TRANSFORMING BORDERS:

Transforming the Airports Built Environment Through
Environmental Psychology, Proxemics and Therapeutic
Design

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ABSTRACT

Keywords: Airport, Environmental Psychology, Anxiety, Stress

Within a hyper-culture, people suffer from mental fatigue caused by daily stress and strains. Placing a hyper-culture within a mass transit hub adds to the chaos and creates a sensory overload within a short period of time that is unnatural to the normal passenger and traveler. The airport is a prime example of a space that heightens anger, anxiety and stress unintentionally due to the unique nature of air travel. The environment of air travel exposes a series of potential adverse events within a brief and concentrated period of time that evokes negative emotions. The airport provides a unique situation where psychology, anatomy and architecture meet and overlap with the potential to resolve most of the situations leading to anxiety and instead create a space designed to be therapeutic rather than induce stress. The unplanned voids of waiting spaces have the potential to become spaces that will not only serve the purpose of waiting but also create a restorative environment rather than an uncomfortable void.

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CHAPTER 1

INTRODUCTION

1. The intricate connections of multiple transportation methods at Dublin Airport.

This thesis seeks to guide you along a pathway defined primarily through the built environment with the understanding of environmental psychology. The built environment is concerned with man's interpretation capacities that are perceived through sensory stimulation. The path of the airport in particular is the key focus of study where the environment is led to be a more stress inducing atmosphere than necessary. Are there alternative methods to be considered? Can the airport instead be rejuvenating mentally and physically?

As the thesis progresses, it will become evident that the healing environments are not limited to hospitals and clinical spaces. Renown science writer, Kirsten Weir, makes a clear point that in creating a healing environment, one must demonstrate outcomes that indicate some sort of improvement in the physical or psychological state for the building's users. Through demonstrating the improvement, a healing environment is formed, leading to meaningful forms of treatment.¹

1.1 Objective

The environment of air travel exposes a series of potential adverse events within a brief and concentrated period of time that evokes unwanted emotions. The space provides a unique situation where psychology, anatomy and architecture meet and overlap. Within this space, there is potential to resolve most conflicting situations leading to anxiety and instead create a space designed to be therapeutic rather than induce stress. The unplanned voids of waiting spaces have the potential to become spaces that will not only serve the purpose of waiting but also create a restorative environment rather than being an uncomfortable void. Therefore, the objective is to design a potential model that will explore future opportunities within the built environment.

1.2 Project Scope

The project scope is to take the Pickering Airport Lands as a base of exploration for assimilating ideas to rethink high transit environments. Within the next few pages, it becomes evident that more than 40% of passengers through an airport will definitely feel a certain amount of stress. This thesis explores in which areas stress is necessary and how to reduce stress in areas where it is not. The investigation of the built environment reveals how individuals can have an overwhelming amount of daily stress from work environments and lack of exposure to sunlight, green spaces, exercise and even appropriate temperatures. Strategically creating spaces within the airport can provide the therapeutic environment a person should be emerged in during an average week.

(Endnotes)

1. WEIR, K. (2013). *DESIGN IN MIND: PSYCHOLOGISTS CAN HELP TO DESIGN SMART, SUSTAINABLE SPACES FOR THE 21ST CENTURY*. NOV. VOL 44: 50.

CHAPTER 2

IDENTIFYING THE PROBLEMS

1. 1970 Jumbo Jet demanding a new set of standards, Naked Airport (2004)

2.1 Psychology of Stress and Anxiety

To understand the stress and anxiety within the airport, the concept of stress and anxiety must first be investigated. According to Lazarus (1966)¹, stress is explained as an emotional reaction that is provoked through an individual's perception of a stimulated situation based on surrounding elements.² Currently, the majority of airports are designed as a realm in which the environment enhances uncommon situational stimulus within a short period of time that is uncommon to the general traveler. Spielbreger³, refers stress to a stimulus, object or situation that generally is considered psychologically or physically dangerous. This perception of stress is considered a threat and a subsequent response may lead to anxiety.

If stress is not chronic or constant, it may not necessarily be bad. Although it can create drastic health issues, it often serves a useful purpose if handled properly and does not last long term. Positive effects of stress could be motivation, or if in accurate settings create a sense of security. For example airport security, customs or baggage scans. Stress does, however, have many negative effects. Some of which are, but not limited to, headache, fatigue

2. The cycle of health reaction to stress.

and irritability. While cognitive disintegration is a basic aspect of anxiety and stress, there are many more conditions which James Averill highlights as: “intrapsychic conflict, psychological trauma, stimulus overload; stimulus deprivation; impairment of neural functioning, separation , alienation from sociocultural system”.⁴ Other causes can be heightened when an individual senses fear of the unknown, lack of control, uncertainty, unable to process information, being lost, confused, mental exhaustion and fatigue. Stressful effects of a crowd or an overcrowded space can lead to sensory overload as there is a high level of stimulation provided by people lingering, talking, laughing and overwhelming one’s personal space. This unaccustomed situation is one of the few situations often experienced within the airport, not only as one enters the airport, but all throughout the queuing process, waiting process and check in process. People already suffer from mental fatigue and daily stress prior to entering the airport from daily activities and with the quick change in pace and environment stress can be unnecessarily amplified.

47% Report being stressed by fearing the flight will be delayed

37% report being stressed by running late or missing the flight

29% report being stressed by mislaying documents and belongings

2.2 Airport Stressors

The environment of air travel exposes a series of potential adverse events within a brief and concentrated period of time that evokes all sorts of emotions. A sample of 2005 adults aged 18+ indicated multiple stress inducing activities within the airport and was

3. Recorded stress levels of individuals traveling through airports in UK separated into male and female.

surveyed through CPP Group International Life Assistance in 2011 in the UK. Although this sample is restricted to the UK it indicates that there are concerns within the airport environment that can be looked into. For example, within the survey, more than 43% indicated that there is stress within the airport, approximately 30% indicate that they are not very stressed, and the rest indicate not being stressed at all. Main factors considered within the stressed environment are: lack of control, busy environment, time deadlines, and accumulation effect.⁵

According to the survey taken, the additional activities also create stress: queuing, check in and baggage drop off, security check points, wayfinding, waiting for flight, engaging with people. Suggested solutions to improve the experience include: less queuing, better seating, quiet and peaceful environments, access to lounge, less people, easier access to gates, outside space, amongst many more.

The amount of stressful situations that can be encountered within an airport are countless. In addition, stress will be manifested in different ways for different people. However, the general consensus indicates a concern for queuing, waiting, quiet and controlled environmental areas that are peaceful and easier access to gates

4. Suggested solutions to improve the airport experience.

will create a better experience. Therefore, the architecture should take into consideration the elements that possess capabilities for creating a better path of experience for each passenger in creating an environment that is less stressful and more therapeutic.

2.3 Satisfaction Motivation Theory

Airports were once described as fantastic places where machines defied gravity.⁶ It was a spectacle and a gateway that led into and out of the city and into the world. Now, there are entire blogs dedicated to a whole array of airport irritations. Common complaints include: confusing signs, chaotic carousel crowding, removing clothes at security, lack of free wi-fi and lack of flight information.

