Design Thinking to Improve Implementation of Public Health Interventions: An Exploratory Case Study on Enhancing Park Use

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Abstract

Design thinking, a human-centred, iterative process to innovate solutions aligned with communities' tacit knowledge, has the potential to augment public health interventions. This paper presents a case study of a design thinking workshop to illustrate the process and methods to train public health researchers. A workshop was conducted to engage participants in a systematic, non-linear process of design thinking to design possible interventions to enhance use of renovated New York City parks.

Participants engaged in exercises to rapidly craft proposals for park re-design. The process involved learning about design methods to overcome limitations of linear thinking and how design thinking can be applied to public health problems that require community input.

The case study demonstrated the feasibility of training public health researchers in design thinking methods that can be applied to public health problems. With increased capacity, public health researchers could apply design thinking to community collaborations to develop solutions embedded in the unique contexts of the community.

Keywords

Design thinking; parks; implementation science

Introduction

Despite increasing recognition of the need for environmental and policy changes to address complex health issues such as obesity and health disparities (Gortmaker et al. 2011; Swinburn et al. 2011; National Center for Chronic Disease Prevention and Health Promotion 2015), data on the effects of these interventions remain limited. Some studies suggest that while introducing parks or supermarkets in under-served neighbourhoods may have many neighbourhood benefits, they do not necessarily lead to an uptake of the health behaviour the intervention was designed to address, such as increased fruit and vegetable consumption or increased physical activity (Boone-Heinonen et al. 2011; Cohen et al. 2009). Changing availability and accessibility alone may be inadequate to change specific health behaviours (Boone-Heinonen et al. 2011; Cohen et al. 2009). Issues within the design phase of an

intervention, such as poor alignment with true community needs, relying on faulty or partial theories of change or lack of prototyping and testing, may exacerbate this disconnect between the specific aims of the intervention and the actual impact on the ground. This suggests the need for different methods of intervention design and implementation.

More intensive community input and involvement may help ensure the effectiveness and relevance of interventions to those receiving them. One method embraced by public health to address this issue is community-based participatory research (CBPR), which engages community members in the research process to ensure that researchers study the right questions, use appropriate research methods, and increase knowledge and capacity among community residents. CBPR calls for the equitable inclusion of community stakeholders – those affected by the public health issue in question – to be active partners in all stages of research. CBPR has been shown to increase trust in the research process and improve the quality of research, intervention design, and implementation (Israel et al. 2013). Despite these benefits of CBPR, the research process, however participatory, remains limited to conventional tools such as surveys, interviews and focus groups that attempt to identify needs and design interventions through a linear (deductive or inductive) form of logic. These research techniques may be insufficient to innovate bottom-up solutions owned by the community from the outset which more directly align with the local context and thus are more effective and sustainable (Mahr, Lievens, and Blazevic 2014).

From a systems science perspective, bridging the gap between the individual and the environment is crucial (Huang and Yaroch 2009; Huang and Ferris 2016). Innovative approaches are needed to optimize the implementation of environmental or policy change so individuals adopt the intervention. One such innovative approach is design thinking, a problem solving framework and set of methods for developing an understanding of those affected by an issue, reframing the issue to generate creative ideas, and rapidly prototyping these ideas and learning from them in an iterative manner. The prioritization of user insights distinguishes design thinking from conventional technocratic design or problem-solving methods. It is well-aligned with CBPR principles but uses a non-linear, creative process that underlines many product and service design innovations in other fields (Brown 2009; Lockwood and Walton 2008; Kolfschoten and de Vreede 2009).

