to cope with the emerging environmental crisis. Christensen has noted:

> *"…designs at the level of individual items or systems, however efficient they may be in various respects, do not add up to a sustainable whole." (Christensen 2005)*

There is evidence to suggest that any adequate approach for tackling environmental challenges, will require "engagement with the *values* that underlie the decisions we make and a sense of who we are" (Crompton 2008, p. 5), not just a reliance on technical efficiencies and green marketing strategies that bypass the need for significant behavioural change.

For significant behavioural change to occur there needs to be an alignment between *practices* of everyday living and the *values* that drive those practices[3]. Research into Self Determination Theory (SDT) conducted by Brown et al suggests the reasons why ecologically responsible behaviour is adopted is important for the behaviour to be maintained and pursued (Brown & Kasser 2005). For example, if an activity is adopted to uphold a set of *intrinsic* values, such as, personal growth, emotional intimacy or community involvement, the behaviour is more likely to be steadily adopted, as opposed to an activity pursued to uphold a set of *extrinsic* values, such as social recognition, financial success or material attainment (Brown & Kasser 2005, p. 351) This implies that introducing new technologies that require significant behaviour change, such as composting toilets, will be more readily adopted within specific social contexts where users' values dispose them to change everyday practices in the use of the technology. It is not the technology or cultural values alone which will influence behavioral change but rather a combination of the available technologies, values, existing habits as well as infrastructures that support the acceptance of a new technology (Knot & Luiten 2006).

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[1] This is not to suggest that 'green consumerism' should be discounted as a way of influencing front-end purchasing decisions but rather to suggest that perhaps it is the role of the designer to look at the broader system within which these purchasing decisions are made and the net effects they may have.

[2] Ecological footprint studies show that we need a significant improvement in how we utilise resources (as much as 90% less energy and materials - a Factor of Ten) to meet human needs equitably within our planet's carrying capacity. (Schmidt-Bleek 2008)

[3] It is important to note that there may be a combination of values or contradictory values occurring at the same time, for example the desire to save water but the enjoyment of having hot showers, therefore the user may buy AAA shower heads to save water but feel less conscious about having long showers – creating a rebound effect of overall increased consumption. The rebound effect in relation to technically efficient systems has been noted by Schmidt-Bleek (Schmidt-Bleek 2008)

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Transitions in practice – A case study of composting toilets

The embedded habits of use associated with the water flushing toilet have been the generally accepted norm in many parts of the industrialised world for the last 100 years. This method of disposing of human waste raises serious environmental concerns not only of the amount of water used to flush and treat waste but also the amount of faecal sludge that is discharged without treatment into waterways.[4] Therefore the problems associated with water borne sanitation does not only relate to the amount of water used but also the amount of grey water contaminated by black water from the toilet. It is estimated that a person produces approximately 400-500L of urine and 50Kg of faeces per year and is flushed away with an estimated 15,000L (approx. 20% of domestic water consumption) of potable water before being combined with an additional 60,000L of grey water from the household. Therefore the relatively small amount of faeces and urine (550L/person/yr) is allowed to contaminate more than 75,000L of water per person per year (ABS 2001).

A critical factor to consider beyond the amount of water used is that considerable energy is required to remove faeces and urine from the water stream prior to disposal or reuse. Carbon and nutrients in faecel sludge are viewed by the existing paradigm as wastes and pollutants but are in fact resources that could be recovered and reused in agriculture.

Considering the expected rise in the global population[5] paired with the prediction that nearly half will face water shortages by mid century (UN-Habitat 2003) this resource intensive sanitation system seems an unsustainable option not only for industrialised nations but importantly also for developing countries where it is not affordable for the vast majority of people and does not offer an approach ensuring sustainable societal growth (Winbad & Simpson-Herbert 2004). Urban sanitary practices of industrialized countries have greatly influenced the aspirations of developing nations where the flush toilet is generally perceived as the most desirable form of sanitation. Therefore the demonstration and use of ecological sanitation in industrialized countries has the added benefit of raising the status of the technology in both contexts.

Ecological sanitation options such as 'composting toilets'[6] which function without water offers a way of potentially reusing the nutrients of human waste and are possible alternatives to the flush toilet. But no matter how technically sustainable these systems may be, uptake depends on the acceptance by the intended user. Although waterless solutions are technically functional there is a gap between the current availability and the cultural acceptance of the technology in many western countries[7].

