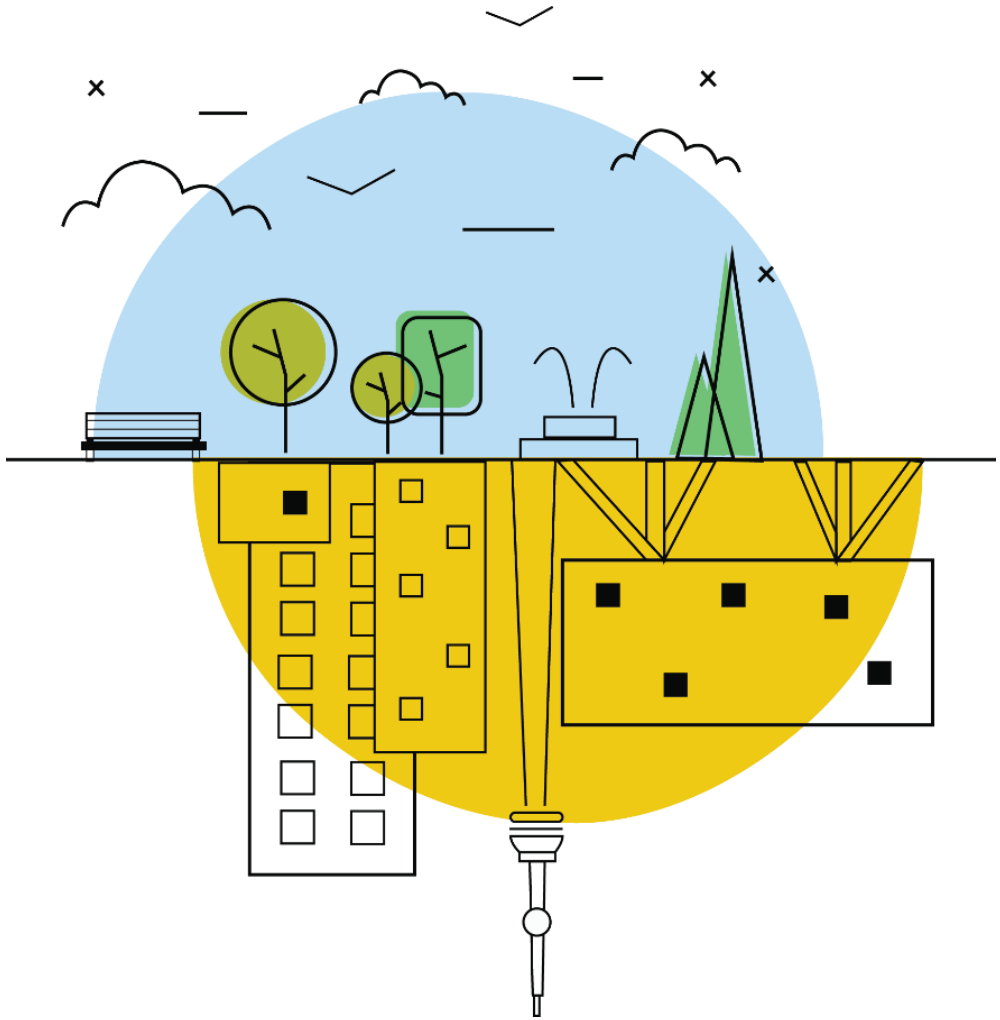

Multi-Sensory Environments and Student Wellness on Urban Campuses:

Co-designing an Inclusive Space at Butterfield Park to Help Support Student Mental Health

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Abstract

Post-secondary education can be an exciting and challenging period in a person's life. Many students are entering a new environment with little experience in the different processes and systems within the educational community. Mental health is a major concern for students because of the various factors that can influence their achievements and failures during their academic career. Over the last century, urban communities have become increasingly detached from nature, which may have attributed to an increase in the development of mental health issues. This study aims to support student well-being and creative thinking by providing them with the opportunity to help redesign Butterfield Park to help promote mental well-being on urban campuses. The feedback from the expert and student interviews, as well as survey and co-design workshops helped to inform the creation of a multi-sensory master plan for Butterfield Park. The identified themes that arose from the data analysis was the need in documenting user needs, creating an inclusive environment and bridging the connection between human and nature interaction. The application of a Multi-Sensory Environment can be transferred to other post-secondary campuses, workplaces and in the greater urban and landscape design context to encourage healthy living and community support.

Acknowledgement

I would like to take this opportunity to thank everyone who had supported and helped me through my research study. Specifically my Principal Advisor, Assistant Professor Maya Desai for her guidance and direction in my research development, as well as Professor Gayle Nicoll for her knowledge in research analytics and resources. Furthermore, I would like to thank Ida Gianvito for providing me with healthcare and mental health resources and connections within the post-secondary community.

Dedication

University can be a difficult and confusing time. Many students are entering a new environment and city that they are not accustomed to. All individuals at some point in their personal or social life encounter a mental health issue (A Guide to Supporting Students in Distress at OCAD University, 2015). This study is for those who have had to deal with a mental health issue or has known someone who has. I would like to dedicate this paper to all students who are trying to find their passion in the life and to let them know that they are never alone.

I would like to dedicate my research to my family and friends who have encouraged, supported and cheered me on throughout my academic career and for that, I will be eternally grateful.

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1 CHAPTER ONE: INTRODUCTION

URBAN CAMPUSES AND MENTAL HEALTH

In the 2013 Ontario Province NCHA Report, 59.2% of students reported having difficulty and expressed feelings of trauma when it came to their academic studies (American College Health Association, 2013). In 2016, 18-24 year olds exhibited the highest levels of stress, anxiety and depression, which negatively affected their grades if they were in school (American College Health Association, 2016).

In this chapter, the area of focus will be on the mental health statistics and design applications of restorative environments as well as, the factors that influence the shift in creating more innovative services and programs to help support mental health in education.

1 CHAPTER ONE: INTRODUCTION
URBAN CAMPUSES AND MENTAL HEALTH

Problem Statement

Mental health is defined as, “a state of well-being in which every individual realizes his or her own potential, can cope with normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.” (World Health Organization, 2017). Human experiences are becoming increasingly urban as the population continues to move towards metropolitan areas. It is important to consider the diverse needs of the community through the design features in these environments, as it can affect human health and behaviour.

Research on the effects of therapeutic gardens have demonstrated how natural stimulus from plants and engagement with nature can positively influence mental health as seen in hospital, health care facilities and elementary school environments (Balode, 2013). Barton and Rogerson (2017) suggest that encouraging human interaction with green spaces will improve well-being and health. Detweiler et al. (2012) defines the purpose of a therapeutic garden as a place,

> ...to stimulate the senses, which typically include a variety of plants to promote visual, olfactory, and tactile stimulation and to attract birds and butterflies. Also, trees may provide shade, color, seasonal variation, and sound when the leaves rustle in the wind. Walking paths promote movement, encourage contact with plants (all nontoxic and non-injurious), and lead the residents to protected areas for sitting and socializing (p. 102)

There is growing evidence that supports the interaction with the natural environment and the key role it can play in improving the mental well-being of individuals. It is important that post-secondary institutions understand the necessity of providing a safe and welcoming environment for all students (A Guide to Supporting Students in Distress at OCAD University, 2015). At George Brown College, the Healthy Campus Initiative was created as a wide scale campus approach to prevent and minimize mental health issues on campus, which includes the assessment of the institutional structures, awareness, coping skills and management of the campus community (Klein, 2015).

The campus health framework emerged from the identified relationship found between well-being and learning techniques in post-secondary environments. Post-secondary institutions are developing protocols and programs to help address the mental health issues on campuses around the country (American College Health Association, 2013). Studies related to student success and learning, outlined that the learning environment can positively and negatively influence academic performance. One of the goals was to provide more opportunities for students to feel acknowledged on campus and allow them to co-create their experiences (Klein, 2015). Students should have the opportunity to develop outside of the classroom to enhance their learning and coping skills (Canadian Mental Health Association, 2014). Collaboration with students in the development of programs for mental health will improve the level of success in the success of the design for health.

Mental Health and the Urban Context

BUTTERFIELD PARK

Over the years, there has been increasing interest in the influence that mental health can have on students' in post-secondary education. Detweiler et al. (2012) suggests that an individual's interaction with natural features through the various senses provides a level of personal safety and comfort in a space.

The use of nature as a restorative toolkit to improve mental health has been used in hospital and mental health care facilities to promote healing and restoration (Balode, 2013). However, the design concept has yet to be implemented in a post-secondary environment to help with student health. In Figure 1, the study site of Butterfield Park is outlined under the OCAD University building at 100 McCaul Street, to the east of Grange Park and south of the Art Gallery of Ontario. There are various pathways and trails that lead to the surrounding areas, which include the Grange Village, Above Ground Art Supplies and the Art Gallery of Ontario. Grange Park is a newly renovated community park that re-opened in July 2017 and consists of a dog park, playground structures and leisure space (Novakovic, 2017). Features of the park include multiple playgrounds, a splash pad, public art, a dog park and various green spaces. Prior to the revitalization of the park, the area was comprised of the Boulton family manor house and run-down street furniture and equipment. The advisory committee was made up of a diverse range of neighbourhood organizations, the Art Gallery of Ontario, City of Toronto and the residents. The restoration project allowed the residents of Toronto to participate and have a say in the features that would establish Grange Park as an interactive space that encouraged social interaction. Butterfield Park requires updates to the existing green and paved areas to improve the accessibility standards. The parks proximity to various services and amenities like the Art Gallery of Ontario, Above Ground Art Supplies and Village by the Grange make it a good transitional

5 - ***Figure 1***. Aerial View of Butterfield Parks Location under the OCAD University Building in Downtown Toronto. (Google Maps, 2018).

space that can connect the natural and artificial environments through active and passive design activities. Similar to the features at Grange Park, the redesign of Butterfield Park would offer students and the community opportunities to participate in active and passive activities. These activities will include study spaces with charging stations, interactive fragrant gardens, student public art displays and interactive elements to foster creative learning outside of the classroom. The features in Butterfield Park will allow students to adapt and change their experience depending on their needs in order to help support to suit their mental wellness.

DRIVERS OF MENTAL HEALTH AS THEY RELATE TO RESTORATIVE GARDENS

In the 2012 Canadian Community Health Survey, it was reported that Canadians aged 15 to 24 had a 7% depression rate compared to 5% in people aged 25 to 64. Among the 15 to 24 age group, approximately 42% consulted professional resources, while 61% consulted informal sources like friends and family (Findlay, 2017). These statistics suggest that Canadians do seek assistance to help address their mental health concerns, either formally or informally. In order to succeed in higher education, students need to understand how they can sustain their psychological, emotional, social, and physical state of mind (Douce & Keeling, 2014).

Identifying innovative techniques and learning experiences to help students succeed is essential in creating a supportive campus environment (Douce & Keeling, 2014). By 2030 the United Nations Population Division estimates that two thirds of the population will be in urban areas. The urban factors that can affect an individual's mental health include crowded areas, vehicular noise and traffic, as well as limited access to

green spaces for community gathering. The neighbourhoods that consider the diverse needs of the community and provide a variety of amenities that encourage social engagement produce a healthier setting than areas that lack community development (Balode, 2013). This consideration is important when introducing design features into communities to help support health and interaction.

Restorative environments use a variety of sensory stimulations to enhance physical and mental recovery, where individuals are able to regulate the amount of interactions in the space. One of the key drivers of mental health is over-stimulation, which can occur when the individual is introduced too many interactions that affect their cognitive and physical function (Detwiler et al., 2012). A therapeutic garden is designed to minimize the amount of stimulation and allows the person to curate the level of engagement in the space. This technique provides different areas that contain both passive and active levels of engagement that can adapt to the needs of the individual. Examples of such activities include, a water feature, interactive herb garden and public art. Stigsdorrter et al. (2017) suggests that a well-designed environment should provide a sense of being away, create fascination with the space, be compatible with the individual and allow them to curate their own experiences.

In the Attention Restoration Theory (ART), it was theorized that voluntary attention would diminish a person's ability to concentrate on their tasks, whereas involuntary attention like walking along a path would help restore their focus and concentration (Detwiler et al., 2012). Conserving unnecessary exertion is beneficial to a person's health because they will experience less stress inducing activities. Enhancing the awareness on the impacts of urbanization on mental health is imperative to the urban community (Social & Mental Health, 2005). Identifying inclusive and immersive techniques that encourage community participation will benefit the level community support (Treviranus, 2016).

Mental Health and Post-Secondary Education

POST-SECONDARY EDUCATION IN ADDRESSING STUDENT MENTAL HEALTH

In a study conducted by OCAD University, about 95% of students were found to be overwhelmed, with 53% of students reporting that they were too depressed to function (Wiens, 2013). Studies have shown that the leading mental illnesses experienced by students are depression and anxiety (Nami et al., 2014). Depression is defined as, a common mental disorder, characterized by persistent sadness and a loss of interest in activities that you normally enjoy, accompanied by an inability to carry out daily activities, for at least two weeks. Anxiety is defined as by feelings of anxiety and fear, including generalized anxiety disorder (GAD), panic disorder, phobias, social anxiety disorder, obsessive-compulsive disorder (OCD) and post-traumatic stress disorder (PTSD) (Depression and Other Common Mental Disorders, 2017). Mental health advocates have stated that the demand from students exceeds the available resources that they can provide. With the stigma around mental health slowly being broken down it is imperative that more availability in resources are available to students and professors (Lau et al., 2014). Post-secondary institutions which strive to promote critical thinking, innovation and research need to understand the needs of the student population. Their ideologies would be strengthened if they consider collaborating and encouraging student participation in campus planning for student mental health (Lau et al., 2014). Having mental health issues does not always result in an unsuccessful post-secondary education. Students can still participate in extracurricular activities, student groups and perform well in their academic career, while dealing with an issue such as anxiety (Lunau, 2012). However, the institution should be able to provide and work with students to establish a healthy campus environment to enhance their level of success. When American college students from 16 post-secondary institutions were surveyed it revealed

that 51.1% of surveyed students were healthy, with 48.5% of students identified with having a lower level of mental illness (American College Health Association, 2013). Within the healthy population, 752 students stated that they experienced anxiety, while 1130 students had felt depressed. This illustrates that students who identify as mentally stable can still experience drops in their mental state. Community participation and advocacy can play an important role in providing students with the support system needed to deal with various mental health issues.

SELF-CARE AND MENTAL WELLNESS IN POST-SECONDARY INSTITUTIONS

Self-care is about taking care of oneself and being aware about the aspects that are good for one's health and well-being, while understanding how to support those around you (A Guide to Supporting Students in Distress, 2015). In recent years, the number of self-reported cases of students seeking help for a mental illness has increased. Looking at the study done by NCHA for Ontario, the percentage of students who did not seek treatment from a professional decreased from 80.7% in 2013 to 73.9% in 2016 (American College Health Association, 2013, 2016). This illustrates that students are readily seeking help and support to address their concerns.

There have been a variety of post-secondary guidelines created to help support student health and success. For example, the Canadian Association of College and University Student Services created a framework to help inform post-secondary institutions on the strategies and

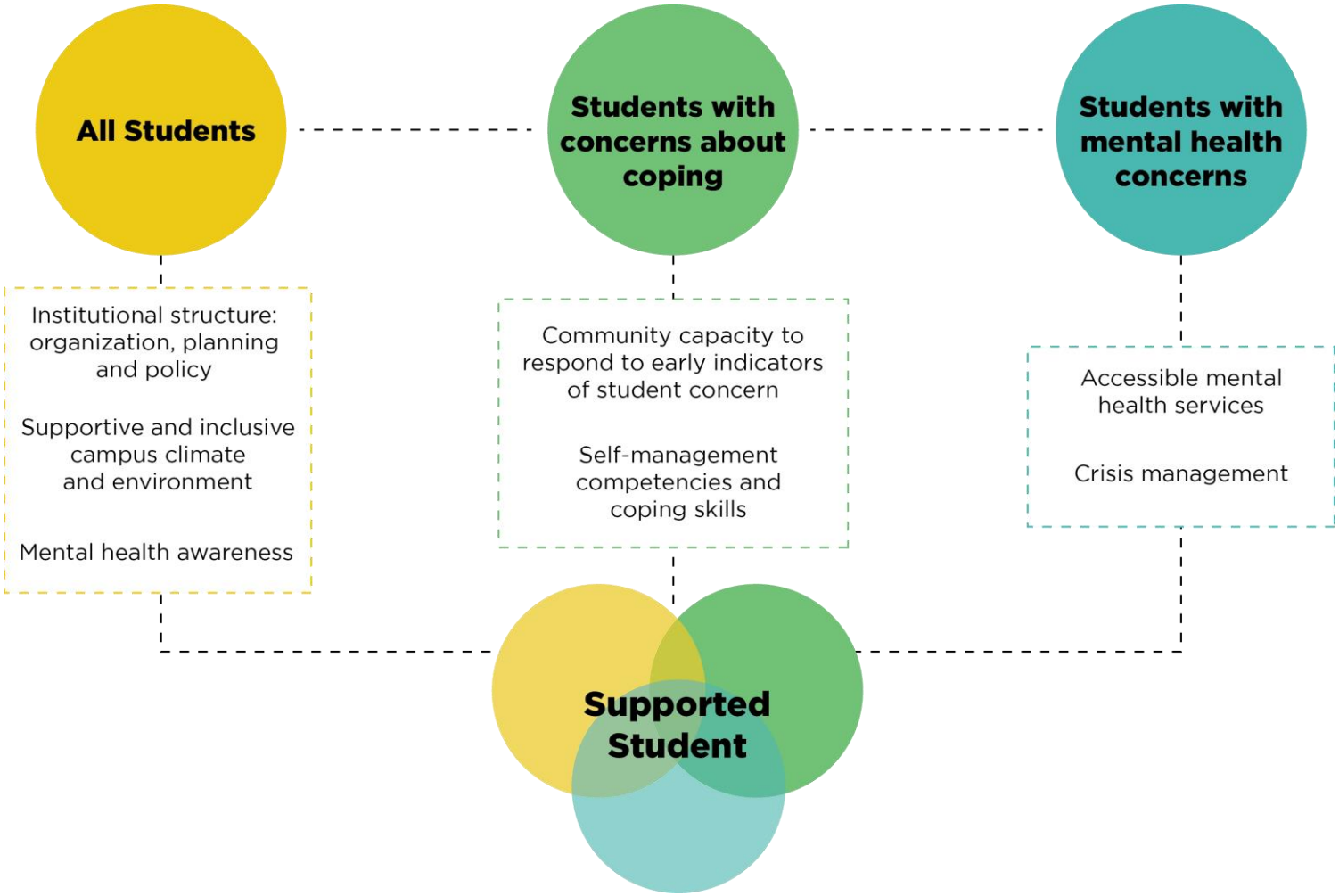
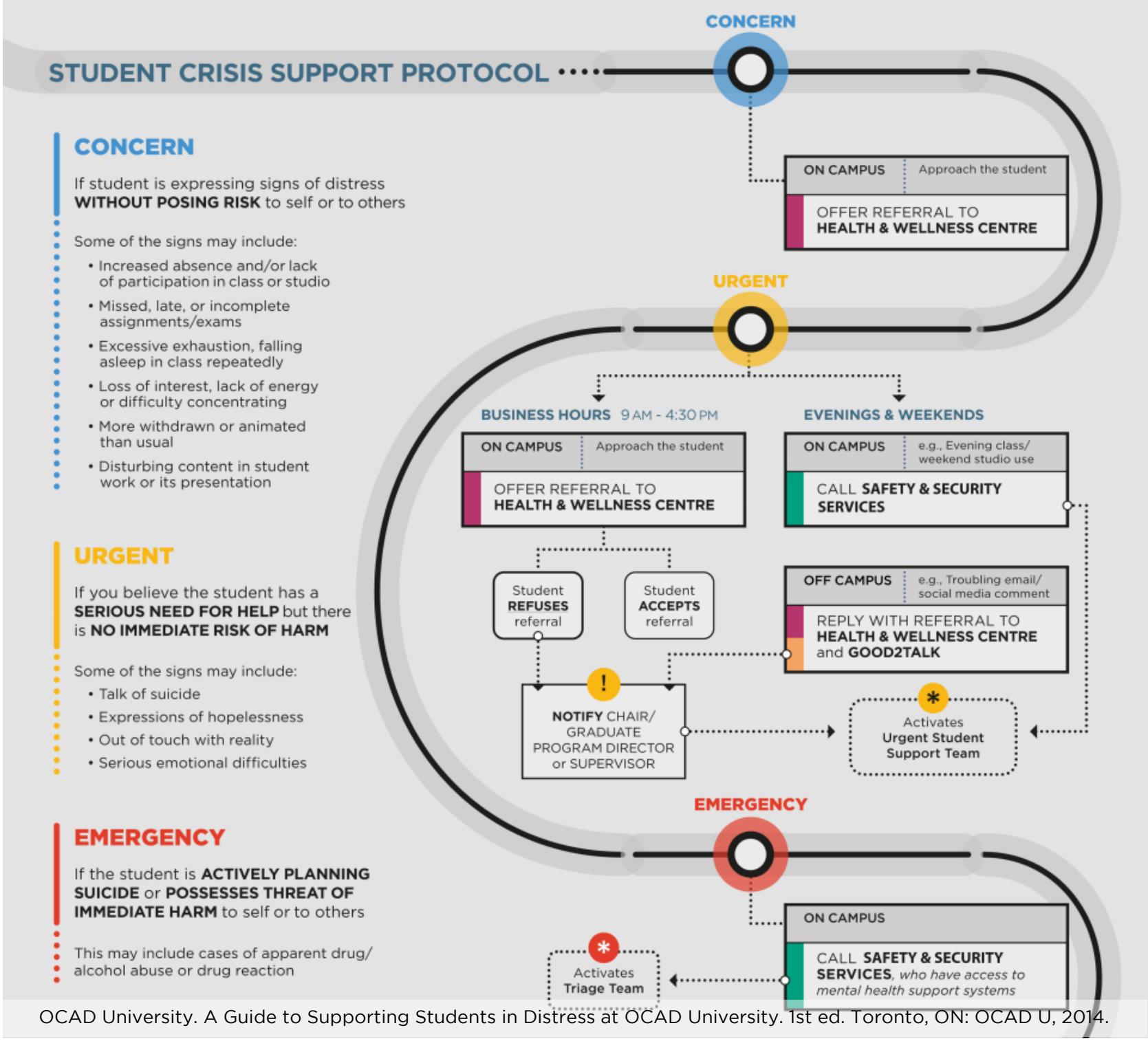


Figure 2. Framework for Post-secondary Student Mental Health. (Campus Mental Health, 2016).

principles aimed at supporting student mental health. The framework highlights seven strategies that cover the institutional planning structure, inclusive environment design, coping strategies and addressing students with mental health concerns (Klein, 2015).

The diagram in Figure 3, illustrates the seven principles that can help support student success that depend on the level of support required by the student population. The goal is to address student physical and mental health, behavior, social interaction and success (Campus Mental Health, 2016). From the campus perspective, it is essential to establish policies that address the physical environment, social, counselling and crisis intervention areas. The objective is to provide a diverse range of campus interventions that meet the various needs of the student population, from the design of the campus environment to the self-management practices for the students (Klein, 2015). Post-secondary institutions such as OCAD University, George Brown College and the University of Windsor have adopted these strategies in establishing their campus initiatives. OCAD University released “A Guide to Supporting Students in Distress” in 2015 to provide students with a recommendation on how to help students. The document outlines the support protocol when a student is in need and provides strategies for peer support. Additionally, the guide addresses the possibility of helping students using an environmental human centric approach (A Guide to Supporting Students in Distress at OCAD University, 2015). This approach allows students and the campus community to work together to create various activities and services that will better suit their needs in addressing their experiences with mental health. This can relate back to the idea of creating a Multi-Sensory Environment as it can help support a variety of mental and physical needs. The student protocol in Figure 4, provides a framework at OCAD University to help students when they feel distressed or are in need of support. It is a shared responsibility for all members of the university to help their peers understand that they are not alone; building a community that supports and helps them overcome personal challenges. The George Brown College Healthy Campus Initiative strives to create a healthy campus for the entire community with focus on supportive and inclusive campus environments (Klein, 2015). The college is working to organize student workshops, panels and conferences to share different perspectives.



OCAD University. A Guide to Supporting Students in Distress at OCAD University. 1st ed. Toronto, ON: OCAD U, 2014.

12 - ***Figure 3.*** Student Crisis Support Protocol at OCAD University (A Guide to Supporting Students in Distress at OCAD University, 2015).

The University of Windsor has also created a strategy to help with student mental health which outlines a two phase protocol that analyzed the current post-secondary frameworks in place, as well as collect student feedback to properly address their needs and concerns (Student Mental Health Strategy, 2018). These initiatives outline the significance of engaging, empowering, and sharing the responsibility of addressing mental health from the entire university community.

Although, the strategies do not outline specific activities to help support students, they do stress the need to create innovative solutions that reflect the needs of the campus community. The implementation of a Multi-Sensory Environment at Butterfield Park is a strategy to boost cross-campus participation to create a safe space for students to learn and develop. Mental illnesses are not caused by a single factor, therefore there should not be a single solution to student mental health issues on campuses (Krone, 2016). A mixed disciplinary approach when dealing with health and design on campus, will promote inclusive and supportive practices in post-secondary institutions.

MENTAL HEALTH AND STIGMA ISSUES ON CAMPUSES

As students enter post-secondary education there are a variety of factors that influence their social and psychological development. About 75% of students will experience some type of mental health issue before the age of 25 (Taking Action on Student Mental Health, 2017). Taking this fact into consideration, it is imperative to provide accessible, flexible and responsive services to help students cope with their mental health.

Stigmatization is defined as “the negative social attitude to a characteristic of an individual that may be regarded as a mental, physical, or social deficiency. A stigma implies social disapproval and can lead unfairly to discrimination against and exclusion of the individual (Krone, 2016).” Krone (2016) stated that the prevailing negative experiences that students expressed related to sexual orientation, ethnicity and gender. The features relate to the stigmatism experienced by students on

campus environments. Research studies have shown that stigmatization can be experienced both in the campus and health care environment. Even in areas where students seek help there is known prejudices and negative associations with mental health issues. This may result in active concealment of mental health problems, which could be detrimental to the student's success.

The diagram in Figure 5 illuminates, Corrigan's Model of Stigma that highlights the two groups of public (social) and self-stigma (personal). In the social spectrum, the perception is what the person perceives in the environment in terms of stereotypes, discrimination and prejudices. The personal spectrum illustrates how individuals perceive their own mental health or that of someone else's (Krone, 2016). Aspects that can help decrease social stigmatism are establishing contact, providing education and encouraging social activities (Corrigan, 2004). Being transparent about the causes and methods of treatments for the different mental illnesses will help to open up a discussion and enhance the understanding for the whole community.

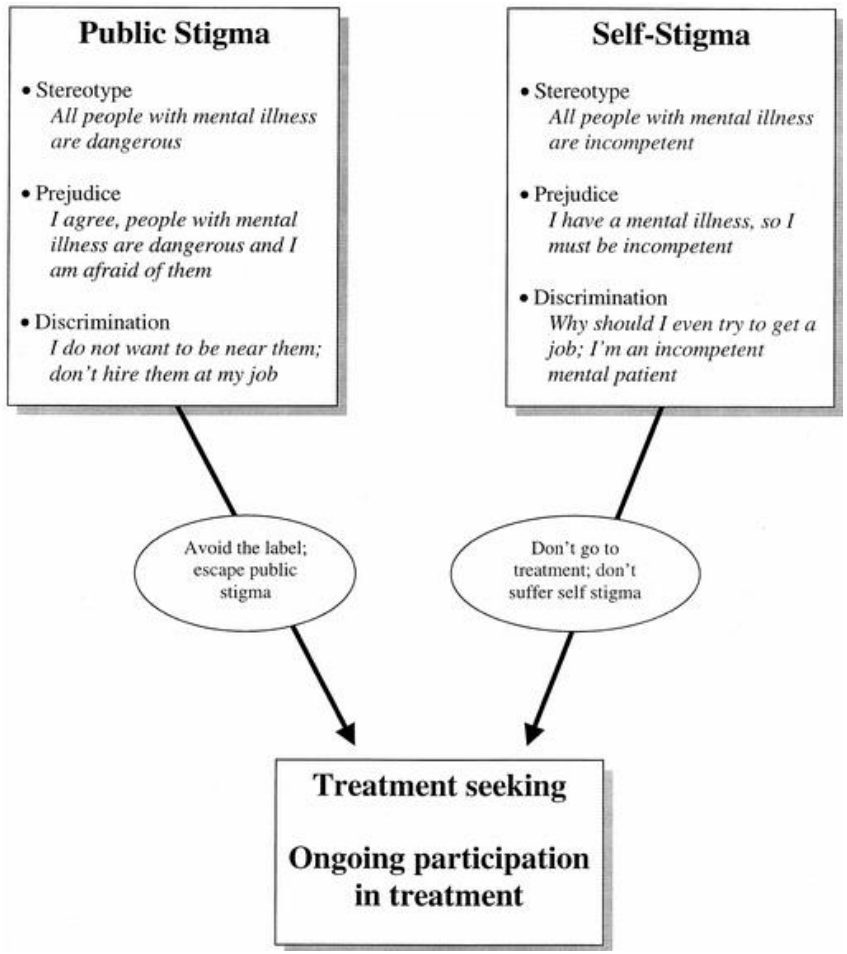


Figure 4. Corrigan's (2004) Model of Stigma. (Krone, 2016).

