ALIGNING THE DESIGN INTENT WITH THE ACTUAL USE OF A GARDEN IN A PEDIATRIC HOSPITAL

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ABSTRACT: The combination of an increased value placed on quality of life and hospital satisfaction with the known health benefits of nature have fostered healing gardens to become a standard programmatic element in hospital design. Given the complex relationships between health and habitation, program and occupancy, healing gardens would benefit from greater study and research. This research observed use patterns of a healing garden located adjacent to the third-floor oncology unit of a pediatric hospital in Portland, OR. Use patterns recorded through observation and behavior mapping include user group, length of stay, and activity. Additionally, weather data taken onsite was correlated with use patterns to better understand the impact of temperature, relative humidity and light levels. Some findings in terms of healing garden use are concurrent with past research from literature reviews while other findings are not. While this particular healing garden is successfully used for longer durations than those found in the literature review (despite only being accessible from an upper floor), many aspects of this healing garden are not used as envisioned by the design team for a variety of reasons outlined in the paper. This research serves as an initial set of data to inform design decisions to improve the quality of life for patients, providers, and visitors.

KEYWORDS: Healing garden, Research-based design, Post occupancy evaluation, Design intent

INTRODUCTION

Roger Ulrich's study in 1984 found nature to have a direct benefit to the health and wellbeing of an individual primarily through the reduction of stress (Ulrich 1984). The realized benefits of nature subsequently coincide with a shift in hospital care. "Subjective domains of health outcomes... are becoming increasingly important in health and hospital culture, as the paradigm shifts from mobility and morality as primary outcomes of a hospital experience to a broader view that includes health-related quality of life and satisfaction (Sherman et al., 2005)." The combination of an increased value placed on quality of life and hospital satisfaction with the known health benefits of nature have fostered healing gardens to become a standard programmatic element in hospital design. Healing gardens are a natural space where physical symptom relief, stress reduction, and/or improvement in one's sense of well-being can occur through passive or quasi-passive activities, such as observing, listening, strolling, sitting, or exploring in that space (Marcus and Barnes, 1994). From a design perspective, healing gardens are unique as they are "both a process and a place. It is a concept at the meeting point of medicine and design (Marcus, 1994)." Given the complex relationships between health and habitation, program and occupancy, healing gardens would benefit from greater study and research. Specifically, documentation of occupancy use, environmental conditions, and a comparative analysis of design intent to evidenced use can solidify healing garden's role as an architectural space that contributes to occupant health and wellbeing.

1.0 LITERATURE REVIEW

1.1. User-group, duration, activity

Through observational findings in existing literature, three distinct user groups have been identified (patients, providers, and visitors) that utilize a healing garden. A 2005 observational study of 1400 healing garden users found patients to represent 4% of documented users while providers and visitors make up 45% and 46% respectively (Sherman et al., 2005). The averages of multiple case studies (Whitehouse, et al., 2001, Sherman et al., 2005, Abbas and Ghazali, 2010) reveal similar user percentages with 4% patients, 38% providers, 46% visitors, 7% non-patient non-hospital participants, and 4% with mixed/unknown user-group identifiers (Figure 1).



Figure 1: User Groups (data averaged from multiple studies) and Duration (data from Sherman 2005). Source: Author

An average of past literature reveals 73% of users stay less than five (5) minutes inside a healing garden, 9% stay 6-10 minutes, 9.5% stay 11-20 minutes, and 6.8% stay over 20 minutes. These averages can be used as a base standard for comparison. For example, Sherman et al. (2005) showed a short length of stay in a particular healing garden. Of the 276 users in that study, almost two-thirds stayed less than one (1) minute in the healing garden studied (Figure 1).

Healing gardens accommodate a range of activities based upon the ability, physical and emotional health, and desire for each user group. Activities previously recognized in studies include: lunch, sit and talk, sit and relax, quick chat, structural interactions, work meeting, walking around, patient room, patient interaction, natural features, let children play, cell-phone, sit and wait, and play (Sherman et al., 2005). Figure 2 documents the frequency of activity as a colorcoded bar collected from the literature review. Activities are organized by physical exertion; most exertion (play) is, therefore, on the far left while most stationary (sit and relax) is on the right. Activities from left to right are as follows: play (5%), structural interaction (10%), natural features (9%), patient interaction (7%), patient room (9%), walk around (13%), let children play (4%), work meeting (2%), lunch (2%), cell-phone (5%), sit and talk (19%), sit and wait (4%), and sit and relax (11%). Children's most frequent activity is "play" while both visitors and provider's most frequent activity is "sit and talk." Passive uses of a healing garden, such as viewing the healing garden from an interior space, are not recorded or documented for the purposes of this research.



