

Design Patterns for Urban Gardening

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Abstract Urban agriculture (UA) is practised in many forms within urban spaces, ranging from large organised community gardens to individuals with a backyard or balcony. We present the synthesis of findings from three studies exploring different types of UA: city farms, residential gardeners, and a grass roots group that supports local communities. Where the findings of individual studies are used to justify a design approach, there are often difficulties encountered because of different context of the original study. Through our understanding and synthesis of multiple studies, we propose a set of design patterns. The proposed patterns can be utilised concurrently depending on the scale and context of both the physical garden and community. The relationships between the patterns and their concurrent use are discussed, and the resulting links provided the foundation for a pattern language. The eight initial patterns provide a foundation on which we would encourage other researchers to contribute, in order to develop a pattern language to holistically consider UA beyond the scope of our experiences in Brisbane and to enrich the patterns with a variety of gardening practices.

Keywords Urban agriculture · Interaction design · Gardening · Food · Design patterns · Pattern language · Urban informatics

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1 Introduction

Recently, there have been a number of studies exploring the intersection of urban informatics and urban agriculture (UA) communities. UA offers a variety of benefits to practitioners in the form of mental and physical health (Bellows et al. 2003), improved food security to the community (Kortright and Wakefield 2011), and a reduction in energy requirements to process, store, and transport produce (Bellows et al. 2003; Schnell 2013). The impact of UA on society is becoming more important as the level of urbanisation increases; for example, in Australia where we have conducted studies with local urban gardeners, the urban population constitutes 89 % (United Nations 2014). Urban informatics refers to study, design, and practice of urban experiences, using technology that connects people to each other, both in the physical and digital spaces (Foth et al. 2011). With the increasing ubiquitous nature of interactive technology, urban informatics research has been exploring the opportunities and challenges that this presents.

Pattern languages and design patterns (the constituent parts) have been of interest to a number of areas within human–computer interaction (HCI), although originating in the field of architecture. Based on three studies, we have conducted with different types of UA in Brisbane, Australia, between 2010 and 2014, and supported by existing studies, we propose an initial set of design patterns for urban gardening as practical guidelines for the design of interactive technologies for UA communities. We intend these design patterns to provide for a foundation for a future pattern language, and moving forward, we encourage other researchers to contribute new patterns, and test and improve the current patterns.

We give an overview of the use and role of pattern languages in architecture and civic engagement, as well as different uses within ICT and HCI research. We then provide an overview of the three studies from which we have analysed for the purpose of the developing our patterns. We then discuss the theoretical implications of pattern languages as an approach to generalising findings, before outlining our method of analysis. We then present eight design patterns, following a format consistent with existing pattern languages. Finally, we conclude with an open call for contribution to build upon the pattern language foundation.

2 Design Patterns and Pattern Languages

A pattern language is a set of interrelated design patterns that serve to solve reoccurring problems (Alexander et al. 1977). The pattern language approach proposed by Alexander et al. (1977) is well established in architecture. The design patterns follow a consistent structure—problem, discussion, and solution—which clearly articulate how and when the pattern applies. The work also separates patterns based on a category of scale including ‘towns’, ‘buildings’, and ‘construction’, starting broad and general before narrowing the focus on the specific. The nature

of the patterns is also practical and prescriptive in terms of how they apply. An example of these patterns is ‘Necklace of Community Projects’ that discusses the idea of central town halls that are only useful to local communities for political discourse if surrounded by types of activities and businesses relevant to the town (Alexander et al. 1977).

‘Liberating Voices’ is a pattern language promoting equitable and effective civic engagement (Schuler 2008). Schuler (2008) applies a different approach to the grouping of patterns not by scale, but instead by where they fall on the axis of theory and practice, and by the relationship to different types of communities and groups. We draw on this approach by Schuler (2008), as our patterns involve a level of abstraction from the prescriptive approach of Alexander et al. (1977). Studies with gardeners have provided a mixture of themes relating to information and social interaction, physical environment, and use of resources. By employing a pattern language to support interaction designers, we aim to build on the understanding of existing work to guide the design of pervasive technology.