Largely developed and implemented in the design field, design thinking is relatively uncommon in the health field (Altman, Huang, and Breland In press.) and is not a standard method taught in public health schools, in part due to the strong positivist, linear cause-and-effect tradition that dominates public health. Because our research team is involved in the evaluation of a large natural experiment on the impact of citywide park redesign and renovation on New York City residents' physical activity, mental health and quality of life (Huang et al. 2016), we sought to build internal capacity to use design thinking to generate ideas about how to increase park usage among community residents post-renovation. We aimed to gauge the feasibility of training public health researchers in design thinking by conducting a workshop with our own colleagues (d.school 2017; Brown 2009). We did not cover the full scope of prototyping and testing, due to time constraints, but focused on the ideation of design concepts. The goal of this paper is to illustrate the potential utility of integrating design thinking as a tool that could complement traditional public health

methods to enhance innovation, while recognizing that the scope of the design thinking process depends on the design challenge.

Methods

We assembled a team of nine researchers, including five public health faculty and four graduate students, in a day-long design thinking workshop in November 2016. The goal was to engage in a series of exercises that demonstrated key design thinking concepts and, through a hypothetical project, applied design thinking to a public health problem: creating the physical space and programming that would increase park use and thereby increase physical activity. This public health problem was selected because of the research team's existing work evaluating the impact of citywide park redesign and renovation. The workshop was led by one of the authors who is a designer with extensive experience in implementing collaborative design thinking projects (JA). The co-authors, along with six other colleagues, were participants in order to build internal capacity and gain a basic understanding of the feasibility of incorporating design thinking into public health research before engaging with outside community members. Participants, all design thinking novices, were clustered into two groups of 4–5 people. Participants included both regular park users and non-users. While demographic information was not collected, the participants were university students and faculty and therefore had a number of years of higher education.

The workshop adapted the critical steps from the Stanford Design School's protocol for design thinking: empathizing, defining the problem, ideating, prototyping, and testing (d.school). This protocol was selected as the Stanford Design School is considered a leader in design thinking. The first two steps represent 'need-finding' and involve a deep exploration into 'tacit knowledge' that may be hidden from the stakeholders. Tacit knowledge is knowledge that everyone has but is so taken for granted that few of us even realize that we have it. This knowledge comes from experience, perception, emotions, visceral senses, attitudes and values to which we are trained to avoid paying attention as scientists (Polanyi 1967; Nonaka 1994; Mareis 2012; Kothari et al. 2012). Tacit knowledge can inform solutions that better fit stakeholders' needs. Following need finding, ideating, prototyping and testing design solutions constitutes an iterative rather than linear process, unlike conventional public health methods. As opposed to moving from hypothesis to test, design moves from need to multiple ideas, then prototypes and tests (and often back to revising ideas). The ideas come from a creative process, not purely from previous results. Outputs do not need to perfectly represent the ideas. The cycle from ideas to prototypes, tests and new ideas moves rapidly, as the most important thing is to fail often and rapidly, so that the most innovative, promising solutions can emerge (Brown 2009).

Protocol

The workshop involved engaging the researchers in a sequence of exercises to introduce the concept of design and design thinking and to engage the researchers in the process.

Introduction to Tacit Knowledge—To illustrate the value of tacit knowledge to the design process, the researchers were led through a 45-minute long activity, Stanford's 'wallet exercise.' Participants were asked to spend a few minutes developing wallet design

ideas, without preparation. Next they were directed to identify the characteristics of an ideal wallet for one specific person by asking open-ended questions that probed for emotions, values and needs. Based on this information, they were asked to create a new personalized design. They worked individually and sketched their designs and then discussed the designs with the group. The goal was to orient participants to consider how tacit knowledge can affect design outcomes, and to experience the value of rough prototypes in generating understanding and feedback.

Recognizing limits of implicit assumptions: Two 'mini exercises' (the '9-dots' exercise and 'dividing-a-square' exercise) were assigned to illustrate the assumptions we bring to problems and how assumptions often limit our ability to devise a solution. Participants were given 5 minutes to connect 9 dots arranged in a square (3 by 3) without lifting the pen from paper, with 4 straight connected lines. The only solution is to allow the lines to extend past the implied boundaries of the rectangle, yet most people assume that lines must fit within the square and don't question the parameters.