Research Question

The purpose of this research study is to explore the benefits of restorative natural elements, like trees and plants, in a Multi-Sensory Environment to help support student well-being. The goal of the study is to develop strategies for reducing the stigmatization associated with mental health issues by providing a safe space for students to engage and socialize in a new learning experience on campus.

Butterfield Park, which is adjacent to the main OCAD University building provides the campus with a unique open space in the downtown core. The park presents an opportunity to be redesigned into a multi-functional setting to support social, psychological, physical and intellectual development. An outdoor green space creates an opportunity to produce creative and innovative thinking away from the traditional classroom environment (Lau et al., 2014). Green spaces are defined as natural and landscaped areas both publicly and privately owned. It includes parks, ravines, school yards, private yards, street trees, landscaped open spaces along streets and around buildings, cemeteries and green roofs (Medical Officer of Health, 2015). A therapeutic green space can help reduce cognitive fatigue by encouraging passive and active interaction with plants and other natural elements that reflect the intrinsic needs of the person. Compared to an urban setting, individuals were shown to have positive improvements when engaging with the natural environment because they were not required to be actively alert of their surroundings, unlike if they were crossing a busy intersection (Lau et al., 2014). This study analyzed the health effects of natural and urban landscapes using blood pressure tests, self-reported assessments and recovery time (Hassen, 2016).

The use of a Multi-Sensory Environment would be beneficial to urban campud development because they have been proven to enhance mental and physical functions through their design features. These spaces are able to adapt and meet the intrinsic needs of the user

depending on their sensory preferences. Each activity in the environment will create a sensory stimulation that enhances a person's cognitive and mental capabilities (CDHAP, n.d). In this study, the objective is to identify the key natural features that help improve overall mental health in the urban student population. The following research questions will be investigated:

1 **How can we redesign Butterfield Park at OCAD University into an outdoor Multi-Sensory Environment that can be specifically tailored to support student mental well-being? How might we better design urban parks to support mental health?**

2 **Does the exposure to natural features such as plants, and stimulation of the five senses create a positive impact on a student's mental well-being?**

These research questions will help to structure the study and identify the potential restorative qualities in a multi-sensory space that are beneficial in supporting the mental health issues prevalent in the urban campus environment today.

Key Terms

Biophilic Design: "seeks to create good habitat for people as a biological organism in the modern built environment that advances people's health, fitness and wellbeing" (Kellert and Calabrese, 2016)

Built Environment: "spaces such as buildings and streets that are deliberately constructed as well as outdoor spaces that are altered in some way by human activity" (Jenkins, Yuen & Vogtle, 2015)

Green Space: "a wide variety of natural and landscaped areas both publicly and privately owned. It includes parks, ravines, school yards, private yards, street trees, landscaped open spaces along streets and around buildings, cemeteries and green roofs (Medical Officer of Health, 2015)."

Hardscape Features: "man-made features of landscape architecture, such as walls or pathways which are nonliving elements of the design. "(Admin, 2017).

Health Promotion: "the process of enabling people to increase their control over their health and its determinants and therefore improve their health." (Okanagan Charter, 2015)

Inclusive Design: design that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference." (IDRC, n.d.)

Landscape Architecture: the art and science of creating and conserving outdoor environments with respect to cultural values and ecological sustainability." (p 281)

Mental Health: "a state of well-being in which every individual realizes his or her own potential, can cope with normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community." (World Health Organization, 2017).

Mental Well-being: “includes cognitive, emotional and behavioural responses at a personal level.”

Multi-sensory Environment: “a space that helps enhance a person’s cognitive and mental capabilities through various sensory stimulations and interactive experiences. It is a semi-controlled environment, which can be manipulated by the user and designer to help meet the needs of every individual.”

Soft-scape Features: “any living horticultural element like grass, flowers and trees that provide the natural beauty to the environment” (Admin, 2017).

Stigma: “the negative social attitude to a characteristic of an individual that may be regarded as a mental, physical, or social deficiency. A stigma implies social disapproval and can lead unfairly to discrimination against and exclusion of the individual” (Krone, 2016, p. 18).

2 CHAPTER TWO: LITERATURE REVIEW

THE ENVIRONMENT, WELL-BEING AND INCLUSION

This chapter will look at the concept of Multi-Sensory Environments and identify the inclusive aspects that it presents to the redesign of Butterfield Park. The structure of urban landscape and its relationship to mental health will be addressed as well as, examining current urban landscape designs and their functionality and benefits within the community.

The health structures of post-secondary institutions will be outlined and assessed for their reflection of student support and success in campus design and development through policy and mental health awareness structures.

Multi-Sensory Environments and the Urban Community

MULTI-SENSORY ENVIRONMENT DESIGN

A Multi-Sensory Environment (MSE) is used to help enhance a person's cognitive and physical abilities through the interaction with different sensory spaces and experiences. It is a semi-controlled environment which can be manipulated by the user and designer to help meet the needs of every individual. These environments can help enhance concentration and attention levels while heightening personal awareness and social engagement (CDHAF, n.d). The purpose of this design is to help establish a safe environment that allows the user to interact and explore their surroundings regardless their unique abilities (Daljevic, 2013). The space is designed to bring out their hidden potential and find a balance between their mental, social and physical facilities. The environment is comprised of various sensory equipment that helps to target the five senses of sight, touch, taste, sound and smell. These environments have traditionally been created for indoor spaces in hospitals and elementary schools. However, the features and strategies found in these facilities can be combined with the elements in a restorative garden to create to an immersive multi-sensory outdoor environment. It is important for a sensory environment to be adaptable to a diverse range of individuals. The level of stimulation is

essential in the promotion of self-care and support the user that allows them to reach their optimal potential (Collier & Truman, 2008).

According to Jenkins et al. (2015), the relationship that a person has with an environment can be enhanced when there are a variety sensory stimulations that go beyond visual aesthetics like smelling a flower and/or touching an object. When an environment relies solely on a single sense it decreases the ability of the space to engage and welcome a diverse range of individuals because their needs are not met (Jenkins et al., 2015). For example, an individual with low to no vision would not be able to navigate a park that had no signs and limited textured pathways unlike a sighted person would have. A multi-functional space should provide a balanced sensory experience that does not overwhelm or deter a person from using the space (Jenkins et al., 2015).
Sensory spaces are designed to relieve stress and anxiety by providing a calm environment that encourages creative thinking and natural responses to sensory interactions rather than a set of instructions (Daljevic, 2013). The Multi-Sensory Environment encourages individual exploration with different activities that are able to meet the different needs of every person. The environment contains the tools to help the user become independent by using their senses to understand their environment, like an information board with available braille and audio capabilities. Using various surface textures along with the senses to indicate a change in the space can help expand the accessible areas of the public realm. Outdoor spaces should bring the principles of a sensory room into the landscape design to create a welcoming space. A Multi-Sensory Environment that promotes sound cues, accessible information and orientation techniques will help to improve the overall comfort and safety for the individual.

THE FUTURE OF MULTI-SENSORY ENVIRONMENTS AND MENTAL HEALTH

The Eden Project in Cornwall, England is an example of a Multi-Sensory Environment that is designed to promote education, engagement, inclusivity and recreational use. It is comprised of different tropical green spaces and educational programs that are housed in biomes, which contain various plant species from around the world. The programs encourage people to interact with the natural features and understand how different ecosystems interact with humans and other species (Eden Project, 2018).

The project collaborated with Sensory Trust, an organization that aims to make outdoor environments accessible and inclusive for the entire community (Stoneham, 2017). Throughout the implementation of the project, visitors were encouraged to provide feedback on the accessibility standards and their experiences as seen in Figure 6 (Eden Project, 2018). The collaboration between the Eden Project and Sensory Trust, developed the Social Sustainability Toolkit: Inclusive Design, that works to balance the environmental, economic and social

Figure 5. The Eden Project (Eden Project, 2018, Stoneham, 2017).

23 - ***Figure 6***. Aerial View of the Village of Yorkville Park. (Google Maps, 2018).

aspects of a design (Stoneham, 2017). The toolkit contained a secondary assessment that used the visitors' perspective through a journey map outlining their experiences and suggestions for improvements. The first stage of the toolkit identified the visitor reasons for visiting the Eden Project, followed by their journey and arrival experience, on-site experience and journey home (Stoneham, 2017). This co-design technique allowed the project to enhance and adapt the environment to make the spaces accessible and inclusive.

The Village of Yorkville Park, designed by Martha Schwartz, Ken Smith, David Meyer Landscape Architects and Oleson Worland Architects in Toronto, is an example of an interactive urban landscape that uses natural features as its key design aesthetics. The design was completed in 1994 and is comprised of eleven areas that reflect the Ontario landscape. Each space provides different sensory stimuli through the introduction of shrub gardens, groves, and marshes that allow for social congregation and varying points of interests, as seen in Figure 7 (The Village of Yorkville Park, 2012). The design reflects the history and environmental culture of the Canadian landscapes through a series of visual and non-visual techniques. Some design elements include a large granite rock for seating space and aesthetic appeal, as well as an integrated water feature to provide natural sounds. The park is an example of bringing nature into an urban environment by creating areas that promote walking, social engagement, transitional space and relaxation in the city. It reflects the Canadian identity and provides unique public spaces throughout the year (American Society of Landscape Architects, n.d.).

The Urban Mind Project (2018), is an advancement in the healthcare field, that allows users to provide their real-time emotional and health attributes in an urban environment. It was conducted over a one-week period with 108 participants who completed 3013 survey questions. The results of the assessment indicated that there was a prevalent positive association between the natural environment and an individual's mental state. The highest rated natural associations included, being outdoors, seeing trees, hearing birds sing and feeling in contact with nature (Bakolis et al., 2018). These findings help to support the idea that the exposure to natural features can help improve a person's mental health. The Urban Mind Project collected multiple measurements

over time, which maximizes the ecological validity; as it provides insight into the changes of a person's mental state in real time. However, there are limitations to the study as researchers relied on the participants to provide truthful experiences, which adds a bias to the results (Bakolis et al., 2018). Additionally, the natural features that were analyzed in the study can help inform the design of urban campuses in improving the mental state of students.

MENTAL HEALTH AND URBAN GREEN SPACES

The association between public green spaces (PGS) and physical health has been long established by various studies and reports. However, the mental health benefits within a PGS have not been identified and measured to the same extent as physical health (Wood, Hooper, Foster & Bull, 2017). For the purposes of this report, public green spaces are defined as "vegetated areas located within built-up areas, including natural and planted trees, grass, shrubs and flowers that are designed for recreational and aesthetic purposes" (Taylor & Hochuli, 2017)."

Given that the site is located within the Toronto urban core, the green space definition was selected to reflect the specific geographic area. Mental health is characterized as a state of well-being that looks at the individual's ability to cope with normal stressors in life and illustrates their responses in terms of productivity and quality of life (World Health Organization, 2017). There are different iterations of the meaning depending on the context that it is situated too. This definition will

provide a basis in understanding the relationship between mental health and the urban green spaces. Green spaces have become increasingly popular in urban metropolises because of their positive contributions to human health by providing spaces for physical activity, social engagements and restorative areas. Hassen (2016) states that there are a variety of factors that make a good green space suitable for promoting mental well-being (Hassen, 2016). These factors include incorporating features that minimize noise from vehicular traffic and allow for users to interact with their surroundings (Delamont, 2016).

According to Stigsdorrter et al. (2017), there are four features required to produce a restorative environment. The first being the fascination in the environment and its offerings, which attracts the individual to their surroundings and keeps them interested. Second, providing a sense of being away is important to allow them to relax their mind from the urban environment. The last two elements are the scope and compatibility with an individual's inclinations (Ohly, 2016). The effectiveness of an urban environment relies on a person's sense of familiarity and comfort so that they can feel a connection

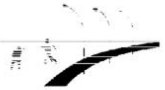
Nr.	PSD name	Images	Key nature qualities and features
1	Social		• Possible to watch entertainments • Possible to watch exhibitions • Possible to visit a restaurant or a simpler open-air restaurant
2	Prospect		• Plane and well-cut grass surfaces • Vistas over the surroundings • Cut lawns
3	Rich in species		• Several animals, like birds, insects, ect. • Natural plant and animal populations • Many native plants to study
4	Serene		• Silent and calm • No bikes • It is possible not to come into contact with too many people
5	Culture		• Decorated with fountains • Decorated with statues • A wide range of foreign plants, ornamental plants and kitchen plants
6	Space		• Spacious and free • Possible to find areas not crossed by roads and paths • Lots of trees
7	Nature		• Nature like • Wild and untouched • Free growing lawns
8	Refuge		• Many bushes • Kept animals that children and adults may feed and pet • Sandpits

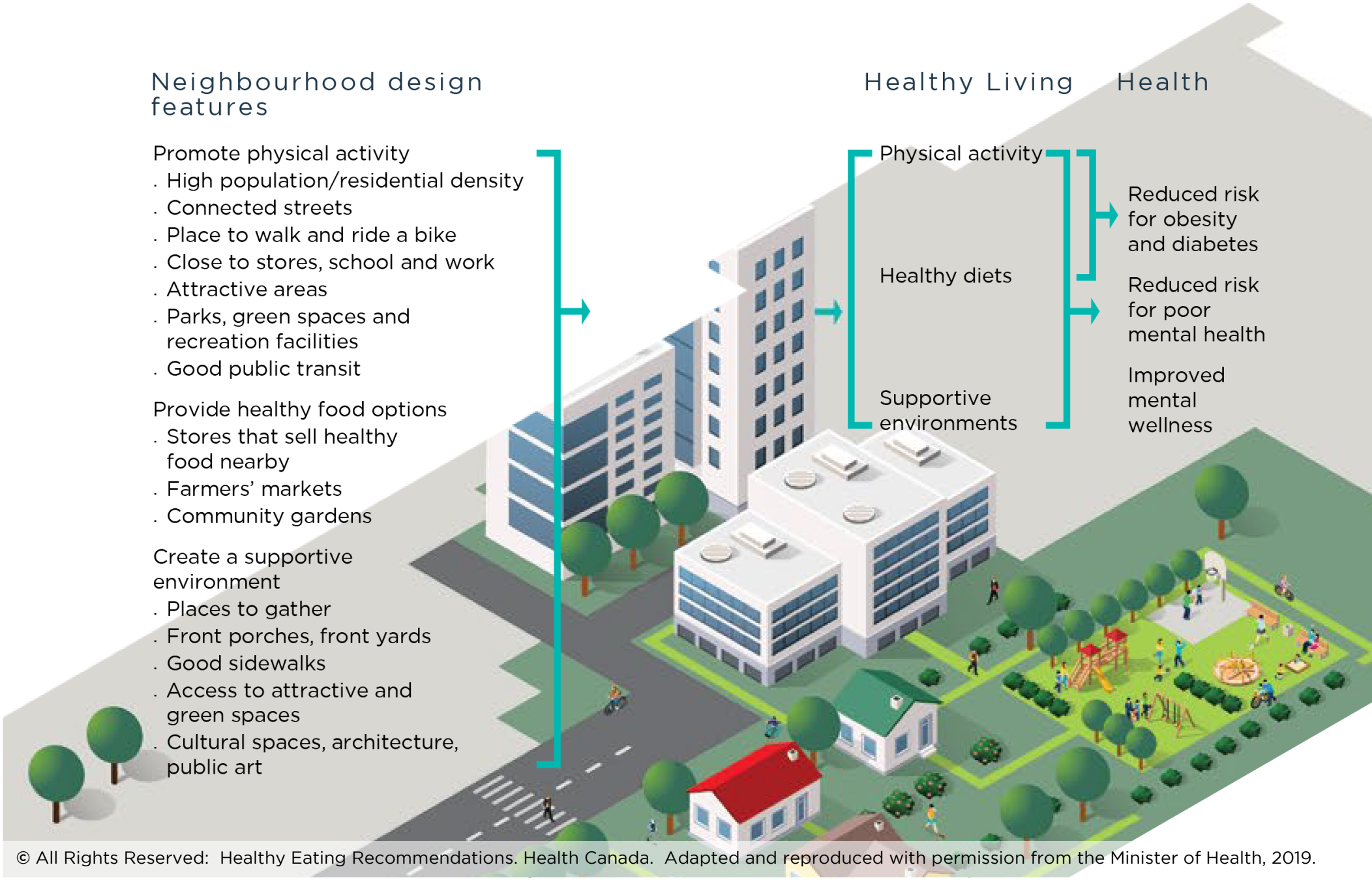
Figure 7. The eight perceived sensory dimensions (PSD) within city pockets.

with the environment. Figure 8 demonstrates the features associated with each perceived sensory dimensions (PSDs) along with a visual description of its key attributes. The PSD categorization helps to distinguish contrasting features within the same environment, which are useful in determining how to design the space. The various qualities that each dimension brings to an environment can help designers understand the essential qualities and features that are important to the users of the space (Stigsdorrter et al., 2017).

URBAN AND LANDSCAPE DESIGN ON URBAN CAMPUSES

Urban Design has traditionally been focused on providing sacred spaces that have basic security and allow for commercial market space. However, there has been a discussion on the true function of an urban environment as either being economically or socially driven (Boyce et al., 2006). Public Health and Urban Design have had a long history of addressing issues such as sanitation, overpopulation and pollution (Willson, 2017). The idea of using green spaces as communities to foster social engagement, interaction and support for mental health has yet to be fully incorporated into urban cities, work places and post-secondary institutions.

Boyce et al. (2006) states that schools and educational institutions have a responsibility to provide health education, physical education and help educate on environmental protection. These should be further adapted to encourage inclusive solutions that can meet the needs of the whole community. There have been studies that link open space environments with common urban stress triggers (Knoll et al., 2017). The more



28 - ***Figure 8.*** Urban Design Features that Influence Human Behaviour and Social Belonging. (Designing Healthy Living, 2017).

crowded and congested a space, the more likely that it would trigger urban stress. The environments that were determined to be the best measurements of urban stress were parks, streets, squares and courtyards as they provided a wide range of human and vehicular activity. This assessment enhances the understanding of the different design features that are essential to support the needs of the entire community.

Figure 9 illustrates the associated community elements that influence a person's experience and behaviour in an urban environment. It highlights the urban design features that influence the social wellness and health of the human population (Willson, 2017). One of the challenges in urban planning is maintaining a balance between the social and mental health outcomes from implementing certain design features (Lahey, 2011). Urban campuses can use these features to help inform their campus design to better suit the diverse needs of the institutional community. For instance, Ryerson University in Toronto, Ontario is comprised of old and new infrastructure with pockets of green spaces sprawled around the campus. The university has the opportunity to develop these spaces to address the accessibility and inclusive needs of the university (Ryerson University Campus Public Realm Plan, 2016). Ryerson University is working towards the revitalization of their large green spaces, such as the Community Park, by connecting the space to the downtown core and updating the vegetation and street furnishings. Although the plan identifies areas for green space improvement, there is no mention of how the space will work to improve student life and social engagement on campus.

Concordia University in Montreal, Quebec is another example of an urban campus with various green spaces that can be enhanced both in function and accessibility. Its structure and development is similar to Ryerson University with both old and new buildings in the downtown campus. It contains various public realms from the Quartier Concordia to the Concordia Greenhouse. In improving community development, Concordia University hosted a workshop in partnership with the City of Montreal's Department of Public Works to bring the community together to create an inclusive urban space (Staniforth, 2016). The new campus design focuses on the needs of all users and encourages participation from the whole community. The Concordia Greenhouse is an all-

year round space that hosts meetings, events and social engagements for the university community. It offers educational information on gardening and helps raise awareness on sustainable living in urban environments (About the Greenhouse, 2017). These practices and strategies can help bring awareness of the importance of green space design for urban campuses in supporting mental wellness. Enhancing the green spaces in the urban environment can increase the number of social communities that provide students, staff and faculty with places to get away from the hustle and bustle of city in order to create their own learning and social experiences.

Understanding the Design Practices for Urban Environments

This section outlines the various features and aspects that help create a sensory outdoor environment within the urban environment. Plant species identification and sensory inputs will be analyzed to determine their viability within the context of an urban outdoor space.

CASE STUDY: HARD AND SOFT LANDSCAPE DESIGN FEATURES

There are two essential components to consider when creating an outdoor space, which are hardscape and softscape features. A hardscape feature is defined as, “man-made features of landscape architecture, such as walls or pathways which are nonliving elements of the design. “(Admin, 2017). Whereas, a softscape feature is any living horticultural element like grass, flowers and trees that provide the natural beauty to the environment. It is important to understand how these elements work together to produce an environment that promotes water conservation, sustainability, usability and overall visual appeal. One of the biggest factors to consider when designing a space is to establish a purpose and use, so that it will be able to thrive and support the environment as it grows and adapts to the users and surroundings (Admin, 2017).

The David Braley and Nancy Gordon Rock Garden at the Royal Botanical Gardens in Hamilton Ontario and the Native Child and Family Services of Toronto Roof Garden in Toronto Ontario are two examples of using both features to create a welcoming and accessible environment. The Rock Garden at the Royal Botanical Gardens was revitalized in 2012, was to enhance

accessibility and visibility standards for all visitors as well as, create a destination for events and special occasions (CSLA, 2017). As seen in Figure 10, the new Rock Garden employs sustainable practices by requiring less water, reduced soil erosion, plant waste and human maintenance because of the selected hard and softsscape material. The plants are comprised of year-round perennials, conifers and waterfall features to provide a vibrant colour palette throughout the year and minimize the amount of plant debris (CSLA, 2017). The renovated space included the Dalglish Family Foundation Courtyard which used stone and alpine plants to create a resting area and interest points for visitors. The garden serves as a multi-functional space that welcomes both leisure and social activity from scenic resting spots to a wedding venue (CSLA, 2017). The accessible features include, the new pathway system was enhanced with a widened surface area and lighting to help with navigation and visibility. It was important during the revitalization that existing features and materials were repurposed to mitigate the amount of human disturbance on the natural environment (Canadian Architect, 2016).

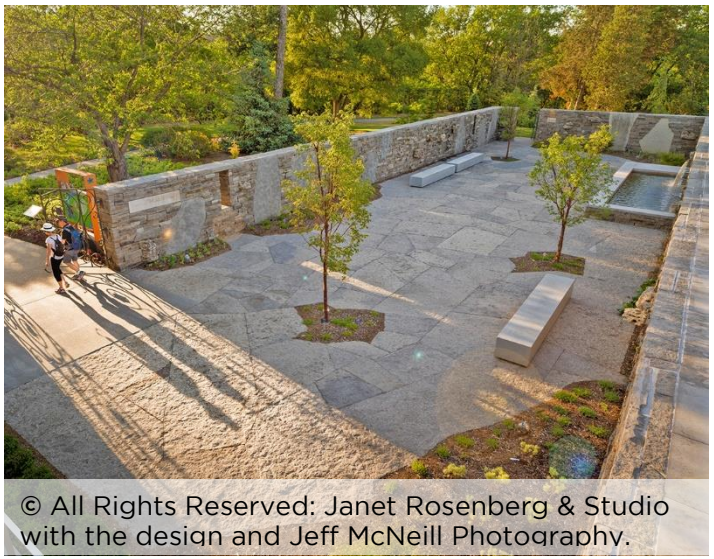


Figure 9. RBG Rock Garden and Dalglish Family Foundation Courtyard. (CSLA, 2017).

The Native Child and Family Services Roof Garden in Toronto, Ontario illustrates landscape design practices that encourage cultural, social and environmental standards. Scott Torrance Landscape Architect Inc., worked with various Indigenous artists and graphic designers to plan a space that reflected the community values and heritage. The roof top garden contains a variety of spaces for educational, environmental, ceremonial and recreational purposes (WLA, 2013). The garden is located on top of a converted office building that now provides the Indigenous community to have access to nature, social gatherings and sacred spaces within the city. Features on the roof garden include a healing lodge, medicine garden and crops that are native to the Great Lakes Region. Additionally, the plant and vegetation selection was chosen to reflect the Indigenous community, as well as its ability to survive in an urban setting with minimal maintenance requirements. These species include conifers, wildflowers, herbs, corn, beans and squash (WLA 2013). Metal fencing is an example of a hardscape feature that functioned as both a protective barrier and noise mitigation tool. As well as, rusted corten steel and cedar for the fire pit and soft turf floor material to provide comfort and familiarity to the natural

Figure 10. Native Child and Family Services Roof Garden. (WLA, 2013).

environment, seen in Figure 11 (Greenroof & Greenwall Projects, 2018). These areas are surrounded with beds of shrubbery and plants to help connect the users with elements from the natural environment in the urban landscape. The revitalization of the space created a sense of community for the urban Indigenous population and can help to educate the public on their traditions and practices. These environments combine both natural and manmade features to create a cohesive design that promotes sustainability, usability and reflects the values of the community.

DESIGNING A LOW ALLERGEN ENVIRONMENT

When designing an outdoor landscape, it is important to understand the different environmental allergens related to plant pollen which include hay fever, seasonal allergies and allergic rhinitis (Outdoor Environmental Allergies, 2018). There have been comparisons between the effects of windborne pollen and insect transferred pollen in their influences on human response. The term pollen is used to explain the transfer of genetic material from a male part of a flower to a female part of another flower (The Low Allergy Garden, 2016). This method of transfer occurs through wind pollination, which can be an inefficient process as the pollen particles are released into the air in an uncontrolled state. The recommended method of release is by insect pollination where the pollen particles are attached to the insect and are transferred directly from flower to flower (The Low Allergy Garden, 2016). Insect pollination lowers the rate of allergies experienced by the human population. To enhance insect pollination levels the plant variety should include vibrant colour blossoms to attract the insects. Some examples of flowers and shrubs include boxwood, lavender, and

coneflowers. The tree selection should be comprised of female plants in the dioecious family, whereby the female and male plant parts are separated from one another. The pollen particles are only produced by male plants and therefore, make female plants hypoallergenic solutions to creating a low allergen environment (Allergen-Free Gardening Tips, n.d.). Other factors to reduce allergen levels include using synthetic grass and turf lawn which are low maintenance solutions over natural grass. As well as, using paving stones, fertilizers and filling in cracks in the brick to reduce the amount of weed growth (The Low Allergy Garden, 2016).

However, there are a variety of factors that need to be considered along with low allergen techniques that work to create a sustainable, adaptable and maintenance friendly environment. Although, the female plants are hypoallergenic they often produce more debris, while male plants are low maintenance and are more accessible to find in garden centres. Synthetic grass requires no water and maintenance but can be expensive and creates environmental waste (The Low Allergy Garden, 2016). The goal is to design a balanced space that has the ability to adapt to the needs and requirements of all visitors.

PLANT COVERAGE AND SELECTION IN URBAN CITIES

Urban tree planting programs are focused on improving the tree canopy coverage but should keep in mind the implications of increased tree planting and long-term maintenance needs (Kenney et al., 2011). The urban tree coverage should factor in the level of biodiversity that each tree brings to the environment and select those native to the region that can adapt to the harsh urban conditions. Other factors include (Kenney et al., 2011):

- **mortality rate:** tree survival rates in urban spaces
- **climate change**: extreme weather changes
- **invasive species:** able to spread rapidly with no known predator or disease control to minimize their effects
- **intensification**: space allocation for mature tree canopies in the built environment
- **land ownership:** private land ownership standards
- **financial needs:** resource and maintenance needs

Introducing trees and plants into the urban environment is one solution to improving the sustainability of the

urban tree canopy. Other considerations in the selection process should factor in the ability of natural features to mitigate urban stressors like traffic noise and congestion.

A native species is defined as, "a class that has existed in a given area prior to European settlement (Racette, 2014)." Native plant species like Red Maple, Blue Spruce and Snowy Mountain ash are well adapted for restoration projects because they are able to adapt to the harsh conditions of an urban setting. On the other hand, non-native species are those, which were introduced through human interventions that have a different geographic origin. A non-native species is introduced to the environment to help maintain and improve its structure, whereas an invasive species threatens the environment and health of the community. Invasive species have the potential to overwhelm the existing vegetation and breakdown the level of biodiversity in the community once they are introduced (Racette, 2014). The reliance on increasing the tree canopy alone cannot provide a sustainable, healthy and adaptable urban environment (Kenney et al., 2011).

The features and environmental needs of native plant species for the City of Toronto outline the preferred habitat, sun coverage, and hardiness of each species (refer to Appendix D). There are a variety of different native and non-native species that would suit the Toronto climate and help maintain a balance between the natural and artificial environment. It is essential to recognize the difference between native, non-native and invasive species when restoring an urban environment.

Selecting the appropriate tree species to incorporate into the urban canopy is essential to improving overall health and mental well-being in the city (Knoll, 2017). Research studies have shown that incorporating natural elements in urban areas can improve the mental restoration rates while decreasing levels of anxiety and depression (Lau et al., 2014). A healthy urban environment should encompass a diverse range of spaces to satisfy the needs of the community.