‘Beautiful Trouble’ (Boyd and Mitchell 2012) provides resources for activists, divided into modules that are networked similar to a pattern language. It consists of high-level categories including tactics, principles, theories, case studies, and practitioners. Each category comprises different entities—the equivalent of patterns—with relationships between entities. Beautiful Trouble provides a rich visualisation of the links between all entities, which is where we draw a parallel with pattern languages. As our proposed design patterns grow in number, we will explore ways of presenting the interconnectivity inherent in pattern languages.

In HCI, design patterns and pattern languages are used in a number of areas, as highlighted by Pan and Stolterman (2013) who reviewed and explored the current and future trajectory of pattern language use within research. They describe the variety of different uses, which include approaches to user interface design problems (Seffah 2010), programming patterns in object-oriented software development. Pattern language use in HCI also includes specific design contexts such as the domestic setting (Crabtree et al. 2002) and research fields such as computer-supported cooperative work (CSCW) (Martin et al. 2001).

Specific to the goals of environmental sustainability, Knowles et al. (2014) outline a set of design patterns of persuasion, using examples of eco-feedback technologies and understanding their impact on behaviour change. Examples of their patterns include the following: ‘Designing to the value’, which is concerned with personal values and how to address this in design by exploring underlying causes, and ‘Consistency’, which refers to the importance of the way persuasive messages to encourage behaviour should avoid introducing doubt. While behaviour change departs from our intent, a focus on sustainability via eco-feedback is relevant. This presents opportunities for further generalisation of similar studies in order to develop links between sets of design patterns.

Finally, Wania and Atwood (2009), while exploring real-world use of pattern languages by designers and in the ICT industry, suggest they hold value to facilitate communication between designers and stakeholders, more so than they exist

to guide design. This traces back the original intention of the pattern language developed by Christopher Alexander (Wania and Atwood 2009).

2.1 The Problem of the Single Case

The choice of employing case study methodologies in areas usually guided by constructivism such as interaction design, but also action research, has prompted not only quantitative research proponents but also commentators within qualitative research domains to critically assess theory-building efforts. Gustavsen (2003) speaks of ‘the problem of the single case’ lamenting the unequal distribution of knowledge beyond the community, the lack of transferability of findings and interventions, and the difficulties in re-appropriating prior findings to new contexts (Foth 2006).

Scholars that question the transferability of qualitative research outcomes argue that the individual context found in a particular community, environment, or local setting renders the research results and findings idiographic. Martin et al. (2001) discuss the balance that must be struck between general design guidelines and those that are specific to a single case. However, just because a study’s main objective is not to deliver nomothetic research insights, does not deny the fact that new knowledge is generated in rigorous case study research. Gustavsen (2003, pp. 162–163) concludes that

To learn from practices, research needs to develop social relationships; internally within the research community as well as in relation to other actors. ‘The new production of knowledge’ as identified by Gibbons and colleagues (Gibbons et al. 1994) is above all a network activity, and research cannot stay outside this process and remain as isolated individuals looking at the world from up above.

The purpose of our design patterns has been to create guidelines that are useful and can be adapted to different types or scales of gardens. The outcome of design when applying each pattern will differ based on the contextual information of each case, and while these patterns could be applied to designing for city farms, grass roots communities, or residential gardeners as we have studied, they are not limited to these cases.

3 Urban Gardeners and Gardening Communities

A growing body of research explores the different needs and values of community gardens, both in Australia and internationally (Heitlinger et al. 2013; Odom 2010). Residential gardening on a household scale, typically undertaken by individuals, has been studied as ‘pottering’ activity by Taylor et al. (2008). These studies provide additional support for the development of our design patterns.

We conducted three studies between 2010 and 2014 with different gardening communities in Brisbane, Australia. We draw on the themes from these studies

in order to develop our design patterns. These three types of gardening practices we studied represent a UA scales of macro (large shared location), meso (smaller community organising group events), and micro (individual practice).