Value of Iterative Design: In the third exercise, participants were asked to divide a square into 4 identical and equal-sized shapes, within 5 minutes. This activity illustrates how initial solutions to problems are obvious—most people quickly reach the same results. When pushed to further iterate, participants generated additional solutions, demonstrating the power of iteration and how quickly generating variations on a solution requires and encourages creative thinking. This process illustrated opportunities in moving beyond obvious designs to a wider range of choices, and that the same solution set could be arrived at through different cognitive and physical pathways.

Identifying Design Assumptions: The fourth exercise required participants to spend 20 minutes to consider current uses of parks and assumptions the participants held about park design. The aim was to make explicit the usually implicit constraints people might apply to a more complex design problem, such as a whole-park redesign.

Ideation: Several exercises illustrated the ideation process. The participants were asked to reimagine parks and how they connect to communities. Participants were asked to consider open-ended questions designed to elicit different approaches to the problem space. These included probing for emotions, values and attitudes around parks to move participants beyond preconceived notions of parks. Participants had 90 minutes to consider such questions as:

- Do parks play a role in local social networks?

- What does that connection look like?

- How do I want to feel in a park?

- What do parks represent to me?

- What values do parks embody?

Participants visualized the answers on paper, an iterative process that itself involves thinking, drawing, discussing, stepping back and explaining, receiving feedback, and

revising. This step allowed participants to respond to each other and make direct connections among concepts. In 30 minutes, the groups developed mission statements encapsulating their collective understanding of parks and community.

The final activity required the participants to use the mission statement to brainstorm and generate multiple ideas for community parks as quick sketches in 90 minutes, without judging or evaluating the ideas, and disregarding practicality. They considered the social context of the park, and how changes to that network might affect park usage.

Results

Wallet Exercise

By providing a contrast in experience from an 'expert led' design process to a 'human-centred' process, the wallet exercise effectively demonstrated the power of tacit knowledge in designing a product that 'fits' a user. In all cases, the intended user preferred the second wallet over the first.

Mini-exercises

As expected, only one participant solved the '9-dots' exercise. One participant generated 5 designs in the 'dividing the box' exercise, but most developed 3–4 designs. While there is an infinite number of designs possible in this exercise, most people did not consider the possibility of dividing lines in the box that were not straight (Figure 1). In discussing this possibility participants noted the constraints of prior assumptions and the value of forcing multiple iterations of design solutions.

Probing exercises

The open-ended exercises which probed for values, emotions and attitudes around parks generated the following results.

The participants identified the following park uses (Table 1): diverse individual and group activities; a space for physical activity and passive recreation; engagement with nature; a space for organized events and organic social gatherings; to facilitate structured activities and programming such as concerts; as spaces for illicit activities; and as a facilitator of social connections and networks by providing gathering space for different groups such as parents/caretakers and as venues for informal social gatherings including pick-up sports.

Participants discussed the assumptions they were making during the park design process. They noted that current park functions underpin many of the implicit assumptions held when re-designing or renovating parks (Table 1). These implicit assumptions related to park design include the value of parks as places to experience nature, engage in physical activity or passive recreation, and socialize. Additional implied assumptions focused on the possible impacts of parks beyond their borders, including the potential to raise adjacent property values and the potential for dangerous or illegal activity. Participants noted that their own class, race, gender and cultural backgrounds influenced their implicit assumptions.

Participants explored the connections that exist between parks, local social networks and communities. As they sketched the elements of the park they were designing, each participant explored how he/she wanted to feel in the park, what the park would look like, what it represented, and the values that it embodied. Parks and local social networks might connect in several ways (Table 2), including as a space for existing networks or defined groups to meet. Existing communities could use, appropriate and transform parks to meet their needs and help to strengthen or grow the community. Alternatively, parks could serve as a setting for communities to develop organically through the common use of park features. For example, communities of parents/caretakers might form around their children's use of playgrounds.

