“Mate, we don’t need a chip to tell us the soil’s dry” Opportunities for Designing Interactive Systems to Support Urban Food Production

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ABSTRACT

We describe findings from ethnographic fieldwork and a participatory design workshop conducted with members of urban agriculture communities. The aim of this work is to critically understand community members’ agricultural practices as well as uses of interactive technologies in the service of investigating how the values of these communities might shape future sustainable HCI research. We found members heavily resisted technological augmentation of their agricultural practices, but suggested several novel ways in which interactive systems could be leveraged to help achieve their goals and potentially engender more sustainable ways of living. We conclude with a discussion of opportunities for designing interactive systems to support small-scale urban food production and implications for future research.

ACM Classification Keywords

H.5.2 Information interfaces and presentation: Prototyping

Keywords

Sustainability, Sustainable HCI, Urban Agriculture

INTRODUCTION

Sustainability has emerged as a critical concern for researchers and designers of interactive systems. To date, the sustainable HCI movement has largely focused on environmental impacts of consumer behaviors such as product recycling and resource consumption [5]. These nascent works generally frame sustainability in terms of individual consumption, however recently researchers have begun to articulate the need for the HCI community to move beyond an overt emphasis on consumer behavior and towards an understanding of sustainability that combines environmental, social and economic concerns [5, 6]. In particular, exploring the needs, values and practices of small scale food producers has been cited as a key point of departure to (i) foundationally consider crucial interrelations among environmental, social and economic sustainability, and (ii) further critically develop HCI research and practice as an agency for sustainable ways of being [6]. However, little work exists that concretely illustrates how the practices of small-scale food producers could inform the design of interactive systems aimed at facilitating broader uptake of urban food production.

In this paper, we present findings from 8 months of ethnographic fieldwork with members of urban agriculture communities in a large city in northeastern Australia. The aim of this work is to develop a sensibility for understanding the values and practices of these communities with an eye toward their uses—and non-uses—of interactive systems and technologies. We additionally conducted a participatory design workshop with community members, which resulted in several novel ways in which interactive systems could be designed to help better achieve their goals as a matter of facilitating more sustainable ways of living in the urban environment. In what follows, we describe an overview of related work on urban agriculture and sustainable HCI. We then describe findings from our fieldwork and workshop. We conclude with a discussion of opportunities for designing interactive systems to support small-scale urban food production.

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BACKGROUND AND RELATED WORK

Currently, 50% of the global population lives in urban settings; by 2015 it is estimated that 26 cities worldwide will have populations of 10 million people or more [8]. The mass migration of populations from rural to urban areas worldwide places increased strain on local food production infrastructures, which often cannot support current demand [8]. For example, Vijoen et al. estimate an average of 6,000 tons of food will have to be important daily to support a city of 10 million people [9]. These increasing food demands, paired with the globalization of trade, have resulted in significant consequences for social and environmental sustainability. On one hand, the average produce item is estimated to travel between 1500-2500 miles before being purchased for consumption, resulting in significant levels of pollution and carbon dioxide emissions [8]. On the other, lack of availability of fresh produce has been cited as a key contributor to increased consumption of processed foods, which have widely been linked to the growing epidemic of diabetes and obesity in the western world [8].

Urban agriculture is the practice of integrating low-energy food production techniques within city boundaries to increase the amount of fresh food available to urban

consumers [9]. As cities expand to accommodate growing populations, they often occupy significant amounts of agricultural land. Urban agriculture has the potential to bring this land back into productive use to meet current and future produce demands, in addition to stimulating local economies through sale of locally grown food.

Very recently HCI researchers, such as Blevis and Morse [1], Hirsch et al. [6], Patel et al. [7], and Brynjarsdóttir and Sengers. [2], have collectively articulated the virtues of exploring the intersection of HCI and small-scale food production, and how work in this area could productively shape future sustainable HCI research. Our study builds on this emerging area through describing the practices of urban agriculturalists as well as key opportunities for designing interactive systems to support urban agriculture.

METHOD

Our study was conducted over the course of 8 months from July-March in a large Australian city. Through personal contacts we established rapport with communities members participating in and across two urban agriculture sites—one ground level garden and one rooftop farm. These sites were situated in a prominent urban area, which represented a variety of commercial, governmental, residential buildings, in addition to several public green spaces. During the first phase of the project we conducted ethnographic fieldwork to gain a better understanding of community practices and values, as well as to record in situ insights into the everyday interactions and collaborations associated with maintaining an urban agriculture site. We also observed members perform a variety of other activities around the city, such as exploring the city for future sites, administering urban agriculture workshops to the public, and organizing political campaigns and demonstrations to draw attention to issues of public urban land use for food production. To complement these observations, we also conducted semi-structured interviews with 19 community members across both urban agriculture sites, which focused on issues such as motivations for participation, perceptions of urban space, as well as uses and non-uses of technology. This portion of the study produced rich data consisting of handwritten field notes, audio recordings, and several hundreds of photographs. We listed to recordings and transcribed relevant segments. We then organized these relevant portions into these and coded the textual and visual documents using these emergent themes.