3.1 *City Farm*

We conducted a study at Northey Street City Farm (Fig. 1, www.nscf.org.au), located 2 km north of Brisbane's CBD. The findings of this study were published by Lyle et al. (2013). Our study involved participant observation (through regular volunteering onsite) and five semi-structured interviews, all analysed through a coding and thematic analysis process that derived four key themes (Lyle et al. 2013). The findings gave insights into four themes.

- There is a preference for face-to-face communication, which has led to breakdowns in communication as a result of a flat hierarchy and a large physical site.
- Despite a number of income stream, NSCF is dependent on ongoing work of volunteers, demonstrating the need for frugal investment in any new technology, and to respect the commitments of volunteers.



Fig. 1 Northey Street City Farm, located to the north of Brisbane

- NSCF does not exist in a vacuum, and while participants are interested in the bigger picture of UA in Brisbane, those interviewed were content to focus their involvement on NSCF.
- The physical environment is naturally constrained, located on a floodplain (allowing such a large UA community so close to the city centre), and regular flooding stresses the operation and requires disaster management.

3.2 *Grassroots Community*

We conducted a study with Perma blitz Brisbane (www.blitzbrisbane.org), a community that organises daylong events throughout Brisbane overhauling backyards (such as in Fig. 2) following permaculture design principles. The findings of this study were published by Lyle et al. (2014).

The group is the local chapter of the international Perma blitz movement that began in Melbourne. Our study involved participant observation through volunteering at six *perma blitzes*—events where local members of a community are invited to help transform a garden, typically a backyard, following a tailored permaculture design plan. We also conducted semi-structured interviews



Fig. 2 Site of a Perma blitz event in Brisbane

with event organisers to develop an understanding of the process that goes on in planning and running events. The findings gave insights into four themes:

- Participants who organise the events have a high level of involvement, but also tend to burn out, which is attributable to the scale and scope of each event.
- Operating entirely with volunteers, the lack of financial resources limits their activities. Resourcefulness, however, is highly valued, and those involved borrow gardening tools and equipment wherever possible.
- It is important for the material resources and volunteers for events to be sourced from the local community, because after the event occurs, it will depend on the efforts of the local community to maintain the garden and serves to encourage interaction among community members.
- Permablitz Brisbane does not want to be a central authority on permablitz events and would rather just provide information and empower local communities to organise and run gardening events independently.

3.3 Residential Gardeners

Our study of residential gardeners in Brisbane included a survey (36 participants); a convergent semi-structured interview process (seven interviews, participants located in Brisbane and surrounding areas); and a focus group and semi-structured interviews with gardening experts (which involved an excursion to a nearby community garden, as shown below in Fig. 3). The experts were involved in a mix of managing community gardens, running educational workshops and hosting national television programmes about gardening, for over 10 years. Our findings gave insights into six themes:

- That experimenting and observational learning is a common approach to gaining gardening experience, rather than focusing on didactic learning.
- Gardening is often done as a recreational activity, and as such, it is often a low priority in the life of the urban gardener, so the time invested is limited.
- Gardeners discuss their success and failures, as well share their produce with family and friends, which serves to motivate ongoing engagement.
- Discerning the quality of online information can be intimidating, especially when navigating online opinions.
- Information sources are often specific to a particular location, and for participants in Australia, it is difficult to evaluate the relevance of gardening information for the Northern Hemisphere.
- The main areas where gardeners encountered difficulty were as follows: in understanding how they could make use of space; maintain a garden, making decisions about what/when to plant; and learning the practice of gardening and share their experiences.



Fig. 3 Expert gardeners inspecting a community garden near Queensland University of Technology in Brisbane

4 Design Patterns for Urban Gardening

The process of pattern creation is similar to that employed by Martin et al. (2001), which begins by exploring the themes and findings of prior work, looking for signs of a clear problem with a possible solution. We have—by exploring links and overlaps between findings of different studies—developed eight patterns.