Figure 2: Activities Bar (data averaged from multiple studies). Source: Author

1.2. Rationale

This research aims to record use patterns of a healing garden for comparison to design intent of a healing garden at a Portland, Oregon pediatric hospital. Documentation of use patterns is valuable as it has the potential to validate existing design approaches, reveal unanticipated uses, and inform future designs. The aspirational goal for this research project is to contribute to a body of knowledge where intent and use are reckoned for healing gardens to more fully impact the quality of life for patients, providers, and visitors.

This research also aims to establish an initial comparative data set between healing garden use and weather with an emphasis placed on occupancy. During the literature review, little documentation was found on weather during the observational period. The relationship between weather and healing garden use is, therefore, speculative and unknown, but it may have a direct impact on occupancy which would naturally influence design choices such as location, proportional shading devices, and feasibility. Incorporating a collection of technical weather data will provide additional insight to the occupancy and use patterns documented at the healing garden.

Finally, this research aims to provide knowledge on healing garden use specific to the Pacific Northwest. Healing gardens previously studied are clustered around regions with research on healing gardens is previously established. Without a collection of data on healing gardens throughout the United States, it is unknown how applicable existing research is outside of those documented regions. Furthermore, while healing gardens are becoming a standard programmatic element in hospital design, there is not enough published research on healing gardens to enable

comprehensive evidence-based design decisions to be made. This research will add knowledge of healing gardens in the Pacific Northwest to the existing set of research.

2.0. METHODOLOGY

In collaboration with the architecture firm Zimmer Gunsul Frasca Architects LLP (ZGF), a healing garden at a children's hospital (children 0-18 years of age) was selected for this research. Completed in 2012, Randall Children's Hospital (RCH) is a 165-bed hospital with a including neonatal intensive care unit, pediatric intensive care unit, a emergency department and a day surgery unit. RCH features many family friendly and child focused design elements such as animal cutouts within the wall of the lobby, soft material choices, and a vibrant color scheme. There are two outdoor spaces at RCH including a courtyard adjacent to the main lobby on the ground floor of RCH and a healing garden, known as the Terrace Garden, located on the third floor. ZGF was interested in studying the Terrace Garden as it has some unique circumstances. The programmatic elements on the third floor include the Children's Cancer and Blood Disorder Unit and an administrative wing; neither of which encourage accidental discovery or walk-by advertisement for the garden. Additionally, access to the garden is limited; only registered guests or patients of the hospital may enter the elevator at the lobby. There is only one entrance to Terrace Garden with alternate exits available for emergency egress only. For those with access, Terrace Garden is open from 6:00am until 11:00pm every day. The combination of these circumstances enable a uniquely controlled condition for research and study.

2.1. Design intent

The Terrace Garden is in the shape of an elongated rectangle. A four-foot high transparent wall runs along the east, south, and western sides of the garden with the exterior hospital wall to the north. There are a number of features and spatial arrangements, which are a direct response to ZGF's design intent. For the purpose of this research, design intent is broken into (1) circulation, (2) spatial zones/areas, and (3) elements and features. When categorized in this way, design intent is aligned with spaces that incorporate biophilic patterns (Browning 2014).

Circulation, including surface material choices, is designed to accommodate patients regardless of mobility status (i.e.: access to the garden is provided to patients in wheelchairs, hospital beds, and with an IV pole). A specific design intent was to allow views from the infusion bay windows into the garden while still providing privacy for patients receiving treatment. ZGF designed a series of raised gardens in front of these windows, located on the north side of the garden, which distances garden users from the window surface thereby increasing privacy while still maintaining views to the garden.



Figure 3: RCH Terrace Garden Plan (based on ZGF drawings). Source: Author

Spatial zones/area are largely dictated by the raised (terraced) gardens in the Terrace (Figure 3). The far west area is intended primarily for providers as it is designed with a private door to/from the hospital and is farthest from the largest gathering area. The provider space was designed for activities such as lunch, sit and talk, sit and relax, and work meeting. Adjacent to the provider space is a space dedicated for children to play with special attention given to the design of surface materials. For example, a grass/turf material covers the ground so children may play on the ground comfortably. Three semi-private spaces are located between the play-space and large gathering area. These spaces accommodate a variety of activities and include fixed benches and natural features (ZGF, 2012). The main entrance to the Terrace Garden opens onto the main gathering area. The main gathering area includes a variety of movable seating and a large overhead canopy constructed of metal and translucent material overhead. This gathering area is intended to be an active area where all activities are encouraged. The last two intended spaces include a small niche appropriate for 1-4 people with direct exposure to the elements of weather and a secluded, privacy garden intended for respite and reflection (Barton, pers. comm.). The privacy garden had very specific goals in design to be a space dedicated for families experiencing extreme stress or loss.

