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ATTITUDES TOWARD GREEN INFRASTRUCTURE STRATEGIES FOR MORE LIVABLE AND SUSTAINABLE COMMUNITIES

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ATTITUDES TOWARD GREEN INFRASTRUCTURE STRATEGIES FOR MORE LIVABLE AND SUSTAINABLE COMMUNITIES

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by

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Attitudes Toward Green Infrastructure Strategies
For More Livable and Sustainable Communities

A Dissertation Presented

by

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DEDICATION

For my family

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ABSTRACT

ATTITUDES TOWARD GREEN INFRASTRUCTURE STRATEGIES
FOR MORE LIVABLE AND SUSTAINABLE COMMUNITIES

MAY 2018

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Green infrastructure refers to multi-functional elements that integrate ecological and anthropogenic factors and processes to support healthy ecosystems and communities (Austin, 2014; Benedict & McMahon, 2002). While green infrastructure has been embraced by planners, there is not a great deal of research among planners regarding the public's attitudes towards green land uses at the individual level. The dissertation studies explored three urban green infrastructure strategies: residential tree canopy, neighborhood green space, and community gardens; at the scale of user preferences and experiences.

The first study (Chapter 3) used photo preference methodology to explore the tension between residential density and urban greening. Study results suggested several aspects of neighborhood spatial form associated with higher preference by study participants (n=212): a green canopy and neighborhood greening; a vegetative buffer between housing and street; and a provision of sense of privacy by building form and vegetation.

The second study (Chapter 4) used descriptive analysis for a participatory planning and design activity to imagine an "ideal neighborhood", as part of a larger study on urban ecology within a family science museum. Study results suggested that participants (n=172), many of whom were children, highly preferred green space as compared to other land uses when constructing imaginary neighborhoods. The project also explored engaging children in participatory planning within a museum setting and the use of this activity beyond the museum.

The third study (Chapter 5) contributes to scholarship about the attitudes and experiences of community gardeners within an urban garden network. Results from the study suggest that for participants (n=112), community gardens provided a setting to engage with neighbors and build community based on a shared interest. Attachment to place and people grew from these interactions, which, for many, motivated ongoing involvement in the garden and community.

The complexities of creating healthier, sustainable and adaptive urban settings makes it critical to engage urban populations in green infrastructure responses. Green spaces and elements are important to people and failure to provide the multiple benefits of access to nature in the city for all communities can have substantial costs to health as well as overall quality of life.

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CHAPTER 1

INTRODUCTION

The multiple benefits and multi-scalar nature of green infrastructure strategies provide attractive and timely responses to the impacts of climate change for an increasingly urban world population. While green infrastructure has been embraced by planners at the scales of region and city, there is not a great deal of research among planners regarding the public's attitudes towards green land uses at the individual level. How are green infrastructure elements perceived by people who interact with them daily? This dissertation explores attitudes towards three elements of urban green infrastructure: residential tree canopy, neighborhood green space, and community gardens. The themes and questions of this inquiry are sited at the personal scale: at the juncture of green infrastructure elements with human preference, inclinations and experience.

1.1. Green infrastructure and planning

Green infrastructure is a comprehensive term that describes a network of multi-functional elements that integrate ecological and anthropogenic factors and processes to support healthy ecosystems and communities (Austin, 2014; Benedict & McMahon, 2002). Throughout former industrial cities in the United States, green infrastructure can provide vital ecosystem services and remediation of ecologically degraded urban environments by regulating climate and sunlight; providing carbon storage, abetting noise and air pollution; aiding water purification; and cycling soil and nutrients (Benedict & McMahon, 2006; Haaland & van den Bosch, 2015; Hansen & Pauleit, 2014). In addition,

green infrastructure elements can impact a variety of social, health and quality of life issues by providing a respite in nature within the dense, hardscape urban environment; cleaner, cooler air; as well as space for physical exercise and community gathering (Austin, 2014; Childers et al, 2015; Herzele & Vries, 2012; Wells & Rolling, 2012). Green infrastructure not only organically connects urban areas to the natural environment (Abunnasr & Hamin, 2012; Benedict & McMahon, 2012) but also provides settings for citizens to better understand urban nature and the complexities of integrating human habitat within a larger ecological framework. (Herzog & Flynn-Smith, 2001; McPhearson et al., 2016). The intangible and non-material benefits of urban nature, such as landscape aesthetics, outdoor recreation, personal restoration and spiritual regeneration are important to health and well-being (Jennings et al., 2016.) Yet the value of urban nature may be underestimated, and the metrics for measuring positive associations of health outcomes and green space are still being developed (Ekkel & de Vries, 2017; Jennings et al., 2016.) In addition, traditional patterns of urban inequity are often replicated with urban nature, so that low-income and minority communities have less access to green space and the benefits that come with it (Heynen et al., 2006; Jennings et al., 2016).

1.2. Research issues and background

The first study in this dissertation explored attitudes towards spatial configuration of residential density and urban tree canopy and follows previous work by Cheng et al. (2017) which involved scenario planning for a greener Boston. The densification of urban form has been recommended by planners to support long-term ecological and community sustainability by reducing urban sprawl, improving transportation efficiencies, preserving

existing rural green space, reducing community isolation and supporting economic and environmental equity (Benedict & McMahon, 2006; Churchman, 1999; Daniels, 2001; Neuman, 2005). Yet in the process of making cities more dense, there may be a lack of or removal of green spaces (Haaland & van den Bosch, 2015). In addition, the promotion of the general concept of density in compact urban development does not always consider differences in land use patterns and physical design (Neuman, 2005) and there is tension between the notion of the compact city and people's desires for living in spacious, green and quiet areas (Van den Berg, Hartig & Staats, 2007; White & Ellis, 2007). One of the more sustainable responses to urban development points to higher density neighborhoods coupled with extensive urban tree canopy (Alberti & Marzluff, 2004). Additional research is needed to ascertain how denser habitation patterns can be made suited to the preferred settings of urban residents.

The lives and health of children are heavily influenced by the land use decisions of policy makers and planners yet children are not typically included in planning processes. The purpose of the second study was to contribute to knowledge about children's preferences for neighborhood spatial form. Using results from the "City-Science" museum exhibit at the EcoTarium Science Museum in Worcester, Massachusetts, this descriptive study explored patterns of neighborhood land use by museum participants, many of whom were children. Of particular interest were the kinds of green space elements and arrangements that were most important to children when they constructed an imaginary "ideal neighborhood". This activity was a form of scenario planning, in which potential futures were imagined, and was consistent with a constructivist learning approach to climate change, whereby learners are actively engaged

in exploring new concepts and constructing mental models in association with new information and experiences (Bardsley & Bardsley, 2007).

The third dissertation study sought to understand attitudes and experiences of community gardeners within' the context of an urban community garden network in Providence, Rhode Island. Community gardens provide an opportunity to explore people-nature relationships at both a personal and community scale, in what Bethaney Turner (2011) terms "embodied sustainability". Community gardens can provide multiple benefits in alignment with sustainability and livable community goals (Barthel et al., 2012; Ferris et al., 2001; Poulsen et al., 2014) including food provision (Ghose & Pettygrove, 2014); sense of community and empowerment (Armstrong, 2000; Glover et al., 2005; Holland, 2004; Middle et al, 2014); intergenerational and cross-cultural contact and knowledge sharing (Barthel et al., 2012; Ghose & Pettygrove, 2014); ecosystem services (Goddard, et al 2010; Tidball & Krasny, 2007); promoting self-reliance and independence, and empowering civic engagement (Tidball & Krasny, 2007). However, community gardens also face challenges including lack of secure land tenancy; inter-personal conflicts and organizational issues (Tidball & Krasny, 2007); and potential replication of environmental injustice across garden networks due to resource inequity (Lovell & Taylor, 2013).

While the multiple benefits and multi-scalar nature of green infrastructure strategies provide the impetus for this dissertation study, the tensions between residential density and preference (Chapter 1); a green space planning activity suitable for all ages (Chapter 2); and activities and experiences of urban community gardeners (Chapter 3) provide the focus.

1.3. Research questions

This dissertation sought to understand how the participants valued residential greening, green spaces and community gardens; what users perceived to be the benefits of these green infrastructure elements; and to what extent the benefits contributed to a higher quality of life. The first two studies were conceptual and were variations of scenario planning: the first study related to preference for tree canopy, the second to neighborhood land use planning. The third study explored the attitudes and experiences of community gardeners in an urban garden network. The research questions include (Figure 1.1):

Chapter 1: Urban Greening: What is the relationship between the varying amounts of tree canopy and residential density; moderated by demographic factors of age, gender and residential experience; and preferences for residential settings?

Chapter 2: Magnetic Neighborhood: How did participants who created their ideal neighborhood within a planning museum exhibit value green space? How were green space elements, connectivity and variety related to neighborhood spatial form? What was the relationship between participant age and the land use choices and arrangements, especially in regard to green spaces, in the imaginary ideal neighborhoods?

Chapter 3: Community Gardens: Among community gardeners, how are gardening knowledge, experience, connection and motivations related to the perceived changes in the participants as the result of community gardening?

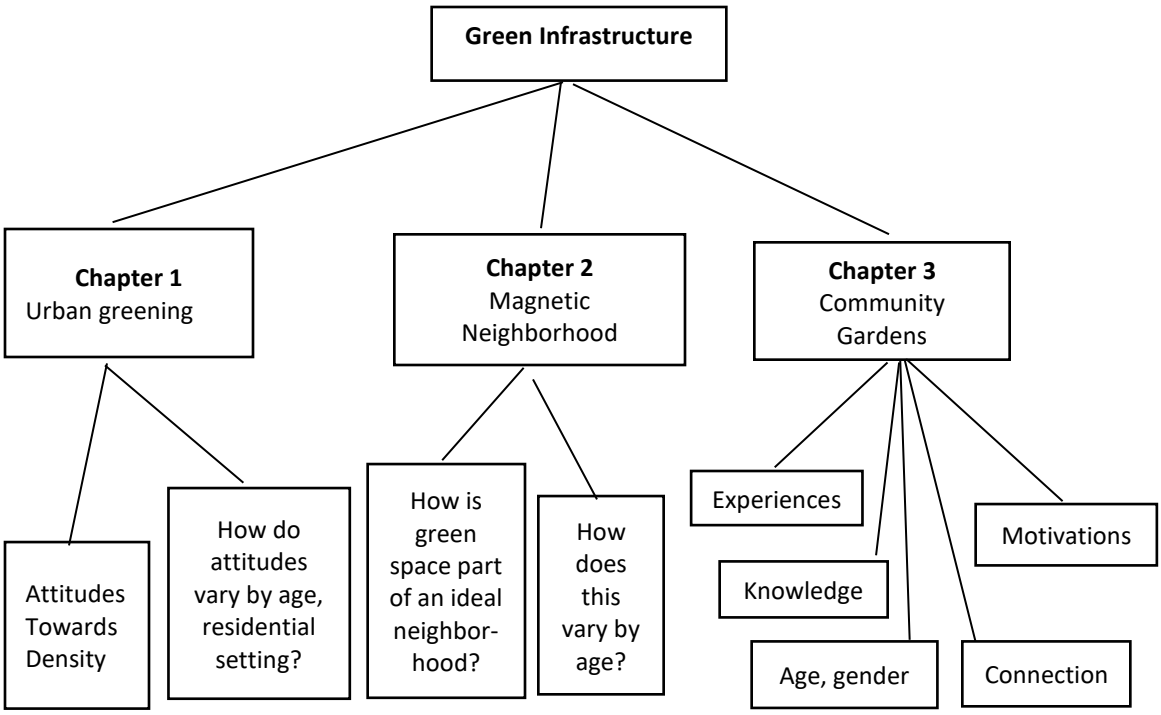


Figure 1.1: Dissertation diagram: Exploring attitudes towards green infrastructure strategies

The Urban tree canopy study and the Magnetic Neighborhood exhibit were associated with the "City Science" EcoTarium Museum exhibit. The City Science exhibit was developed in association with the National Science Foundation-funded project (DRL1323168) called "Pathways: From the Lab to the Neighborhood: An Interactive Living Exhibit for Advancing STEM Engagement with Urban Systems in Science Museums." The goals of the Pathways project were to develop both an interactive experience in association with a museum exhibit exploring issues of urban sustainability and to contribute to larger planning discussions regarding the value of green infrastructure. The project was a collaborative, interdisciplinary effort of contributors from three universities and seven science museums; with museum exhibit designers, landscape architects, and urban ecologists developing interactive ways to convey climate change impacts on human-ecology relationships in urban environments. Within the City

Science exhibit, museum visitors engaged in the practices of urban ecologists and planners in five exhibit design areas exploring urban biodiversity, the urban heat island effect, land use, and neighborhood design.

1.4. Organization of chapters

This dissertation consists of three independent but related studies. Chapter 1 provides the introduction and background for the three studies. Chapter 2 reviews the background literature that informed the three studies and provided the theoretical underpinnings for this work. Chapters 3, 4 and 5 describe the three studies in detail with their respective methods, results, and discussion sections. Chapter 6 looks at research themes and future directions.

Chapter 3 describes the Urban Greening study that employed photo preference methodology to explore attitudes towards the balance of density and urban ‘2greening in residential settings. While there is a fair amount of research about the association between tree canopy and density, the question of whether tree canopy can counteract the aversion to density has not been well studied.

Chapter 4 concerns the results of the Magnetic Neighborhood, a green space planning activity that engaged children, who are an underserved population in participatory planning. While it is clear that children’s lives are heavily influenced by their physical environment, their preferences and attitudes are rarely solicited in planning urban form. To access children’s input, developmentally appropriate and interactive means are important.

Chapter 5 describes the Community Gardening study, which sought to understand attitudes and experiences of community gardeners within the context of an urban community garden network in Providence, Rhode Island. The overall theme of the study was the relationship between the gardeners' participation in community gardening and their perceived life changes due to community gardening. In addition, the conceptual framework of the Reasonable Person Model (Kaplan & Kaplan, 2009) was used to provide a lens with which to view the people-environment relationships in community gardens.

CHAPTER 2

LITERATURE REVIEW and RESEARCH QUESTIONS

2.1. Planning for livable and sustainable communities

2.1.1. Green infrastructure

While current forces of urbanization and climate change have strengthened the imperative for green infrastructure, the concept has deep roots in urban design, landscape architecture and planning. Earlier efforts to balance human habitation with nature were in response to worsening urban environments and public health as the result of urban densification in conjunction with the industrial revolution in Europe and the United States (Austin, 2014). Two prominent proponents, Ebenezer Howard in the United Kingdom and Frederick Law Olmsted, Sr. in the United States, endeavored to design communities which integrated nature, home, work, and recreation situated in settings with green spaces and corridors (Austin, 2014; Howard, 1902; Lawson, 2005). Olmsted's designs of urban parks and parkways such as Boston's Emerald Necklace intended to function and function still as both ecological and anthropogenic restorative spaces. By the end of the 1800s, large scale municipal-park planning, such as the plan for the Minneapolis-St Paul park system by Horace W.S. Cleveland included networks of interconnected greenways and ecologically functioning systems intended to provide optimal urban environments (Benedict & McMahon, 2006). The development of industry in urban areas continued during the following decades until an awareness of the environmental impacts of unchecked resource use and depletion led to the environmental legislation of the 1960s. The greenway movement, articulated in Charles Little's book "Greenways for America"

(1990) influenced planning and implementing green linear corridors for urban transportation routes. The overall concept of green infrastructure has continued to evolve as the framing of the urban nature-human relationship has changed over time (Austin, 2014).

Green infrastructure strategies that take advantage of natural processes, such as filtration of water and shade provision, are responsive to ecological disruption from climate changes. Green infrastructure can provide greater resilience to urban areas; for example, by providing permeable surfaces for water infiltration and heat absorption; as compared to the sheeting and reflective qualities of concrete and asphalt pavement (Childers et al, 2015). The multi-scalar aspects of green infrastructure provide useful functional redundancy (Austin, 2014): at the neighborhood scale, green infrastructure supports human health by providing spaces and elements for stress reduction, strengthens self-sufficiency and provides social benefits such as community building and knowledge sharing (Childers et al, 2015); at the city scale it supports the function of urban ecological systems and processes; while at the regional scale it connects the city to the surrounding regional ecosystems (Lovell & Taylor, 2013).

Urban design can use green infrastructure strategies to contribute to the ecological functioning of living environments at the neighborhood, community and regional scales. However, an inherent challenge in the integration of green infrastructure strategies with dense urban form is that more space may be required in order for the strategies to function effectively (Hamin & Guerren, 2008). For example, networks of green infrastructure elements may be planned to manage increasing precipitation from sea level rise and increased precipitation that may overwhelm existing underground storm water

discharge infrastructure. However, in order for these green infrastructure elements; such as bio swales, flow-through planters and rain gardens; to function effectively, more space may be required as compared to underground culverts. While it is possible to to green the compact city, it requires careful planning and can be difficult to implement once the green space is lost (Haaland & van den Bosch, 2015).

Green infrastructure planning also has an important role to play in changing historic patterns of environmental injustice reflected in urban communities. The creation and ongoing support of green spaces across the socio-economic fabric of urban communities enables crucial planning and societal goals of health equity and environmental justice (Jennings, et al., 2016; Sutton & Kamp, 2002).

2.1.2. Urban ecology

Urban ecology, landscape ecology and conservation biology have their roots in the United States at the turn of the twentieth centuries in the works of biologists such as Henry 'Allen Gleason and Aldo Leopold. Leopold's holistic concept of a "land ethic" described a way of looking at the environment as the setting for all living things, and drew from multiple disciplines including biology, agriculture, forestry, ecology and education (Benedict & McMahon, 2006; Leopold & Udall, 1966). Over the course of recent decades, the concerns and efforts of urban design and urban ecology have merged, in part due to the need to plan for habitable and sustainable cities that can adapt to climate change impacts such as the urban heat island effect, drought, floods, and social impacts on health and well-being (Childers et al, 2015; McPhearson et al, 2016). The integration of ecological knowledge with urban planning and design has evolved using

various forms and terminology including “ecological planning”, the understanding of ecological systems prior to and in conjunction with planning design (McHarg & Mumford, 1969); “landscape urbanism,” arising as an ecologically informed response to New Urbanism; “ecological urbanism” the use of design to connect ecology and urbanism; and “landscape ecological urbanism” which endeavors to have a more holistic emphasis on ecological, economic and social conditions of urban environments (Steiner, 2011).

2.1.3. Sustainability

Sustainability can be seen as a process and broad ideal that links social, environmental and economic integrity, rather than an outcome (Chiesura, 2004). As urban populations grow, the green infrastructure link between design and ecology become all the more important. While sustainability plans have often focused on sectors, e.g. transportation, they may lack both the broader view that connects across sectors and regions, and the small neighborhood scale of urban design (Childers et al., 2015).

While there are many interpretations as to what a sustainable city may be, it is clear that urban sustainability not only concerns ecological functioning but also the lived experiences of the people who live and work in urban regions. Quality of life is part of sustainability and nearby urban nature fills important immaterial and non-consumptive human needs that contribute to quality of life (Chiesura, 2004).

Planning has a significant role to play in creating livable and healthy communities (Wells, Evans & Yang, 2010). Planners can be engaged in decisions about the quantity and quality of urban open space, parks and green corridors that support access to the

healthful benefits of exercise, community gathering spaces and urban agriculture. In turn, this can help address many current health problems in the United States including obesity, diabetes, asthma, heart disease and stroke.

Resilience is an important feature of sustainable cities and refers to the capacity of a system to absorb stress and continue to function in a way that balances economic, environmental and human well-being (Ahern, 2013; Holland, 2004; McPhearson et al, 2016; Steiner, 2011). Creating and sustaining resilient, multi-functional urban form requires an understanding of design as an interactive activity across disciplines and with multiple stakeholders (Ahern, 2007). At a personal and community level, having green spaces integrated into living environments may help provide respite for people under the stress of normal as well as challenging life circumstances, thus providing personal and community resilience (Alaimo et al., 2016; Holland, 2004; Wells, Evans & Yang, 2010).

2.1.4. Neighborhood

The three studies in this dissertation are sited at the neighborhood scale, yet "neighborhood" is a subjective and context-laden spatial concept that is not only spatial, but also bound to community, history, life stage, race and gender (Guest & Lee, 1984; Guo & Bhat, 2007) For the purpose of this dissertation, perhaps a more salient definition of neighborhood is to consider what matters to people over the area that matters to them (Guo & Bhat, 2007).

2.2. Environmental psychology

2.2.1. People-place relationships

The aim of environmental psychology is to explore the relationships between human behavior and the physical environment. The experience of place that people have in their immediate environments, including factors like environmental conditions, crime, violence and access to healthy food, can have important health implications (Jennings et al., 2016). In addition, the environmental conditions, perceived quality of nearby nature and the presence of trees in a neighborhood are associated with the emotional ties; attachment to place; neighborhood satisfaction; and as a sense of community (Jennings et al., 2016; Kaplan, 1983, 2001; Lee et al., 2008).

Research suggests that there are three kinds of direct experience of nature that may contribute to a decreased experience of stress, support a sense of well-being; cardiovascular benefits and improved mental health: 1) those from "indirect interactions" such as a view from window of home or work, 2) "incidental interactions" with nature that occur such as walking by a street tree; and 3) "intentional interactions" where people visit a park or garden (Cox et al., 2017; Kaplan, 1993, 2001). Cox et al (2017) suggest that the amount and kinds of nature-person interactions among urban residents are the result of both orientation, with some people being more inclined toward nature interaction; and opportunity, which is linked to access.

In some respects, the fields of planning and environmental psychology have complementary ways of seeing people-place relationships. While planning tends to look at the relationships between the environment and people system wide (e.g. transportation), institutions (e.g. policy); or in terms of the public in general;

environmental psychology tends to look at those relationships at the individual level, and the degree to which the environment supports the needs of the individual. Churchman (2002) suggests that one way to look at the nexus between planning and environmental psychology is through the Ecological Systems framework of psychologist Urie Bronfenbenner. According to this model, planning focuses on the "macro-system" level of larger environments, such as the institutions of the culture and economy in which one lives; or "exosystem", which includes the social and physical settings of the neighborhood; while environmental psychology focuses on the "microsystem", which relates to relationships between people and their immediate environments such as home, neighborhood, school and workplace (Bronfenbrenner & Morris, 2006). With this model in mind, the neighborhood would be the smallest of the units that planners usually focus on, while for environmental psychology the neighborhood would probably be the largest unit. (Churchman, 2002).

