Living on the Hedge: Creating an online Smart Garden Watering Community

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ABSTRACT
SmartGardenWatering is a free online simulation to advise gardeners about how to water their garden with the objective of sustainable use of water. We have redesigned this software to incorporate social networking features and, in so doing, identified several important issues relating to the use of social networking to effect change, in a sustainability context. We describe the changes that we have made to the original software and then discuss several research questions that need to be addressed.

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H5.0. Information interfaces and presentation: General. K.4.2 Social Issues.

INTRODUCTION
In many areas of endeavour, technology is being used to effect change in people’s behaviour. This influence is clearly evident in advertising, politics, community groups and movements, etc. Social networking technologies provide numerous ways to implement the mass communication required to get a message or product out to a large number of people. The viral nature of some uses of technologies such as Facebook and Twitter provides an extremely powerful way to encourage people to ‘spread the word’ about a product or idea and see it multiplied though access to email address books, twitter accounts, Facebook walls, and other means of communication.

However, it is not the message that is of prime importance, but rather the impact that the message has on the recipient. The message might be to buy a product or to reduce energy use – and this might reach a huge number of people – but the hope is that the message will have an impact and that people will take notice and actually buy the product, or vary their energy usage, and then ideally pass on the message, with personal endorsement, to their friends.

The research reported here is part of a project aiming to change Melburnians’ behaviour in their approach to watering their gardens. Elsewhere we have reported on our approach to this issue; we have described the background research and development into an online simulation at http://SmartGardenWatering.org.au that provides gardeners with a weekly watering schedule for their particular garden together with advice about sizing a water tank and other horticultural issues (Pearce et al. 2009; Pearce et al. 2008). We now address the issue of building a sustainable online community to encourage gardeners to actually take note of the advice and follow its recommendation.

Our approach has been to implement various social networking technologies to support virtual communities. The new functionality recently offered by these technologies provides new and exciting ways to establish systems that might engage and motivate people to do more than just download software, have a quick look, and then move on. We are exploring ways to captivate an audience through the tight integration of simulation software and social networking.

Hence the question that we are addressing is: Can the synergy of gardening advice and watering practice be brought together in a virtual community as an effective way to influence behaviour supporting sustainable watering practice?

In this paper we identify some of the issues that have become apparent to us as we redesigned our software with a social networking focus. We then describe the changes that we have made to the software, and finally raise further questions that we hope to explore as the software comes online for the summer of 2010.

SOCIAL NETWORKING & SUSTAINABILITY
To many gardeners, computing technology is the last thing they think of in relation to their gardening practice. Whilst the Web provides much valued theoretical advice on gardening issues from within the home, once the practice of gardening begins in the garden (watering, identifying troubled plants, pruning, etc.) the computer is often a far off device overruled by experience and rules-of-thumb. In this sense gardeners are a challenging audience to work with. In this section we identify some of those challenges that we have had to contend with.

SmartGardenWatering 1.0 – the original system
Our starting point was software that we have developed over the past few years as part of a project funded by the Smart Water Fund from 2006 to 2010 (2010). This online simulation software, SmartGardenWatering.org.au, was launched as a free public website in April 2009 and allows gardeners to quickly model a garden (define plants, soils, micro-conditions, climate information) and be provided with a schedule for watering throughout the year. The software allows the gardener to model the behaviour of a water tank used to supply the garden and determine the best combination of size, catchment roof
area and sections of garden watered. The software was designed to be highly interactive, encouraging the gardener to change variables and see the impact on water demand through animated, real-time effects. A fuller description of the software and research into its design and use is available elsewhere (Pearce et al. 2009).

Through 2009 we took the successful features of this software and re-wrote it to incorporate new features – most significantly, the ability to save and share garden models online and to use social networking technologies to ‘spread the word’ about its use. We refer to this new software as SmartGardenWatering 2.0 (SGW2.0). Below we first discuss some of the critical design issues we grappled with. In the later section that follows we describe the new software itself.