THE EFFECTS OF ARTIFICIAL AND NATURAL LIGHT ON MENTAL HEALTH

When designing an outdoor space to help support mental health, light can play a variety of factors in providing illumination in dark and dim areas as well as, provide safety areas for user interaction (Brawley, 2001).

Bedrosian & Nelson (2017) states that the human body uses light as a tool to determine the time of day and when the routine is disrupted it can be consequential to their health. Studies have illustrated the effects of artificial light in the reduction of melatonin, which helps the brain function and perform daily routines. Often referred to as the human body clock, a change in melatonin levels can negatively impact a person's mental and psychological abilities in performing tasks and procedures, as well as affect their alertness (Sahin & Figueiro, 2013). Healthcare professionals encourage increased hours of sunlight to help improve the brain's productive processes (Bedrosian & Nelson, 2017). Butterfield Park's location outside of the OCAD University building provides natural sunlight which can provide beneficial outcomes to a person's health (Brawley, 2001). However, the park is situated directly under the OCAD University building and therefore, does not possess a large amount of sunlight exposure throughout the day. Maximizing the amount of sunlight in the park can help increase the daily exposure to natural light for the students and community. By including seating and resting features in areas with longer hours of sunlight, this will encourage visitors to use the outdoor spaces as an alternative to staying inside of the campus buildings. To help control the amount of glare from the sunlight, design techniques such as vegetation and terraces can be used as shade cover.

During the nighttime, artificial light can be used to help increase alertness for visual and safety purposes (Sahin & Figueiro, 2013). Additionally, the use of warm colour tones in the lighting design can help create a relaxed environment when artificial light is needed to illuminate the space. Figure 12 illustrates the psychological impact that influence the mood of a person depending on the lighting effects in the space. Low lighting with warm colour variations such as red tones promote a more

private and relaxed environment. Integrating spaces for activities that are normally conducted inside, like studying and group meetings and bringing that into the outdoor environment will enhance the exposure of natural light thereby creating diverse spaces that meets the needs of the campus community. The variety of spaces will help to engage a person's senses and immerse them in the natural setting. Redeveloping Butterfield Park will ensure that students and the OCAD University community have regular and accessible exposure to urban nature in their daily routine.

PSYCHOLOGICAL IMPACT	LIGHTING EFFECT	LIGHT DISTRIBUTION
Tense	Intense direct light from above.	Non-uniform
Relaxed	Lower overhead lighting with some lighting at room perimeter, warm color tones.	Non-uniform
Work/Visual Clarity	Bright light on work-plane with less light at the perimeter, wall lighting, cooler color tones.	Uniform
Spaciousness	Bright light with lighting on walls and possibly ceiling.	Uniform
Privacy/Intimacy	Low light level at activity space with a little perimeter lighting and dark areas in rest of space.	Non-uniform

Figure 11. Psychological Impacts and artificial lighting effects on humans. (TCP, 2017).

Human Health, Behaviour and the Environment

This section of the chapter, discusses environmental design techniques related to human behaviour and health. In creating an inclusive outdoor environment the diverse experiences of every individual depends should be considered and reflected throughout the design process.

SENSORY GARDENS AND THEIR THERAPEUTIC ATTRIBUTES

A study conducted by Roger Ulrich, identified key benefits in interacting with the natural environment which include, the reduction in stress, the ability to block out negative emotions and improving positive feelings (Barton and Rogerson, 2017). These observed benefits have been studied in hospital and mental institution environments, as well as some development in elementary schools and botanical gardens (Balode, 2013). Sensory gardens are designed to stimulate the senses through interaction with natural features like trees and water features and other sensorial elements (Worden & Moore, 2016). Figure 13 illustrates the sensory features that help create a multisensory experience. It is important to offer a diverse range activities that engage the different senses in order to appeal to the needs of all users (Collier and Truman, 2008). Daljevic (2013) states that,

"Sensory integration is the process that organizes sensations received through the senses which come to the central nervous system, that should provide their processing and enable our usable functional outputs."

This statement suggests that the environment should offer activities that appeal to all of the five senses in order to support a person's mental, social and physical functions. The space should be able to encourage self-motivated activities that help develop and enhance various opportunities for learning and health growth.

Sight	Sound	Smell	Touch	Taste
Colour and light	Water sound	Floral scents	Braille text	Herbs
Sculptures	Clay bells	Herbal plants	Plant leaves	Berries
Near and distant scenes	Bird songs	Mosses	Surface strucutre	Vegetables

Figure 12. Examples of the Five Senses (Balode, 2013).

Given that the regular school year goes from September to April, the plant selection will focus on providing areas of interest and engagement throughout the year. Species that maintain their foliage throughout the year include English Ivy, Blue Spruce, and Yew shrub species. It is important to understand which plants and features will best achieve the sensory interaction in the environment. These plants will help encourage human interaction through the smell, sight and touch sensory stimulations. Features that can provide sound include artificial water features that provide white noise to mitigate the urban sounds from traffic and construction. The tree and plant selection influences the sound stimulations as some plant species like Honey locust and Snowy Mountain Ash contain flowers and berries that attract birds to the space. As well as, Lavender and Pineapple Sage which are edible herbs that humans can use for either taste, touch or smell stimulations. The tactile sensation can come from more than natural features like flowers and plants, such as accessible information boards that contain braille and audio information.

Smell walking is a practice that helps people identify the various scents in an environment (Kubartz, 2014). This concept encourages the community to actively locate the different scents in an environment which can help design outdoor spaces to minimize unwanted scents like garbage and fuel (Kubartz, 2014). In urban design, the sense of smell has been compared to place experience. The smell of the environment contributes to how the

space is perceived and understood by an individual. The smell wheel seen in Figure 14, illustrates the different scents found in the urban London core. As depicted, the natural scents are found on the opposite side of the spectrum away from the emissions and waste, which indicates the distance between the smell categories (Quercia et al, 2015). There are a variety of factors and sensorial elements that can play a key role in creating a Multi-Sensory Environment through the use of all of the senses.

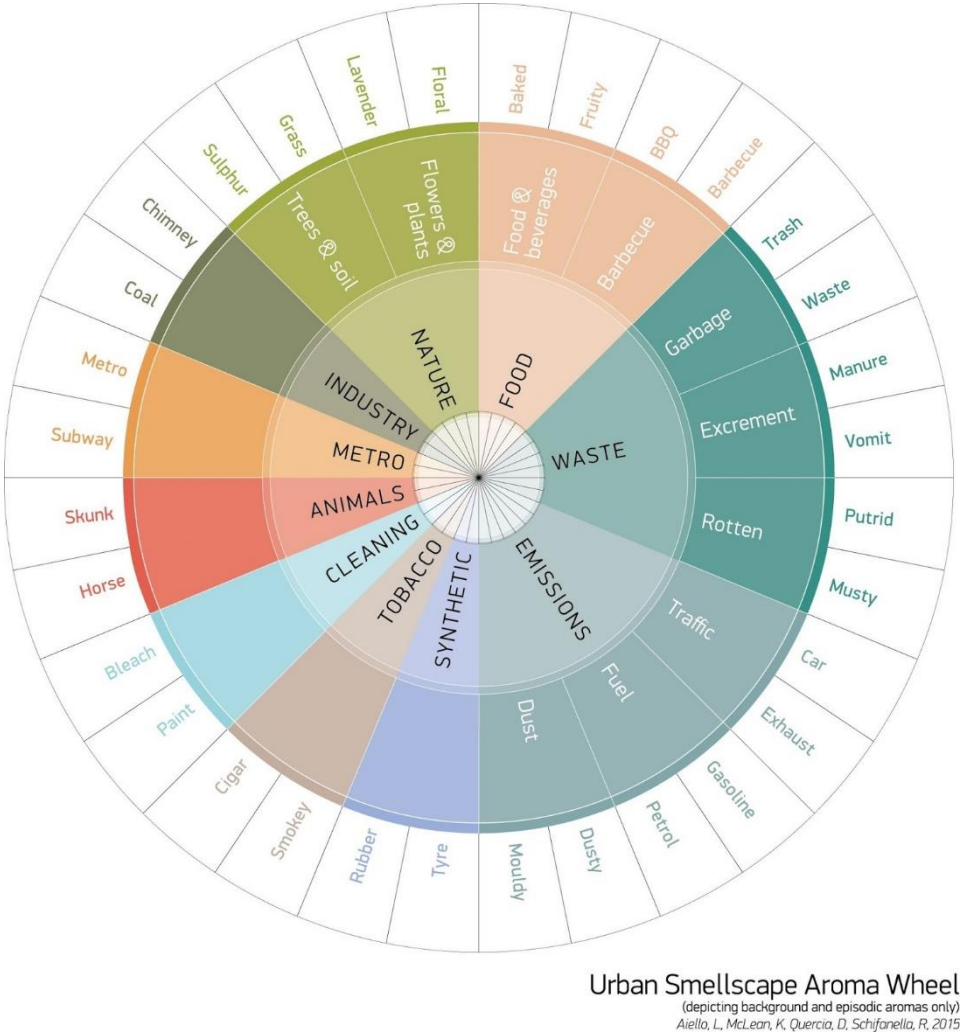


Figure 13. Urban Smellscape Aroma Wheel (Quercia et al, 2015).

OUTDOOR SPACES AS PUBLIC MEMORIALS FOR THE COMMUNITY

Monuments and memorials encourage the community to remember and reflect on their past, present and future actions and experiences (Mitchell, 2013). Public memorials are those that allow us to "remember the events and the pain they caused to the public through (civil) war, terrorism, genocide, etc" (Gurler, 2013).

Modern memorial sites have moved away from the traditional idea of a large-scale monumental observation to a space that encourages development of a social community. The new spaces encourage interaction and connect the individual with the community by providing a living space for everyday life. By creating an environment that establishes a strong connection between the user and the memory, it will allow the memory to live on (Gurler, 2013). Figure 15 outlines the elements of both the traditional and modern design for a memorial site. It highlights the positive elements that a memory driven space creates by strengthening the cultural memory, creating a good urban identity and promoting cultural prosperity. Gurler (2013) outlines a design strategy that contains four principles to creating a memorial space.

The first principle is called, "Never again," which is to educate and provide visitors with the opportunity to understand how to mitigate and avoid situations that result in this setting. However, the site is not meant to create a negative environment or trivialize the event for any person. The second aspect is to have the visitors reflect on their own life experiences and think about similar situations in their life or someone else's. Thereby helping to establish a connection between the environment and the user. Including participants in the design process will strengthen the meaning behind the design and allow everyone to have an input on an essential social infrastructure in their community. An environment dedicated to remembering the victims and family of the memorial will help identify the design and structure of the space. Other key features include gender, age, sex and ethnicity in directing the design of the outdoor space (Gurler, 2013). An example of a memorial park is the Richard and Annette Bloch Cancer Survivors Park in Ottawa as seen in Figure 16. It is a 4.5-acre space that contains sculptures and messages of recovery and

Figure 14. Conventional versus Memory site for Memory and Public Engagement. (Gurler, 2013).

support spread around the park (Cook, 2008). It was designed and established to help support patients, survivors, friends and families. The environment uses natural and manmade features to create a space that provides the community with serenity and reflection (Cancer Survivors Park, 2018). Often in urban communities, there is a focus on large storefronts and transit hubs to cater towards a constant flow of movement throughout the city.

Pittenger (2011) calls this series of areas as non-places, which are defined as "sites where individuals travel or shop together, but have little meaningful interaction with one another, thereby diminishing a collective sense of place and leveling all traces of local memory." Cities are designed to maintain constant flow and movement and focus on the global perspectives through the large-scale shopping centres and metro stations. The community identity becomes lost because of the constant movement and reduction in social community spaces.

Memorial spaces that promote social engagement and memory provide a center for belonging and community (Puttenger, 2011). A memorial encompasses multiple functions from passive park environments to spaces for formal events like Remembrance Day and December 6th (National Day of Remembrance and Action on Violence against Women), that boosts social support and restorative engagements. For instance, Sheridan College commemorates December 6th at the Trafalgar Campus in SCAET Lobby. These events provide a collective space for the community to reflect and support each other. It contains restorative attributes that provide individuals with a sense of being away and allows them to curate their own experiences in a therapeutic manner (Detwiler et al., 2012).

By creating an environment that provides comfort and support to those in need, it will create a stronger bond within the community. It is about creating a social memory that symbolizes a shared community value where everyone feels a sense of belonging, support and acceptance (Curtis, 2016).

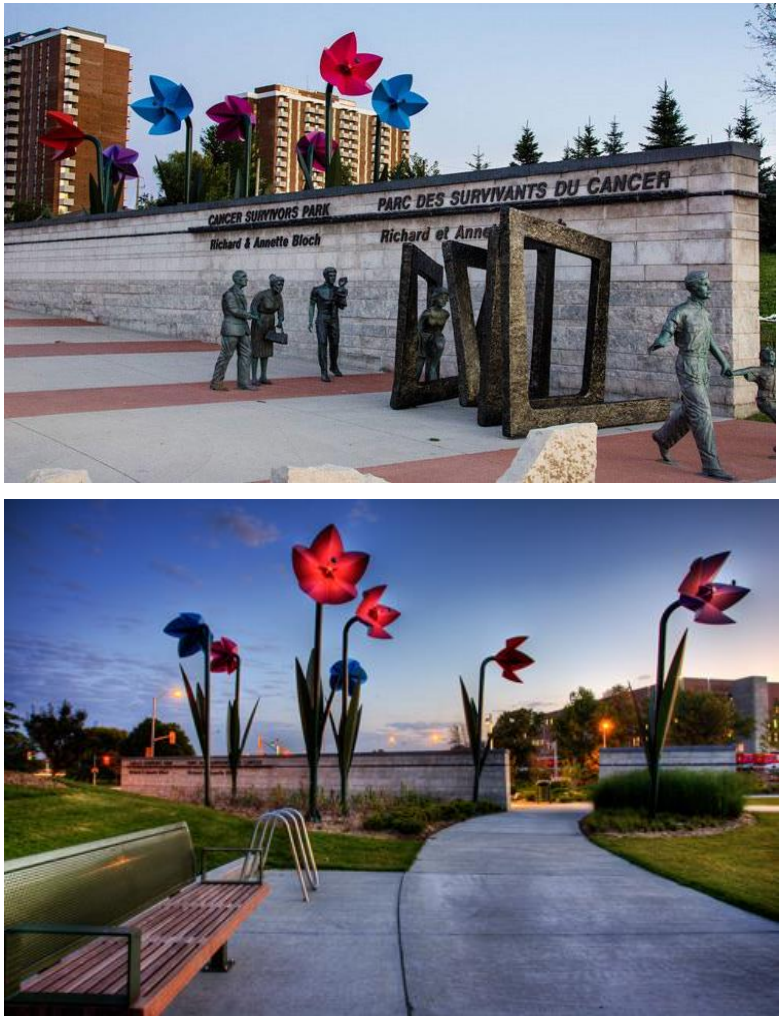


Figure 15. Richard and Annette Bloch Cancer Survivor Park Entrance (Cancer Survivors Park, 2018).

HUMAN BEHAVIOUR AND THEIR ENVIRONMENTAL INTERACTIONS

Dunnett and Qasim (2000) stated that when an individual is able to interact with nature through either direct or indirect actions, it can help boost their self-esteem and improve their anxiety levels. Different types of interactions can help improve academic performance and completion of perplexing mental tasks. Connecting humans to other living organisms like plants and trees is essential in supporting cognitive development. Edward O. Wilson defined the relationship between humans and nature as biophilia, which is “an innate emotional affiliation of human beings to other living organisms” (Krcmarova, 2009). Throughout history, human interactions with natural substances have been reflected in attaining nutrition and agriculture (Keniger et al., 2013). Wilson asserted that an individual’s development relied on their social environment and interaction with other living organisms in order to develop proper learning and adaption techniques (Krcmarova, 2009). This concept reconnects humans with the natural world and fosters an emotional and physical connection to the natural processes found in parks and green spaces.

There are three different types of interactions that can provide beneficial qualities between humans and the natural environment. The first interaction is indirect where the individual is exposed to natural features but is not in the physical environment. Incidental interaction where they are performing another activity in nature and intentional interaction where they want to engage with nature (Keniger et al., 2013).

When analyzed researchers determined that the interactions produced similar results with the individual having improved emotional responses when they had exposure to natural elements. The amount of physical and mental restorative qualities varied with different natural environments because of the selection of the design features. It was difficult to find a balanced comparison between natural and urban environments because of the intricate matrix of factors within these spaces. These factors included crowded areas, noise pollution and lack of green space (Keniger et al., 2013). In creating an inclusive space it is important to understand the personal intent behind each interaction.

In the Attention Restoration Theory (ART), involuntary and voluntary attention is used to assess the benefits of the environment on an individual's mental state. The theory suggests that when a person interacts with natural characteristics in a space, they are more likely to show involuntary responses which can improve their cognitive performance (Ohly, 2016). Conversely, when they are in areas that involve high traffic levels and large crowds they will revert to their voluntary attention to focus on crossing the busy roads thereby, reducing their recovery time and restorative abilities. This is the result of the individual exerting higher levels of mental stimulus to function in the environment, which can result in mental exhaustion as well as having difficulty performing an array of tasks (Keniger et al., 2013). Being able to find the balance between indirect and direct attention is imperative in creating a space that produces optimum restorative properties. There needs to be more research to identify the specific natural features that attribute to the beneficial aspects for an individual's mental well-being. Berman et al., (2008) looked at how cognitive function was influenced in a various controlled natural environments. The results indicated that natural environments required modest attention and limited the amount of directed focus from the individual. Different levels of natural interactions enhance cognitive control and development over environments that require focused attention. Recognizing nature as a tool that can help cognitive function is imperative to the success of community engagement and design.

3 CHAPTER THREE: METHODOLOGY

RESEARCH DESIGN

A mixed methods approach was used in this research study utilizing both qualitative and quantitative data. The information gathered from interviews, survey responses and co-design workshops helped to inform the design and developing of the Butterfield Park design proposal.

OCAD University Research Ethics Board reviewed and approved this research study. The REB reference number is 2018-55. All interviewed experts listed in the following sections gave their consent to have their name included in the study. Interview guides and the survey outline are included in Appendix A and B.

Research Design

SEMI-STRUCTURE EXPERT AND STUDENT INTERVIEWS

This was a staged research study. The first stage of the study consisted of secondary research with a literature review on the various aspects of Multi-Sensory Environments, human behaviour, student wellness and practices on campus, as well as existing post-secondary frameworks to help shape the conversation about mental health on campus. Following the review and analysis, the primary collection stage began with semi-structured interviews.

The semi-structured interviews were created using the research collected from the theoretical and case study information on restoration garden design, mental health in post-secondary education and multi-sensory features. Participants included experts in landscape architecture and mental health, as well as university students. The interviews were semi-structured, which allowed the participants to expand on the questions.

Three landscape architects and one landscape architect intern were interviewed, along with one healthcare professional from Sheridan College as well as, the manager of the Health and Wellness Centre from OCAD University. Four student interviewees from OCAD University participated as well. The length of the expert and student interviews ranged from 15-30 minutes. There were three different sets of interview questions for the

landscape architects, mental health experts and university students which can be found in Appendix A. The landscape architect recruitment was developed using the Ontario Association of Landscape Architects (OALA) website and the principal advisor to identify architects related to the research topic. The mental health experts were contacted with assistance from the healthcare committee member and Robyn Shaw the manager of the Health and Wellness Centre at OCAD University. University student recruitment was completed through contacting colleagues at OCAD University. All potential participants were sent a pre-approved invitation letter that included a brief summary of the research study, contact information of the student investigator, Melissa Diep, the interview structure and dates. Participants were sent the consent form, mode of contact (i.e. in-person or phone call) and an availability timeline. The interview stage took place from September 26th to November 6th, 2018. The main themes from the landscape architect interviews included the need for the space to be accessible for the whole community, contain inclusive features, as well as provide a sense of place, comfort and functionality throughout the year. The recommendations from the mental health experts outlined the importance of peer support, group socialization and creating a connection with the space. Finally, student interviewees expressed their desire to have access to more services on campus that would allow them to study, design and relax. Suggestions included bringing plants into the classroom, more space for group work and access to creative spaces during their free time. The ideas and recommendations from the interviews helped to structure the survey and co-design sessions of the research study.

ONLINE SURVEY

The third stage of the study was an online survey that was structured by the literature review, as well as the expert and student interviews. The survey was open to all OCAD University students, staff and faculty from September to October 2018. Posters were displayed at 100 McCaul St, 205 Richmond St and 230 Richmond St and provided an overview of the research topic and outlined different ways to access the survey either through a URL link or a QR code to allow for ease of access. Additionally, the Health and Wellness Centre office agreed to post the survey in their office and their social media page. The purpose of the online survey was

to gain more insight into how students felt about their experiences on campus and what they would like changed to the urban outdoor environment. Before beginning the survey, participants were prompted to review the consent form and give their consent to participate in the survey. There were a total of 10 questions including a question to ask survey participants if they would like to participate in the co-design workshop. The estimated completion time for the survey was 10-15 minutes to allow participants ample time to complete the questions. The results indicated that when students were asked about their preferences for the outdoor environment, the choices were split between study, social and art space.

CO-DESIGN WORKSHOP

The co-design workshops applied the theory collected from the initial literature study, interview and survey results. The recruitment process occurred throughout the interview and survey stages. Interested participants were contacted after their participation in the interview and survey phases. However, when the survey participants where contacted through their email there were no responses which resulted in an additional recruitment that occurred from October 10th to October 31st, 2018 at the Sharp Centre at OCAD University. Students in the environmental design thesis courses were recruited on the fifth floor of the building. All participants were sent the consent form and facilitation guide a week before the co-design workshop. The first workshop took place on November 12th, 2018 from noon to 2PM at 51 McCaul St in room 200. The second co-design workshop took place on November 19th, 2018 at the same location. The participants included OCAD University students and landscape architect students in the Master's program from the University of Toronto.

To accommodate the students' schedules, the co-design timeline was changed to a two hour period instead of three hours. Students were given a photo release form at the start of the session to ensure that they consented to photographs being taken throughout the workshop. Each participant was given a package that outlined the structure of the co-design with defined terminology like Multi-Sensory Environment and mental health. All participants were informed of their right to opt out of the co-design at any time. The first activity was a warm-up exercise to help students relate their experiences in

outdoor environments with the five senses. The exercise results indicated that the majority of the participants used sight, sound and touch to interact with the outdoor environment. The second activity contained two parts with a walking tour of Butterfield Park, while filling out a form on the eight perceived sensory dimensions (PSD) related to how natural features influence human perception to natural features (Stigsdorrter et al., 2017). The PSDs were explained to the participants with examples provided for each of the categories on a sample sheet. Participants were given 15 minutes to explore and record their observations individually and/or in groups. Key observations included the need for more green spaces and shrubbery, as well as accessible and comfortable seating.

The participants emphasized the need for bold colour and spaces specifically for student work and design. Following the exploration of Butterfield Park, student participants were asked to reflect on their observations and fill out a form of the different senses that they experienced or would like to experience in the park. The PSDs and sensory form helped to guide their Butterfield Park multi-sensory visualizations. Their design creations were aided with sensory stations that contained objects related to sight, taste, touch, sight and sound to help inform their design, Additional material included, clay, glue, paper, markers, photographs, and crayons. At the end of the design activity, participants were asked to share their designs and ideas where everyone was able to provide feedback and suggestions for future co-design workshops.

4 CHAPTER FOUR: DATA ANALYSIS

UNDERSTANDING THE NEEDS OF THE USERS AND DESIGN THINKING

In this chapter, the aggregation of the data collected from the interviews, online survey and co-design workshop will be assessed for their influence on the design of Butterfield Park. The analysis will help identify the needs and perspectives of the participants and the OCAD University community will be addressed in relation to the redevelopment of Butterfield Park into a Multi-Sensory Environment to support student well-being.

4 CHAPTER FOUR: DATA ANALYSIS
UNDERSTANDING THE NEEDS OF USER

Understanding the Needs of the User

STUDENT NEEDS AND ACCESSIBILITY

Abraham Maslow developed the hierarchy of needs that identified the basic human desires that influence self-motivation and innate curiosity (Zhang and Dong, 2008). The data collected from the interviews, survey and co-design workshops reinforced the necessity to provide green spaces on campus to support student health and success. When surveyed, students stated that on average parks and urban gardens were important features on a campus, with a rating of 8.47 out of 10 with 10 being very important to them. The three main areas that students felt had a positive influence on their mental health included interacting with friends and family, academic work, and proximity to amenities. Students stated that the negative impacts on their mental health were academic work, social life and housing issues. By redeveloping Butterfield Park into a Multi-Sensory Environment, the social spaces and access to surrounding amenities would be enhanced.

Post-secondary institutions are introducing programs catered towards promoting student mental health like mood walks and dog therapy, as well as developing guidelines to help students in distress and direct students on how to help their peers (A Guide to Supporting Students in Distress at OCAD University, 2015). Additional activities include open forum discussions, yoga sessions, and recreational programs designed to

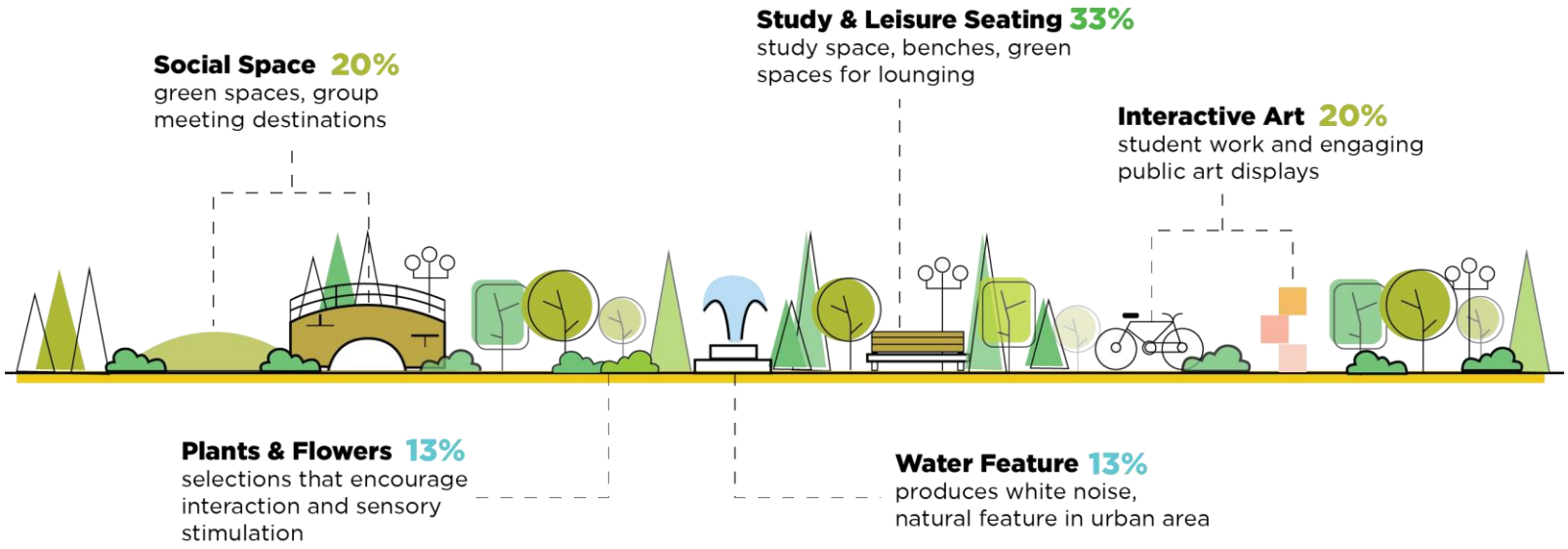


Figure 16. Multi-sensory Items important to students in an outdoor space from the survey results.

support mental health on campus. Tammy Datars, the Manager of Health Services at Sheridan College outlined the different services available for students at the three campuses. The Trafalgar Sheridan campus in Oakville, contains a large mental health sector that hopes to bring a natural element into addressing mental health by creating a mood walk program for students. On the other hand, the HMC and Brampton campuses focus on the physical medical requirements for off-campus and international students (Datars, 2018, phone interview).

The mood walks allow students to engage with their peers and interact with the natural features during these excursions. Introducing new and interactive activities will encourage innovative learning and development away from the classroom environment (Student Mental Health Strategy, 2018). Figure 17 outlines the results from the online survey with approximately 33% of participants wanting an outdoor space for leisure and study spaces. Social spaces and interactive art followed with 20% of students wanting areas dedicated to these activities. The

desired activities within the Multi-Sensory Environment look at both direct and indirect interaction with nature. Being physically engaged with plants and trees does not mean that the individual will have a higher positive outcome then if they were reading on a bench in a park. The study by Dunnett and Qasim (2000), stated that a person's interaction with nature either directly or indirectly can help improve their cognitive development by restoring mental fatigue. The purpose of the multi-sensory space is to provide activities and tools that reflect the needs of every individual. Brief and modest engagement with natural features possess the ability to improve the cognitive and social development of the individual.