2.2.2. The Reasonable Person Model conceptual framework

The work of environmental psychologists, Stephen Kaplan and Rachel Kaplan, in people-environment relationships and the influence of nature on human health and functioning underpins the Reasonable Person Model conceptual framework (1989, 2001, and 2008). Their research is the foundation of a legacy of research into people-nature relationships including the influence of nature to support more harmonious relations in inner city projects (Kuo and Sullivan, 2001); psychological resilience to cope with stress (Wells & Evans, 2003), and worker satisfaction (Kaplan, 1993). The Reasonable Person Model (RPM) is a conceptual framework that seeks to describe conditions that support

people to be at their best, both individually and in a group (Kaplan & Kaplan, 2009). According to the RPM, people are especially motivated by three domains of information: 1) to explore and understand what is going on; 2) to learn and discover at one's own pace and gain a sense of competency and clarity, and 3) to participate in an activity that is important to oneself, to be respected and to take meaningful action. The Kaplans suggest that "reasonableness" characterizes the state of balance that is possible when the three domains are present and mutually supportive (Kaplan & Kaplan, 2011).

This model suggests a way to look at the acquisition of understanding, and the capacity for empowerment which can inform public participation and planning. The RPM proposes that when participants feel that their contributions are respected and valued, they are more likely to want to participate. In addition, a mutually reinforcing loop of respect and participation can provide the foundation for future participation and provide the basis for making a difference in small to larger contexts.

The studies were conducted in Massachusetts and Rhode Island. The Urban Greening study (Chapter 3) and the Magnetic Neighborhood study (Chapter 4) were sited at the EcoTarium Museum in Worcester, Massachusetts. The siting of the studies at the EcoTarium science museum provides an intriguing setting to explore the balance of density and urban greening in residential settings; and to explore green space planning in a hands-on museum activity. Informal learning environments, such as museums, create opportunities for lifelong learning and can introduce, incorporate and link urban sustainability issues to provide an accessible and engaging introduction to the subject (Falk & Dierking, 2010). The Urban Greening photo survey was also administered at the University of Massachusetts, Amherst in the Landscape Architecture and Regional

Planning Department. The Community Garden study was conducted in community gardens in Providence, Rhode Island.

The three studies were conceived as investigations into personal experiences with green infrastructure strategies. The study participants vary by age and background, and care was given to include portions of the public who are normally under-represented in planning, such as children and marginalized urban community members. The first of the studies (Chapter 3), explores people's preferences for urban greening in association with residential density.

CHAPTER 3

EXPLORING PREFERENCES FOR URBAN GREENING

3.1. Introduction

There can be tension between the notion of a compact city, recommended by planners, and people's desire for living in spacious, green and quiet areas (Kabisch et al., 2015; Van den Berg et al. 2007). The potential ecological and community sustainability benefits of densification are notable: reducing urban sprawl, improving transportation efficiencies, encouraging pedestrian and bicycle transportation, preserving existing rural green space, reducing community isolation and supporting economic and environmental equity (Churchman, 1999; Daniels, 2001; Cheng, 2010; Neuman, 2005; Benedict and McMahon, 2006; Kytta & Broberg, 2014). However, the promotion of density does not always consider differences in land use patterns, physical design (Neuman 2005), and the personal preferences of urban residents. The goal of this study was to explore whether urban greening helps to ameliorate negative perceptions of density in an imagined ideal residential setting. Landscape photo preference methodology was used to elicit preferences for visual spatial form that includes neighborhoods with a range of density and greening.

This study was developed in association with a National Science Foundation-funded project (DRL1323168) called "Pathways: From the Lab to the Neighborhood: An Interactive Living Exhibit for Advancing STEM Engagement with Urban Systems in Science Museums." The Pathways project was a collaborative effort of three universities, seven science museums, with museum exhibit designers, landscape architects, and urban ecologists working interdisciplinary to explore climate change impacts on human-

ecology relationships in urban environments. The goal of the Pathways project was to develop both an interactive experience in association with a museum exhibit exploring issues of urban sustainability as well as to contribute to larger planning discussions of the value of green infrastructure and compact development.

3.2. Literature review

3.2.1. Urban densification

The current interest in planning for compact development and densification of existing cities arises from the trend of increasingly urbanized worldwide habitation (Wheeler, 2013). Towards that end, municipal planning policies may encourage high density, mixed use developments, efficient mass transportation systems and the promotion of walking and bicycling (Duany et al., 2000; Haaland and van den Bosch, 2015). Urban densification has been promoted as more energy efficient due to proximity of work, homes and commerce; being more practical for public transport connectivity (van den Berg et al., 2007); reducing suburban sprawl; and supporting community cohesion and satisfaction (Jacobs, 1961; Duany et al., 2000; Dovey & Pafka, 2014).

While planners may favor density, exactly which groups of the public like a denser environment and which prefer less density is not well understood. Partly this is because density can be an elusive concept with many definitions, metrics and scales across the disciplines of planning, design and environmental psychology (Churchman, 2002; Dovey & Pafka, 2014; Waters, 2016). While density can be quantified in terms of the concentration of buildings, neighborhoods and populations in a given unit area,

density is experienced via the interrelationships between urban form, human well-being and environmental sustainability (Pafka, 2013; Dovey & Patka, 2014; Boyko & Cooper, 2011), and is fundamentally relative, subjective and context-dependent (Churchman, 1999; Lawson, 2010). The concept and experience of density may be especially evocative because it can be associated with negative consequences of overcrowding such as lack of privacy, noise, congestion, territoriality and troublesome neighbors; and because of the historically powerful association in the United States between having a single-family home and a middle-class lifestyle (Churchman, 1999; Cheng, 2010; Lindsay et al., 2010; Haaland & van den Bosch, 2015).

3.2.2. Urban greening

Interestingly, a renewed appreciation for the role of urban greening has grown contemporaneous to the promotion of urban density. Networks of green infrastructure in increasingly urbanized societies have been proposed to improve both quality of life (Kuo & Sullivan, 2001; Chiesura, 2004; Lohr et al., 2004) and ecosystem health (Wheeler, 2013; Nowak et al., 2006; Alberti & Marzluff 2004). Research suggests that urban forms that integrate moderate mixed-use density with ribbons and corridors of multi-purpose green infrastructure may best support healthy communities and climate change resilience (Hamin & Gurran, 2008). However, familiar patterns of environmental and spatial injustice are evident at the small scale of urban residential neighborhoods. Neighborhood greening tends to be found in neighborhoods with higher socio-economic factors (Landry & Chakraborty, 2009; Danford. et al., 2014; Shanahan et al., 2014) and the availability and prioritization of funds may determine the installation and maintenance of

neighborhood greening (Heynen et al. 2006). When neighborhood greening is implemented it may lead to gentrification, resulting in residents no longer being able to afford their greener neighborhoods (Haaland & van den Bosch, 2015).

Healthy street tree canopies in compact neighborhoods can integrate the valuable attributes of green infrastructure and nearby nature into urban settings. This is significant because more than half of all available green space in many cities is located in residential areas (Lin et al., 2017). Urban tree canopy and greening contribute to various ecosystem, sustainability, and personal benefits, including improving air quality and carbon sequestration (Nowak et al., 2006), decreasing storm water runoff (Benedict & McMahon, 2012), providing biodiversity and habitat for avian species (Alberti & Marzluff 2004), contributing to water and energy conservation (Akbari et al., 2001), and providing relief from the stressors of insufficient privacy (Kaplan, 2001; Ryan, 2002).

3.2.3. Landscape preference methodology

In addition to knowing about the benefits of green infrastructure in compact settings at the planning scale, it is important to understand the attitudes of citizens who live their lives within these settings. Landscape preference methodology enables elicitation of public feedback on landscape and design preferences in order to guide planning and decision making about visual impacts (Daniels & Vining, 1983). This method has its origin in the work of environmental psychology and has been used to explore the values behind preferences for certain elements and assemblages in the natural and built environments (Gerson et al., 1977; Kaplan & Kaplan, 1989; Kaplan et al., 1998; Walker & Ryan, 2008). Previous landscape preference research indicates that not all

settings are equally preferred: natural environments are generally preferred over built environments (Ulrich, 1986; Kaplan et al., 1998); buildings with vegetation tend to be preferred over those without (Kaplan & Kaplan, 1989); and street canopy may impact the perception of thermal comfort (Klemm et al., 2015).

3.2.4. Literature summary and research questions

In summary, while densification may provide many benefits by supporting environmental and economic sustainability; promoting exciting community life; and providing access to services and public transportation; there is tension between the idea of the compact city and people's inclinations towards nature, privacy, quiet and space. Tree canopy and other forms of greening can provide environmental and health-related benefits for urban residents. The goal of this exploratory study was to contribute insights to the planning and design of urban greening in compact residential settings in order to support user needs and preferences. Data analysis allows insight into what types of people prefer which types of neighborhoods. The following research questions structured this study (Figure 3.1):

1. What qualities characterize the images ranked most and least preferred overall?
2. What neighborhood types emerge from photos of neighborhoods that depict various levels of greening and density?
3. Do density and amount of green predict preference?
4. What is the relationship between demographic factors (participants' age, gender, community type and housing type) and neighborhood type preference?

5. Using digitally altered preferences, what is the relationship between the amount of greening and preference?
6. What themes emerge when participants reflect on their photos preferences?

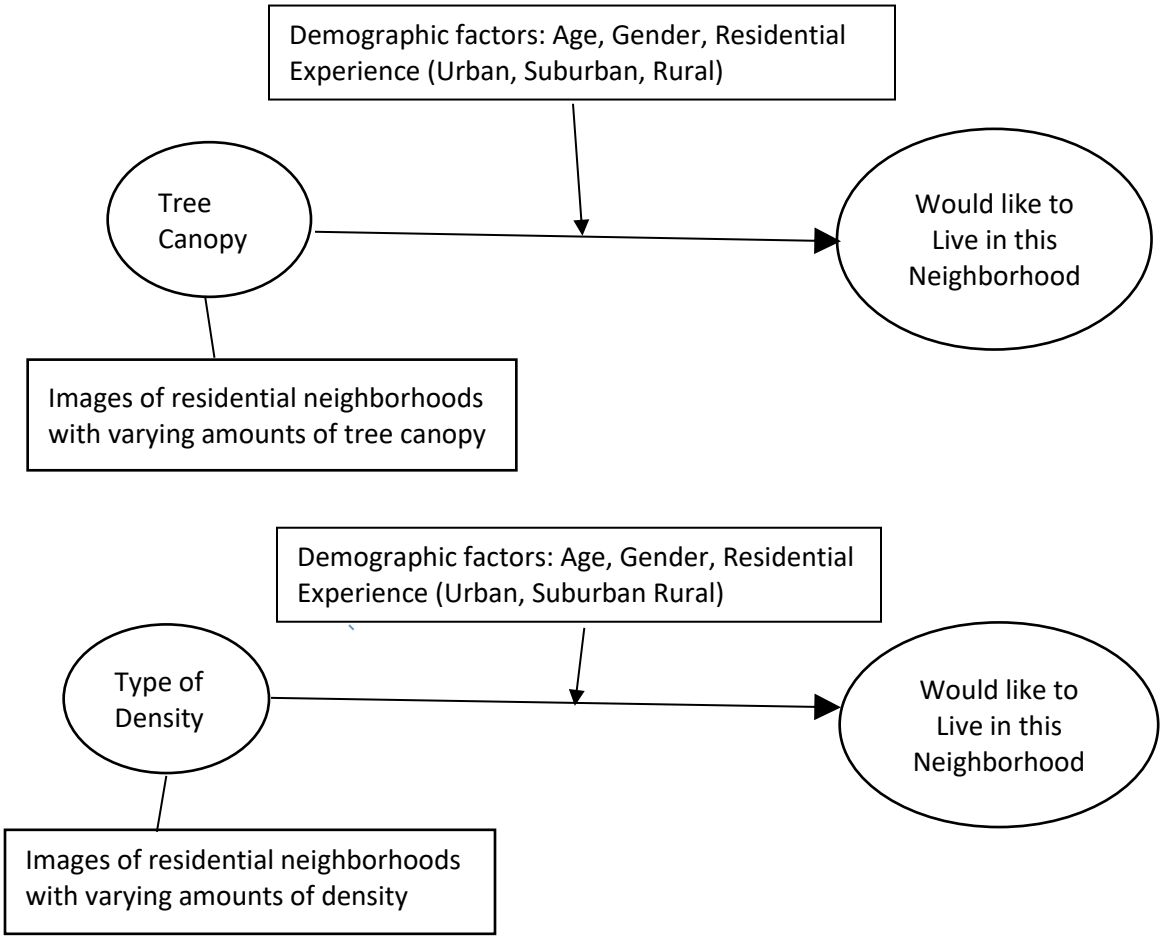


Figure 3.1: Research diagram: Exploring preferences for urban greening

3.3. Method

3.3.1. Setting

The origin of the study was associated with the prototyping of the "City Science exhibit", which was located at the EcoTarium Science Museum in Worcester, Massachusetts. This regional museum has approximately 130,000 visitors per year and is

located in a city with the second largest population in New England. Data was collected at three study sites: the EcoTarium Museum (45% of the total participants), two public gatherings in the City of Worcester (16% of total participants) and two classes in the Department of Landscape Architecture and Regional Planning at the University of Massachusetts, Amherst (39% of total participants).

3.3.2. Participants

A total of 212 people participated in the study of whom 87 (41%) were male and 123 (58%) female. Unusually, the study included children. The participants' ages in years ranged from 5-11 (8%); 12-17 (19%); 18-25 (39%); and 26 and older (38%). Participants came from the following community types: urban 29%, suburban 54%, and rural 14%. The Worcester participants were self-selected – they chose to attend a family science museum or civic festival and to participate in the photo survey. The participants in Amherst were students within the Department of Landscape Architecture and Regional Planning.

3.3.3. Constructs and measures

A survey instrument was developed to explore participants' levels of preference for greening and density in residential settings. The survey was composed of two parts. First, there was a photo survey with 24 images of residential and mixed use neighborhoods in Massachusetts and Rhode Island with varying degree of external density and greening (Appendix A). Accompanying the photos was a two-page survey with which participants recorded their residential setting preferences for the 24-images

and recorded demographic information. In addition, the survey had two short-answer questions in which participants recorded why they rated some photos high and some photos low in preference (Appendix B).

The two independent variables, density and greening, were varied in the photo images of the residential neighborhoods. The dependent variable was preference for residential settings.

The construct of density was operationally defined by asking thirteen professors from the Department of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst to rate each of the images for density (Appendix C). The density value of each photo was calculated as the mean score, on a scale of 1 (not at all) to 5 (very much), that resulted from combining the density ratings. It is not known whether the survey participants would have perceived the same density as the professors, who by virtue of their expertise in planning and design bring previous knowledge and assumptions to the task of rating density. A variety of building styles and setbacks were represented in the photos. The neighborhood image with the lowest density was a single family home surrounded by lawn, and the image with the highest density was a large, four-story housing complex. It should be noted that the neighborhoods represented in the photos reflected the range of neighborhood densities and types of the Worcester area, and so did not include extremely dense urban neighborhoods or rural neighborhoods.

The second independent variable, greening, refers to the amount of tree canopy and vegetation in each image. Some photos were manipulated to incorporate more greening and some were used in a previous project (Cheng et al., 2017). Greening was

operationalized by using Adobe Photoshop to calculate the percent of greening, relative to the total image area.

The dependent variable, preference for residential settings, was measured by responses to the 24-photo survey. The images were chosen with the intent to reflect typical residential types in the study area, in order to relate to the life experiences of the local participants. Survey participants indicated preference for each image in response to the prompt: "Please circle the choice that describes how much you would like to live in a neighborhood such as those shown in the pictures" on a 1-5 Likert scale: (1) not at all, 2) a little, 3) somewhat, 4) quite a bit, 5) very much).

3.3.4. Analytic strategy

First, descriptive statistics were used in order to explore how study participants ranked the photos for preference. Second, a factor analysis was conducted to determine whether neighborhood types emerged from photos with various levels of greening and density, and to what extent these types might be associated with preference. Third, t-tests and one-way ANOVA were used to explore the relationships between demographic characteristics (gender, age, residential setting, home style, survey setting) and participants' neighborhood type preferences. Fourth, paired t-tests were conducted comparing the preference ratings of seven pairs of images, an original image and the same image with digitally added greening, in order to explore the relationship between greening and preference. Fifth, content analysis was conducted on the responses to the open ended questions to explore emergent themes and associations.

3.4. Results

Frequency and descriptive statistics were used to explore the first research question: what qualities characterized the images that were ranked most and least preferred overall? The three photos with the highest overall means (Figure 3.2) included two versions of the sole single family house in the survey, with and without additional greening (P13 and P5) and a photo of a neighborhood built in the New Urbanism style (P15).

P13 mean 3.41 P15 mean 3.22 P5 mean 3.09

Figure 3.2: The three most preferred scenes

A review of the three photos with the lowest overall means (Figure 3.3) share characteristics of narrow buffer between the street and housing and minimal greening.

P12 mean: 2.17 P19 mean: 2.16 P23 mean: 1.83

Figure 3.3 The three least preferred scenes

After exploring overall preference rankings, the study looked at research question two: what neighborhood types emerge from photos of neighborhoods that depict various levels of greening and density? A principal-axis factor analysis with Varimax rotation resulted in both data reduction and the aggregation of photo groups from the pattern of image preferences into five neighborhood types (Table 3.1). When Cronbach's alpha was calculated to assess the reliability of the preference ratings the scores were relatively high for all types, suggesting that there was internal consistency in the factor analysis groupings. A total of six photos did not group into any neighborhood type: one was in a type of its own; another had too low a loading to fall into any neighborhood type; and four photos had dual loads. While none of the neighborhood types were highly preferred, the images were not chosen to depict ideal settings across multiple dimensions. Rather, they were chosen as typical settings that the survey participants may have seen or lived in, with a range of density and greening characteristics.

Certain patterns emerged in the neighborhood types from the factor analysis. The first neighborhood type was characterized by multi-family units, with significant greening. The second type had duplex/triple decker detached homes, with street and sidewalk frontage. The settings in the third neighborhood type had downtown apartment blocks with mature tree canopy. The fourth type, which yielded the lowest mean preference score as compared to the other types, had multi-housing units in large complexes, in close proximity to the street and small vegetated setbacks. The single family home neighborhood type, which had the highest preference score of the five types, was composed of two photos of the same single family home with lawn and trees, one of which had additional trees digitally added.

Table 3.1: Neighborhood types derived from factor analysis, percent green and mean density

Neighbor-hood Types	Pref-erence Mean	Cron-bach's Alpha	Photos	Example of neighborhood type	Photo Mean	Load-Ing	% green	mean density rating
Multi-Family Units Eigenvalue: 7.925	2.549	.813	P24		2.22	.624	43.59	3.17
			P 7		2.44	.618		
			P17		2.70	.593		
Duplex/ Triple Deckers Eigenvalue: 2.615	2.426	.789	P21		2.46	.782	19.76	3.12
			P10		2.25	.641		
			P 3		2.71	.564		

Neighbor-hood Types	Pref-erence Mean	Cron-bach's Alpha	Photos	Example of neighborhood type	Photo Mean	Load-Ing	% green	mean density rating
Downtown Apartment Blocks Eigenvalue: 1.858	2.777	.737	P20		3.06	.780	54.97	4.00
			P 2		2.48	.744		
Multi-units in large complex Eigenvalue: 1.443	2.372	.811	P12		2.17	.685	27.73	3.77
			P11		2.59	.652		
			P 1		2.36	.598		
Single Family Homes Eigenvalue: 1.060	3.254	.815	P 5		3.09	.963	60.35	1.58
			P13		3.41	.692		

Research question three sought to tease apart the independent variables of greening and density in predicting neighborhood type preference. In order to do this, the composite percentage greening and mean density ratings for the neighborhood types were calculated (Figure 3). The single-family homes neighborhood type ranked highest for preference and percent green; as well as lowest in mean density. Interestingly, the opposite of these attributes did not cluster: the neighborhood types with the lowest mean preference, the multi-unit in large complex, did not have the lowest mean percent green or the highest density score. This suggests that while more greening and lower density may be highly preferred, their lack does not necessarily mean that a neighborhood will be least preferred. Rather, it may be that a strategic use of greening; and the dynamic relationship between greening, density and neighborhood design, can help buffer the perceived consequences of more dense living environments.

The study participants spanned a range of ages and backgrounds, prompting the fourth research question: What is the relationship between demographic factors (participants' age, gender, community type and housing type) and neighborhood type preference? A one-way between subjects ANOVA test was conducted to assess the relationship of gender on neighborhood type preference, and did not yield a statistically significant result at the .05 significance level. When the same test was used to explore the relationship of age on neighborhood type preference, there was a statistically significant result for the young adults group (ages 18-25) at the $p<.05$ [$F(4,201)=5.650$, $p<.001$] as compared to the 26-60 years-old and the 60+ age groups. In terms of the two study sites, Worcester and Amherst, an independent t-test was conducted to compare the neighborhood type preference ratings for the study participants, finding that the

preferences of the study populations from the two locations did not differ to a statistically significant degree. A one-way between subjects ANOVA conducted to compare the association of participants' community type (city, suburb and rural residents) on neighborhood type preference yielded statistically significant results at the $p < .05$ level for multi-family units [$F(2, 140)=10.903$, $p<.001$] and multi-units in large complex [$F(2, 153)=6.779$, $p=.002$] (Table 3.2). In both neighborhood types, the differences between the city residents and rural residents were of statistical significance; as were the differences between suburban and rural residents. A one-way between subjects ANOVA was also conducted to compare the association of participant housing (house, apartment and condo) and neighborhood type preference. There was a statistically significant effect of housing on neighborhood type preference at the $p < .05$ level for the multi-family neighborhood type between participants who live in houses and apartments [$F(2,188)=5.098$, $p=.007$].

