

Persuasive Design and Building User Engagement

Gerard Healey



Figure 1: Poor Little Fish Basin – an emotional-feedback device for saving water. See p. 9
(Image: Lu, 2010)

ABSTRACT

To perform well, buildings require not only good design and construction but also good operation – and designers cannot dismiss operation as the solely the responsibility of occupants. All our designs are teaching or reinforcing behaviours in building occupants, therefore the question to ask ourselves, as designers, is what messages are we sending?

This paper presents a conceptual framework for analysis of persuasive designs and applies it to a wide range of examples designed to support or encourage particular behaviours in building users, particularly those which optimise environmental performance.

Introduction

As designers, we must not forget that our designs are not inherently sustainable, only that a well designed building, if constructed and used appropriately, can support and even encourage sustainable patterns of living (Cole and Brown 2009, Challenger et al 2009).

For buildings to perform well usually requires three elements: good design, good construction and good operation (Austin and Wright 2010). Good operation is not only the responsibility of occupants because building design can influence behaviour. In this view, buildings are more than just places to live or work; they can be teachers about how to live more sustainably (Fox and Kemp 2010; Brown et al 2009). A major challenge for designers, then, is to send the right messages to occupants, through a mix of subtle and overt signs, signals and feedback.

The ability to influence occupant behaviour in buildings is well known and exploited in the design of retail spaces (Salisbury 2008; Saunders 2008; Lewis 2010). Supermarkets use bakery smells to make us hungry, and the strategic positioning of products to make us walk through as much of the store as possible, and to emphasise the higher profit items.

This paper argues that this type of approach can be used for more altruistic motives than sales, and that designers should explore opportunities to support and encourage sustainable behaviour through their designs. The aim of the paper is to empower designers by presenting a conceptual framework on persuasive design and using this to review a range of building elements that seek to influence behaviour. The hope is that this will spur a new critique of sustainable building design and inspire new ideas to promote user engagement.

Behaviour Model for Persuasive Design

This section presents the conceptual framework, which was developed in the Persuasive Technology Lab at Stanford University by B J Fogg (Fogg 2009a) as a tool for analysing behaviour change. The framework is designed to help understand opportunities and barriers to encouraging action using technology. It gives designers a relatively simple and accessible way to analyse a situation and respond through their designs, or to review the effectiveness of a design. The value of this approach is its simplicity and ability to organise a range of related concepts into a coherent framework.

This paper applies the Persuasive Design framework to the following examples:

- Encouraging proper building use through building user guides
- Encouraging creative expression through an interactive art installation (case study: Eden Project)
- Encouraging the use of natural ventilation through user operated controls (case study: the Syracuse Center of Excellence)
- Encouraging increased cleanliness and amenity (case study: urinal fly at Schipol Airport)
- Encouraging education using interactive projections (case study: California Academy of Science)
- Encouraging environmentally friendly behaviour using building dashboards (case study: Subiaco Oval, ANU SA4 student accommodation, and Arup Melbourne office)
- Encouraging environmentally friendly behaviour using emotional feedback

These examples cover a range of target behaviours, of target audiences, of approaches and of building types. It is intended to expose readers to the range of opportunities, rather than to be an exhaustive list.

Key Aspects of the Persuasive Design Model

There are four key aspects to the Persuasive Design behaviour model.

The first is the target behaviour: i.e. what is it that you are trying to encourage the building users to do? Common sustainability goals in buildings include:

- Reduce energy use
- Reduce water use
- Increase recycling and/or reduce waste to landfill
- Increase awareness / education
- Increase physical activity
- Increase interaction and social connection between occupants
- Increase creativity

And there may be a range of specific actions that would help achieve these goals, for example shorter showers to save water, turning off lights when leaving a room, using the stairs rather than the lift etc.

The second aspect is motivation; to what extent does the building user want to perform the target action? Fogg (2009a) organises motivations into three groups: sensation, anticipation and social cohesion.

