THE SENSORY GARDEN EXPERIENCE

A SENSORY ENRICHMENT DESIGN FOR THE ARIZONA SCHOOL FOR THE DEAF AND BLIND

Master's Report
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The focus of this master’s report was to examine the sensory garden experience - a comforting space that emphasizes the broad stimulation of all 5 of the user’s senses. Tucson’s beautiful Arizona School for the Deaf & Blind (ASDB) provides an education and sense of place for its students and community; moreover it serves as a cultural resource and center for Deaf culture and developing young minds. However the problem is that the campus truly lacks an outdoor space that unifies the campus as a whole and provides an enhanced sensory experience for its student body and populace.

The intent of this master’s report was to develop a set of comprehensive guidelines and principles that designers will be able to use in the future to enhance the sensory experience for deaf and blind users. These guidelines have been applied towards the design of a master plan for the Arizona School for the Deaf and Blind located in Tucson, Arizona. The sensory garden serves as a means of providing students, faculty and guests with an opportunity to interact with the environment, engage in passive recreation, spaces for opportunistic meetings, the promotion of cultural awareness, and last it provides all of its users with a heightened sensory experience.

This report has investigated: the various components of a sensory garden, the concept behind sensory designs, and how our senses interact in relation to spaces. The report also examined potential design standards used in DeafSpace and blind spaces, and last it examined sensory mapping and how its methods are involved in the design process.
Tucson’s beautiful Arizona School for the Deaf & Blind (ASDB) provides an education and sense of place for its students and community; moreover it serves as a cultural resource and center for Deaf culture and developing young minds. For deaf and blind users, sensory stimulation is used as a means of connectivity, employed to maintain relationships with their surroundings. Unfortunately, through overuse, weathering, multiple campuses renovations, missed design opportunities, and various budget constraints - the campus has lost this connectivity and what would appeal most to its users: adequate outdoor spaces that stimulate the user’s senses and provide enhanced sensory experiences for the school population and surrounding community.

The purpose of this work was to focus on the unique situation of designing, developing, and implementing a set of guidelines for 2 distinctly different user groups, that were then to be used in the creation of a series of sensory gardens and corridors that would enhance the sensory experience for the deaf and blind communities. The benefits of enhancing the sensory experience were realized by providing all of the users with opportunities to interact with the environment, to engage in passive recreation, and last by providing all of the site’s users with a heightened sensory experience.

I. SIGNIFICANCE

The Sensory Garden Experience
The current ASDB campus first opened in 1922 as an educational facility for deaf and blind students from all around Arizona. Located on the Westside of Tucson along the Santa Cruz River, 25 buildings sit on roughly 70 acres of land making up a campus that educates up to 300 hundred students and houses anywhere from 30-60 students in their on campus dorm facilities.

Designed by noted Tucson architect Roy Place, the site was part of Tucson’s 1920’s Spanish Colonial Revival found frequently in the American Southwest. Typical of many school designs, the campus was laid out in an institutionalized linear fashion. Early imagery depicts curved roadways and sidewalks at the main entry, with smaller sidewalks leading to and through many of the site structures. As was common with many school designs at the time, plant selection was based more on aesthetics rather than function or water use. Presently, the site is a hodgepodge of palms, privet buses, pine, olive and elm trees are used extensively throughout the site.

The campus has gone through several reconstruction and expansion projects over the years. The early 1960’s saw the first major expansion of dorm, classroom and administration facilities. In the early 1990’s many of the buildings were falling apart and required upgrades. This led to an upgrade in more modern classroom facilities, administration, and dining facilities – but at the expense to the character of the school site.

The loss of congruent pathways, disruption of circulation continuity, and spaces designed for buildings and not for the users - has led to a dysfunctional school layout. Several of the aged existing building structures are vacant and either being retrofitted or reexamined for their usefulness. The corridors and accompanying landscapes surrounding these buildings have fallen to the wayside and suffer from misuse and constitute dead space.

What was once a unified campus has lost its connectivity and its essence through designs that failed to take into account the unique needs of its user groups. A cookie cutter approach to school campuses will not work at a school with distinct user needs. This master’s report addressed these issues.
How does one create an enhanced sensory garden that provides sensory richness and comfort for all of its users?

Develop a master plan for an enhanced sensory experience, then apply to design specific areas within the site that will . . .

- Encourage passive recreational usage
- Promote cultural awareness
- Provide educational opportunities
- Create opportunistic meeting spaces
- Promote sensory stimulation
V. METHODS

The design process for this report consisted of an ongoing concept development phase. A research and review process entailed a literature review, several case reviews, descriptive data, internet resources and design publications aided in discovering how other areas have approached the design aspect of developing innovative softscapes, hardscapes and multiuse pathways for sensory enhancement.

As part of the site analysis portion of this report, various resources from the City of Tucson, Pima County, the State of Arizona, the internet, site visits and A.S.D.B. staff were aided in the assessment of existing site conditions. This collective data was used to help determine various functions and existing site conditions, energy resources, spatial relations and circulation patterns around and through the site.

As part of the program, a series of design guidelines and standards were developed and incorporated into a final site master plan. These design standards determined site location, element usage, and multiple design features. A paper and presentation containing a collection of innovative graphics showcasing designs, design implications, materials, and features have been used to demonstrate the end product of the process.

VI. TERMINOLOGY

Sensory garden
Sensory design
DeafSpace
Gallaudet
Blind spaces
Tactile experiences
Acoustical landscapes
Wayfinding
Soundwalking
Sensory mapping
The final outcome of this project was a master’s report consisting of: 1) a literature review and collection of data that pertains to developing an innovative multiuse sensory garden space for ASDB, 2) an examination of data relating to site selection for development for an innovative sensory garden, 3) a set of guidelines for developing an innovative multiuse sensory garden, 4) the application of said guidelines resulting in a master plan and a set of site plans for 3 different sensory garden spaces, a compilation of various perspectives to showcase site organization and selected sensory elements.

VIII. PROCESS

CONCEPT DEVELOPMENT:
- SITE SELECTION
- GOALS / OBJECTIVES
- METHODS

RESEARCH and REVIEWS:
- LITERATURE REVIEW
- CASE REVIEWS
- COMMITTEE REVIEW

SITE ANALYSIS:
- SITE VISIT
- FUNCTIONS
- QUESTIONNAIRE

DESIGN APPLICATION:
- ELEMENTS
- GUIDELINES
- PLAN

DESIGN OUTCOMES:
- EVALUATION
To better understand what a sensory garden is, several terms needed to be defined. First, what is the definition of a sensory garden and how do our responses help to define such a space? Next, because we are dealing with the senses or human interactions, there was a need to examine users and how their interactions help to define the sensory garden’s spaces. Various principles of Sensory Design and how its methods are involved in the design process were also assessed. Because this master’s report addressed a specific sensory garden design for the Arizona School for the Deaf & Blind, the work needed to examine ways to incorporate into the program specific design concepts and standards for the deaf and blind communities, such as DeafSpace and tactile experiences. Last, ways to better approach and understand designing spaces for deaf and blind communities were explored.
II. SENSORY GARDEN

What is a sensory garden? A simplified understanding of the sensory garden would be one with a design that appeals to all five of the senses (Furgeson 2006). A more defined and encompassing definition of a sensory garden, according to the Sensory Trust, “would be a self-contained area that concentrates a wide range of sensory experiences” that provides “a valuable resource for a wide range of uses” (Sensory Trust 2010). It is best understood to be a small garden that has been specially designed to fulfill the needs of a group of people who want to be involved in active gardening and who also enjoy the passive pleasures of being outdoors (Hussein 2009). We need to ask ourselves; Are all gardens considered sensory gardens? A garden is defined by Webster’s Dictionary as:

1. a: a plot of ground where herbs, fruits, flowers, or

vegetables are cultivated b: a rich well-cultivated region c: a container (as a window box) planted with usually a variety of small plants

2 a: a public recreation area or park usually ornamented with plants and trees <a botanical garden> b: an open-air eating or drinking place c: a large hall for public entertainment.

The definition above does not differentiate between a garden and a sensory garden. The key point missing in the interaction between the garden and the user’s senses; this helps to distinguish a garden from a sensory garden. This involvement of the senses becomes one of the key concepts for sensory gardens; they are designed specifically for the purpose of stimulating and interacting with our senses. In fairness, all types of landscapes and gardens stimulate and illicit some type of a sensory response but it is the concentration of different experiences that sets sensory gardens apart from its counterparts (Sensory Trust 2010).

An argument could be made that the typical function of a sensory garden is to encourage users to “interact with objects” (Sensory Trust 2010) with the intention to provide experiences for seeing, smelling, hearing, touching, and tasting (Eva C. Worden 2012). Determining how many of the senses were used and to what extent they were stimulated, informs the designer on the extent of interaction the users encounter within a site and the type of design standards that need to be considered.

For this report, the users were primarily the deaf and blind...
As research suggested, understanding who experiences the sensory garden has assisted in deciding the functionality of a design (Furgeson, Healing Gardens 2006). What one does not want to do then is to overpower the senses. Historically sensory gardens and their designers assumed that because someone has a ‘reduced sensory range’ that there was a need to ‘over-emphasize’ the few remaining sensory experiences (Sensory Trust 2010). The Topiary Park in Columbus, Ohio and its topiary of Georges Seurat’s A Sunday Afternoon on the Island of La Grande Jatte is a perfect example of over stimulating the senses. So would be the use of plant massing’s with overbearing fragrances (Sensory Trust 2010).

This assault on the senses was for a long time in history seen as the remedy for the deaf or blind. Other such issues that negate the functionality and sensory experience of the typical sensory gardens have been: inaccessible paths to significant features, unreachable water features, no water features at all, steps, slopes, and lack of maintenance (Hussein 2009).

As pointed out by Hazreena Hussein, study of sensory gardens demands research in both the environment and behavior because such garden must be designed, maintained and managed to fulfill the users’ needs. In order to meet those needs, landscape architects should understand how these users behave, use and engage with the attributes in the sensory garden (Hussein 2010). This shows that there seems to be some discourse as to how inclusive a site could or should be. On one hand Robinson promotes what could be described as the more inclusive designs of the Arizona School for the Deaf and Blind, but the site was also utilized by hearing and sight users, so the garden took on the form of a more Inclusive Design.

During the design process it is important to determine which users are interacting with the sensory garden. Does it always matter who the users are? Can we achieve garden designs that appeal to the masses? Some argue that what is needed are inclusively designed space(s) that think about who will be using it, what for and why (Robinson 2010). It has also been pointed out that we as designers know enough about inclusive or universal design practices that we can create engaging spaces for all people regardless of age or disability, “enough with the labels, enough with the designated areas, enough with the ghettos” (Robinson 2010).
emotional argument, whereas Hussein takes the more scientific and cautious approach of understanding the user.

It is clear that designing for your user is just as important as for those who may not be the intended users. Knowing how your users could experience the site assists in determining the success of the design.

Evidently there was a need to understand how a successful sensory garden functions. What Hussein points out as being a positive approach for designers was for designers to address accessibility, continuous circulatory pathways, engagement with the surrounding features, and the functionality of soft, and hard landscapes within the sensory garden space (Hussein 2009).

Hussein also pointed out the possibility of integrating the garden design into the overall school’s planning phase. He also recommended the school kids (and school) become actively involved in the design process. Other research stressed the importance of not assuming you understand the needs and preferences of the people the garden is being designed for (Sensory Garden Design Advice 2010).

With more knowledge of what a sensory garden does, who their users are, and how they function, a clearer understanding of what a sensory garden actually consists of becomes definable. But in order to design a properly functioning sensory garden, one needed to address in more depth what kinds of physical attributes or typical spatial patterns a designer includes in specific sensory gardens for the deaf and blind.
III. DESIGNING for OUR SENSES

THE HUMAN ELEMENT

So let us make sense out of sensory design. As designers, we want and need to understand how our senses help to define the character of a space. Earlier it was stated that the purpose of a sensory garden, as opposed to our typical house variety garden, is that the sensory gardens purpose is to stimulate the senses. What purpose do our senses play in sensory design? How do our senses facilitate the experience of a space? As pointed out by Marc Treib in Theory in Landscape Architecture (2012), this interaction or use of our senses - between the human and the site creates the user experience.

One of the primary purposes of a sensory design is to provide a “wide range of sensory experiences to people with disabilities (Sensory Trust 2010).” This is what gives sensory designs their uniqueness – designs that are specifically meant to trigger the senses of the people with disabilities. For the sake of clarity, this literature review has been geared towards and focuses on the deaf and blind community at a non-mainstream regional school. The Sensory Trust states that the goal of a sensory garden (i.e. sensory design) is to create a space that appeals to the users’ senses (Sensory Trust 2010), so fostering that human connection between a space and the user would be a key to a successfully functioning sensory design. As pointed out by Jenet Laminack, sensory design cannot be used without considering the human element. Laminack (2002) goes on to say that unlike traditional display gardens that are meant to be observed from a distance, sensory gardens draw the visitor in to touch smell and actively experience the garden with all senses. But it is the interaction, or movement, between the users and the space itself that triggers or helps one to define and register our surrounding landscapes. As pointed out by Arnold Berleant,

“To sense is to sense something. But what we sense stands out from the rest only if it is ‘put into perspective and coordinated by space’. Our understanding of space, in turn, is constituted by moving through it. Without experience through movement, tactile, auditory and visual distance lack context (Berleant 1995).”