Participants discussed how parks could embody a community's values or represent different emotions or attitudes for different residents. Further, parks could play a role in shaping a community's identity. Parks could contribute to a neighbourhood's sense of safety and the natural landscape might add to the neighbourhood's liveability. Residents might be exposed to different people, activities and cultures through their local park. Moving beyond parks as a place to connect with nature, socialize or engage in physical activity, parks could also serve as a focal point for neighbourhood pride and as a representation of civic engagement, neighbourhood vitality or community ownership. Additionally, parks could reflect the culture or history of a neighbourhood.

Participants developed mission statements that articulated what feelings they wanted the park to foster, the activities that could engender these feelings, and how the park could embody the values that lead to such feelings (Table 3). The mission statements included goals at both the individual and community level. Some mission statements focused on individual growth fostered through park programming and space for solitude and reflection. Mission statements focused on the broader community including goals such as civic engagement, community belongingness, pride and ownership. For example, some supporting activities and features generated included inviting spaces for people to sit together, provision of refreshments, or culturally relevant programming. Incorporating features or programming designed for a diverse age range was thought to increase accessibility and further the goal of belongingness.

Designing your park

The wallet and 'mini-exercises' helped participants consider design from an emotion/value based perspective and encouraged innovation and iteration. Based on this newly established framework, participants applied a similar process towards designing parks. Before iteration began, groups considered community-based values, and supporting activities. This was then distilled into an overarching design principle or mission statement to guide participants in the iterative stage. Examples of the links between these values and the designs they fostered can be seen in Figure 2. Civic engagement, for example, was established as a value early in the iterative process and its influence on proposed activities, mission statement and design outcomes is clear. Another group considered that spaces that facilitated networks was an important way to link communities to parks. This concept was reflected throughout the process, and manifested as collective and market spaces in a park. Another example showed

that a community might feel more 'ownership' of a park if there was a natural connection to the neighbourhood through a blurred sense of park edges, rather than rigid boundaries or fences.

Discussion

While prevalent in other fields, public health practitioners rarely use design thinking. Design thinking is non-linear and iterative. It emphasizes hands-on doing, not just thinking. It encourages failing often and quickly as a key path to innovation. This contrasts with conventional problem solving approaches in public health. This paper illustrates that it is feasible to train public health researchers to begin to think in design terms, and that within a one-day workshop a research team can generate diverse ideas that could inform future implementation strategies of park renovation interventions. Workshop participants identified the diverse emotions and values associated with parks, and a wide range of activities that might help foster these emotions or values. By incorporating deeply held emotions and values in the design of park prototypes, the public health researchers were able to imagine ways design thinking might enhance the impact of parks' physical renovation. Furthermore, examples from the 'Designing your park' exercise suggested that considering community values as an integral part of the design process directly affected design outcomes.

Design thinking by non-designers

Design thinking encompasses a wide range of activities focused on providing a replicable process-oriented approach to creativity and innovation. This emphasis on a systematic process rather than on an expert-driven model allows its application to various disciplines by non-design research practitioners. Edward de Bono championed lateral thinking as a useful method of problem solving that is 'concerned with breaking out of the concept prisons of old ideas… [leading]…to changes in attitude and approach' (De Bono 1983). de Bono pioneered this as a process learnable by anyone. Many design thinkers have extended de Bono's ideas. Sanders and Stappers base their ideas of co-creation around the assumption that everyone is creative, and that given the right tools, lay people can contribute to the design process (Sanders and Stappers 2012; Sanders and Stappers 2008). Design thinking could potentially facilitate implementation science and health disparities research. Public health interventions often fail to translate into the real world due to misalignment with the context in which they are delivered (Lobb and Colditz 2013). Community participation in human-centred design may ameliorate this, ensuring that intervention strategies address the tacit knowledge held by target audiences of interventions from conception. This could represent a novel way of undertaking CBPR and of improving intervention implementation outcomes, but future research is needed to explore this approach further. Though incorporating community feedback is out of the scope of this case study, there are many examples from other fields demonstrating how the inclusion of design thinking into the community setting can help enable community stakeholders to be in the driver seat to generate bottom-up solutions that would be truly tailored to the specific needs of a community (IDEO. 2018; Center for Systems and Community Design 2018).