**Living on the hedge – a community of gardeners**

Social networking sites are extraordinarily powerful ways of communicating ideas to increasingly diverse networks of people. Through these we can encourage people to paste information in virtual locations that will be viewed by many, knowing that it will be seen by friends and is likely to be passed on to many others within the community.

The social technology Facebook has the potential to carry many of the features that we required in SWG2.0. A Facebook group page could house help information about the software, education information about gardening, ‘how to’ videos on using the software, forums giving advice to individuals about gardening issues, and postings from the software informing others that a garden has just been modelled or edited.

However, much of the above could also be housed within the software itself, leaving Facebook simply as a vehicle for sharing information to others about new gardens. Also, this type of technology is still very much a young person’s game, and many in the gardening community are not Facebook users and might regard it as a barrier to be overcome.

Facebook has recently added new functionality that allowed us to take a middle line here without compromising social networking opportunities and yet also not moving users into the unfamiliar world of a Facebook page. We have been able to embed some Facebook information within the SGW2.0 screens so that, for example, users can see other ‘fans’ of the site. If a user has a Facebook account, we are able to post a comment on their wall containing a ‘deep link’ to their garden model. On clicking on this link, the user is taken straight to the simulation, and to the actual conditions set up by the garden’s creator, so that they can start exploring immediately. In this way we are providing non-Facebook users with some of the benefits of Facebook, without actually having to go there, and Facebook users can very easily send to friends a link to their garden that requires nothing but a single click to display the actual working simulation.

Through this careful use of social networking technologies we hope to begin building a community of people talking about their watering strategies and sharing their models online.

**Looking over the hedge – a matter of privacy**

Whilst social networking allows a user to share almost any data with almost anyone, we have had to consider what aspects of their garden a gardener would be happy to share with others. For example, many gardeners are curious and enjoy walking around their neighborhood looking ‘over the hedge’ at the gardens of others. We decided to emulate this sharing of garden information by using Google Maps to display gardens in Melbourne have been modelled using SGW2.0, and hence help a visitor find and link to another person’s garden. It is technically possible to enable a visitor to ‘wander’ up and down a street seeing who has modelled their garden, how they manage their watering requirements, what size tank they have, etc. Indeed, the ‘satellite view’ in Google maps could be used to help a gardener design his or her initial layout of a garden, and also to help a visitor get a better sense of the garden than from the information in the model alone.

However, in the current climate of government imposed water restrictions allowing users to water only at restricted times, there are serious privacy concerns about letting people find out too much about other people’s gardens. For example, in October 2007 a man was hosing his front lawn in the Sydney suburb of Sylvania, when a passer-by accused him of wasting water. Although the man was legally watering his garden, an altercation ensued and tragically the man died from a heart attack. This resulted in the other man being sentenced to 3 years and 3 months gaol for manslaughter. This story reminds us how everyday water use is becoming increasingly contested and politicised in Australia.

With such privacy concerns in mind we have restricted the granularity of our use of Google maps so that we locate gardens only down to a suburb level. We allow users to name their gardens as they wish (and they might choose to include their address) but we try to ensure that that they will not be easily identified apart from by garden model features (suburb, size of garden, mix of plants, size of water tank, etc.).

**Hedging your bets – rating gardens**

A popular feature on social networks is the ability for users to give a rating to something they experience online. This might relate to the helpfulness of an information page, the quality of a wine or simply how much they liked or disliked something. Our aim is to cause a beneficial impact on water consumption hence an ability to rate a garden related to this might seem appropriate. But how do you rate the ‘goodness’ of water use in a garden? And what impact might it have on consumption patterns?

One approach would be to display an ‘average’ of water use for a particular set of conditions, to support users making comparisons with their own water use. Aside from the obvious problems of trying to ensure that we compare like with like, such comparisons to social norms brings other dangers. Some studies identify a
‘boomerang’ effect in which users shown normative messages tended to move towards the mean. That is, in a water saving context, those using more water than the mean might reduce their usage, but those using less might be tempted to increase their usage (Schultz et al. 2007). A more effective method was found by adding an injunctive message (conveying social approval or disapproval, e.g. smiling or frowning emoticons).