In essence, it is movement that helps to activate our senses, which in part help to map out the surrounding spaces we encounter and experience physically and emotionally.

When using sensory design as a baseline for developing a concept, it
was important to consider that fully understanding the role the user’s senses play in experiencing the site is the key to success. “Close” senses such as touch and taste provide different accessibility issues as compared to the “distance senses” such as sight, smell and hearing (Hussein, Affordances of Sensory Garden towards Learning and Self Development of Special Schooled Children 2012).

As it is understood to be, a sensory design is meant to appeal to the senses. So taking into account what senses may or may not be fully utilized by the user would become important in the design process. Just as important was coming up with design standards that take into consideration not just the site specifics, but the user’s abilities as well. It comes down to avoiding assumptions about what was needed for the particular users of a design (Robinson 2010).

Frequently, intended sensory designs are perceived by users as inadequate, while they are considered adequate by the designers - a common factor being that designers often presume that they know what the needs of the users are (Hussein, Sensory Garden in Special Schools: The issues, design and 2009). Or as put forth by Treib, the success of the place ultimately hinges on the skill and care with which the design is made and on what it offers the visitor (Treib 2002).

This brings to point what Judith Anodea states in her book Eastern Body, Western Mind: Psychology and the Chakra System as a Path to the Self that “through movement, we extend our field of perception, increasing our sensory input” (Anodea 2004). Anodea makes the case that movement serves as the conduit for our senses to connect the user to the space. Or as stated by Anodea “The senses are the gateway between the internal and external world” (Anodea 2004) and in essence provide for the user an evolving “inner matrix of the world.”

Understanding this helped in determining and selecting elements and design features that have been properly incorporated into a sensory design. The interaction between the site and the user was important not just physically, but also emotionally. As pointed out by Anodea, our senses are stimulated as a way to promote positive or negative stimulations. The greater the sensory experience, the greater the positive or negative interaction the user has with a space (Anodea 2004). This collective of sensory experiences and stimulations is what helps to create that special
identity of a sensory garden (Sensory Trust 2010)."

Interestingly enough, it is not just the physical movement through space that triggers a sensory response from the user, but also emotional movement. As stated by Marc Treib in his writing *Must Landscapes Mean?* He states that "sensory experience moved the viewer, causing him or her to reflect upon religious meaning as well as one’s position in the universe. (Treib 2002)"

The sensory experience, if properly triggered is not just physically moving through a site, but being emotionally *moved*. Our senses trigger an emotional response towards a site that gives the site part of its identity through emotional value (Anodea 2004). One could make the argument then that the product of a sensory design is not just a space that stimulated the senses, but a space that has created an emotional connection with the surrounding environment. A successfully functioning sensory design thus should draw in the users by appealing to not just their visual senses, but by activating and creating the user’s experience through motion or emotions.

The Sensory Trust offered several characteristics that are important considerations for sensory designs; they should be passive, inviting, and comfortable spaces. Unusual design approaches are encouraged, such as water features, or trees near pathways so they can be touched. Also, the mantra of a proper sensory design should be to “encourage users to explore, touch, pick and crush plants or interact with objects.” Plant materials and planting designs are the keys to a functional sensory design. The types of plants, how they are used, and their function within the site are all characteristics that have been combined to create a positively functioning sensory design with very unique features. To elicit sensory appeal, common design features should be passive spaces that the designers should want to come across as comfortable or inviting (Sensory Trust 2010).

Secondly, recognizing physical attributes and how users relate to them in order to create an encompassing sensory experience was important. Visual and kinesthetic materials may be the primary means of sensory stimulation, but the non-tactile senses (sound, smell, and taste) are just as instrumental in the experiencing of a landscape (Meiss 1990) Negative design issues such as lack of adequate user accessibility to the site or its
“What if we designed for all our senses: Suppose, for a moment, that sound, touch, and odors were treated as the equals of sight, and that emotion was as important as cognition. What would our built environment be like if sensory response, sentiment, and memory were critical design factors more vital even than structure and program?”

Joy Monice Malnar – Sensory Design

features, stairs, uncluttered pathways, and overall maintenance issues are viable factors that do negatively affect the functionality of a sensory design. (Hussein, Sensory Garden in Special Schools: The issues, design and 2009).

One may ask, what were some of the pitfalls from a designer’s standpoint while utilizing sensory design? This is an important consideration and one of the critical processes in the development of a sensory design, the need of designers to truly embrace the user experience, the sensory experience. Treib makes a point that essentially we as designers are more focused on the professional output than the actual design itself.

He states . . .

“. . . In most professional design publications, the aspect of pleasure is almost completely missing from the discourse, while it thrives in poplar gardening magazines and in seed catalogs. This is not to say the pursuit of pleasure is not a goal of professional work; one assumes that park design, for example is to a large degree predicated upon the contented use of its grounds. But a discussion of pleasure is rarely a part of trade and academic writing (Treib 2002).”

He goes on to state that “lay publications in contrast, discuss the delight of the garden and that making one is so easy. Color and fragrance and delight are givens. (Treib 2002)” Treib makes a well-noted point of view, that as designers the attention being paid to the user experience is overshadowed by the need to produce egomaniacal designs that cater to professional presentations, instead of user-friendly designs. Treib made the argument that as designers, there is more of a need to take into account the user experience and the ways one can provide more sensory stimulation, and to focus more on output and product, and less on the professional bells and whistles (Treib 2002).

A functional sensory design embraces the idea that sensory events occur around us all the time and are used for processing and interpreting a landscape. Take for example the old philosophical statement “If a tree falls in a forest, and no one is around to hear it, does it make a sound?” When the tree falls, our senses take in the surrounding context and events, then process it, and finally produce a moment or series of moments for our mind to remember and reference. This experiencing of an event, whether it
Movement of and through the site’s features was also commonplace. In essence, the program elements for a sensory design revolved around their ability to trigger a sensory response from the users. This sensory response in turn went on to define the success or failure of a space for its users. This user experience based on the sensory responses is key.

A tree falling in a forest is one example of a sensory event, but sensory design enables us to acknowledge and address the sensory appeal that any design has obtained. The scent of rosemary being crushed on a cobbled pathway, the reflective light and shadows gaming along a curved seating structure or the passage through a howling wind sculpture, these are all human interactions within a space. These simple sensory events that create a user connections with a design and, in the end, have the potential to create a magnificent sensory experience.

To summarize how to design with our senses, literature states that design principles associated with sensory design promote aesthetic enrichment by stimulating the senses. To stimulate the senses, there was an emphasis placed on the use of textures, shapes, colors and contrasting elements.
The origins of DeafSpace stem from what Gallaudet students viewed their campus to be more hearing centric building spaces, or not deaf friendly. It was better stated by Dr. MJ Bienvenu, the department chair of ASL and Deaf Studies at Gallaudet University “If no one was using sign language, how could a visitor to Gallaudet know it is a university for deaf people?” The deaf student designers through their own experiences understood the importance of a design that would foster place identity (Byrd 2007). Being the only Deaf university in the world, Gallaudet campus consists almost entirely of the deaf and users (students, faculty, staff) of American Sign Language (ASL), their designers were able to provide a firsthand understanding of what the user’s needs were for a more adequate and functioning space (Byrd 2007). The deaf designer’s project set out to rectify what earlier designers failed to address: the user’s specific needs. DeafSpace has become a common sense approach to addressing the needs of deaf users, by going directly to the users. This is what sets DeafSpace apart from other endeavors that create enhanced sensory environments. These spaces are constructed specifically for visual listeners (Ceraso 2011).

In 2005, Hansel Bauman (HBHM Architects) along with ASL Deaf Studies Department at Gallaudet University created the DeafSpace Project (What is DeafSpace? 2012). By 2008, a set of 150 design recommendations for creating a deaf friendly space were implemented in a campus remodeling project of a communications building (H. Architecture n.d.), (D. K.)
Architecture n.d.).

To many, DeafSpace is seen as a way to provide inclusive products and environments that benefit as many people as possible. (Ceraso 2011). DeafSpace also serves as a means to provide valuable insights about the interrelationship between the senses, the ways we construct the built environment and cultural identity from which society at large has much to learn. (What is DeafSpace? 2012). An interesting analogy is made by Mike Gulliver in his Introduction to DeafSpace, he states... 

“Imagine two villages, one that only has hearing people living in it, and one that has only deaf people. How will each of those villages develop over time as the people in them use space? Imagine, for example, what their communicative habits might be, what that might do to their houses, or how it might guide their technology as it develops, or how they might conduct their politics (or even their scams, practical jokes, family times, education etc...)

The point being made by Gulliver was that different cultures have evolved because of different cultural traits. Understanding those cultural traits goes a long way into being able to create and design a functional sensory design.

Understanding the user’s needs was important, but understanding why they have those needs helps to clarify why those needs are important. The DeafSpace Project identified 5 concepts that should be addressed and included when designing for the deaf: 1. Sensory reach, 2. Space and proximity, 3. Mobility and proximity, 4. Light and color, and 5. Acoustics (What is DeafSpace? 2012). There was a need to examine each one briefly and how they are used in a landscape design.

1. Sensory Reach: Sensory reach was best described as the ability to maintain spatial orientation and awareness within our surroundings to maintain a sense of wellbeing (What is DeafSpace? 2012). As pointed out earlier in this literature review, taking into account the users and their needs was paramount to any successful design. In the case of deaf individuals, it was the need to foster their ability to freely communicate and in essence create and maintain what are considered open visual sign language spaces (Gulliver 2006). This was one of the unique considerations to deal with when designing for the deaf. Deaf

“DeafSPACE is about creating connections.”
- Hansel Bauman
people utilize all of their senses to read and take in their surroundings. *Promoting 360 degree spatial awareness will be what enables orientation and wayfinding for the deaf* (What is DeafSpace? 2012).

2. **Space + Proximity:** Considering that ASL is a visual-kinetic that uses not just the hands, but body language, and facial expressions to communicate language (What is DeafSpace? 2012) (Michael L. Harman 2010). It was critical for ASL users to maintain clear and open fields of view to communicate (What is DeafSpace? 2012) (Pascall 2012). George Balsey, a deaf architect conveys it best to his hearing counterparts when he states . . .

> “We create visual-centric spaces where the Deaf could see everything which helps with visual communication. For our designs we also deal with light - natural and artificial, high tech that’s available for the deaf especially in educational settings and communications. We look for one communication system that works for both the deaf and hearing. We focus more on seeing and being seen. (Rains 2011)”

Another important use of Space + Proximity was seen in hardscape elements and features such as circular seating. The use of circular seating was an innovative way that DeafSpace promotes visually accessible spaces. Linear seating prevents users from maintain open fields of communication with many (H. Architecture n.d.) (Monaghan 1997). Whereas linear seating arrangements inhibited free flowing communication between everyone seated. Communication across the table was far easier than with individuals seated say to the left and right of each other. A more circular seating arrangement provides any ASL user with clear views of the surrounding space.

3. **Mobility + Proximity:** The third DeafSpace concept that was examined was Mobility + Proximity. To better understand the theory behind Mobility and Proximity, one needed to only look at the common use of sidewalks: two hearing people will walk comfortably down a sidewalk side by side having a conversation. Whereas people using ASL with each other need slightly more elbow room for communicating with both hands and body language (Pascall 2012). Thus, wider sidewalks are just one example of design recommendations.
made by design student for DeafSpace (What is DeafSpace? 2012)

Another example to explore within the Mobility + Proximity concept was the need for open visual spaces for clear communications. This can be better understood when one thinks of individuals approaching the corner of a building or at the intersection of two hallways. Hearing people can hear the steps or voices of others approaching from around a blind corner. Rounded corners or openings through corners (windows) on the other hand offer the potential for the deaf to better access visual cues for safe navigation (What is DeafSpace? 2012). Again, one finds how different DeafSpace concepts come into play to alleviate hindering design programs. Mobility, acoustics, reach and spatial proximity all come into play.

4. Light + Color: Next, one needed to address the practical uses of light and shadows as a tool to promote contrast and sensory awareness for the deaf. This was where the DeafSpace concept of Light + Color came into play. It was important to take into account lighting when designing a space for the deaf (Rains 2011). Having a light source behind someone signing makes it nearly impossible to see or understand them, all that will be visible is a silhouette (Pascall 2012). Even the glare of the sun reflecting off of white sidewalks is a factor to consider when designing a space for the deaf (Rains 2011) (Furgeson 2006). Contrasting colors to skin tones and reflective colors or surfaces - all impact the ability of the deaf to communicate clearly (What is DeafSpace? 2012).