Design thinking applied to health

Design thinking has only recently been applied to solving complex health problems, though there is growing interest in doing so from the design and healthcare sectors(Altman, Huang, and Breland In press.). These collaborations demonstrate how systematic approaches to creative innovation can be applied to issues in diverse healthcare contexts. Previous projects have incorporated design thinking to improve employee workflow (Shaikh et al. 2017) and patient experience (IDEO, 2012; MindLab n.d.). Other researchers incorporated elements of design thinking to increase the uptake and efficacy of mobile health behaviour change interventions (Fjeldsoe et al. 2012; Mummah, King, et al. 2016). The Alameda County Public Health Department underwent a human-centred design pilot to increase internal capacity and to innovate strategies to stimulate the local economy as part of Oakland Best Babies Zone, a place-based initiative to reduce infant mortality inequities (Vechakul, Shrimali, and Sandhu 2015). Recognizing gaps in the health sector's capacity to implement design thinking models, frameworks for co-creation and learning (Elg et al. 2012; Mummah et al. 2016) have been advanced to help healthcare professionals operationalize these models. Researchers have started to examine outcomes of interventions developed with design thinking. For example, based on an iterative, co-design process, a hand hygiene compliance (HHC) intervention modified alcohol-based-rub dispensers to monitor frequency of use and centrally project the frequency data, providing real-time feedback to hospital staff and visitors. Use was higher on dispensers with data visualization, and staff reported increased motivation for HHC (Kupis et al. 2017). Further research is needed to better understand and measure how the inclusion of design thinking processes in healthcare interventions impacts health outcomes.

Challenges using design thinking in public health

The workshop illustrated specific challenges in the application of design thinking in a public health setting. Largely developed by the design field, design thinking methodology has not been readily accessible to public health professionals. Those trained in traditional evidence-led processes may be suspicious of design thinking, and its emphasis on empathy, tacit knowledge and 'disruptive change.' As discussed by Jones in *Design for Care*, 'Because change incurs both costs and risks, healthcare has significant incentives not to change the system'(Jones 2013) which discourages the adoption of new systems or disruption. This systemic conservatism maintains stability, but inhibits necessary changes. Public health professionals' knowledge of existing systems and barriers to change inhibits new thinking. Furthermore, increasing 'silo-ization' and reduced budgets create an environment where change may indicate a subsequent loss of power—and protection of the status quo becomes the default. In the pilot workshop, though public health participants were engaged and enthusiastic, interesting limitations emerged. For example, while open-ended exercises generated rich discussions, participants seemed uncertain as to how to proceed, and outcomes were mostly simple lists. These participants, like most non-designers, were unaccustomed to thinking through sketching and may have been uncomfortable or unfamiliar with brainstorming and iteration; both essential components of design thinking. As discussed by Barbara Tversky, 'drawings are an integral part of the dialogue a designer conducts with him or herself during design. They are a kind of external representation, a cognitive tool developed to facilitate information processing'(Tversky 1999). Designers

spend years refining visual communication and iteration skills. Health professional workshop participants were more comfortable *discussing* ideas than *sketching* them.

Though participants were comfortable discussing questions, at the ideation phase, most drew independently without interacting or adding to each other's ideas. In addition, the workshop revealed that public health professionals, like most non-designers, have some difficulty adapting to the non-linear needs of design thinking, which could be ameliorated with practice. Where possible, providing more physical materials could further stimulate creativity. If participants get stuck, workshop facilitators should de-emphasize the importance of the quality of drawings to allow participants to create quickly, without being limited by their sketching abilities.