Airports are known as complex service settings where passenger satisfaction is influenced by various dimensions of services. Several studies based specifically on researching airport services have identified several significant factors that passengers look for in terms of satisfaction. The list includes: amenities, efficiency of security and check-in procedures, flight timelines and information convenience, orientation, and signage convenience.⁷ According to marketing and tourism research, it is not sufficient for the product service to be merely memorable and satisfying. The key factor has to do with delight.⁸ In addition, Fuller and Matzier (2008) claimed that there are necessary products and service elements which are required to be present. The presence does not cause higher customer satisfaction, but assists in creating environments with the absence of dissatisfaction. Customer service satisfaction is a theoretical factor grounded in Herzberg et al.'s (1959) job satisfaction theory. The theory revolves around two factors, satisfaction and dissatisfaction, which are two independent continua and not opposite extremes. An example of this theory can be associated with service attributes that cause dissatisfaction. When services are executed poorly, it can lead to complaining and disappointing behavior, yet services executed perfectly will not necessarily result in complimentary behavior.

An essential component of airport quality correlates to the passengers' perception of the building's physical environment. The airport however, is a multifaceted environment. The overall design must exhibit a visual appeal, where functionality, comfort and efficiency are also prevalent. Bitner identifies this as an "elaborate

servicescape”.⁹ Servicescape research in the context of airports have been largely examined by multiple sources.¹⁰ Within the research, convenient building layouts along with intuitive signage systems are directly correlated to the success of passenger satisfaction. Jeon and Kim (2012) evaluate the servicescape attributes in comparison to passengers’ emotional mentality and behavioral intentions. Positive emotions are tightly connected to the behavioural intentions of a passenger, which is influenced by the aesthetics, safety and functionality of the airport during the airport experience.¹¹ Branded retail stores, restaurants, and well lit spacious clean lounges also positively influence the passenger experience.¹²

Satisfiers

It can be assumed that customer satisfaction is a direct result of a successful service outcome. However, there is a difference between the incentive that returns a loyal customer versus a satisfied customer, and thus a difference between satisfaction and delight. The ultimate goal is to then create delight and not merely satisfaction.¹³ To further understand satisfaction, Herzberg’s two-factor theory of motivation and hygiene can be applied. The two factor theory distinguishes between motivators which can be challenging work, recognition, and responsibility that directly results in positive satisfaction and hygiene factors such as status, job security or working conditions. The hygiene factors do not provide satisfaction, but can create dissatisfaction from the absence of hygiene.¹⁴ In other words, motivators can provide passengers with satisfaction as they travel through the airport, but the absence of motivators will not lead to dissatisfaction. Similarly, the presence of hygiene factors will not provide most satisfaction, but the absence of hygiene factors will lead to dissatisfaction.

Although the two-factor theory was originally created through office environments, Cadotte and Turgeon (1988) applied the motivation-hygiene theory to the hospitality industry. The analysis of restaurants and hotels indicated that the absence of parking spaces, service speed and adequate pricing elicited customer dissatisfaction, but the presence did not generate satisfaction. In contrast, ambiance, spaciousness and convenience of location created satisfaction, but the absence would not create dissatisfaction. Matzler and

Sauerwein, (2002) enhanced the motivator-hygiene factors to reflect three similar, but new, applications of the theory. Basic factors (dissatisfaction), which are the prerequisites for services. Excitement factors (satisfaction), which are secondary service attributes. Performance factors (hybrids), which influence satisfaction as performance is high and decreases satisfaction when performance level is below average.¹⁵

Within the airline industry core attributes and basic services would include transportation of passengers, cleanliness, facilities, technology and wifi. Whereas all the steps between drop off and boarding can be considered secondary attributes and excitement factors. However, if performance of core attributes are poor, such as check-in procedures or baggage claims and security screening, then all secondary performance attributes are likely to elicit dissatisfaction. "Strong dissatisfaction is a barrier to the factors that generate satisfaction".¹⁶

(Endnotes)

- 1 Lazarus, R. S. (1966). *Psychological Stress and the Coping Process*. New York: McGraw-Hill.
- 2 Levitt, E. (1980). *The Psychology of Anxiety*. Hillside, N.J.: L. Erlbaum Associates. P.10.
- 3 Spielberger, C. (1976). *Emotions and Anxiety: New Concepts, Methods, and Applications*. Hillside. N.J.: L. Erlbaum Associates. New York.
- 4 Spielberger, C. (1976). *Emotions and Anxiety: New Concepts, Methods, and Applications*. Hillside. N.J.: L. Erlbaum Associates. New York. P.122.
- 5 Jones, N., (2011). *CPP Stress and Airport Traveling*. <http://www.slideshare.net/CP PUK/stress-and-airport-travelling#>.
- 6 Kloos, Martin. Maar, Birgitte. (1996). *Schiphol Architecture: Innovative Airport Design*. Amsterdam. ARCAM. Print. P.7.
- 7 Chen, F.Y. and Chang, Y.H. (2005), "Examining airline service quality from a process perspective", *Journal of Air Transport Management*, Vol. 11 No. 2, pp. 79-87.
- 8 Fuller, J. and Matzler, K. (2008), "Customer delight and market segmentation: an application of the three-factor theory of customer satisfaction on life style groups", *Tourism Management*, Vol. 29 No. 1, pp. 116-126.
- 9 Bitner, M.J. (1992), "Servicescapes: the impact of physical surroundings on customers and employees", *The Journal of Marketing*, Vol. 56 No. 2, pp. 57-71.
- 10 Correia, A.R., Wirasinghe, S. and De Barros, A.G. (2008), "Overall level of

service measures for airport passenger terminals”, *Transportation Research Part A: Policy and Practice*, Vol. 42 No. 2, pp. 330-346.

- 11 Jeon, S. and Kim, M.-S. (2012), “The effect of the servicescape on customers’ behavioral intentions in an international airport service environment”, *Service Business*, Vol. 6 No. 3, pp. 279-295.
- 12 Rowley, J. and Slack, F. (1999), “The retail experience in airport departure lounges: reaching for timelessness and placelessness”, *International Marketing Review*, Vol. 16 Nos 4/5, pp. 363-376.
- 13 Oliver, R.L., Rust, R.T. and Varki, S. (1997), “Customer delight: foundations, findings, and managerial insight”, *Journal of Retailing*, Vol. 73 No. 3, pp. 311-336.
- 14 Herzberg, F., Mausner, B. and Snyderman, B.B. (1959), *Motivation to Work*, Transaction Publishers, New Brunswick, NJ.
- 15 Matzler, K. and Sauerwein, E. (2002), “The factor structure of customer satisfaction: an empirical test of the importance-grid and the penalty-reward-contrast-analysis”, *International Journal of Service Industry Management*, Vol. 13 No. 4, pp. 314-332.
- 16 Sulzmaier, S. (2001), *Consumer-oriented Business Design: The Case of Airport Management*, Physica-Verlag HD, New York, NY.

CHAPTER 3

IDENTIFYING THE SOLUTIONS

1. Sponge Slip, Sunken Park

Voluntary / Directed Attention
Signages, advertisements, writing.

Involuntary / Indirect Attention
Nature, aquariums, moving people.