Table 3.2: Significant relationships between demographic factors of residential environment and housing type and neighborhood type preference

	mean difference	**f**	**d.f.**	**p value**
Residential environment: city vs. rural				
Multi-family units	.85375	11.516	2	<.001
Multi units in large complex	.7984	6.779	2	.002
Residential environment: suburban vs. rural				
Multi-family units	.83741	11.516	2	<.001
Multi units in large complex	.74425	6.779	2	.003
Home type: apartment vs. house				
Multi-family units	.41293	5.098	2	.01

The goal of the fifth research question was to isolate the greening variable: what is the relationship between the amount of greening and preference with respect to the settings in the seven pairs of images with digitized greening added? Two-tailed paired t-tests were conducted with each of the pairs of original and greened photos (Table 3.3). The results of the paired photo comparisons indicated that the addition of trees consistently improved the overall preference ratings for the settings. T

Table 3.3: Paired photos with additional greening

Original photo	**Digitally manipulated photo with more greening/trees**	**t**	**df**	**p value**
 P1 mean: 2.36	 P11 mean: 2.59	3.796	210	<.001
 P21 mean: 2.46	 P3 mean: 2.75	3.755	208	<.001
 P5 mean: 3.09	 P13 mean: 3.41	4.815	206	<.001

Original photo	Digitally manipulated photo with more greening/trees	t	df	p value
 P23 mean: 1.83	 P6 mean: 2.87	11.832	207	<.001
 P24 mean: 2.22	 P7 mean: 2.44	2.965	208	.003
 P19 mean: 2.16	 P8 mean: 2.49	4.848	207	.01
 P12 mean: 2.17	 P22 mean: 2.55	4.975	29	.01

Finally, the study used short answer questions to explore research question six: what themes emerge when participants reflected on their photos preferences? While this type of semi-qualitative data cannot support causal hypotheses, it can suggest clues as to how meaning is made and used (O'Cathain & Thomas, 2004; Dovey & Pakfa, 2014; Yin,

1999; Marshall & Rossman, 2016). Content analysis was conducted on responses to the open ended questions and yielded emergent themes of greening, privacy, crowding, safety, housing characteristics, pavement, intangibles and capacity to provide amenities that were important to the participants.

3.5. Discussion

Increasing urban canopy and greening addresses green infrastructure needs while sustainable development points to higher density neighborhoods. This study sought to understand how people of all ages would rank settings with a variety of density, greening and housing styles when prompted to imagine living in those neighborhoods. Five distinct neighborhood types, composed of 18 of the 24 images, emerged from the data analysis. Efforts were made to separate the independent variables of density and greening; and to ascertain whether there was a relationship between demographic factors and neighborhood type preference. Qualitative responses to short answer questions were examined in order to provide insight into the personal values underpinning the preference ratings.

3.5.1. Greening and preference

In general, greener settings were more preferred than less green settings. The seven pairs of original and digitally-greened photos provided the clearest view of this inclination towards greening, with participants consistently preferring the digitally greened images over the original images. By using this paired-photo technique, a methodological challenge in photo preference research was addressed: the potential for

image variation due to camera angle, time of day, weather and subject. Using the paired comparison, the association between greening and image preference could be seen more clearly because the other elements of the image remained constant. The added digitized greening, consisting of one or two small to mid-size deciduous trees between the housing and street, at times partially obscured the view of the housing, or provided a vegetative element in an otherwise hardscape setting. The greening was intentionally done at a minimum scale in order to approximate a feasible neighborhood greening intervention. These results lend support to the notion that even modest neighborhood greening efforts can contribute to more highly preferred residential settings.

3.5.2. Density and preference

Untangling the association of density and preference was less straightforward. While the single family neighborhood type with the highest green and lowest density had the highest preference, there was not a simple linear relationship between amounts of density, greening and preference. For example, the neighborhood types with the lowest mean preference, the multi-units in a large complex, did not have the lowest mean percent green or the lowest density score. Likewise, the downtown apartment block type rated highest in density, was second in percent greening and second in overall mean preference. This suggests that while more greening and lower density may be preferred, their lack does not necessarily mean that a neighborhood will be non-preferred. Rather, it may be that the dynamic relationship between housing type, density and a strategic use of greening, can help buffer the perceived consequences of more dense living environments.

This supports promoting urban neighborhood greening in compact residential environments in conjunction with thoughtful design of residential spatial form.

Some of the results suggest that perceived density is influenced by previous life experiences (Churchman, 1999). First, urban residents rated all the images higher than the participants who reside in suburban and rural settings. Also, apartment dwellers rated the higher density settings more favorably than the non-apartment dwellers, perhaps due to familiarity with higher density residential neighborhoods. Second, there were statistically significant differences in the way that participants of the different residential conditions (city, suburb and rural) rated two of the denser neighborhood types: the multi-family units (moderate density, greening, setback from street) and the multi units in a large complex (higher density, less greening, narrower setback). Third, there were statistically significant difference in preference for the multi-family type by participants who live in houses and apartments; suggesting that while house dwellers may not perceive the multi-family type with high preference, apartment dwellers view this neighborhood type more favorably.

The participants' short-answer responses may provide clues to the attitudes underlying these results. When participants were asked to identify why some settings were rated higher for preference, participants wrote of positive associations with the more dense settings because they evoked memories of similar settings, because they supported sustainability, and because they liked the closer proximity to other people. The preference scores of participants from the two study cities, Worcester and Amherst, did not differ significantly, perhaps because both populations had a mix of people from rural, suburban and urban settings.

In addition to the role of previous life experience in neighborhood preferences, participant age, associated with life-stage linked affordances, may have played a part. The images in the downtown apartment block type were more highly preferred by participants in the 18-25 year-old age group than any other, and the single family homes type appealed less to this age group than to both younger and older participants. It seems reasonable that this young adult age group would find the amenities of a downtown apartment block area attractive; such as the potential for a lively, engaging public life and access to employment and public transportation. The short answers support this idea, with comments less favorable towards the less dense environments, because they are boring or uneventful; and more favorable towards the downtown street as being more interesting and lively. On the other hand, many participants from the age groups other than the 18-25 group preferred the single family neighborhood type and wrote comments regarding preference for a place for children to play, trees to climb, and lawn; aversion towards potentially dangerous traffic; as well as concerns for safety and limited outdoor space.

The most frequently cited themes in the short answer data concerned greening, privacy, crowding, safety, housing characteristics, pavement, intangibles and capacity to provide amenities that were important to the participants. The most frequently mentioned theme overall was centered on greening: both in the value of having greening and the negative association with its absence. Within the greening theme, trees were the most frequently mentioned element, followed by green space, yards, nature and grass. The high frequency of trees as compared to other greening elements, follows previous research highlighting trees as a highly valued green element (Kaplan, 1983).

Density concerns were also evident in the short-answers, including thoughts about privacy, dwellings, neighbors; and proximity of the housing to the street. The comments that clustered in this theme align with previous research, that the perception and experience of density are related to both the interrelationships between the buildings and people, in the context of the setting (Pafka, 2013; Dovey & Pafka, 2014) as well as social elements, such as concerns for privacy territoriality and social hierarchy (Cheng, 2010). However, the comments about privacy were nuanced. Similar to previous research (Lawson, 2010) the participants' concerns were not necessarily about a desire for personal isolation but rather having the means to have some sense of control over boundaries in interpersonal contacts and in daily spatial experience.

The housing theme was expressed in comments about housing type (e.g. single family versus attached), apparent age, style and aesthetics. Pavement appeared as both a positive attribute, for example accessible sidewalks and enough room to park; as well as a negative attribute, such as pavement that was excessive or poorly maintained. Some responses were grouped in the theme of intangibles, with descriptors ranging from exciting, peaceful, quiet, welcoming and family-friendly; to depressing, noisy, bleak and boring. Some participants assessed the settings by whether they would support affordances that were important to them, such as a sense of community, having a yard in which children could play, or a tree to provide cooling shade. Interestingly, the affordance theme often overlapped with the greening theme, for example, a preference for green space to socialize with friends. It may be useful to consider the land use characteristics that support both affordances and greening as a guide for making urban residential neighborhoods more preferred.

3.5.3. Limitations and future directions

This aim of this study was to explore the relationship between the independent variables of greening and density, and the dependent variable of preference for residential settings. The study began in concert with the prototyping of an urban ecology exhibit at a regional science museum and was modestly scaled to work in that setting and with a population that spanned all ages. The study population grew to include participants from the Worcester downtown area and students at the University of Massachusetts, Amherst, which broadened its demographics, while retaining the original simple survey instrument. To further interpret the results several potential limitations should be considered in this exploratory study design.

While most potential threats to internal validity, including temporal precedence, selection, maturation, regression, attrition, testing, and instrumentation do not appear to be a concern, the extent to which history (i.e., the chance that something happened during the time that the surveys were taken, that might have influenced the preference ratings) is not clear. The seven pairs of images were mixed among the 24 photos and were never adjacent to each other, however, some participants voiced recognition that some of the photos were duplicated with more or less greening. It is possible that participants who recognized the greening difference between the photo pairs, may have viewed the second of the pairs differently than if there had not been paired photos.

While most potential threats to construct validity do not appear to be a concern, there are two potential threats that should be considered. The selection of photos in photo preference methodology is important, complex and inherently subjective. The study was based on various levels of the greening and density in images of residential

neighborhoods and photo preference. Efforts were made to isolate the potentially confounding variables of greening, by digitizing the photos for percent green; and density, by having design professionals render a perceived density score for each photo. However, there was a potential threat of inadequate explication of the density construct because design professionals may have had background and knowledge that result in perceptions of residential density that differed from those of the non-expert survey participants. This research could be improved in the future by asking the participants to rate the photos for density, as well as overall preference, thereby disentangling the characteristics of expertise and perception of density.

A second threat to construct validity was posed by the potential for construct confounding. Construct confounding refers to failing to describe all of the constructs that may result in drawing inaccurate inferences from the existing constructs. In this study, potential confounding factors that were not accounted for include characteristics of housing. In order to capture typical neighborhood types in the study area, the images captured in the photos had different styles and age of housing, which may have influenced the preference ratings. For example, the second most preferred photo was from a neighborhood built in the New Urbanist style, with a modest vegetated buffer, low fence, front porch and characteristic architectural detailing. In this case and others, the preference ratings did not reveal to what extent participants' photo preferences were associated with housing style. This potential for construct confounding may have compromised the inferences that can be drawn about the relationship between the constructs of greening and density; and preference. The short answer portion of the

survey did provide insight into the personal values underlying the ratings, and architectural style was a theme among reasons that an image was more or less preferred.

The portion of the study that may be the least vulnerable to a threat to construct validity includes the seven pairs of original and greened residential settings, in which the original images served as a control treatment. Since the only feature that had changed in the pairs was the addition of digitized greening, the differences in the preference means between the original and greened photos can be attributed to the treatment of greening.

Threats to external validity may compromise the degree to which inferences from the study may apply beyond the study population and setting. In this study, the participants were not a randomized population sample, they were people who chose to visit a regional science museum, to stop by a table at a public event, or to take a class within the department of Landscape Architecture and Regional Planning at the University of Massachusetts, Amherst. As such, the findings of this modest study can only be seen in the context of the study participants and may not generalize to the general population or to other regions of the United States or the world. In order to improve the external validity of the study, the photo survey could be conducted in other settings with other population groups.

3.6. Conclusions

It is clear that people care about how they live in proximity to neighbors and nature. Previous life experience, life stage and anticipated environmental affordances all seem to play a part in preference for residential neighborhood types. While people's inclination towards greening is well documented in research, many urban residential

neighborhoods, including those in the study City of Worcester, have minimal to non-existent greening.

If planning for higher densities is going to succeed in being implemented, people will need to choose it – even if they have the means to choose lower densities. The results suggest several strategies for potentially making higher density residential neighborhoods more preferred:

- The presence of a green canopy and neighborhood greening was highly preferred, it was seen as providing nearby nature, beauty, a buffer from crowding and cooling shade.
- A vegetated setback from the street can help provide a buffer between public and residential spaces and provide multiple ecological benefits. Housing that abuts the street consistently received lower preference ratings from all respondents.
- Privacy was important to people. While many appreciated the amenities of urban life, there was a strong preference for settings that afforded a sense of a safe and protected haven with greening or spatial form. There are attainable methods to support privacy needs including modest greening and provision of vegetative buffers, however these solutions will not automatically be present in the urban residential fabric without deliberate intent and follow through.
- Scale also seemed to matter. Multi-units in larger complexes were less preferred.

A robust body of research suggests that urban greening supports green infrastructure goals and that contact with nature contributes positively to personal well-being. However, efforts to garner support for urban greening are not always successful and urban greening is inequitably distributed along the urban socio-economic gradient.

This points to the importance of street trees and residential greening to provide localized, incidental access to nature. In recognition of historic and ongoing economic inequities among urban communities, this study supports the value of the public provision of vegetation, for example municipal and community tree planting, especially for underserved neighborhoods. If we listen to the call of urban planner Anne Whiston Spirn (2017) to take on the goal of designing cities as life sustaining and life enhancing habitats, incorporating a robust and equitable network of greening at the neighborhood scale is a start.

CHAPTER 4

GREEN SPACE AS PART OF AN "IDEAL NEIGHBORHOOD" IN AN INTERACTIVE MUSEUM EXHIBIT

4.1. Introduction

Planning for a sustainable urban future requires understanding the types of neighborhoods that local residents imagine as ideal or preferable. Often times, certain segments of the population, especially children and adolescents, are left out of public participation and visioning processes. Therefore, this study explored the use of one participatory planning and design activity in which youth participants constructed an ideal neighborhood.

Best practices for participatory planning have an underlying concern for the marginalization of participation and input from less resourced communities: one of these groups is children (Derr & Kovacs, 2017; Frank, 2006; Hart, 1992; Mueller & Dooling, 2011). While approximately half of the world's children live in urban environments, they are often segregated from public places and they are not typically included in planning processes (Derr & Kovacs, 2017; Frank, 2006; Knowles-Yanez, 2005; Simpson, 1997). Yet the lives and health of children, in both the present and future, are heavily influenced by the land use decisions of policy makers and planners (Chawla, 2002; Sutton & Kemp, 2002; Wells, Evans & Yang, 2010). The neighborhood is a salient setting for exploring children's experiences and attitudes in residential planning, because children's lives are lived at the neighborhood scale and children may have limited experience, mobility or

perspective beyond the neighborhood (Christensen, Mygind & Bentsen, 2015; Ellis, 2004).

The purpose of the study was to contribute to knowledge about children's' preference for neighborhood spatial form. The method used for this purpose was the "Magnetic Neighborhood" planning activity, which was designed and implemented as part of the "City Science" exhibit at the EcoTarium Science Museum, in Worcester, Massachusetts. In addition, the study considers how this activity could be applied in the larger planning context beyond the museum setting.

The Magnetic Neighborhood was a hands-on, self-directed museum exhibit activity in which participants used magnets imprinted with various land uses to assemble their personal "ideal neighborhood." The Magnetic Neighborhood exhibit was part of the City Science museum exhibit which was developed in association with the National Science Foundation-funded project (DRL1323168) called "Pathways: From the Lab to the Neighborhood: An Interactive Living Exhibit for Advancing STEM Engagement with Urban Systems in Science Museums." The goals of the Pathways project were to develop both an interactive experience in association with a museum exhibit exploring issues of urban sustainability and to contribute to larger planning discussions regarding the value of green infrastructure. The project was a collaborative, interdisciplinary effort in which contributors from three universities, seven science museums, museum exhibit designers, landscape architects, and urban ecologists; developed interactive ways to convey climate change impacts on human-ecology relationships in urban environments. Within the City Science exhibit, museum visitors engaged in the practices of urban ecologists and

planners in five exhibit design areas exploring urban biodiversity, the urban heat island effect, land use, and neighborhood design.

In the neighborhood design activity, called the "Magnetic Neighborhood," participants weighed options for land uses, a process that has similarities to the process of prioritizing land uses that is done by planning professionals. While the museum exhibit results provide an interesting case study to explore neighborhood design preferences, especially among children, the larger design and planning questions relate to whether this activity might also be useful beyond the museum walls and populations as a portable, flexible, accessible and hands-on method for public participation and design visioning.

4.2. Literature review and research questions

4.2.1. Learning about sustainability in a museum setting

Complex scientific concepts, such as those that underlie urban ecology and green infrastructure planning for sustainable futures, can be made accessible to the public by connecting the issues to local, tangible and daily life experiences (Falk & Dierking, 2010; Falk, Storksdieck & Dierking, 2007). Place-based education and experiences with green infrastructure provide opportunities to connect people to local environments, increase understanding of ecosystem services, make abstract ecological principles real, and teach about sustainability, climate disruption and resilience (Chawla, 2001; Collins & Ison, 2009). The Magnetic Neighborhood exhibit provides visitors the opportunity to engage in participatory planning within the City Science exhibit, bridging the distance between experts and the public in a tangible, accessible and child-friendly format (Gallant, Hawrylchak & DeLisi, 2015).

4.2.2. The role of green spaces

Substantial research supports the ecological and human health benefits of urban and peri-urban green infrastructure elements such as parks, playgrounds, gardens, tree canopy, residential greening and even unattended vegetative growth in vacant lots (Austin, 2014; Taylor et al., 1998). The ecological benefits include reduction of air pollution and urban heat island effect; storm water management; noise abatement and preservation of habitat (Austin, 2014; Wheeler, 2013). Green spaces also play important roles in human health and well-being including providing settings for exercise, stress reduction and socializing (Braubach et al., 2017; Chiesura, 2004; Dunn, 2010; Kuo & Sullivan, 2001). In addition, decades of research support the notion that when people are able to choose environmental elements and settings, the natural elements in green spaces are highly preferred (Chawla, 2004; Kaplan, Kaplan & Ryan, 1998; Van den Berg, Hartig & Staats, 2007). Finally, nature and green spaces seem to have an especially strong resonance for children, as settings for play, exploration, imagination, physical activity and psychological integration (Heerwagen & Orians, 2002; Taylor et al., 1998; Wells & Evans, 2003).

4.2.3. Children and planning

Children are a marginalized group in planning: when they are considered at all it may be either in regard to the problems they pose or to their inconvenient vulnerabilities (Gillespie, 2013). Yet, having opportunities for authentic participation and being heard are important for children, who may feel that they don’t belong to the larger society; and

who need experience contributing to the adult society that they will eventually inhabit and manage (Breitbart & Kepes, 2007; Chawla, 2002; Derr & Kovacs, 2017; Lewis, 1978). Efforts to connect children with planning require awareness of developmentally appropriate means and methods in order to be meaningful (Chawla, 2002; Derr & Kovacs, 2017; Simpson, 1997). When purely communicative approaches to planning are used, participation by children can be marginalized because communication is defined in adult terms and the inherent discrepancies in power between children and adults trivialize children's contributions (Gillespie, 2013; Hart, 1992; Knowlez-Yanez, 2005).

Children think in different ways than adults do, and the capacity to spatially visualize, foundational to design and planning, evolves over time as children mature (Halseth & Doddrige, 2000; Piaget & Inhelder, 1967). Influential psychologist, Jean Piaget (1967), theorized that children's cognition progressed through four stages from birth through age 15, with increasing understanding of symbols, spatial relationships and abstract thought over time. Urie Bronfenbrenner's ecological model of human development (1994) describes how, as children mature, their activities, roles and relationships unfold from close-to-self; to home; to neighborhood; and then to less immediate environments in a series of nested circles. Similar to Bronfenbrenner, Sobel (1998) found that when children drew maps of their town, the range of area that children drew extended further away from home as the child matured. Using Bronfenbrenner's ecological model of human development, we would expect that the conception of space by young children would be comprised of an area which mediates between home and a distant setting - a neighborhood.

Children's daily lives are enveloped by their immediate settings and in order to create healthy environments for children we need to pay close attention to their surrounding at the neighborhood scale (Chawla, 2002; Ellis, 2004). The idea of neighborhood is paradoxically a vague, subjective term but also one that is perceived as a knowable spatial entity. In addition, the idea of neighborhood extends beyond a spatial meaning to encompass community, race, age, gender, life stage, memory, history and culture encompassing a recognizable and shared spatial form (Guest & Lee, 1984; Guo & Bhat, 2007; Lee & Schmidt, 1988). One way to operationalize the idea of neighborhood is to focus on users' personal, subjective attitudes and perceptions of neighborhood through their mental maps (Coulton, Korbin, Chan & Su, 2001).

Mapmaking is a form of visual communication that is accessible to children, is manipulative, can engender a sense of place and develops progressively in stages as children mature (Sobel 1998). Previous work with children envisioning their "perfect neighborhood" was done by Emily Talen and Mary Coffindaffer (1999). In their study, 248 elementary students (K-2nd grades) were given a paper with a street grid and instructed to draw "the perfect neighborhood" after which the most common elements and land use types were tabulated. They found that children indicated preference for commercial elements and suggested that this may indicate a preference for familiar places that they visit with their caregivers doing daily activities, as well as an interest in sharing the experience of the adult world. Interestingly, the results also suggest the children's non-preference for separate, child-oriented recreational settings that are isolated from the larger community (Talen & Coffindaffer, 1999). Additional research suggests that children appreciate undefined spaces that are usually natural areas, undeveloped, leftover

spaces inside or outside the home, free from adult planning and authority (Chawla, 1992; Ellis, 2004; Holt, Spence, Sehn & Cutumisu, 2008).

Halseth & Doddridge (2000) found that when children drew maps of important neighborhood places, the dominant districts were residential and commercial areas. Younger children drew single districts with the immediate residential neighborhood, including home and school. Older children, including middle and senior school age participants, more frequently drew multiple district maps, which included shopping areas, but also restaurants and recreational facilities.

Foundational spatial theories of Kevin Lynch and Donald Appleyard provide a vocabulary and spatial classification system to explore how people perceive and experience their physical environments. Lynch (1960) observed that when people were asked to draw a familiar environmental setting, their drawings, or "cognitive maps" could be decoded using a combination of spatial elements: path, edge, node, landmark and district. Donald Appleyard (1970) conceived of a typology of spatial forms including two larger categories sequential and spatial patterning. The sequential pattern, organized by linear elements such as paths and streets; and centers of activity, or nodes; were classified in four increasingly complex subcategories: fragmented, chain, branch/loop and network. The spatial pattern, organized by elements or districts, also had four increasingly complex subcategories: scattered, mosaic, linked and patterned (Appleyard, 1970; Lee & Schmidt, 1988). While Appleyard's seminal work on mental maps has been replicated with adults, a literature search suggests that it has rarely been done with children.