A further issue here is the question of who judges the ratings. Younger social network users are generally comfortable with a ‘wisdom of the crowds’ approach (Surowiecki 2004) in which the average of a large number of opinions provides useful information. However, we don’t yet know how more conservative, slightly older, gardeners might react to this. We have experienced concerns from a horticulturist on our team that garden water use should be rated by gardening professionals and hence a rating of ‘good’ would carry some level of expert opinion.

Our current approach is to give the user an option to rate a garden with a ‘like’ (thumbs up) or ‘dislike’ (thumbs down) indicator and display the total number to the other users. This approach is based on community rating, but is deliberately ‘fuzzier’ than our original ideas of one to five star (or water droplet) rating scheme both from the perspective of limiting the rating levels and also the language being more subjective i.e. ‘like/don’t like’ versus ‘good/bad’.

Growing the hedge – from individual to community

Our discussion so far has regarded the gardener as a lone user eager to accept advice from a technological online source. But our aim is to create a community of gardeners talking to each other and sharing news about the economic use of water. We want to change not only individuals’ attitudes and practices, but that of the greater community. This is an issue of ‘scale’. Scale is a term we use (Dourish 2008; Dourish 2010) to make visible key differences in the ways humans organise and the technologies that interact with those organisations. In particular scale highlights whether technologies are intended to support individual or collective action and if collective (e.g. families, communities, societies) the size, structure, purpose etc. of those collectives. In the space of the last few years we have seen how social media such as FaceBook and YouTube (Boyd and Ellison 2007) have facilitated a step change in the scale of everyday experience, radically transforming individual experience in many ways, increasing the numbers of people we interact with, enlarging the scope of everyday life made collectively visible and stretching the distances across which the emerging communities are distributed.

One early (and facetious) vision behind SmartGardenWatering could be that of a domestic garden, fully established with a reticulated water supply and timing devices for each outlet, and a gardener sitting behind the screen of a computer, adjusting variables to bring the complex system within some desirable envelope of sufficiency yet sustainability. However, other visions are revealed when viewed through the lens of scale. Gardening can be viewed as a social act, a form of social practice (Reckwitz 2002; Shove 2008; Warde 2005) made accountable locally; the craft of gardening and its associated knowledge is an emergent outcome of a distributed and ongoing dynamic in which objects are embedded and form a part of gardening as an activity (Sofoulis 2005). In context we must take care not to innocently introduce ‘smarts’ into such social practices, potentially rendering the community embedded social actor a make-shift control room attendant.

To this end we have tried to move the software away from a scientific look-and-feel, with intricate arrays of sliders to adjust detailed settings, towards a simpler, yet still highly interactive, environment that supports a sense of control, a feeling of community, and a recognition of existing social practice.

DESIGNING FOR VIRTUAL COMMUNITIES – SGW2.0

Our initial positive experience with developing the original version of SmartGardenWatering (SGW1.0), and the research with carried out with it (Nansen et al. 2009; Pearce et al. 2009) made us keen to address some of the above issues by applying for, and receiving, more extensive funding from the Smart Water Fund. This funding for 2009/2010 has enabled us to re-think completely our approach not only to the design of the software (SGW2.0), but also how we deliver it to users and encourage participation. The new site will be accessible from the same address as SGW1.0 (http://SmartGardenWatering.org.au). The welcome screen is shown in Figure 1.

The concept of a garden model

The software is designed on the concept of a ‘garden model’. This refers to the physical attributes of an area within a garden (area of garden; types of plants, soils, mulches, slope), the climate (regional rainfall and evaporation, as well as the garden’s microclimate), and the watering system and water tank employed. A garden may comprise several such areas.