As part of expressing these design patterns, we are also interested in how they relate to patterns identified in similar fields, including Schuler (2008) and Knowles et al. (2014). For example, there is a link between the pattern we propose ‘Understanding Impact’, which can involve reflecting on gardening practice, and the pattern ‘Retreat and Reflection’ by Schuler (2008).

As part of understanding in pragmatic terms how different patterns can be used, examples are provided for existing technology or design efforts that show capabilities and limitations of each pattern. The structure we have used to explain our patterns follows a similar format to Schuler (2008). This approach is prescriptive, framing the design patterns on problems and their solutions, and although this

ensures consistency, we recognise that this limits the types of patterns we can create (Martin et al. 2001):

- 1. **Name and Number**
- 2. **Problem**—statement of the reoccurring challenge;
- 3. **Context**—an overview of which types of gardening communities the issue applies;
- 4. **Discussion**—detail of where and how the problem occurs, examples of ways in which the problem has been approached by existing systems;
- 5. **Solution**—criteria or approaches that are likely to address the problem.

We have framed these patterns along two axes, the first covering themes of resources, information, and social connection; and the second highlighting whether the pattern applies to the physical or digital space. The patterns sharing axis are indicative of the links between patterns, as shown in Fig. 4.

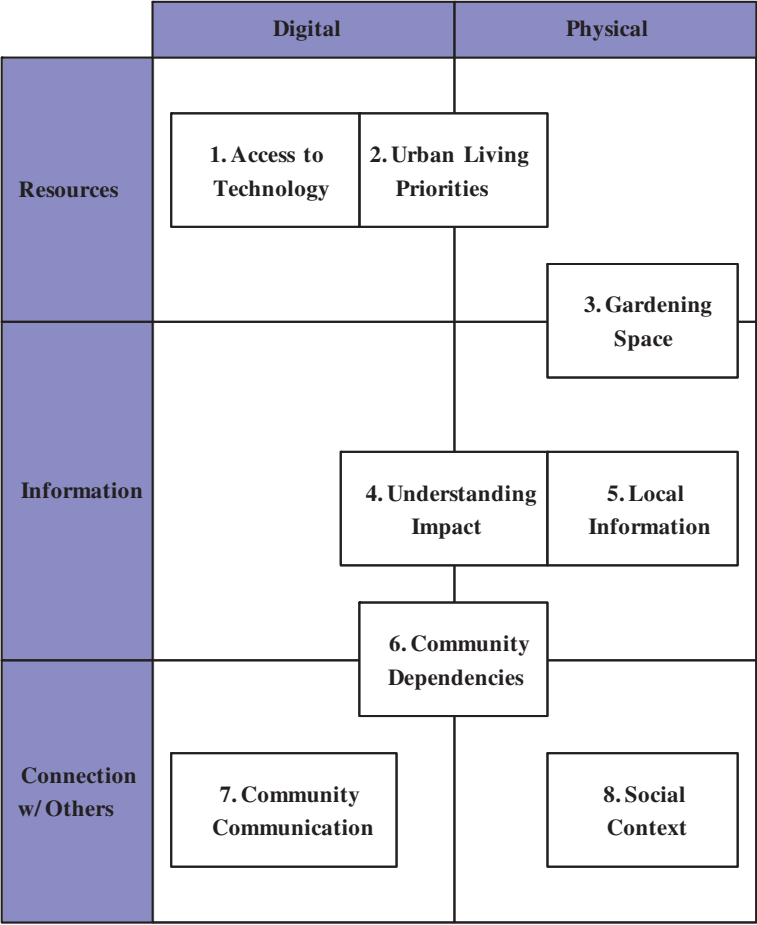


Fig. 4 Design patterns visualised in relation to each other

4.1 Pattern 1: Access to Technology

Problem

Gardeners can come from any background and as such have a wide variety of access to existing technology. Access to technology refers to whether an audience has a particular gadget or service, and their ability or willingness to use it as part of gardening practice.