Public Health Implications

The public health community generally is organized around the scientific method, which reflects a linear approach to problem solving. While the field has acknowledged the importance of engaging the community as participants in research, often the methods remain conventional, linear, and therefore limited in fostering innovation. This is necessary but not sufficient in public health, where many interventions - even those based in evidence-led strategies - do not achieve their desired impact due to poor or insufficient design. Linear thinking may be even more limited in addressing public health and community *systems*, which are complex and messy. Design thinking offers a way forward by providing a structured and replicable process for creative problem solving. This process allows for new connections between existing ideas and encourages rapid prototyping in order to identify issues or problems early on in the process. This paper shows that it is possible to increase public health researchers' capacity to engage in design thinking, and challenges around visual thinking could potentially be overcome through further refinement of the design thinking tools used. With increased capacity, public health researchers could incorporate and adapt design thinking into the intervention design process as a tool to gather and employ greater community insight.

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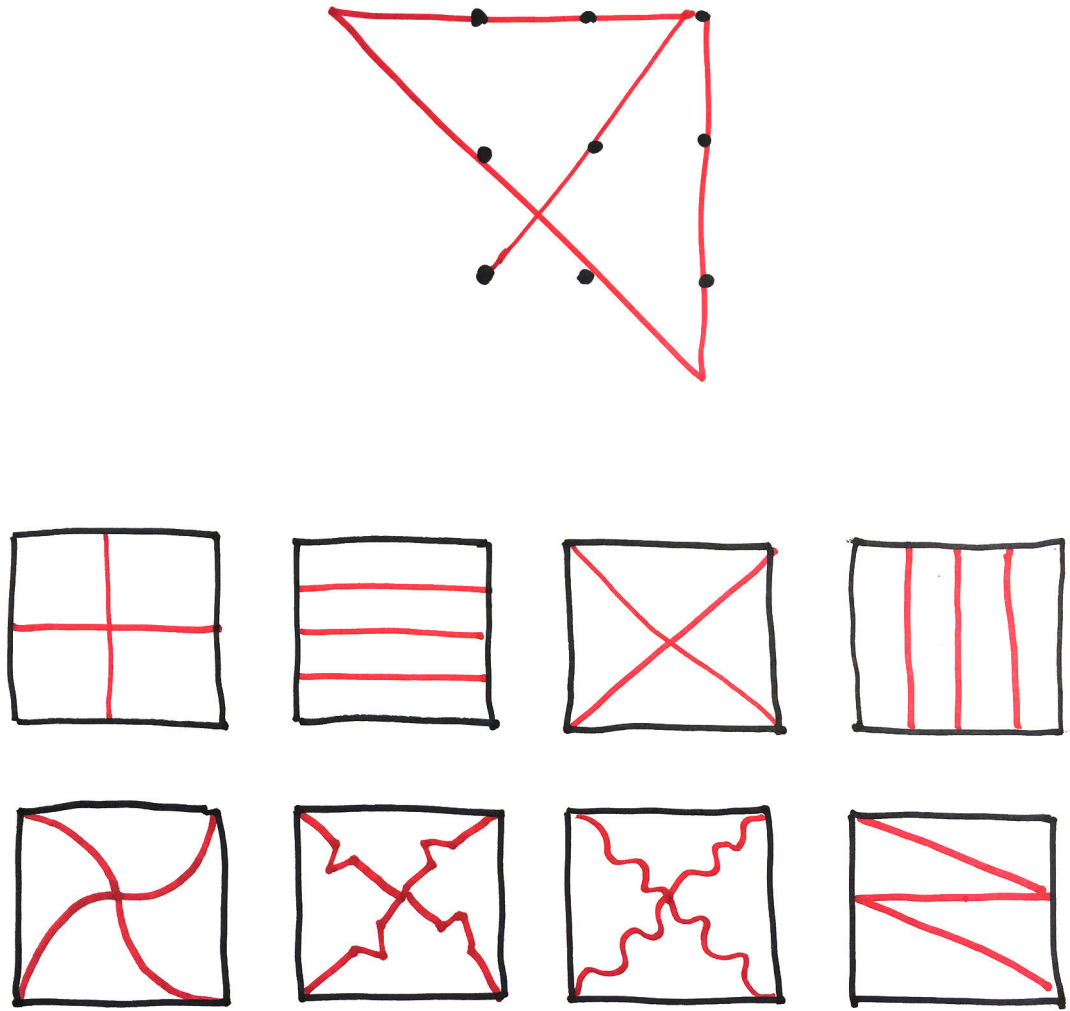
Figure 1.
The '9 dots' and the 'Dividing a square' exercise