Elements and features specifically designed/selected the Terrace Garden include seating, surface materials, plant

selection, and art. Seating (that is not a part of the raised gardens) is movable, and each piece has an intended location in plan drawing. Dark gray ground surfaces are made of a softer material and located where the intent was for children to play. Bamboo was selected to act as vertical privacy elements that can respond to climate and user needs. A local artist designed sculptures which act as playful elements in the landscape and are functional light wells for the neonatal unit below.

2.2. Weather and use observation

Research at RCH include two separate research periods. The first research period was conducted in March 2015 for approximately a week, and the second research period was from May 1, 2015 to May 31, 2015. HOBO meters were utilized to record weather and occupancy of Terrace Garden. Light, temperature, and humidity were collected every 15 minutes in the play-space, the privacy garden, the main gathering space, and the private respite area. An occupancy sensor was placed on the main entrance door of the garden to record each time the door was opened (subsequently referred to as an occupancy instance) throughout the duration of each research period.

Use observation data was collected by on-site observation done by one researcher, the primary author of the paper. Periods of data collection occurred from 9:00am to 5:00pm, Monday through Friday, in order to acquire a basic understanding of garden use during typical business hours. Use observation data collection includes recordings of user group, duration, and activity. User groups were categorized as either provider, adult visitor, or patient (child/ adolescent). User group identification was determined through physical appearance and apparel. Duration is time passed (in minutes) from the onset of an event (enter garden) to the closure of that event (exit). An event can include multiple user groups and activities. Categories of activities include: quick chat, work meeting, cell-phone, sit and talk, sit and relax, sit and wait, walking around, natural features, struck interaction, play, let children play, patient interaction, patient room, and lunch. Activities were documented by visual observation on site. Behavior mapping was utilized for the recording of circulation, views, and sitting locations for each user.

3.0. RESULTS

A total of 2168 occupancy instances were recorded during the research periods. Data collected from occupancy sensors suggest occupancy for a typical week is varied and does not follow a day-of-the-week pattern. There are periods of several days with high use and periods of several days with low use. The data collected indicates an increase in occupancy use with higher recorded temperatures. There is also an increase in occupancy instance when recorded low humidity is within a range of 20-40%. Results also indicate occupancy is lower on days with an illuminance of 5,000 lux or less. As this paper specifically focuses on design intent compared to actual use, additional analysis done on relationships between temperature, humidity, light, and occupancy are not included within this paper but are a part of the larger study.

A total of 41 occupants were observed over 7 days of on-site observation. Three recognized user groups frequent Randall Children's Hospital Terrace Garden: patients (20%), and providers (33%), and visitors (48%) (Fig. 6). The mean average duration at the Terrace Garden was nine (9) minutes with a median duration of six (6) minutes. Of the 27 events recorded, 11.11% stayed 0-1 minute, 40.74% stayed 2-5 minutes, 29.63% stayed 6-10 minutes, 11.11% stayed 11-15 minutes, 11.11% stayed 16-20 minutes and 7.41% stayed over 20 minutes (Fig. 4).



Figure 4: User group, duration, and activities at RCH. Source: Author

During observation, eleven (11) of the thirteen (13) recognized activities were present: work meeting (2.38%), cell-phone (9.52%), sit and talk (4.75%), sit and relax (16.67%), walking around (28.57%), natural features (11.90%), let children play/play (2.38%), patient interaction (4.76%), and lunch (14.29%). A new observational category, view, was added in response to observed behavior. View was a purposeful recorded activity 4.76% of the time.

Behavior mapping was utilized to spatially track the circulation and movement of user groups during garden use. Each user group is distinguished by color with blue as visitor, red as provider, and purple as patient. Squares signify moments of pause greater than five (5) seconds, gradients indicate a purposeful viewing moment, and an "X" indicates sitting. As can be seen through the mapping, each user group circulates the garden differently. Providers primarily stay in the main gathering area (Figure 5). Patients and visitors walk through the garden in a similar fashion with visitors expressing a more exaggerated path of circulation. A loop or track motion is documented by both patients and visitors in which they move through the main gathering area, pass by the semi-private and play spaces, come to the provider space to then turn around and exit the garden.