Context

This problem applies to individuals and communities, whenever the intent is to design interactive technology. The context varies depending on the available resources of a community and the target demographic of design.

Discussion

When designing for a known person or group, infrastructure and access to technology may be prescribed. Typically, the context must be understood in order to know what is suitable. For example, Australia has a high level of smartphone market penetration, and if targeting residential gardens, there is a likelihood of high-speed Internet access. This would allow for the use of rich media and high levels of interconnectivity.

Communities on the other hand, such as Northey Street City Farm or Permablitz Brisbane, are limited in time and money to invest in additional technology or infrastructure. In these instances, it is important to understand what technology community members already use or what infrastructure is already in place, and how is it currently used. With this understanding, the ability to repurpose or make use of technology as part of a design will become clear. Understanding the role technology plays in the lives of gardeners, and when they have access to technology, will result in a more inclusive design (Heitlinger et al. [2013](#)).

Solution

Designers need to consider the existing infrastructure; time and money to invest in new technology; and attitudes of gardeners to different technologies and incorporate these preferences accordingly.

4.2 Pattern 2: Urban Living Priorities

Problem

Gardening demands an investment of time, over time. Whether it is time used to engage in gardening, learning about gardening, or relates to working with other people in a gardening community, this investment of time competes with other priorities in urban environments, where gardening is rarely a full-time job.

Context

This pattern can be used with any type of gardening practice where competing interests, priorities, and time constraints may exist. Residential gardeners may only have irregular time to invest and treat food growing as a hobby, undeterred by failure with financial security and access to food at shops to respond to lost crops. Community gardens often involve the time and resources of volunteers, in addition to tight budgetary constraints, and this may influence crop choice decisions, based on what is easiest to grow for the largest volume or financial return.

Discussion

This pattern indicates a need to understand the priorities and values of the people and communities that are the demographic of design. For urban residents, the level of commitment they have available to engage in gardening, either individually in their own space, or as part of a larger community, will depend on their work-life balance. For many, gardening will be a hobby (Taylor et al. 2008), and the frequency and duration of time available to garden will be limited, creating a situation where plants may not receive the attention required to yield a significant result. However, the effectiveness and efficiency of growing food may be less important than the act of participation (Heitlinger et al. 2013).

In two studies of gardening communities at a city farm and grass roots movement, there was a dependence on volunteers and a lack of resources to invest in time or infrastructure. In the case of PermaBlitz Brisbane, the clash between involvement as an organiser and other priorities resulted in volunteers halting or reducing their involvement.

While resources are tight as part of the daily operations of these communities, the idea of resourcefulness is an important value, an aspect shared by other community gardening groups (Odom 2010).

For technically competent, but time-poor gardeners, systems that provide automation are an example of responding to this pattern. An example of existing technology that responds to this pattern would be *Flower Power* (www.parrot.com/usa/products/flower-power) that uses sensors to make information available in real time, wirelessly to smartphones. These data help reduce or streamline the time needed to invest in the garden. *Hydrawise* (hydrawise.com) is a smartphone application that uses local weather information to assist with the management of water and automated irrigation.

Solution

Gardeners need help to enjoy their gardening time and manage its effectiveness. The approach of designers should involve understanding where gardening sits among the gardener's priorities. Ensuring that barriers to entry remain low, and leveraging context-aware pervasive technology, is one approach that would address this problem.

4.3 Pattern 3: Gardening Space

Problem

The ability to have a successful crop with specific plants and the level of required maintenance will be dictated by the physical gardening context. How do gardeners know what is possible, what is ideal, and what hazards exist within a given space?

Context

This pattern applies to all types of gardens and gardening communities as it focuses on the physical environment in which gardening occurs, and the planning, opportunities, and limitations of this space.

Discussion

It is difficult to prescribe if-then statements to explain how different spaces impact gardening, however, how a gardener gardens will differ between a pot plant on a balcony, a suburban backyard garden, a community garden or a city farm. The objectives of each type of garden also shape the best options, from the need for low-maintenance gardening for a busy urbanite, to the need for high yield if selling/trading produce at markets.