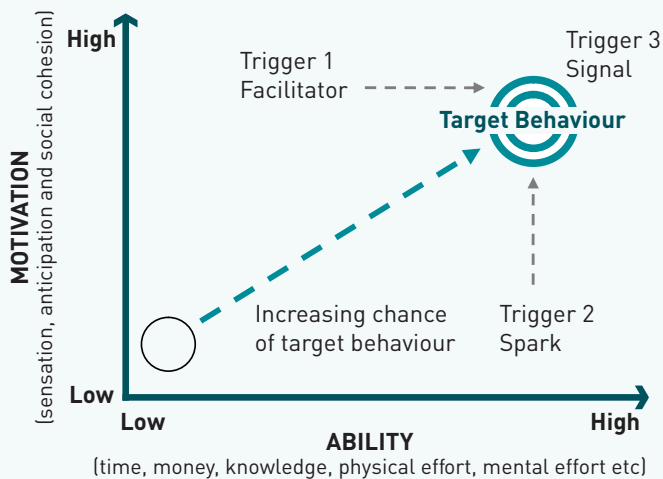


Figure 2: Behaviour Model for Persuasive Design
(Adapted from Fogg 2009a, 2009b)

- **Sensation** refers to feelings such as pleasure and pain; to immediate sensations.
- **Anticipation** refers to expected good or bad outcomes; a sense of hope or fear.
- **Social cohesion** refers to social acceptance and rejection. Challenger et al. (2010) similarly note that social or peer groups can have a significant influence on behaviour.

Which of these will be most effective at motivating the target behaviour depends on the specific demographic or even individual. Motivation may also change, indeed will need to change, if the target action is to become habitual.

The third aspect is ability – how easy is it for the building user to perform the target action? Fogg (2009b) suggests that ability is a function of the user's scarcest resource at that moment. Resources that might be required to perform the target action include :

- Time
- Money
- Knowledge
- Physical effort
- Mental effort (skill, cognitive ability, breaking old or establishing new habits or routines)

Again, which of these abilities is the limiting factor will depend on the demographic and/or individual.

The fourth aspect is a trigger. Triggers can be categorised based on a person's location in the motivation / ability axes (Figure 2):

- **Spark** – Low motivation, high ability. A trigger that motivates people who already possess the ability. For example, seeing people having fun with an

interactive projection or art installation, or, as will be discussed later, due to a simulated emotional response aimed at encouraging energy saving actions.

- **Facilitator** – high motivation, low ability. A trigger that assists people who lack ability. It could be as simple as knowledge about how to operate systems correctly conveyed through a building users guide, or knowledge about how energy is being used conveyed through a building dashboard.
- **Signal** – High motivation and ability. Fogg (2009a,b) suggests that when motivation and ability are both high, they create a latent condition that can be activated by a signal. An example of this, discussed later, is the mixed-mode ventilation system at the Syracuse Center of Excellence.

Those with low motivation and ability may require both spark and facilitator triggers.

Examples of Persuasive Design

We will now apply the Persuasive Design framework to a range of examples.

Building Users' Guides

Building users' guides are a way for the design team to convey the design intent to occupants and explain how to operate systems correctly. They are rewarded in Green Star and advocated as part of the Soft Landings Framework (UBT et al 2009).

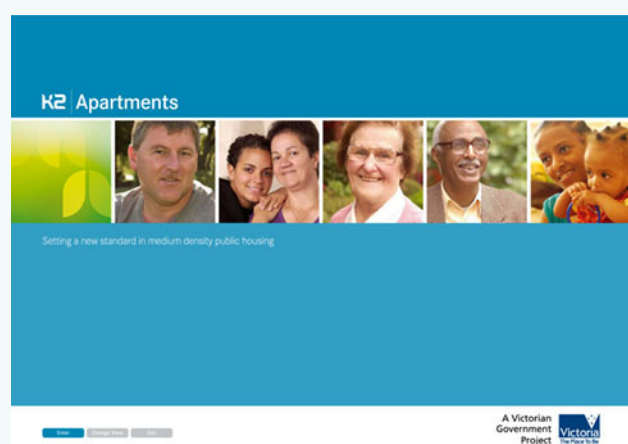


Figure 3: Building users' guide from K2 Apartments
(Source: DesignInc, Department of Human Services (Victoria), 2007)

The target behaviours of a building users' guide could be almost anything associated with the running of a building, but all are trying to ensure the running of a building in line with its design intent.