INCLUSIVE SPACE DESIGN FOR EVERYONE

Inclusive design strives to establish innovative designs and tools that enhance the accessible and adaptable features for all users. Dennis A. Winters (in-person interview, 2018), a Landscape Architect describes an ideal landscape as,

"Having an empty cup and within that empty cup there's an open cylinder in that you have a repository of memories and dreams and images, it's like anything is possible within that. So you are providing the place where people can dream."

This metaphor reflects the intrinsic human desire to create a space that is unique and familiar, while breaking down the restraints that keep it from being enjoyed by the entire population. The goal of landscape design is to be inclusive and reflective for all users. Students should be able to have a say in creating their own unique experiences to help support during their time on campuses. The outdoor space design for Butterfield Park will include a variety of features offered through the five

senses to create an immersive sensory environment. Figure 18 indicates that 80% of the surveyed OCAD University students rely on their sight, followed by sound and smell at 47% and 33% respectively. Survey participants were able to select more than one sensory option for this selection. Balote (2013) offers examples and features for each of the five senses that help create the sensory design. These include natural elements like herbs, floras, interactive art, microclimate control and sounds that help mitigate unwanted distractions from the city.

Virginia Burt, a Landscape Architect, states that the key to a good landscape design is creating an open and immersive experience that allows nature to act as an innate distraction from the surrounding environment (phone interview, October 2018). An example of a feature would be to integrate a tree alongside a building that provides pedestrians with a human scaled object that provides a transition between the natural and artificial features in the environment. The co-design workshop provided participants with the opportunity to help create an immersive space, while outlining the important features that students want to have on campus.

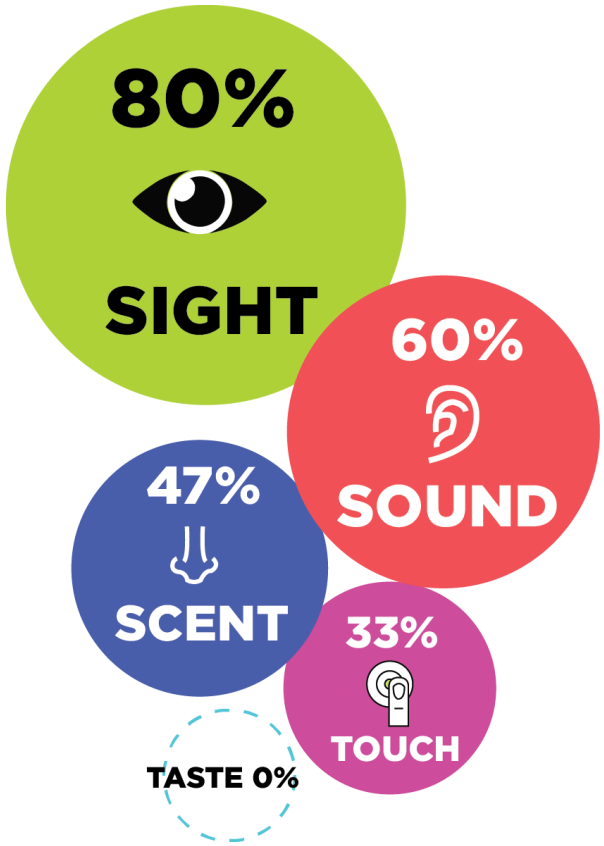


Figure 17. Breakdown of senses survey participants used in a park or urban green space environment.

ESTABLISHING A CONNECTION BETWEEN HUMANS AND NATURE

As cities continue to intensify and grow, it is essential to understand how natural elements can play a part in shaping human health and behaviour. Creating accessible and complete green spaces is important in developing a variety of spaces that meet the needs of the community and promote social development (Stigsdorrter et al. (2017).

Biophilia is a theory that suggests that there is an innate affiliation between human beings and nature, which is the result of over hundreds of thousands of years of evolution (Krcmarova, 2009). The theory claims that regular engagement with nature strengthens mental, physical and social development in humans. Biophilic design follows a human centered approach by using natural elements in the built environment (Kellert and Calabrese, 2016). The experiences can either be direct or indirect through the interaction with a pond feature to looking at a tree through a window. Examples of biophilic designs include the tactile green walls at the Student Learning Centre on the Ryerson University campus, the sound from the waterfall at Paley Park in Manhattan and the lights and sounds from the Supertree Grove in the Gardens by the bay in Singapore (Paley Park, 2018, Macatulad, 2019). These biophilic examples use natural attributes to enhance a person's mental health by providing restorative natural features in an urban setting. Table 1 below outlines the different sensory responses and activities that OCAD University students engage with when they are in these environments. The alleviation techniques that they use to decrease their stress or anxiety levels include interacting with nature through gardening, going for a walk or moving through forest environments. It is important to note that their interactions do not always involve being in an outdoor environment. Some students stated that having plants in classrooms or a view of a tree from a window was enough of a connection with nature, as stated in Table 2. When given the opportunity to design a space there were many suggestions on how to improve the campus environment. The improvements included bringing natural aesthetics into the campus building with real plants in the halls as well as providing creative spaces that students could contribute too.

Table 1. Sensory Inputs and Interaction with Green Space Environments

Student #	Sensory Uses	Alleviation Techniques	Activities in green spaces
1	Sight and smell	Smelling gardens, no visual distractions, working out, family time, painting	Taking in the environment and breathing
2	Sight and touch	Being in an open space with no noise from cars, alone time with nature, quiet study spaces	Going on walks, being immersed in the environment, sit and relax
3	Sight and smell	Listen to music, go for a walk, wander around nature	Have picnics, go on walks and bike around, take a break from electronics
4	Sight and sound	Hang out with friends and work on drawings or designs	Eat lunch, talking with friends, walk past on the way to school or home

Table 2. Suggestions and Features for an Enhanced Campus Environment	
Student #	**Ideas and Recommendations**
1	Providing more services to students like gym space, personal green spaces like Grange Park, patio areas, cafeteria with well-priced food, meal plans, natural elements inside the building, creative spaces like a graffiti wall, more design planning into spaces as multi-functional
2	Work with students to see what they want, create a collaborative space where natural elements are included like potted plants, vertical green walls, silent study areas and more windows
3	Including spaces that promote create thinking and allowing students to customize their experiences an dmake the campus feel like a second home
4	More spaces for students to hang out, do work away from a classroom setting, more spaces for casual meetings and to take a break, have access to natural light and views

The connections between humans and nature are separated into indirect, incidental and intentional interaction. This scale identifies the varying levels of engagement a person can have with nature through physical and/or mental interactions (Keniger et al., 2013). For instance, viewing natural features through a picture or window can have positive improvements to a person's mental health as if they were walking in the forest. Relating these ideas back to their alleviation techniques, the review of the interviews indicated that the student participants felt a sense of comfort and belonging when they felt a connection with nature.

Congruently, the Attention Restoration Theory (ART) proposes that people benefit from being in a space that provides a sense of being away, experience expansive spaces, engage in activities related to intrinsic needs and have experiences that are passive (Ohly, 2016). This theory focuses on the active and passive levels of attention fatigue and how interacting with nature can help alleviate this issue. An environment that is dedicated to meeting these four principles will improve the use of the space and social engagement and help to ease the daily stressors of school work and deadlines. Being in these natural spaces, provides them with relief from stress and gives them the ability to address their core desires within the environment.

Co-designer Creations for the Butterfield Park Redevelopment

During the co-design workshop, students were able to transform Butterfield Park into a Multi-Sensory Environment. The co-designers produced unique landscape designs that addressed the inclusive and multi-sensory aspects of the design, while incorporating features that were important to their needs in creating a supportive design for health.

DESIGN ONE: ARTISTIC DESIGN AND NATURALISTIC CONCEPTIONS

The first multi-sensory design came from the co-designer's experience of growing up in a rural environment and their interactions with nature. The park design included light, natural elements like trees, shrubs and ample green space for socialization and leisure activity. The sensory stimulations reflected that of sound and smell, followed by sight and touch. It was essential to maintain an unobstructed view at points around the park and provide white noise to mitigate the noise from the road. Natural sounds from a water feature, the wind, trees and birds would help create a sense of being away. The water feature was a key element as it brought back the childhood memory of picking up worms after a rainfall. Inspiration came from Kintsukuroi, which is a Japanese pottery technique for mending broken cracks with gold resin. Each design is unique and provides a personalized touched to the design. In terms of plant species, micro flowers were selected for their low maintenance needs and calming nature. Other species included, lemon basil, lavender, pine and aromatic cedar to enhance the multi-sensory aspects. An important consideration was to incorporate the wood trail from Grange Park into Butterfield Park to create an accessible pathway connection. The use of natural and weather treated material, as well as low impact techniques were considered in the enhancement to the sustainability of the design.

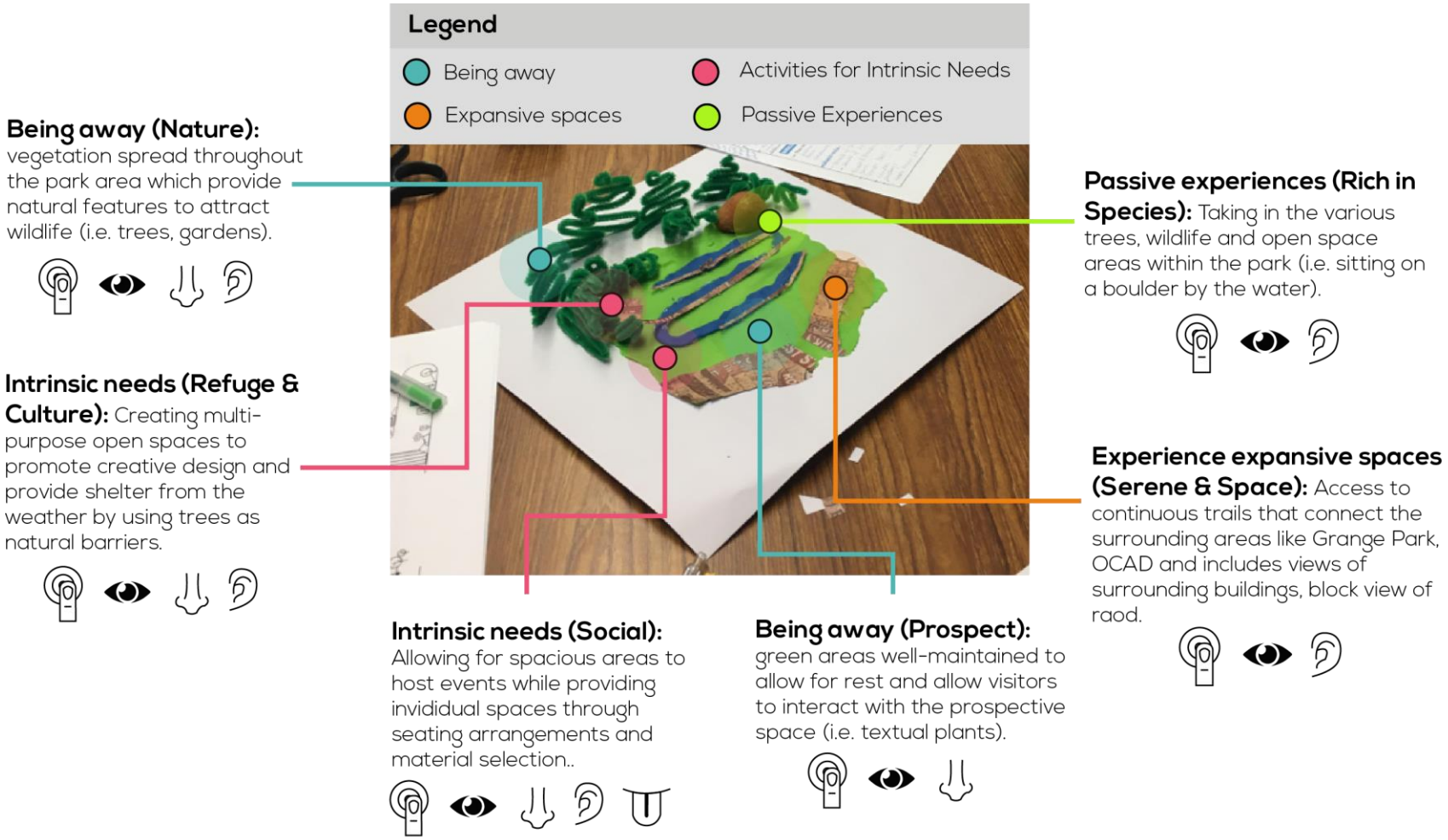


Figure 18. Attention Restoration Theory and PSD analysis of co-designer one landscape design.

In Figure 19, the student participant redesigned Butterfield Park based on their initial observations of the existing conditions and features, as well as using the perceived sensory dimension (PSD) categories to help categorize their observations. In order to further the relationship between outdoor spaces and mental health, the attention restoration theory principles were used with the PSD categories for the analysis. Kaplan's Attention Restoration Theory highlights four principles of providing an individual with a sense of being away, experiencing an expansive environment, participating in activities that reflect their intrinsic needs and having passive experiences within the space (Ohly, 2016). In the design one, the principle that was highlighted was the need for activities that reflected the student's intrinsic needs, which included creative spaces to design and open spaces for group and individual work.

Providing students with a variety of multi-functional spaces is essential in improving their mental wellness on campus. Kirk (2017) suggests designing environments that include green, active, social and safe spaces. In Figure 19, the design suggestions outline all four of the design elements in providing shelter from the weather, cultural spaces for student engagement, an array of plant species and spaces socialization. The design places emphasis on providing activities for the essential needs of every student. Fostering creativity and incorporating interactions with nature was the core of the design proposal.

DESIGN TWO: MOVEMENT AND DIRECTIONAL DESIGN

In the second design, the redevelopment focused on preserving and enhancing the existing soft and hardscape features. The improvements addressed the accessibility, functionality and safety of the space. In terms of a multi-sensory design, sound was an important factor when designing the space because it would allow users to remain aware of the environment around them. The design promotes comfort and safety through module seating and placement of emergency systems around the park. Sight and touch are connected in this design to encourage interaction with the plants and natural features. The materials used in the open space design evoke feeling and reaction when experienced through the different senses. For instance, rather than sitting on flat

surface, the seating contained concave surfaces that would form to every user. Tiered level platform seating to add additional seating to the space and the top of the tiers can act as a stand for sculptures and exhibitions. Various aromas can be found in the design from the smell of plants and floral species to the surrounding restaurants around the campus. Taste can influence a variety of experiences from eating lunch, sharing snacks or having a fly fall into your drink. The use of coloured lines to create a navigational pathway will improve the user needs. A unique design would be to create a platform along the building façade that could have multiple purposes of being a stage and gallery area. The coloured pillars could be incorporated into the new design to act as guides and informational posts that display information on OCAD University and the park features.

In Figure 20, the design focused on the attention restoration principle of creating activities to meet the needs of the users (Ohly, 2016). The design interventions included creative spaces like a theatre platform to promote artistic expression; modular platform seating for group meetings and individual activities. The focus was placed on the center of the park where a multi-coloured open space would be used for events, meetings and provide an additional way finding tactic to maintain a flow through the park. By including features that would attract users to the space, the park can improve its level of safety and comfort for students and thereby, enhance their well-being on campus. The design creates a sense of being away with the selection of trees, shrubs and plants placed around the site that forms a natural landscape in an urban environment. Designing a variety of accessible and connected spaces can help improve the value of the park and promote community growth and support.

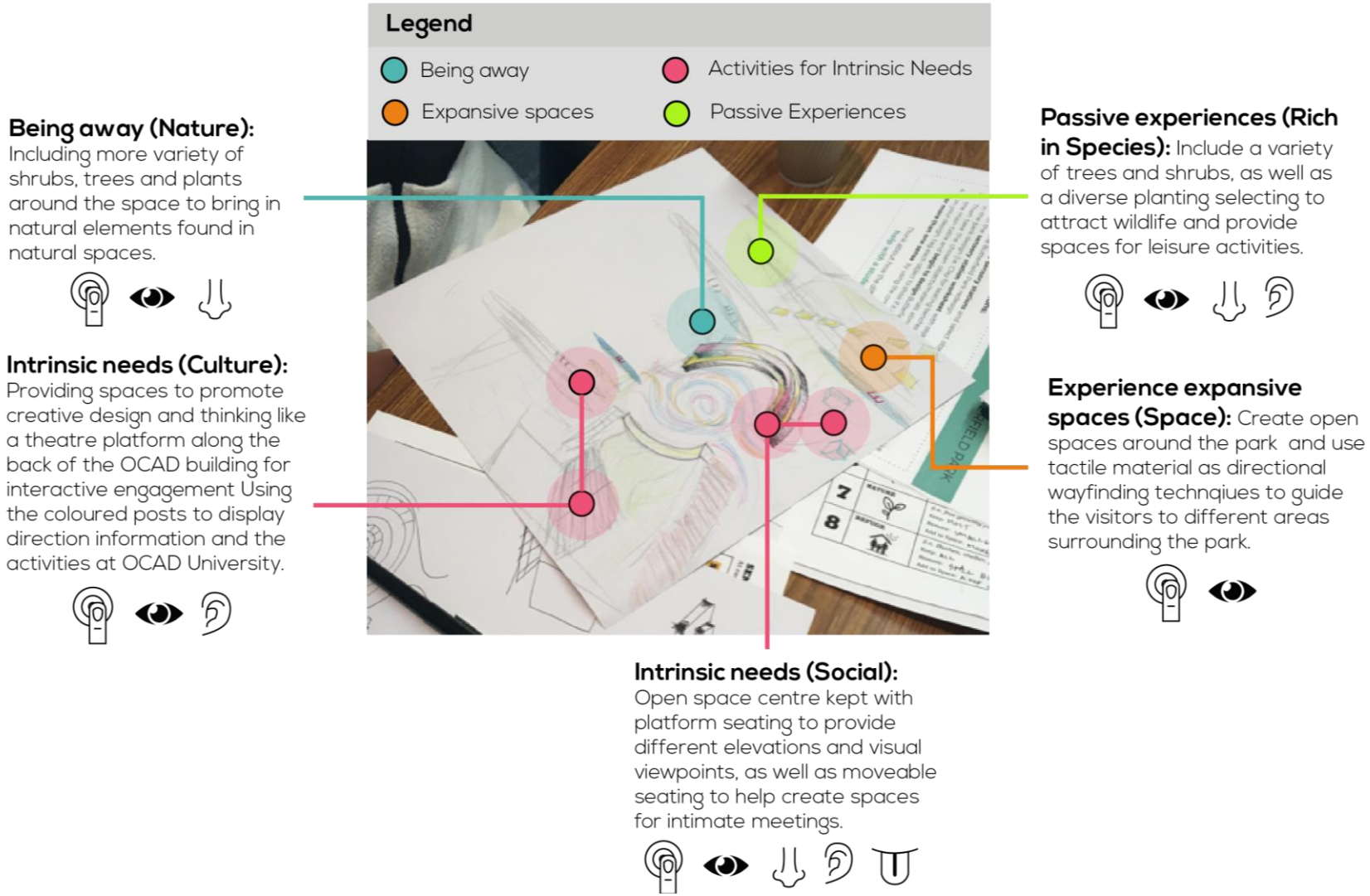


Figure 19. Attention Restoration Theory and PSD analysis of co-designer two landscape design.

DESIGN THREE: THREE PHASE DESIGN

The proposed landscape design focused on the importance of having a thematic connection with adjacent spaces like Grange Park and the Art Gallery of Ontario. Multi-sensory design features included tactile and interactive areas like a rock garden, which would provide a natural enclosure away from urban noises like construction and traffic. Currently, the material used for the seating benches in the park is cement, which can be cold and unwelcoming. An additional drawback from the seating selection is the lack of accessible design because there are no back and arm rests. Introducing softer materials like wood for seating with back and armrests will improve the level of comfort and convenience for all visitors.

Creating different themes throughout the space can help inspire students to have their artwork incorporated into the design of the park. Garden and exhibit design festival in Quebec, Jardin de Metis. Water feature, reflecting pond that shows the structure above and/or active fountain to create natural noises. Adding a lighting element at night and focused on the sculptures. Providing a sense of privacy for intimate conversations. The inclusion of the vegetative enclosures and designated areas of rest with a water feature would help mitigate sounds from the traffic and construction. Figure 21 focused on natural spaces that created a sense of being away from the urban environment. Features such as, large tree canopies, integrated seating and educational boards that allow the visitors to interact and learn about the different natural elements in the park are at the core of this design. The focus was on social engagement with nature and people to help strengthen the OCAD community.

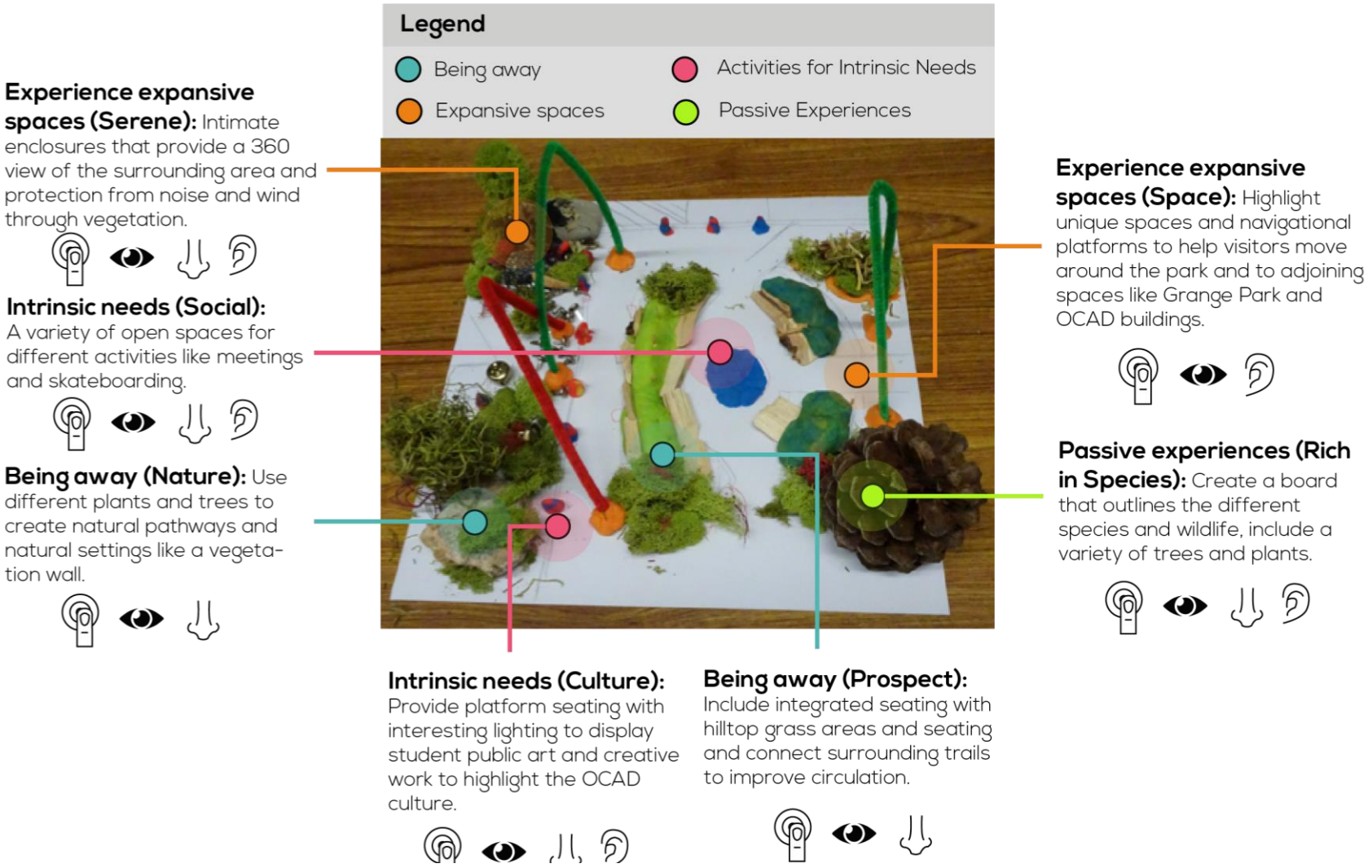


Figure 20. Attention Restoration Theory and PSD analysis of co-designer three landscape design.

5 CHAPTER FIVE: CONCEPT DESIGNS

MULTI-SENSORY SPACE DESIGN AND DEVELOPMENT

In this chapter, the analysis and design iterations developed in the previous chapters from the literature review, interviews, online survey and co-design workshops will help form and create the design plan for Butterfield Park. This will include preliminary concept plans, the assessment of the existing park conditions, overview of the design and policy guidelines and finally, the design concepts for the park redevelopment.

Preliminary Design Concepts

DESIGN ITERATIONS FOR BUTTERFIELD PARK

The concept designs were based on the ideas and suggestions of the students, industry experts and literature analysis. The Attention Restoration Theory and the Perceived Sensory Dimensions were used in the design process to identify natural and urban features that can help support mental health and development (Ohly, 2016, Stigsdorrter et al., 2017).

The first concept for Butterfield Park, focuses on the attention restoration theory principles of being away and experiencing passive interactions. These principles allow an individual to interact with natural elements that can help restore their cognitive and physical functions (Ohly, 2016). In Figure 22, the first design contains areas of rest with ample seating and green spaces to promote leisure and social activity. The areas that help provide a sense of being away are located on the outer sections of the park to create a unique transition and barrier from outside noise. Willson (2017) suggests that creating different pathways that provide access and connection will help support mental well-being in social outdoor spaces. The perceived sensory dimensions for this design looked at nature and the prospect of the space. The prospect of a space highlights the attractive features and the maintenance of the trees and vegetation (Stigsdorrter et al., 2017). Other elements include, a space for meetings with tables and seating, as well as a public art display to exhibit the work of students at OCAD University.

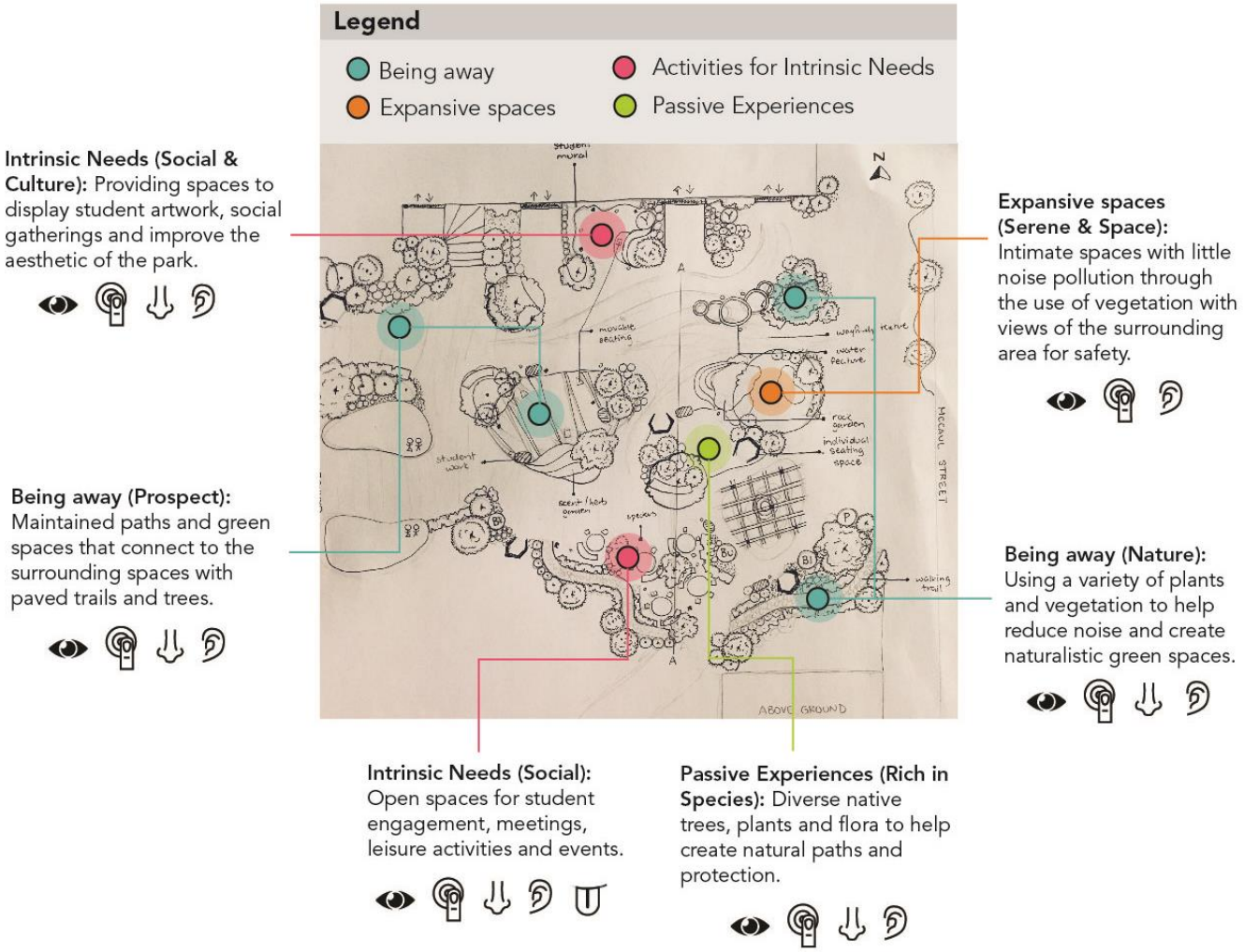


Figure 21. Concept One for Butterfield Park.