Figure 1. Welcome screen for SGW2.0

User’s experience

The user can work in anyone of three ways within the software: modelling, exploring and sharing.

‘Modelling’ is the process of a user creating their own garden. We have built heavily on our experience with
SGW1.0, retaining an animated graphical representation of water supply and demand throughout the year. Figure 2 shows this screen which is the central ‘working’ screen of the software.

However, we have put a much stronger visual focus on the selection of plants than in SGW1.0. The user-design aspects of plant choice are complex and it was something that we grappled with in the previous version. We are fortunate to have access to data from the Burnley Plant Directory (Burnley, 2009) containing extensive information on about 2000 plants. The challenge was to provide an easy way for the user to search or browse these plants, using common names, botanical names, images, or search criteria, and make appropriate selections representing their garden. We settled on presenting plants in a visual hierarchy of ‘types’, ‘categories’ and ‘species’ (see Figure 3). The user sees plant images at each level of the hierarchy and can add plants to their garden from any level. For example, clicking on the image type ‘climbers’ displays a general image of climbing plants, and an invitation to either add them to your garden or select from the two categories of climber: ‘evergreen’ and ‘deciduous’. From here the user can select one of the broad categories or delve further to see the four species of climber available to choose from.

Other modelling actions relate to choosing mulches, watering systems and water tank in a similar fashion to SGW1.0 (Pearce et al. 2009).

‘Exploring’ relates to the process of finding garden models created by others that might be of interest. We let the user do this in two ways. A list view is available that gives information such as garden name, creator, some of the garden features and a Facebook ‘like/don’t like’ rating. A more interesting view is a Google Map that shows the distribution of gardens around Melbourne, grouped by suburb (Figure 4). Clicking a water droplet on the map displays a visual representation of the first few gardens in that suburb and links the user to those gardens. When a user displays a model, he or she is shown the same views as the creator, except, of course, it cannot be edited.

The map view is the way that a user can start to ‘look over the hedge’ and see what others are doing. This might be to find out how others use a water tank in a large suburban block, or maybe to search for ideas of how to design a native garden requiring no additional water to be applied.

‘Sharing’ features of this software not only provide an environment in which users can save their models online and look at the models of others, but also employs social networking technologies to facilitate the bringing together of gardeners all over Melbourne. One of the benefits of using Facebook as the vehicle for this (as well as Twitter and RSS feeds) is it has recently provided the ability to use features, such as voting and showing ‘fans’, without the user needing to have an account or even visit a Facebook page – something that some in the user group we target would have some reticence towards. Figure 5 shows a Facebook window embedded in the programme.

For those with Facebook accounts, there are many ways to interact with other gardeners. When a new garden is created, a post can be sent to the user’s Facebook wall announcing its presence. Facebook users who see this can...
follow a link directly to the user’s model. This is a very powerful feature – not only is the user taken to the SGW2.0 site, but they go directly to the user’s garden model with all parameters set as defined by the user. We hope to use this feature to facilitate discussion between gardeners about water use and other gardening topics.

Maintaining engagement
An aim of both SGW1.0 and SGW2.0 is not to just provide a watering schedule to the user, but also to engage the user in an active learning experience. We do this partly by providing rich educational material in the form of an associated help document linked to the software. But there are two other approaches that we have taken to help sustain an engaging, learning environment.

First, we recognize that unnecessary navigational cognitive load can be an impediment to learning (Mayer and Moreno 2003) and hence the importance of the preventing the user developing a sense of ‘moving through’ a web site. Hence we wish to minimize the associated cognitive load of being aware of where they are and how to get back.

SGW1.0 showed us clearly these benefits of keeping the user one page, and not giving the impression of ‘travelling’ to new pages and the threat of becoming ‘lost’. We achieved that in by programming in Flash and using five concertinas that opened up the five areas of the program. SGW2.0 is a far more complex program due to the additional functionality of the site (registration, searching other gardens, social networking, visual maps, etc.). Our approach this time has been to still give the user the sense of staying on the one page, but to use a small number of tabs (‘Welcome’, ‘Model a Garden’, ‘Explore Gardens’, and ‘Community’) to provide different aspects of the program (Figure 6).