A building users' guide can act as a facilitator type of trigger for its target actions by providing knowledge about how things (should) work.

Building users' guides typically do not inherently motivate people to read them – people need to be motivated in some other way to start reading the guide. This might be through interest in the building, difficulty operating an aspect of the building, or other incentives provided by relevant stakeholders. The ability of people to read the guides will depend largely on whether the guide has been written for the target audience. UBT et al (2009) suggests that guides avoid technical jargon and use diagrams. To this I would add that guides need to take into account the literacy level, native languages and cultures of the target audience. A guide for social housing should look and read differently to one for a university office building.

Building users' guides should generally include information on the following topics (UBT et al 2009, GBCA 2008): the building systems and associated user interface, security and access, environmental performance targets, waste and recycling storage and procedures, transport options (including bike parking and public transport), and links and contact details for further information.

Interactive Art Installation



Figure 4: The Eden Project, Cornwall
(Image: Healey, 2010)

During a study tour (Healey 2010), I was fortunate enough to visit the Eden Project, in Cornwall. In the Eden Project's education centre, known as The Core, there was an interactive art installation consisting of doors from fridges and dishwashers. These were covered with alphabet fridge magnets, with the (apparent) intention that people could write messages with them (see Figure 4).



Figure 5: People using the interactive art installation
(Image: Healey, 2010)

I suggest that the target behaviours of this installation are creative expression and social interaction. My personal motivation was fun – 'pleasure', in framework terminology. The novel use of old whitegoods combined with alphabet fridge magnets brought back childhood memories and encouraged a sense of playfulness. During my time there, I observed at least as many adults writing messages as children.

It is very easy for people to interact with the display. The magnets are easy to reach, require little physical effort to move around and it is free to do (once you are inside the Eden Centre). Users do not even need to be literate – some used the letters to create images.

I observed a number of triggers for the installation, including the dominant physical presence of the wall in that space (signal), curiosity as to the purpose of the letters (spark), and seeing other people interacting and having fun (spark). However I did notice a sign (spark, or perhaps anti-spark?) on a near-by roller door (Figure 6), suggesting a desire to put bounds on people's creative expression.



Figure 6: Overt building user engagement device
(Image: Healey, 2010)

Occupant Operated Controls

The number of mixed-mode buildings has been increasing in Australia over the past decade. Mixed-mode buildings are those that can be either naturally or mechanically ventilated, depending on the environmental conditions at the time. In some cases the control of them is fully automated, with the Building Management System (BMS) deciding when to use natural or mechanical ventilation based on sensors and its programming. In other cases, occupants are able to open windows to naturally ventilate a space. The headquarters building of the Syracuse Center of Excellence, in New York State, has a mixed-mode ventilation system that is automatically controlled in the common room and manually controlled in the office area (see Figure 7).

The Center is a collective of companies, organisations and education institutions that investigate and develop systems related to indoor environment quality and the environmental performance of buildings. The headquarters building is a LEED platinum rated building that is designed to be a test-bed for the research of the Center (Healey 2010).



Figure 7: Suresh Santanam, Deputy Executive Director of Syracuse Center of Excellence, demonstrating how to open the building's windows
(Image: Healey, 2010)

The target behaviour is for occupants to open windows and naturally ventilate the space. This should reduce energy consumption and give occupants greater connection to the outside world.

The system does not include any overt motivational strategies. It relies on occupants wanting to save energy by naturally ventilating the space. Given that the building is dedicated to research related to sustainable buildings, it is reasonable to expect that the occupants will have a high awareness of the potential benefits of natural ventilation, and therefore be intrinsically motivated.

The process of opening the window involves a number of steps. Occupants open the office door, walk out into the corridor, lift the insect screen, open the window, then close the insect screen. The air-conditioning in that zone automatically switches off when the window is open so that energy is not wasted. While this does not require much physical ability, it does require people to know the process. This will require education of new staff as they move in to the building.

The triggers for this system are an indicator light (signal) located high up in one corner of the room and a desktop notification. These items show a green light or appropriate message respectively when outside conditions are suitable for natural ventilation.

At the time of writing, the Center had been occupied for approximately eight months. The system was reported to be working correctly from a technical perspective (i.e. active systems turn-down when windows are open), while the operation of the indicator system and response of occupants are being studied in detail by researchers at the Center (Santanam, 2010).