2. Differences between Direct and Indirect Attention with examples.

3.1 Attention Restoration Theory

The concept of mental fatigue is often associated with stress and in many situations the terms are used to describe each other. Although the two terms run parallel, they are intrinsically different. According to Kaplan, stress is a result of anticipating an event that could potentially be threatening or harmful to an individual. Mental fatigue may be a result of such circumstances, but does not necessarily derive from the same components and may in fact be a result of pursuing enjoyable goals or working hard on preferred projects. Within this study of mental exhaustion comes an interesting result regarding two types of attention and the attention restoration theory. William James (1928) identified two types of attention that are distinguished by effort of use. James determined that the first type is known as voluntary or directed attention requires a lot of effort, especially when attempting to focus on uninteresting things.¹ Through focusing or directing one's attention, it requires a great deal of effort since the attention devotes itself to avoiding stimuli from more interesting attractions. The attention resists the natural urge to involuntarily be attracted and requires more effort to resist more

potent stimuli. The second type of attention requires minimal to no effort at all and is classified as involuntary attention or fascination. This occurs when observing interesting or exciting situations and become fascinated. Through understanding this process, it is easier to see why directed attention has a finite duration and the correlation between mental fatigue and the depletion of the directed attention span is evident. In contrast, the involuntary attention is infinite and provides opportunity for the directed attention to recover.

3 Times Square, NYC Lights and Nightlife
Overwhelming Attention

4 Times Square, NYC Lights and Nightlife
Overwhelming Attention

3.2 Fascination

Fascination is a key element in this theory as it provides the unique stimulus that cues involuntary attention. It is therefore one of the most important roles to the restoration experience theory. The significance of the fascination stimuli is that it keeps people from being bored, yet at the same time allows a person to continue functioning properly without requiring directed attention. According to Kaplan, examples of fascination would include, but are not limited to, violence, moving objects, competition and cooperation. Other elements include people, nature, sunsets, waterfalls, caves and fires.² Fascination can be taken a step further in understanding that there are two types: strong fascination where you cannot redirect your attention and soft fascination. Soft Fascination is usually

5. Wind in Leaves Soft Fascination

6. Gorgia Aquarium, Soft Fascination

created from natural settings such as clouds, sunsets, scenery and leaves in a breeze. Therefore, soft fascination is more relaxing as it holds attention in a humble fashion and is considered a combination of captivation and pleasure.³ The decline in directed attention capacity raises a more significant concern and circumstance than most people realize. With a declined capacity for mental functioning comes a decline in cognitive responses and the potential to suffer inhibitory control through fatigue arises. Kaplan states: “without directed attention one is likely to be rash, uncooperative, and far less competent”.⁵ With this comes irritability which is expressed quite frequently within overcrowded environments. The human is an information-based animal and survival relies on mental capability to recognize the surrounding situation while predicting suitable solutions and taking action. There is a high priority on exploration and motivation to learn more about the surrounding environments

7. Devitaki Cave, Bulgaria

8. Mellisani Cave, Greece

9. Ice Caves, Chile

"In principle, there are many types of restorative environments. However, research has repeatedly highlighted the role of time spend in natural settings in the effort to remain mentally effective" - Kaplan

which requires cognitive control and the ability to think clearly.⁴

Studies regarding the different types of attention were performed in 1995, instructing individuals to carry out tasks requiring directed attention within conditions of high distraction. After a significant amount of time, individuals were found to be more intolerant, less likely to help others, more aggressive, and more oblivious to significant cues.⁵ Although the tasks were attention demanding tasks, it's interesting to note that the consequences of depleted mental stamina were not attention oriented, but instead resulted in issues of decline in inhibitory control.

It is clear that restoring the capacity to direct attention requires an environment that has minimal directed attention that absorbs the finite resource of maintaining mental focus. Kaplan clarifies that when fascination is engaged, the function of directed attention is greatly reduced allowing for recovery. Biophilia and nature contain mechanisms that relax and calm the mind. In addition to the rejuvenating prospects, the natural features influence generosity, and trust amongst people.⁶ This becomes an essential quality within the restorative environment since it has the ability to establish fascination. A contrasting environment to this would be one with sharp angles, and corners which release stress hormones and trigger fear centers within the brain. The visual stimulus replicates impressions of sharp thorns or knives.

“Evidence-based design is a process for the conscientious, explicit, and judicious use of current best evidence from research and practice in making critical decisions, together with an informed client, about the design of each individual and unique project” - Kirsten Wier

3.3 Healing Environments

To create therapeutic pockets within the airport, one must understand the values and elements of a therapeutic environment in order to apply the ideas to the built environment. Evidence based research is a fundamental study that has recently emerged with evidence relating therapy to the natural environment and is especially significant within healthcare settings. Roger Ulrich, PhD. published a study within the 1984 Science Magazine comparing results from randomly assigned group of recovering patients. Half of the patients had views of trees, and the other half could only see a brick wall. The results showed positive results for patients with views of nature. The duration of stay at the hospital was shorter, required less analgesics and had more favorable remarks within the charts.⁷ A more recent study was done in 2013, using technology and cell-phone applications as the catalyst for the study. The entire study was based on defining happiness and where the sources of happiness come from. Through randomly surveying individuals who installed the application onto a smart-phone with global positioning systems activated, the application would ping or message the individual at random times throughout the day. The alert would instigate a survey identifying the level of happiness for the individual, amount of people in the surrounding, environmental and social situation, and type of setting the individual is in.⁸ The study resulted in new evidence that links nature and the subjective wellbeing. Generally, people were happier when in nature environments. The happiness levels were significantly higher in marine and coastal margins, and other green and natural environment types opposed to urban environments. Additional elements of therapeutic environments include controlled water and light within various spaces, and art as installations or aesthetics of a building as it creates both fascination and distraction.

Physical Stress Results and Calmness

Physical Stress and Systolic Blood Pressure

Physical Stress and Diastolic Blood Pressure

11. Statistical graphs from Tsunetsugu study regarding moods, emotions and blood pressure of participants.

3.3.1 Shinrin-Yoku: Japanese Nature Bath

A new form of study known in Japan as Shinrin-Yoku is encouraged by doctors as a prescribed method of healing for individuals in Japan that are stressed, anxious and have high blood pressure. Morita et al., conducted a study with 541 participants to which 244 were male and 254 were female. The duration of the stay in the forest was approximately from 1 hour up to 3 hours and the walk was approximately 4km up to 7.4km long. The study focused on the effects of the walk on hostility, depression, boredom, liveliness and wellbeing and provided positive results. Acute emotions were improved by participation reporting that hostility and depression scores were dramatically decreased during the shinrin-yoku compared to those that were unable to participate in the walks. Furthermore, the study suggested that there were drastic improvements indicating the advantageous forest environment, particularly on positive emotions.⁹ As mentioned previously, Ulrich indicates how having a view of nature reduces patient stay and promotes patient recovery, it can be assumed that merely viewing trees or having visual connections with nature have beneficial effects.

In addition, a study done by Tsunetsugu, et al., resulted in demonstrating significant differences in the three parameters of the study (systolic and diastolic blood pressure, and pulse rate) between the Shinrin-Yoku and the city. The temperatures within the forest were roughly 3 degrees cooler than the city, providing a comfortable, refreshing and calm atmosphere as well as psychological relaxation with reduced mental stimulants. The whole environment in the forest demonstrated to reduce blood pressure and pulse rate.¹⁰ The graphs to the left indicate the calmness, and blood pressure results of the studies. There are also significant results showing the level of comfort is improved and refreshness comparison between the city and the forest.