This pattern covers social attributes of how gardeners interact with the space and physical attributes of the natural environment. While limited irrigation might impact gardens, a more serious example of physical limitations is natural disasters, e.g. floods and bush fires. Considering disaster management as part of interacting with the physical environment can have an impact on gardening safety.

While drafting paper and sketching tools are useful (and drafting on paper is how the Brisbane Permablitz plans are presented), there is opportunity to build on computer-aided design tools, such as Google SketchUp, 3D Studio Max, or Blender, with the restrictions and knowledge of the physical environment, in an accessible way to assist gardeners and communities to understand their available space.

Solution

The scale of the gardening space and the environmental conditions of the space must be known in order to understand what meaningful options or approaches to gardening should be considered. Designs should enable gardeners to realise the potential of their space and plan around the limitations.

4.4 Pattern 4: Understanding Impact

Problem

Gardeners need to be able to understand the practice of gardening, both in individually and in communities. Having or gaining the knowledge of what options

there are when planting, harvesting, or treating pests/diseases is not always known, and the non-deterministic nature of gardening outcomes is problematic without a frame of reference.

Context

This pattern applies to all scales of community, but in different ways. A residential gardener with limited time and a small gardening space will have low amounts of gardening activity, and the ability to recall the changes in the garden over time will be relatively easy. Whereas for a community garden, a large amount of work performed by multiple people may lead to difficulty in understanding the impact.

Discussion

Decisions made while gardening either individually or as part of a group create expectations—planting seeds lead to growth and harvest. A number of factors will impact the outcome of this process, some of which are controllable, such as the ongoing garden maintenance, weeding, pest, and disease management. Others, such as weather, can only be planned for based on previous trends. In situations where crops fail, this failure can be demotivating. Reflecting on the process, to establish an understanding of why the outcome was a certain way, can help improve knowledge and experience.

Experimenting and observing the impact of gardening decisions is a method by which individual gardeners learn—this is a theme of our interactions with residential gardeners. Survey participants were asked how they gain a sense of seasonality and the most common response related to the process of experimentation, and observation of their own experiments, local farmers markets, and available super-market produce.

For communities, there is value in understanding the impact of their efforts, as well as to understand their efforts in the context of other community gardening in the surrounding area. For Permablitz Brisbane, understanding the impact of each event on the garden is a means of celebrating the work of the volunteers, to encourage ongoing engagement and reduce risks of burnout (Lyle et al. 2014). Permablitz Brisbane and Northey Street City Farm benefit from understanding the wider context of UA in Brisbane (Lyle et al. 2013, 2014).

This pattern resonates with Liberating Voices pattern #136 ‘Retreat and Reflection’ (Schuler 2008), which discusses the importance of reflection, but in the context of taking a step back from the pressures of modern life. This is relevant to *Understanding Impact* in cases where community gardening involves volunteers. Retreating and reflecting can create space for volunteers to appreciate the effort and impact they have invested.

This pattern also corresponds with ‘Facilitate reflection’ (Knowles et al. 2014), which calls for celebration and reinforcement of values, in order to avoid being overwhelmed when faced with how to respond to environmental sustainability. An example of how this is relevant to *Understanding Impact* is in encouraging enthusiasm in volunteers, celebrating progress to avoid burnout.

Examples include a journal of gardening activity (online or offline) or a regularly updated newsfeed on a community garden Website. Permablitz Brisbane’s

Website (www.blitzbrisbane.org) includes a written article with images of each event, details about what occurred, and follow-up events.

Solution

Gardeners need to be able to understand the impact their efforts have in the garden as part of their own learning and to encourage ongoing engagement. Designers should explore ways to create opportunities for gardeners to appreciate their own gardening and the gardening of their community.

4.5 Pattern 5: Local Information

Problem

Information about gardening practice is readily available via online resources and in books, but its relevance is tied to specific locations that may differ from the gardener's own. The location context of the information is not always explicit or accurate.