Urinal Fly

In the men's bathrooms at Schipol Airport, Amsterdam, you can find an interesting example of a user engagement device – it is called the urinal fly. Essentially, the urinals have a picture of a fly stuck on them in a strategic location. The company that makes them claims that they keep bathrooms up to 85 per cent cleaner (Urinal Fly 2010).



Figure 8: Urinal fly installed in a men's bathroom at Schipol Airport, Amsterdam
(Image: Healey, 2010)

The target behaviour in this example is more accurate 'aiming' by users, reducing the need for cleaning and increasing amenity. The company also offers other images, such as cross-hairs, trees and rubber ducks, for use in commercial buildings or to help children with potty and toilet training (Urinal Fly 2010).

The motivation in this case is subtle and doesn't easily fit with Fogg's (2009a,b) categories. The closest I could suggest is pleasure, although this may give the wrong impression of men's habits at urinals. Typical urinal users do not want to make a mess and therefore tend to aim roughly in the right direction in the first place. The urinal fly helps them aim in the optimum location to prevent splashback.

The trigger (signal) is simply the sight of the fly in the urinal. It would seem that many males are already sub-consciously motivated and able to aim at something if presented with the opportunity.

Interactive Projections

On a recent study tour I saw two examples of interactive projections (Healey 2010). The first was at Newark Airport (New Jersey, USA) and was of an underwater scene. Fish were swimming around and as people walked past the whole image rippled (Figure 9). I could not discern what the target behaviour was for this installation; the best I could suggest is that it is a way to pass the time while you wait for your plane.



Figure 9: Interactive project of an underwater scene at Newark airport, New Jersey USA
(Image: Healey, 2010)

The other example I saw, at the California Academy of Science, had a much clearer purpose.

The California Academy of Science is a multi-disciplinary museum and research institute located in San Francisco. Among the various exhibits is an interactive projection of a Madagascan forest floor, including plants, leaves, logs and insects (see Figure 10).



Figure 10: Interactive projection of a forest floor at the California Academy of Science. The accompanying sign says: 'Move slowly and watch for bits of banana, apple or oatmeal to appear. Soon, insects will crawl out of their hiding places towards the bait. To capture them, push the bait into the pitfall traps. Once an insect is trapped, look to the video screen to learn more about it.'
(Images: Healey, 2010)

The target behaviour is to educate children (and adults) about the insects of Madagascar. The motivation to engage was most definitely pleasure. Many children (and some adults) spent a lot of time laughing and chasing insects around the floor. The ability for people to interact with the projection was high, however, the ability for people to do this as intended by the exhibit designers though seemed to be low. It was very easy make parts of the projected image move – leaves and insects, however, very few people seemed to be following the intent of the exhibit of catching the insects in order to activate the instructional video. Most people (the author included!) simply tried to stand on the insects.

The trigger for engaging with the exhibit was the spark of seeing the projection and other people enjoying it. The facilitator trigger for using it properly though, was a sign located nearby. In this case, the spark of the projection and people was much stronger than the facilitation of the sign. This could be because the sign

was far more passive than the projection and people. Also, the sign may not be the best form of instruction because for children, who were by far the most common users of the exhibit, it would have generally required an adult to read the sign and pass on the instructions to them.

Building Dashboards

There is increasing interest in providing feedback to building occupants in the form of dashboards. These are typically displays located in prominent areas, or web interfaces that give charts on energy consumption, water consumption etc. As Austin and Wright (2010) note, quantitative data combined with relevant benchmarks can greatly assist good building operations. With sensors, computers, and data storage becoming smaller, cheaper and more powerful, there is an increasing number of companies offering dashboard systems.

In residential applications, various studies have found energy savings of between 0 and 15 per cent, depending on whether the feedback is direct or indirect, and the time delay between the energy consuming action and the feedback (Darby 2006, Ehrhardt-Martinez et al 2010). Savings of this magnitude make these types of systems very attractive as ways of influencing users. Three examples are

discussed here, WA Football Commission, Australia National University SA4 student accommodation, and Arup's Melbourne office. One thing that these three examples have in common is the use of what might be called socio-technical approaches (Challenger et al 2010), i.e. they combine persuasive technology and social interventions.