5. Acoustics + EMI: Sound waves bouncing off walls or hard surfaces lead to reverberation that is distracting for individuals who use assistive listening devices. Therefore the incorporation of features that reduce background noise or reverberation was viewed upon as beneficial for a functional design (What is DeafSpace? 2012). Just the same, reverberation was seen or has been used as a way of getting someone’s attention, therefore considered useful. For example, in Deaf culture foot stomping is used as a means to gain one’s attention (Pascall 2012) (Sauerburger 1993).

Acoustical elements could be used as an educational tool for deaf student’s to explore, but creative features still need to be functional (Hussein, An Exploratory Study of Sensory Gardens 2009). Metal pipes for tapping, elements that cause sound reverberation and enable individuals to experience sensory stimulation through
touch are important. Use of wind instrument or wind elements offers an opportunity for users to touch and feel the reverberation emitting from the sound element (Sensory Trust 2010).

As for DeafSpace and the use of plant design, research did not turn up a source that specifically defines or offers recommendations for incorporating plants into DeafSpace. This could be one of the areas where improvement to DeafSpace is highly recommended. Aesthetically, plants could be incorporated into DeafSpace as ways to promote variety and contrast for the visual experiences (Eva C. Worden 2003). Physically, interacting and touching plants is also promoted (Eva C. Worden 2003). Visually, it was beneficial to incorporate a proper plant palette that offers the full spectrum of seasonal colors (Sensory Trust 2010).

For designers, the question needs to be asked: how can we make DeafSpace more efficient? There is no direct or easy answer for this question. To put it bluntly, the design standards for DeafSpace were created by deaf individuals with a far better grasp of their environment than any hearing individual could comprehend. Or as put forward by Hansel Bauman, the lead architect in the redevelopment of the University of Gallaudet campus, “Deaf culture centers on the language. The language has all the elements of architecture—the spatial kinesthetic of sign language, the desire of deaf people for the visual access that open space affords—lends itself to express the deaf way of being.” One could make the argument that it would be naive for hearing people to assume that they could improve on DeafSpace guidelines without being deaf, understanding or involved in Deaf culture.

That said there is always room for improvements with proper research, input, and openness. Maybe a better approach to making DeafSpace more efficient would be by embracing it and incorporating more of its principles into the “hearing world’s” mainstream designs. To do this, one needs to educate oneself about the principles of DeafSpace. Next, a willingness then to develop a design program that incorporates various concepts associated with DeafSpace. There are several simple yet effective program elements that when incorporated into mainstream designs, will develop a more effective deaf friendly space: providing wider sidewalks to ease cramped spaces, having open or curved corners to enhance circulation and communication, providing circular spaces to foster visual communication, and develop proper lighting or shade so visual communication is not hindered.
How would one describe or interpret a space - if they were blind? What would one experience within a space, if say sound and touch were their primary means of sensory stimulation? As designers approaching a design, in particularly when designing for the blind, one needs to put oneself in the shoes of the user to understand how they use a space. For the instance of this section of the literature review, one needed to consider being “in the shoes” of the blind and the spaces they experience.

Unfortunately for the blind community there has been no clear defined term or student design group that has developed concepts for blind spaces. But what has been possible was incorporating the frameworks from successful concepts used in other similar communities into this design. For this instance, the previously
Incorporation of textured ground surfaces was one technique used by designers to aid the blind in spatial orientation (Furgeson 2006) (Hussein, Using the sensory garden as a tool to enhance the 2010). The incorporation of tactile art has also been commonly used, found in blind spaces and seen as a means of promoting sensory stimulation (Furgeson 2006). Understanding the users and their preferences, how they interact with a site, and which elements work for them, goes a long way to successful design outcomes.

Tactile stimulation was also used for wayfinding. A space being utilized by the blind frequently has elements such as tactile maps to create spatial awareness; hand rails embedded with braille or symbolology, and textured surface areas for wayfinding (Hussein, Using the sensory garden as a tool to enhance the 2010) (Berger 2009) (The Dog Rose Trust 2010). Wayfinding opportunities for the blind are essential for any efficient design. Floor markings, symbol signs, location of signs, handrails with braille, color contrast and lighting, and tactile maps are all critical elements that need to be included within a blind space (Berger 2009). It has also become common for the blind to use the smell or sound of particular plants as a source of wayfinding (Hussein, Using the sensory garden as a tool to enhance the 2010).

Not to discourage the use of braille, but the National Federation of the Blind has stated that less than 10 percent of the 1.3 million legally blind people in the United States actually read braille (Aviv 2009).
Much of this has been attributed to the advances of technology and less of a need or reliance on braille for the blind to read. Audio books, the internet, even cable television all offer new alternatives for the blind to gather information (Aviv 2010). So there could be some debate as to how prominent braille is used within a design for the blind.

Tactile maps are an essential part of wayfinding for those experiencing vision losses (Subryan 2010). As much as we want to utilize tactile maps within a design, one must also consider the overuse or over expectancy for tactile maps to solve all of the spatial awareness issues associated with being blind. As pointed out by Heamchand Subrayan’s piece Tactile Maps as Navigational Aids,

“…Sight impaired users sometimes find it more challenging than do sighted users to comprehend tactile information, but studies show that the benefits realized by using this type of aid are substantial. Fundamentally tactile maps have the capability to provide a more comprehensive understanding of the site and to give the user access to additional layers of information from which they are able to generate more precise mental representations of their occupied environments (Subryan 2010).”

So while there is a reliance on their usefulness, they are hardly a solve-all for the blind community to use when navigating a space. But tactile maps provide an opportunity for blind users to experience a space to its fullest.

2. Space and Proximity: Accessibility to the site and to its elements is one of the first important principles to consider when designing a blind space (Hussein, An Exploratory Study of Sensory Gardens 2009). Lack of waypoints, unseen obstacles, and un-kept spaces, are three examples of ill-conceived site design (Hussein, An Exploratory Study of Sensory Gardens 2009). Navigating the landscape for the blind is often dependent upon the quality, availability and accessibility of navigational aids (Subryan 2010). Spatially, the ability of the blind to safely navigate a space is important. Even such simple features as tactile maps or linear pathways (compared to curved or more organic pathways) are more preferable and has aided in the blind users experience (Furgeson 2006).

As with many blind designs, hand rails
are a prominent feature. With this in mind, access too many elements needed to be within reach or acceptable distance from such rail features (Berger 2009). A railing acts as a means to support a blind individual while getting around, they also act as a hindrance or barrier to a site’s features. A proper plant design that promotes accessibility to the plant was another important factor to consider when designing for the blind. The promotion of sensory stimulation through plant selection goes to waste if the users are not able to interact and with the plants (Eva C. Worden 2003).

Water features are another common feature found in spaces for the blind; the ability to touch the water was a key way to provide sensory stimulation. But, there is a need to provide access to a site’s water features. It is not uncommon to find water features out of touching range or not in working condition all together in some designs (Hussein, An Exploratory Study of Sensory Gardens 2009). The lack of access to a site’s features inhibits a blind person’s opportunity to fully experience the site, and in essence loses the purpose of creating the space in the first place (Hussein, An Exploratory Study of Sensory Gardens 2009). From a functional standpoint, a blind space needs to have some unique features and physical attributes. Catering to the user’s abilities was what helps to set a blind space apart. One needed to ask them self: How would one interpret a space differently if they were without the sense of sight and only sound, touch, smell and taste? These are the considerations one must think of when designing for the blind.

3. Mobility and proximity: The lack of separation of traffic from pedestrian use for safety reasons needs to be a key concern of designers (Thomas n.d.). Blind users in a study did not have a favorable opinion of shared spaces. Three main issues stated with share space were: Proximity to vehicular and pedestrian traffic, difficulty locating and using crossing points, and lack of adequate markers or waypoints for navigating a street or site (Thomas n.d.). Mobility and proximity as a safety issue for blind users around design features and elements was a concern to be addressed as well.

4. Light and Color: The blind or persons with low visibility does still discern light from shadows, and provides contrast to a setting (Eva C. Worden 2003). So there was still a need to enhance the sensory opportunities provided by light and
shadows (Eva C. Worden 2003). For individuals with low-visibility large blocks of riotous color (Eva C. Worden 2003) and the color yellow being the most visible from the color spectrum to use (McManus 2001). If shade and light are to be used as waypoints for the blind, then plants and shade structures should be used to differentiate between spaces (Hussein, Using the sensory garden as a tool to enhance the 2010).

5. Acoustics: The promoting and exposing of acoustic experiences is a more unorthodox approach to creating sensory experiences for the blind. But, acoustics played an important role for the blind when it comes to determining distances (Hussein, Using the sensory garden as a tool to enhance the 2010). Auditory cues within a site were used for depth perception. Sound intensity (loudness), auditory pitch, and the time lapse between visual perception and auditory perception all helped to relate to the blind users audio cues for their surroundings (Encyclopedia Britannica 2012). Creating these acoustical elements within a blind space was thus considered important.

As mentioned, acoustical elements are used as a form to waypoint. This design looked at acoustical phenomenon as a way to create and promote different or new sounds. Within Mesoamerican Archaeology there is an acoustical phenomenon known as the rain-drop affect (Jorge Antonio Cruz Calleja 2009). It is a certain pinging or chirping sound that is made when walking or clapping between a flat and corrugated surface (Ancient Wisdom n.d.). It is an acoustical phenomenon that is found in at the Snake Temple locates in the Mayan Pyramid of the Sun complex, the pyramids of Tikal, and the Chichen Itza Great Ball-court and The Castillo (Ancient Wisdom n.d.). On a smaller scale, one experiences this phenomenon while walking down a sidewalk and approaching a corrugated sheet metal fence – roughly 10’ away.

Ideally, the acoustic experience one wants to create was one that provided and promoted spatial awareness. Art pieces or wind structures are common features within blind spaces, how well they work or how receptive the users are too the features can be argued. “Sound fences” made of pipes or tubing where children drag sticks over is one plausible idea (Sensory Trust 2010). Some art pieces as the Aeolus Acoustic Wind Pavilion found in London are excellent examples of potential uses of acoustical art pieces for the blind. Using zero energy and no electrical power or amplification, this
The giant Aeolian harp sculpture has nylon harp strings attached to some of the tubes, which redirect the passing air into the piece’s center to create sound. The tubes with no strings attached have been tuned to an Aeolian scale and hum at low frequencies (Alperovich 2012).

In some spaces wind elements are incorporated into designs that are too difficult for children to use, so selection and placement are equally important as the wind instrument itself (Hussein, An Exploratory Study of Sensory Gardens 2009). Also, one aspect of sound stimuli, or acoustic art to consider was that they offer the more immediate sensory experience, yet for a shorter time of experience, as compared to such elemental features as plants, textured surfaces and seating elements (Hussein, Sensory Garden in Special Schools: The issues, design and 2009). Noise pollution or over stimulation was considered distracting and thus creates a negative stimulatory response to a site (Furgeson 2006).

The best starting point to develop a successful blind space was to gather as much input and feedback from the blind people who use the site, and as to what features or elements would work for best them (Hussein, An Exploratory Study of Sensory Gardens 2009) (Thomas n.d.). Not making an assumption about what was best for the user was equally important (Sensory Trust 2010). Getting their first hand input ensures the design has quality elements that cater to their needs. Considering how to incorporate waypoints into a space for the blind was instrumental in creating a functional design. Waypoints cover several of the concepts presented earlier in this paper; they serve as a source for spatial awareness in sensory reach, acoustically through reverberation and resonance, and last through use of touch and tactile stimulation. Also, it is considered to be understood that the disable don’t want to be considered disabled or be “segregated from the able-body” community when it comes to enjoying the outdoors (Hussein, Sensory Garden in Special Schools: The issues, design and 2009).

In summary, it could be said that a blind space is best created when one aims to create a user friendly environment that promoted the tactile experience through sensory stimulation and accessibility to the site’s accompanying elements. To do this, one should utilize the 5 design concepts:

- Sensory reach
- Space and proximity
Because there are no clear cut, laid out design guidelines for designers to follow, strategies and elemental design uses of unorthodox and abstract concepts need to be employed to create a properly functioning space for the blind. But it has been the creative and innovative use of incorporating waypoints, textured surfaces, lighting, and acoustics that defines the sensory experience for the blind user. Thus, it was a key during all design phases to garner the input of the users to aid in the quality of the final design and product. These factors should lay the foundation for a successful blind space design and promote a positive user experience.

Soundwalking was one way individuals and researchers have mapped and documented the sensory stimulation that sound provides. Soundwalking in essence is an exploration of sound with the intent of active listening, hearing all environmental sounds while moving in and throughout the environment. It is a practice to re-remember sounds and re-learn how to hear (Schine n.d.) (Dietze 2000). As designers, we should take the time to stop and listen. Not talk but embrace the sounds, for “when we are talking, we are not really listening” (Dietze 2000). Or just the

UNDERSTANDING “THEIR” SPACE

How would our designs differ if we were to experience a site differently, say blindfolded or walking around with earplugs crammed into one’s ears? It was an interesting concept, and one that sensory mapping takes to the next level.
same, embrace the silence of a soundwalk. Or as put forward by Mike Gulliver in his piece Places of Silence “it is ‘silence’ that gives us the key to what these deaf people are saying.”