4.2.4. Literature summary and research questions

To design sustainable ecological and residential environments for the public, we need to understand the users' values and preferences. Planners attempting to balance the competing demands of urban form may overlook the needs of children who spend crucial, foundational years in that environment. If participatory planning with children and families is to be meaningful, care must be taken to incorporate developmentally appropriate means and measures. Scholarship on the maturation process of cognition and mental mapping support using hands-on tools at a scale appropriate to children's growing sense of self and place.

Earlier research looked at the development and results of the Magnetic Neighborhood exhibit and how visitors' understanding of urban planning and design was impacted by participation in other urban ecology exhibits within the overall City Science exhibit (Gallant et al, 2015; Silva-Pinto, 2014). This study uses a version of scenario planning in which learners are actively engaged in exploring new concepts and constructing mental models in association with new information and experiences (Bardsley & Bardsley, 2007). The siting of the Magnetic Neighborhoods within the City Science exhibit provided a rich environment for scaffolding knowledge and experiences about land use planning and green infrastructure elements that may contribute to children's landscape literacy, engender an appreciation of place, and support an understanding of sustainable land use decisions (Whiston Spirn, 2005). This study was concerned with the neighborhood, a spatial concept that can have multiple meanings, goes beyond a collection of separate land use elements, and is especially appropriate to the developmental stages of early to mid-childhood (Christensen et al., 2015).

Magnetic Neighborhood activity participants assembled their imagined, ideal neighborhoods using a variety of land use elements (Figure 4.1). The resulting data was analyzed to explore the following research questions:

- How did participants value green spaces as compared to non-green spaces?
- How were green space elements, connectivity and variety related to neighborhood spatial form?
- What was the relationship between participant age and the land use choices and arrangements, especially in regard to green spaces, in the imaginary ideal neighborhoods?

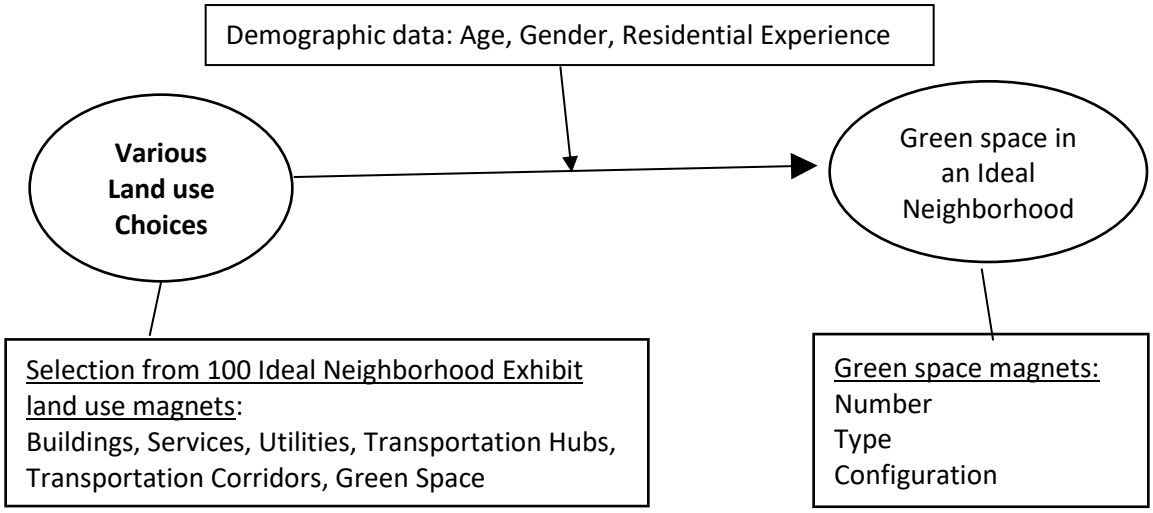


Figure 4.1: Research diagram: Green space as part of an "ideal neighborhood"

4.3. Method

The Magnetic Neighborhood exhibit was designed to explore patterns of neighborhood land use by museum participants, the majority of whom were children, when they constructed an imaginary ideal neighborhood.

4.3.1. Participants

There were 172 neighborhoods created by museum visitors during the months of August and September, 2015. Of the 172 neighborhoods, 26 (15%) were completed by participants who were less than 5 years old, 86 (50%) by participants between the ages of 5-11; 16 (9%) by participants between 12-17 years old; 26 (15%) were ages 18 and older; and 18 (10%) did not record their age.

4.3.2. Constructs and measures

Each participant was given a metal tray (9” x 13”) with instructions to assemble their ideal neighborhood (Figure 4.2) using multiple copies of 36 magnets elements, grouped under six categories (Table 4.1, Appendix D). The study data consisted of the number and kinds of magnets that were chosen by the museum visitors and the arrangement of the magnets. The size of the magnets was calculated to relate to the size and space occupied by the same real-world elements.

Figure 4.2: Assembling a neighborhood

Table 4.1: Land Use Magnet Categories and Elements

Land Use Category	**Category Elements**
Green Spaces	Park, Vegetable Garden, Flower Garden, Roof Garden, Cemetery, Multiple Trees, Single Tree, Lake/Pond, Water (large, small)
Buildings	House, Apartment, Skyscraper
Services	Store, Hospital, Place of Worship, Police/Fire, Mall, School, Museum
Utilities	Power plant, Wind power, Solar panel (large, small)
Transportation Hubs	Airport, Train/Bus Station, Parking lot
Transportation Corridors	Roads (large, small), Walking path (large, small), Bike paths (large, small), Railroad tracks (large, small)

The construct of "green space" in an ideal neighborhood was operationally defined by the frequency, percentage, variety and connectivity of green space magnets used by the participants. Green space percentage was determined by using a value for each element based on the proportion of area it occupied within the tray. Green space variety refers to the number of unique green elements chosen and connectivity refers to the number of adjacent green space elements.

4.3.3. Analytic strategy

The descriptive nature of the study resulted in the data analysis being composed of both quantitative and spatial typology data, with initial work completed by University of Massachusetts masters students Jon Bronenkant and Erica Roper. The first research question: how are green spaces valued as compared to non-green spaces by participants, was explored by first counting the frequency of land use element and categories, calculating the percentage of the tray used by those elements and categories, and counting

the frequency of green space connectivity. The participants were required to use a process of prioritization when constructing their neighborhoods because there were more land uses available than could fit onto the tray. Thus, the participants' spatial preferences were made visible and could be quantified.

The second research question: how are the green spaces organized, was assessed by evaluating the magnet types and patterns using a methodology which adapts concepts of cognitive and spatial mapping originating with Kevin Lynch (1960) and Donald Appleyard (1970). While the spatial typologies of Lynch and Appleyard were derived from participants sketching familiar environments from memory, the current study uses an adaptation of their typologies previously used by Silva-Pinto (2014) to classify the structural qualities of the magnetic neighborhoods.

The third research question: what is the relationship between participant age and the land use choices and arrangements in an imaginary ideal neighborhood, especially in regard to green spaces; was explored by comparing the use of the green space elements across four age groups: under five years old, 5-11 years old, 12-17 years old and 18 years and older.

4.4. Results

4.4.1. Data analysis

In order to explore the first research question: how are green spaces elements preferred compared to non-green spaces; and question three: is there a relationship between participant age and land use categories chosen; a one-way ANOVA was conducted comparing the mean number of land use categories used by age groups for the

172 neighborhoods (Table 4.2 and Figure 4.3). The only differences of significance between the age groups at the .05 confidence level was in the Services category between participants younger than five years old and those older than 18 years old ($p<.001$). This suggests that participants across all age groups were almost always consistent in how they valued the different land use categories.

Table 4.2: Descriptive Statistics for Percent Land Use Categories

Age Groups in years	**Green Space**	**Services**	**Buildings**	**Transportation Hubs**	**Transportation Corridors**	**Utilities**
<5						
Mean	29.72	8.23	5.43	5.42	4.27	2.35
SD	25.37	7.93	6.20	5.96	5.47	3.01
N	26	26	26	26	26	26
(5-11)						
Mean	22.56	14.01	5.78	5.62	6.67	3.53
SD	13.62	9.19	4.76	7.11	7.21	3.82
N	86	86	86	86	86	86
(12-17)						
Mean	24.23	16.63	5.46	4.27	6.94	2.27
SD	19.17	10.87	3.63	5.12	9.42	2.46
N	16	16	16	16	16	16
18+						
Mean	23.91	18.36	5.79	5.03	6.24	4.47
SD	9.77	9.57	4.71	5.01	5.67	3.20
N	26	26	26	26	26	26
Total Category Mean	24.02%	13.41%	5.62%	5.57%	5.52%	3.19%

In the most striking result of this study, the magnets from the Green Space category were most frequently chosen as compared to all of the other land use categories. The second most frequently chosen category across all groups was Services.

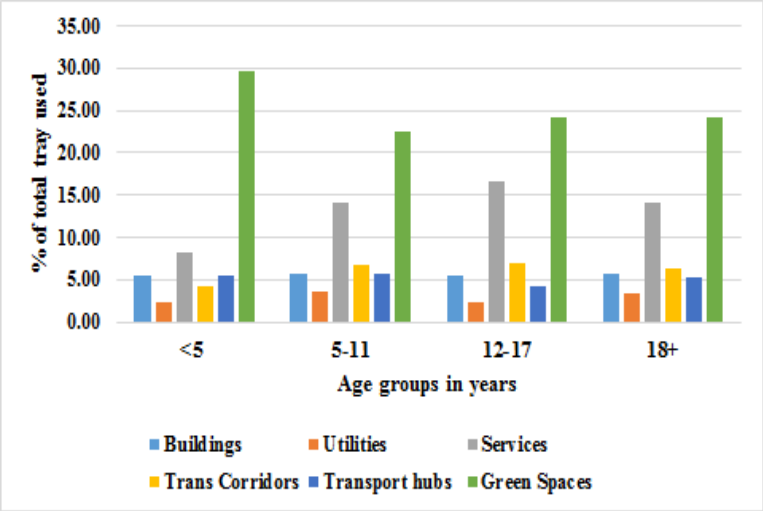


Figure 4.3: Land use categories as percent of tray by age groups

Within the green space category, (Figure 4.4) the single trees and multiple trees were the most frequently chosen elements. After the tree elements, the Lake/Pond magnet was the next most frequently chosen followed by the vegetable and flower gardens.

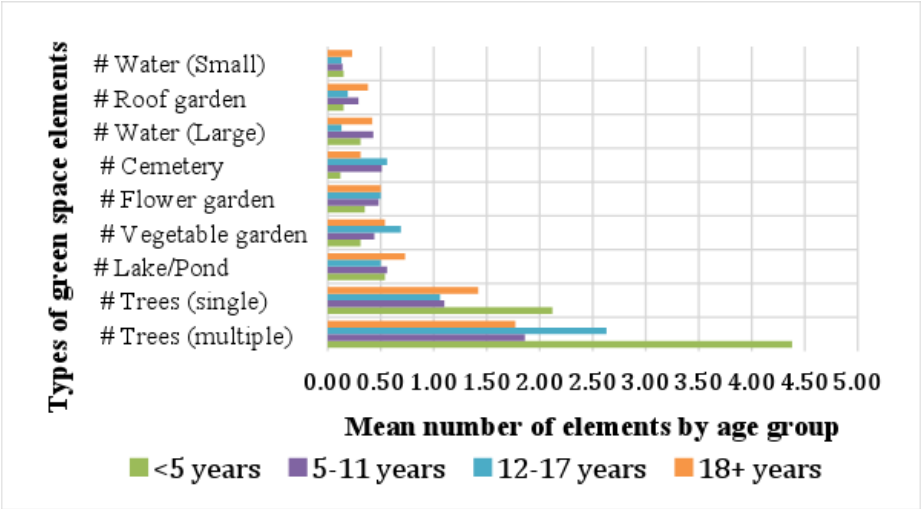


Figure 4.4: Types of green space by age group

Next, a one-way ANOVA statistical test was conducted to explore the connectedness and variety of green space elements across the age groups (Table 4.3,

Figure 4.5). The results indicate that older participants tended to connect the green space elements more frequently than did the younger participants. The mean number in the variety of green space elements chosen, in general, also progressed in an upward trend with age, with the exception of 16 of participants aged 12-17, who had the lowest variety in green spaces.

Table 4.3: Green space connectivity and variety by age groups

Age in years		Green Space Connectivity	Green Space Variety
<5	Mean	1.73	3.54
	SD	.874	1.97
	N	26	26
(5-11)	Mean	2.31	4.21
	SD	1.56	2.08
	N	86	86
(12-17)	Mean	2.38	3.19
	SD	1.82	2.01
	N	16	16
18+	Mean	2.73	5.15
	SD	1.22	2.05
	N	26	26
Total	Mean	2.29%	2.11%

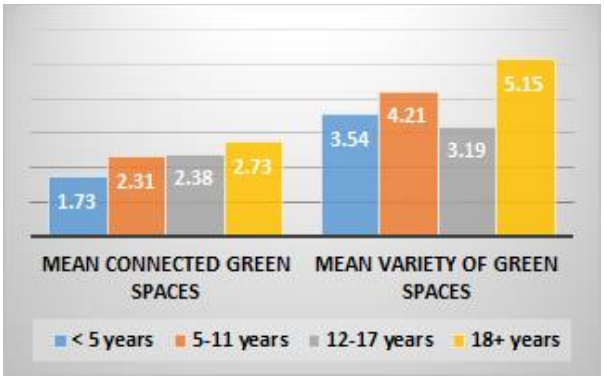
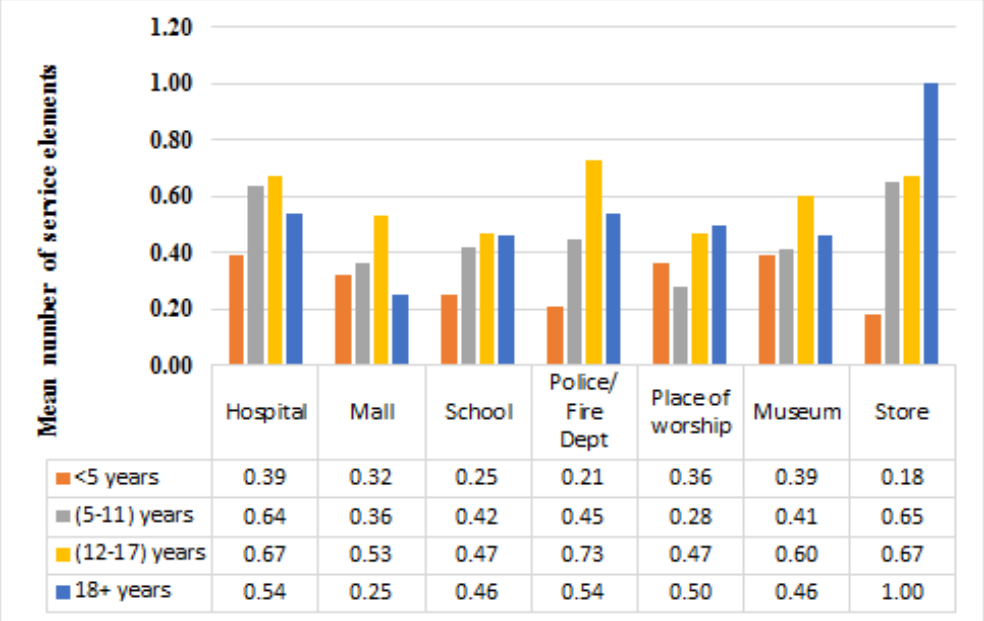


Figure 4.5: Green space connectivity and variety by age groups

In order to understand the context of the participants' neighborhoods, it is useful to explore the most frequently-chosen magnets in each of the six categories of land uses.

In the Building category, every age group chose the house magnet most frequently, a reasonable result given the neighborhood scale of the activity. The use pattern of the Utilities magnets was more varied: for children up to 11 years old, power plants had the highest frequency; age 12-17 the small solar panel; and for those 18 and older the most frequently chosen utilities magnet was the large solar panel. Within the Services category (Figure 4.6), the stores element (mean: .61) was used most frequently, and increasingly as the participants got older - perhaps reflecting the participants' increasing familiarity with shopping with increasing age. Interestingly, within the Services category, the hospital magnet was a close second highest frequency (mean: .60).



	Hospital	Mall	School	Police/ Fire Dept	Place of worship	Museum	Store
<5 years	0.39	0.32	0.25	0.21	0.36	0.39	0.18
(5-11) years	0.64	0.36	0.42	0.45	0.28	0.41	0.65
(12-17) years	0.67	0.53	0.47	0.73	0.47	0.60	0.67
18+ years	0.54	0.25	0.46	0.54	0.50	0.46	1.00

Figure 4.6: Service elements by age

In Transportation Corridors, large roads were the most frequently chosen magnet overall with large walking path second overall. For participants aged 12 and younger, the

airport magnet in the Transportation Hub category was most frequently chosen while older participants most frequently chose the train/bus station.

When the neighborhood assemblages were assessed using Lynch's typology of paths, edges, districts, nodes and landmarks, the results suggested that the elements of paths and district were the most salient in this study, while nodes and landmarks less discernible. Among all age groups, the most frequently used path element was large roads, followed by large railroads for children up to age 11 and large walking paths for those older than 11 years.

The land use patterns that the participants made from the selected magnets were then analyzed using a categorization technique developed by Silva-Pinto (2014) that is a modification of Appleyard's work on mental mapping (1980) in which maps were categorized by spatial and sequential patterns. Using this method, the structural characteristics of the neighborhoods separated spatial form into two major types, Sequential Patterns and Spatial Patterns:

- **Sequential Patterns** have roads/paths as the structural element. There are five subcategories: Fragmented, Chain, Linear, Branch and Loop, and Netted which pro'8gress from less to more complex arrangements.
- **Spatial Patterns** are characterized for being formed by individual buildings or districts with four subcategories: Scattered, Mosaic, Linked and Patterned which progress from less to more complex arrangements.

Of the 172 trays, 52% were classified as having a Sequential Pattern, and 48% with a Spatial Pattern. Figure 4.7 and Figure 4.8 contain brief descriptions of the patterns, schematic examples of the patterns (Silva-Pinto, 2014), a photo example of each pattern

from the current Magnetic Neighborhood data set, and data related to the percent frequency of the spatial patterns by age group in the data set.

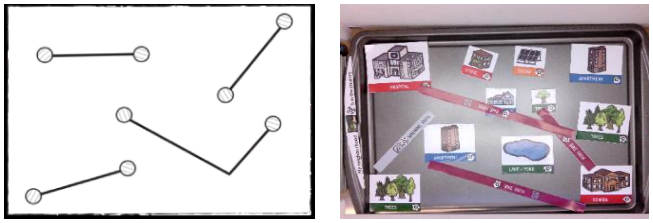
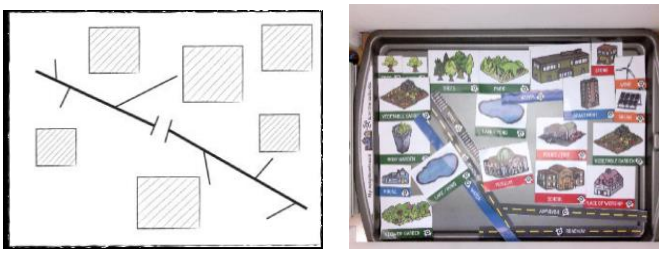
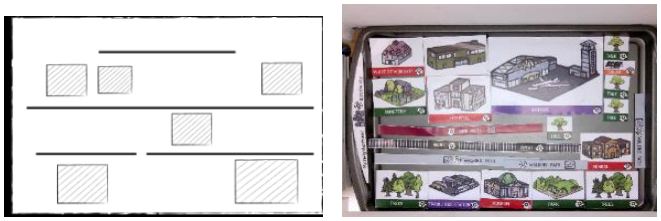
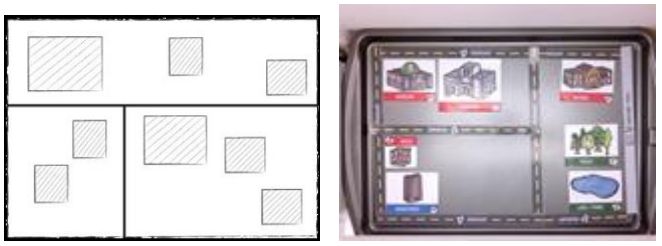
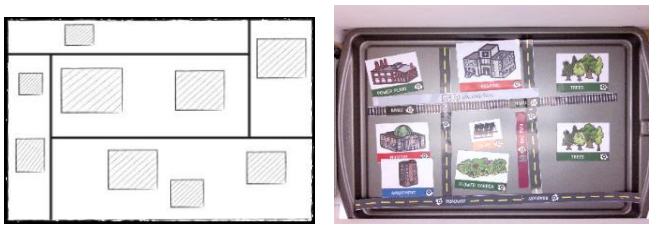
Sequential patterns: from least to most omplex	**Pattern Schematic and data sample**	**Percent pattern by age**
Fragmented: The most simple of the sequential patterns, with small sequences of connected elements.		16 trays: <5: 13 % (5-11): 50% (12-17): 6% (18+): 31% no age: 0%
Chain: Connected by one main road or path		15 trays: <5: 20% (5-11): 47% (12-17): 7% (18+): 13% no age: 13%
Linear: Parallel roads or paths		23 trays: <5: 9% (5-11): 61% (12-17): 13% (18+): 13% no age: 4%
Branch and Loop: Partial grid; one to three blocks		14 trays: <5: 0% (5-11): 71% (12-17): 14% (18+): 0% no age: 14%
Netted: Four or more blocks		21 trays: <5: 19% (5-11): 24% (12-17): 14% (18+): 29% no age: 14%

Figure 4.7: Categories and percent frequency of Sequential spatial patterns

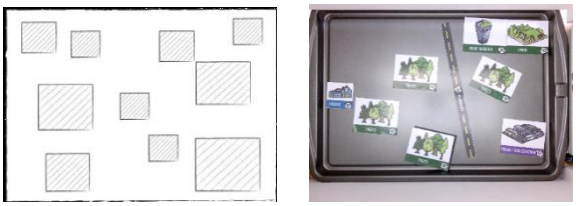
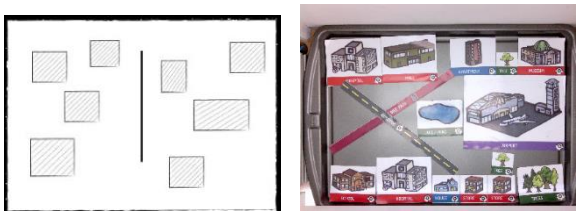
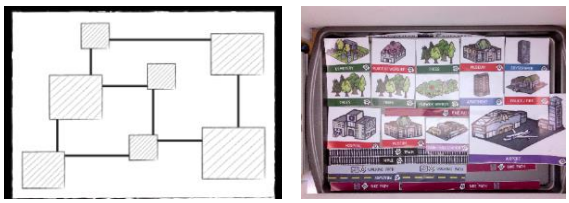
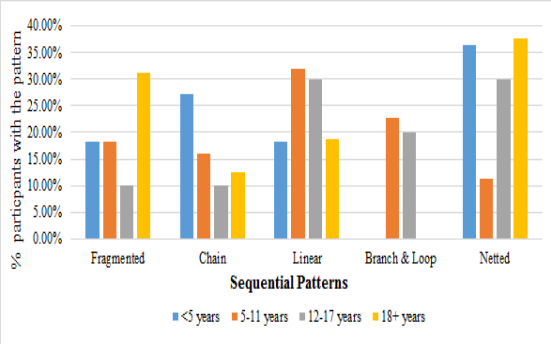
Spatial Patterns from least to most complex	**Pattern Schematic and data sample**	**Percent pattern by age**
Scattered: Isolated pieces; basic connections		29 trays: <5: 17% (5-11): 52% (12-17): 3% (18+): 3% no age: 24%
Mosaic: Small connections; units are still dispersed		20 trays: <5: 20% (5-11): 55% (12-17): 5% (18+): 20% no age: 0%
Linked: More connections; organized by districts		6 trays: <5: 33% (5-11): 33% (12-17): 33% (18+): 0% no age: 0%
Patterned: More districts and organization; roads are not the organizing element		28 trays: <5: 14% (5-11): 50% (12-17): 7% (18+): 18% no age: 11%

Figure 4.8: Categories and percent frequency of Spatial Patterns

There does not appear to be a relationship between the complexity of the Sequential Patterning type and age group. However, participants whose neighborhoods suggested Spatial Patterns appeared to become more complex with increasing participant age: the basic Scattered Pattern decreased in percent of total neighborhoods as the participants grew older, while the number of the more complex Patterned typology increased with age (Figure 4.9).