The general lack of acceptance and limited diffusion of the technology can be attributed to certain technical and institutional factors which has led to the path dependency of the existing system

[4] "In Europe, 79 major cities out of 542 are estimated to have full treatment of their sewage. For example, as late as 1998, Brussels—the political capital of the European Union—had no treatment whatsoever on 70% of its sewage prior to directing it into the waterways" (Rosenquist 2005, p. 335)

[5] There is an projected rise in the global population from 6.7billion to 9.2billion by mid century (UN-Habitat 2003)

[6] A composting toilet is a dry toilet that does not use water but rather composts the waste aerobically for up to 12 months before being sanitized, free of pathogens and safe enough to potentially be reused to fertilise soil.

[7] This is not to suggest that acceptance of waterless toilets is purely a cultural phenomena, there are also technical issues and building constraints that may limit the feasibility of adoption in many areas. Eg. lack of space below the bathroom floor to install the composting chamber

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and the technology of the 'flush toilet' (Quitzau 2007). As defined by Rip and Kemp 'path dependencies refer to the interrelatedness of artifacts with other artifacts, infrastructure and routine' (Rip & Kemp 1998, p. 354), configurations of which make extreme changes in the direction of the technology complicated, thereby limiting alternative socio-technical developments (Rip & Kemp 1998; Shove 2003).

The historical development of waste water treatment in many industrialized countries has been a result of the co-evolution of infrastructure, technology and practices over the last century (Panebianco & Pahl-Wostl 2006). Technological development evolved as a way to deal with water pollution and subsequent outbreaks of diseases such as Cholera and Typhoid. The engineering solution to the problem originally perceived the social dimension as an external factor, however the technology is only the hardware and it is becoming increasingly obvious that the human element must be an integral part of any socio-technical transition (Panebianco & Pahl-Wostl 2006). As Shove has critically noted, the social dimension is neglected in transition literature which focuses rather on the technical system and infrastructures and as a result "sustainability is tacitly defined as a matter of resource management, efficiency and ecological modernization" (Shove 2007, p. 768). This focus neglects habits and practices of everyday living which involve consumer-citizens and transitions not only in technology but importantly also in practice (Shove 2007).

Emphasising a technological transition, underestimates the social environment in which the technology is used. For example, the 'flush toilet' is not an isolated artifact but part of a socio-technical landscape. It is made up of sewerage pipes, waste water treatment plants, water supply, extensive capital infrastructure investment, rules and regulations dictating health standards on treatment and cultural habits of use which have become embedded in western society over the last century. The combination of the artifact and the socio-technical landscape has been termed by Mumford as the 'megamachine' (Mumford 1961) which in the case of water borne sanitation has created an enormous physical barrier to change. In spite of this, the design of the flush toilet disposes it to be treated as an isolated artifact, supporting the cultural disconnection in relation to water use and waste production.

Therefore if design is to influence shifts in the socio-technical landscape towards more sustainable outcomes then considering how alternative technologies such as waterless toilets are *adopted and supported* is important for the transition to occur in practice. It is interesting to note that much of the research has been focused on how novel technologies are *introduced* rather than how they have been adopted (Rip & Kemp 1998). And importantly for the diffusion of alternative technologies, there is limited understanding about strategies for supporting and harnessing innovative niches that diverge from mainstream regimes and meet human needs in environmentally sustainable ways (Smith 2003). What is known about technological development is that technological change is inherently social (Rohracher 2006) so it would be logical for designers to consider how composting toilets are culturally accepted within a specific social context.

The 'Dry Flush' project

Responding to the problem by designing the artifact alone disregards the well established practices associated with the 'flush toilet' and the configuration of artifacts, infrastructures and routines which have co-evolved over time to establish the existing paradigm of water borne sanitation. The adoption of alternative technologies that require a divergence from conventional practices is not just about *buying and installing* them but also about integrating them in *practice,*

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described by Lie and Sorenson as the *domestication process* (Lie & Sorenson 1996).

The 'Dry Flush' project, undergraduate research conducted by the author, was originally aimed at developing a design solution to issues of cultural acceptability of composting toilets within an urban Australian context. Rotaloo Australia,[8] a local manufacturer of composting toilet systems, was initially involved as an industry partner in the project where the aim was to redesign the hardware as a way of increasing cultural acceptability. The design of the toilet pedestal was user-centered and took into consideration the embedded habit of 'flushing' as a way of maintaining a sense of normality in use. A flushing mechanism was designed to flush 'fine grade pine bark' into the composting chamber as a way of adapting to the existing habits and contributing to dehydration of the collected waste[9].