Context

Individual urban gardeners need to understand their gardening context. For gardening communities, the physical size of the gardening space may be greater; however, the shared knowledge of the community can contribute to a more accurate overall set of aims and ideas in the garden. It may do so at the expense of social cohesion if strongly held conflicting opinions and experiences exist.

Discussion

For events such as those organised by Permablitz Brisbane, sourcing locally and temporally specific information is crucial to understanding the surrounding environment, the available suppliers for materials, and what can be planted, according to the season. Residential gardeners benefit from this information, and similarly struggle, when they search online and stumble across conflicting suggestions for how to respond to a pest. Our study of residential gardeners in Brisbane found that information sourced online was often implicitly or explicitly assuming USA or European as the users' location, limiting its usefulness.

ABC Gardening Australia is one of the most popular responses on our survey of residential gardeners (mentioned by seven respondents) regarding where they source information. They regularly provide information through a national television programme, Website, and social media presence. Their Web presence includes a 'vegie guide,' (www.abc.net.au/gardening/vegieguide)—a planting calendar that provides different recommendations depending on the selection of one of five climatic zones. This is an example of tailoring information to local context, although depending on the level of detail, dividing a country the size of Australia into five regions may be too coarse. Despite this, a number of residential gardeners still depend on the ABC Gardening Australia as an authoritative source.

Another example is the exploration of sensor and automation systems that take into account different elements of your context and provides information and advice on garden maintenance that is tailored, such as Smart Garden Watering (www2.smartgardenwatering.org.au).

Solution

Gardening occurs in the real physical world, and as such understanding the role of location, season on macro-, meso-, and microlevels is critical for information to be useful. Metadata should encode the temporal and spatial context in order to be effective. Training can provide a better understanding on how to use this contextual information and to be able to filter by relevance.

4.6 Pattern 6: Community Dependencies

Problem

Gardeners transition in and out of involvement of gardening communities, and with this, they both bring and take their knowledge and experience. This can have a negative impact on a community's autonomy where the involvement of certain members who represent key tacit knowledge creates a dependency. When key members leave, move on, or become less involved, how will communities continue?

Context

This pattern applies to gardening communities, online and offline, and the ways in which their individual experiences are shared and stored. The impact differs between communities of residential gardeners, such as a gardening club, compared to a community with shared involvement in a specific garden.

Discussion

We found, through our study with Permablitz Brisbane, that while the organisers were interested in helping provide information on running events (such as manuals for event hosts, the organisers and planners etc.), there was a concern that local communities may become dependent on the expertise and experience of Permablitz Brisbane, and look to them as an authority.

While there is value in recognising the experience and expertise of individuals and groups, local communities should be empowered to develop their own rather than rely on others. Encouraging documentation of systems and decentralising the way groups interact reduces the impact of tacit knowledge loss when people move on. Storytelling systems may also encourage oral mechanisms of transferring tacit knowledge to others.

Wiki systems provide an example of simple methods of capturing and updating information about different processes, practices, and expertise of a group. Wikis

are not without issues, however, as a lack of maintenance leads to the relevance of the information becoming stale over time.

Solution

The solution to community autonomy is to both encourage community members with useful information and practices and discourage dependence on centralised systems of control. Approaches worthy of consideration include designing for wide dissemination of both tacit and codified knowledge about specific communities and general gardening and empowering individuals to contribute using open-source and/or collaborative systems.

4.7 Pattern 7: Community Communication

Problem

When gardening at a shared location, members of a community may prefer face-to-face communication; however, other gardening communities exist solely online where interactions are asynchronous. The means of communication create opportunities for communication breakdown, and designers should carefully consider what means of communication is appropriate.

Context

Understanding the way gardeners communicate, and whom they communicate with, is crucial. Community members who are co-located may explicitly prefer face-to-face communication. Individual attitudes towards different technology or means of communication also provide scope to shape designs.