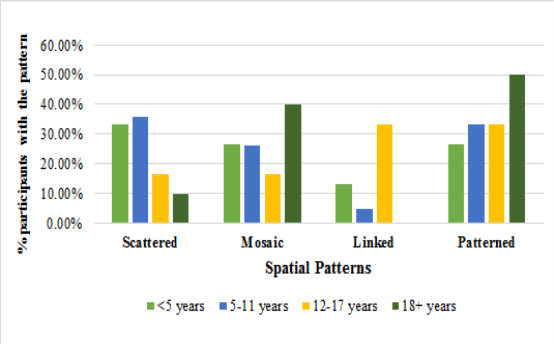


Figure 4.9: Percentage of trays with Sequential and Spatial Patterns by age

4.5. Discussion

The Magnetic Neighborhood activity provided an opportunity for families to engage in scenario-based neighborhood planning within the context of learning about climate science. The current study focused on the number and types of green space elements, the percentage of total green space in the neighborhoods, and the frequency of connecting the green spaces by participants, the majority of whom were children. The study looked at the exhibit results, not only to look at the preferences and patterns of the participants, but also to explore whether this type of exercise could be used in larger planning circles.

4.5.1 Green space

In the most striking result of the study, the land uses in the Green Space category were greatly preferred across all age groups, as measured by the percent of the tray that they used, relative to the other land uses. These results are consistent with previous research that the most common desire of people who live in cities is to have greener streets and parks (Appleyard, 1980; Halseth & Doddridge, 2000; Lynch, 1984). Of all the potential Green Space elements, single and multiple trees were the most commonly used

by participants. The data also shows that green spaces were often connected, with the population aged 18 and older connecting the green spaces most frequently, perhaps reflecting greater understanding or experience with ecological corridors. For younger participants, the unstructured nature of connected green spaces may have part of their appeal, in that they can support self-initiated play and social engagement, both of which play a prominent part in children's perception of their neighborhood (Halseth & Doddridge, 2000; Kellert, 2002; Taylor et al., 1998). This may suggest an intriguing link to green infrastructure planning: the importance of connected green space in the public's vision of a preferred living environment. As has been reflected in other research, in this study there seemed to be a lesser preference for green spaces during the teenage years, relative to the built environment (Kaplan & Kaplan, 2002).

4.5.2. Developmental processes

When the participants created their ideal neighborhood with magnets and trays, their creations were informed by differing frames of reference due to the age-related developmental processes. Similar to previous work with children's cognitive mapping, large roads were the most used transportation corridor used in the magnetic neighborhoods for every age group, suggesting the primary role that automotive transport plays in the participants' environmental experiences (Halseth & Doddridge, 2000; Lynch, 1960). In addition, the neighborhoods of older children had a greater variety of paths, perhaps due to latter groups' increasing experience in the larger environment. The popularity of the airport magnet for younger participants speaks to both the strength of this planning exercise and its potential limitations. While airplanes are undeniably

fascinating to watch, the consequences of having an airport in a neighborhood may not be fully grasped by children. Similar to Talen's study with children's neighborhoods (1992), the store element was the frequently chosen element in the Service category. Interestingly, the second most frequent Service element across all age groups was Hospital, perhaps due to the intensity of the association with that service. In addition, this suggests that it may be worthwhile to consider including neighborhood hospitals or clinics when designing residential neighborhoods.

The neighborhoods created by the participants in the Magnetic Neighborhood activity provided an engaging way to explore spatial planning across a wide age spectrum. While Appleyard's research with neighborhood mapping was done by adults, the majority of the participants in the current study were children. His two categories of patterning, Sequential and Spatial, are described as progressing through increasingly more complex subcategories. It seems reasonable that there might be a relationship between participant age and complexity of spatial form of the neighborhoods, given previous scholarship suggesting that developmental processes during childhood impact cognitive mapping capacities and patterning (Halseth & Doddridge, 2000; Sobel, 1998; Talen, 1999). However, the current study's findings concerning the relationship between participant age and complexity of Appleyard's spatial forms was mixed. There appears to be a relationship between age and Spatial Pattern category complexity with spatial districts becoming more complex as the participant age increased. However, there did not appear to be a relationship between age and complexity within the Sequential Pattern categories. These exploratory descriptive results suggest that further study with additional data sets might be useful to help inform additional insights in this area.

Scenario planning exercises, like the Magnetic Neighborhood, in which potential futures are imagined, are consistent with a constructivist learning approach, whereby learners are actively engaged in exploring new concepts and constructing mental models in association with new information and experiences (Bardsley & Bardsley, 2007). In this case, participants who created their ideal neighborhoods were integrating information about green infrastructure and ecological systems from the entire City Science exhibit. The participants were faced with making land use choices and trade-offs similar to actual planning and design professionals. In addition, part of the experience for the participants was the knowledge that their ideas mattered. When they decided they were done with their neighborhood, the participants scanned the trays for digital capture (Figure 4.10). Signs informed the participants that their contributions would be part of the ongoing study of neighborhood form at the museum, and that they were engaging as social scientists in this endeavor. For participants, especially for children, this sends a powerful message that their input is recognized and valued, an important component of participatory planning (Arnstein, 1969; Breitbart & Kepes, 2007; Derr & Kovacs, 2017; Kaplan & Kaplan, 2009). This interactive approach allows reciprocal learning within the exhibit between the museum staff and the visitors and provides participants with a sense of contribution to the museum.

4.10: Viewing the scanned tray

4.5.3. Limitations and future directions

The strength of the study is that it describes a land use planning activity that is appropriate to use with youth, an under-represented population in planning practice. However, there are several limitations in this observational study related to the magnetic neighborhood activity, the museum setting, and the applicability of the study findings beyond the museum setting. In addition to describing the study limitations, future directions for research will be considered.

Threats to internal validity may compromise the inferences that can be drawn between the independent and dependent variables. This was a descriptive study of an activity in which participants independently constructed their neighborhoods, without the presence of a researcher, suggesting that social desirability was not a factor in the participants' assemblages. Additionally, potential threats to internal validity including maturation, selection, mortality or history do not appear to apply to the study as the participants created their neighborhoods at one time, without a pretest.

Construct validity refers to the extent to which inferences can be drawn from the study constructs, in this case when participants have 100 magnets to choose from, how are green spaces used in terms of frequency, percentage, variety and connectivity. While the magnet data can be quantified and compared, there are six aspects of construct validity, relating to the design of the study design that should be considered.

First, in order to understand the magnets as a spatial planning tool, participants needed to have the capacity to correlate the magnet images with their real-world land use and have the life experience to be familiar with the settings depicted on the magnets. For example, it is fair to conjecture that the children younger than five years old who chose

the power plant magnet did not have the life experience to understand its purpose or implications.

Second, spatial thinking is required in order to visualize how the land elements are oriented in space and the inter-relationships between the elements. Children develop capacities for spatial representation and relationships over time and since the majority of participants were younger than 12 years old, developmental processes undoubtedly impacted their responses and might compromise construct validity.

Third, some categories, such as green space and transportation corridors, have many more choices than others, such as transportation hubs. While this may reflect real life differences in spatial form within the categories, it is worth considering if the variety of elements in some magnet categories contributed to them being more frequently chosen.

Fourth, the activity was an independent, stand-alone activity in a busy science museum. While instructions were posted with the activity, it is not possible to know the degree to which they were read, understood or followed. Therefore, the scans of the neighborhoods which form the data of the study only provide visual evidence of the values and land use choices of the participants. Future research could be strengthened by both having a researcher present at the activity to facilitate understanding; and including an interview portion of the activity to further probe the values behind the choices.

A threat to the external validity of the study stems from the fact that the data was collected from participants who attended a regional science museum with family members, school groups or camp groups and chose to engage in the exhibit activity. Demographic information was not collected, and the results reflect the choices of the

specific population and time and cannot be generalized to a larger population. One way to explore this aspect of external validity would be to try the activity with other populations.

In fact, the magnetic neighborhood activity has already been used in two adult settings outside of the museum: at a museum exhibit conference and at a regional planning conference. While data from these conferences is not included in this study, it is notable that in both cases, participating adults enthusiastically engaged in the Magnetic Neighborhood activity, suggesting its potential utility in larger planning environments and a promising avenue for future research.

Interestingly, there are several aspects of the Magnetic Neighborhood that make it well suited for use beyond the museum exhibit setting. First, after the initial investment of planning magnets and trays, the tools are reusable and easy to store and transport. Second, the Magnetic Neighborhood is inherently flexible: participants can suggest personally or spatially meaningful land uses to include in the magnet options. For example, the "Places of Worship" magnet was added during the prototyping process at the suggestion of local high school students when they were asked "What magnets do you wish you had for your neighborhood?" Third, the Magnetic Neighborhood proved resilient in crossing language barriers. In several observations during the prototyping process, once the directions for the exercise were explained to non-English readers, usually by their family members, language differences did not limit full participation in the activity. These characteristics provide additional impetus for future research with the Magnetic Neighborhood.

4.6. Conclusion

While everyday life is often taken for granted, it provides the setting for personal and place identity formation, processes that are especially salient during the childhood years. The experience of childhood has the unique characteristics of being both universal, transitory and marginalized within the context of designing and planning living environments. Children's opinions are seldom sought, yet they are the experts in knowing about their own lived experiences. The Magnetic Neighborhood provided an engaging planning activity at the most personal and child-centric scale: the neighborhood.

Participants were given a wide variety of land uses with which to design their neighborhoods, however their choices were constrained by a limited neighborhood size, necessitating participants to prioritize their choices and land use patterns. The nature of the activity provided an intriguing means to explore visitors' preferences, making visible a neighborhood through participants' eyes. Once this hands-on form of scenario planning was explained to participants, it was accessible for participants of all ages and languages. A similar model could potentially be used across multiple spatial planning scales, from the neighborhood to the regional.

Insights from the study include:

- Participants of all age groups valued green space over all other land uses when asked to design their ideal neighborhoods. In addition, green space connectivity was valued increasingly with participant age. Do t'he neighborhoods that we plan and design reflect these desires?
- Single and multiple trees were the most frequently used green space elements, supporting their importance in desired living environments. In addition, tree planting

and maintenance may require a relatively low investment in land and programing as compared to other green infrastructure elements.

- There appeared to be a relationship between participant age and neighborhood Spatial Patterning categories. This suggests that, with increasing age, participants envisioned beyond their immediate neighborhood district of home to include additional districts such as shopping and recreation.
- The Magnetic Neighborhood was created to be an independent activity within the City Science exhibit. While participants were not asked questions about their neighborhoods, doing so in the future would impart greater meaning to the data, and utility to its analysis.
- This activity lends itself well to use beyond the museum walls to learn about what kinds of environments people prefer.
- This kind of activity could also potentially be used as an assessment tool, for example participants could create their land use assemblages before and after learning about an ecological principle, to measure the impact of the educational intervention on preference for spatial form.

The purpose of the study was to contribute to knowledge about children's preferences for neighborhood spatial form. The Magnetic Neighborhood is a hands-on, flexible and transportable planning activity that can engage people across age and cultural differences in neighborhood design and planning; making visible how users see and value neighborhood elements. While this research looked at this neighborhood planning exercise in a museum setting, it could also be used beyond the museum walls to bridge

the gap between planning environments for citizens of all ages in a way that is accessible, useful and enjoyable.

CHAPTER 5

EXPLORING COMMUNITY GARDENERS' ATTITUDES AND EXPERIENCES

5.1. Introduction

Community gardens provide multiple benefits for ecological sustainability and livable cities. As part of a larger study of attitudes towards green infrastructure strategies for more livable urban environments, this study used the Reasonable Person Model (Kaplan & Kaplan, 2009) as a conceptual framework to explore the relationships between gardeners' experiences, motivations and connections to the community gardens at a personal scale with particular interest in place attachment in the community garden. The method of this inquiry was individual surveying of community gardeners within a garden network in Providence, Rhode Island.

5.2. Literature review and research questions

The foundations of community gardens are associated with the need for urban residents to secure food; the enculturation of new immigrant groups; and the augmentation of food production in times of economic depression or war (Barthel, Parker & Ernstson, 2012; Irvine, Johnson & Peters, 2007; Lawson, 2005; Warner & Durlach, 1987). More recently, community gardens are seen as a potential green infrastructure strategy that can combine to form a network providing ecological, health and social benefits to urban residents.

5.2.1. Community gardens as a green infrastructure strategy

The role of urban agriculture is evolving with the dynamics of urbanization, green infrastructure and climate change (Austin, 2014; Beilin & Hunter, 2011). By providing opportunities for the provision of food, community gardens are a particularly salient example of sustainable land use, both at the personal and regional scale (Lovell, 2010; Turner, 2011). Underserved urban communities which often have fewer options for convenient buying of fresh produce, can benefit from opportunities to grow vegetables, herbs and fruits. In addition, access to a community garden plot enables urban residents who rent their homes and may not have access to their own land to grow food (Ghose & Pettygrove, 2014). Finally, organic food, which is usually an option for the wealthy, is available to all who use organic garden practices in community gardens (Ghose & Pettygrove, 2014). Having a planned and permanent network of gardens supports local food production as part of the enduring fabric of urban spatial composition, while also playing a crucial role in making dense cities more livable and sustainable (Austin, 2014; Holland, 2004; Lovell, 2010; Wheeler, 2013).

In addition, urban greening projects such as community gardens support ecological sustainability and resilience. Sustainability, the capacity to meet the needs of the present generation without hindering future generations, is enhanced by community gardens' capacity to both perform crucial ecosystem functions and enhance the livability of the urban communities. Community gardens support resilience, defined as the capacity of a system to undergo change and return to function; in two ways. First, by creating an environment for communication, information sharing and deliberate co-learning (Okvat

& Zautra, 2011); and second by the provision of ecological characteristics that are more resilient to environmental change as compared to purely hardscape environments.

Community gardens provide environmental benefits to neighborhood, city and region and contribute to the amelioration of multiple environmental stressors on urban systems. The soil, vegetation, and relative lack of hardscape help 1) reduce the urban heat island effect; 2) provide permeable ground surfaces for water infiltration; 3) contribute to storm water management by reducing or eliminating runoff on site; 4) provide wildlife habitat; 5) contribute to soil remediation; and 6) enable carbon sequestration (Ferris & Sempik, 2001; Goddard, Dougill & Benton, 2010; Holland, 2004; Jackson, 2003; Middle et al., 2014; Okvat & Zautra, 2011). Furthermore, produce grown in local community gardens is fresher and requires less energy use because it is not transported from a different region (Austin, 2014; Beilin & Hunter, 2011).

Community gardens provide non-commercial places that are outside of home and work, in which to forge neighborhood identity, gathering and networking. Gardeners make friends with neighbors in a neutral space (Armstrong, 2000; Kaplan, Kaplan & Ryan, 1998; Glover et al., 2005; Middle et al., 2014), in relationships crossing boundaries of race and socio-economic groups (Agustina & Beilin, 2012; Krasny & Tidball, 2009). Gardeners' willingness to share resources is supported by the social capital engendered by the social bonds made by working alongside each other in their individual plots, participating in garden-wide workdays and social gatherings (Comstock et al., 2010; Glover et al. 2005). Participation in these kinds of garden-wide activities can, in turn, support a sense of meaningful action, competency and satisfaction (Glover, et al., 2005; Holland, 2004; Litt et al., 2015; Ryan & Buxton, 2015).

Both anecdotally and in research findings, community gardening settings seem to have conditions that support cultural adaption and community formation (Anguelovski, 2013; Holland, 2004; San Juan, 2005). Shared gardens can be spaces where fragmented communities can be concentrated and strengthened, traditional produce grown, competencies built, and where new place-making, in a new country can be established (San Juan, 2005; Warner & Durlach, 1987).

Shan and Walter (2015) explored community gardening within a sociocultural psychology framework in a descriptive, qualitative study of six Chinese immigrant women in a Canadian university community garden setting. In this framework, learning in the garden was seen as an inter-relational process with ways of learning that fostered sharing and co-production of knowledge across cultures. In exploring the conditions for learning in the garden, Shan and Walter focused on the inherent natural qualities of the garden itself; such as the soil, wind, plants, sunshine, rain, space, and beauty as well as the personal experiences and wisdom associated with the gardeners. They suggested that the holistic learning that happens in community gardening, which employs sensory and bodily interactions, helps gardeners understand their place and responsibility in the natural world.

Some studies suggest that the kinds of social bonds engendered in community gardens may counterbalance troublesome dynamics, suggesting an association between greened neighborhood spaces, such as vacant lots and community areas, and less neighborhood crime (Branas et al., 2011; Kuo and Sullivan, 2001). Economically, benefits are provided when gardeners learn work skills, grow healthy food for personal

use and sale (Barthel et al., 2012), and improve property values of nearby real estate (Voicu & Been, 2008).

Community gardens have long been seen as important sites for passing on practical knowledge, ecological memories and cultural wisdom regarding food production (Barthel, Parker & Ernstson, 2012; Ghose & Pettygrove, 2014) and can provide agricultural extension education for their members, via garden organizers and workshops (Shan & Walter, 2015). Gardens are settings in which people share knowledge across generations, across cultures and within a culture; resulting in a shared history among participants (Barthel et al., 2012; Ghose & Pettygrove, 2014). In addition, community gardens can support the acquisition of environmental and political literacy and awareness (Holland, 2004).

Research is ongoing regarding potential pathways between community gardening and personal health. At the individual level, community gardeners report mental and physical health benefits connection with nature; and satisfaction in their efforts (Kaplan, 1973; Litt et al., 2015; Poulsen, et al., 2014). Hale et al. (2011) interviewed urban community gardeners (N=67) to explore the connections between community gardening experience and positive health outcomes, through meaningful people-place relationships. The authors found that aesthetic aspects of the community gardening experience, such as sensory experiences and spiritual rewards, generated a sense of meaning and connection to the community garden; which, when combined with emotional bonds to community and place, together forged the bonds between people and place.

Litt et al. (2015) conducted interviews, surveys and street data analysis (N=469) in their research exploring the link between community garden participation and

improvements in mental and physical health. The researchers suggested 4 theoretical constructs or "levers of change": aesthetics, social involvement, collective efficacy, and neighborhood attachment; which were thought to link involvement in community gardening with health improvement. Of particular interest to the current study, neighborhood attachment was seen as being associated with the quality of green space, and social connections forged by friendly neighbor relationships and participation in garden activities.

5.2.2. People-place relationships

Literature on place attachment and neighborhood attachment may provide insight into the person-place bond that is woven throughout community gardening research. Place attachment refers to the emotional bond between person and place while neighborhood attachment refers to the emotional bond between individual and neighborhood setting (Gerson et al., 1977; Comstock et al., 2010). In the social-ecological conceptual framework used in the research of Okvat and Zautra (2011) it was suggested that, for community gardeners, the relational nature of people and place may extend beyond the immediate garden to include all of the community.

When community gardens are sited at the neighborhood scale, place attachment may further support neighborhood attachment. According to Comstock, et al. (2010) neighborhood attachment enables stability and integration in the neighborhood physical and social setting, which brings benefits to the individual, the neighborhood, and to community sustainability. Comstock et al (2010) used multivariate analysis to analyzed data from a survey of neighborhood environments in Denver (N=410), regarding the

relationships between objective and perceived neighborhood characteristics of crime, physical activity, sense of safety and social processes such as collective efficacy; with experiences of gardening and neighborhood attachment. Their results suggested that the length of residency, community gardening; and collective efficacy were associated with neighborhood attachment.

The Reasonable Person Model (Kaplan & Kaplan, 2009) describes conditions under which people may feel supported and empowered in a multitude of environments and contexts, including planning and design (Kaplan & Basu, 2015). This model seeks to identify the types of information and actions that support people to function well individually and in the larger social context. RPM suggests that people have certain inclinations that, when supported, may make successful people-environment interactions more likely.