WA Football Commission at Subiaco Oval

The Western Australian Football Commission occupies has a number of offices and has multiple tenants at the Subiaco Oval. Motivated by a combination of energy costs and environmental responsibility, the WAFC installed a wireless metering and dashboard system to give staff feedback on energy usage (Greensense 2010a,b). See Figure 11 for a dashboard similar to the one installed.

The target behaviours in this case are a range of energy saving actions. The specific motivations of staff in undertaking these actions are not known in detail. However, there are at least two general aspects. For facility management, the motivation is at least in part related to cost and environmental responsibility. The sub-metering and feedback gave them the ability (i.e. were a facilitator-type trigger) to identify where energy was being wasted; for example high usage in the



Figure 11: Greensense View building dashboard of the type installed at Subiaco Oval
(Image: Greensense, 2010)



Figure 12: Architect's render of the SA4 student accommodation building for ANU
(Image: Nettleton Tribe Architects /Morph Media, 2011)

early hours of the morning. For office staff, an energy challenge was set up, with a structure inspired by the football rounds and weekly prizes. Here the motivation is at least in part pleasure and social inclusion, and the dashboard and competition acted as a spark to increase motivation.

ANU SA4 Student Accommodation

During 2010, a project team including the ANU, Alba Capital, Nettleton Tribe architects and Arup prepared a performance brief for a new 500-apartment student accommodation building just outside the Canberra CBD.

ANU's goal for the project was for it to have a number of green features and to engage the occupants. One of these features, specified in the performance brief, is a dashboard system, giving feedback on energy use and generation, water use and collection, and movement of people up and down the main stair case. The target behaviours, at least initially, are just good energy and water saving practice such as turning lights off, short showers etc.

The dashboard system enables the operator of the building, Unilodge, to motivate (spark) students and give them the ability (facilitator) to take action. Petersen et al (2007) note that because dormitory residents typically pay a flat rate that includes utilities, there is not a financial incentive for them to be resource efficient. Some students may already be motivated by environmental concerns, though, and by having access to feedback, may take action themselves.

To encourage the target behaviours in more of the residents, Unilodge will run competitions (spark) and

other related education activities. The dashboard system will likely also have the ability to communicate using twitter and other new media, which is expected to provide better engagement with the student demographic.

Arup Melbourne Office Dashboard

Challenger et al (2010) note that aligning persuasive technology and organisational initiatives can help encourage behavioural change. This is something that Arup's Melbourne office will be trialling from early 2011. In 2010, Arup's Australian offices became ISO 14001 certified. Objectives under the EMS relate to energy, water, waste and recycling, paper use and office products.

To help track progress, motivate performance towards these targets and encourage awareness of transport options, a dashboard system has been set up that will display: energy usage per floor, paper usage from

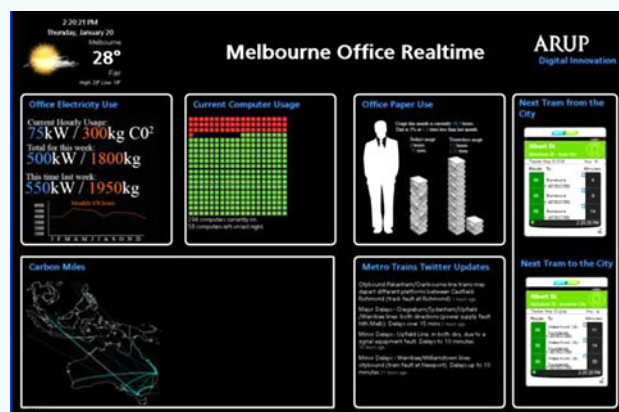


Figure 13: Arup EMS dashboard
(Image: Arup, 2010)