The second concept seen in Figure 23, emphasizes the activities that meet the intrinsic needs of the students and community to help strengthen the compatibility for all of the users. The purpose of a Multi-Sensory Environment is to provide a variety of sensory stimulations that can adapt and meet the needs of the user. Therefore, it is essential that the redevelopment of Butterfield Park contain elements and features to help support the diverse range of individuals.

The design is comprised of spaces for students to display their artwork and contribute to the design of the park through an inclusion of a wall mural. For natural aesthetics, incorporating a rock garden and interactive water feature will help bridge the connection between nature and human interaction. By engaging with these features directly and/or indirectly, a person can begin to restore their mental fatigue (Ohly, 2016, Depledge et al., 2011). The design features provide varying levels of multi-sensory stimulations to ensure that no one becomes overwhelmed during their visit. The inclusion of spaces for social gatherings, creative displays and vegetative elements contribute to the level of fascination in the park (Stigsdorrter et al., 2017).

The third concept, highlights three out of the four attention restoration theory principles in creating a sense of being away, experiencing expansive spaces and engaging in passive experiences (Ohly, 2016). The active and passive experiences are spread around the park with variations in the level of interaction depending on the needs of the visitor. For example, in Figure 24, a tiered seating arrangement is included beside a water feature with surrounding trees to encourage engagement and use of the natural features in the space.

Every area in the park contains natural buffers to minimize the noise from adjacent spaces, while providing clear view points for visitors to take in their surroundings. The third iteration is a compilation of the first two concepts with the goal of balancing both active and passive activities. A Multi-Sensory Environment ensures that a person does not become overwhelmed when they are interacting with the space (Daljevic, 2013). The design proposal, incorporates areas that create an expansive feeling with various pathway systems that link users to the surrounding area, while providing natural enclosures to create a sense of serenity like the terraced garden.

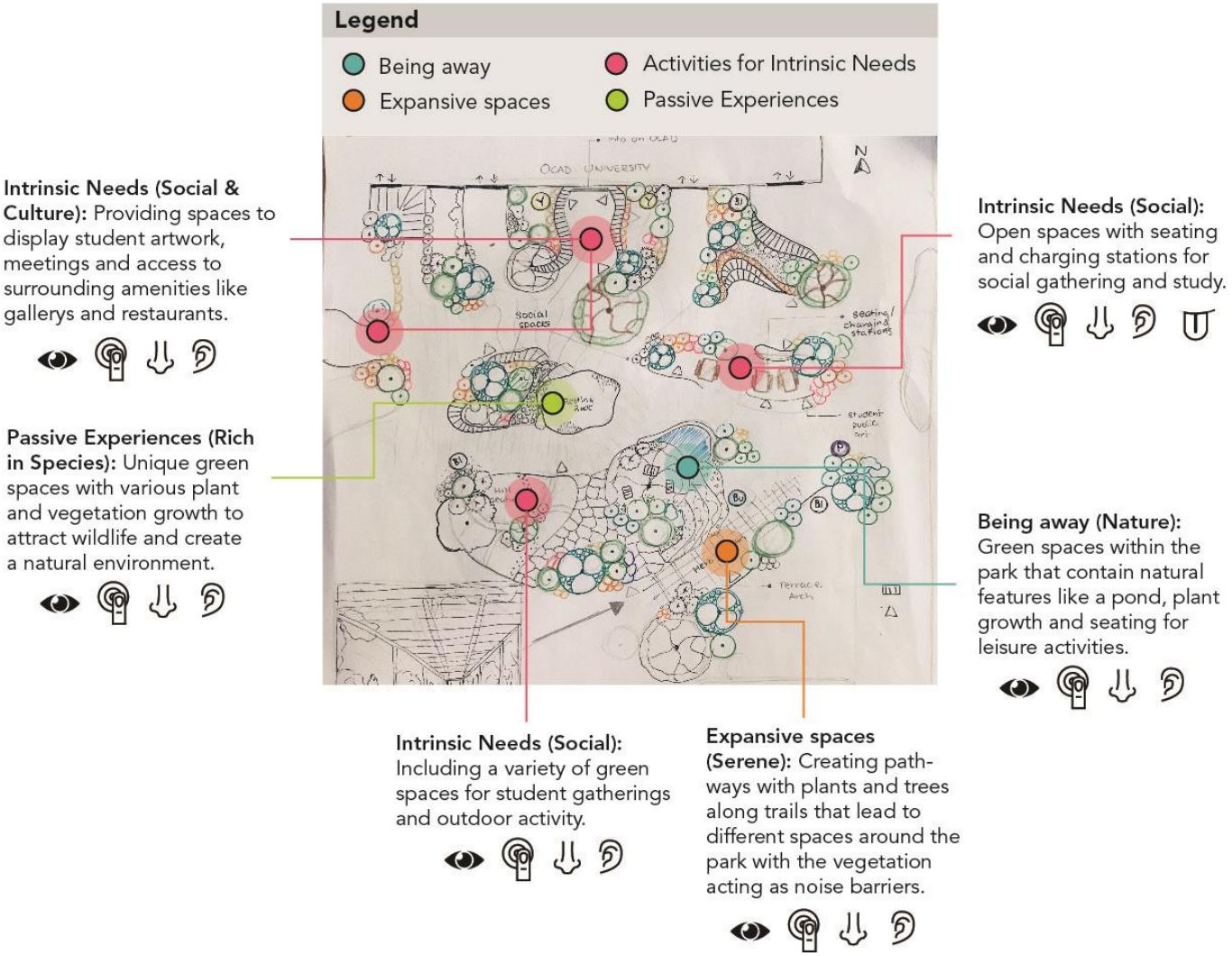


Figure 22. Concept Two for Butterfield Park.

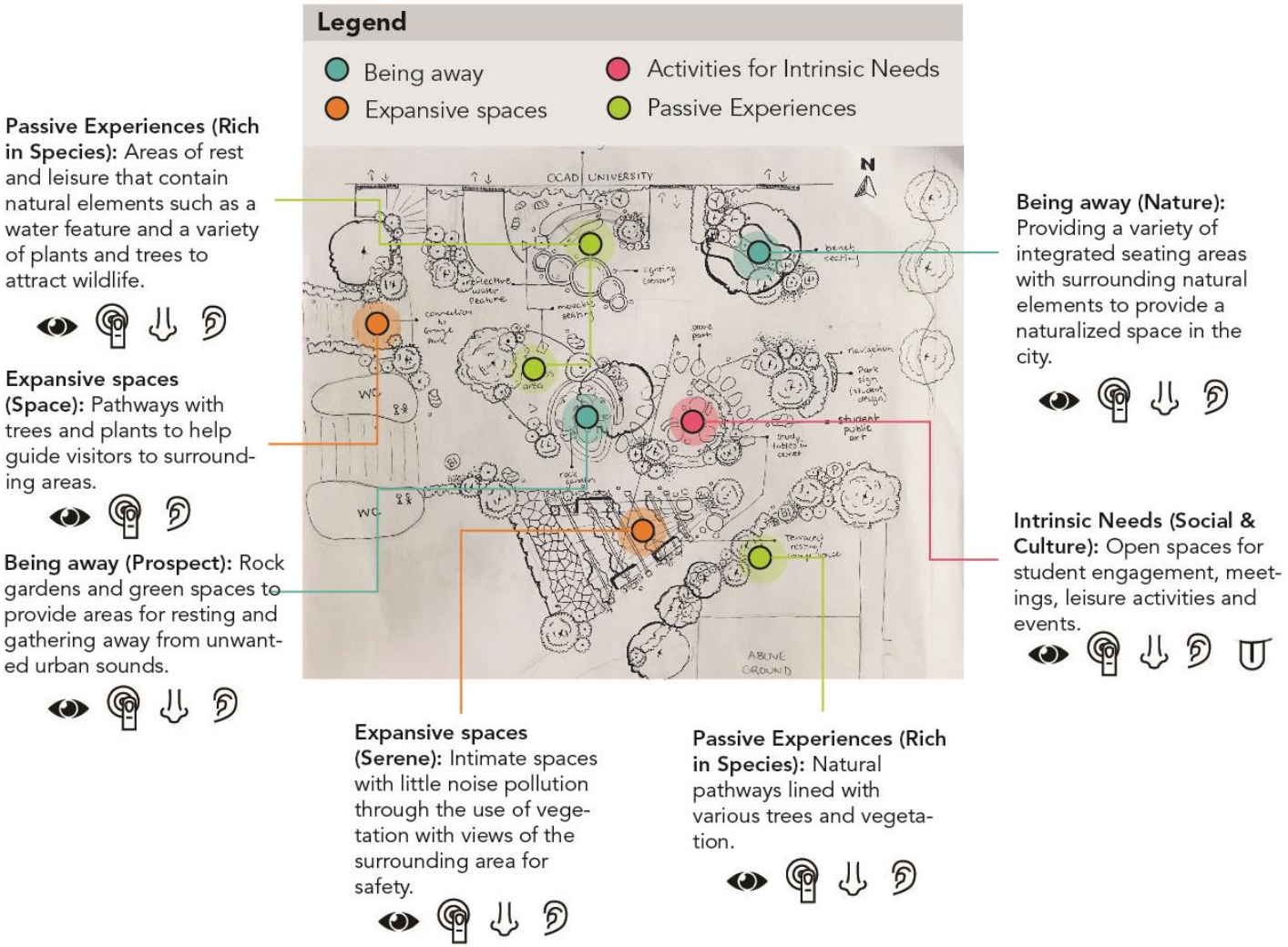


Figure 23. Concept Three for Butterfield Park.

As Keniger et al., (2013) suggests, a space should provide restorative features to help improve mental fatigue by minimizing the amount of urban stressors that a user may experience in the environment. In the design, there are three passive areas of engagement like the pond area, terraced trail and green space. These spaces were designed to create a distinctive natural setting in the park that would take the visitor away from their urban surroundings. The design contains unique and adaptive experiences that can be changed depending on the needs of the user. For instance, the open green space can act as a study, lounge or lunch area depending on the needs of the individual. The multi-sensory features in the space encourage people to experience the area using a variety of the different senses.

The three concept proposals propose various elements that work together to create a Multi-Sensory Environment that can help support student well-being on urban campuses. Each of the designs, provide unique features and techniques that can be incorporated into the final master plan proposal for Butterfield Park. The goal of the design is to create a variety of intimate and inclusive spaces that can provide a creative and welcoming space for students outside of the traditional campus environment. It will be a place for everyone to feel supported and reflect on how to incorporate design, culture and technology into an interactive environment.

Existing Conditions and Design Assessment

EXISTING SITE CONDITIONS

Butterfield Park is located at 100 McCaul Street West at OCAD University. The site is designated as an institutional general zone (2.0 x88) as termed in the provincial zoning-by law. Under this designation, the permitted uses include recreational, park and art gallery uses (Zoning By-law 569, 2018). The park is approximately 1,065 square meters in area and located directly under the Sharp Centre at OCAD University with an easterly frontage of approximately 30 meters along McCaul Street and a southerly frontage of about 40 meters along Grange Road. The majority of the site consists of a large open space with concrete seating around a central open area with trail access to Grange Road, Grange Park and McCaul Street. To the north of the park is the main building for OCAD University – the Sharp Centre – with two entrances and two exits. Grange Park is located to the west of Butterfield park and contains a large green space, dog park, playgrounds, and casual seating throughout the site. Further to the east and south, mixed-use residential and commercial buildings surround the park, which include the Art Gallery of Ontario and various restaurants within an 800 meter radius. Figure 25 illustrates the land use breakdown from the City of Toronto Official Plan (2015). The percentage breakdown for mixed use areas, residential, open space and

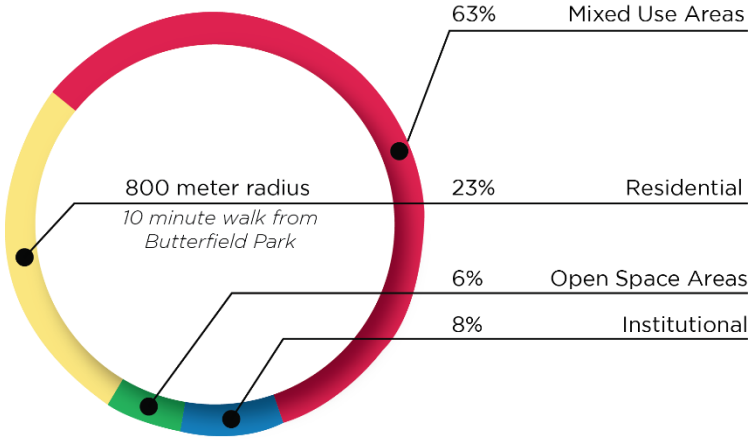


Figure 24. Land Use Breakdown (within an 800 meter radius of Butterfield Park)

institutional areas were calculated within an 800 meter radius of Butterfield Park. Mixed-use areas represent the majority of the land uses at 63%, followed by residential dwellings at 23%, institutional space at 8% and open space areas at 6%. These statistics suggests the need to prioritize the redevelopment of open space environments to create a balanced land use breakdown around the campus environment. Figure 26 outlines the sun and shade study for the month of March from 5AM to 6PM for Butterfield Park. The diagram illustrates the amount of sun exposure that the park will contain throughout the day. This study will help determine the plant selection and placement of each species depending on their sunlight requirements. For the design features, there will be seating and shade cover located in areas with high sun exposure to utilize the natural light in the park. These studies will help form the multi-sensory master plan to reflect an inclusive and open park design.

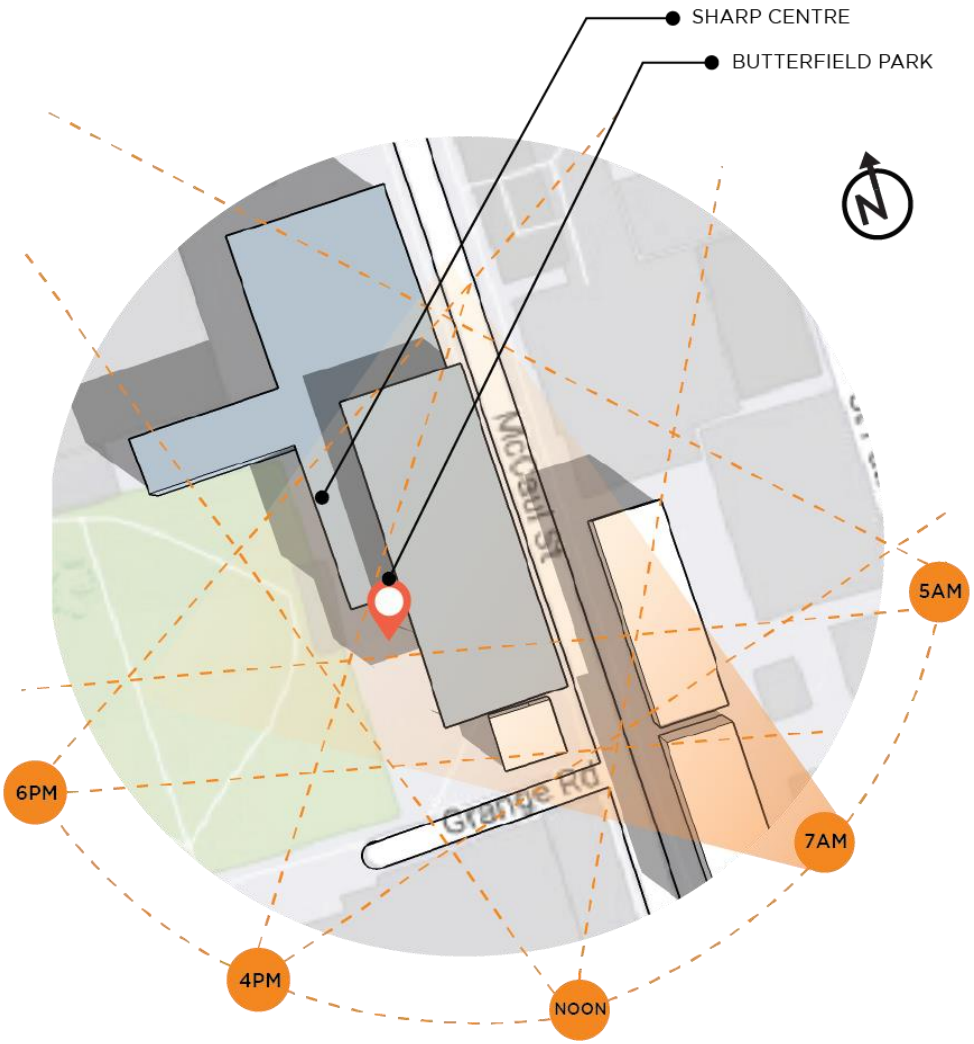


Figure 25. Sun and Shade Study for Butterfield Park in March at 7AM.

SITE ASSESSMENT

The vision for the redevelopment is to create a sense of place on the campus that reflects a sustainable and inclusive design that can educate, inform and engage the entire community. Butterfield Park will be designed to support student mental well-being by providing a place for rest and leisure away from the stressors of daily life. The location of the park is a transitional area to surrounding sites like Grange Park, the Art Gallery of Ontario, and OCAD University. However, in its current state, the connection of the park to the surrounding areas does not provide a memorable experience for visitors. The park is easily missed; sandwiched between the Above Ground Art Supplies Store, Grange Park and OCAD University. The services and amenities around the park include a public park, art gallery, various business and retail stores within an 800 meter radius, which is about a 10 minute walking distance from the park. The small size of the park creates a unique opportunity to introduce intimate interactive spaces for the university and community. The current uses for Butterfield Park include social events for the OCAD University community, public art space and community Tai Chi activities. The location and proximity of the park also lends itself well to connecting the community with the downtown amenities and services.

SWOT ANALYSIS

The current design and layout of Butterfield Park presents a variety of strengths, weaknesses, opportunities and constraints (SWOT). Figure 27 and 28 outline the main features that can be kept, enhanced or removed to create a restorative Multi-Sensory Environment to help support student wellness at OCAD University.

The strengths of the site include the overhead from the Sharp Centre building at OCAD University, which provides shelter and protection from the weather. The existing trees and plants in the park provide a stable growth environment for when new vegetation is introduced to the space. A key benefit is Butterfield Park's close proximity to various amenities and services like Grange Park, the Art Gallery of Ontario, subway lines and restaurants. According to Stigsdorrter et al., (2017) an important feature in an outdoor environment is the

Figure 26. Strengths and Weaknesses of the Existing Butterfield Park

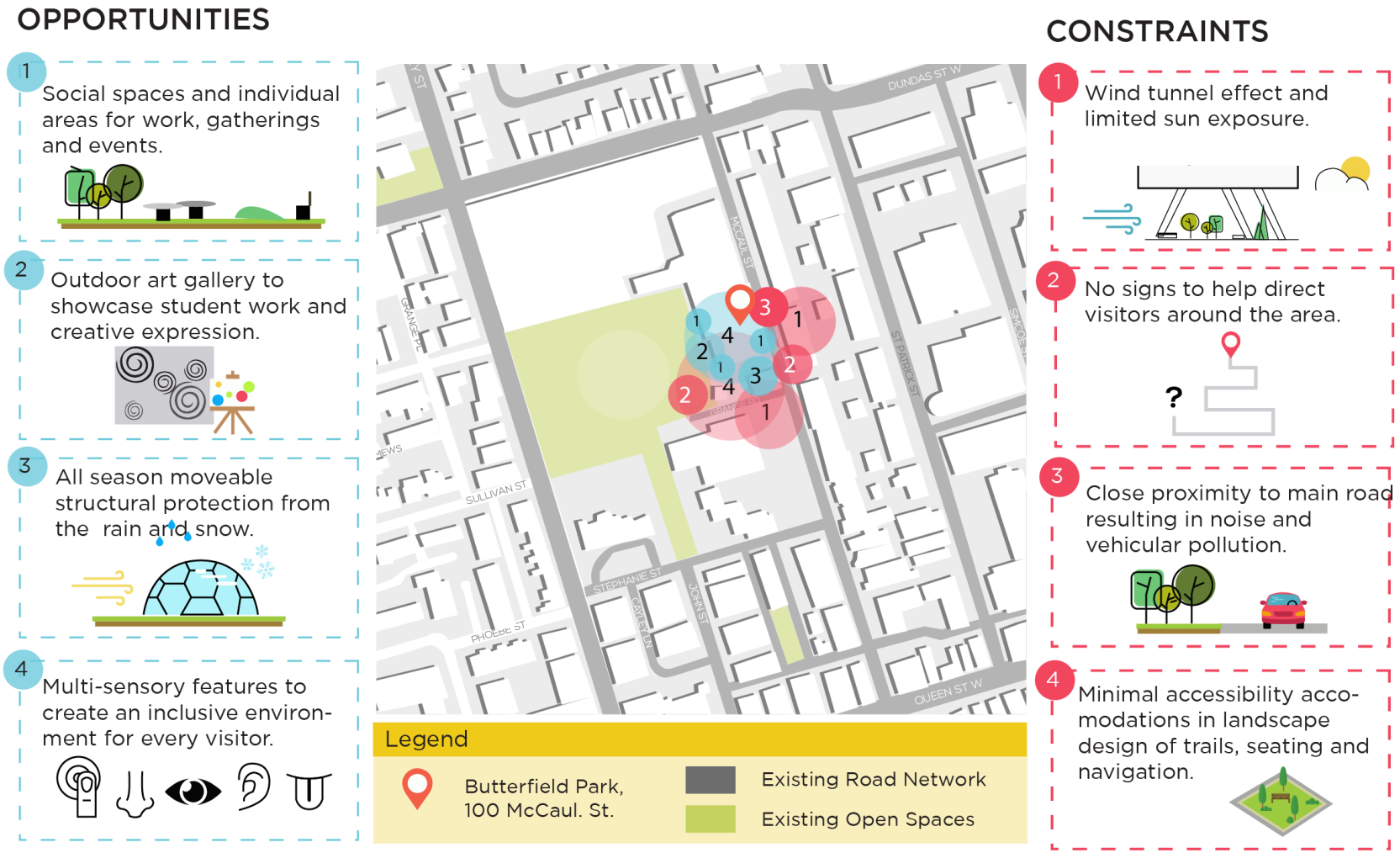


Figure 27. Opportunities and Constraints of the Existing Butterfield Park

social principal found in the perceived sensory dimensions. This principal outlines the essential need for services and facilities like museums and restaurants in improving the overall user experience. The proximity of Butterfield Park to various restaurants, shops and transit lines reinforces the goal of the social sensory dimension of providing features that visitors prefer.

The existing park design does presents some weaknesses, which include the lack of seating diversity and accessible design in the use of materials. Section 1.4.1 Benches and Seats of the Accessibility Design Guidelines (2004) states that exterior benches should include backrest and arrests for ease of transfer and movement. The lighting fixtures are not sufficient according to the design standards outline in section 1.5.2 of the design guidelines (2004), which suggests including lighting fixtures along pedestrian routes and entrances. Though, the current lighting is found under the cement seating, it is only able to illuminate the immediate seating area. Some constraints of the design of Butterfield Park include, the limited way finding features in the area that could help direct and inform visitors. This makes the park inaccessible to visitors who are new to the space, as well as those who wish to explore the surrounding environment. The surface texture used for the trails and pathways do not include a colour variation that would help notify users for when they are entering a new space. For pedestrian routes, in section 1.1.8 the accessibility design guideline (2004) recommends including a colour change between surfaces to help with navigation and use of the space.

The design opportunities for Butterfield Park can be seen in Figure 28, which include designing social spaces like a public art gallery and study areas for students and the community. As well as, providing moveable sheltered structures during the winter months in the park. A key design feature would be to introduce multi-sensory features in the environment to promote an inclusive and accessible space for everyone. By creating an adaptable space, users will feel a sense of belonging and engage in activities that meet their intrinsic needs, which is the purpose of a (Ohly, 2016).

Policy and Regulatory Framework

The provincial and municipal policy frameworks, as well as the design guidelines will help structure the design features and principles of the Butterfield Park redesign to ensure that the features comply with the regulatory standards.

PROVINCIAL POLICY STATEMENT

The Provincial Policy Statement (2014) provides an overview, “for appropriate development while protecting resources of provincial interest, public health and safety, and the quality of the natural and built environment”. For instance, Section 1.5 of the policy, ‘Public Spaces, Recreation, Parks, Trails and Open Space’, emphasizes the importance of developing healthy and active communities by providing a variety of open spaces in the built environment for recreational purposes (Provincial Policy Statement, 2014). These spaces can be used to help connect the community and to promote physical activity. Additionally, Section 2.1 ‘Natural Heritage’ outlines the importance of preserving, restoring and improving on natural features to maintain biodiversity and ecological health.

CITY OF TORONTO OFFICIAL PLAN 2015

As part of the vision for the City of Toronto’s Official Plan, the city will strive to design green spaces and public areas to bring the community together and introduce a variety of recreational activities to promote health and wellness to ensure everyone has a sense of belonging (Official Plan, 2015). In particular, Section 2.3.2 of the Official Plan states that, “Toronto is connected by a wonderful system of green space - from beaches and bluffs, through deep ravines, to parks and cemeteries. This system is vital to both our quality of life and to the health of our natural ecosystem...They should be protected, improved and added to whenever feasible (2-25).” This statement provides a strong incentive for open spaces like Butterfield Park to be designed and adapted to promote quality of the life and wellness, while protecting and improving the natural elements within the

community. Furthermore, the section outlines the importance of providing opportunities for both passive and active engagement through urban gardens and environmental education (Official Plan, 2015). In section 3.2.3, 'Parks and Open Spaces', the plan hopes to promote the use of private spaces like Butterfield Park to help increase community gardening and connections to the different open spaces in the city.

CITY OF TORONTO STREETSCAPE MANUALS AND ACCESSIBILITY GUIDELINES

The City of Toronto Streetscape Manual and Accessibility Design Guidelines echo the intent of the previous plans in establishing accessible, well-connected open space areas. The Streetscape Manual outlines the design and layout standards for paving, tree, furniture and lighting design. The Accessibility Design Guidelines (2004) outline the design specifications for accessible designs for trails, street furniture, lighting fixtures and wayfinding techniques. Both guidelines outline the importance of the site to provide accessible standards and be usable to all visitors of varying abilities and disabilities. In particular, sections 1.3 (Special Areas and Features), 1.4 (Outdoor Amenities) and 1.5 (Outdoor Support Systems) provide specific standards and policies on how to design an accessible and inclusive outdoor space. Additional policies outline the importance of visual and tactile tools to help with safe way finding within the environment. The redevelopment of Butterfield Park will ensure that the design features incorporated into the space will reflect the all of the streetscape and accessible design guidelines to provide easy access to all individuals. The City of Toronto Streetscape Manual (2019) contains the various guides to the street furniture, lighting and planting options for the city. The street furniture guideline suggests parameters and standards for benches, signs, planters, and street furniture size and placement. The redesign of Butterfield Park would use both the street furniture guidelines and accessible design guidelines to determine the proper structure and placement of these features. Furthermore, the lighting guide for the streetscape manual identifies the approved lighting fixtures for use in the city like pedestrian and wall lighting (City of Toronto Streetscape Manual, 2019). These options would be selected based on their accessible features as outlined by the accessibility guideline. Finally, the planting guide summarizes the

spacing and position for trees and plants which would be used in conjunction with the selected native trees located in Appendix D. Both the manual and guideline will ensure that the park is inclusive and well-designed.

OCAD UNIVERSITY ACADEMIC PLAN

The Academic Plan for 2017-2022 for OCAD University illustrates the goal and intent to create a sustainable and health conscious university that works with students in order to establish an inclusive and diverse community (OCAD University Academic Plan, 2017). The sustainability directive identifies the need to help maintain ecological health and social wellness. While the health and wellness principles outlines the university's goal to grow their research on health and highlight the solutions and responses to help in the success of the entire OCAD University community through graduate programs like Design for Health and provide educational training on the stressors and illnesses (OCAD University Academic Plan, 2017). The principles and goals set out by the Academic Plan are clear – OCAD University needs to grow as an innovative institution and community that encourages creative learning, inclusive practices and positive learning environments for students, faculty and staff (OCAD University Academic Plan, 2017). Butterfield Park can be emblematic of the ideals outlined by the plan with the university working together with students, staff and faculty to design an environment that reflects the university's direction. The redesign of Butterfield Park should be undertaken in a manner that ensures that these goals are upheld and that the design will meet the needs of all visitors.

Sustainability Practices and Accessible Design in Public Spaces

SUSTAINABLE LANDSCAPE DESIGN

The restoration of Butterfield Park will maintain the existing tree canopy and plant species currently on the site, as well as introduce more native herbaceous species that are Indigenous to the Toronto region. Indigenous plant species will help to enhance the biodiversity and adaptability of the park.