Figure 2.
Examples of the links between the values around parks and the associated park designs

Table 1.

Current park uses and implicit assumptions regarding park design

What are parks used for?	What assumptions are we making when designing new parks?
• Group sports/activities (basketball, tennis, handball, tai chi) • Individual sports/physical activity (swimming, cycling, walking, running, sledding, skiing, hiking, skateboarding, rollerblading) • Passive recreation (sitting, walking chess, birding, reading) • Fitness classes • Volunteering • Urban agriculture/farmers markets • Dog walking/ dog runs • Socializing • Public and individual activities • Dining and eating (picnics) • People watching • Playgrounds and sand boxes • Gathering space for different groups (teenagers, moms and kids, elderly, homeless people) • Foraging • Growing food • Illegal, illicit activities • Escape • Protests, rallies • Public events (concerts, movies) • Gardening • Small vendors, farmers markets • Tarot card reading • stargazing • Compost/recycling collection • Personal celebrations	• A place for foliage, greenery, nature • Physically open space • To express yourself, place to get away, escape city traffic, noise, commotion, respite • Civic space, public interaction • Place for physical activity, sports • Children's play equipment • Positively associated with real estate value • Makes the neighbourhood look nice (beautification) • Rest • Socialize • Liveability • Possibly unsafe after dark/dangerous place to congregate • Good for kids • Free • A place for illicit activities • Outside/above ground • Accessible

Table 2.

Connections between parks and social networks

What does the connection between parks and local social networks look like?	How do I want to feel in this park? What do parks represent to me?
• Space where existing networks can come together • Some communities form organically through park use (dog walkers, parents/children, fishermen) • Allows people to be exposed to different people and different activities • Community feels "ownership"/entitlement • A place for specific, defined groups • Contributing to neighborhood safety • Natural landscape adds to neighborhood livability • Cultural space • Neighborhood pride • Extension of living space	• Freedom of expression • Diversity • Comfort • Connectivity/communality vs nature • Sense of belonging • See/meet neighbors • Cultural and historical connection (local flavor and universal values) • Vitality/restoration/rejuvenation • Democracy • Physical health and activity/outdoor gym • Civic engagement • Functional • Community investment/buy-in, community ownership • Fortune/pride/privilege • Neighborhood pride • Aesthetically pleasing, beautiful • Education

Table 3.

Mission statements and supporting activities for redesigning parks

I want to feel a sense of _____ in this park. / My park will foster_____	What activities could engender these feelings? How can a park embody such values?
Civic engagement	• Diverse activities • Volunteering • Collective activities • Include social services
Individual development	• Education activities • Cultural activities • Recreational activities/physical activities • Allow for solitude, reflection
Community belongingness	• Allow for/invite people to sit together • Provide food/drinks • Include markets and events (e.g., movies) • Host music performances or art shows • Accessible to diverse age range • Field trips (birdwatching)
Pride	• Invite residents to jointly maintain/clean up the space • Pertain to local demographic/culture
Stress relief	• Have sufficient natural landscaping
Ownership/agency	• Include markets and events (e.g., movies) • Host music performances, art shows, dance, movies, cultural activities, games (chess) • Invite residents to jointly maintain/clean up the space • Children's activities • Urban agriculture • Active recreation
History & cultural development	• Pertain to local demographic/culture • Host music performances, art shows, dance, movies, cultural activities, games (chess)
Happiness	