The 'Dry Flush' project emphasised the importance of the *domestication process* which required a change from passive to active involvement in use and maintenance. Therefore the research project shifted from designing the finite solution of the artifact to the systemic solution of integrating the artifact into daily practice. This required a number of stakeholders being considered in the design research process. End-users, cleaners, maintenance staff, installers and the important part each of these stakeholders would play in the enduring effectivity of the design were considered.

With the understanding that technological change occurs in social contexts, there was a perceived need to locate a test-site for the technology. Therefore the Hazelbrook Steiner School was considered as a potential collaborator in the project. The Steiner School curriculum has an established philosophy of combining education and operational practices and has a strong commitment to environmental sustainability within the school community. They were open to the possibility of demonstrating the technology within the school and potentially offered a means by which the 'social learning' could occur in practice[10]. The aim was not only to design the artifact but to design the artifact's entrance into everyday use. This was achieved by designing a template for a website which included information on how the toilet could be incorporated into everyday practice (See figure 1.)

[8] Environmental Equipment Australia is the manufacturer of Rotaloo composting toilets who became an industry partner of the author in developing the 'Dry Flush' toilet pedestal. www.rotaloo.com

[9] The addition of a certain amount of carbon based material such as woodchips is suggested to be added to the composting chamber and is commonly used as a way of balancing the carbon-nitrogen ratio and contributing to the dehydration of the pile.

[10] The author contacted the Hazelbrook Steiner school and the educational facilitator, Amanda Bonnie and discussed the dry flush toilet project and the school's willingness to adopt composting toilets.

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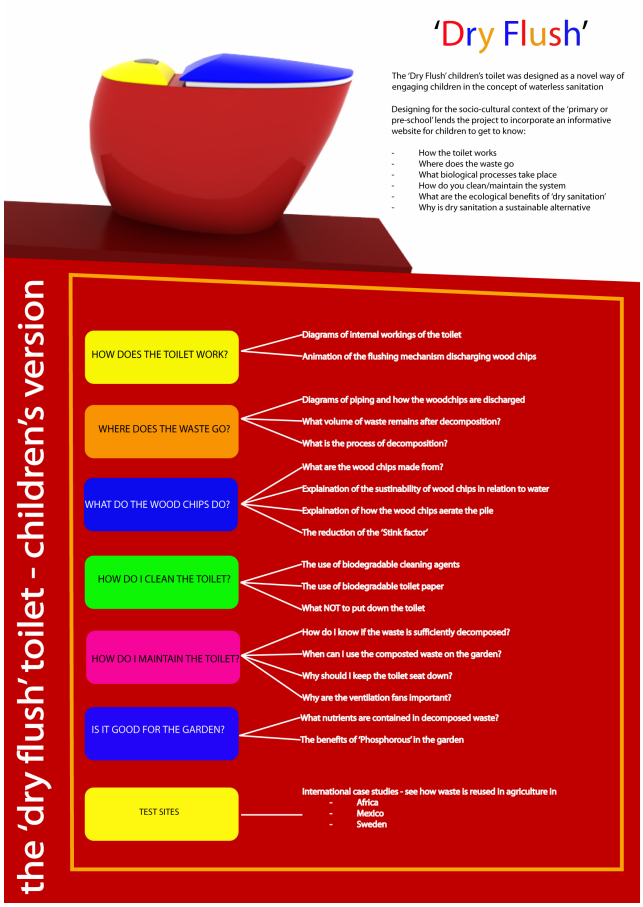

Figure 1. Template for potential children's website

The potential website was designed specifically for the context of the Steiner School in a form that would engage school children in learning about:

- how the toilet worked
- what happened to the waste
- where the waste can be used
- how the toilet should be cleaned and why
- what maintenance issues are involved

Importantly the website aimed to present global test sites of ecological sanitation where users had the opportunity to learn about current projects being installed and implemented in various parts of the world, encouraging the normalisation of alternative sanitary practices.