This was just what sensory mapping has set out to do – creating silence or blindness so one does more than just map out an area with conventional means, but experience as close as possible the sensory mapping stimulations that the deaf or blind may experience. The cartographic process of sensory mapping has become a new tool used by professionals to perform evaluations on existing parks, gardens and greenscapes to determine a site’s sensory value (Stenberg 2010). It essentially allows for professionals to rate and assess how the five senses interact or are triggered within a particular space (Stenberg 2010). Sensory mapping would be a key exercise for all professionals to perform not just in aiding them in determining if a site is appropriate for particular users or stimulates the senses, but what kind of elements or features would stimulate particular senses.

To create a functional space for the deaf or blind, different types of mapping and analysis were necessary. Creative mapping techniques such as soundwalking was one such attempt at addressing design issues that a designer may not quite be aware of. Questions like: How accessible to the users was the site and its features? What kind of user experience does the site offer? Or last, what kind of sensory stimulation does the site provide? When answered these questions will assist the designer in determining the positive steps needed to follow for developing a successful space for the blind. Sensory mapping was just one of the many evolving steps that have been taken to answer questions that have enabled one to gain a better understanding of what the deaf or blind individual’s experience is.

One suggestion has been to introduce sensory mapping as a means of taking the design process one-step further. For designers to fully appreciate the potential user experience there was a need to go back to walking in their shoes. Which brings up the final point once again: how would our experiences in a sensory garden, or any landscape for that matter be different if we could not hear or we were blindfolded? What would we see, feel, hear, and experience differently? Sensory mapping was just one way for designers to relate to their users, and has aided this designer in determining how different elements stimulate the senses in different ways.

Sensory Mapping
IV. CONCLUSION

After examining such design concepts as Sensory Design, DeafSpace, BlindSpace, and sensory mapping, the argument has been made that when it comes to designing a successful sensory garden - function and sensory stimulation play a more prominent role than beautification and aesthetics. Constraints of this type of design program are seen as providing a sensory experience to a limited number of the overall population. The exposure to such theories as DeafSpace and its accompanying design concepts has provided affluent possibilities for inclusive design processes found in the more mainstream, hearing and sighted world design projects. Incorporating the 5 design concepts of DeafSpace (sensory reach, space & proximity, mobility & proximity, light & color, and acoustics) developed by the Gallaudet architectural design students served as a resource that was used as a template for creating this project. In the end, the designer needs to understand not just the needs and abilities of the user, but the triggers and mechanism for creating a heightened sensory garden experience. To accomplish this, a list was formed of consisting of various features found within each design concept. These features served as the basis for a hit list of variables that should be found within a sensory garden design for the deaf and/or blind.
To determine suitable site selections for the case reviews, a classification system was created based on three types of sensory gardens: public v. private access, schools v. non-schools, and the aridity of the site. Based on these three categories, six sites were selected and reviewed as part of the research and review process of this master’s report. A concept variables matrix incorporating the 5 DeafSpace concepts was introduced to extract design implications from the classifications. This data in return was used assess the strength of the design from each case review base on its use of the 5 concepts (sensory reach, space+proximity, mobility+proximity, light/color, and acoustics).

I. INTRODUCTION

To determine suitable site selections for the case reviews, a classification system was created based on three types of sensory gardens: public v. private access, schools v. non-schools, and the aridity of the site. Based on these three categories, six sites were selected and reviewed as part of the research and review process of this master’s report. A concept variables matrix incorporating the 5 DeafSpace concepts was introduced to extract design implications from the classifications. This data in return was used assess the strength of the design from each case review base on its use of the 5 concepts (sensory reach, space+proximity, mobility+proximity, light/color, and acoustics).
• Design layout promotes linear and curvature circulation patterns

PROJECT:
Elise McCarthy Sensory Garden
–Glendale, AZ

• Intimate private spaces that allow for interaction with an assortment of tactile elements

PROJECT:
Oizumi Ryokuchi Park
–Osaka, Japan

• Use of various sensory stimulating elements, including various sound producing elements

PROJECT:
Toa Payoh Sensory Park
–Singapore

• Design incorporates different plant, elemental textures and patterns for wayfinding

PROJECT:
Royal Schools for the Deaf
–Manchester, England

• User input from school staff, students, and parents was incorporated into the overall design

PROJECT:
Center for the Blind
–Mexico City, Iztapalapa, Mex.

• The ample usage of light and shade to define spaces

PROJECT:
New Mexico School for the Blind
–Alamogordo, NM

• Design incorporates different plant, elemental textures and patterns for wayfinding
Project 1:
Oizumi Ryokuchi Park - “Garden of the Blind”

LOCATION: Osaka, Japan
TYPE: Public Gardens
SIZE: 95-hectare
DATE: 1974
DESIGNER: Yoshisuke Miyake
AWARDS: na

SUMMARY:
One of the first sensory gardens, that has been refurbished over the years with the integration of universal design concepts.

DESIGN FEATURES:
• Pathways into seating areas surrounded by water
• Wide ranging plant palette
• Raised plant beds
• Integrated wayfinding system
• Passive spaces
• Water and sculpture tactile stimulation
• Plant accessibility and interaction
• Use of open spaces
Sensory Reach
Starting at the entrance gate, an entrance wall incorporates tactile tiles that represent plants that will be found in the garden. An orientation board at the entrance provides information in braille with text and a tactile map for wayfinding. The site promotes interaction with the plants and various elemental features. Users are encouraged to interact with the various sculptures that can be found throughout the garden. Tactile labels and audio commentary are provided for further identification of site elements and enhance the user experience. Seating nooks, with the floor and seating levels situated below the water line, provides a spectacular space for intimate contact with water and aquatic plants.

Space + Proximity
Oizumi Park is located within walking distance from a local subway line. The sensory garden can hold up to 500 users. Site elements such as benches, walkways, planters, and water features were all situated to maximize the number of users the site could hold. Elements are spaced in close proximity of one another so users do not need to cover long distances within the park proper. Pathway surfaces have no level noticeable level changes. Transitions use various surface materials – but are considered smooth transitions. The sensory garden itself is small enough to provide plant interaction for most users in one visit. Raised plant beds and ponds are easy to experience the garden overall provides ample and unique seating, but lacks circular seating. The site also provides adequate access to maps and wayfinding structures and materials. Signage and art relief heights are set to allow someone with low vision to get close enough to examine and also to touch. Circular “windows” are used in hedges to allow visual access into and through various parts of the site.

Mobility + Proximity
The site provides ample view sheds of the surrounding lake. Starting at the entrance and continuing through the entire garden, a double row of flat, stainless steel bars have been embedded in the walking surface as a navigational guide. Linear and curved pathways, intersections and ample berth along sidewalks are also utilized within the garden design. Surface material changes along the path are used to identify different areas of the garden. Braille labels identifying the plants are also used and placed on the backside of the handrail along the entrance wall. Artistic pillars, surface textures, and contrasting colors, the metal
guild rail and raised flower beds all offer perfect examples of wayfinding techniques.

**Light and Color**
There are over 500 trees within the park proper, plus, a wide variety of plant selections utilized within the garden itself. Wayfinding is both functional and funky. Relief tiles and braille text is used at the entrance. At each display, audio systems and text in multi-languages offer a variety of methods for users to utilize park information. Artistic pillars, surface textures, and contrasting colors present examples of contrasting elemental features. Bold flower colors are thoughtfully selected to provide interest for users with low vision. Strategically placed pillars with brightly colored ornaments and checkerboard patterns indicate pathways and aid in orientation. All text and map lines are presented so they contrast significantly with the background.

**Acoustics**
Acoustical elements are provided by water features and the surrounding lake. Auditory devices are provided to enlighten users on the plant life within the sensory garden. The sheer size of the park and location of the sensory garden would buffer out surrounding traffic noise and unwanted reverberation.
Project 2: Toa Payoh Sensory Park

LOCATION: Singapore  
TYPE: Public Gardens  
DESIGNER: Maria Boey  
SIZE: 118,403sf  
DATE: 2009  
Silver Award, Professional Design: General Design Category  
Consultant, UD Landscape Architect, Mr. Yoshisuke Miyake  
USERS: Public, elderly

SUMMARY:
The sensory garden and its Universal Design background has shown to be an attractive recreational site for the local Singapore residents. User input collected during the design process, in particularly from the visually impaired users, enabled designers to learn best how to enhance the sensory experience in the garden space.

DESIGN FEATURES:
- Universally Designed (UD) philosophy  
- Municipality park  
- Easy accessibility  
- Passive spaces  
- Wide ranging plant palette  
- Plant accessibility and interaction  
- Sound producing elements

THE SENSORY GARDEN EXPERIENCE
Sensory Reach
The sensory garden is located within a urban park surrounded by an elderly population – the garden being the key feature. Sensory elements are considered somewhat ‘prescriptive’ and could be more ‘experimental’. Wayfinding elements such as ‘orientation curbs’ for the blind are utilized.

Space + Proximity
Accessibility to the site is a key feature of the site. Designers took into heavy consideration the surrounding populace and potential users. Because of the urban location of the site, view sheds are limited. Sensory art installations have been incorporated into the design to communicate to the users about our 5 senses. The gardens Universal Design background is evident in the ample usage of accessible features and elements – for not just the deaf or blind, but the elderly and the wheelchair bound users. Spatial variety is created through a series of 5 ‘sensory zones’ – each one corresponding stimulating 1 of the 5 major senses. Passive spaces are also a key feature within the site, providing spaces of respite. Tactically planted aromatic plants are used as a source of wayfinding within the garden design. Sign language panels and braille signage are also incorporated into the design and offer users the ability to interact with the site using their own languages.

Mobility + Proximity
Seating has been calculated at universal heights for users to have access to site features and elements. Sidewalks are not small, but could be wider. Linear and curved sidewalks range in size from medium to wide – but plantings block some views, while low planters provide open views for circulation.

Light and Color
The site is surrounded by a canopy of trees, so offers ample light and shadows. The plant palette consists of colorful and contrasting colors. The garden and surrounding park provides an array of bountiful colors and eye catching artistic elements.
Acoustics
The park features one very unique element: a sound device consisting of two round concave metal objects, where the user is able to manipulate sound waves, a truly unique feature. The garden is located in a popular urban park setting, so noise could be a factor. Because of the urban setting, streetscape noise and reverberation could be prevalent.
Project 3: Elsie McCarthy Sensory Garden

SUMMARY:
The Elsie McCarthy Sensory Garden was developed to stimulate the senses of sight, sound, smell and touch. Funds were donated for “the purpose of establishing, purchasing, improving, expanding or maintaining a scented and tactile garden for the visually handicapped.”

DESIGN FEATURES:
- Regional plants and trees
- Passive spaces
- Plant selection for texture and scent
- Water and sculpture tactile stimulation
- One of Glendale’s proudest locations
- Use of open spaces
- Cooler climate would be more appropriate

LOCATION: Glendale, AZ
TYPE: Public Gardens
Arid Sensory Gardens
SIZE: 64.00sf
DATE: 2002
USERS: Public
**Sensory Reach**
The sensory garden is laid out in an oval shape. The main entry contains a tactile map, but the fact that the bronze map is shaded indicates that during the heat of day the space could be unbearable. The artists, Joan Baron and Robert Miley created a sculpture called Seeing Beyond, which is centered as the axis point of the garden. The artwork promotes interaction by way of tactile stimulation and sensory experiences. The sculpture also features water sprinkling through it with tile mosaic tiles. The garden contains textural walkways with smattering aromatic plants. However, the site lacks a significant amount of supporting plants along the walkway to truly engage the users’ senses. Spatial awareness is achieved through a series of 4 garden rooms and by using different plant materials (grass vs. xeriscaping) and hardscapes vs. softscapes.

**Space + Proximity**
While an adequate space, the site is exposed to elements and its location occurs to be more of an afterthought by the municipality. Summer heat conditions most likely play a factor in its usage and its condition. It’s located close to the parking lot and exposed views. The garden is still relatively new, so plantings could use more time to mature. Larger more developed trees for planting should have been considered to provide more immediate shade in such a hot environment. Providing some context for the site is the usage of regional trees and shrubs is present at the site as well. Access to elemental features such as the sculpture is excellent, but last of overall elemental features downgrades the site. Complete lack of handrails or extensive braille system for say plant identification makes one consider how the garden is to be properly and adequately used by the blind. Spatial variety is present within the site through a series of partitioning of the site – but not to any real extravagance. Last, there is no seating.

**Mobility + Proximity**
The location of the garden, within an exposed park, offers wide open views of surrounding soccer fields. While the walkways are of wide berth changing of materials form dirt to pavement could be problematic for the blind if transitions are not better delineated on the dirt surfaces. Because of its oval shape, the site consists of both linear and curved pathways, which in turn are beneficial to the deaf and the blind.
Light and Color
There is ample natural lighting on the site and a need for more shade. Over exposure to the sun and downplaying the sun’s glare would be advantageous to the site and users. The central sculpture offers an array of color mosaics that offer some tactile variety to the garden. The plant palette offers a limited variety of colorful plants. Contrast in the site is best found in hardscape vs. softscapes and the various uses of the limited plants.