Some ecological strategies to help enrich the urban environment include the implementation of stormwater planters, bioswales and stormwater tree pits (Toronto Green Streets Technical Guidelines, 2017). Bioswale planters are well suited for small areas that are close to roads and streets with high pedestrian and vehicular traffic. These planters collect roadway runoff and overland flows from paved areas which helps reduce the risk of flooding (Toronto Green Streets Technical Guidelines, 2017). The bioswales can be placed in a planting bed with either grasses or other plant species, which can help reduce the erosion and runoff rates. These pits are designed to withstand the demands of an urban streetscape like McCaul Street West along Butterfield Park.

A second sustainable practice is to use stormwater tree pits which help collect runoff from the sidewalks and filter the water through the pit opening under a tree (Toronto Green Streets Technical Guidelines, 2017). These features combine both natural and manmade techniques to help enhance the sustainable longevity of the site. In terms of manmade surface material, sustainable techniques for the park can be to use pervious concrete and permeable interlocking bricks. Unlike normal concrete, the pervious material contains 15%-35% of void space, which will allow water to seep through the surface

(Toronto Green Streets Technical Guidelines, 2017). Furthermore, using permeable interlocking on pathways and trails allows water to move through the material to avoid runoff and overflow along the surface. Both of these techniques are well suited to be in urban streetscape environments.

Low impact principles include: using the existing natural elements to structure the design, improve runoff prevention, treat stormwater close to the source and educate the community (Low Impact Development Stormwater Management Planning and Design Guide, 2011). Low impact development practices can help preserve the existing foliage to enhance the urban tree canopies. Tree canopies are beneficial in reducing flood risks, absorbing carbon dioxide and mitigating the urban heat island effect.

A key strategy is to educate and train universities, cities and other communities on how to monitor and maintain the low development practices (Low Impact Development Stormwater Management Planning and Design Guide, 2011). The next step in the design development would be to meet with the OCAD University facilities department to determine the financial and management requirements to produce a multi-sensory garden on campus. Creating a low impact development is an essential practice in promoting sustainable and flexible design standards.

LOW MAINTENANCE PLANT SELECTION

Butterfield Park will include a variety of low maintenance and hardy trees, shrubs and plants to ensure the longevity of the natural features in the park. Given the unique location of the park, the maintenance requirements need to be considered when planting the different clusters of species around the park. The use of native and low maintenance species in the design can help improve the longevity and sustainability of the site Scattered plants require more maintenance than plants that are grouped into clusters (Racette, 2014). The Toronto Green Standard Tier 1, necessitates that 50 percent of the landscape species need to be water tolerant and native to the City of Toronto (Drought Tolerant Landscaping, 2012).

The key features of a low maintenance landscape needs tree, shrub and other species that are well adapted to the urban environment, can thrive in a variety of soil types and are tolerable to drought conditions (Racette, 2014). Figure 29 illustrates the low maintenance planting selection for the proposed landscape design of Butterfield Park. It is important to note that the low maintenance plants below belong to more than one low maintenance category like Lavender and Blue Spruce. These low maintenance solutions will ensure that the park is sustainable and long lasting. Ecological diversity in the plant selection is an essential feature to a sustainable landscape (Drought Tolerant Landscaping, 2012). There were five key low maintenance features that include (The Tree Atlas, 2019 & Drought Tolerant Landscaping, 2012):

LOW MAINTENANCE FEATURES

1. **Tolerant to Urban City Conditions:** Able to tolerate urban pollution and urban pedestrian traffic
   - Grey Birch, Gold Dogwood, Bush Violet
2. **Soil Tolerance:** Adaptable to soil conditions
   - Red Maple, Blue Spruce, Rosemary
3. **Drought Tolerant:** Does not require regular watering
   - Sassafras, Ninebark, Pin Cherry, Big Bluestem, Pineapple Sage, Lavender
4. **Winter Hardy:** Maintains foliage into the winter and creates visual interest during winter months
   - Lavender, Yew, Rosemary, Blue Mouse Ears, Snowy Mountain Ash, Bearberry
5. **Minimal Pruning:** Maintains foliage and does not leave a lot of debris on the ground
   - Velvet Boxwood, White Cedar, Blue Spruce, Bearberry

Figure 28. Low maintenance Native Tree, Shrub, Flower & Herb Species (The Tree Atlas, 2019, Drought Tolerant Landscaping, 2012)

ACCESSIBILITY AND INCLUSIVE DESIGN LANDSCAPES

In designing a Multi-Sensory Environment, it is essential to include inclusive design features in the development of trails, seating, lighting and planting strategies. The City of Toronto Accessibility Design Guidelines (2004) outlines the standards and requirements in creating an inclusive outdoor space. Figure 30 illustrates the accessibility features and standards that will be implemented in the redevelopment of Butterfield Park.

During the winter months, the use of radiant heating devices at the entrances can help clear ice and snow (Accessibility Design Guidelines, 2004). All street furniture should remain on one side of the pedestrian pathway as well as use a different surface to indicate a change in area. This includes allocating space for wheelchair users beside benches and tables. All surface and pathway textures will be stable and slip resistant to ensure that movement is not impeded and hazards are avoided. The light fixtures should be positioned in areas that minimize the amount of glare for pedestrian navigation and use in the space, as see in Figure 30 (A).

The signage boards will have secondary lights to ensure ample visibility to help with navigation. Along with lighting, other directional tools like braille and audio devices will be available for use at the various spaces in the park (Accessibility Design Guidelines, 2004). The planting and tree arrangements will be clustered together and away from the trails to not obstruct the path of the pedestrian.

Figure 30 (B) outlines the accessible design standards for seating, signage and tree placement along pathway system. The tree branches will not interfere with the pedestrian trail and be placed along one side of the pathway like the street furniture guideline to ensure easy access and movement (Accessibility Design Guidelines, 2004). When introducing an interactive garden feature a good practice is to include raised planting beds with fragrant plants to improve the multi-sensory experience and accessibility standards. The accessible design principles will enhance the usability of the park spaces and encourage community engagement. The goal of the proposed design is to provide easy access and function to all individuals regardless of their abilities.

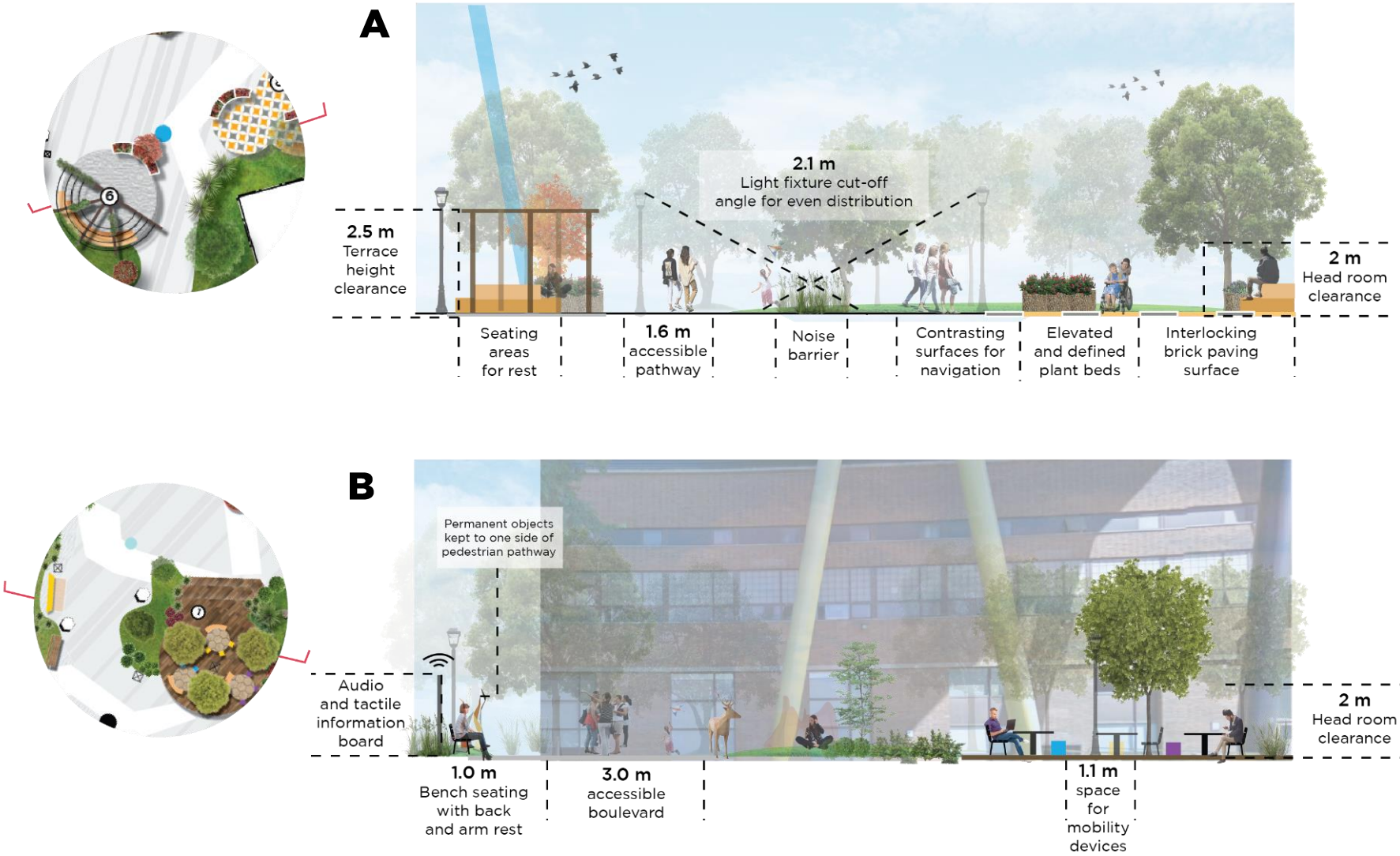


Figure 29. (A) Recommended Accessible Design Features for Clearance, Pathway, Surface material and Noise reduction. (B) Recommended Accessible Design Features for Signage, Clearance and Seating. (Accessibility Design Guidelines, 2004).

Master Plan Design and Vision

THE VISION

Butterfield Park creates an opportunity for a cross-disciplinary and multi-sensory development that will enhance the mental health support and inclusive design structure for the community. The park will bring a sense of place for students, staff and faculty at OCAD University and highlight the biodiversity in the urban environment. It is important to acknowledge that Butterfield Park and OCAD University are on the ancestral and traditional territories of the Mississaugas of the New Credit, the Haudenosaunee, the Anishinaabe and the Huron-Wendat, who are the original owners and custodians of the land on which we live, work and create. The purpose of the redevelopment of Butterfield Park is to establish an inclusive environment where students and the community can enjoy, use and transform the space according to their needs. The goal is to make the Butterfield Park become a unique, interactive and safe environment for everyone.

GUIDING PRINCIPLES

1. To **preserve and revitalize** the existing natural features in the park and introduce native species that are sustainable and adaptable to the urban environment.
2. To promote **sustainable landscape design** and enhance the biodiversity population.
3. To establish **a sense of belonging and place** through recreational and leisure activities that help support mental and physical health.
4. Incorporate spaces that help **foster creative thinking and innovation** outside of the classroom.
5. To **design a multi-sensory environment** that reflect the inclusive design standards and practices to create a space for the whole community.

PRECEDENT DESIGNS

Each precedent image represents the inspiration for the multi-sensory spaces in the redesign of Butterfield Park. The features include creative spaces for socialization and independent study, as well as accessible landscape design and inclusive design practices like raised planting beds and sloped pathways.

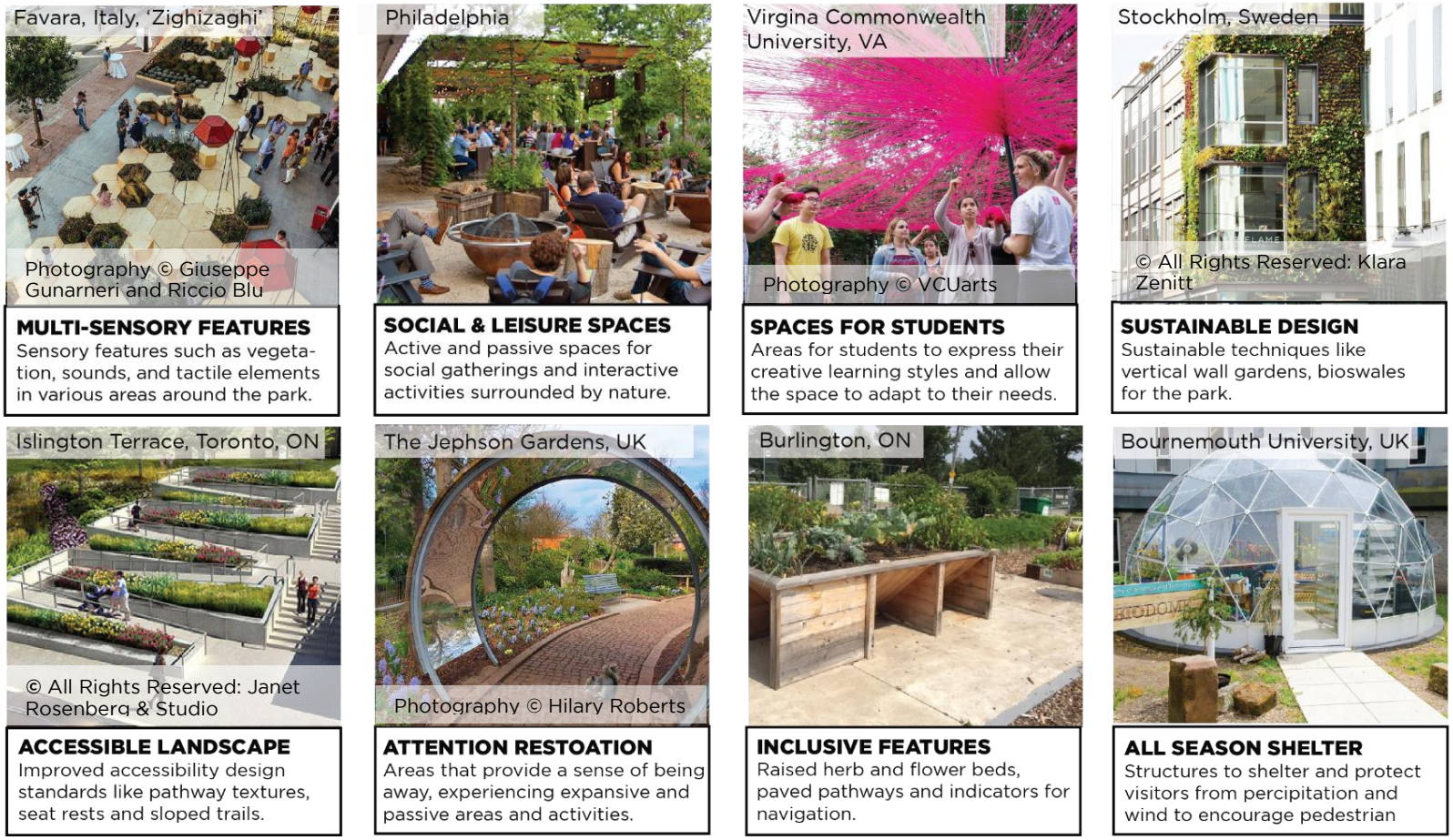


Figure 30. Precedent images to help design the Butterfield Park Master Plan.

MASTER PLAN

Figure 32 illustrates the proposed master plan for Butterfield Park. The design includes ten multi-sensory areas, which were co-developed from the literature review, interviews, online survey and co-design workshops. The spaces include,

1. **Study and Lounge Space** a key feature that participants felt was important in an open space design. This feature provide learning spaces and encourage students to work and gather outdoors, which will enhance their sunlight exposure and create unique spaces that meets their needs (Bedrosian and Nelson, 2017, Ohly 2016).

2. **Resting Rock Garden** a serene and calming quality to the park while addressing the noise issues coming from traffic and construction along McCaul Street. This feature reflects the goal of the Attention Restoration Theory in providing passive experiences that can help connect humans with nature (Stigsdorrter et al., 2017, Ohly, 2016).

3. **Water Fountain** feature provides an additional natural setting and produces white noise to sooth and help mitigate the urban sounds that visitors may want to avoid like traffic. In terms of sustainability, the water feature can act as a stormwater basin to collect runoff and reduce flooding risks in the park (Toronto Green Streets Technical Guidelines, 2017).

4. **Student Art Gallery** will address the OCAD University communities' innate needs by providing a space for creative thinking and development (Detwiler et al., 2012).

5. **Workout Space** will help promote physical activity for the OCAD University Community as the institution does not have an on campus physical education center.

6 **Terrace Lounge Space** contains clusters of plants and trees that provide a living space for visitors to interact with the natural features. The platform seating will include back and arm rests to improve the accessible design to help encourage use of the park and surrounding spaces (Accessible Design Guide, 2004).

7 **Sensory Garden** incorporates sensory integration to help build an accessible and adaptable support system that encourages individuals to interact with their surroundings through self-motivation and helps to improve the social, mental and physical development of the whole community (Balode, 2013).

8 **Interactive Art Space** creating pockets of passive and active spaces through the use of multi-sensory designs like interactive public art will provide unique experiences for visitors who are looking for ways to relax and enjoy the space in a naturalized urban environment (Keniger et al., 2013).

9 **Accessible Information Board** audio, visual and tactile information boards will be placed at the two main entrances of the park to help with accessible pedestrian navigation as directed by the Accessible Design Guide (2004). Figure 33 demonstrates a potential design for the information board.

10 **Urban Bioswales** will be implemented along the edge of the sidewalk on McMcaul Street West to collect stormwater and runoff, which will help reduce flood risks and maintain the plants and trees (Toronto Green Streets Technical Guidelines, 2017).

94 - ***Figure 31.*** Aerial View of Proposed Master Plan for Butterfield Park

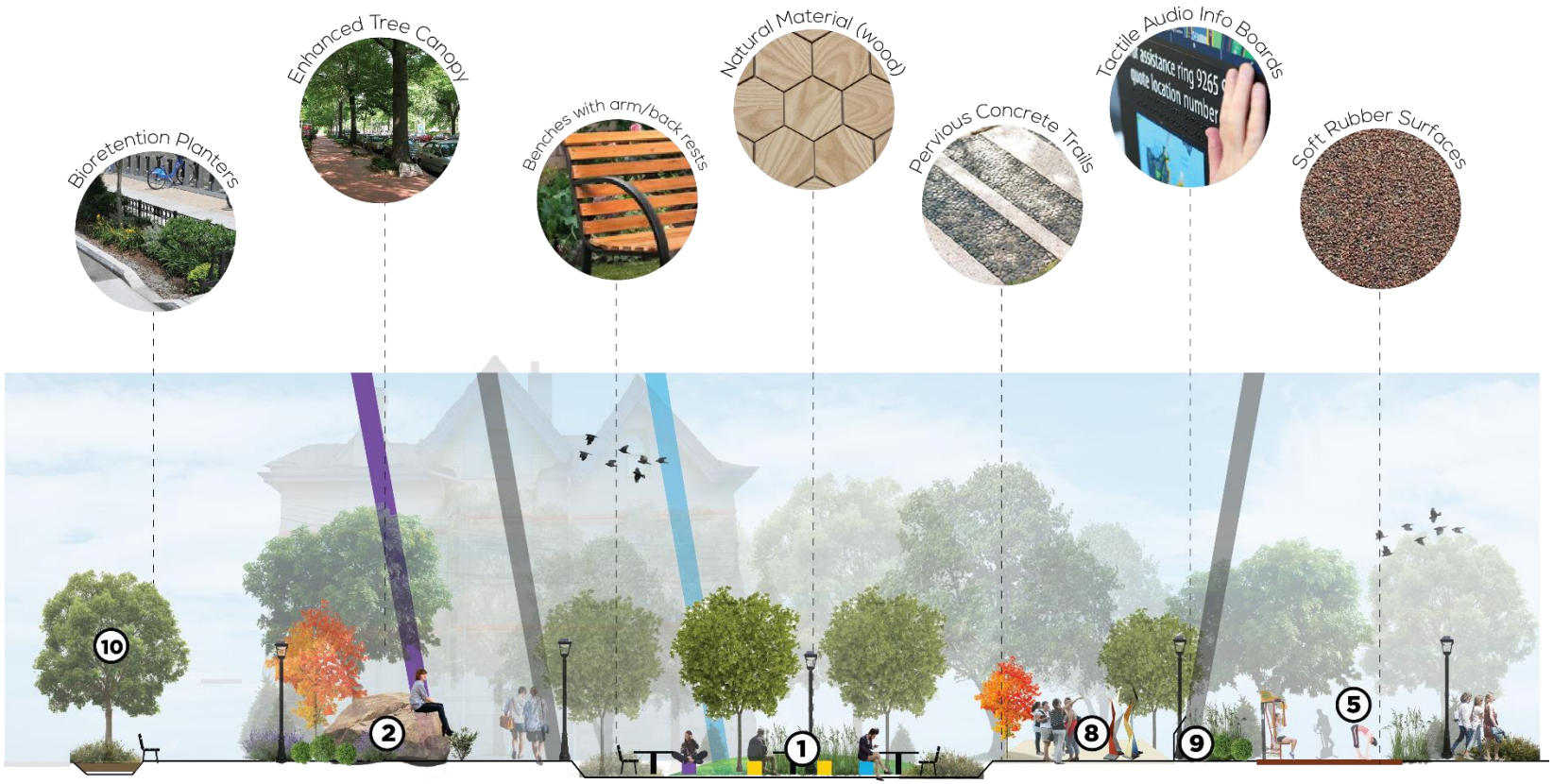
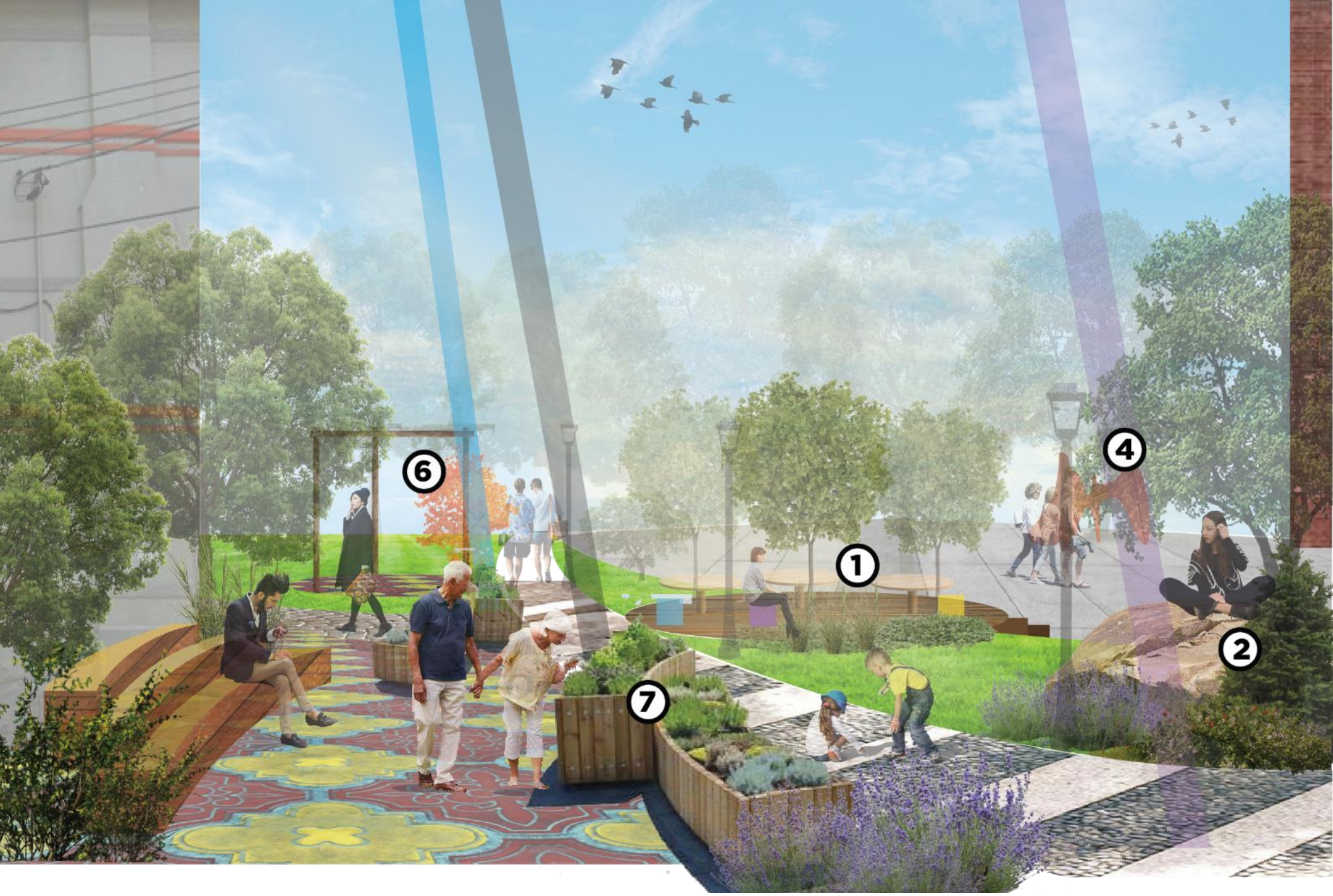


Figure 32. Proposed Sustainable and Accessible Features for Butterfield Park.



96 - ***Figure 33***. Proposed Landscape Design for Butterfield Park showing the Sensory Garden, Rock Garden, Pathway System and Study Spaces.

PLANT SELECTION AND DISTRIBUTION BASED ON SUNLIGHT ACCESS FOR DESIGN

Recommendations from the literature review, expert interviews with landscape architects, as well as the co-design workshops informed the development of the planting list for Butterfield Park. As seen in Chapter Two, the RBG Rock Garden design used native plants and vegetation to help enhance pollination rates and provide a bold colour palette for seasonal interest (CSLA, 2017). Similarly, the Native Child and Family Services Roof Garden used native and hardy perennials, conifers and herbs to reduce maintenance needs. Examples of native plant species include the Bush Violet, Coneflower and Lavender provide a vibrant feature in the park, which help to attract insects and birds to enhance pollination and decrease foliage debris (The Low Allergy Garden, 2016).

Unlike these species, some pine and birch types produce a higher level of allergens than evergreen and conifer species. Native trees like Blue Spruce and White Cedar were selected as low maintenance options as their foliage remains on the branches throughout the seasons (Drought Tolerant Landscaping, 2012). Native species are recommended for restoration areas as they can adapt and tolerate the climate and soil ranges in urban environments (Racette, 2014). The plant selection was influenced by the shade and sun levels of Butterfield Park, which used SketchUp, a 3D modelling system to simulate the sun exposure rates. The location of the park under the Sharp Centre at OCAD University requires a different planting scheme because of the limited sunlight levels. Trees and shrubs rely on sunlight to flourish in the early stages of growth, however, given the decreased sunlight exposure the growth and canopy sizes of each species will change (Takagi and Gyokusen, 2004).

Figure 35 outlines the sun and shade exposure for Butterfield Park during the cold and warm months of the year. During the afternoon, the west and south side of the park have high levels of sun exposure during both winter and summer months. Partial sunlight can be seen in the morning and evening hours in the summer with less sunlight during the winter months. The indications from the sun and shade study, illustrated the sites preference for species that could grow in partial sun to full shade. Figure 36 illustrates the proposed planting plan for

Butterfield Park, as well as the sensory applications that different plants can offer to the environment. For instance, herbs like Pineapple Sage, Rosemary and Lavender have been placed at key entrance points along McCaul Street and Grange Park to create a multi-sensory navigational technique using memory and scent recognition (Perry et al., 2018 and McCaffrey et al., 2009). It was important to organize the trees, shrubs and plants in clusters that create various sensory stimulations for scent, touch and sound. Lamb's ear has a unique texture when touched and Sweet fern releases a sweet scent during the summer months. Combining natural and man-made elements can contribute to the unique experiences at Butterfield Park. In Figure 37, the planting arrangement was organized according to the amount of sunlight the park is exposed to throughout the day. For instance, Sassafras trees and coneflowers can thrive in shaded and partial sunlight areas and produce a vibrant colour and scent during the changing seasons (The Tree Atlas, 2019, Tree Planting, 2019). Each tree, shrub and plant was placed around the site according to the sun and shade diagram. The trees, shrubs and plants were selected based on their sunlight needs, growth rate and sensory outputs.