12. Municipal Offices of LACQ Region
Gilles Bouchez

13. Louisiana Sports Hall

3.3.2 Natural Lighting

The human system is affected both physiologically and psychologically by different spectrums provided by various forms of light. The effects are easily overlooked, but nevertheless identify beneficial forms of lighting, including day-lighting. Creating the ideal lighting conditions within the healthcare environment is often challenging due to the different natures of healing environments. Generally, lack of exposure to sunlight has proven, in many studies, to lead to a condition known as Seasonal Affective Disorder (SAD) as well as other seasonal depression emotions.¹¹ The reduced amount of sunlight deprives an individual of sufficient lux resulting in SAD and declining cognitive functioning through alterations in serotonin levels. Serotonin is a compound present within blood that releases a serum to act as a neurotransmitter which affects mood. The serotonin levels are raised due to natural sunlight and moderately high levels of serotonin create more positive moods and calm an individual resulting in a better mental outlook. For individuals that are constantly in the office during daylight hours, absent of natural light, having an environment with a large amount of natural day light proves to be an improvement in therapeutic environments.

14. Queuing process within street life environments..

3.4 Queuing Theory: the psychology of lines

Queues are a form of nonverbal communication and fall within the study of proxemics, the study of spatial use and the effects on humans within specific proximities. Through this study an individual's perception of space is defined by a distances of intimate space, personal space, social space and public space.¹² The concept of lines are generally designed to conserve space, but create a constant violation within the law of proxemics. Thus, the realm of waiting lines create hostile environments where comfort is greatly compromised.¹³ Within the city, it is already evident to observe how queuing is a part of culture leading to daily stressors, but within the airport it's amplified with concerns for missing a flight or just being mentally exhausted.

Queuing is especially stressing and resulted in multiple studies within itself. The queue violates basic spatial principles regarding intimate, personal, and public space and is therefore easy to identify why stress is created within an individual. Another major reason why the cue stresses people out is because individuals have nothing to do during this period of time where they are not in control, waiting and bombarded with objects and signs absorbing directed attention span. Nothing to distract, fascinate or entertain. Disney World realized this circumstance and has created a solution for the

long rides for waiting by creating different forms of entertainment throughout the cue lineup.¹⁴ It is important to identify that culturally, there are different forms of queuing which can be experienced within airports around the world. Within America, the queuing environment is generally categorized by jealousy and hostility creating three types of user groups; the person waiting in line, the person skipping the line, and the person trying to avoid the line. Social injustice erupts when queues are delayed or are slower in comparison to alternative queues during the same process.¹⁵ Within Britain, a single queue is formed regardless of the number of services provided. The British system is the most efficient manifestation of a “line” since service delays are avoided. The Asia queuing system is often crowded with conditions where aggression is rewarded by a first come, first serve basis. The loud, strong and forceful are served first, creating a queue that denies linear demands. This service consistently results in social injustice and hostility.

15. Queuing process within airport transit environments.

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(Endnotes)

- 1 Kaplan, S. (1995). The Restorative Benefits of Nature Towards an Integrative Framework. *Journal of Environmental Psychology*, 15: P.179.
- 2 Kaplan, R., & Kaplan S. (1989). *The Experience of Nature: A Psychological Perspective*. New York, NY: Cambridge University Press.
- 3 Kaplan, S. (1995). The Restorative Benefits of Nature Towards an Integrative Framework. *Journal of Environmental Psychology*, 15: P.181.
- 4 Young, R. (2013). Environmental Psychology Overview. In Ann H. Huffman & Stephanie Klein (Eds.) *Green Organizations: Driving Change with IO Psychology*. (Pp. 17-33) New York: Routledge.
- 5 Kaplan, S. (1995). The Restorative Benefits of Nature Towards an Integrative Framework. *Journal of Environmental Psychology*, 15: Pp.181-192.
- 6 Montgomery, C. *Happy City: Transforming Our Lives Through Urban Design*. British Columbia: Doubleday Canada Ltd. Print. c2013.
- 7 Weir, K. (2013). Design in Mind: Psychologists can help to design smart, sustainable spaces for the 21st century. *Nov. Vol 44: P.79*.
- 8 MacKerron, G., and Mourato, S. (2013). Happiness is greater in natural environments. *Global Environmental Change*. Online before in print: <http://dx.doi.org/10.1016/j.gloenvcha.2013.03.010>. Pp.992-1000.
- 9 Morita, E., Fukuda, S., Nagano, J., Hamajima, N., Yamamoto, H., Iwai, Y., Nakashima, T., Ohira, H., Shirakawa, T. (2007). Psychological Effects of

Forest Environments on Healthy Adults: Shinrin-Yoku (Forest-Air Bathing, Walking) As a Possible Method of Stress Reduction. Journal of the Royal Institute of Public Health. 121: Pp.60-64.

10 Tsunetsugu, Y., Park, B., Ishii, H., Hirano, H., Kagawa, T., Miyazaki, Y. (2007) Physiological Effects of Shinrin-Yoku Japan. Journal of Physiological Anthropology, 26(2):140-141.

11 Mead, N., (2008). Benefits of Sunlight: A Bright Spot for Human Health. Environmental Health Perspect. April; 116(4):160-167.

12 Andersen, Peter A. 2008. Nonverbal communication: Forms and functions. 2d ed. Long Grove, IL: Waveland.

13 Rapoport, A. (1976). The Mutual Interaction of People and Their Built Environment: A Cross-Cultural Perspective. Aldine, Chicago. Print.

14 Montgomery, C. (2013). Happy City: Transforming Our Lives Through Urban Design. British Columbia: Doubleday Canada Ltd. Print.

15 Rapoport, A. (1976). The Mutual Interaction of People and Their Built Environment: A Cross-Cultural Perspective. Aldine, Chicago. Print.

CHAPTER 4

MAN AND THE BUILT ENVIRONMENT

1. New York City and Central Park

4.1 Mutual Interactions

There is a mutual interaction of man and the built environment. Kaplan states that there is definitely a particularly high resonance between man and the experience of nature. “Functioning in a natural setting seems for many people to be less effortful than functioning in more civilized settings, even though their familiarity with the latter is far greater”.¹ All individuals have sensory capacities which actively explore the environment and perceive it through senses, thus giving meaning to surroundings and situations. However, the ways in which environments are perceived and which sensory modalities are stressed are often affected by an individuals’ interpreted particular values, which are then explored based on beliefs and understanding of the world.² The many characteristics of human’s interactions with communication, social networks, kinship systems and values, will greatly affect decisions about the built environment as they influence one another. The traditional view of the planning and design of environmental determinism is a belief that states how buildings can have major impacts on man’s behavior, happiness and social interaction.

"the queue violates general rules of proxemics"

2. The Laws of Proxemics.

The airport is often referred to as the 24 hour city or a city within a city. As the nickname suggests, it also carries the same concerns that a city carries such as the lack of public and social space within a large public environment. The importance of a successful public space is that it yields happiness. As studies were conducted, it was discovered that as more roads were created, more cars were attracted. With more bike lanes, there were more bikes. With more space for people, more people gathered and thus public life was formed.³ However, within the airport, there is a surplus of people at all times, yet there is a lack of public space and public gathering. It is a city designed for antisociality.