Visitor

Figure 5: Behavior mapping by user group. Source: Author

4.0. DISCUSSION

It appears occupancy increases with warmer temperatures, lower humidity, and higher illuminance. This can be perceived as a typical response to the onset of summer. However, there is at least one recorded day each week that does not reflect this pattern. These anomalies have no apparent relationship to weather conditions for that day. Anomalies do not occur on the same day of the week nor do they exhibit recurring scales (given the current set of data). The presence and behavior of anomalies ultimately suggest factors beyond weather influence occupancy for the Terrace Garden.

User group percentages are slightly unusual at the Terrace Garden with patients representing 20% of the users. This higher patient use could be contributed to several factors. First, the patients at RCH are children and therefore often follow the guidance/direction/desires of an adult, which is in this case a visitor to the hospital. Visitors have a traditionally higher use percentage for gardens, which may lead visitors to more readily encourage patients to visit the garden than if the patient were an adult. Secondly, patients are easier to identify at Terrace Garden; they are children and, given the location of the garden, regularly have identifying apparel or medical equipment with them. Patients' healthcare needs did not seem to influence frequency of use or activity level, as patients observed in the garden ranged in physical abilities, apparent health, and medical assistance required. Additionally, the restrictive nature of the garden could be contributing to patient presence. The unique circumstances of the garden, mainly its 3rd floor location and security protocol, provide a safe, secure space where patients can enjoy nature while still being near a patient's room. Other user groups at Terrace Garden are similar to past literature, with a slightly lower provider usage and a small increased usage by visitors.

A typical user stays longer at the Terrace Garden than the average duration found in past studies. The average length of stay at the Terrace Garden is nine minutes while the majority of users at other gardens stay for five minutes or less. Again, the Terrace Garden's location could be a driving factor in length of stay. Given the programmatic elements on the Terrace Garden floor, the Terrace Garden is likely a sought destination for users. This both encourages users to stay longer as they have invested more into the event and limits opportunistic passerbys that may be curious but would not linger.

The greatest activity recorded at the Terrace Garden is walking around. Other frequent activities include (in order of highest percentage) sit and relax, lunch, and natural features. Both visitors and providers are more active than their past study counterparts. An explanation for visitor's higher exertion could be the long rectangular form and design of the garden as it encourages visitors to walk along the stretch of the garden before returning indoors. Additionally, "views" have been added as a purposeful activity for the Terrace Garden. Views include an extensive forest park to the east and mountain range to the west, and to see both views, a user must walk the entire length of the garden.

There is a clear pattern found in behavior mapping based on user groups. Providers stay near the main entrance in the main gathering area. This could be due to the limited time providers have for break. It could also be because the main gathering area has an over head structure that provides shade and protects a user from rain. While visitors do stay in the main gathering area, they also walk along the southern wall of the garden.

4.1. Design intent

Design intent is discussed through (1) circulation, (2) spatial zones, and (3) elements and features. Circulation was both effective and engendered unanticipated uses. 62% of observed patients utilized a wheelchair or IV pole in the garden. These patients did not exhibit any noticeable difficulty in navigation or activity due to garden design which indicates chosen ground material and spatial circulation effectively satisfy design intent. Additionally, a track-like motion was regularly exhibited by users as can be seen in behavior mapping (Figure 6). This track-like motion was not an original design intent, but it is an effective way for users to experience the garden. Additionally, the track-like motion lasts approximately four minutes, exceeding the minimum duration required for stress reduction benefits (Ulrich 1984). If the track-like motion is incorporated into design intent, rather than an unanticipated result, a looped path could be designed for garden users to continue the track-like motion. A looped path has the potential to increase longer stays, more exercise, and additional engagement with nature, thereby increasing effectiveness of the healing garden.



Figure 6: Track-like motion of users on 5/28/2015. Source: Author

Most of the spatial zones do not function as intended (Figure 7). The far west area intended for providers is not used by providers as can clearly be seen in behavior mapping. Part of this may be due to the lack of accessibility to the door located in the provider space. This door, originally envisioned as a provider door for this space, is inaccessible as it proved to be a source of potential contamination for children receiving chemotherapy. Additionally, the provider space has full exposure to weather. Instead, providers stay near the main entrance where there is shade, an overhead canopy, and tables.