But the domestication process is not only about the practical work through which the artifact is integrated into practice. From a socio-cultural perspective there is also a need to transform the cultural categories that give meaning to the technology – this could be viewed as the *symbolic work* required in the transition. As Horan has noted through her documentation in the social history of the 'toilet', comfort has replaced utility and expanse has replaced brevity. Over time the toilet has transformed from a chamber pot under the bed to a closet behind closed doors to the current transformation in the 21st century where the toilet is now situated in a bathroom which

has become a site for spacious relaxation (Horan 1996). In less than two generations, many industrialized countries have come to take the convenience and comfort of the modern bathroom for granted, unaware of the inconspicuous use of water and the inconspicuous production of waste (Shove 2003). Therefore the design of the website not only served the purpose of social learning but also contributed to transforming the cultural understanding of sanitation from the conventional view as a means to dispose of waste to a means of 'closing the loop' and recycling nutrients.

Reflections

Although the importance of sustainability is becoming a commonly accepted view within our culture, what are lacking are the practices to make sustainability a reality. Design's historical tendency has been to focus on developing technical efficiencies in line with existing conventions but there is also the potential for design to facilitate new practices and routines of everyday living in line with environmental sustainability. This suggests a shift from design's finite approach of a product/system solution to sustainability to considering how the introduction of alternative technologies interacts with conventions and everyday practice.

The diffusion of the 'flush toilet' has brought with it standardized routines and practices. This has created a situation where the adoption of waterless toilets will require significant behavioural change, from passive to active involvement in use and management. The diffusion of waterless toilets must overcome many obstacles related to path dependency, which are characterized both at the systemic level and the level of daily practice. Users and stakeholders need to be included in the collaborative design process not only in relation to the development of the technology but also in developing operative strategies for adopting the technology.

This socio-technical transition requires a certain amount of 'social learning' in adoption of alternative sanitation. Therefore the potential for enabling social responsibility for managing human waste is far greater within the environment of a community with intrinsic values about the technology, such as an educational institution like the Steiner School, than being imposed on communities that do not value the technology or see the need for a change in sanitary practices.

Diffusion of Innovation theory would define the Steiner School as 'early adopters' as they are clearly a minority of the population potentially willing to adopt the technology (Rodgers 2003). The social system of the Steiner school is where the process of diffusion takes place by which the innovation is communicated among its members. The school community has common values about environmental sustainability. They have vegetable gardens educating students on principles of permaculture and recycle all their organic waste on site. The potential adoption of waterless toilets is compatible with their commonly held beliefs about sustainability; therefore there is a greater potential for an alignment of *values* and *practices*. Rogers defines compatibility as one of the four factors that effect the rate of adoption of innovation within society, (compatibility complexity, trialability and observability) (Rodgers 2003).

For much of the wider community the relative advantage of waterless toilets is difficult to perceive especially in many western countries such as Australia, where the environmental impact is inconspicuous and the convenience of the 'flush toilet' is deeply embedded in habits of use. The slow rate of adoption of technologies would categorise waterless toilets as a *preventative innovation* (Rodgers 2003) as the comparative advantage is difficult to appreciate for users. For example, the benefits of water savings and waste reduction of a waterless toilet are not obviously

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apparent as the user is disconnected from the environmental impacts of the conventional system.

The adoption of new technologies and development of practices is a social process and as Rip and Kemp noted:

> *"Individual behaviour, organizations and society have to rearrange themselves to adopt and adapt to innovation. In this sense the introduction of a new technology is an unstructured social experiment"* (Rip & Kemp 1998, p. 346).

Design's potential in creating systemic change lies in its ability to enable the *social experiment* and encourage behavioural change beyond the limitations of a market driven technical product. In the case of the 'Dry Flush' project this meant considering the specific context for the introduction and demonstration of the technology as well as how design could contribute to the social learning process.

Conclusion

> *"Technology is not an external driver of societal change"(Rip & Kemp 1998, p. 335).*

This paper has aimed to highlight that technological change occurs within specific social contexts, where technology, society and everyday practices have co-evolved to shape conventional use of a technology. Therefore if design is to contribute to sustainability beyond the realm of technical efficiency, it must take into consideration how alternative technologies are adopted and supported and this requires an understanding of the socio-technical landscape in which the artifact is being introduced. In the case of the introduction of technologies such as waterless toilets which require significant behavioural change, this will no doubt require close engagement with not only the end-user but a broad range of stakeholders in the design research process.

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