However, the current view on built environment indicates that the built environment is more so a behavioral setting with indirect influence upon human actions. Rapoport explains how people will act appropriate to the settings in order to match congruent behaviors and norms of other people within certain settings to match the surroundings defined by the culture. The built environment creates cues for certain types of behavior and implies that the environment can be seen as a form of nonverbal communication.⁴ To go further, the general term of environment must be explored as it is a term with implicit consensus regarding definition and meaning. Although

there are multiple definitions of environment, this thesis will focus on two key categorical definitions. The environmental definitions will be those that converge on the ideas of the built environment and that which is influenced in human emotions and psychology from that which is built. The first definition is proposed by Lawton (1970b) which explores the environment as an ecological system of having five components. Within these five components, the physical environment is the one of interest. This environment encompasses "natural features of geography, climate, manmade features which limit and facilitate behavior, the spaces and distances between man and objects, and the 'resources' of the environment".⁵ The second definition of environment comes from Ittelson (1960) which is an ecological model of seven categories. The categories of focus will be on; the perceptual area, which concentrates on man-environment interaction; and the expressive area, which is the effect of shapes, colors, lights, textures, sounds, smells, and symbolic meanings on people.⁸ The Proximities of people from each other is another type of environment that creates a different levels of comfort. Figure 4 identifies which level of proxemics is comfortable to the average individual.

Disney's street creates a model example of a public space that induces calming and pro-social environments. The urban landscape is designed from memory or emotion activating symbols. Parks, plazas and facades are composed from significant parts of history and create purpose for each street.⁶ Depressing and alienating settings, such as frequent garbage, graffiti and damaged property have been researched and avoided by Disney. Threatening spaces can create void spaces but are not the leading cause of antisocial spaces. Simple blank walls, cause pedestrians to pass by as quickly as possible. Whereas store fronts, trees, benches or courtyard squares tend to have people linger. The studies on built environment reveal that there is a direct correlation with the mental health and vitality of an individual. With the decline of attention, there is a decline in behavior patterns from reasonable to unreasonable behavior. Rachel Kaplan and Stephen Kaplan argue that the difference between the behavioral patterns can be directly linked to the environments in which people are surrounded by.⁷

The environment, in this case being the built environment, proves to

have a mutual interaction between itself and man, and therefore a link or mechanism must be present to some degree. Understanding the mechanisms that link the built environment to human senses and responses becomes important in redesigning a space to suit the human psychology. Rapoport already indicated that the environment is a nonverbal form of communication. "A code decoded by users, and the environment as a system".⁸ Perception is another cue which can be through various senses. The environment as a cognition, which means the naming, classification and ordering of each space, are also mechanisms for interpreting the environment. Cognition is somewhat related to space organization which also expresses meaning through symbolic properties, signs, colors, materials and forms and thus communicates. A prime example of space organization can be found in distinguishing different spaces from one another such as allocating restricted zones to public zones within an airport.

A study was done by Rober Thayer at the California State University. He was a professor of psychology that equipped students with pedometers to record their daily activities. Throughout the twenty day trial period, the students answered surveys regarding moods, attitudes, diets and happiness. On average, 9,217 steps were taken each day. A strong correlation was shown between those that walked more and those being more energetic and upbeat. The self-esteem levels were higher as well as happiness levels. "In test after test, he proved that the most powerful way to fix a dark mood is simply to take a brisk walk. Walking works like a drug, and it starts working even after a few steps."⁹ The challenge in the airport is how to make people enjoy their walk, which will be taken up in the design section.

(Endnotes)

¹ Kaplan, S. (1995). The Restorative Benefits of Nature Towards an Integrative Framework. *Journal of Environmental Psychology*, 15: P.193.

² Rapoport, A. (1976). *The Mutual Interaction of People and Their Built Environment: A Cross-Cultural Perspective*. Aldine, Chicago. Print. P8.

³ Montgomery, C. *Happy City: Transforming Our Lives Through Urban Design*.

British Columbia: Doubleday Canada Ltd. Print. c2013. P.150.

4 Rapoport, A. (1976). The Mutual Interaction of People and Their Built Environment: A Cross-Cultural Perspective. Aldine, Chicago. Print. P10.

5 Rapoport, A. (1976). The Mutual Interaction of People and Their Built Environment: A Cross-Cultural Perspective. Aldine, Chicago. Print. P17

6 Montgomery,C. Happy City: Transforming Our Lives Through Urban Design. British Columbia: Doubleday Canada Ltd. Print. c2013. P.161.

7 Kaplan, R., & Kaplan S. (1989). The Experience of Nature: A Psychological Perspective. New York, NY: Cambridge University Press.

8 Rapoport, A. (1976). The Mutual Interaction of People and Their Built Environment: A Cross-Cultural Perspective. Aldine, Chicago. Print. P10.

9 Montgomery,C. Happy City: Transforming Our Lives Through Urban Design. British Columbia: Doubleday Canada Ltd. Print. c2013. P.183.

CHAPTER 5

CASE STUDIES

1. Shenzhen Airport, Fuksas Architect

5.1 Case Study 1: Shenzhen Bao'an International Airport (SZX)

Shenzhen's Bao'an International Airport's Terminal 3 provides a well laid design resembling an aeroplane, while presenting a clearly defined path. The concourse extends nearly 1.3km long as the body, with two wings for additional gates and a threelevel stack of services, arrivals, and departure areas within the tail of the plan. The airport places much emphases on creating natural lighting for travellers penetrating through the 640m wide departure hall with an arched ceiling of hexagonal aluminum panels. The openings shine dappled natural lighting throughout the airport onto the polished floor, reflecting the pattern creating a sense of pop art and fascination within the aesthetic view of the architecture. The pop art is further influenced as the hexagonal form also creates a kaleidoscope effect of spatial and lighting effects. The design of the structural span allows for two skins which are separated to filter the bright sunlight throughout the day, provide a lower ceiling for human scale and contain the mechanical systems for hot air to be vented.¹

The design of the terminal is very clear and clean. The pathway is easily identified within the plan and the procession from drop off

to boarding is evident. However, there are still major concerns and complaints within the airport in regards to delays, boarding times and queues for both check-in, security and boarding. This design reveals that although the design is easy to understand, there is a limited amount to do and limited distractions to reduce mental fatigue within the airport.

2. Shenzhen Exterior Entranceway

3. Shenzhen Terminal End View

4. Shenzhen Ceiling Design

5. Shenzhen Airport, Floor Plan

In comparison to case study 2, this airport has no green space and limited forms of entertainment. For travelers catching connecting flights, there is also a problem with flight connections being on opposite ends of the airport creating additional stressors and problems. The airport does, however, create a reliable amount of natural light and visual fascination through the cladding and architectural style of the building which can be considered as art.