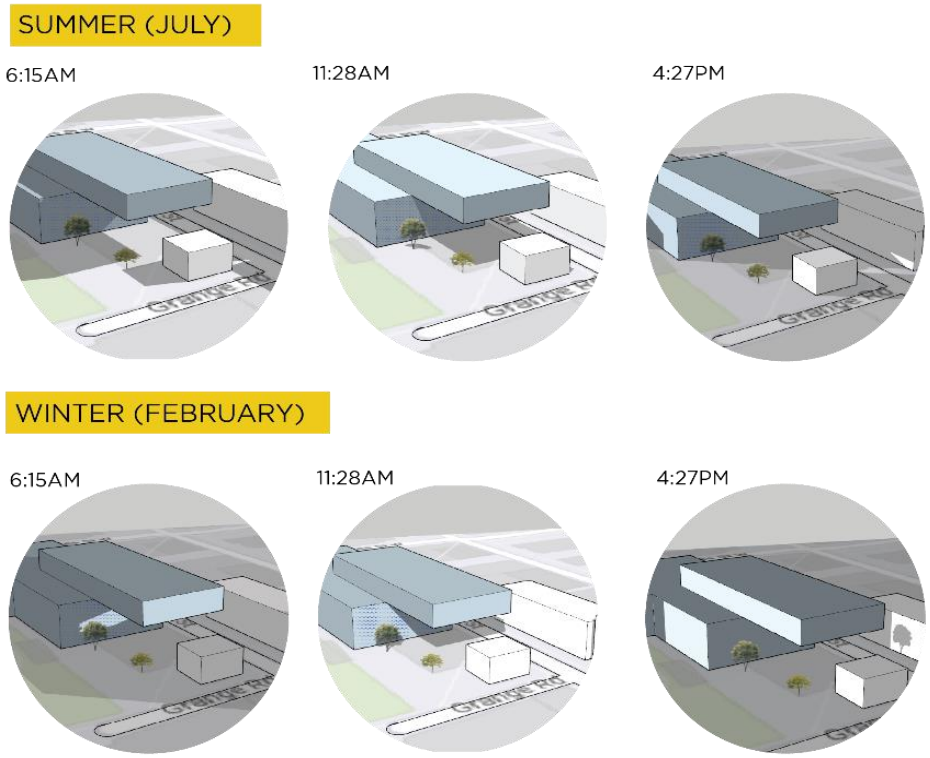


Figure 34. Sun and Shade Study of Butterfield Park for July and February.

99 - ***Figure 35***. Planting Plan Proposal for Butterfield Park and Sensory Applications of Plants.

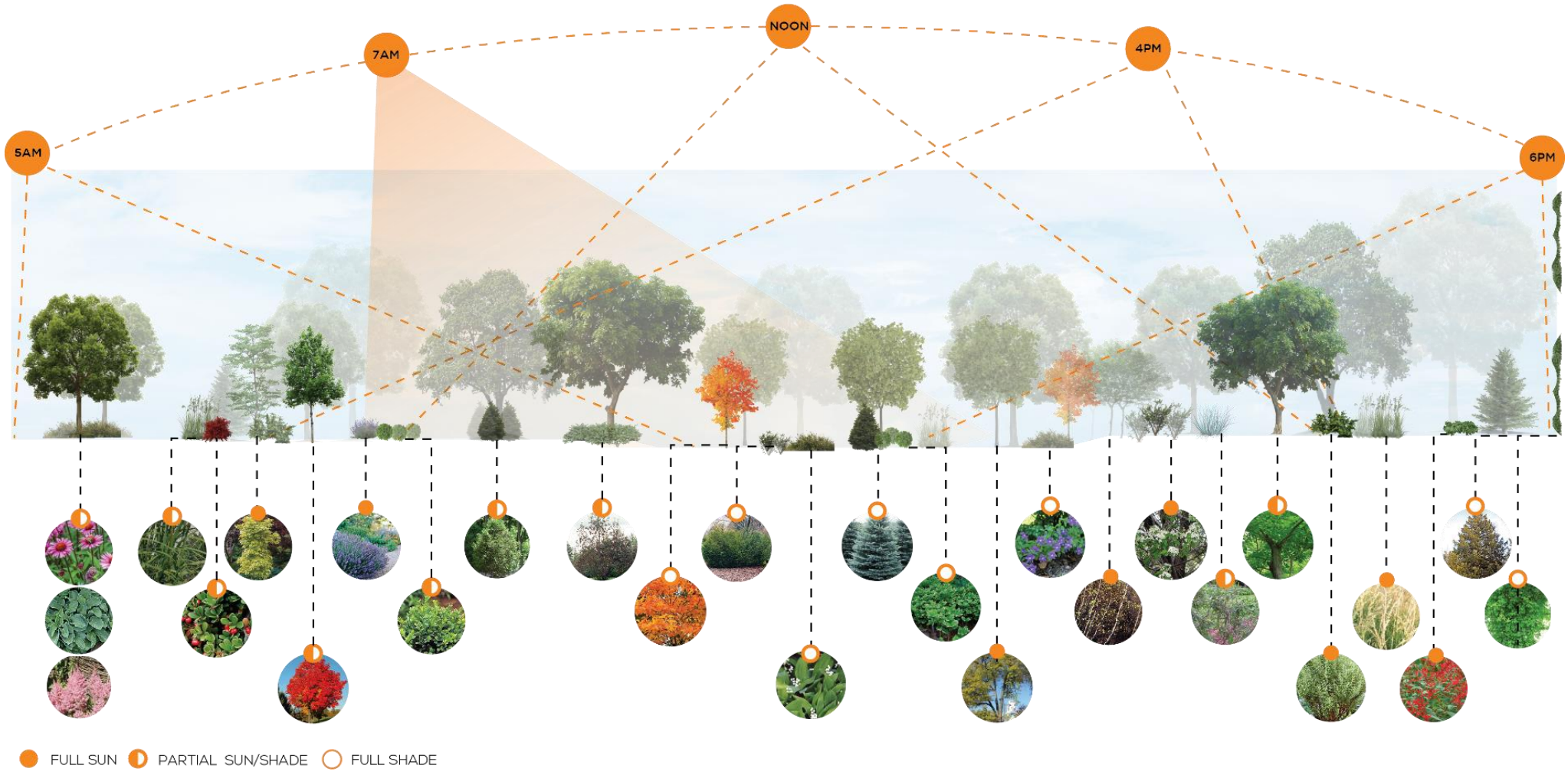


Figure 36. Sun and Shade Cycle for Butterfield Park at 7AM in July and Planting Distribution.

Natural light was an important feature to incorporate in the design. Exposure to natural light is encouraged because it can help improve the brain's productive processes (Bedrosian & Nelson, 2017). Given that the majority of Butterfield Park does not have high levels of sunlight throughout the day, the spaces and seating arrangements should be organized to maximize the amount of interaction and socialization in sun exposed areas.

Natural elements like Rosemary, Lavender and Pineapple Sage possess natural qualities that improve mental health. These herbs provide natural remedies that can improve memory retention and relieve stress (Perry et al., 2018, McCaffrey et al., 2009). Pittenger (2011) suggests creating spaces that create a sense of place and belonging by tapping into a person's memory. By providing features that promote comfort, safety and recollection the space can create strong sense of community for OCAD University (Pittenger, 2011). It is important to understand how plant selection can influence health through sunlight and adaption in an urban environment like Butterfield Park.

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MULTI-SENSORY ENVIRONMENT DESIGN AND SENSORIAL EXPERIENCES

Multi-Sensory Environments (MSEs) are spaces created to help improve human cognitive and physical abilities. This is accomplished through various passive and active sensory features and stimulations in a semi-controlled environment (CDHAF, n.d.). The environment uses the five senses to create interactions that can be adapted and changed depending on the needs of the user. It is a technique that promotes both leisure activities and social interaction to help support and encourage self-care and development for all users (Collier & Truman, 2008).

A therapeutic garden contains natural elements that stimulate the senses through interaction with plants, trees and other natural features (Detweiler et al., 2012). The purpose of the garden, is to provide multi-functional features such as, trees that can act as a shade canopy as well as, release calming aromas. The structure of the pathway system help create movement and engagement between the individual and the environment which can enhance their social interaction and connection with the wider community.

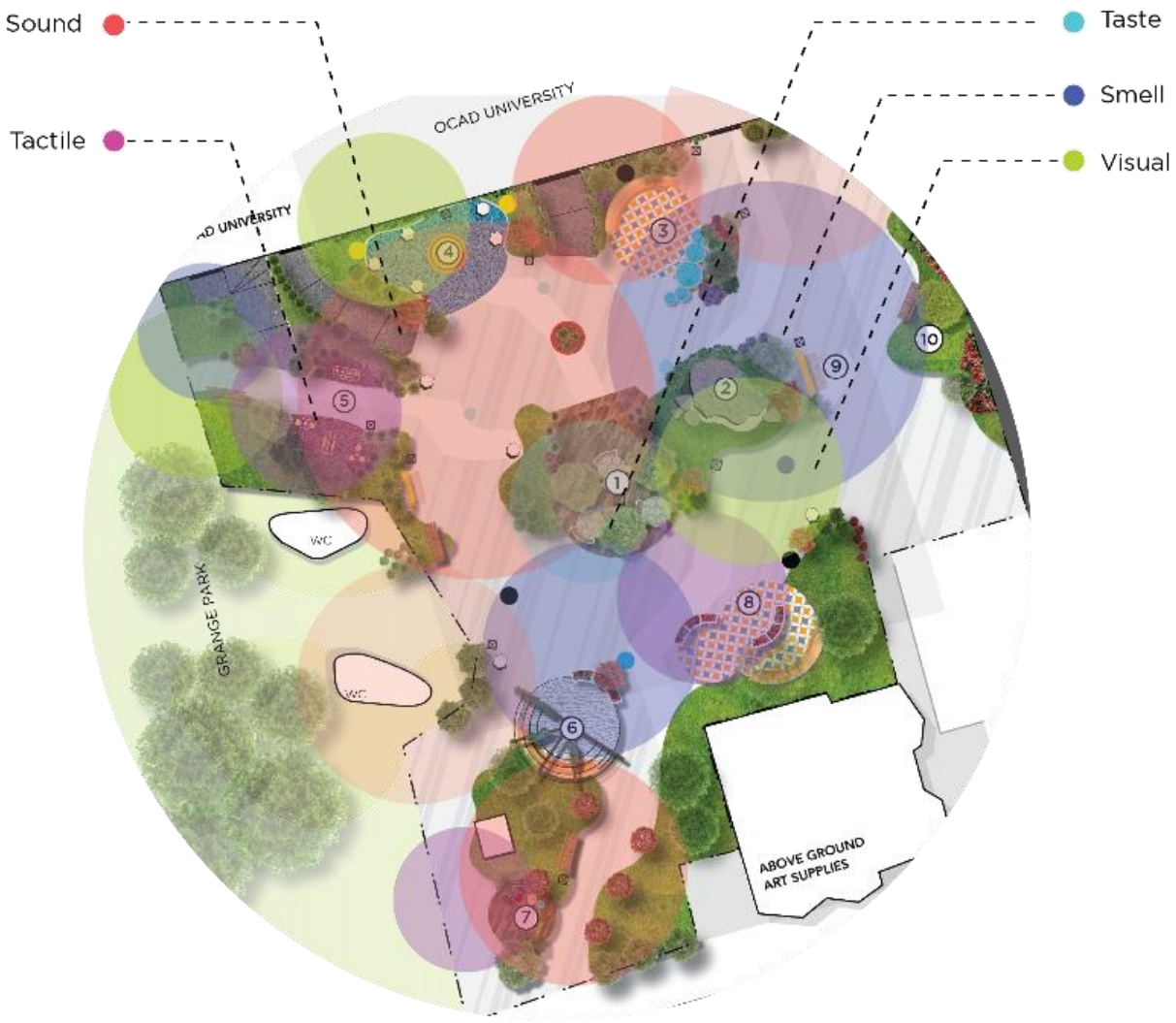

Figure 37. Proposed Sensory Experiences in Butterfield Park.

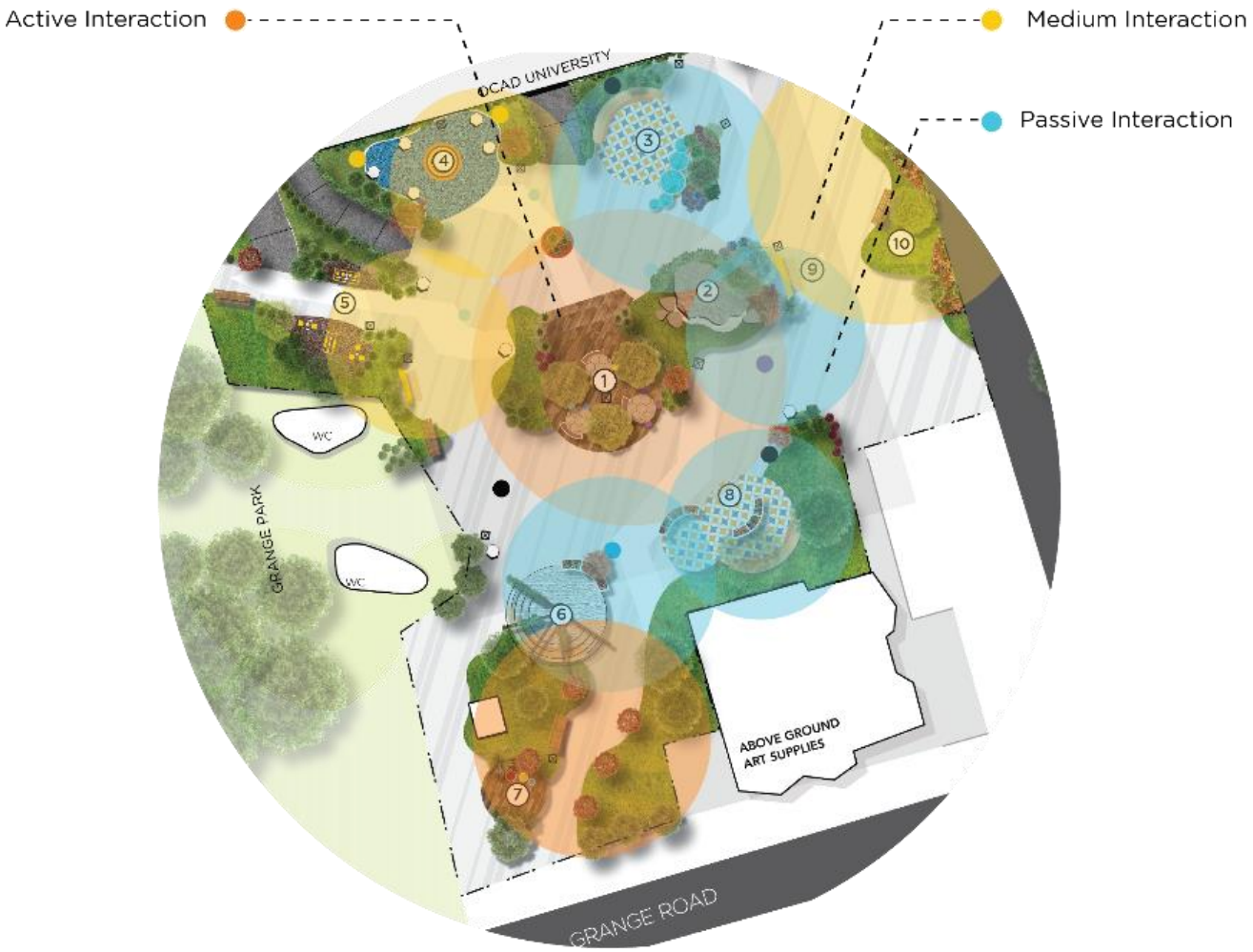

Figure 38. Proposed Levels of Interaction in Butterfield Park according to spaces.

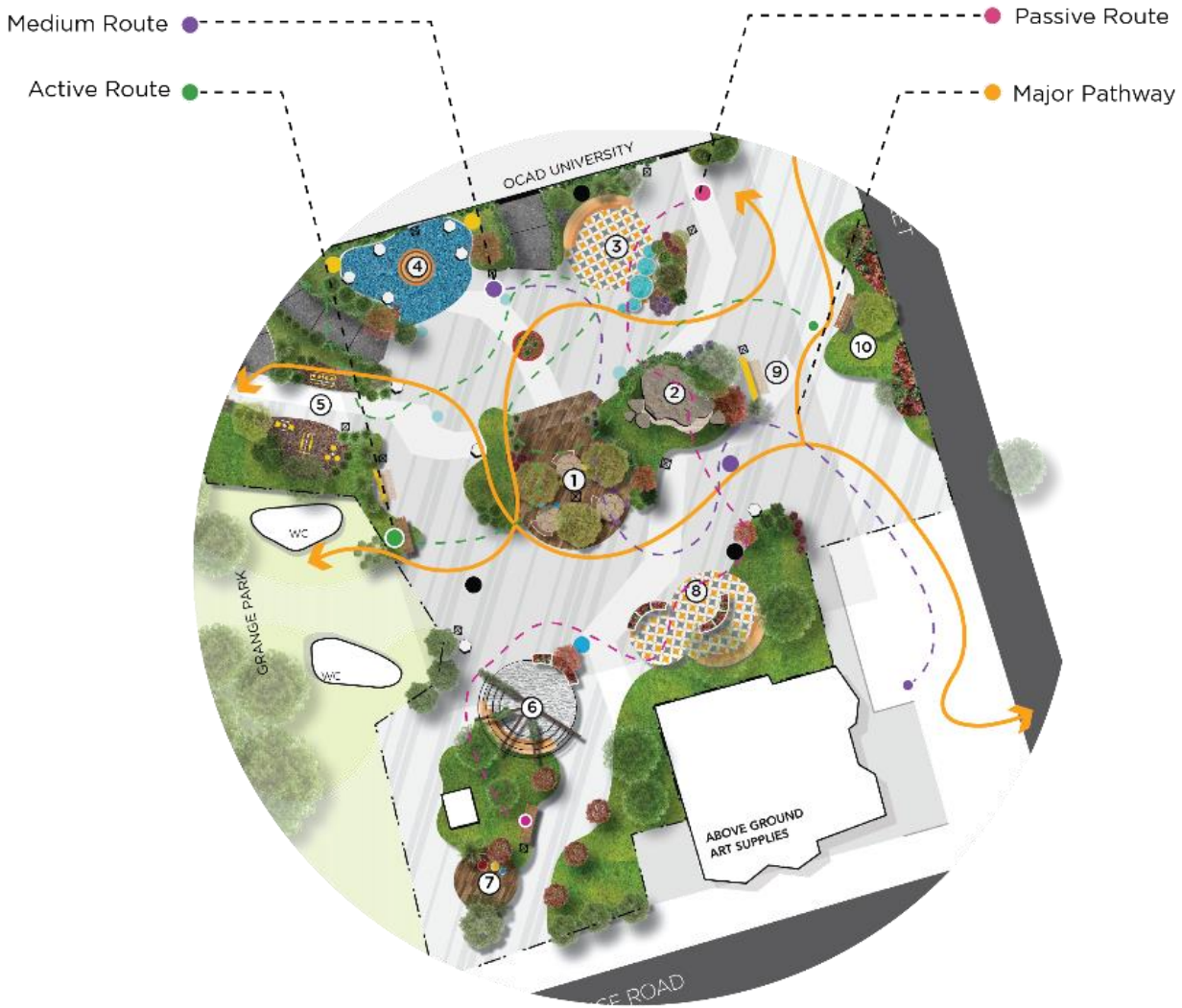

Figure 39. Proposed Circulation and Interaction Routes for Butterfield Park.

Figure 38 illustrates the sensory space allocation for the proposed design of Butterfield Park. A key design feature was to place lavender, rosemary and pineapple sage at the major pathway entrances to create a multi-sensory indication for users when they visit the park. Areas like the interactive sensory garden and rock garden contain two sensory stimulations to ensure that a person would not experience overstimulation. These areas contain soft and hardscape features that create a passive experience and uses a person's voluntary attention in order to decrease mental exhaustion, as outlined in Figure 39 (Keniger et al., 2013).

Spaces like the art gallery, workout area and study space contain three to four sensory stimulations as these spaces are medium and high engagement areas. These spaces are designed to encourage social engagement, collaboration and activity. Keniger et al., (2013) outlines the three areas of human and natural interaction as indirect, incidental and intentional interaction. Studies have indicated that these connections with the natural environment can have a positive improvement on an individual's mental health and emotional state (Stigsdorrter et al. (2017). Activities that help restore mental fatigue include, walking in the forest, biking along a pathway or looking at tree from a window (Keniger et al., 2013). The restorative goals for Butterfield Park are to incorporate the different types of engagements to help ease visitors into the different areas around the park. Based on the different interactive spaces, a circulation key was created in Figure 40, to illustrate the main pedestrian routes around the park, as well as the different routes according to the level of interaction a visitor would like to experience. The active route seen in green would take the person to the workout area, study space through Grange Park and around the front of the OCAD University building. Whereas, the passive route in pink, would include quieter spaces like the terrace space, sensory garden and rock garden. The survey results suggest that there is a need for more connection to green spaces around campus, as well as creative spaces for student art and socialization. The park spaces like the musical space, art gallery and interactive garden help address the needs of the OCAD community. A redesign of Butterfield Park would encourage the use of multi-sensory spaces, experiences and accessible features to establish a supportive and interactive environment.

6 CHAPTER SIX: DISCUSSION

THE FUTURE OF INCLUSIVE AND SUSTAINABLE DESIGN PRACTICES

In this chapter, the multi-sensory design concepts in relation to student mental health will be further assessed in the transferability of the design into the urban city, workplace structure and post-secondary institutions. The application of the design proposal for multi-sensory environments has the opportunity to expand to different innovative, sustainable and inclusive ideations beyond the urban campus.

Design Strategy

The planning process in developing a multi-sensory master plan for the Butterfield Park involved a staged method of expansion. It involved a review of the existing design practices and mental health procedures, as well as identifying the end user needs for an inclusive and accessible landscape design. The design strategy is broken down into four phases:

Phase 1: Conduct a literature review of examples of existing sensory gardens and restorative environment benefits, as well as mental health programs in post-secondary institutions to identify gaps in the research. Work with Landscape Architects, Healthcare Professionals, and the end users to understand the important features and needs of the visitors.

Phase 2: Host a co-design workshop to co-develop multi-sensory design ideations for the Multi-Sensory Environment. This stage included a site visit, an overview of multi-sensory design and sensory stations.

Phase 3: Identify and organize the essential themes for the multi-sensory space which include, sustainable and accessible design standards, planting selection, compliance with official plans and guidelines, as well as the important multi-sensory applications in relation to mental health in for the space.

Phase 4: Develop visualizations and plans with continual communication with end users and stakeholders, which outline the key design features that help support mental health in an outdoor environment.

CREATING A MULTI-SENSORY STANDARD FOR DESIGN APPLICATIONS

Designing an inclusive community should be at the forefront of planning development. The design and mental health frameworks have focused on self-reported studies, interviews or other information flow methods of data collection. An alternative inclusive approach would be to engage participants from the beginning and allow them to co-design the environment to better reflect their needs, as well as establish adaptable design features. The human-centric method will enhance and support social and physical interactions which, in turn can help enhance healthy urban living (Willson, 2017).

Standards like the LEED certification for green buildings, the Accessibility for Ontarians with Disabilities Act (AODA) and the City of Toronto Accessible Design Guidelines (2004), address the planning and design challenges for the built environment. A drawback of using a single guideline is that the design may not create a fully functional design for all users. Designing for mental health should not be the responsibility of healthcare professionals alone (Barton & Grant, 2013). The protocols in place should consider mental health and well-being when designing public spaces for human interactions. The multi-sensory design for Butterfield Park takes the strategy a step further by linking the different policies in order to address the accessible and inclusive needs of all of the users. There is no single solution to designing an environment that supports an entire community. It requires a variety of expertise, development and iteration to identify the qualities and interactions that will produce supportive and healthy environments. Recognizing the diverse perspectives and ideas of the community will be beneficial to the design outcome. Along with the design standardization, the multi-sensory strategy can be used to help educate and enlighten future designers, planners, and landscape architects to generate a collaborative community engagement project, which focuses on participant co-design structures to create future communities for mental, physical and social improvement.

Importance of Multi-Sensory Environments on Urban Campuses

MULTI-SENSORY SPACES AS A STANDARD FOR STUDENT MENTAL HEALTH

Detweiler et al., (2012) states that a sensory environment is created to stimulate the users, while catering towards other environmental needs like protection and sustainability. Every person is unique and possess different practices that help them alleviate their stress. According to Stigsdorrter et al. (2017), the four principles of a good restorative environment include, a fascination with the space and its elements, a sense of being away, and the scope and compatibility with an individual's preferences. These core values are essential to the success of an outdoor multi-sensory design in creating a connection with the community. The connection that humans have with nature can be reflected through the concept of biophilic design, where the space uses natural features as a buffer against the negative impacts of the built environment like stress from school, while boosting well-being and foster creative thinking (Kellert and Calabrese, 2016). Studies have shown that indirect, incidental and intentional contact with nature contributes to positive cognitive functions (Keniger et al., 2013). When participants were exposed to natural elements through one of the three connections, their emotional responses showed positive changes to their levels of anxiety and social behavior. It is important to note, that the majority of Multi-Sensory Environments have been designed for hospitals and mental health institutions. The introduction of these designs into the post-secondary environment can further support students throughout their academic career.

The response from the interviews and surveys highlighted the importance that green spaces afforded for student alleviation. The activities that students attributed to

helping with their coping skills included resting in the park, walking along the trails, reading and being in a quiet environment. These insights suggests that students do value their time in the outdoor environment, as well as, addresses the second research question in how natural features help with the daily stressors. Every individual is different and therefore, the multi-sensory design should reflect a flexible and inclusive practice.

For the purposes of this study, the Multi-Sensory Environment was created and co-developed to help support student mental wellness at OCAD University. By creating a unique and adaptable space, the park can help support students by offering a range of spaces and engagements that work to restore their physical and mental functions. By understanding the needs of the community and incorporating natural elements into the design; the multi-sensory space can become a support structure for students and the broader community. The qualities and goals of a Multi-Sensory Environment address the first research question of creating an inclusive space on campus to help care for student health.

TRANSFERABILITY TO OTHER URBAN CAMPUSES AND ENVIRONMENTS

Boyce et al. (2006) suggests that educational institutions have the responsibility to provide spaces that promote healthy and safe engagement. The design proposal for Butterfield Park integrates sustainable, inclusive and multi-sensory elements to create an innovative design solution for a healthy campus environment. The redevelopment would preserve the existing vegetation and landscape development to ensure that the ecological integrity of the site is maintained. The integration of low maintenance native plant species and surface textures will help reinforce the structure of environment.

Urban campuses like Ryerson University and Concordia University have plans to revitalize their green spaces. The multi-sensory design of Butterfield Park can be transferred to these campuses to help develop an inclusive and sustainable design standard. Ryerson University has developed a Campus Public Realm Plan (2017) that aims to regenerate their campus streetscape and green spaces similar to that of Butterfield Park, in order to help with pedestrian flow and connection to the

downtown core. The university has plans to update the street furnishings, plantings and surfaces in Community Park and the other green spaces on campus. However, there is no detailed outline on the elements that will be included in the park renewal. Applying a multi-sensory outdoor design would provide the university, students and the community with more interactive and restorative spaces away from the classroom environment. The Mental Health Committee Report (2016) completed by Ryerson University did not include a recommendation to use green spaces as a support structure for mental health on campus. The report focuses on policies, awareness, education and curriculum development which are important factors in addressing the mental health issues but should not be the only factors considered. The next step would be to look into innovative projects like a Multi-Sensory Environment as an alternative technique to support student development.

Concorida University created a master plan that addresses the improvements to the Sir George Williams and Loyola campus which include, the conservation and increase in vegetation, as well as connecting the buildings and spaces to the streets of Montreal (Universite Concordia Plan Diecteur, 2012). The vision for the campus is to develop unique spaces that have multi-functional features to reflect the needs of the students and the Concorida University community (Universite Concordia Plan Diecteur, 2012). The university worked with the Department of Public Works and various community groups to create a social space that included terraces, courtyards, street furnishings and signage to establish a diverse public realm (Universite Concordia Plan Diecteur, 2012). The multi-sensory design used the different sensory stimulations to create an accessible experience that promotes independent exploration and discovery (Jenkins et al., 2015).

The University of Manitoba which is located in Winnipeg, is Canada's first Western University and contains the largest Indigenous student population. The U-shaped campus includes Winnipeg's Red River, traditional and modern architecture with various green spaces (Visionary (Re) Generation Master Plan, 2016). The design strategy strives to be an inclusive practice that encourages collaboration with the university and Indigenous community, as well as other stakeholders through a three stage dialogue to help create a community vision.

Although, the discussion encourages public engagement, introducing inclusive activities like a co-design workshop where participants can work as co-designers would create inclusive human-centric designs (Barton & Grant, 2013). The objectives of the University of Manitoba is to establish a sense of belonging through community and inclusive planning, that respects the ecosystem and history through design and function (Visionary (Re) Generation Master Plan, 2016). The principals of the campus vision reflect the goal of a Multi-Sensory Environment in providing immersive and flexible design standards that strengthen the social and physical aspects in the community. The adaptability of the multi-sensory design can extend beyond the post-secondary campus into other spaces like workplace and educational course development. These principles are relevant to the workplace and school environments where social cohesion, learning development and health promotion are key objectives of the respective environments.