Discussion

Our own study with NSCF found a distinct preference for face-to-face interactions, which across the large site created potential situations for communication to break down. This is related to their flat hierarchical structure and the locations of the different community members. During the interviews at NSCF, there was also a distrust of social media technologies and an interest in a closed network of communication. For residential gardeners, and Permablitz Brisbane, the use of social media was more prevalent and accepted.

This pattern is similar and overlaps with Liberating Voices patterns #251 'Online Deliberation' and #260 'Community Networks' (Schuler 2008). The first is directly applicable to our case of communication breakdown, by encouraging the design of technology that allows for collaboration when the gardeners onsite are physically separated. One way that NSCF had engaged with members who were not co-located was to use Google Docs for sharing and collaboration. Pattern #260 relates to communities engaging with different technology and the patience required to convey the benefits.

Designs that respond to this pattern could explore synchronous or asynchronous communication, depending on how the communities already engage with each other. For Permablitz Brisbane, who are not co-located, mailing lists and CMS have been used as the means of communication, and therefore, future design for their case might explore whether a synchronous communication channel could complement their existing approach.

Solution

Do not expect gardeners to change the way they communicate, instead design to complement or repurpose their technology and communication preferences to allow for ease of adoption. Alternatively, design with flexibility of communication explores different types of media and interfaces for communication.

4.8 Pattern 8: Social Context

Problem

Motivation to start and maintain a garden often involves social interaction. How can design take advantage of this opportunity for gardeners with established social support and encourage gardeners with limited support?

Context

This pattern relates to community and individual gardening. In the case of individual gardening, ‘individual’ is perhaps a misnomer, as it does not consider the social support from family and friends. For communities, the social interactions will include a mix of friends and acquaintances, and the interactions will be focused more on the efforts of the group rather than individual reflection.

Discussion

Our study with residential gardeners revealed that the role of family and friends as part of sharing experiences about gardening was important to most participants and at least partially responsible for their continued engagement. For communities such as NSCF, understanding the importance of communication between members is important for social cohesion and is necessary for effective gardening in a shared space.

The social interaction at events organised by Permablitz Brisbane involves an intense time of socialisation (and gardening), but outside of the event, the interactions are much less frequent and intense. Understanding the social support and interactions that take place, and the frequency and intensity of them will allow more tailored approaches in design.

Where #7 ‘Community Communication’ above is concerned with the digital means and preferences for communication, this pattern is focused on the social groups and context in which gardening takes place—Who do gardeners engage

with while gardening, for motivation, for information? Understanding that these social networks can be part of encouraging gardening practice means they can be considered as part of the design.

Solution

As a motivation for initial and ongoing engagement in gardening practice, individuals and communities benefit from communicating with friends and family, or other gardening communities about their practice and gardening experiences. Designers should look to integrate social networks and social connectivity into the experience of gardening.

5 Conclusions

Our contribution has been to outline eight initial design patterns that can be applied in the context of different types of urban gardening. The development of these design patterns is based on three studies of different types of UA, a review of the literature, and other pattern languages. The design patterns we present are a foundation on which a pattern language can be developed, and we encourage others to contribute, both to refine and enrich the proposed patterns and to add new patterns. This is a foundation for a niche area of design, and there is opportunity to adjust the scope of the language in different directions, including for other types of UA, or to encompass more of the sustainable HCI research field.

The proposed design patterns, while developed from the outcomes of existing studies, require further testing to validate, iterate, and refine. We propose future development of a pattern language through the design of interactive and pervasive systems that aim to improve the way in which gardeners engage with each other, reflecting on their individual and community contributions to food production in urban spaces. Future work could also explore if a metalanguage could, at a level of abstraction from this foundation, create tighter links between languages—e.g. where there is overlap with ecological sustainability, (Knowles et al. 2014), civic engagement (Schuler 2008), and food systems (Hearn et al. 2014). Drawing inspiration from the visualisation of *Beautiful Trouble*, (<http://explore.beautifultrouble.org>) there is an opportunity to increase the utility and highlight the connectedness of these design patterns through interactive presentations.

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