Acoustics
Because of its location within a regional park and localized traffic, positive sensory stimulation could be called into question. The one saving grace acoustically would be the sculpture and its accompanying wayfinding water feature. Gravel as a paving material offers one of the few other acoustic properties. The sensory garden lacks overall acoustic cues which could be essential for blind users.
Project 4: New Mexico School for the Blind & Visually Impaired

LOCATION: Alamogordo, NM
TYPE: Public Gardens
School Sensory Gardens
Arid Sensory Gardens
SIZE: (Gardens) 7,000sf, (Campus) 37,000sf
DATE: 2009
USERS: Blind students, faculty, and public

SUMMARY:
The NMSBVI design balances safety with learning through a multi-sensory design. Multiple concepts were studied for the design of the gardens and playgrounds. The final design created a small sensory garden with serpentine paths near the front entry, with a larger sensory garden and playground in the rear.

DESIGN FEATURES:
• Public Gardens
• School Gardens
• Use of open spaces
• Active spaces
• Wide ranging plant palette
• Plant selection for texture and scent
• Plants used for wayfinding
• Plant accessibility and interaction
• Site layout and circulation
Sensory Reach
Structural material is exposed concrete masonry in a variety of colors and textures, to provide a durable, low-maintenance surface with visual and tactile stimulation. Spatial awareness is achieved through a series of separate garden rooms - defined by landscaping and differentiated by visual patterns, colors and textures. The plants were planted at various levels so that all the students could enjoy the garden. Tactile maps were not included or shown in the research.

Space + Proximity
The front of the school has a small sensory garden for the public to enjoy with serpentine paths and curved seating. This garden serves as a key waypoint for users approaching the school. Open views for communication could be the theme for this site with its open vistas. The site has public access and the gardens are easy to locate and navigate through. A small berm surrounds the lawn and gives the students a chance to roll around and experience a different sensation. The garden lacks a prominent water feature because plants are the main element in this sensory garden. An extensive plant palette is utilized to the fullest. Raised planters are used by students to plant their own plants and to interact with biomass. The garden was designed to educate and stimulate the students and allow hands-on exploration of sounds, aromas and textures from a variety of plant materials - the garden has become an integral part of the school’s curriculum. A series of garden rooms serve to promote spatial variety within the site. The plants also play a role to create landmarks to individual classrooms and provide opportunities to teach students about the plant life and seasons.

Mobility + Proximity
The garden spaces lack the presence of handrails. The back of the site was designed on a central axis to create an easy, safe route of circulation. Circular sidewalks and paths were created provide additional opportunities for exploration and mobility training. The back sensory garden is the gateway into the play area. Transition along the center of the sidewalk is marked with a circle of exposed aggregate concrete to help guide the students in a different direction.

Light and Color
Exposed garden that lacks adequate trees or shade structures, this can be attributed perhaps to weather patterns of the area. While shade trees are provided around the general playground, smaller ornamental trees are utilized.
more surrounding the sensory gardens. To compensate the lack of trees, an extensive plant palette of herbs, flowers, and shrubs has been utilized in the site design. The central spine is terminated with a large lawn area for running and rolling in the unique texture of grass.

**Acoustics**
The front garden is exposed to open space and approaching traffic, whereas the back garden is sequestered behind the main building. Wind borne acoustics would be the main source of acoustical output. Acoustical material or elements would be a welcomed addition.
Project 5: Seashell Trust (Royal Schools for the Deaf Manchester)

LOCATION: Manchester, England
DESIGNER: Sue Robinson, Stockport MBC
TYPE: School Sensory Gardens Public Gardens
SIZE: (Garden) 32,400sf, (Campus) 550,000
DATE: 2000
USERS: Deaf students, faculty, and public

SUMMARY:
A day and residential, special school, offers teaching specialist for pupils and students from 2-19 years who have severe and complex learning disabilities combined with significant communication difficulties which include little or no oral language. A sensory garden is considered the heart of the campus.

DESIGN FEATURES:
• School Gardens
• Passive spaces
• Colorful and extensive plant palette
• Water and sculpture tactile stimulation
• Wide ranging plant palette
• Various raised plant levels
• Plants used for wayfinding
• Site layout and circulation
• Elemental accessibility
Sensory Reach
Site lacks tactile maps, but site is not blind-centric. It provides tactile stimulations through textured paving and elements, but lacks the high use of elemental features to denote spatial awareness.

Space + Proximity
The site provides open fields of communication and accessible. However, some elemental features are not within reach of some users. For instance, water features are recessed or tactile elements are placed on elevated surfaces. Plant interaction is highly prioritized in this site design by examination of plant proximity to trails, natural settings, and plant selection for sensory stimulation. Plants and the garden itself are heavily incorporated in the school curricula.

Mobility + Proximity
Hand railings can be found within certain areas along the pathways, but pathways in general are somewhat cramped and lack wide berths. Some of the trails are not paved or are wood planked, this could cause issues with mobility. Transitions spaces could also be more heavily defined and more adequately designed. Open views for navigating the site are adequate with natural curved approaches and a curved walkway around some elements, but most hardscape walkways are still quite linear.

Light and Color
Tree cover provides a mixture of lighting and shadows for the site users. Weather, ample biomass and materials would keep the sites overall glare levels down. The plant palette is vibrant and extensive and offers the most abundant amount of colors for the site. The use of different surface materials, plant materials, transitional spaces, and garden rooms offers a wide variety of contrasting elements and features. One could make the argument to the point of being detrimental to the site. At times, the site feels a hodgepodge of many sensory stimulating elements.
**Acoustics**
The site has a country natural feel to it. Acoustics would not seem to be of importance to this site. Natural settings dampen sounds in some areas, whereas other areas are more open and would carry the natural sounds of a school ground. Some of the garden spots are located between buildings with wooden landings or walkways, which would create their own sound qualities for that specific space. Textured and wooded walkways, water features, and dampening acoustics are all useful wayfinding devices.
THE SENSORY GARDEN EXPERIENCE
Project 6: Center for the Blind and Visually Impaired

LOCATION: Mexico City, Iztapalapa, Mex.
TYPE: School Sensory Gardens
SIZE: (Garden) na, (Campus) 25,500sft.
DATE: 2001
AWARDS: na
USERS: Blind students, faculty, and public

SUMMARY: A sensory garden for the blind located within a campus space. Iztapalapa is the district with the largest visually impaired population in the Mexican capital.

DESIGN FEATURES:
• Public Gardens
• Linear water feature
• Use of open spaces
• Active spaces
• Use of textures
• Light and shade
• Acoustic properties
• Raised surface areas
Sensory Reach
The site lacks tactile maps for wayfinding and provides limited tactile stimulation which lessens spatial awareness. Textured sidewalks are used to delineate a recessed water feature from the pathway. Horizontal and vertical lines in the concrete at hand height offer tactile clues for wayfinding and identifying buildings.

Space + Proximity
Access to and through the site is open. A wide central axis is provided and promotes open fields of communication. The site provides trees around seating arrangements, but in general plant life is minimal. There are only six types of plants and flowers are used along the perimeter of the garden to serve as sensory waypoints. The water feature is a recessed channel in the sidewalk and serves to guide the user through the site. A pebbled strip delineates where the recessed water feature is located – but nothing is provided to prevent users from falling or tripping into the water channel. Not a well thought out element. The site lacks circular seating, instead using linear and square seating arrangements. Spatial variety is provided through a series of corridors, structural materials and spatial vertical changes.

Mobility + Proximity
Wide sidewalks and linear pathways offer excellent views of the site. But, an abundance of 90 degree corners and lack of curved corners and junctions points is limiting. Lack of hand railing within the site could also be considered an issue. Transition spaces are nonexistent. Raised areas are promoted, but should be viewed more of as a hazard.

Light and Color
Light and shadows play a big part in the design of the campus’s outdoor space. Lack of plants and an abundance of hardscape materials create a great deal of glare from surface materials. The site has a very bland color palette consisting of dull earth tones – nothing vibrant – and lacks overall contrasting qualities.
Acoustics
The site and surrounding walls act as a sound barrier for the surrounding city traffic. Buildings form a buffer around a central linear pedestrian axis. Acoustic properties such as reverberation could not be determined, but lack of plants to dampen the flow of sound waves could be seen as beneficial. The site lacks elemental features to promote auditory cues.
III. CASE REVIEW DESIGN IMPLICATIONS

From these six case reviews, seven important design guidelines have been hashed out and implemented in the program development phase of the design process:

- Collection of user input from school staff, faculty, and parents for the design
- Exploitation of various innovative sensory stimulating elements
- The need for access and interaction to the site, to site elements, and to a wide ranging palette of plants makes for a strong design
- An imaginative design layout that promotes linear and curvature circulation patterns
- Incorporation of linear pathways and curved seating
- The ample usage of light and shade to define spaces
- A wayfinding system that utilizes a creative plant palette, resourceful water features, textured elements
THE SENSORY GARDEN EXPERIENCE
The current ASDB campus first opened in 1922 as an educational facility for deaf and blind students from all around Arizona. Located on the west-side of Tucson along the Santa Cruz River, 25 buildings sit on roughly 70 acres of land making up a campus that educates up to 300 hundred students and houses anywhere from 30-60 students in their on campus dorm facilities.

Designed by famed Tucson architect Roy Place, the site was part of Tucson’s 1920’s Spanish Colonial Revival found frequently in the American Southwest. Typical of many school designs, the campus was laid out in a linear, institutionalized fashion. Early, imagery depicts curved roadways and sidewalks at the main entry, with smaller sidewalks leading to and through many of the site structures. As was common with many school designs at the time, plant selection was based more on aesthetics rather than function or water use. A hodgepodge of palms, privet buses, pine, olive and elm trees are used extensively throughout the site.

The campus has gone through several reconstruction and expansion projects over the years. The early 1960’s saw the first major expansion of dorm, classroom and administration facilities. In the early 1990’s with buildings falling apart upgrades were required. This led to more modern classroom, administration, and dining facilities being built, but at the expense to the character of the school site. Currently, several of the aged existing buildings are vacant and either being retrofitted or reexamined for their usefulness. Because of this, several spaces on campus suffer from misuse and constitute dead space.
II. SITE INVENTORY

8 major functions were inventoried and examined to gain a better appreciation for site specifics. In particular were building uses and the circulation patterns that connected them. This led to locating and examining transition zones and entry spaces along the sites corridors. Inventory of natural systems such as tree canopy cover and water drainage through the site were also necessary to gain a better understanding of how to maximize water harvesting and shade harvesting techniques. Distances traveled to different spaces on site by the different aged students was also examined and of equal importance for gaining a more thorough understanding of site dynamics.
There are 3 Transitional Zones that students utilize on the campus. Each zone corresponds with the general distance students from and within the zone will travel on site. The elementary students have a relatively small zone of influence (350’ radius), only reaching to the library and cafeteria to the north, the gymnasium complex to the east, and the Main Gate to the west. The Elementary Zone lacks extensive sensory elements and utilizes standard playground equipment. Elementary students are close enough to visit one of 2 preexisting sensory gardens located on campus, but the distance to reach the main sensory garden next to the High School facilities were too great for the little ones to cover. Because of size of this Main Gate zone, it was a prime candidate to house one of the sensory gardens.

The Junior High School Zone radius extends roughly 550’ out from its building, also reaching as far as the cafeteria to the north and the gymnasium complex to the east. But students within this zone were within walking distance to the existing High School area sensory garden. This zone also occupies the Main Gate area and some of the corridors within the site that were in need of immediate sensory stimulation and maintenance care. This Zone was full of many of the older corridors found on the site, so contained much of the old growth. At the same time, much of the canopy cover consisted of non-drought tolerant tree species. This Zone also housed several microclimates and areas of shade, but was not utilized because of location and circulation connectivity issues.

The High School Transitional Zone has the greatest coverage of the three zones, extending out with a radius of over 950’. Users of the High School Zone utilize the most area within the site, offering many different sensory design opportunities. Their influence reaches all of the same areas covered in the previous two zones, but also extends off campus. The High School location itself was in need of shade and direct sensory stimulation. Because of its distance from the Elementary school, the High School sensory garden offered an ideal location for any cacti to be incorporated into a design for sensory stimulation.
AREAS OF CONFLUENCE

There are 3 areas that see heavy traffic and usage throughout the day: the Main Gate, the Lost Corner south of the cafeteria, and the space adjacent and east of the High School.

The Main Gate contained a central greenspace, but its exposure and lack of sensory stimulating elements left it mainly unused. Poor circulation patterns that were not deaf or blind friendly plagued the space, as with the other two spaces.