The model posits there are three domains of information and experience that are especially supportive of human needs (Figure 5.1): 1) Model building - being able to explore and understand the environment in order to construct a mental model of the setting or situation; 2) Being effective - having enough competence and clarity to feel that one is being effective (versus helpless) in the environment; and 3) Meaningful action - because one feels that one's contributions are respected and may make a difference, being willing

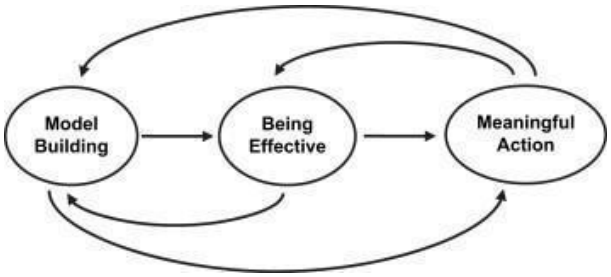


Figure 5.1: The Reasonable Person Model (Kaplan & Kaplan, 2009)

to take meaningful action towards a goal. While these three domains are described separately, they are in fact interlinked and reciprocal.

5.2.3. Potential conflicts

Important as green spaces are, they are usually not equitably sited across the urban fabric, with areas of marginalized populations often having the fewest number of green spaces and the ones that are most poorly maintained (Boone et al., 2009; Joassart-Marcelli, 2010; Strife & Downey, 2009). This is striking not only from the standpoint of environmental inequity but also from the potential implications on public health, as some of the most striking research findings are those that suggest nature may moderate or buffer the impact of income disparity or disadvantage on health (Wells & Phalen, in press; Wolch et al., 2005).

In order to quantify access to green space and demographic factors, Wolch et al. (2005) analyzed the spatial relationships between parks in Los Angeles and average income levels based on census tract information. The study was done following the passage of Proposition K in 1996, a city-wide ordinance intended, in part, to provide funds to equalize access to green space for Los Angeles city residents. The researchers determined that there were city-wide patterns of environmental inequity in the distribution of parks and accessible green space within Los Angeles whereby neighborhoods whose residents with income in the low income ($20,000 to $30,000) and poverty (< $20,000) census categories having relatively fewer accessible park spaces (1.4 acres per 1,000 population and .05 acres per 1,000 population respectively) as compared to more affluent areas (27.1 acres per 1,000 population). When the park location was

analyzed by ethnicities, neighborhoods which had the majority of the population being African American, Asian-Pacific Islander, and Latino have lower rates (1-2 acres per 1,000 total population) as compared to whites (almost 17 acres per 1,000 total population).

In addition to historic patterns of environmental injustice in green space distribution, the community garden land use has historically been marginalized. There are several possible explanations for this marginalization. First, designating a lot as urban agriculture has sometimes been used to temporarily hold land until a more profitable land use is developed (Ghose & Pettygrove, 2014). Second, the tenuous nature of urban land allocation for community gardens may reflect attitudes towards the marginalized populations who historically have used them: women, families, immigrants, refugees and ordinary citizens in times of economic need (Lawson, 2005; Poulsen et al., 2014).

There are also potential conflicts at the levels of community and individual. While public spaces can provide social opportunities for community interactions across diverse populations, they can also preserve hierarchies and conflicts of gentrification (Aptekar, 2015). Some gardeners appreciate the opportunities to interact with people they would not ordinarily encounter. However, group differences can also lead to social conflict, which may not match the stereotype of harmonious community gardens. People with differing backgrounds may have different ideas about gardening in a shared public space (Apetekar, 2015).

At times, conflicts may arise because community gardeners differ in their vision of the purpose of a community garden. In Apetekar's (2015) research, he wrote of four ways that community gardeners viewed their garden plots: 1) as small private spaces,

where gardeners have personal freedom to create the garden of their choice; 2) as green space, which needed to be kept clean, beautiful and orderly, to distinguish he garden from messy vacant lots; 3) as a farm, whose sole purpose was to grow food and; 4) as community space, where the idea of ensuring amiable community relations comes before green space or food growing. It is clear that when gardeners have a diversity of views about the purpose of a garden, it can result in conflicts around social norms as well as design and maintenance of the garden.

Previous research (Ryan & Buxton, 2015) suggests that garden leadership plays a key role in the success of community gardens and other citizen-led greening efforts. Effective leaders can empower gardeners by accessing the resources of the larger organization for the gardeners, providing structure within the garden, and promoting respectful relationships in the garden.

5.2.4. Literature summary

Urban regions can be made more sustainable and livable by having a planned and permanent network of green spaces, including community gardens. To be engaged in community gardening is to experience green infrastructure at the personal level: growing food for one's family, getting exercise outside, keeping cultural traditions alive, learning new skills, socializing with friends and acquaintances, and enjoying a respite from urban hardscapes. However, this engagement is not without challenges and networks of neighborhood community gardens may replicate historic patterns of environmental injustice.

The goal of this approach was to use the research findings and RPM conceptual model to clarify characteristics that may support or undermine people's engagement in community gardening. Specifically, the study posited 5 conceptual domains that might inform the relationship between the gardeners' participation in community gardening and their perceived life changes due to community gardening (Figure 5.2). The research questions for the study included:

1. Why do participants get involved in community gardening, and what connections do they have to their gardens?
2. How are the motivations and connection to the garden associated with participants' perceived changes, such as changes in behavior, knowledge, emotion and actions?
3. Are there aspects of gardening knowledge, such as expertise, and history of learning to garden; that are associated with gardeners' motivations and connection to the garden?
4. How are the gardeners' experiences in the garden; including the level of involvement and type of activity engagement; associated with motivations to garden and connection to the garden?
5. How are characteristics of the individual gardeners, such as their age and gender related to their motivations and connection to their garden?

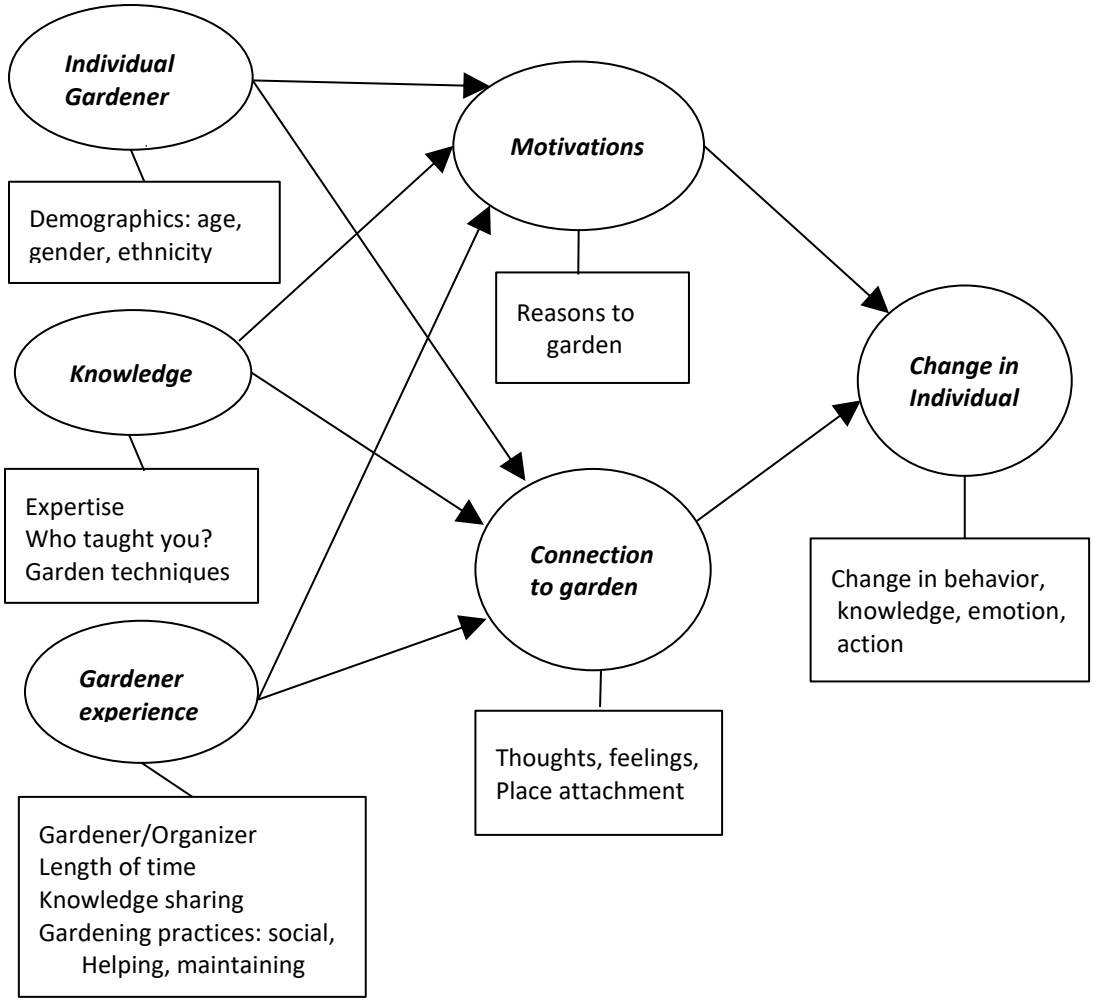


Figure 5.2: Research diagram: Exploring community gardeners' attitudes and experiences

5.3. Method

The purpose of the study was to explore gardeners' experiences and attitudes within an urban community garden network.

5.3.1. Study area

The Providence Community Garden Network (PCGN) is composed of 34 gardens, the oldest of which was established in 1981. At the PCGN, approximately 8,500

residents each year are served by the network community gardens, youth education programs, workshops, farmland, events and city-wide urban agricultural initiatives.

Study participants were from 11 community gardens within the community garden network including: Peace & Plenty (15 participants); Davis Park (9); Somerset Garden (6); Potters Garden (2); Martin Luther King Garden (7); Sessions Street Garden (14); Riverside Garden (3); Brattle Street Garden (2); Fox Point Garden (34); Roger Williams Garden (16); and UEL-Brown University (4).

5.3.2. Survey instrument

Surveys were conducted from April 2016 to October 2017. The survey was developed to include six broad constructs of interest about the community gardeners: *demographic* characteristics; garden *knowledge* possession and sharing; gardening *experiences* and practices, *motivations* to garden; perceived *connection* to the garden; and perceived *change in the individual* as the result of being involved in community gardening. Both qualitative and quantitative data were collected using a two-page, double-sided written survey instrument (Appendix F). The survey was developed to be self-administered, with an average completion time of 15 minutes for English readers. In addition, it was translated into Spanish.

There were a variety of quantitative question types within the survey. Some of the questions required checking a choice (e.g. What is your involvement in the community garden: Gardener or Organizer); some required short answer: (e.g. What is the name of your community garden?); most of the questions were rated on variations of a 5-point scale, for example (5=Almost never to 1= Almost always); (1=none at all to 5= high level

of knowledge); and (1= not at all to 5= a great deal). In addition, there were 4 open-ended qualitative questions that sought to provide greater depth to the quantitative data.

5.3.3. Study participants

Of the 112 participants, 38 (34%) were male and 74 (66%) were female. The participants ages were 3 (3%) younger than 25 years; 33 (29%) ages 26-40 years; 35 (32%) 41-55 years; 25 (23%) ages 56-70 years) 26 participants; and 7 (6%) age 71 and older. Ethnicities were self-reported as Asian/Pacific American: 7 (6%); Black/African American: 10 (9%); Hispanic/Latino: 4 (4%); Multi-Racial: 4 (4%); Caucasian: 83 (74%); and 3 (3%) participants chose not to identify ethnicity. In terms of length of community gardening at the current site, 30 (27%) had been gardening up to and including 1 year; 42 (38%) for 2-4 years; 19 (17%) for 5-9 years; 7 (6%) for 10-20 years; 3 (3%) for 20-30 years and 11 (10%) did not answer.

Participation in the survey was voluntary and while most of the surveys were completed by the gardeners themselves (N=105), 6 surveys were recorded by the researcher at the participants' directive for a total sample of 112 respondents. A local refugee transition organization was instrumental in identifying 7 survey participants as well hosting and providing a translator for non-English speaking participants.

5.3.4. Constructs and measures

The survey questions were associated with 6 construct domains:

- *Motivations:* The construct of motivations was operationalized by 1 survey question with 13 items in which the gardeners rated why they go to the community garden on a

5-point scale from “Almost Never to Almost Always”. Sample items of this question include “grow food for me/my family to eat;” “to be in nature;” and “to be physically active.”

- *Connection to Garden:* The construct of connection to garden was operationalized by 9 questions regarding thoughts and feelings about the community garden.
- *Change in individual:* The construct of change in the individual was operationalized by a question in which there are 10 items related to the themes on emotional, behavioral and knowledge-based changes that they have experienced and attribute to being a community gardener. In addition, there was an open-ended question in which they could note any additional changes they had experienced since gardening.
- *Gardener knowledge***:** The construct of gardener knowledge was operationalized with questions regarding the both the gardeners’ perceived levels of knowledge, and how the gardeners sought knowledge if they had a question.
- *Gardener experiences:* The construct of gardener experiences was operationalized by questions about the level of involvement in community gardening, information sharing and gardening activities.
- *Gardener demographic factors:* Gardener demographic variables assessed in the Community Gardener Survey included: age, gender.

5.3.5. Analytic strategy

It was hypothesized that there could be several reasons why participants chose to garden. The analysis focused on exploring the gardeners’ motivations to garden and connection to the garden (research question 1); and the relationship between both the

motivations and connections with the participants' perceived change in their lives as the result of being a community gardener (research question 2). The participants' knowledge and gardening experiences were analyzed for their components, and also in relation to gardener motivations and connection (research question 3). Finally, the study explored the relationship between the three independent variables of participants' individual demographic factors of age and background, in relation to gardeners' knowledge, background, motivation and connection to the garden (Research Question 4).

The survey contained both qualitative and quantitative data. Quantitative data was initially assessed for frequency and means. Next, factor analyses were conducted, with principal axis factoring to explore and clarify latent constructs, and Varimax rotation for data reduction. Independent t-tests were conducted to ascertain if group means differed to a significant degree.

There were 3 qualitative questions: *what do you like about your community garden*; *what could be improved in your community garden*; and *has your life been changed by being a community gardener.* These questions related to research questions 1 and 2 regarding motivations to garden, connection to the garden and perceived life change as the result of being a community gardener. The responses to the qualitative questions were recorded and assessed to explore commonalities and emergent themes.

5.4. Results

5.4.1. Motivations to participate in community gardening

The study sought to understand why participants chose to be involved and stay involved in their community gardens (Table 5.1). To explore how participants perceived their motivations to garden (research question 1), they were asked to rate twelve items

Table 5.1: Survey question for the motivations construct

Construct	Survey Question
Motivations	I go to my community garden to…. (12 items)

on a scale of 1=almost never to 5=almost always. The items related to possible reasons to engage in community gardening such as growing food, to be in nature, and to be with other people. As a factor analysis on these items did not generate a factor solution, they were analyzed as individual items (Table 5.2). When the responses to the questions exploring motivations were organized by highest-to-lowest overall means, the responses cluster into several sub-groups. The question with the highest mean seems reasonable given the setting: “to grow food to eat”. The items with the next three highest means seem to relate to the garden setting as a restorative setting: “because it is a beautiful place”; “to be in nature”;” “to relax and relieve stress”. The next item, “to be physically active” is a singleton, followed by two items related to community: “to be with other people” and “reminds me of where I grew up”. The next group alludes to cultural benefits: “to grow food I can’t buy in the market”; “adjust to my life in Providence/the U.S”; and “to have family time”. Each of these sub-groups of motivations to garden:

restoration, physical activity, community, and cultural, were evident in the qualitative responses as well.

Table 5.2: Motivations items

(I go to my community garden to…)

Items	Mean
Grow food for me/my family to eat	4.40
Because it is a beautiful place	4.33
To be in nature	4.31
To relax and relieve stress	4.26
To be physically active	3.75
To be with other people	3.17
Reminds me of where I grew up	3.12
Grow food I can't buy in the market	2.58
Adjust to my life in Providence/the U.S.	2.57
To grow flowers	2.38
To have family time	2.30
Grow food to sell	1.25

Scale: 1=Almost never; 2=Seldom; 3= sometimes; 4=often; 5= Almost always

5.4.2. Connection to the garden

A series of questions about participants' thoughts and feelings about their garden were used to assess perceived sense of connection to the garden (research question 1) (Table 5.3).

The questions in this construct had the highest overall means as compared to other constructs, suggesting the importance of connection to the garden for the participants. A factor analysis was conducted on the 8 rated items and revealed one factor: *Place Attachment* (Table 5.3) The high means of the Place Attachment factor, and the items within this category suggest that participants have a very strong attachment to their garden as manifested by feeling good in their garden, pride, and talking about their garden with other people, among other items.

Table 5.3: Factor analysis for Connection to the Garden

Factor	Mean	SD	Loading	α
Place Attachment	**4.65**			**.848**
I feel good in the garden	4.73	0.49	.752	
My garden is important to me	4.73	0.48	.790	
I am proud of my garden	4.67	0.49	.712	
I feel a strong attachment to my garden	4.57	0.58	.786	
I talk about my garden with other people	4.54	0.64	.718	
My community garden feels safe	4.42	0.76	-	
My community garden is well cared for	4.39	0.69	-	
Theft is a problem in my garden	2.23	1.22		

Scale: 1=Almost never; 2=Seldom; 3= sometimes; 4=often; 5= Almost always

Independent t-tests were conducted in order to explore if there was a relationship between the demographic characteristics of age and gender (independent variables); and the place attachment factor (dependent variable) (research question 5). Results of the t-test shows that the place attachment factor differs between males (M = 4.56, SD = 1.13, n=36) and females (M = 4.71, SD = 1.06, n=71) at the .05 level of significance (t = -1.97, df = 105). On average, women felt more attachment to the garden than men, but both groups had high scores on this factor.

5.4.3. Change in the individual

Research question 2 explored if motivations and connection to the garden were associated with the participants' perceived changes (Table 5.4). Two survey questions were used to assess the perceived change in the individual gardeners. One question

Table 5.4: Survey questions for the change in individual construct

Construct	Survey questions
Change in the individual	Since you've been involved in community gardening have you… (10 items) Has your life been changed by being a community gardener? If yes, how?

asked participants to rate ten items in response to the prompt: "Since you've been involved in community gardening have you…". A factor analysis on the item ratings resulted in three factors: *Community networking, Activities* and *Food consumption* (Table 5.5). The overall changes were rated mid-scale with the strongest change related to increased community networking with the highest rated item being "encouraging others

Table 5.5: Items contributing to Change in Individual, factor analysis
(Since you've been involved in community gardening have you...)

Factors	Mean	SD	Loading	α
Community networking	**3.38**			**.811**
Become more active in your community	3.18	1.33	.725	
Gotten to know your neighbors	3.45	1.34	.712	
Encouraged others to join	3.50	1.37	.778	
Activities	**2.11**			**.670**
Joined other greening projects	1.79	1.46	.664	
Become a garden organizer	2.02	1.57	.648	
Started selling produce at markets	1.16	0.80	.637	
Food consumption	**3.08**			**.662**
Increased you concern about organic foods	3.27	1.58	.740	
Begun to eat more vegetables and fruits	3.21	1.46	.842	
Changed your food buying habits	2.76	1.46	.583	

Scale: 1=not at all; 2=a little; 3= somewhat; 4=quite a bit; 5= a great deal

to join." While participants reported that their food consumption habits had changed since beginning gardening, the qualitative answers suggest that a concern for organic foods and fresh produce may be a motivation to engage in community gardening, rather than a consequence of gardening. A second question within the change in individual construct

asked participants if their lives had been changed by being a community gardener and 88 (79%) recorded yes.

One-way Anova comparisons between the garden motivation factors (independent variables) and the changes in individuals' outlook and behaviors did not find any statistically significant relationships. Nor did the comparisons with the place attachment (connection to the garden) and change variables. However, the responses to the open-ended questions provided additional insights. When asked in an open ended question: "how has your life been changed by being a community gardener", the short answers themes, several of which were similar to the domains of the Reasonable Person Model (Table 5.6).

Table 5.6: Responses to how your life has been changed by being a community gardener

Categories	**RPM domains**	**Themes**	**Sample Comment**
Larger community	Model Building	Growth of community Neighbors Diversity	"I've gotten to know people I wouldn't have"
Sense of purpose	Efficacy Competence	Pride Sense of satisfaction	"I feel much more productive in my daily life and gives more purpose to my life"
Learning about gardening	Model building	Knowledge acquisition and sharing	"I now have an incredible knowledge for gardening and know almost everyone in the area".
Mental restoration	Clear head	Peace, relaxation, Sense of clarity	"In the garden, it slows us down. You can't rush the garden. It forces you to relax"
Time outside	Clear head	Nature	"Gives me more time outside"
Produce		Organic produce Improved health	"I eat healthy foods I grew from my garden"

Community gardeners' qualitative responses regarding what they liked about their community gardens grouped under five categories (Table 5.7) and also reflect the knowledge building of model building, being effective and meaningful action from RPM.

Table 5.7: Categories of what participants like about their community garden

Categories	**RPM domains**	**Themes**	**Sample comment**
Social rewards	Exploration Model building	Sense of community Opportunities to interact with a diverse group of people Cultural exchange	"Very diverse, different life experiences. We can talk about life and gardening, everyone is friendly. You meet all kinds of people here."
Rewards of growing own food	Being effective Competence Meaningful Action	Accomplishment, efficacy Value organic produce Save money Secure food not available in market	"It helps our family to get good food and save money". "Sense of satisfaction."
Personal restoration and clearing of the mind	Clear head	Being in nature Quiet, peaceful Beauty Physical activity Improved health	"Peaceful, beautiful nature". "A place to stay active and healthy."
Constructing '2mental models	Model building Understanding	Knowledge acquisition and sharing Experiencing community support	"Working with other gardeners – learning and sharing gardening experiences."
Spatial affordance	Participation	Proximity to home Supports neighborhood cohesion	"..close to home and a good way to be part of neighborhood community."