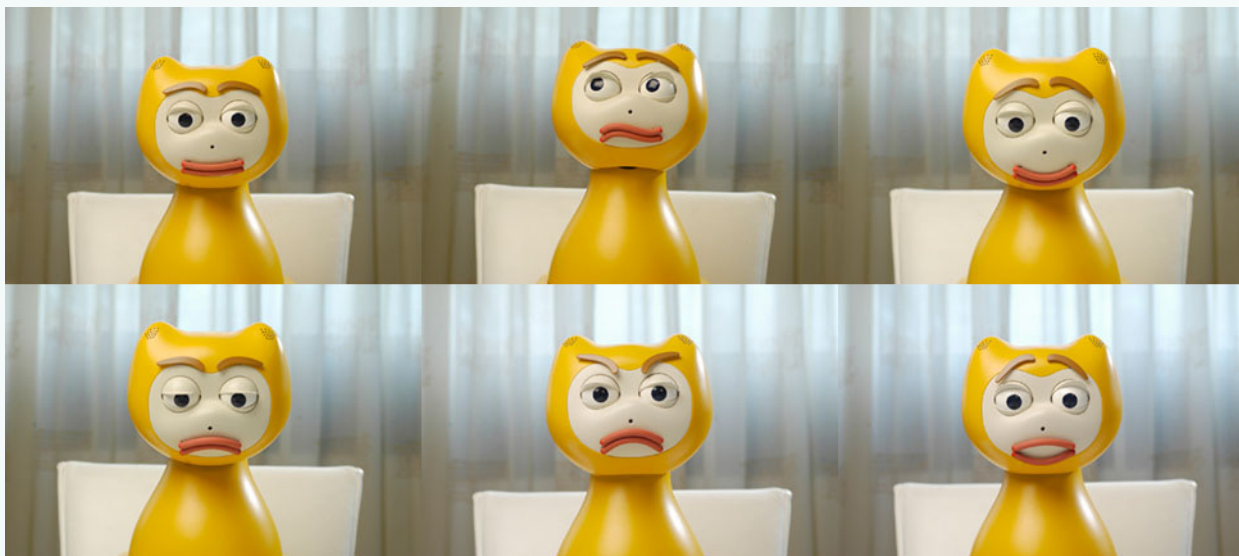


Figure 14: Philips Research iCat technology
(Images: Philips, 2010)

photocopiers and printers, the number of computers that are on, the Yarra Trams tram tracker for nearby stops, and air travel (see Figure 13).

This system will be used in conjunction with other office activities to encourage behaviours that will help Arup achieve its EMS targets. As with the previous two examples, the presence of the dashboard enables Arup to use both spark and facilitator-type triggers, to give a greater chance of effective behavioural change.

Emotional Feedback

The final set of examples also provides feedback, but in contrast to the quantitative feedback of the dashboards, these examples are emotive. Whereas dashboards use numbers and benchmarks to provide feedback on whether performance is good or bad, these examples tap into intuitive emotional cues (or at least the designers hope so).

The examples provided below are research or design propositions; however this type of approach is also being used in real applications. For example, new Ford hybrid vehicles will have dashboards that can give feedback on driving efficiency using of a leafy vine, which grows more lush and healthy if the car is driven efficiently (Ideo 2009). Perhaps we will see a digital tree representing a building's environmental performance, similar to the Ford dashboard vine, in an office lobby in the future?

Virtual Polar Bear

An example for behaviour in buildings is the use of a virtual polar bear pet on an iceberg (Dillahun et al 2008). The iceberg increased in size when test subjects reported that they had performed environmentally responsible actions and shrunk when they did not

perform those actions. A number of strategies were used to strengthen the connection between subjects and their virtual pet, including: information on the impact of climate change, getting subjects to name their pet, and encouraging personal reflection. The study showed that test subjects reported increased environmentally responsible behaviour.

Poor Little Fish

A second example is a sink with a gold fish bowl, including fish, on top of it (see Figure 1, p. 1) – the designer calls this the Poor Little Fish Basin (Lu 2010). The target behaviour of this device is for people to turn the tap off as soon as possible. It is reasonable to expect that if someone could turn the tap on, then they will have the ability to turn it off. The interesting aspect is how it motivates (spark-trigger). When the tap is turned on, the water level in the fish bowl begins to drop. The water in the bowl is not connected to the tap, rather the level is adjusted to give the impression that it is. Yu's (2010) aim was to make consumption tangible and emotive.

iCat

The third example is the iCat by Philips. The iCat is a desk-top robot for studying human-robot interaction. It uses motors to control different parts of the face, such as the eyebrows, eyes, eyelids, mouth and head position, so that it can simulate different facial expressions (Philips 2005). This has been used in a range of research; the example here is in relation to programming a washing machine for maximum efficiency.