The Lost Corner, situated at the north-south/east-west axis sees a fair amount of pedestrian traffic coming to and from campus. It also sees high usage during the lunchtime hours. But it is during afterschool hours that the space still sees traffic compared to the other two sites. This has to do with the site being adjacent and leading into the playing fields which are used for sporting events and by students living at the dorms. Because of its location and traffic usage, this was a site that had potential for a sensory garden experience.

Last of the 3 Main Spaces is the High School space located in the north-west section of campus. What was promising about this space was its proximity to centralized cooling systems and areas that encounter high volumes of water discharge during rain, all water that can be utilized in the water harvesting process. While it is somewhat removed from the central campus, the space offers means of connecting this western portion of campus with the campus proper. There was an existing, rundown sensory garden that lacked many garden amenities let alone sensory stimulation. Lack of maintenance and elements was reflected in its usage by the staff and students. One of the glaring problems with that and the surrounding space was its lack of developed microclimates and the exposure to the westerly sun. But adequate water harvesting techniques, plant selection, and sensory features would have made this a potentially deaf and blind friendly space.
ENTRY POINTS

Entry points into the schools buildings served as an excellent space to connect the user and sensory elements of the outdoor spaces with those of the indoor spaces. The standard seemed to have been the architectural surroundings dictated the character of entry points. Most, if not all of the entry points lacked any types of sensory stimulating wayfinding elements. Quite the opposite, very standardized if not institutionalized wayfinding elements had been the norm and incorporated into past designs.

A more creative approach was to have the outdoor space dictate the character of the entry points through a series of elemental features that would meet the objectives previously laid out for this design. Seating, shade, sensory stimulating plants, acoustical elements, and tactile stimulation are all features that were introduced into these Entry points to create character for users entering or exiting interior spaces.
TRANSITIONS

There were numerous transition spaces throughout the site. Intersecting sidewalks particularly were one of the major flaws found throughout the campus. The sidewalks reflect a hodgepodge of renovations over the century with different philosophies or lack therefore of, has left various sidewalk widths (6’-20’) and designs. The site also lacked wayfinding or sensory stimulation centered on these or key transition zones. This goes along with the sites general lack of a cohesive wayfinding system along its pathways. Many of the transitions zones are also in need of spatial definition and sensory output.

In the design, these wayfinding points were beneficial at intersections that transitioned from pathways and into buildings or their entry points. Different elements were incorporated into various transition zones based on their location and usage.
The center of the site and the main thron of campus buildings sit on high ground, with a roughly .015-.02% slope throughout the site. The main drainage through the site flows either east 1000' towards the Santa Cruz River or west into a smaller neighborhood tributary.

On campus, the eastern watershed collects in the field adjacent to the new track field before heading towards the Santa Cruz. While the western watershed forms a lush Bosque area along the boundary of the school between two of its parking lots. While far removed from the campus proper, this area could be utilized either in the sensory garden design or future projects (seeing-eye dog training facility). Seasonal summer monsoons and heavy winter rains can flood surrounding roads leading from the site, causing users to have to drive through campus proper and its sidewalks in their vehicles. There are ample opportunities to harvest rainwater on the site. There was also the potential to collect recycled HVAC condensate for several months of the year.
Overall the site lacked connectivity, or a means of unifying and congealing the campus as a whole. This can be attributed to the hodgepodge of renovations that have taken place over the last century and the evolving ideas on how best to meet the user’s needs. Circulation patterns through the site stem from where kids arrived, go to class, eat lunch, take recess, and then leave for home or the dorms.

There is a major east-west axis that runs through the main portion of campus, connecting the cafeteria in the East to the High School and one of two existing sensory gardens to the west. This central axis serves as a conduit for not just pedestrian users, but also for vehicular and emergency transportation. From the eastern end of this axis heading south, one finds the other end of this major circulation corridor. This corridor primarily used by users heading towards the parking lot or off campus. This corridor experiences heavy flooding during rain storm events with water heading out into the adjacent field.

Minor pedestrian corridors finger off south of the major east-west axis and towards various other buildings on campus. These minor north-south corridors were some of the areas on campus in most need of upkeep, sensory stimulation and user interaction. Remnants of the old roundabout that was the focal point of the old campus can still be seen in the sidewalk footprint along the eastside of the present day library. This 20’ sidewalk should be the corner stone for expanding and designing through the rest of the school site. Small sidewalks, lack of plantings, and multiple entry points, allowed for these corridors to be utilized as part of the redevelopment of campus and the promotion of the sensory garden experience.

Another east-west axis sits just south of the Elementary and Junior High School facilities. This axis connected the southern portion of campus (the bus stop and drop-off zone along Speedway Blvd.) with the western end of campus (Berger Performing Arts Auditorium and the Junior High facilities). This smaller east-west axis also ran along the smaller of the two sensory gardens presently on site.
A.S.D.B. being over a century old, has some of the more well established tree canopies in Tucson. The main thrust of trees and greenspace can be found at the Main Gate, the A.S.D.B. Museum, and the Library building, consisting mainly of pines and olive trees.

Spreading out from the center of campus and through some of the major renovation spaces, one would notice a thinning out of the tree canopy and use of more water-friendly mesquite and Palo Verde. A series of out of place palm trees ring around the newer Junior High facility, over emphasizing their vertical scale to the rest of the site. Heading further out from the center of campus, one would begin to encounter the parking lot facilities and their abundant collection of shade providing mesquite and Palo Verde. On the southern and western boundaries of campus, one would find amble and beautiful tree cover, producing shade and screenage from adjacent streets. Last, along the far eastern boarder of campus running parallel between the track field and the Santa Cruz River is a massive strand of eucalyptuses that not only provide a captivating view, but also provides animal habitats, microclimates, and a windbreak.
While analysis would show ample and extensive tree coverage within the site, further analysis showed the lack of trees within the site proper. As shown in the map above, if one were to take away the existing tree coverage from the site boundaries, parking lots, and areas off-limits to the school children, areas worthy of design considerations have much more potential for additional greenspace and microclimate development.
The school has been built up and extends out from a central axis centered on the school’s library (orange). The three classroom facilities (purple) consist of the highest amount of onsite users. From these three buildings, users frequent several of the different school facilities: Administration (red), the Cafeteria (blue), the Gymnasium Complex (green) and areas designated as Other (grey) that are off limits to students. A.S.D.B. also houses about 10% of their students in on-campus dorms (yellow) centered on campus adjacent to the library. Several of the buildings designated as Other consist of older dorms that are under extensive renovations that have been left in limbo because of budget constraints.
ANALYSIS

Site A is the first thing users will encounter when they enter the main school grounds off of Grande Ave. The entry and view provides visitors with a view of the oldest part of the school campus. Renovations have changed much of the original Spanish Revival context of the site, present mainly in architectural form.

Four major school functions either take place or are located at site A: the main gate entry point, the A.S.D.B. museum, the auditorium complex, and the administration facilities are all located along its south-southwest boundary. Along the west side is the junior high school building and to the north is the campus library, and to the east is the elementary school. All four of these facilities feed directly into or through site A. Because of the sites size proximity and central location, both the elementary and junior high schools are able to enjoy and utilize the sensory garden design to its fullest.

Circulation patterns through the site were a hodgepodge of former designs with good intentions, but lack adequate blind-friendly wayfinding amenities and surfaces. A wonky sidewalk shaped like a sickle and lack of planters as a wayfinding source, provided the opportunities to improve mobility concerns. Many of the more modern sidewalks are of standard size, but the older north-south running sidewalks are aged and less deaf-friendly because of their narrower width. Site A also contained a vast lawn with little offering of shade and is within close proximity to parking and its reflective heat. Relocating the lawn space and north facing parking spaces and replacing them with a microclimate friendly space was determined to be beneficial.

Because of its central location and main gate status, this site was determined to be the most suitable for demonstrating the advantages and opportunities available within a campus sensory garden design. Just east of Site A was one of the two pre-existing sensory gardens located on campus. Only 100’sqft, lacking access, space, and usage, this older and outdated sensory garden space was replaced and incorporated into the overall sensory garden master plan.
ANALYSIS

Site B. is located in the north-west portion of the campus site next to the high-school and second pre-existing sensory garden. The pre-existing sensory garden were established by a group of Boy Scouts and was in dire need of attention. While the site provided shade, a plastic water pond, and some potted herbs, its location, overall exposure and lack of maintenance left it mainly unused by students and staff. It also housed the schools 2 goats, and flock of chickens.

A more desirable site to be utilized for a sensory garden was determined to be just south of the present site and located adjacent to the high-school facility. The former sensory garden was located too far to the north and cattycorner to the main high-school building, essentially separated from the main campus. Having the Site B located directly east of the High School building also enables the new sensory garden to take advantage of the microclimates created between two buildings. One building being the High School, the second being a 2-story historical dorm in the process of renovations for the foreseeable future. This space already had existing and well developed plants for the arid environment which will serve as part of the garden’s foundation. Positioning the new sensory garden more to the south was to put it in closer proximity to the Junior High school and the girl’s dorms that are located just southeast of the High School space. Within the space itself, there are ample opportunities to create an environment conducive to outdoor learning and sensory stimulation. This was done by creating a sensory that is more of a foray or extension of the existing High School building, then having the elements flow and carry the user out into the campus’s central axis.

Lastly, by positioning the sensory garden adjacent to the High School the garden connects with the other sensory gardens by way of the major east-west circulation axis that runs through the campus proper. This corridor serves as the main avenue for user’s who wish to take the most direct route through campus. At the west end of this corridor is Site B and the High-School Garden, located at the opposite end along the south-eastern end of the campus is Site A.
SENSORY CORRIDORS

Sensory corridors serve as the connecting fabric of the campus as a whole for this design. Many of the pathways and corridors lost their sensory appeal over the years. The design called for addressing these corridors and utilizing them in a way to develop various tactile stimulation and create sensory appeal.

Sites A and B provided many design opportunities for incorporating deaf and blind friendly elemental features. The encouragement of sensory stimulation, engagement, and connectivity can be carried out in such a manner, as to create a positive and educational environment for all users. It is the sensory corridors that will serve as the linking mechanism between the two.
III. CONSERVATIONS:
THE USER’S EXPERIENCES

Following informal conversations with her fellow educators from the school, my wife Lana Pedersen passed along some knowledge and design tips that came to fruition. The teachers are very aware of what specifically a sensory garden and its purpose.

A majority know of the two sensory gardens presently located on campus (see images above). A small few did not know of their existence, or did but didn’t know where they were precisely located. In general they seldom used the sensory gardens, for lack of amenities and upkeep. They gave the existing sensory gardens low marks, but considered it to have potential. When it came to accessing or enjoying the sensory gardens, both were considered unfriendly for little kids. The lack of plants, the maintenance issues, and the remote location of the gardens makes for them to be difficult for the educators to utilize. Improvements and various elements that staff recommended included: making the garden the focal point of the campus, incorporating a wider variety of plants, use of friendly cacti, more edible plants, perennial plants for easier maintenance, more tactile and auditory stimulating elements, and water features. The teachers also expressed the need for adequate seating, tables, and shade structures, with places for kids to explore, and better advertising of the garden and its contents through a series of signs. They felt these would all be beneficial and would like to see incorporated into their sensory gardens.

All agreed the idea of a sensory garden would be embraced if it were improved on. The space would be utilized as an outdoor classroom. Features that are currently present, such as the horse shoe shaped planter, are incorporated into curriculum that teaches the four cardinal directions to the blind. The teachers felt a sensory garden would offer many benefits for the students. For example: getting the students into the outdoors, exposing them to forms of sensory stimulation, fostering exploration of their environment, and last promoting land stewardship and the natural sciences with a hands on approach.

In all, the teachers felt an improved sensory garden would be a beneficial teaching tool, a welcomed outdoor space, and a useful sensory stimulant.
There are three different areas within the site that were the most suitable locations to create a sensory garden experience: the Main Gate Plaza, the space to the east of the high school facilities, and the walkways and corridors linking the two said spaces. Each of the three sites were selected based on their ability to promote connectivity while also promoting the most sensory stimulation.
I. PROGRAM

This program lays down the foundation for developing a sensory garden experience by creating the necessary functions and elements for developing passive recreational use, opportunistic meeting spaces, promoting sensory stimulation, and providing educational opportunities. The accompanying list is a compilation of elements, features, and spaces, and the various design objectives that they met. This design program was used as a working blueprint for the implementation of the Sensory Garden Experience. This program lays out a template for fostering aesthetic character, promoting navigability, providing proper access, encouraging outdoor education, and last for developing connectivity for users with the site and each other.

The program also incorporated the 5 design principles mentioned and developed from the previous Case Reviews. These design principles will be the foundation for much of the sensory garden experience. In conjunction with the Case Review Design Guidelines, a set of design features produced a criteria assessment matrix (see Appendix) that was used in the design implementation phase of the sensory garden design process. Each feature falls under 1 of the 5 design principles mentioned earlier, and served as the standard for design implementation. From this list of design features and elements, a set of program standards were developed and processed for use in site plans for the sensory garden experience.