It was also important to know what the participants did not like about their gardens and hear their suggestions for improvement. When participants were asked what could be improved in your community garden, the themes included: 1) more participation by all members in garden maintenance: "More involvement from all, tends to be small group that always volunteers regularly". Using the lens of RPM, this may speak to the need to feel that one's efforts are respected and make a difference. If a gardener is

faithful in contributing their effort to maintain the garden, but sees that fellow gardeners do not do the same, it may seem like that contribution was not valued or worthwhile. 2) Technical concerns, e.g., more water, more soil, help with pest management: "collective pest control." This speaks to the need to have accurate information in order to make the mental model of a functioning garden and satisfying gardening experience satisfying. 3) Communication concerns with garden leaders and fellow gardeners: "more detailed follow-through by leader." Poor communication can undermine feelings of competence and clarity and compromise effectiveness in the garden and elsewhere.

5.4.4. Knowledge sharing

Research question 3 sought to understand if there were aspects of gardening knowledge that were associated with motivations and connections to the garden. In order to do so, participants were asked about the perceived level of expertise and how they learn about gardening. Two categories of questions were used to explore gardening knowledge: *gardeners' self-reported knowledge,* and *learning about gardening* (Table 5.8)

Table 5.8: Survey questions within the knowledge construct

Construct	**Subcategories and survey questions**
Knowledge	*Gardeners' self-reported knowledge* How expert do you feel you are about gardening How much knowledge and experience do you have with (7 items) *Learning about gardening* How much have you learned how to garden from (6 items) If you have a gardening problem, where do you go for information How do you learn best (3 items)

There were two questions under the gardeners' *knowledge* category. The first question was a self-assessment of gardening expertise, on a scale of 1 to 10 and yielded an overall mean of 6.06. The second question began with "How much knowledge and experience do you have with…"and then had 7 items to rank from 1, none at all to 5, high level of knowledge. A factor analysis on the item responses yielded 2 factors, *garden support* and *plant knowledge*, which each had 2 items (Table 5.9). The means of the items under this second question under the *gardener's self-reported knowledge* domain are moderate, suggesting that while sharing these types of information is part of the community gardening experience, it is not the predominant association.

Table 5.9: Gardeners' self-reported knowledge

(How much knowledge and experience do you have with…?)

Factors	Mean	SD	Loading	α
Garden Support	**2.76**		-	**.859**
Pest Control	2.85	1.08	.827	
Fertilizer	2.67	1.07	.809	
Plant knowledge	**3.47**		-	**.816**
Caring for plants	3.90	.86	.708	
Designing the garden	3.23	1.08	.607	
Select plants	3.48	.89	-	
Weeding	3.86	1.04	-	
Natural Environment	3.72	9.27	-	

[1] Scale: 1=none at all; 2=a little; 3= some knowledge; 4=quite a bit; 5= a high level of knowledge

The second knowledge category, *learning about gardening*, was composed of two questions. The first question was an open ended question that asked where the participants go for gardening information. The most common answer was the internet (38%), followed by fellow community gardeners (27%), then the garden organizers (9%). The second question asked how the participants learned best, with three choices to rate. The item means results were that these community gardeners most commonly learn by

watching other people (mean 4.29), followed by reading (mean 3.81) and then lecture (mean 3.16). The relatively high rating for learning by watching other people is interesting given the socially interactive nature of community gardens.

5.4.5. Gardener experiences

One goal of the research was to try to understand the characteristics of community gardening that made it a worthwhile activity for participants. The questions under the gardener experiences construct explored the kinds of gardener experiences thought to be typical in a community garden (Table 5.10). In addition, research question 4 sought to understand if there was a relationship between the independent variable of gardener experiences and the dependent variables of motivations to garden and connection to the garden.

Table 5.10: Gardener experiences survey questions

Construct	**Survey questions**
Gardener Experiences	Type of involvement: gardener versus organizer How long do you usually stay in the garden [Who] do you share ideas about gardening with (4 items) What type of information are you more likely to share (5 items) I participate in garden group work days I borrow the equipment at my garden I help other gardeners at my garden I help maintain my community garden I participate in social events in the garden

In order to assess the participants' level of involvement in the garden, they were asked about their role in the garden (gardener versus organizer) and the length of time they had been involved in the garden. There were 107 people who identified themselves as gardeners, and four as garden organizers as well as gardeners. The mean length of time

of gardeners' involvements, 4.22 years, suggests an enduring commitment to community gardening. This speaks to the notion that, for these participants, the rewards of community gardening have merited continued involvement. The mean length of time that people spent in the garden per week was 3.60 hours. Regarding learning style, "learning by watching other people" was ranked highest, which seem reasonable in a group setting, and could be a potential contributor to attachment, following by reading, then lecture.

A factor analysis was conducted on two questions within the Gardener Experiences construct (Table 5.11). One question sought to understand with whom the gardeners shared their gardening knowledge and yielded two moderately-strong factors: *Social Network* and *Family*. The factors showed that respondents shared their gardening ideas much more often with their Social Network (i.e., other gardeners, neighbors, and friends) than they did with their family, perhaps indicating shared interests within social networks. In order to explore if there was a relationship between years of involvement in community gardening and with whom the gardeners shared their ideas, two-tailed T-tests were conducted. Gardeners with four or more years of experience ($M= 2.96$, $SD=1.73$) had significantly higher levels of sharing information with their children than those with less than four years of experience ($M=1.77$, $SD=1.32$), $t(61) = 2.99$, $p<.01$; and those with four or more years of experience ($M=2.15$, $SD=1.69$), $t(61) =2.66$, $p<.05$.

Table 5.11: Elements contributing to Sharing knowledge, factor analysis

(Do you share ideas about gardening with?)

Factors	Mean	SD	Loading	α
Social Network	**3.76**			**.674**
Other community gardeners	3.81	1.20	.565	
Neighbors or friends	3.70	1.14	.840	
Family	**2.03**			**.695**
My children	2.46	1.57	.791	
My grandchildren	1.59	1.27	.652	

Scale: 1=not at all; 2=a little; 3= somewhat; 4=quite a bit; 5= a great deal

A factor analysis was conducted on responses to the five items about the types of information that the gardeners share, and yielded two factors: *Technical knowledge* and *Cultural knowledge* (Table 5.12). While participants were more likely to share technical knowledge such as soil preparation and plants selection, the items in the cultural knowledge sharing also formed a factor.

Table 5.12: Elements contributing to Types of information shared, factor analysis

(What type of information are you more likely to share?)

Factors	Mean	SD	Loading	α
Technical knowledge	**3.35**			**.761**
Plant selection	3.48	1.15	.692	
How to plant	3.43	1.24	.720	
Soil preparation	3.13	1.30	.677	
Cultural knowledge	**2.03**			**.706**
How I learned to garden in my childhood	2.34	1.44	.767	
Gardening customs from my home country	1.99	1.54	.677	

Scale: 1=not at all; 2=a little; 3= somewhat; 4=quite a bit; 5= a great deal

Five questions concerned the kinds of participatory practices the gardeners did in the garden. Participants recorded high participation in garden work days (mean 4.29); and helping to maintain the garden (mean 4.21). Perhaps by contributing to the gardens upkeep the participants are expressing their attachment and commitment to the gardens.

The items of helping fellow gardeners (mean 3.64); attending social events (mean: 3.60) and borrowing equipment (mean 3.54) also occurred but to a lesser degree.

In order to explore if there was a relationship between the years in the garden and the participatory garden practices, independent, two-tailed t-tests were conducted (Table 5.13). Among participants who helped maintain their garden, helped other gardeners and participated in social events, there were statistically significant differences between those who had gardened for four or more years, and those who had gardened for less than four years. Among participants who participated in work days and borrowed equipment, the years in the garden did not make a difference.

Table 5.13: Results of t-tests and descriptive statistics: Garden practices by years in the garden

Outcome	**Group**									
	Less than 4 years				**More than 4 years**					
	M	**SD**	**n**		**M**	**SD**	**n**	**p value**	**t**	**df**
I help other gardeners	3.44	0.95	59		3.97	1.01	35	.012	2.51	68
I help maintain my community garden	4.07	0.78	59		4.43	0.81	35	.036	2.10	69
I participate in social events	3.19	0.97	59		3.91	0.74	35	.009	2.98	91

Most participants felt their life had been impacted by being involved in community gardening. Connection to the garden was an important part of community gardening experience, and participants were motivated for practical as well as more intangible reasons. Learning and sharing knowledge was a valuable attribute, as well as gaining competency and meeting social needs.

5.5. Discussion

The aim of this research was to explore attitudes and experiences of community gardeners within an urban community garden network. The study hypothesized that there could be several domains including knowledge acquisition and sharing; individual gardener experiences, gardener demographic factors; motivations to garden and connection to the garden; which could contribute to the gardeners' perception that their lives had been changed by being involved in community gardening.

Perhaps the most remarkable finding from this study was that 79% of participants said that their lives had been changed by being a community gardener. The survey items that assessed change in the individual, which received mid-level ratings, mostly asked about behaviors that conceivably could have been stimulated by community garden involvement. However, the participants told a different story in the qualitative answers, indicating that their life changes had rather to do with contact with nature, neighborhood, community, health and satisfaction.

5.5.1. Motivations to garden

Of key interest in the study is the question of motivations: why do people get involved in community gardening and stay engaged? The categories of motivations from the quantitative and qualitative data suggest several themes. The theme of growing food and learning about gardening within a community setting were highly valued as were the associated themes of perceived sense of accomplishment and efficacy. In the open ended responses, participants noted the value social rewards, in getting to know neighbors and interacting with a diverse group of people.

While contributing to ecological health of urban settings, participation in urban community gardens share some characteristics with other volunteer environmental stewardship activities such as tree planting, in contributing to associated benefits and capacities. For example, in a study of a Boston tree planting program, Ryan (2015) surveyed 52 volunteer participants to explore their experiences as voluntary urban tree stewards. The results suggest that engagement in urban tree planting projects both fostered and was fostered by place attachment, sense of community and sense of efficacy. In a second example, a study by Grese et al (2000) explored the benefits that were experienced by volunteers who participated in ecological stewardship activities as compared to people who were outdoors for recreational purposes. The characteristics of making a difference (meaningful action, in RPM terms) and learning about new things (exploration, in RPM terms) were highly motivating for the volunteer stewards, as they were for community gardeners in the current study.

The benefit of a regular dose of nature and relaxation, noted in previous research by Kaplan (1973) among others, were almost equally valued. Participants noted a wide range of restorative benefits of being outdoors, from the sense of getting away, to the beauty of nature and a place to relax and unwind. Participants also were motivated to garden for the opportunity it provided for outdoor physical activity. These findings are similar to other research suggesting that natural spaces not only support social interactions and neighborhood cohesion, but also individual restoration (Wells & Phalen, in press).

5.5.2. Connection to the garden

The study results contribute to previous scholarship regarding the importance of person-place bonds in identity formation and satisfaction. In the current study, connection to the garden was an important part of the community gardening experience, suggested by high ratings of the questions in the attachment factor. For participants, the gardens felt like a good, safe, and well-cared for place that they were proud of and felt an attachment to. In further support of the importance of place attachment, many of the qualitative responses expressed these place-based emotional ties.

If place attachment was a salient aspect of the community gardening experience, what kinds of experiences helped foster that attachment? The notion of safety is important. Previous research regarding citizen-led urban greening by Ryan & Buxton (2015) suggested that perceived safety is a foundational characteristic for use and attachment to neighborhood green spaces.

Furthermore, the study results suggest that community work days served to both foster and be fostered by attachment to community gardens (Figure 5.2). Participants highly rated gardening practices that contributed to the overall benefit of the garden, such as participating in group work days and helping to maintain the community garden. Working in a friendly group setting, towards tangible goals with concrete results complements multiple human inclinations such as social engagement, being effective and taking meaningful action.

Figure 5.3: Attachment can foster and be fostered by community work days

The themes of the study reflect those in other community gardening research and various models have been proposed to understand the pathways between experience, perception and perceived benefits of community gardening. Attachment was one of the "levers of change" linking involvement in community gardening and positive health outcomes in Litt et al. (2016). Another model for exploring the person-place dynamics of community gardening will be considered next: The Reasonable Person Model (Kaplan & Kaplan, 2009).

5.5.3. The Reasonable Person Model

RPM uses an environmental psychology perspective for making supportive environments that aim to bring out the best in people (Kaplan & Kaplan, 2009). RPM has been used as a conceptual model to understand person-place relationships in multiple settings. Previous research into voluntary urban greening projects using the RPM framework (Ryan & Buxton, 2015) looked at the types of circumstances where greening efforts were successfully initiated, created and maintained. For that research,

neighborhood leaders of the greening efforts were interviewed. Insights from the study included the role of effective leadership; the reality that learning and meaningful action take place in small steps accompanied by trial and error; and that a vision of the overriding goal for the neighborhoods was necessary in order to persist when setbacks inevitably occurred. The current study expands on this study by focusing on community gardeners and using a survey to study a larger sample than the previous study that used interviews of a small sample of leaders.

Viewing community gardening with the RPM lens may help clarify some of the powerful and enduring associations between this form of public green space and multifaceted personal benefits; as well as problems that can arise in the gardens. A foundational idea in the model is the importance of information to people as they interact with their environment (Basu & Kaplan, 2015). RPM may help to understand why information, knowledge, modeling and interpersonal relationships are so important to community gardeners, potentially providing useful insights to garden organizers and planners.

Feelings of competence in gardening may takes time and experience, especially for gardeners dealing with other life challenges, such as the demands of relocation and urbanization. However, with the community of fellow gardeners, and gardening organizations, gardeners have access to resources for learning and gaining competence. With the feeling of competence, clarity, and a workable mental model, gardeners can feel a sense of efficacy, expressed in the gardeners' comments about satisfaction and empowerment. Learning and gaining competency is a satisfying process. Study participants reported satisfaction about learning about gardening in both the quantitative

and qualitative data. It is reasonable to conjecture that such satisfactions help keep interest alive in community gardening and support participants' ongoing involvement in their gardens.

Natural settings, like gardens, are especially well suited to support relaxation, clearing of the mind, a sense of getting away from other concerns, and personal restoration (Grese et al., 2000; Ryan, 2015). An additional interesting attribute of gardening is the periodic maintenance that it requires. Unlike more elaborate experiences of relaxation in nature, such as a yearly camping trip, keeping up with one's garden requires regular visits. Thus, periodic sessions of personal restoration may occur, even if only for short time periods. The study participants very highly valued the experiences of nature, relaxation, and being away.

Finally, most gardeners reported satisfaction in doing something useful and productive, growing their own food: an example of taking meaningful action. One who tends a garden: planting, weeding, harvesting; know that one's efforts have made a difference and these participants reported pride in their accomplishments. These results are similar to the study of volunteer ecological stewards (Grese et al., 2000) for whom contributing one's efforts to something that was personally important was a highly rated benefit. Additionally, in the best of circumstances, when participants experienced mutual respect from their fellow gardeners, they were happier in the garden.

Understanding the interconnected and mutually supportive domains of model building, sense of effectiveness, and meaningful actions, can help garden organizers create settings that bring out the best in participants. Given the expense involved, in dollars, effort and time, to establish and maintain urban community gardens, planning for

successful gardens is crucial. Towards this end, it can be useful to explore challenges in the study gardens using the RPM framework as a lens to understand problematic dynamics.

Some garden leaders were more effective than others in providing information regarding resources and expectations. This means that in some gardens without clear leadership, the gardeners had a more demanding task to create a mental model of how the garden worked and what the social norms were in the garden space. For example, feelings of competence and clarity may be difficult if rodents eat one's produce during the entire growing season and repeated pleas for pest management yield no response from a garden leader. Some gardeners felt they were left to figure things out alone, and expressed frustration and discouragement. The satisfactions of taking meaningful action and making a difference are heavily impacted when one feels less competent to navigate a setting. Some participants thought the garden would be improved if others did more of the shared community work. This is a recurring theme in public participation in community greening efforts (Ryan & Buxton, 2015), wherein there is an implicit social contract that one is more willing to do one's share of community work, when one sees that others are doing the same.

Differences in garden vision also can play a part in garden conflicts (Aptekar, 2015). Some gardeners, who may have seen the garden as a social place, expressed frustration when gardeners rebuffed social overtures, feeling that those less inclined to socialize somehow compromised the purpose of a community garden. Some gardeners

built innovative garden structures that did not align with others' visions of garden order and uniformity (Figure 5.4). Some gardeners viewed their plots as a mini-farm, and chafed at the limits of plot size.

Figure 5.4: Innovative garden structures

5.5.4. Limitations and future directions

This study was conducted in order to explore the contributions that community gardens make to urban residents' quality of life and whether a community garden network can be a responsive and adaptive land use that contributes across multiple dimensions to livable and sustainable urban regions. The study was designed to explore associations between the independent variables: gardener experiences, motivations, connection to the garden and demographic factors; and the dependent variable: the perception that one's life had changed by being involved in community gardening. The data suggests that participants rated their connection to the garden highly and valued the setting for the opportunities for purposeful, productive efforts in a neighborhood social setting. However, there are limitations to the study.

In consideration of potential threats to internal validity, this was a non-experimental, cross-sectional study. Future research using control groups and data collected at multiple time points would strengthen the study's internal validity. Among the most salient threats to internal validity is ambiguous temporal precedent (which intertwines with self-report as a threat to construct validity). Because the study relies on retrospective self-report regarding how "one's life had changed" rather than measuring aspects of life before and after community gardening participation – as a longitudinal

study would do – causal linkages between the independent variables (experiences, motivations, etc.) and changes in life are unknown. While a second potential threat to internal validity, social desirability, is possible, most of the participants (N= 104) completed their surveys anonymously and confidentially. However, for eight participants, surveyors or translators were involved in asking the survey questions and recording the responses. In these cases, the potential threat posed by the participants' desire to supply desired responses should be considered.

A significant area of limitation in the study concerns potential threats to construct validity, or reasons why inferences from the study constructs may be inaccurate. As noted above self-report is a threat to construct validity. In this study the threat is amplified by asking participants to report retrospectively regarding life changes which is limited by memory and other issues. Furthermore, the construct of *motivation* was measured by the participants rating twelve items on a scale of 1-5, in response to the prompt "I go to my community garden to…." Examples of the items include "grow food for me/my family to eat" and "Because it is a beautiful place". While having twelve items lessened the potential threat of mono-operational bias, it is possible that the items listed for rating did not include all of the reasons to go to the community garden for all participants, a potential threat of inadequate explication of constructs (Shaddish et al., 2002). In order to offset this threat, the survey included short answer, qualitative questions so that the participants could add their own thoughts, which might not have been included in the rating items.

In the future, it would be interesting to explore each of the construct domains: *knowledge, gardener experiences, motivations, connection to the garden and change in*

the individual; in greater depth and using a more open-ended method, with the goal of gaining a more nuanced understanding of the constructs. In addition, an open-ended interview process would be especially valuable for gardeners for whom the survey was too long or rigid a format.

In terms of external validity, the potential threat of population validity should be considered. Population validity questions the degree to which the study findings can be generalized to other populations, regions and climates. While one goal of the study was to explore the community garden experience for participants with a wide variety of demographic characteristics and substantial efforts were made to widen the demographic pool from which the participants came, ultimately the study data was heavily weighted towards a less diverse population sample than was originally intended. This potentially omits large swaths of Providence urban gardeners, whose experiences and attitudes are not represented in the study results and lessens not only the potential insights from the study, but also the degree to which the study findings can be generalized beyond this study setting. In addition, participation in the survey was voluntary and while efforts were made to have the survey accessible by mail and by internet, in actuality almost all of the surveys were completed by participants interacting with one of the surveyors. Finally, the study population and findings represent a sampling from the Providence urban garden network, which may limit the external validity of the study beyond this particular setting. The external validity of future research could be strengthened by a wider demographic participant population.

5.6. Conclusion

Community gardens are green infrastructure strategies that provide settings for people to engage with neighbors and build community based on a shared interest. Attachment to place and people grow from these interactions, motivating more involvement in the garden and community. Although it was not the focus of the study, a recurring theme was the importance of the garden leadership. Effective leadership at the garden scale provided a coherent working structure to the garden, provided to organizational resources beyond the individual garden, and ensured ongoing satisfaction over the growing seasons.

For community gardening to be successful, it is not enough to designate the lands, divide and assign the plots, and install an irrigation system. Based on the study participants' responses and the conceptual RPM framework, several recommendations can be made for community garden organizers and leaders:

- Gardeners need accessible and reliable sources of information in order to build mental models of the setting. Gardeners need to be able to understand what is expected of them, and what will be provided for them in the garden (e.g. shared tools), and who to go to for help.
- Sharing information with others helps expand gardeners' mental models and supports rewarding senses of contribution and efficacy. Garden leaders can help model and foster knowledge sharing in the garden.
- Being heard is important. In gardens where there were unaddressed issues, such as pests or poor mulch supply, participants voiced feelings of frustration and futility. Successful gardens had responsive leadership.

- Collaborative garden experiences, such as work days and social gatherings, are important to build social bonds, connection to the garden and gardener satisfaction. In addition, working together supports a sense of taking meaningful action. These kinds of activities need to be scheduled and held.

Looking at community gardens as a green infrastructure strategy for more livable urban communities, the study suggests some additional recommendations for community planners:

- Study participants experienced strong attachment to their community gardens. This land use can be considered one strategy to foster community and sense of place in urban areas.
- Community gardens are an important source of urban nearby nature. For study participants, periodic immersions into green space, even for short periods, was a highly valued benefit of community gardening.
- Planners and policy makers can influence support of community gardening by zoning and working with municipalities to enable permanent agricultural land designations, conservation easements and transfer of development rights (Austin, 2014; Bartel et al, 2012; Benedict & McMahon, 2012).

Planning for supporting human inclinations, so that people may be able to feel better and do better, is in the interest of the greater society. People who feel defeated or confused cannot take meaningful action in the garden or elsewhere in their lives. When the study participants contributed their efforts towards a tangible goal, and when their contributions were valued, a sense of pride and empowerment was nurtured. This is

especially important in neighborhoods that to outsiders are perceived as economically-challenged and in decline.

Community gardens have great potential on numerous levels for supporting more livable cities. In relatively small spatial units, community gardens may provide many characteristics that are vital for people: feelings of accomplishment and pride, growing food, community interaction, learning, sharing knowledge, time in nature, relaxation, physical exercise and reprieve from urban stressors. When the benefits to ecological sustainability are added, community gardens are a valuable resource for livable communities.