Based on findings from the first project phase, we organized a participatory design workshop. The aim of this workshop was to explore key barriers inhibiting the uptake of urban agricultural practices within the city and, more generally, critically envisage more preferable future states of local urban life. Ultimately, through presentations and iterative sessions two design concepts were selected to be further developed and brought to action. In what follows we provide a brief description of general findings from our fieldwork; we then describe outcomes from our workshop and resulting design opportunities they suggest.

FINDINGS

Resourcefulness as core community virtue

Intentionally acting and living resourcefully was a pervasive value shared across all urban agriculture community members we observed. For example, that urban agricultural practice is fundamentally about the appropriation of unused urban space for productive re-use was a widely cited motivation for members to take part in the community. Additionally, drawing on materials that would otherwise be treated as waste and creatively putting them to beneficial use was highly valued. We observed many instances in which discarded materials such as steel drums, wooden posts, aluminum cans, and corrugated iron roofing segments were composed into complex assemblies for a variety of uses, from rooftop rainwater collection systems to ground-level composting receptacles and attendant tools. This theme also emerged through members' ongoing work to acquire leftover organic materials to produce fertilizer. In particular, that this leftover 'waste' was directly metabolized by the urban agricultural site local ecosystem to produce new fresh produce for consumers was recognized by many members as an embodiment of these communities' resourceful nature and practice.

Resistance to augmentation of gardening practices

While participants typically exhibited a strong sensibility for appropriating materials and artifacts to augment their gardening practices, the issue of how interactive technology might fit in this context emerged as highly contentious. In particular, the notion of using sensing technology to provide dynamic information on soil moisture level or chemical composition was speculated to produce a series of potential negative consequences. Several participants described how ongoing direct interaction with the site (e.g. garden plots, plant installations, soil, etc.) helped establish a reflective sensibility for understanding, predicting and reacting to how environmental changes would affect the local urban agriculture system. It was widely reported that such a sensing system could be relied on too heavily, subverting members' ongoing development of environmental knowledge and intuition. Moreover, instances in which participants new to the community had questions during gardening sessions were viewed as key opportunities for other community members to offer insights into local urban agriculture practice—in essence building community member relations through social interaction and informal transfer of tacit knowledge. Several senior community members speculated that the presence of information from this kind of sensing system could supplant instructional interactions between new and more experienced members, thus potentially complicating the development of community relationships and practice.

Emergent uses of technology

On the whole, it was clear that the application of new technology to directly augment agricultural practice did not map to community values nor appear to be beneficial, "*We don't need something new* [to be designed to] *help in the garden. We have so many things that people toss that find*

new homes here and work fine. …mate, we don't need a chip to tell us the soil's dry and wants tending. …especially when you can tell by the way they're [plants] *leaning*" (**P10**). Despite the widespread resistance to potential in-garden applications of technology as reflected in this quote, community members did widely appropriate interactive systems and technologies for several purposes. For example, several participants reported using the internet to project information into the public domain about issues related to urban food production as well as organize local action to draw attention to use (and lack of use) of public space for food production.

We observed a deep underlying tension between community members' perspectives on how public urban land ought to be used for food production and current policies in place by the local government preventing gardening outside of a few designated areas. Community members held several events in which public spaces, such as sidewalks, parking spaces, and public parks had been temporarily appropriated and populated with small scale plants and crops to re-image how city space could be used. These instances were documented and integrated into ongoing web campaigns run by members aimed at envisaging future scenarios for urban life in their local area. Members also reported engaging in ongoing initiatives to document 'public' spaces ripe for urban agriculture interventions, which the city government had prevented in favor of maintaining lawns, which required notable water consumption. Oftentimes these spaces were described to purport artificial motifs of how interactions with nature could manifest in the city, and significant community discussion and critique emerged on these websites. One of the most prevalent uses of the internet by community members centered on documenting locations around the city in which urban agriculture was taking place. With the exception of a limited number of community gardens around the city, most urban agriculture practices took place on rooftops and other areas largely out of sight to city citizens at large. The aim of these community-run websites was to highlight key places around the city in which these practices were unfolding in order to generate additional exposure and, potentially, public interest. Nonetheless, despite these collective efforts, numerous community members reported dissatisfaction over the general lack of visibility of their efforts more broadly within the city and among its citizens.