The outcomes for this Master’s Report are a compilation of plans and perspectives from 3 different focus areas that detail the various program features that are present within the site design.

Acoustic elements, various colors arrangements, plant selection, water features, innovative seating details and the overall access to the site and its features is what makes this a truly unique design - and sensory garden experience.
<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>ACTIVITIES</th>
<th>ELEMENTS &amp; SPACES</th>
</tr>
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<tbody>
<tr>
<td>Encourage passive recreational usage / Provide educational opportunities / Create opportunistic meeting spaces / Promote sensory stimulation</td>
<td>Educational, recreational</td>
<td>WATER FEATURES, Seating areas, communal areas</td>
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<td>BRAIL SIGNS, Entry points</td>
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<td>SOUND BOARDS, Entry points, transitions</td>
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<td>QUALITATIVE CHARACTERISTICS</td>
<td>MATERIALS</td>
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<tr>
<td>3</td>
<td>Fountain and mini-pond, Spanish mosaic tiles, focal point of gardens</td>
<td>Stone, concrete, metal</td>
</tr>
<tr>
<td>7’x7’</td>
<td>Granite boulders, bored out holes of varying depths, smack to make a sound</td>
<td>UA drilling rocks, granite</td>
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<tr>
<td>2’x1’</td>
<td>Copper plated, braille on the sides, interpretive signs for the sensory gardens and campus</td>
<td>Copper</td>
</tr>
<tr>
<td>.5’x3’</td>
<td>Incorporated into interpretive and educational signs</td>
<td>Concrete</td>
</tr>
<tr>
<td>5’x8’</td>
<td>Tin panels; provide screenage and acoustical properties through sound reflection</td>
<td>Corrugated metal</td>
</tr>
<tr>
<td>1’x2’</td>
<td>Used as educational tools for the users, information regarding the school and sensory gardens</td>
<td>Various</td>
</tr>
<tr>
<td>various</td>
<td>Cultural art, tactile or sensory based, student or local artists</td>
<td>Various</td>
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<tr>
<td>OBJECTIVES</td>
<td>ACTIVITIES</td>
<td>ELEMENTS &amp; SPACES</td>
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<td>U.V. / I.R. PERISCOPE</td>
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<td>Gathering spaces, respite, elemental access, outdoor classrooms</td>
<td>SEATING, various spaces, utilize in sensory gardens, southern and eastern facing preferred</td>
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<td>SIDEWALKS</td>
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<td>Educational</td>
<td>PLANTS, raised planter beds, ground level planter beds, public and semi-private spaces, transitions, waypoints</td>
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<td>Encourage passive recreational usage / Provide educational opportunities / Promote sensory stimulation</td>
<td>Plant interaction, sensory stimulation, educational</td>
<td>RAISED PLANTER BEDS</td>
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<tr>
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<td>QUALITATIVE CHARACTERISTICS</td>
<td>MATERIALS</td>
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<tr>
<td>various</td>
<td>Tactile imagery, sculptures, student and public work</td>
<td>Metal, plaster, stone, wood</td>
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<tr>
<td>6, 3’x3’ 6’x8’ corrugated metal</td>
<td>Acoustical sound wave detectors, acoustical wind devices, natural acoustics</td>
<td>Metal, wood, plastic</td>
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<td>3</td>
<td>Viewing periscope altered with I.R. or U.V. lens, 4’height</td>
<td>Metal</td>
</tr>
<tr>
<td>3–4 per garden, sensory corridors, close proximity to entry points</td>
<td>Curved, low walls, accommodate large groups to semi-private groups, earth tone colors</td>
<td>Concrete, masonry</td>
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<td>3’x15’</td>
<td>Textured, corrugated, cement cuts</td>
<td>Aluminum, steel, iron, smooth stones,</td>
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<td>15”</td>
<td>Earth tones, Spanish colonial colors, contrast with seating element colors</td>
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<td>small, medium, large</td>
<td>Used as accents, screens, for shade, tactile, and sensory experiences</td>
<td>Plants, 1-gal, 5-gal, 5’-boxes</td>
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<td>Site appropriate, low height for children to experience, utilize for bind circulation</td>
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</tbody>
</table>
The Design Matrix was used to allow for design patterns involving compatibility between various design elements that are used onsite. Green determines a positive outlook on the usage of two elements together, a black-ringed white circle indicates indifference, and red indicates it is not ideal to place the two elements together. Some of the findings that were utilized in the design process were as follows:

- Acoustics should be separate from areas that involve concentration or quite spaces
- Awareness of water features in direct proximity to circulation
- Sensory wayfinding offers many opportunities, caution must be taken to make sure and not overload the senses with too much or conflicting stimulation

### DESIGN MATRIX

<table>
<thead>
<tr>
<th>WATER FEATURES</th>
<th>STATUES</th>
<th>ROCK FORMATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TACTILE MAPS</td>
<td>BRAIL POSTS</td>
<td>SOUND BOARDS</td>
</tr>
<tr>
<td>INTERPRETIVE SIGNS</td>
<td>ART</td>
<td>TACTILE ART</td>
</tr>
<tr>
<td>ACOUSTICAL ART</td>
<td>U.V. / I.R. PERISCOPE</td>
<td>SEATING</td>
</tr>
<tr>
<td>GROUND TRANSITIONS</td>
<td>SIDEWALKS</td>
<td>PLANTS</td>
</tr>
<tr>
<td>RAISED BEDS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND**

- **NEGATIVE** - Does not provide or meet standards
- **NEUTRAL** - Undetermined, neither (+ or -)
- **POSITIVE** - Provides or meets standards
II. DESIGN CONCEPTS

CONCEPT DIAGRAM

The overall concept called for 2 sensory gardens interconnected by a series of sensory garden corridors linking the campus together. The classroom buildings served as the catalyst of this design concept. From those buildings circulation patterns connected the users with the various functioning building that are used in a typical school day: the cafeteria, the library, the gym/playground and the principal’s office. The 2 sensory gardens provided the foundation for the sensory garden experience, while the thoroughfares and corridors were to provide the design with spaces to develop transition and various minor spaces.

Each of the sensory garden space was to have its own unique design that centers on creating connectivity amongst its users, the surrounding space, and encompassing area. Utilizing the converted 5 Design Principles of DeafSpace and taking into consideration the needs of the users, aided in providing an enhanced sensory experience for the user’s surroundings.
The concept for this design revolved around how to create a space for the needs of two distinctly different user sets. Figuratively, it is similar to that of a puzzle piece, a riddle of sorts to be solved.

There were various design inspirations developed based on comfort, circulation and areas of interest. It took taking the puzzle piece quite literally, as a design inspiration for the concept to come to fruition: it has the outer obtuse angles required by blind users for linear walkways and at the same time has the curvilinear inner working required by deaf users for circular seating.
FINAL DESIGN INSPIRATION

The puzzle piece represents two distinctly different user groups that operate as one. When you join these puzzle pieces together, they begin to form a foundation for a series of interlinking sensory gardens that serve to unifies the campus for all its users.
III. FINAL PLANS

FOCUS AREAS

The three focus areas will showcase various examples of the five design principles present within each site. These design principles are meant to be employed in conjunction with the usage and development of this and other future design guidelines.
The teachers use various plants on campus to help teach the students the cardinal directions. This activity also enables students to more easily learn and navigate the school campus.

Because of this, the program called for a planting plan that divides the sensory gardens into different sensory zones, based on the type of sensory stimulation the plants provide. This process was followed more for the shrubs and understory, whereas trees were left to developing the shade canopy for each sensory garden site. Larger trees would be used along the pathways, and smaller trees to be found around seating areas and entry points.

The sensory gardens and corridors were divided according to the rose compass: the northern half utilizes plants for the deaf (sight and touch); the south half of the sensory gardens will provide plants more geared for the blind (sound and taste). Plants that provide smell and or sensory richness to both user groups are freely joined where applicable.

All plants were selected based on their sensory appeal. For the trees, a mixture of deciduous and evergreen species of various sizes (small 10’-20’, medium 21’-35, large 36’+) were chosen for their hardiness and water requirements. Other important factors in determining which plants to select came down to when particular plants bloom. Selecting plants that bloom when students would be on campus (fall, winter, and spring) was a final factor when applicable.
One of the keys to this design was incorporating natural acoustics and innovative acoustic elements for users to interact with, yet not lose interest in. The first acoustic element to speak of would be the parabolic dishes: two large round metal bowls that sit apart from one another. When speaking or making sounds into one bowl, the sound waves are carried over into the over bowl behind the user. Whispering, talking, and clapping all produce sound waves that the users are able to hear or feel.

Also incorporated into the design are a series of rock bongos. These blocks formerly sat outside Old Main on the University of Arizona campus as part of a student engineering drilling contest. After being shaped to smaller sizes and relocated to the A.S.D.B. campus, they will be utilizing as rock bongos. The holes that the engineering students drilled, when slapped with an open palm, produce different bongo sounding effects.

Corrugated metal screens are used to reflect acoustics. These acoustics can be produced by activities ranging from children playing to students walking by. These corrugated metal screens are also used as a means of shielding users from various utility boxes and water pipes.
**DESIGN APPLICATION**

**MAIN GATE**

**SENSORY GARDEN HIGHLIGHTS**

**SITE ACCESSIBILITY:**
- Main entry is ideal location

**SPATIAL VARIETY:**
- Circular seating with raised planters - the puzzle piece

**SPATIAL AWARENESS:**
- Wayfinding: Tactile maps and informational signs

**ELEMENTAL FEATURES:**
- Parabolic dishes

---

THE SENSORY GARDEN EXPERIENCE
SITE ACCESSIBILITY:
• Main entry point on to the campus, ideal for a sensory garden
• Creation of outdoor classroom spaces
• Circular seating, the puzzle piece design inspiration

AUDITORY CUES:
• Reduce car noise and vibration with rubber surfaced parking lot and noise wall

SPATIAL AWARENESS:
• Incorporating ASL and braille into the school’s new entrance sign
As wayfinding devices these acoustic elements all have some form of function, but for the most part require an active participant. One of the natural acoustical elements present on site not requiring an active user is the sound and vibration producing wind harps. These 5’hx10”w metal boxes are filled with a series of strings, that when wind blows through produces a natural acoustic sound.

**SPATIAL AWARENESS:**
- Wayfinding techniques such as tactile warning strips for parking, seating, and transition zones
- Tactile maps and interpretive signs that provide spatial layout, details on the sensory gardens and the school grounds

**SITE ACCESSIBILITY:**
- Circular seating that takes advantage of newly created or preexisting microclimates that maximize shade and comfort
- Creation of outdoor classroom spaces
DESIGN APPLICATION

TACTILE STIMULATION:
- Simple water feature that utilizes recycled water and provides users with abundant sensory stimulation, a key feature to any sensory garden design

CONTRAST:
- Utilize different colored cements for sidewalks and seating

REDUCED GLARE:
- Use of natural lighting and shade harvesting techniques to reduce glare.
- Use of contrasting surface and plant colors

AUDITORY CUES:
- Water Feature

SCREENAGE:
- Minor spaces used to block surrounding noises/vibrations
DESIGN APPLICATION

TACTILE STIMULATION:
• Use of various textured plants

SPATIAL VARIETY:
• Circular seating, walled seating, raised planting beds

ELEMENTAL ACCESSIBILITY:
• Raised planters for easy plant accessibility and interaction

ELEMENTAL FEATURES:
• Parabolic dishes that transfer sounds and vibrations from one dish to the other

AUDITORY CUES:
• Natural acoustics through use of various plants
**CAMPUS**

**SENSORY CORRIDOR**

The key elements to any sensory garden designs are its wayfinding elements. Tactile warning strips are one of the most universally recognized and used elements in this field. Utilizing tactile strips with unique and innovative materials is one of the components of this design.

ADA requires 3’ wide tactile warning strips throughout the site marking and alerting users to any potential hazards. In the case for this campus design there were several spaces that required tactile warning strips: parking areas, water features, transitions, entry points, and seating spaces. Surface materials were selected and used based on their tactile makeup and ability to be incorporated into a cohesive site design. Smoothed down pebbled river rocks were used for seating areas, rough small pebbled concrete strips are found at seating entry points, scored concrete tactile strips are used at paths leading into buildings, and metal coverings were used at walkways and intersections.
**WAYFINDING:**
- Utilize various forms of tactile art and warning strips to alert users

**SPATIAL VARIETY:**
- Incorporate public and semi-private spaces for opportunistic meetings

**CIRCULATION:**
- Utilize wide sidewalks with clearly marked transitions

**CONTRAST:**
- Use different colored cements for sidewalks and seating features

---

**CAMPUS**

**SENSORY CORRIDOR HIGHLIGHTS**
WAYFINDING:
- Tactile art located at the bases and corners of walled seating
- Textured tactile warning strips found at locations for building entry points
- Used to alert users to hazards found at transitions, entry points, and seating areas

VIEWSHEDS:
- Wide, 15’ sidewalks
- Linear pathways
- Clearly marked transitions
- Open views for mobility and spatial awareness

- Open views for various forms of communications
- Utilizing raised planters to encourage plant accessibility
CONTRAST:
• Utilize different colored cements for sidewalks and seating

REDUCED GLARE:
• Use of natural lighting and shade to reduce glare
• Use of contrasting plant and hardscape colors

AUDITORY CUES:
• Metal tactile warning strips and water conduits

SPATIAL VARIETY:
• Public and semi-private spaces for opportunistic meetings
To produce more conducive avenues with increased personal space, walkways are a wide 15’. To increase the contrast, thus the user’s ability to discern different objects more clearly, natural materials and colors were incorporated into the design to reduce glare. Earth tones such as Spanish red were incorporated into the concrete to minimize glare and hide the wear and tear of school children usage. One final procedure for reducing glare around walkways involved the cultivation of natural lighting and shadows.