The target behaviour was for test subjects to programme the washing machine to be most efficient for the laundry load described (Midden and Ham

2009). To give participants a base level of motivation, they were instructed to use as little electricity as possible and informed that washing uses electricity. Participants were also given instruction and trial runs at programming the washing machine so that they had the ability to use the machine efficiently. Participants were then asked to programme for a particular washing type (e.g. washing dirty jeans). The spark was delivered via the simulated emotional response of the iCat robot. The iCat used a combination of facial expressions (movement of mouth, ears, eyebrows), illuminated eyes (red or green) and speech recordings, to convey a positive or negative emotion in relation to the energy efficiency of the washing machine's programming. Interestingly, the researchers compared this against purely quantitative feedback with an energy meter. Midden and Ham (2009) report that the emotional feedback from the iCat had a greater impact on behaviour than the quantitative feedback, and that negative emotional feedback had a stronger effect than positive.

Conclusion

This paper has shown through theory and examples that it is possible for designers to support and encourage sustainable behaviour in buildings. The range of examples shows that the possibilities are limited only by imagination; with it possible to achieve engagement with low-cost, low-tech designs such as the fridge magnet wall at the Eden Project, as well as high-tech installations like interactive projections.

It is also possible to provide feedback to people in various ways, from the quantitative charts of a dashboard to the emotive feedback of an iCat. The conceptual framework presented and used to analyse the examples was shown to be a simple but effective way of reviewing persuasive designs.

All our designs are teaching or reinforcing behaviours in building occupants, the question to ask ourselves is: what messages are we sending? With Persuasive Design, we can begin to answer that question.

References

- Abrahamse, W, Steg, L, Vlek, C, Rothengatter, T, 2007, 'The Effect of Tailored Information, Goal Setting, and Tailored Feedback on Household Energy Use, Energy-Related Behaviors, and Behavioral Antecedents', *Journal of Environmental Psychology*, 27, pp. 265–276
- Advanced Environmental, 2009, *University Of Melbourne Economics and Commerce Building - Building Users Guide*, www.pcs.unimelb.edu.au/data/assets/pdf_file/0007/148696/EC_Building_Users_Guide.pdf
- Austin, B, and Wright, D, 2010, 'Building Performance Feedback to Promote Behavioural Change', *The Arup Journal*, Issue 1/2010, pp. 20–21
- Bordass, B, Leaman, A, Bunn, R, 2007, *Controls for End Users*, Building Services Research and Information Service, www.bsria.co.uk/bookshop/books/controls-for-end-users-a-guide-for-good-design-and-implementation-bcia-12007/?v=306&search=controls+for+end+users§ion=bt
- Brown, Z, Dowlatabadi, H, Cole, R, 2009 'Feedback and Adaptive Behaviour in Green Buildings', *Intelligent Buildings International*, Issue 1, pp. 296–315
- Cole, R and Brown, Z, 2009, 'Reconciling Human and Automated Intelligence in the Provision of Occupant Comfort', *Intelligent Buildings International*, Issue 1, pp. 39–55
- Challenger, R, Clegg, C, Davis, M and Jofeh, C, 2010, 'Understanding and Promoting "Green Behaviour" in the Use of Existing Buildings', *The Arup Journal*, Issue 1/2010, p. 19
- Cheng, I (ed), 2010, *Active Design Guidelines – Promoting Physical Activity And Health in Design*, City of New York, <http://ddcftp.nyc.gov/adg/>
- Dillahunt, T, Becker, G, Mankoff, J and Kraut, R, 2008, 'Motivating Environmentally Sustainable Behavior Changes with a Virtual Polar Bear', *Pervasive* 2008, May 19–22, Sydney, Australia
- Fogg, B.J, 2009a, *BJ Fogg's Behavior Model*, Stanford University, www.behaviormodel.org/
- Fogg, BJ, 2009b, 'A Behavior Model for Persuasive Design', in the *Proceedings of the 4th International Conference on Persuasive Technology*, Claremont, CA, USA, April 26–29, http://portal.acm.org/ft_gateway.cfm?id=1541999&type=pdf&CFID=251660&CFTOKEN=79292866
- Fox, M and Kemp, M, 2009, *Interactive Architecture*, Princeton Architectural Press, New York
- GBCA, 2008, *Technical manual – Green Star Office Design and As-Built Version 3*, Green Building Council of Australia
- Greensense, 2010a, *Greensense View Customers – Patersons Stadium (Subi Oval)*, www.greensense.com.au/products/greensense-view-customers/
- Greensense, 2010b, *Greensense View Introduction and Hardware*, presentation obtained from Greensense 30/7/10