Structural Design Concept

The natural lighting and formwork comes from the double layered structural screen that allows for unblocked views and penetrating light. The structural system of the terminal concourse adapts a more common method of spatial framework between varying truss chord lengths.² The roof system is a truss girder grid that has regular support bracings at every 36 meters. There are additional supporting

pendulum columns are also placed throughout the terminal portion to carry loads in the larger open area. However, the structural system of the concourse is essentially an extrusion of arch shaped trusses with varying chord distances up to a maximum of 3 to 6 meters. The arched spaceframe creates the structural curve for the building and is fixed into a concrete base system, that creates the support, at each side of the airport as per Figure 6 - Cross Section.³ The concourse follows a trapezoidal configuration, commonly used in airports, that was modified to an architectural honeycomb since it the form did not initially correspond to the super-efficient structural integrity. The trapezoidal configuration for the Shenzhen Airport required bracing to reinforce the structural system and through investigations resulted in bracing at 18 meter intervals as seen in Figure 7.

6. Shenzhen Structural Section Diagram

7. Changi Airport, Singapore

5.2 Case Study 2: Singapore Changi Airport (SIN)

Changi International Airport is the main airport in Singapore. It is situated on a site approximately 3,200 acres 17.2km north east of the city centre. The airport consists of 3 passenger terminals capable of handling traffic at 66 million passengers per year. The airport won over 430 awards and claimed 30 best awards in 2012. There are three terminals with the anticipated fourth terminal on the way. Terminal four has a target opening date of 2017 allowing an extra 16 million passengerse. Currently, this airport is ranked the number one airport in the world. The oldest terminal was built in 1981 and the latest, terminal 4, began construction in 2014. Terminal 5 was announced to be constructed in the next decade reclaiming Changi land in the East.

Terminal 3 is the fifth terminal that was built. The gross floor area is 430,000m² spread over sevel levels to which three are underground. The terminal produced 28 extra borading gates and increased car parking by 1,800 spaces. 25,000m² of the terminal is dedicated to 100 retail spaces and over 40 food and drink outlets and 20 service concession stands. The roof structure is created specifically to allow soft natural light into the building while maintaining the comfortable temperature and obstructing tropic heat from entering.⁴ Glass facades allow for expanding the sense of openness. There is also a

8. Right: Large, open, well lit, check in area in airport terminal.

9. Below: Five gardens within the airport in different terminals.

Sunflower Garden

Orchid Garden

Cactus Garden

Butterfly Garden

Enchanted Garden

five storey vertical garden known as the green wall within the check in area. This green wall spans 300 meters across the main building so that it is visible both to arrivals and departure halls.⁵ In addition, the airport has multiple gardens located within the terminal to allow for fascination and distraction of the passengers. There is also a kids zone within the central portion of the airport giving children the opportunity to play and adults the opportunity to relax.

Terminal 3 is created with a lot of glass and steel, but uses natural elements to soften and warm the environment that these materials create. The difference between the Changi Airport and all other airports is not the exterior design of the airport, but the interior layout being efficiently designed for passenger comfort and entertainment. The impression of the airport at first glance upon arrival seems unlike any other modern airport. However, once the passenger walks through the airport, it becomes evident that the airport is more like an attraction in itself, rather than merely a mode of transportation. The interiors are very large and spacious, clean and surrounded in lush greenery. Through the design tailored to the passengers, the airport flow limits the amount of anxiety from taxi to departure. Terminal 3 also uses a common waiting area system at some gates whereas most airports always use separated waiting spaces for gateway boarding.

10. Above: Canoe Feature Ottawa Airport.

11. Below: Ottawa Airport Waterfall Feature by Baggage Collection

12. Check-In Area, Ottawa Airport

5.3 Case Study 3: Ottawa International Airport (YOW)

Ottawa International Airport, is situated just south of Ottawa's city core. It serves a passenger capacity of two to five million passengers per year. According to Airport Service Quality in February 2011, this airport was ranked number one in the world for customer satisfaction. This serves as a prime example for exploration in determining which elements meet customer satisfaction levels.⁶

This airport is slightly different from the previous two case studies in terms of its size. With the airport being smaller, it does have certain benefits which the other two airports do not have, such as shorter walking distances and conceptually assessing the airport size at a single glance. However, it does not mean that the techniques cannot be applied to larger airports. Firstly, Ottawa airport is fantastic in terms of visual connections and circulation. Upon entering the building, passengers are placed in front of neatly placed check-in counters that distinguish a barrier between visitors and passengers within the airport. This airport allows for a visual connection between the passenger at the check in desk to the plane that will be boarded. Therefore, a clerk could simply instruct the passenger to go to the plane within eye sight for simple instruction and immediate relief from wayfinding. Secondly, the airport has a distinct flow that guides the passenger toward the gateways. There

is only one direction to move and prohibits the traveler from getting lost within the airport. The circulation diagram below explores the departure path in orange, and the arrival path in blue. Each path is very simple to see and easy to understand upon entering the airport.

Additionally, the airport has many calming features that serve a dual purpose of visual aesthetics. Some features include natural daylighting, material selection and simple organization, but there are two significant elements that are unique to this airport. Firstly, the airport allows for a direct visual connection into the terminal concourse from the public visiting area. This is located at “A” on the diagram below. This location is actually the food court area prior to the security checkpoint down the escalators below. From this viewpoint, a visitor is able to ensure that the passenger made it through security or simply to wait with the passenger until they board the flight. Secondly, at point B, is the airports featured waterfall that represents parts of the river that flows in ottawa. As the airport is a gateway, this shares a small portion of what Ottawa is to the traveler. Similarly, it creates a calming effect on travelers passing through the airport. Being around water revitalizes the indirect attention spans while creating white noise to drown out unwanted airport noises.

13. Ottawa Airport Circulation Case Study

The structural design of the airport allows for the most optimal lighting with this built design. The airport is fixed with bright lights, just like any other airport, but they are rarely used due to the sufficient natural lighting and well designed building.

(Endnotes)

- 1 Webb, M., Finotti, L. (2014). Mark Magazine. April-May. Issue: 49. Pp.120-129
- 2 Helbig, T., Kamp, F., (2014). New Terminal 3 for Shenzhen Bao'an Airport: a 1250m long structure. http://www.knippershelbig.com/sites/default/files/pdf/new_terminal_3_shenzhen_boa_an_airport_th_fk1.pdf. (Accessed 23 October 2014).
- 3 Helbig, T., Kamp, F., (2014). New Terminal 3 for Shenzhen Bao'an Airport: a 1250m long structure. http://www.knippershelbig.com/sites/default/files/pdf/new_terminal_3_shenzhen_boa_an_airport_th_fk1.pdf. (Accessed 23 October 2014).
- 4 "Changi Airport Case Study", (2014). Accessed June, 2014. <http://www.airport-technology.com/projects/changi/>.
- 4 "Changi Airport Case Study", (2014). Accessed June, 2014. <http://www.airport-technology.com/projects/changi/>.
- 6 Ottawa Airport Site. (2014). Accessed May 2014. <http://ottawa-airport.ca/corporate/about-us/airport-master-plan>

CHAPTER 6

SITE SELECTION: PICKERING LANDS

1. Rouge Park public trail within Pickering Lands.

6.1 Pickering Lands History

Pickering Airport is a site that has been on debate for the last 40 years. The Pickering Lands are 7,530 hectares (18,600 Acres) or approximately 4 times the size of Pearson Airport property. The lands were acquired by the federal government in 1972 and were kept for the potential of an airport and future aviation options. It is approximately 65km east of Toronto Pearson International Airport. 2,300 Hectares are dedicated to airport development whereas the remaining amount is dedicated to land conservation. The goal is to create a natural environment similar to Stanley Park, but 12 times larger.¹ Studies have already been done to determine the location of runways and directions of flight based on wind patterns and space by Transport Canada.