Participatory Design Workshop

Based on findings from our observations of and interactions with community members we conducted a participatory design workshop aimed to (i) critically identity key themes and design concepts that could engender broader uptake of urban agricultural practices among city citizens and (ii) explore how interactive systems might be designed to support these directions. In total 23 members of the two urban agriculture communities we observed participated in this two-day workshop. During the first day participants and organizers broke into several groups to develop and discuss design themes; at the conclusion of the day themes were presented and through a collective discussion three key design strategies were identified:

Recoding food waste as fuel for a metabolic city. Acquiring organic material to fuel composting efforts and generate fertilizer is a persistent task for urban agriculturalists. Participants reported frequently attempting to provide compostable food waste themselves, but perpetually being in short supply. Nonetheless, sites in dense urban areas are generally in close proximity to restaurants in which compostable food waste is often discarded daily. *Re-coding* restaurant food waste as fuel that could be metabolized within local urban agriculture sites, which could in turn produce fresh food catered to restaurant menus represented a key strategy to facilitate new urban food production initiatives. Moreover, such a system could function as a case example illustrating the social, economic and environmental benefits of bringing various city stakeholders in relation to support localized metabolic cycles of food production and consumption.

Amplifying visibility of urban agriculture practices in and on city infrastructure. A key issue inhibiting broader uptake of urban agriculture practices by city citizens cited across workshop participants was a lack of visibility of urban farming sites. Aside from a select few community gardens, the majority of urban agriculture sites resided well outside of public view on private plots and building rooftops. Projecting these sites, spaces and practices more prevalently into the public sphere was widely agreed to be a productive step toward generating new opportunities for discussion of issues grounding the need for local food production, raising questions over who decides how public space is utilized, and, more generally, engendering wider interest in local food production among citizens.

Engaging diverse stakeholders groups. A pervasive issue across workshop discussions was community members' perception that urban agriculture producers were marginalized in the sense that the benefits and motivations of their practices tended to be misunderstood by—or remained largely unknown to—the general public. Engaging with local commercial, governmental and non-governmental stakeholders was identified as a key strategy to embed urban agriculture practices within urban infrastructure, processes and culture.

Workshop participants and organizers used these themes as framing mechanisms in several brainstorming sessions to generate design concepts. 40 design concepts were developed in total; through a series of iterative sessions participants increasingly narrowed design concepts down until two actionable concepts remained. The first concept centered on the design of an interactive system to facilitate relationships between a local restaurant known to produce large amounts of compostable food waste and two local small-scale urban farms. This service was envisioned to be

used by restaurant workers to notify urban agriculture community members of the types of food waste available, when and where it could be picked it, as well as types of produce desired for their menus. Subsequently, community members could use the system to notify restaurants of the types of produce they had available, quantity and anticipated future stock. The second concept centered on the use of a prominent governmental building's roof as an urban agriculture demonstration space. This concept aims to amplify the exposure of the demonstration site by projecting a live video feed of the space on the Internet as well as onto the façade of the building at night. This visualization would be augmented with facts and figures conveying benefits of local food production, to draw attention to the often-limited visibility of urban food production efforts. A secondary aim of these projections is to stimulate interest in several public workshops held at the building on urban agricultural practices as well as a series of open discussions on increasing use of public land for food production. While these interventions will require longer-term evaluation, our study does suggest insights into the role interactive systems could potentially play in supporting local urban food production.

DESIGN OPPORTUNITIES

While we found members exhibited resistance to technological interventions aimed at directly augmenting gardening practices, several novel applications of interactive systems emerged. For example, there appear to be opportunities for designing interactive systems and services that facilitate relationships between local urban agriculture sites and commercial restaurants producing unused compostable organic waste. Ongoing exchanges engendered through these systems could concretely illustrate how food waste can be used—and perhaps symbolically *re-coded*—as a productive resource catalyzing future local urban food production. Long-term uses of such systems could open new opportunities for establishing case examples of the novel benefits produced when urban food production is systemically integrated within local social and economic structures. This direction could complement emerging work exploring how the values and practices of subsistence fishing communities can shape food production initiatives and more generally future programs of sustainable HCI research [2].

There also appear to be significant opportunities for designing systems that amplify the presence of urban agricultural practices and sites on, in and around the city. On one hand, systems could be designed that implicitly or explicitly code urban structures and land using (or offering) space for local food production. Additionally, there appear to be opportunities in developing interactive media facades that could be projected on urban spaces to envision potential future ways in which key sites could be brought into productive use. Moreover, these systems could be used to critically draw attention to political issues such as future public land use and water resource allocation policies. Collectively, these directions could leverage ongoing work exploring the use of public displays and interactive facades to increase citizen knowledge of their local urban settings [3] as well as citizens' critical engagement with interactive systems in the service of constructing and projecting a public rhetoric reflective of their concerns and agendas [4].

CONCLUSIONS

This study presents work contributing to the emerging intersection of HCI and sustainable food production. The aim of this study is to illustrate one way in which the values and practices of small-scale urban agriculture communities could inform the design of interactive systems aimed at supporting local food production. We found several design opportunities emerged, however they collectively emphasized a broader focus on drawing key resources, stakeholders and issues into systemic relation, as opposed to device level interventions augmenting specific agricultural practices. However, one can imagine garden-plot level sensing interventions could be useful in situations in which less community support is available and remote farming applications are required; clearly more research is needed in this area. Ultimately, this study contributes an initial step toward understanding how interactive systems could be designed to effectively support the values and goals of small-scale food producers, in the service of producing more viable human and environmental futures.

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