CHAPTER 6

SUMMARY

6.1. Contribution to the field of planning

The wide range of benefits of green infrastructure for urban communities, ecosystems and climate resilience provided impetus for exploring public attitudes towards green infrastructure strategies for livable and sustainable communities. The complexities of creating healthier, sustainable and adaptive urban settings makes it critical to fully engage urban populations in understanding and participating in green infrastructure responses. The spatial arrangement and rich biodiversity potential of urban patches and corridors of tree canopies, green spaces and community gardens can play an important role to reinforce ecosystem benefits (Austin, 2014; Okvat & Zautra, 2011). Place-based learning and experiences that encourage authentic participation and contribution provide the basis of the three dissertation studies in Chapters 3, 4 and 5.

6.1.1. Living with green infrastructure

Well designed and well-functioning green infrastructure strategies contribute to more livable and sustainable urban communities. Multi-purpose and multi benefit strategies support more ec'ologically healthy communities, which are better suited to support dense human habitation and respond to climate change events. Efforts to incorporate green infrastructure practices in urban environments reflects an evolving view of urban ecology and livability whereby urban ecologists, designers, planners, engineers, residents and policymakers are pursuing more sustainable urban environments (Childers et al., 2015). The use of green infrastructure practices not only addresses the

needs for a better functioning ecological city (McPhearson et al., 2016), but also are increasingly important in the light of indisputable climate change effects (Okvat & Zautra, 2011). Urban design solutions, policy and management that can incorporate ecological systems will increase capacity to adapt and respond to both unpredictable weather events and patterns of social injustice (Childers et al., 2015). Citizens who have personal experiences with green infrastructure learn about the ecological systems that impact their daily lives and will be more likely to understand and support the issues of urban sustainability and resilience (Childers, et al., 2015).

While design solutions are important, it is in the lived relationships and experiences between people and place that the foundation of sustainable futures will be formed (Derr & Kovas, 2017). A contextual approach was used in this dissertation to study the relationships between people and potential green infrastructure solutions within three settings: urban residential greening, neighborhood green space planning and community gardens. The first two studies were both sited at the neighborhood scale, were scenario-based, and located at a regional science museum. The third study was sited at the neighborhood and community scale, in Providence, Rhode Island. All three of the studies sought to understand what matters to people in their environments and why.

6.1.2. Assessing and protecting the value of urban nature

Green spaces and elements are important to people. Urban nature, in the form of neighborhood greening, green space and community gardens, provide a wide variety of environmental and psychological services. Because the services provided by nature are intangible and immaterial, they may be undervalued. Yet, failure to provide the multiple

benefits of access to nature in the city for all communities can have substantial costs to health as well as overall quality of life (Chiesura, 2004). If a city is to be sustainable, it needs to meet the needs of its citizens, and publicly recognize of the importance of urban nature. Listening to people's lived experiences, preferences and inclinations provides important information that planners need to know. Planning for supporting human inclinations, so that people may be able to feel better and do better, is in the interest of the greater society. People who feel defeated or confused cannot take meaningful action in the neighborhood, their garden or elsewhere in their lives.

6.2. Dissertation insights

The three dissertation studies yielded insights about how participants experienced green spaces in their everyday lives. To review, insights from Chapter 3: Exploring Preference for Urban Greening include:

- The presence of a green canopy and neighborhood greening was highly preferred, it was seen as providing nearby nature, beauty, a buffer from crowding and cooling shade.
- A vegetated setback from the street can help provide a buffer between public and private spaces and provide multiple ecological benefits.
- Privacy was important to people. While there are indisputable benefits to urban living, there was a strong preference for settings that afforded a sense of a safe and protected haven with greening or spatial form.
- Residential building scale also seemed to matter. Multi-units in large complexes were less preferred.

Insights from Chapter 4: Green Space as Part of an "Ideal Neighborhood" in an Interactive Museum Exhibit include:

- Participants of all age groups valued green spaces over all other land uses when they assembled their ideal neighborhoods using magnets. In addition, older participants more frequently connected the green spaces as compared to the younger participants.
- Single and multiple trees were the most commonly used green space magnets, supporting their importance in preferred living environments.
- The complexity of the neighborhood spatial patterns seemed to increase in older participants as compared to the younger participants, perhaps reflecting maturation in spatial orientation and increasing familiarity with land uses as people get older.
- While the Magnetic Neighborhood was created to be an independent museum activity, it could easily be used in other planning settings.
- Using developmentally appropriate means can help support the participation of youth in planning.

Insights from Chapter 5: Exploring Community Gardeners' Attitudes and Experiences include:

- Study participants experienced strong attachment to their community gardens. This land use can be considered one strategy to foster community and sense of place in urban areas.
- Community gardens are an important source of urban nearby nature. For study participants, periodic immersions into green space, even for short periods, was a highly valued benefit of community gardening.

- Gardeners need accessible and reliable sources of information in order to build mental models of the setting. Gardeners need to be able to understand what is expected of them, and what will be provided for them in the garden (e.g. shared tools), and who to go to for help.
- Sharing information with others helps expand gardeners' mental models and supports rewarding senses of contribution and efficacy. Garden leaders can help model and foster knowledge sharing in the garden.
- Being heard is important. In gardens where there were unaddressed issues, such as pests or poor mulch supply, participants voiced feelings of frustration and futility. Successful gardens had responsive leadership.
- Collaborative garden experiences, such as work days and social gatherings, are important to build social bonds, connection to the garden and gardener satisfaction. In addition, working together supports a sense of taking meaningful action. These kinds of activities need to be scheduled and held.

The overarching themes of the studies are that people care about their neighborhood settings and value accessible green space. In addition, the types of green infrastructure explored in the studies, residential greening, neighborhood green space, and community gardening plots, are relatively modest spatial interventions, as compared to, for example, a large, programmed urban park. Despite the modesty of the measures, the potential benefits of these types of green spaces are not trivial and are worth understanding, promoting and protecting.

6.3. Limitations

While each of the studies had limitations, some limitations were consistent across all the studies. The participants in each of the studies volunteered to provide study data, and were not randomly selected members of the population at large. As such, the findings are considered in the context of the study populations, and do not generalize across wider populations or settings. There was also a descriptive, exploratory theme that is consistent in this dissertation research. With the exception of the 7 pairs on original and greened photos in Chapter 3, there were no instances which have conditions of control and treatment groups.

The operational constructs of question domains that were used in Chapters 3 and 5 could be subject to threats from unaccounted factors or misattribution. Limitation sections in those chapters suggested that housing style (Chapter 3) or misattribution of the items that comprise a construct (Chapter 6), both should be considered when reviewing the research findings.

There were also challenges in the research instruments. In Chapter 3, the photo-preference survey instrument was developed for participants of all ages and attention spans, necessitating a relatively quick but engaging task of rating 24 photos. Selecting photos is an inherently biased process, and the design professionals who rated the images for density may not represent the average participant in terms of visual acuity. In the Magnetic Neighborhood study, the tray images visually captured by the scanner were the sole input for analysis and exploration. If qualitative questions could have been asked of the participants, it would be possible to ask why people chose and arranged the magnets in their neighborhood and so get more in-depth results. The participants who completed

the Community Gardening survey were, for the most part, people who were comfortable with surveys and surveyors. Using surveying as the sole data collection method limited the participant population of the study.

While the application of the findings from all of the studies is limited by the small and exploratory nature of the research design, the research did suggest some interesting inclinations among the study participants regarding attitudes and experiences with green spaces in daily life. In addition, the findings suggest potential areas of research and application in planning and design.

6.4. Implications for planning, design and further research

- The aim of Chapter 3 was to add to scholarship regarding balancing the demands of urban densification and green space. Ongoing research is need on how to develop highly functional green space under compact building conditions.
- An activity like the Magnetic Neighborhood could be used with populations beyond the museum walls in order to assess how people view and value spatial form and land uses. Due to the simplicity and transportability of the activity, it could be used in community gathering in different settings with the spatial continuum, from urban to rural.
- Research findings from the Chapter 5 can contribute to the substantial efforts involved in establishing and maintaining a successful community garden.
- Metrics and methods of valuation for the benefit and importance of providing and protecting the benefits of urban nature need to be developed, so that the valuation can be integrated into planning assessments and decisions (Childers, 2004). Such metrics

could complement and be a practical application for exploratory research, such as the three chapters in this dissertation, regarding personal experiences with urban nature.

- Given the contribution of urban nature to sustainable and livable communities, there is a need to identify and employ successful policies, legislation and practices that support development of well-functioning urban green space.
- In addition, deliberate efforts towards equalizing access to well-functioning and well-maintained green spaces are crucial for the remediation of environmental injustice. Spatial research at the neighborhood scale is especially important to recognize and address inequity issues that may be obscured at the regional scale (Haaland & van den Bosch, 2015).
- While the three studies looked at green infrastructure strategies at the neighborhood scale, in actuality, green infrastructure will only be effective for sustainability and livability if it is linked beyond the neighborhood (White & Ellis, 2007). Therefore, further research and support is needed for green space development plans for entire urban regions.

6.5. Final remarks

Sustainable, resilient urban design and regional planning are grounded in understanding complex inter-connecting relationships between social, ecological, economic and built factors and processes in urban settings (Alberti & Marzluff; 2004; Childers et al, 2015). Urban ecosystems are an increasingly common human habitat: as of 2014, fifty-four percent of world's population live in urban areas (McPhearson et al, 2016). Cities not only provide habitation for increasing numbers of the world's population, but are also uniquely configured to be at the forefront of climate change

impacts such as sea level rise, coastal flooding, drought and extreme weather (Rozenzweig et al., 2010). With climate change no longer in question, it has become increasingly clear that sustainability and adaptation need to be planned and designed proactively; with multidisciplinary expertise; using participatory processes that include input from residents (Childers et al, 2015).

An understanding of the attitudes and experiences that citizens have with green infrastructure elements can contribute to planning scholarship at the intersection of green infrastructure strategies, sustainability and resilience with lived preferences and experiences. This dissertation has explored public attitudes and experiences with three types of green infrastructure at the personal scale of neighborhood and community. Suggestions for further research have been made, based on promising features of the current research as well as ways to address the methodological challenges. The goal of the research has been to contribute to a greater understanding of attitudes and preferences towards green infrastructure, in order to support a robust overall implementation of successful green infrastructure strategies for healthier and more sustainable human and ecological communities.

APPENDIX A

PHOTO PREFERENCE POSTER FOR TREE CANOPY STUDY

Neighborhoods can take many different forms..
We would like to understand what makes a neighborhood appealing!
Will you help us learn about what your ideal neighborhood might look like?

APPENDIX B

PHOTO PRFERENCE SURVEY

UMASS AMHERST

We are interested in learning about the types of neighborhoods where you would like to live. This research is contributing to the development of the new *City Science* exhibit at the EcoTarium Museum in Worcester, MA and will help planners develop cities that are better places to live. Your answers to these questions are anonymous; we won't share your answers with anyone. For more information about this survey, please contact Professor Robert Ryan (rlryan@larp.umass.edu).

Picture Ratings:
Please circle the choice that describes **how much you would like to live in a neighborhood** such as those shown in the pictures.

	Rating Scale						Rating Scale				
	Not at all	***a little***	***some-what***	***quite a bit***	***very much***		***not at all***	***a little***	***some-what***	***quite a bit***	***very much***
Picture #1	1	2	3	4	5	Picture #13	1	2	3	4	5
Picture #2	1	2	3	4	5	Picture #14	1	2	3	4	5
Picture #3	1	2	3	4	5	Picture #15	1	2	3	4	5
Picture #4	1	2	3	4	5	Picture #16	1	2	3	4	5
Picture #5	1	2	3	4	5	Picture #17	1	2	3	4	5
Picture #6	1	2	3	4	5	Picture #18	1	2	3	4	5
Picture #7	1	2	3	4	5	Picture #19	1	2	3	4	5
Picture #8	1	2	3	4	5	Picture #20	1	2	3	4	5
Picture #9	1	2	3	4	5	Picture #21	1	2	3	4	5
Picture #10	1	2	3	4	5	Picture #22	1	2	3	4	5
Picture #11	1	2	3	4	5	Picture #23	1	2	3	4	5
Picture #12	1	2	3	4	5	Picture #24	1	2	3	4	5

Age	<5	5-11	12-17	18-25	26-65	66+
F						
M						

Observation # _____

Date:_____

What town, state do you live in? _____

Do you live in the _____ city _____ suburb _____ country

Do you live in a _____ house _____ apartment _____ condo

Can you briefly describe why you rated some photos the highest?

Can you briefly describe why you rated some photos the lowest?

APPENDIX C

DENSITY SURVEY

Density Rating Survey
May 2017

This inquiry is contributing to the dissertation research of Jane Buxton, LARP, who is interested in understanding factors that contribute to making cities that are better places to live. Your answers to these questions are anonymous and won't be shared with anyone. For more information about this survey, please contact Jane Buxton (jbuxton@larp.umass.edu) or Professor Robert Ryan (rlryan@larp.umass.edu).

Picture Ratings:

Please circle the choice that describes **the level of density you perceive** in the neighborhoods shown in the pictures.

	Density Rating Scale						**Density Rating Scale**				
	Not ***at all***	*a little*	*some-what*	*quite a bit*	*very much*		*not at all*	*a little*	*some-what*	*quite a bit*	*very much*
Picture #1	1	2	3	4	5	Picture #13	1	2	3	4	5
Picture #2	1	2	3	4	5	Picture #14	1	2	3	4	5
Picture #3	1	2	3	4	5	Picture #15	1	2	3	4	5
Picture #4	1	2	3	4	5	Picture #16	1	2	3	4	5
Picture #5	1	2	3	4	5	Picture #17	1	2	3	4	5
Picture #6	1	2	3	4	5	Picture #18	1	2	3	4	5
Picture #7	1	2	3	4	5	Picture #19	1	2	3	4	5
Picture #8	1	2	3	4	5	Picture #20	1	2	3	4	5
Picture #9	1	2	3	4	5	Picture #21	1	2	3	4	5
Picture #10	1	2	3	4	5	Picture #22	1	2	3	4	5
Picture #11	1	2	3	4	5	Picture #23	1	2	3	4	5
Picture #12	1	2	3	4	5	Picture #24	1	2	3	4	5

Neighborhood Density Survey
V0DENS517

Age	26-65	66+
F		
M		

What town, state do you live in? _____

Do you live in the _____ city _____ suburb _____ country

Do you live in a _____ house _____ apartment _____ condo

UMASS Faculty Affiliation:

Landscape Architecture: _____ **Planning:** _____ **Both:** _____ **Other:** _____

Thank you!

APPENDIX D

MAGNETIC NEIGHBORHOOD ELEMENTS

APPENDIX E

LETTER TO COMMUNITY GARDENING PARTICIPANTS

Department of Landscape Architecture and Regional Planning
University of Massachusetts, Amherst
109 Hills North
Amherst, MA · 01003-9328
(413) 545-2255

July 10, 2017

Dear Community Gardener:

We are working on a research project that aims to understand how participating in community gardening activities affect local residents, neighborhoods and communities in Providence, Rhode Island. Since you are a community gardener, or garden organizer we would like to learn about your experience and views of various aspects of community gardening.

Attached to this letter is a 4-page survey that usually takes about 10-15 minutes to complete, in which we ask questions about your experience as a community gardener. We will not share your comments directly with the University or anyone else. We will report general findings from the range of surveys we collect, without attributing comments or perspectives to any particular person. If we would like to quote you in articles or reports, we will assign an alias to you, unless you directly ask us to use your name in published format.

We hope that these project surveys will provide us a greater understanding of the experiences and opinions of community gardeners and garden organizers. The goal of this study is to contribute to efforts to create more livable neighborhoods, improve green space planning; and support human and environmental health in Providence and beyond.

Many thanks for your help.

Sincerely,

Jane Buxton
PhD candidate
jbuxton@larp.umass.edu

Robert L. Ryan
Professor
rlyan@larp.umass.edu
Tel: (413) 545-6633

APPENDIX F

UMASS AMHERST

COMMUNITY GARDENING SURVEY

We are interested in finding out about some of your experiences as a community gardener and/or organizer. All information from this survey will be anonymous. Please complete this from to the best of your ability. Thank you for participating!

1. **What is your involvement in the community garden?**
   - □ Gardener for how long at this garden? _____
   - □ Organizer. If organizer, job: _____ for how long? _____

2. **What is the name of your community garden(s)?**
   _____

3. **Do you share a garden plot?** _____ No ____ Yes If yes, with whom? _____

4. **How often do you visit your community garden**? ____ daily ___ 2-3 times a week ____ weekly ____ other

5. **How long do you usually stay?** _____ hours _____ minutes

6. **Do you garden alone?** _____ with family members? _____ with friends? _____

7. **On a scale of 1-10, how expert do you feel you are about gardening?**

   1 2 3 4 5 6 7 8 9 10

For each question asked below, please circle the number that best represents your experience with community gardening in Providence.

	Almost Never	***Seldom***	***Sometimes***	***Often***	***Almost Always***
8. I go to my community garden to:					
Grow food for me/my family to eat	1	2	3	4	5
Grow food to sell	1	2	3	4	5
Grow food to donate	1	2	3	4	5
Grow food I can't buy in the markets	1	2	3	4	5
To relax and relieve stress	1	2	3	4	5
To be in nature	1	2	3	4	5
Reminds me of where I grew up	1	2	3	4	5
To have family time	1	2	3	4	5
To grow flowers	1	2	3	4	5
Be with other people	1	2	3	4	5
Adjust to my life in Providence/ the U.S.	1	2	3	4	5
To be physically active	1	2	3	4	5
Because it is a beautiful place	1	2	3	4	5

Other reasons? _____

	Not at all	*a little*	*some-what*	*quite a bit*	*a great deal*
9. I have learned how to garden from:					
My parents	1	2	3	4	5
My grandparents	1	2	3	4	5
Neighbors	1	2	3	4	5
Garden organizers	1	2	3	4	5
Other community gardeners	1	2	3	4	5
From books, TV, magazines, on-line	1	2	3	4	5

10. **If you have a gardening problem, where do you go for information?** _____

11. I learn best by					
Reading	1	2	3	4	5
Lecture	1	2	3	4	5
Watching other people	1	2	3	4	5
12. I share ideas about gardening with					
Other community gardeners	1	2	3	4	5
My children	1	2	3	4	5
My grandchildren	1	2	3	4	5
Neighbors or friends	1	2	3	4	5
13. The type of garden information I am more likely to share is					
How to plant	1	2	3	4	5
Soil preparation	1	2	3	4	5
Plant selection	1	2	3	4	5
Gardening customs from my home country	1	2	3	4	5
How I learned to garden in my childhood	1	2	3	4	5
14. Since I have been involved in community gardening I have					
Joined other greening projects	1	2	3	4	5
Gone to community meetings	1	2	3	4	5
Become a garden organizer	1	2	3	4	5
Started selling produce at markets	1	2	3	4	5
Changed my food buying habits	1	2	3	4	5
Increased my concern for organic foods	1	2	3	4	5
Begun to eat more vegetables and fruits	1	2	3	4	5
Become more active in my community	1	2	3	4	5
Gotten to know my neighbors more	1	2	3	4	5
Encouraged friends/family to join me in the garden	1	2	3	4	5

Gardening Practices:	***Almost Never***	***Seldom***	***Sometimes***	***Often***	***Almost Always***
15. **I participate in garden group work days**	1	2	3	4	5
16. **I borrow the equipment at my community garden**	1	2	3	4	5
17. **I help other gardeners at my community garden**	1	2	3	4	5
18. **I help maintain my community garden**	1	2	3	4	5
19. **I participate in social events in the garden**	1	2	3	4	5

20. How much knowledge and experience do you have with each of these?

1 = none at all 2 = a little 3 = some knowledge 4 = quite a bit 5 = a high level of knowledge					
Selecting plants	1	2	3	4	5
Pest control	1	2	3	4	5
Fertilizer	1	2	3	4	5
Weeding	1	2	3	4	5
Designing the garden	1	2	3	4	5
Caring for plants	1	2	3	4	5
The natural environment	1	2	3	4	5

Consider each of the statements below in relation to your community garden. Please circle the number that best describes your thoughts and feelings.

1 = not at all 2 = a little 3 = somewhat 4 = quite a bit 5 = a great deal					
21. **My community garden feels safe**	1	2	3	4	5
22. My community garden is well-cared for	1	2	3	4	5
23. I am proud of my community garden	1	2	3	4	5
24. I feel a strong attachment to my community garden	1	2	3	4	5
25. I feel good in the community garden	1	2	3	4	5
26. I talk about my community garden with other people	1	2	3	4	5
27. My community garden is important to me	1	2	3	4	5
28. Theft is a problem in my community garden	1	2	3	4	5

29. Is your community garden in your neighborhood? _____ Yes _____ No

30. How long does it take for you to get to your garden? ___ minutes by ___ walking ___ bus ___ car

31. What do you like about your community garden? _____

_____

32. What could be improved in your community garden? _____

_____

33. Has your life been changed by being a community gardener? _____ yes _____no

If yes, how? _____

34. Would you like to say anything else about your community gardening experience?

_____

Please circle the answer that best describes you:

35. What is your age range? <25 26-40 41-55 56-70 71+

36. What is your gender? Female Male Transgender

37. How long (in years) have you lived in your current neighborhood? 0-5; 5-10; 10-20; 20-50; 50+

38. How many people currently live in your household? 1 2 3 4 5 6 7 8 9 10+

39. Which best describes your current employment?

Employed outside the home	Employed at home
Unemployed, seeking work	Not employed and not seeking employment
Retired	

40. With what racial or ethnic group do you most closely identify? Choose one.

American Indian/Alaskan Native	Asian/Pacific Islander
Black/African American	Hispanic/Latino
White/Caucasian	Multi-racial

Other _____

41. What is the last year of education you completed?

Some high school	High school graduate or equivalent
Some college or post high school education	College graduate
Some post-graduate	Master's degree or higher

42. What language is spoken most in your home?

English	Spanish	Vietnamese	French	Russian	Italian
Portuguese	Kirundi	Creole	Khmer	Mandarin	Arabic
Hmong	Swahili	Cantonese	Other		

_____

43. How many generations live in your household? ____ one ____ two ____ three ____ four

Any additional comments?

THANK YOU FOR TAKING THE TIME TO FILL OUT THIS SURVEY!

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