During observation, no children played in the play-space which indicates the play-space is not used as intended. Two observed interactions occurred in the play-space. Both interactions were visiting adults without children curious about the artistic sculpture in the space. The semi-private spaces, located between the play-space and large gathering area, were also not used with the exception of one walk through during observation periods. These smaller, semi-private spaces would greatly benefit from the addition of mystery elements as they would both reward visitors that walk through those spaces and draw new users into those spaces.

The large gathering area appears to be used as intended. Seating is arranged by the user to accommodate different group sizes and preferred views. The overhead structure makes the large gathering area an ideal place to eat or read as it prevents direct sun from landing on a visually focused surface. 85.7% of observed activities recorded as lunch were located in this area. The south-east corner of the Terrace Garden is also used as intended. The small niche is regularly frequented by one (1) visitor with one (1) patient. The combination of direct sun, a small semi-private space that is close to the main entrance are likely driver for frequent use of this space.



Figure 7: Space utilization. Source: Author

The north-east corner of Terrace Garden is not used as intended. The doorway to the north-east corner was closed off to the public due to administrative hospital expansion. As this doorway was the only access point for this portion of the garden, users must now walk through a garden bed to gain access to that space. As such, the north-east corner receives very little occupancy use even though it is perhaps the most visually stimulating area.

Seating is not kept in the locations laid out in the plan drawing, but they do allow users of the garden to interact with the garden by personalizing the space through chair motion. The dark gray ground surfaces were not noticed by users during observational periods. As such, it is unlikely children congregate in those areas for play, even though

the gray material is softer and more suitable for such activities. Bamboo has been successful in acting as a vertical privacy element. However, the maintenance bamboo requires is greater than the available resources, and it has become overgrown. As such, it was removed from the garden entirely in summer of 2015 due to high maintenance requirements. Lastly, the sculptures designed by an artist are not sources of play as they were intended to be. Users asked questions such as, "What is this? Why is it in the garden?" As answers to these questions are unknown to the user, other artistic elements in the garden are typically avoided.

CONCLUSION

This research provides post occupancy insight on a healing garden in a hospital facility. While larger contextual relationships (such as floor location and adjacent program) are important, they do not necessarily negatively impact the potential use of a healing garden. In fact, factors that may limit occupancy may also increase duration and patient presence both of which increase healing garden effectiveness to improve health and wellbeing.

To answer the initial question which prompted this research, "who actually uses a healing garden anyways?" the simple answer is everyone. Everyone does not infer a high occupancy count but rather an established presence of each type of user group at a hospital facility. Percentages vary, but healing gardens are not primarily used by one user group, nor are they used in predominantly one way. Design decisions can be informed by research to increase the effectiveness of healing garden design. While seeking as many occupants is ideal, a healing garden is most effective when users stay a minimum of three minutes in the healing garden. This, rather than shear occupancy or specifically chosen features, should be a primary design intent for healing gardens in the future.

5.1. Next steps

The relationship between weather conditions and occupancy use would greatly benefit from additional study. Through this initial collection of weather conditions with occupancy use, it appears healing gardens have a higher frequency of use with an increase in temperature, illuminance and lower humidity as can be seen in the transition from spring to summer for Portland, Oregon. This trend does not, however, explain the frequent anomalies where occupancy does not respond to weather conditions. A full year of documented occupancy and weather at RCH would solidify the correlation of weather and occupancy.

Additional research at RCH should include an incorporation of surveys and interviews. Data gathered from these qualitative research methods can then be further compared to weather, occupancy, and observation in order to more fully understand (1) the behaviour of occupants in the garden (2) why this particular garden encourages extended duration and (3) opportunities for optimization.

Lastly, more healing gardens need to be observed to understand the relationship between location, duration and general use. Healing gardens are typically seen as most beneficial if they are located in a central, easily accessible area of the hospital. The Terrace Garden at Randall Children's Hospital is not central nor easily accessible, yet is has a significantly higher duration than past research. This indicates healing garden duration may be influenced by location, and centrality may not be the most effective design decision. To compare location and duration, a massive collection of healing garden data, including their location within a hospital should be collected. Documenting context such as geographic location, user group, and hospital information is critical to decipher what use patterns are unique to location and what use patterns are consistent. This data can also be used to establish both place-specific design strategies and general use patterns across the United States, enabling designers to make informed decisions when designing healing gardens.

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