Design Affordances for Butterfield Park as a Multi-Sensory Environment

COST ALLOCATION OF PARK FEATURES

The cost analysis for the proposed multi-sensory features need to be assessed to determine the feasibility of the park. There are ten main areas outlined which include, a Study and Lounge Area, Resting Rock Garden, Fountain Area, Student Art Gallery, Workout Space, Terrace Seating, Interactive Public Art, Sensory Garden, Accessible Information Boards and Urban Bioswales. The purpose of these spaces is to provide a diverse range of passive and active activities, as well as social interactions that meet the needs of all visitors.

The interactive spaces around the park have varying levels of maintenance and feasibility costs, which can be seen in Figure 42. An analysis of the ten spaces indicated that three out of the ten areas contained high cost features such as the water fountain seating area, wand the study lounge. These areas can cost between $980 to $4,500 depending on material and equipment selection (Outdoor Fitness Price List, 2012 and Pricing Guide, 2018). There are three medium cost estimation can range from $200 to $1,000, which include the rock garden, public art installation, accessible information signs and the bioswales (Brennan, 2011). The low cost items for the proposed design are comprised of the student gallery, terrace area and sensory garden. These spaces contain smaller objects that have a variety of alternative choices to help reduce maintenance and design costs. For instance, low maintenance plants and flowers will be included in the sensory garden that are drought tolerant and winter hardy like Lavender and Bush Violet. Other low maintenance selections can be seen in Figure 29. The existing landscape will help minimize the amount of

excavation needed during the revitalization to ensure that the existing plants are not disturbed. A key improvement to the park as stated by the co-design participants is to address the noise levels. A water feature produces white noise which can mitigate the noise from the street traffic and construction. The sound and visual aesthetic of the water feature can help decrease stress levels and improve relaxation (Vasseur, 2017). A low cost alternative to the water feature would be to include more trees and long grasses like Feathered Reed Grass to help reduce the noise issues, however, it cannot produce white noises like the water fountain. The fitness equipment will encourage physical activity and engagement in spaces outside of the classroom environment. Introducing areas that help enhance physical and mental health will promote a positive effect on student mental wellness on campus (Design for Healthy Living, 2017). The next step would be to work with OCAD University and the facilities department to determine the prospective cost allocation of the multi-sensory design for Butterfield Park to assess the feasibility of the proposed design recommendations.

Figure 40. Cost Allocation for Proposed Butterfield Park Design According to Space.

Application of Proposed Design in an Urban Metropolis and Transferability to Urban and Landscape Design

BROADER DESIGN CONTEXT

By 2030 the United Nations Population Division, estimates that two thirds of the population will be living in urban areas, which will influence the city's social, economic and environmental structures (Bajirao, 2015). Urbanization produces a variety of urban stressors and determinants of health like noise pollution and green space availability that can negatively affect the mental and physical health of the population. (Srivatava, 2009). In large metropolises like Toronto, city planning is focused on housing and intensification through high density development, while park planning and green space allocation come second (Vasseur, 2017, Lahey, 2011). The preservation and rehabilitation of the natural environment is essential to help support mental health (Social & Mental Health, 2005). Inner city gentrification is a negative result of intensification, that attributes to employment loss and deindustrialization which results in lower income areas. In general, these areas have more access to green spaces but lack proper maintenance and accessible design allocation (Kabisch et al., 2015). This can result in a lower level of mental wellness in the population because there is not enough adequate community and recreational space availability (Seeds of change, 2018). To address these issues, the multi-sensory design of Butterfield will use low maintenance plants and materials to help reduce the level of cost. Examples of low maintenance species include, Canadian Yews and Witch Hazel which are winter hardy and are tolerant to drought conditions (refer to Appendix D).

Selecting plants that are drought tolerant, adaptable and hardy will improve the sustainability of the green space (A Healthy Dose of Green, 2012). Native plants and shrubs will be incorporated into the existing tree canopies to help minimize the ecological disturbance (Low Impact Development Stormwater Management Planning and Design Guide, 2011). By incorporating a low impact multi-sensory design, the quality of the green spaces can be standardized throughout the city (Rigolon et al., 2018). Factors like age, culture and the social environment are key determinants in identifying the features in a green space that will provide positive mental, physical and social outcomes (Willson, 2017).

Understanding the location of the environment, as well as the background of the community is essential in ensuring that the unique needs of the community are met (Design for Healthy Living, 2017). Research in the area of health and Multi-Sensory Environments, is relatively young and requires understanding across different sectors to collect appropriate information on how to create an inclusive and healthy community. The goal is to design innovative concepts that make healthy choices possible.

THE IMPORTANCE OF GREEN SPACE DESIGN IN URBAN ENVIRONMENTS

A study by Knoll et al (2017), stated that people have a higher occurrence of stress in heavy traffic areas compared to pedestrian only zones. Green spaces are distinct areas in urban metropolises that contain an array of natural elements and establishes a link to the natural environment (Depledge et al., 2011). The purpose of these spaces is to be multi-functional and beneficial to the community by offering areas for social interaction, recreational and educational activities. Green spaces are part of the social infrastructure of the community that establish places to gather and promote community engagement. They have the added benefit of acting as retention surfaces and climate regulators through the tree canopies and root structure of the landscape. (Vasseur, 2017).

Willson (2017) suggests that environments possess the ability to shape human behaviour and social interaction through the design of neighbourhood features. Studies have indicated that easily accessible green spaces help improve community visits and encourage outdoor

activities. Often, in urban cities, green spaces have been created mainly for aesthetic and recreational purposes (Barton & Rogerson, 2017). The Multi-Sensory Environment at Butterfield Park hopes to introduce a restorative space that removes the user from their daily stressors like assignment deadlines and noise pollution (Lau et al., 2014). Green spaces can be used in targeted ways to create a supportive environment structure, which address,

- **Individual features** like age, perception of risks and experiences with nature
- **Social features** include social engagement, cultural and accessibility standards
- **Environmental features** look at biodiversity levels, air quality, climate control and noise reduction (Barton & Rogerson, 2017).

It is important to integrate green spaces into schools, health care centres, offices and communities to establish communal spaces that encourage social engagement, sense of belonging and nurture well-being (Kellert and Calabrese, 2016).

7 CHAPTER SEVEN: CONCLUSION

FUTURE APPLICATIONS AND STUDY LIMITATIONS

The research study was conducted to illustrate the benefits of introducing a multi-sensory environment on an urban campus as an amenity that supports student mental wellness. It is important to offer a diverse set of experiences and environments that can help support their mental well-being.

Understanding the positive influences of nature in an urban context is imperative to the sustainability and improvement of green spaces in environments like Downtown Toronto and other urban communities. The literature review supports the application of therapeutic garden design in creating supportive environments to help mental wellness in post-secondary education, as well as the benefits of multi-sensory spaces in providing positive mental health outcomes.

7 CHAPTER SEVEN: CONCLUSION
FUTURE APPLICATIONS & LIMITATIONS

A multi-sensory design creates an opportunity to consciously design sustainable, accessible and inclusive communities that help to support a healthy lifestyle for generations to come. It is about creating an interdisciplinary solution that engages the public and stakeholders in designing unique spaces that reflect the collective goals of the community. A healthy community is not held together simply by a shared value, they are held together by shared spaces that establish a social connection between the people and their interactions.

The survey and interview outcomes indicated the importance of providing students with creative spaces for social gatherings, leisure activities and learning development. The insight from the landscape architects and healthcare professionals, provide an essential perspective in how design can positively influence mental health aspects in urban communities. The mental health framework by Campus Mental Health (2016) has provided post-secondary institutions with a structure to create strategies to help support students, faculty and staff in addressing mental health. For instance, Tammy Datars (phone interview, October 2018) from Sheridan College stated that support services and activities created by the college included mood walks where students and peer mentors can connect with nature through forest trails which is a new program that helps to promote healthy living on campus. The mood walks illustrate the transformation in post-secondary approaches in how they address mental health beyond policy and program frameworks.

Scott Torrance (in-person interview, October 2018) a Landscape Architect, stated that the space should bring a sense of place and unique quality in order to build a connection with the environment and individual. This was echoed in the student interviews and survey responses, where students expressed the need for more creative spaces and services like gym space, green areas and social areas. Participants in the co-design workshop, suggested designs that integrated natural features like water, trees and rocks into the landscape to act as places to gather and encourage multi-functional uses for events and student gallery space. The mental health strategies

created by institutions like Sheridan College, George Brown College and OCAD University demonstrate a progressive movement in the introduction of nature to help with student mental health. Post-secondary institutions are beginning to understand how interactions with nature can positively impact academic performance, social development and behaviour. A multi-sensory design for Butterfield Park will create an accessible and adaptable space to promote self-care among the student population.

By providing passive and active activities that can adapt to the needs of the person, the space can act as a supportive structure outside of the traditional healthcare office. The perceived sensory dimensions outline the essential design features that influence how humans react and interact with their environments, while the Attention Restoration Theory identifies the aspects that an individual needs to maintain their health (Stigsdorrter et al., 2017, Ohly, 2016). The Center for Urban Design and Mental Health summarize the four purposes of an open space as acting as a social, active, safe and green environment (Kirk, 2017). These principles reflect the standards seen in the Attention Restoration Theory, as well as the perceived sensory dimensions. A cross-sector collaboration will help to improve the quality of green spaces that are accessible and inclusive to the entire community (Sarkar, 2018).

The Inclusive Design Research Centre created the three dimensions of inclusive design that outlines the need to recognize diversity and uniqueness amongst users, use inclusive tools and methods in the iteration process and create a broader impact in the design (Treviranus, 2016). The research proposal on the benefits of Multi-Sensory Environments in supporting student wellness address these dimensions by:

1. **Recognizing diversity and uniqueness:** The research study worked with students, landscape architects, health care professionals and the OCAD University community to understand how certain features of Butterfield Park will provide mental health support. The multi-sensory features consider the different sensory stimulations that visitors will use when interacting with the environment.

2. **Using inclusive processes and tools:** The interview and online survey were designed to be accessible mediums and allow for full participation from the whole community. The co-design workshop encouraged designers and students to work together in the iteration process.

3. **Creating a broader impact:** For the research proposal, the multi-sensory design focused on creating a space to support student mental health on urban campuses. However, the design concept has the ability to be applied to other community environments and used as an inclusive design standard in design and health sectors to promote healthy communities. It can be incorporated into landscape or urban design programs to help educate future planners and designers.

Working with diverse perspectives and different strengths in the community will contribute to the sustainability of the environment (Treviranus, 2016). The multi-sensory design is an innovative strategy that creates an interactive environment that can adapt to the needs of the society.

LIMITATIONS AND RECOMMENDATIOSN FOR FUTURE RESEARCH

The interview, survey and co-design sessions were met with time constraints and the conflicting schedules of the participants. An additional co-design workshop could not be scheduled due to these constraints. The long-term mental health benefits of introducing a Multi-Sensory Environment to Butterfield Park could not be observed as the final master plan was completed after the participant stages. In terms of the mental health measurements, the survey and co-design workshops did not have a specific tool to help determine how the design of the park affected a person's mental health outcome. Design and health theories like the perceived sensory dimensions and attention restoration theory were applied in the design process, but did not have a follow-up opportunity for the students to review the final proposed master plan for Butterfield Park. A sampling bias may have influenced the design and direction of Butterfield Park, as environmental and landscape design students were asked to participate in the design process, as opposed to individuals with no design background.

The feedback provided by the participants will help inform the future iterations of the design. Future research in multi-sensory environments on post-secondary campuses would benefit from a wider sample population from students at different campuses. Including more participants from different backgrounds will help enhance the diversity in the design features.

Additional participatory activities could include visiting outdoor spaces with and without multi-sensory features to analyze the mental health benefits of each environment. Using a tracking system to analyze long-term changes in the well-being of participants as they are interacting with these spaces can improve the inclusive design standards for open spaces. A key development in addressing traffic noises would be to incorporate geometric sculptural elements into the public realm along the side of McCaul Street. An important action would be to work with OCAD University and the facilities department to determine the appropriate maintenance and cost allocation for multi-sensory spaces. These are essential strategies for future research to properly design accessible and inclusive spaces to help support mental wellness in communities.

AN INCLUSIVE DESIGN STANDARD

The creation of a Multi-Sensory Environment at Butterfield Park is a step in launching an inclusive multi-functional space for the whole community. It is about understanding the needs of the end users and providing access to features that can adapt to those needs. This research proposal contributes to the understanding of how natural features can have a positive impact on mental health in the urban environment. Not only does the park address techniques to support mental health but it establishes a connection to the concepts of design in relation to visual cultures, ecological technology and artistic expression. The purpose of this framework is to combine all elements of post-secondary education to create an immersive design standard for the whole community. The proposed redesign of Butterfield Park compliments the design of Grange Park to the west because it provides intimate levels of engagement that can help curate experiences for people in a smaller environment. Introducing a design that reflects the needs of all of the communities and allows them to engage with the environment is essential to the sustainability and success of the multi-sensory design. The outlined

strategies and standards reinforce the importance of cross-sector communication between urban design, landscape architecture, public health, and education. All of these sectors contain an array of principles that focus on the macro-level solution, however, this proposal works with the micro level to better understand the experiences and perspectives of everyday life. This is a stride in helping to enlighten, inspire and empower designers, planners, health care professionals and others who like to take part in shaping a healthy city.

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APPENDIX A: INTERVIEW GUIDES

APPENDIX A: INTERVIEW GUIDES

Semi-structured Interview Questions (Landscape Architect)
Multi-sensory Green Spaces & Mental Well-being at OCAD University

As a landscape architect, I would like to ask you some questions about your experiences with green spaces around Toronto and other urban areas. As well as, gain more insight on the features and elements that make for a good open space design. Please let me know at any time if you need clarification on a question.

1. How did you get into your career? Can you describe what projects you have worked on in the past and/or currently working on that relate to this topic?
2. In your opinion, what constitutes a good open space design?
3. What soft and hardscape features would do well in a small urban space like Butterfield Park at OCAD University?
4. What techniques can be used to maintain an outdoor space throughout the four seasons?
5. What natural and/or manmade features help mitigate urban factors like noise pollution, traffic and other hazards?
6. What are the types of plant species that I should focus on when creating a space where people are encouraged to interact with the environment?
7. What techniques can be used to balance the transition from the natural environment into the built environment within a small space?
8. What do you think is an important factor to consider when designing an outdoor sensory space for students?
9. The purpose of the redesign for Butterfield Park is to incorporate multi-sensory features in the design. What would you say are key features to include in the multi-sensory design?
10. Is there anything else I should look into when designing an outdoor multi-sensory space?

I will be hosting a co-design workshop in October 2018, which will allow all participants to take part in a redesign of Butterfield Park using the different senses like smell, touch and sight. There will be two sessions each taking no more then 3 hours of your time. Lunch and refreshments will be provided. Would you like to participate in a co-design?

Semi-structured Interview Questions (Healthcare Professional)
Multi-sensory Environments & Mental Well-being at OCAD University

As an industry professional, I would like to ask you some questions about your experiences with green spaces around Toronto and other urban areas. As well as, gain more insight on the features and elements that make for a good open space design.

Please let me know at any time if you need clarification on a question or would like to skip a question.

1. Can you tell me what interested you about this topic?
2. In your opinion, what are the main factors that influence a student's mental well-being within an urban campus environment like OCAD University?
3. There is a campus program called Mood Walks for Campus Mental Health. It is an educational walking program that helps with the mental and physical health of students at post-secondary institutions. What do you think about programs such as this one in providing support for students?
4. Do you think the current green spaces around Toronto provide a good design that promotes mental well-being?
5. Could you describe a time where you noticed an open green space positively affecting visitors?
6. In your opinion, what can be done to make the built environment and natural environment work together to support mental health in cities?
7. Have you visited a sensory garden or multi-sensory environment before? What features within these spaces resonated with you the most?
8. What do you think is an important factor to consider when designing an outdoor sensory space for students?

I will be hosting a co-design workshop in October 2018, which will allow all participants to take part in a redesign of Butterfield Park using the different senses like smell, touch and sight. There will be two sessions each taking no more then 3 hours of your time. Lunch and refreshments will be provided. Would you like to participate in a co-design workshop?

Semi-structured Interview Questions (Student)
Multi-sensory Environments & Mental Well-being at OCAD University

I would like to ask you some questions about how you experience green spaces like parks and gardens, and how they influence your mental well-being. Please think about your experiences with green spaces in Toronto or other urban areas.

Please let me know at any time if you need clarification on a question or would like to skip a question.

1. What does “mental health” mean to you?
2. Describe a typical day on campus. What part of the day makes it enjoyable to you? Are there any elements that you would remove?
3. During the school year, have you ever studied or had group meetings outdoors? If yes, how was your experience outdoors compared to an indoor space?
4. Why did you choose to go to an urban university like OCAD?
5. When you are in urban areas like downtown Toronto, what features of the city do you find create a positive or negative experience for you?
6. When you are in an outdoor green space area, what sense do you find that you use the most? (smell, sight, touch etc)
7. During stressful times, what do you do to help reduce and alleviate those feelings?
8. On average, how often would you say you visit or walk through green spaces around campus?
9. What activities do you like to do in green spaces? For example, running, studying or hanging out with friends. Are there any other reasons why you visit green spaces?
10. How would you improve on the campus community if you had unlimited power and resources to help support mental health on campus? What features would you include or remove to help students?

I will be hosting a co-design workshop in October 2018, which will allow all participants to take part in a redesign of Butterfield Park using the different senses like smell, touch and sight. There will be two sessions each taking no more then 3 hours of your time, with lunch and refreshments being provided. Would you like to participate in the workshop?

APPENDIX B: ONLINE SURVEY

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APPENDIX B: ONLINE SURVEY

1. Are you an undergraduate student, graduate student or staff/faculty member?
    a. Undergraduate student
    b. Graduate student
    c. Staff/faculty

2. Has your mental health changed since attending OCAD University either positively or negatively?
Mental health is defined as "a state of well-being in which every individual realizes his or her own potential, can cope with normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community." (World Health Organization, 2017).
    a. Positive change
    b. Negative change
    c. Both

3. What general experiences on campus have influenced your mental well-being positively?
    a. Security/safety
    b. Proximity to leisure activities
    c. Housing
    d. Friends/family
    e. Social life
    f. Employment
    g. Other _____

4. What general experiences on campus have influenced your mental well-being negatively?
    a. Security/safety
    b. Proximity to leisure activities
    c. Housing
    d. Friends/family
    e. Social life
    f. Employment
    g. Other _____

5. Do you agree with this statement? OCAD University provides enough support and services for students who have a mental health issue?
    a. Strongly agree

b. Agree
c. Neutral
d. Disagree
e. Strongly disagree

6. How important is it to you to have access to outdoor spaces like parks and urban gardens for students on campus?
1 2 3 4 5 6 7 8 9 10

7. Out of the five senses (taste, touch, sight, smell, hear), which one(s) do you use when you visit an outdoor space?
a. Taste
b. Touch
c. Smell
d. Hear
e. See

8. Which multi-sensory environment do you like the most? (with picture examples) A Multi-sensory environment is "a dedicated space or room where sensory stimulation can be controlled (intensified or reduced), presented in isolation or combination, packaged for active or passive interaction, and matched to fit the perceived motivation, interests, leisure, relaxation, therapeutic and/or educational needs of the user." (CDHAF, n.d)
a. Indoor meditation space with lights and lounge furniture
b. Outdoor garden with a textured sandbox to walk on
c. Urban garden with hexagonal seating and vegetation with lounge areas
d. Highline Park in New York, an urban garden on an old railway line that has seating and various plant species along the path

9. Below are some items that could be used in a multi-sensory environment in an outdoor setting. Please rank each item in terms of the value you feel it would add to your sensory experience. 1 is least valuable and 5 is the most valuable. (with picture examples)
a. Lounge & Study Seating: with charging outlets and comfortable seating
b. Flower & Plants: subtle scent and can be touched
c. Water feature: passive feature with interactive elements
d. Interactive Public Art: created by the OCAD community
e. Social Space: for student socialization

10. Would you like to participate in a multi-sensory workshop to help redesign Butterfield Park? Please enter your email and I will contact you with more information. Thank you!

APPENDIX C: CO-DESIGN GUIDES

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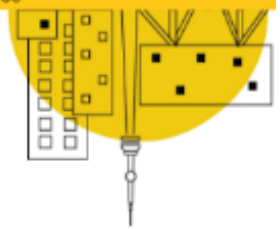
APPENDIX C: CO-DESIGN GUIDE

AGENDA FOR THE DAY
(12:00 PM TO 2:10 PM)

12:00 – 12:10 Introduction & Overview
12:10 – 12:15 Activity 1: The Warm-Up
12:15 – 12:20 Walk to Butterfield Park
12:25 – 12:40 Activity 2: Observe & Record Your Experience
12:40-12:45 Walk back to workshop room
12:45 – 1:00 BREAK
1:00 – 1:40 Activity 4: Multi-sensory Park Design
1:45 – 1:55 Presentation of Designs
1:55 – 2:05 Co-designer Feedback
2:05 – 2:10 Thank You



IMPORTANCE OF RESEARCH

- Limited knowledge on influence of green spaces on campus and student mental health
- Presenting alternative activities and solutions to help enhance mental well-being
- Bringing students in as co-designers in creating a space on campus
- Using multi-sensory elements to make an inclusive and adaptable space for all visitors
- Giving students the opportunity to have a say in the way campuses are designed

TERMINOLOGY

Inclusive Design is design that considers the full range of human diversity with respect to ability, language, culture, age and other forms of human difference. (Inclusive Design Research Centre, n.d.)

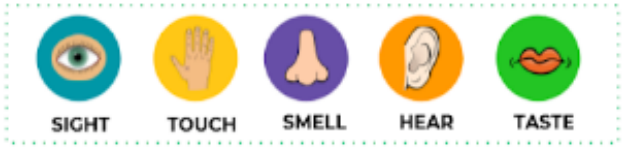
Mental Health "a state of well-being in which every individual realizes his or her own potential, can cope with normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community." (World Health Organization, 2017).

Multi-sensory Environment "a space that helps enhance a person's cognitive and mental capabilities through various sensory stimulations and interactive experiences. It is a semi-controlled environment, which can be manipulated by the user and designer to help meet the needs of every individual." (CDHAF, n.d.)

ICEBREAKER - SENSORIAL MEMORIES
Skittles Sharing (12:10 PM - 12:15 PM)

THINK (2 MIN)
Take 2 minutes and think about a time you visited a space/environment that improved your mental well-being and/or mood.

SHARE (3 MIN)
Then, with your selected environment, choose one or more coloured skittles that correspond with the five senses (sight, touch, smell, hear and taste) that you like to use when your are in the space. Share your experience.



EXPLORE - RECORD & OBSERVE EXPERIENCE
Sensory Experience (12:25 PM - 12:40 PM)

FILL OUT THE PSD WORKSHEET TO DESCRIBE YOUR EXPERIENCES IN THE CURRENT BUTTERFIELD PARK

The facilitator will guide the co-designers through Butterfield Park and explain the features that are currently within the Park and around the area. Then, the facilitator will ask the co-designers to observe the site and express what they're experiences at the park. The first five minutes will be dedicated to the description of the Park and the statement of the goal for the redesign of the site. The PSD analysis of perceived sensory dimensions (handout sheet with information will be provided)

Co-designers will have the opportunity to explore the park and the surrounding area to take in the experience. Each co-designer will be given 5 minutes to record their observations and feelings about the site. For the remaining 5 minutes, the facilitator will ask the co-designers to share one of their observations from the site visit.

DEVELOP & DESIGN - CREATING BUTTERFIELD PARK
(12:45 PM - 1:50 PM)

GOOD OUTDOOR DESIGN QUALITIES:

- Accessible to the community
- Inclusive to all members
- Functional throughout the year
- Sense of place
- Safety & Comfort
- Reflects the community culture and values

FEATURES TO CONSIDER FOR MENTAL WELL-BEING:

- Sense of being away
- Restores mental cognition
- Connection to the space
- Space for individual or group socialization
- Engaging actively or passively with the features in the space

DEVELOP & DESIGN - CREATING BUTTERFIELD PARK
(1:00 PM - 1:50 PM)

Designing with Sensory Stations:

1. **Visit each of the sensory stations** and select objects and materials that you would like to use in the Butterfield Park redesign
2. Fill in the **sensory station worksheet** with objects/materials that you would like to see in the park design (i.e. Clay for seating benches and tables)
3. Then take the chosen objects/materials along with the additional design materials on the main table and **begin to design** Butterfield park
4. In your design, tag each object to show if it is **representing sight, sound, smell or touch or more than one sense** by using the corresponding sticker tags.

Think about how the different sensory objects can
help with a student's mental wellness.

SHARE & DISCUSS - CO-DESIGN PRESENTATIONS
(1:50 PM - 2:00 PM)

If you are comfortable, please share your design ideas for Butterfield Park and explain,

A. The inspiration for the multi-sensory design
B. How the design is inclusive to post-secondary community
C. How it is adaptable and flexible to the needs of every visitor
D. How it provides features to help support mental health on campus

APPENDIX D: NATIVE TORONTO PLANTS BY PREFFERED HABITAT

APPENDIX D: NATIVE TORONTO PLANTS
BY PREFERRED HABITAT

Native Plants for Toronto by Preferred Habitat Type

	Full Sun	Full Sun – Partial Shade	Partial Shade - Shade
Dry Soil	Black Oak (*Quercus velutina*) White Pine (*Pinus strobus*) Smooth Rose (*Rosa blanda*) American Bittersweet (*Celastrus scandens*) Harebell (*Campanula rotundifolia*) Big Bluestem (*Andropogon gerardii*) Wild Bergamot (*Monarda fistulosa*) Hoary Vervain (*Verbena stricta*) Wild Strawberry (*Fragaria virginiana*)	Black Oak (*Quercus velutina*) White Pine (*Pinus strobus*) Choke Cherry (*Prunus virginiana*) Snowberry (*Symphoricarpos alba*) Smooth Aster (*Aster laevis*) Common Wood Sedge (*Carex blanda*) Foxglove Beardtongue (*Penstemon digitalis*) Cylindric Blazing Star (*Liatris cylindracea*) Hairy Bush-clover (*Lespedeza hirta*)	Sugar Maple (*Acer saccharum*) Maple-leaf Viburnum (*Viburnum acerifolium*) Round-leaved Dogwood (*Cornus rugosa*) Big-leaved Aster (*Aster macrophyllus*) Bottlebrush Grass (*Elymus hystrix*) Woodland Strawberry (*Fragaria vesca*) Woodland Sunflower (*Helianthus divaricatus*) Zig-zag Goldenrod (*Solidago flexicaulus*)
Average Soil	Trembling Aspen (*Populus tremuloides*) Black Cherry (*Prunus serotina*) Grey Dogwood (*Cornus racemosa*) Virgin's Bower (*Clematis virginiana*) New England Aster (*Aster novae-angliae*) Evening Primrose (*Oenathera biennis*) Showy Tick Trefoil (*Desmodium canadense*) Pale-leaved Sunflower *(Helianthus strumosus)* Spreading Dogbane *(Apocynum androsaemifolium)*	White Ash (*Fraxinus americana*) Red Oak (*Quercus rubra*) Virginiana Creeper (*Parthenocissus vitacea*) Smooth Serviceberry (*Amelanchier laevis*) Wild Columbine (*Aquilegia canadensis*) Common Wood Sedge (*Carex blanda*) Michigan Lily (*Lilium michiganense*) Wild Geranium (*Geranium maculatum*) Starry False Solomon's Seal *(Maianthemum stellatum)*	Sugar Maple (*Acer saccharum*) Witch Hazel (*Hamamelis virginiana*) Alternate Dogwood (*Cornus alternifolia*) Soloman's Seal (*Polygonatum biflorum*) Zig-zag Goldenrod (*Solidago flexicaulus*) Mayapple (*Podophyllum peltatum*) Red Baneberry (*Actaea rubra*) Virgin's Bower (*Clematis virginiana*)
Moist Soil	White Cedar (*Thuja occidentalis*) Silver Maple (*Acer saccharinum*) Buttonbush (*Cephalanthus occidentalis*) Red-osier Dogwood (*Cornus stolonifera*) Thimbleweed (*Anemone virginiana*) Canada Wild Rye (*Elymus canadensis*) Dense Blazing-star (*Liatris spicata*) Blue Vervain (*Verbena hastata*) Green-headed Coneflower (*Rudbeckia lacinata*)	Yellow Birch (*Betula alleghaniensis*) Green Ash (*Fraxinus pennsylvanica*) Common Elderberry (*Sambucus canadensis*) Nannyberry (*Vibrunum lentago*) Wood Rush (*Luzula multiflora*) Thin-leaved Sunflower (*Helianthus decapetalus*) Great Blue Lobelia (*Lobelia siphilitica*) Turtlehead (*Chelon glabra*) Bebb's Sedge (*Carex bebbii*)	Hemlock (*Tsuga canadensis*) Black Maple (*Acer nigrum*) Spicebush (*Lindera benzoin*) Black Currant (*Ribes americanum*) White Baneberry (*Actaea pachypoda*) Red Baneberry (*Actaea rubra*) Canada Anemone (*Anemone canadensis*) Wild Sarsaparilla (*Aralia nudicaulis*) Wild Ginger (*Asarum canadense*)