*Figure 6. The four main tabs*

When input information is sought from the user (e.g. plant selection) a pop-up is used, with the main screen being faded into the background.

Second, an important aspect of engagement and learning is immediate feedback to the user in response to their actions. For educational material to be interactive ‘something in the “world” must change observably as a result of their actions’ (Laurillard 1993, p. 100). Hence one design feature aims to support the user to learn from observing cause and effect as they move sliders on the screen and see a watering schedule graph animatedly responding in real time. Where possible we have synchronized this animation with the movement of the slider; in other cases we have waited for a pop-up to close before letting the animation begin. If the bars on the graph grow too large for the area on the screen, we let this growth happen first, before changing the graph scale to pull them back down. We want the user to first be aware of the movement, then be aware of the consequential scale change.

Technical issues
From the original SGW1.0 – a small Flash application that could run standalone with a few data files – we have moved to a complex system with a sophisticated back-end database of user registration data, horticultural data and user models. Due to the rapid development of new features in HTML and JavaScript in the past year or two, we are now able to develop the whole program without using Flash, making it available on iPads and iPhones (for those with very good eyes and very small fingers!).

The system is hosted on a cloud server and demands particular rapid development tools and operational requirements (Ruby; Ruby on Rails; MySQL; ImageMagick; and Apache with Passenger (mod_rails); for source control and deployment we are running ‘Git’ with ‘Capistrano’ and an SMTP service).

The backend database has been designed so that an administrator can add new data (horticultural as well as geographical and climate data for different regions of Australia). This will allow us to extend the system beyond the Melbourne area.

RESEARCH PROGRAMME
SmartGardenWatering 2.0 is a sophisticated interactive environment with which we can explore several research questions.

There are evaluation questions to ask regarding the usability of the software and our aims of seeking a high level of engagement from users. This will be pursued through targeting some specific aspects of the software: plant selector, animated graph, links to and use of Facebook.

An important aim of the project is to form a vibrant virtual community of users sharing ideas about water use. This we will assess partly through usage logs and site hits, but also through seeding a small community of users and following their usage of, and communications about, the site. We know little about how accepting a community of gardeners are of social networking sites such as Facebook. We are interested in the age profile of users and how or if they apply their knowledge to an actual garden or simply treat their experience as an online computing adventure.

Apart from the usage of the site, we are also interested in the impact that it has on water use. Is there a disconnect between sitting at a computer and exploring horticultural issues in a technological context and actual practice in the garden? What can we learn here about changing practice?

We have another pilot project underway (‘Gardens of Tomorrow’, funded by The University of Melbourne) that is exploring using sensor networks to monitor parameters within the garden (soil moisture, temperature, humidity, garden water use, etc.). Our aim here is to explore how data garnered from many gardens might be
used in a ‘wisdom of the crowds’ sense to inform people about their own garden management.

We are also interested in the use of mobile devices in this context. What information could be pushed to a gardener’s mobile smart phone that would be useful? Watering reminders? Alerts to skip a scheduled watering due to a recent rain event? Or are such intrusions by technology into the gardener’s headspace the antithesis of what a gardener craves – namely, moments amongst the hedges making judgements based on experience?

Finally, the issue of scale. We have designed software for individuals, not for groups who might wish to communicate and collaborate online about a common ‘good’ to save water. What can we learn about designing interventions in the sustainability space that supports and encourages the mass mindset change that is required to have any real impact of a scarce resource such as water?

CONCLUSIONS

We have described an exciting project that is well positioned to research important issues relating to how social networking technologies can effect change in individuals and groups. As SmartGardenWatering evolves from a boutique online simulation to a substantial community asset, we look forward to learning much about how to design and implement software environments in a social context that make a difference in the sustainability arena.

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