The major issue of the 40 year debate is based on the land that the airport is situated on. Within the plot of land resides many residents and farmers. However, the land belongs to the federal government with intent on building an airport when the cities expand. With the city focus on reducing urban sprawl, the idea is for the cities to grow closer together with the intent of eventually merging. The airport

2. Site context of Cities surrounding the Pickering Airport Site.

becomes a central portion of the city with an integrated program equally dividing the land into three portions: airport, rouge park and economic development. The controversy develops around the fact that the Pickering Lands are potentially prime farm land and the airport is projected to begin construction in 2027. With technology, growing cities and new airports emerging, this site will be an ideal location for an airport connecting a larger city together rather than driving an hour or more to get to an airport. With the connection to Rouge Park, it provides potential to redesign the idea of an airport with respect of integrating man's built environment alongside nature and proposing a pleasing environment prior to take-off.

As per Figure 2, the site is located within the center of 4 major and growing suburbs; Markham, Stouffville, Uxbridge and Pickering. The purple lines reflect the major roads and the dark black lines are the major highways. Cities are marked with bold black text and smaller townships are indicated through smaller grey text. This gives context to the existing site which is located within the **red bold**

3. Airport approved flight paths.
Information found from Transport Canada.

border. Rouge Park's history goes back over 10,000 years including being a habitation and historical hunting ground. In 1956, the Rouge Duffins Highland Petticoat Conservation Authority created a vision to preserve and protect the land. Almost 40 years later in 1990, the Province of Ontario announced it's goal to create a Park that will Protect the Rouge River.² The map shows how the park begins south of Highway 401 and currently goes slightly beyond 16th Avenue. The intent shows that the parklands will expand to just south of Stouffville Road.

6.2 Pickering Airport Site Analysis

Figure 3 is a proposed flight plan path for the pickering lands with information provided from Transit Canada. This figure reveal the proposed runway layouts in solid grey at the centre allowing for 3 runways. The extruding triangular hatches represent existing approach surfaces that restrict any building or construction within these regions above a certain height. Currently, these regions skirt along the exterior of the cities and do not allow for airplanes to

intersect above the airspace of the city. The green hatch shows the existing outer surface just beyond the property line. The blue shows existing transitional surfaces. Finally, the blue triangle within the center of the map indicates the location for the airport reference point.

The proposal was put into motion due to the limiting capacity of Pearson Airport. With the surrounding communities continually expanding as the population grows, preparations for a new airport or an expansion of Pearson are becoming growing concerns. The chart below represents the passenger traffic from 2008 as 32.3 million passengers per year. The passenger traffic in 2012 was 34.9 million passengers. Given the rate of growth is approximately 2.5 million per 4 years, the projection for 2016 can be estimated at 37.4 million passengers. Since the the maximum capacity of Pearson Airport is 41.8 Million passengers, going at this rate, the airport will be at maximum capacity in approximately 8 years.

PEARSON CAPACITY

4. Pearson Capacity Statistics,

SURROUNDING CITY POPULATIONS

	PREVIOUS POPULATION	LATEST POPULATION	INCREASE
STOUFFVILLE		37,628 (2011)	-
PICKERING		90,000 (2006)	-
UXBRIDGE	11,531 (2001)	20,623 (2011)	9,092
MARKHAM	208,615 (2001)	261,575 (2006)	50,960
RICHMOND HILL	132,030 (2001)	162,705 (2006)	30,675
VAUGHAN	182,020 (2001)	238,865 (2006)	56,845
TORONTO	2.48M (2001)	2.50M (2006)	20,000

5. Surrounding Area Population Growth

The above chart shows the statistics for the areas surrounding the Pickering Airport Site. The main cities are Pickering, Markham and Stouffville. The cities that would be between Pearson and the Pickering Airport are Richmond Hill, Vaughan and Toronto. The general population increase is a 5 year span ranging from 2001 to 2006 and therefore it would be safe to estimated a multiplied increase of 3 for 2016.

(Endnotes)

¹ Lu, V. "New Pickering Airport Plans Leave Farmers in Limbo," Toronto Star, October 10, 2013, accessed May 15, 2014, <http://torontostar.newspaperdirect.com/epaper/viewer.aspx>.

² Rouge Park. "Our History", (2013). <http://www.rougepark.com/about/history.php>.

CHAPTER 7

CONCEPTUAL DESIGN PROPOSAL

1: Conceptual Layout of Airport Site in Pickering Lands.

2: Four basic and most common terminal types.

Ideally, having a single terminal massing down the center of the site would be most appropriate, allowing for entrance at the west end and a single direction of travel for passengers up and down the concourse. However, due to site restrictions, that would create, at the least, a 1km distance from each gate to the runways. In order to address the distances, the simplest method is to split the single massing and create two terminals closer to the runways limiting the maximum distance as 500m to the runways. The form further evolves to connect the two terminals down the centre in order to create a central access point for arrivals and departures, thus limiting confusion of multiple terminals. The exterior form is gently squeezed in at the central axis as per figure 3. allowing for a smooth curve tailored specifically to allowing more airplane boarding surface area. Finally, a connection bridge is added to be east end of the airport for more efficient travel through the airport for connecting flights while creating space for external gardens to be enjoyed by passengers.

Figure 1 represents the location for proposed area of development on the site. The red indicates the most ideal location for the terminal

3: Programmatic Massing Studies.

design as it has the largest clear area from flight obstruction. Automotive traffic will enter the site through the west. Highway 407 and Brock Street Northbound, will become the main road in order to enter the airport lands. Brock Road is the only road which will allow access from the west direction to the airport lands. A single three lane roadway will lead into the area and split into arrival, departure and parking lanes to allow for passengers to go to appropriate directions. The design will follow a typical multi-level terminal type with vertical stacking of arrivals and departures as in Figure 2.

The starting point was attempting to design a bar through the middle of the property allowing for single point access. However, it created issues with distances from terminal to runways. The distances were approximately 1.5km.

Separating the building allowed for reduced distances to the runways with a maximum distance being 600m. This also created more distinct separation between International and Domestic terminals.

Pushing the two points in created more space for gateways and airplanes and allows for optimizing the use of the site. This creates two outward curves increasing the perimeter of the building and a bigger radius for docking.

Finally, joining the two terminals at the central core creates a central check-in location, reducing confusion of having multiple terminals as well as creating a connection for transfers. It also allows for more airplane space to access the runways.

The diagram consists of three vertical flowcharts, each representing a different traveler's itinerary. The flowcharts are labeled at the bottom as "BUSINESS TRAVELER", "SINGLE TRAVELER", and "PARENTS WITH CHILDREN".