Healey, G, 2010, *Intelligent Buildings Study Tour Blog*, Arup, <http://fieldsofactivity.com/buildings/intelligent-buildings-study-tour/>

Ideo, 2009, *Hybrid Electric Vehicle Interaction for Ford Motor Company*, Ideo, www.ideo.com/work/hybrid-electric-vehicle-dashboard-interaction

Lewis R, 2010, *Supermarket Psychology*, Weight Watchers website, www.weightwatchers.com.au/util/art/index_art.aspx?tabnum=1&art_id=36461&sc=3017

Lu, Y, 2010, *Poor Little Fish*, www.yanlu.com

Midden, C, Ham, J, 2009, 'Using Negative and Positive Social Feedback from a Robotic Agent to Save Energy', in the *Proceedings of the 4th International Conference on Persuasive Technology*, Claremont, CA, USA, April 26–29, http://portal.acm.org/ft_gateway.cfm?id=1541966&type=pdf&CFID=1659751&CFTOKEN=13057961

OoH, 2007, *K2 Apartments (Tenant Education Kit)*, Department of Human Services – Office of Housing, www.housing.vic.gov.au/data/assets/pdf_file/0017/166022/k2_apartments_tenant_report.pdf

Petersen, J, Shunturov, V, Janda, K, Platt, G, and Weinberger, K, 2007, 'Dormitory Residents Reduce Electricity Consumption when Exposed to Real-Time Visual Feedback and Incentives', *International Journal of Sustainability in Higher Education*, Vol. 8 No. 1, pp. 16–33

Philips, 2005, iCat User-Interface Robot, Philips Research, available at www.research.philips.com/technologies/projects/robotics/downloads/icat.pdf

Salisbury, C, 2008, 'The Psychology of Supermarkets', *ABC Radio 666*, Canberra, www.abc.net.au/local/stories/2008/08/29/2350161.htm

Saunders, A, 2008, Trends - Environmental Psychology and Retail Design, interview with Mark de Teliga, By Design, *ABC Radio National*, 15/3/2008, www.abc.net.au/rn/bydesign/stories/2008/2188360.htm

Santanam, S, 2010, Deputy Executive Director of the Syracuse Center of Excellence, personal communication, email to the author, 14/12/10

UBT, Way, M and Bunn, R, 2009, *The Soft Landings Framework*, Usable Buildings Trust and Building Services Research and Information Service, <http://www.bsria.co.uk/download/soft-landings-framework.pdf>

Urinal Fly, 2010, Urinal Fly Website, www.urinalfly.com/default.aspx

About the Author

Dr Gerard Healey is a mechanical engineer and Green Star Accredited Professional. His PhD drew on sociology and innovation studies literature to learn how to better foster sustainable technologies using the development of wind power in Australia as a case study. Since joining Arup in 2006, he has been adapting and extending his findings to the built environment. In mid 2009, he was awarded a travel fellowship from the Construction and Property Services Industry Skills Council (CPSISC) and the International Specialised Skills (ISS) Institute to study skills gaps related to intelligent buildings. The tour took him to England, Ireland, the Netherlands, USA and Canada.

DISCLAIMER

The views expressed in this paper are the views of the author(s) only and not necessarily those of the Australian Institute of Architects (the Institute) or any other person or entity.

This paper is published by the Institute and provides information regarding the subject matter covered only, without the assumption of a duty of care by the Institute or any other person or entity.

This paper is not intended to be, nor should be, relied upon as a substitute for specific professional advice.

Copyright in this paper is owned by the Australian Institute of Architects.



Australian
Institute of
Architects