One of the key factors to creating a sensory garden is accessibility to its plants. Incorporating raised planter beds is one of the solutions to promoting plant accessibility. These raised planter beds also serve a dual purpose as seating elements throughout the site. These ADA 18”hx24”w walled seating features create a raised planting bed, located away from building structures. To help contrast the walls, corners, and seating from the walkways, earth tone colors have been utilized. One of the aspects of these walled seating elements throughout the site, is it provides users with opportunistic meeting spaces.

Also incorporated into the site design are various circular outdoor seating spaces. Ranging anywhere from a 7’-10’ radius, these circular seating areas can be found opposite of entry points along the sensory corridors, and if possible, facing away from the sun and classrooms in the sensory garden.
spaces. These outdoor seating areas are perfect examples of providing sensory exploratory spaces to accommodate outdoor classrooms for all age levels.

WAYFINDING:
- Use of contrasting colors and materials
- Incorporation of cultural tactile art, located at the bases and corners of walled seating
- Tactile warning strips used to alert users to hazards found at transitions, entry points, and seating
The last of the sites is the High School Sensory Garden. Providing access to and from the High School classrooms, it provides ample open viewsheds for communicating and outdoor classroom teaching. Stadium seating is used to accommodate more people, with smaller semi-private circular seating spaces found along the eastern side of the sensory garden.

Innovative acoustic elements are incorporated at various entry points. Wind harps and a water element provide natural acoustical elements and calming effect to the site. Rock bongos and a pair of parabolic dishes cap off the acoustical elements that provide sensory stimulation to the users. Corrugated metal serve as a screening element throughout the site, providing not only providing screenage from unwanted utilities, but they also act as an acoustic reverb to users who pass by. Known as the “raindrop effect”, this acoustical phenomenon provides users with another innovative acoustical wayfinding system throughout the site.
SITE ACCESSIBILITY:
- Create public areas for outdoor classrooms, with circular seating

SPATIAL AWARENESS:
- Use of innovative acoustical wayfinding elements

AUDITORY CUES:
- Use of different elements that produce natural acoustics

HIGH SCHOOL

SENSORY GARDEN HIGHLIGHTS

THE SENSORY GARDEN EXPERIENCE
WAYFINDING:
- Tactile maps, tactile strips, acoustic elements

TACTILE STIMULATION:
- Tactile warning strips, tactile art

CIRCULATION:
- Open views for mobility and awareness
- Linear pathways
- Wide sidewalks
- Clearly marked transitions

ELEMENT ACCESSIBILITY:
- Sound elements, wayfinding elements, plant interaction
- Ease of access, defined with wayfinding elements

SPATIAL VARIETY:
- Walled seating, raised planter beds
ELEMENTAL FEATURES:
• Wind harps, rock bongos, parabolic dishes natural acoustics

AUDITORY CUES:
• Natural acoustics produced through the use of wind harps and sound boards

CONTRAST:
• Use of natural lighting and shadows
• Natural material colors to reduce glare
• Vibrant elemental color palette that contrasts well

ELEMENTAL FEATURES:
• Soothing water sounds
• Parabolic dishes
DESIGN APPLICATION

SPATIAL AWARENESS
• Public areas/outdoor classrooms with circular seating

PLANT INTERACTION:
• Access to the sensory gardens

CIRCULATION:
• Open views for mobility and spatial awareness

ELEMENTAL FEATURES:
• Bongo rocks/granite with drilled holes of varying depths, laid out in a grid pattern, used to make sounds
DESIGN APPLICATION

SPATIAL AWARENESS:
• Use of acoustical wayfinding elements

TACTILE STIMULATION:
• Sensory stimulating acoustical elements

SITE ACCESSIBILITY:
• Circular seating with stadium seating to accommodate more users

VIEWSHEDS:
• Open views for various forms of communication

SCREENING:
• Corrugated metal panels to screen utilities, deflect sound from classroom windows (selective usage, west facing windows, behind seating, around outside classrooms)

AUDITORY CUES:
• Sound reflection from screening panels, acoustic pings

THE SENSORY GARDEN EXPERIENCE
The beautiful and historical ASDB campus over time, through lack of understanding and renovations, has lost its sensory appeal and stimulus. Through research, analysis, and development, a program containing a series of guidelines emerged from this design process that created an enhanced sensory experience.

The design for the A.S.D.B. Sensory Garden Experience provides its users a unique opportunity to experience their surrounding environment to the fullest of their capabilities. This innovative design process also tackled a major issue by providing outdoor environments that are friendly for both the deaf and blind communities and their specific needs.

Several design standards emerged, standards not just for the designing of a properly functional space for the deaf and blind, but standards that can and should be incorporated into our more mainstream designs concepts, particularly for arid climates.

For the future, there is a need, there is interest, and there is potential for extraordinary and invigorating sensory gardens. This sensory garden experience serves as a means of providing all of its users with the ability to interact not just with their surrounding environments and engage in various forms of passive recreation, but to provide for the users a heightened sensory experience.

Acoustic elements, various colors arrangements, plant selection, water features, innovative seating details and the overall access to the site and its features is what makes this a truly unique design - and sensory garden experience.
## PLANTS COMMON NAME

### PLANTS

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>USES</th>
<th>SIZE</th>
<th>BLOOM</th>
<th>TOUCH</th>
<th>TASTE</th>
<th>SMELL</th>
<th>SOUND</th>
<th>SIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phyllostachys Aurea</td>
<td>Golden Bamboo</td>
<td>20', large</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Muhlenbergia dumosa (sp)</td>
<td>Bamboo Muhly</td>
<td>3'x4', medium</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Agave geminiflora</td>
<td>Twin-flowered agave</td>
<td>2'x2', medium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muhlenbergia negas</td>
<td>Deer grass</td>
<td>medium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nolina microcarpa</td>
<td>Beargrass</td>
<td>accent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Penrosea setaceaem 'Cuprem'</td>
<td>Purple fountain grass</td>
<td>medium</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muhlenbergia c. Regal Mist</td>
<td>Regal Mist muhly</td>
<td>3'x3', Fall</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Dasylirion Quadrangularum</td>
<td>Toothless Desert Spoon</td>
<td>5'x6'</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

| Euphorbia rigida | Gopher plant | accent/transitional | lime green | small | | | | |
| Aloe ferox | Tree aloe | Parry's aloe | red/orange bloom | 2', small | | | | |
| Yucca baccata | Banana yucca | Spring | | | | | | |
| Asparagus d. 'Purpureus' | Spanger's asparagus | white bloom | | small | | | | |
| Asclepias subulata | Desert Milkweed | white bloom | | | | | | |

| Pachyurus regnans | Mexican fencepost | transitional | fruit, green-white bloom | 12' | | | | |
| Aloe barbadensis | Aloe vera | transitional | yellow bloom | small | | | | |
| Ferocactus wislizenii | Fishhook barrel cactus | transitional | orange bloom | medium | | | | |

| Lycium (sp.) Solanaceae | Wolfberry | transitional | red berries | medium | Summertime/Fall | | | |
| Citrullus vulgaris | Calamondin | transitional | fruit | medium | Spring | | | |
| Myrtus communis Compacta | Compact myrtle | transitional | white bloom | medium | Summertime/Fall | | | |

| Laurus nobilis | Sweet bay | transitional | limegreen bloom | 30' medium | Spring, Summer | | | |
| Brachychiton populneus | Bottle tree | transitional | big leaves | city | | | | |
| Acacia farnesiana | Sweet Acacia | transitional | sweet smell, cornflakes | 40' | | | | |
| Dalbergia sissoo | Indian rosewood | transitional | big leaves | large | Spring | | | |
| Havardia pallens | Tenaza | transitional | medium | Summer | | | | |
| Acacia stenophylla | Shoestring Acacia | transitional | birds, yellow bloom, edible flowers | 30' medium | Spring | | | |

| Acacia salicina | Willow Acacia | transitional | big leaves | medium/large | Spring | | | |
| Quercus ilex | Holly Oak | transitional | big leaves | medium/large | Spring | | | |
| Quercus virginiana | Southern live oak | transitional | big leaves | 50' large | | | | |
| Quercus suber | Cork Oak | transitional | big leaves | 10'-15' medium | | | | |
| Prosopis juliflora | Velvet Arizona mesquite | transitional | knobby | large | Spring | | | |
| Callistemon viminalis | Bottlebrush | transitional | knobby | medium | | | | |
| Chilopsis linearis | Desert Willow | transitional | hummingbirds, pink bloom | 25', medium | Spring | | | |

## TREES

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>USES</th>
<th>SIZE</th>
<th>BLOOM</th>
<th>TOUCH</th>
<th>TASTE</th>
<th>SMELL</th>
<th>SOUND</th>
<th>SIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prosopis velutina</td>
<td>Velvet Mesquite</td>
<td>30' medium</td>
<td>Spring, Summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraxinus velutina Río Grande</td>
<td>Fan-Tex’ ash</td>
<td>20', large</td>
<td>Spring, Summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brachychiton populneus</td>
<td>Bottle tree</td>
<td>transitional</td>
<td>small green blooms</td>
<td>40'</td>
<td>Spring</td>
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<tr>
<td>Acacia farnesiana</td>
<td>Sweet Acacia</td>
<td>transitional</td>
<td>sweet smell, cornflakes</td>
<td>40'</td>
<td>Spring</td>
<td></td>
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<tr>
<td>Dalbergia sissoo</td>
<td>Indian rosewood</td>
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<td>big leaves</td>
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<td>medium</td>
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<td>Acacia stenophylla</td>
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<td>birds, yellow bloom, edible flowers</td>
<td>30' medium</td>
<td>Spring</td>
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<td>Parkinsonia Florida</td>
<td>Blue Palo Verde</td>
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<td>Spring</td>
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<td>Acacia salicina</td>
<td>Willow Acacia</td>
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<td>big leaves</td>
<td>medium/large</td>
<td>Spring</td>
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<tr>
<td>Quercus ilex</td>
<td>Holly Oak</td>
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<td>medium/large</td>
<td>Spring</td>
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<tr>
<td>Quercus virginiana</td>
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<td>Quercus suber</td>
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<td>10'-15' medium</td>
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<tr>
<td>Prosopis juliflora</td>
<td>Velvet Arizona mesquite</td>
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<td>knobby</td>
<td>large</td>
<td>Spring</td>
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<td>Callistemon viminalis</td>
<td>Bottlebrush</td>
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<td>knobby</td>
<td>medium</td>
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<td>Chilopsis linearis</td>
<td>Desert Willow</td>
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<td>hummingbirds, pink bloom</td>
<td>25', medium</td>
<td>Spring</td>
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</tbody>
</table>
In conjunction with the Case Review Design Guidelines, a set of design features produced a criteria assessment matrix that was used in the design implementation phase of the sensory garden design process. Each feature falls under 1 of the 5 design principles mentioned earlier, and served as the standard for design implementation. From this list of design features and elements, a set of program standards were developed and processed for use in site plans for the sensory garden experience.

<table>
<thead>
<tr>
<th>ACCESS</th>
<th>ARIDITY</th>
<th>SCHOOL</th>
<th>Oizumi Ryokuchi Park</th>
<th>Tao Payoh Sensory Park</th>
<th>Eksue McCarthy Sensory Garden</th>
<th>N.M. School for the Blind and Visually Impaired</th>
<th>Royal Schools for the Deaf</th>
<th>Center for the Blind Visually Impaired</th>
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<tbody>
<tr>
<td>Spatial awareness</td>
<td>Tactile stimulation</td>
<td>Open communication view</td>
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<td>Circular seating</td>
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**CRITERIA ASSESSMENT**

- **NEGATIVE** - Does not provide or meet standards
- **NEUTRAL** - Undetermined, neither (+ or -)
- **POSITIVE** - Provides or meets standards
THE SENSORY GARDEN EXPERIENCE


Jorge Antonio Cruz Calleja, Nico F. Declercq. “The Acoustic Raindrop Effect at Mexican Pyramids: The Architects’ Homage to the Rain God Chac?” The lack of separation of traffic from pedestrian use – in this particular case the blind and their animals— for safety reason needs to be a key concern of designers (Thomas n.d.). Blind users in a study did not have a favorable opinion of shared spaces., 2009: 849-856.