- BUSINESS TRAVELER:** This itinerary starts with "BOARD PLANE", followed by "WAIT...", "CHECK EMAIL/INTERNET", "FIND CAFE", "BATHROOM BREAK", "BAGGAGE DROP-OFF", "CHECK IN", "WAYFIND THROUGH AIRPORT", and finally "ARRIVE AT AIRPORT".
- SINGLE TRAVELER:** This itinerary starts with "BOARD PLANE", followed by "WAIT...". It then branches into two paths: one leading to "RUSH TO GATE" and another to "CURRENCY EXCHANGE". From "RUSH TO GATE", it goes to "EAT FOOD" and then "EXPLORE AND WAYFIND". From "CURRENCY EXCHANGE", it goes to "QUICK NAP IN POD". Both paths converge at "BAGGAGE DROP-OFF", followed by "CHECK IN", which branches into "BATHROOM BREAK" and "LAST SMOKE BEFORE ENTERING AIRPORT". Both paths then lead to "ARRIVE AT AIRPORT".
- PARENTS WITH CHILDREN:** This itinerary starts with "BOARD PLANE", followed by "BATHROOM BREAK", "WAIT...", "EAT FOOD", "ENTERTAIN CHILDREN", "BAGGAGE DROP-OFF", "CHECK IN", "BATHROOM BREAK", and finally "ARRIVE AT AIRPORT".

The flowcharts use simple icons to represent various activities: an airplane for boarding, a clock for waiting, an envelope for checking email, a coffee cup for finding a cafe, a person at a sink for bathroom break, a suitcase for baggage drop-off, a person at a desk for check-in, a person walking for wayfinding, a train for arrival, a fork and knife for eating, a person running for rushing to the gate, a currency symbol for exchange, a person sleeping for napping, a person with a suitcase for exploring, a person smoking for last smoke, and a car for arrival.

In response to the motivation-hygiene factor theory, the basic factors are addressed through the efficient coordination of passengers from car park or drop off until the boarding gate. The site is organized through having a large central area for both domestic and international terminal receptions. The international and domestic terminals are split between the north and south of the building. Yet

5: Programmatic separation between International and Domestic Terminals.

6: Direct flights and transfer flight locations within the airport and location of transfer bridge.

share the large common area within the lobby portion of the airport. Having one parking area and check in area eliminates the confusion of having to navigate through multiple roadways upon approaching the airport and transit time between the two terminals. The check-in desks are located directly upon entering with signage indicating that international is toward the north portion of the airport and domestic is located toward the south portion of the airport. Security check points are found directly after the check-in sections along the central grid of the airport leading into each terminal. Two security check in points are present to accommodate high traffic volumes and more efficient transition through security.

The airport is then further divided to reduce and isolate international and domestic transfer distances to the east side of the airport. As shown in figure 5 the airport is divided down the middle with a connection bridge allowing for transfers and additional flight docking areas. By controlling the location for direct flights and connecting flight locations it also allows for better circulation and sense of direction for passengers.

In terms of circulation, the layout allows for a simple understanding of the direction of flow. Upon arrival to the airport, the passenger has the opportunity to park, and then walk into the central core, or to be dropped off at the central area by the check in. Signs will be mounted in various locations indicating the directions for international and domestic check-in. After check-in, the passenger has the opportunity to linger prior to passing through the security check point or to simply pass through security. Another feature of this design, is providing more space for non-passengers, such as family and friends. This provides space and activities for family and friends prior to security check points. The central core becomes the public space, and the rest of the building including the external garden areas are proposed as private areas available to passengers post security check. The central core includes a restaurant at the top level with a view of the runways, providing opportunities to bring back the spectacle of flight and transportation to the public.

7: Departure diagram showing parking, check-in and terminal flow at level 2.

8: Arrival diagram indicating landing, baggage claim and terminal flow at level 1.

As per the queuing theory and the factors of mental exhaustion, there should be some feature in this area to create fascination in order to revitalize the directed attention span and rest mental fatigue. The feature will be revitalizing but not too distracting as a security section should not be entirely stress free and the elements should not be too distracting for security officers. With the security check-in being side by side, I propose placing an aquarium in the centre as a shared wall. This would allow for people to have something to be mentally relaxing as it has both revitalizing aspects of water, as well as moving elements within the aquarium to grasp fascination and replenish directed attention spans and mental stamina. The security layout is simple and logical providing visual connections from entrance to exit giving a clear understanding of the length of the process. Duty free and retail are placed directly after security for two reasons. Firstly, for economical purposes, duty free sales and retail are found to be most effective after security. Secondly, retail is a form of therapy that can destress and help an individual relax. Upon emerging into the terminal, the passengers will be greeted by a large atrium of multiple stories of retail and amenities. Signage will indicate which direction to go, and sunken garden areas with imbedded seating will be available along the central axis of each terminal.

As mentioned earlier, within man and the city, there are key elements to happiness that can be found within a city. One aspect of happiness is found from walking and public spaces. The problem within the airport is that people do not want to walk. Instead, they prefer to take people movers to get them to their destinations as quickly and efficiently as possible. Likewise with stairs, given the choice, people will almost always choose to take an escalator than to actually use a staircase. There are multiple designs which lure pedestrians to use stairs or exercise more frequently that is built into the design of the built environments. Within the design lies an element of *shinrin-yoku* where the central axis will be lined with a sunken garden of trees and greenspace. The elements will represent parts of Rouge Park that the site is interconnected with as well as portions representative of Canada as this international airport will serve as a gateway for travelers going through Canada. Additionally, having a line to follow creates a form of wayfinding and serves as a guide. The second purpose is the calming effects of nature on the

human psyche. Nature calms, soothes, nourishes and rejuvenates the human brain.

The Herzberg Theory clarifies the distinction between satisfiers, motivators and how to stimulate delight. Figure 9 below is a diagrammatic representation of the ground floor plan with highlighted key elements within the airport. The identified elements reveal the location of the satisfiers that are obligatory to have within the airport and their functional efficiency. The arrows clearly indicated the directions and flow of the building which reveal the simplicity of the design and ease of wayfinding. It also shows the logical layout of the necessary elements which assist in reducing stress but also creating the most basic components to satisfy the passenger which provides a greater possibility of impressing delight upon a passenger.

Additional activities represented in the Figure 10: Motivators, with squares, reveal elements that add to the spectacle of the airport. On the ground level, the large green space will be accessible inside of the building providing a regulated fresher environment. The space will mimic a interior soft socialscape portion of the exterior allowing for alternative community seating rather than typical isolated airport chairs. The regular seating is also provided within the airport closer to the gates. Some additional facilities of the airport is an external access point within the terminal. This provides passengers the freedom to go outside into fresh air. Within the international garden portion will be a water feature that can freeze in winter allowing for travelers to partake in opportunities to go skating and enjoy some Canadian sports during transfers and waiting times. Shopping is available on the ground level, but the second level and above will be dedicated specifically to shopping as retail plays a significant part in relaxation and therapy. Food, drinks, theatres and lounges are also available. As well as exercising facilities, such as workout gym, rock climbing and screen golf locations.

9: Ground floor program and locational diagram of the basic satisfiers within the airport terminal.

10: Ground floor program and locational diagram of the motivators within the airport terminal.

Structural Design Concept

Determining the structural component of the airport combined a series of precedents and combining ideas in order to arrive at the desired terminal appeal. The grid, Figure 12, concept split the building into 3 separate sections: the central core, international side, and domestic section of the building. Then as studies were done to determine the most efficient layout for airplane traffic, a grid of 34.5 meters was established through using the midsized 787 airplane as a form of reference. Figure 11 represents the size of the 787 and how the distances created the spacing for the basic grid system. Since the building is not a straight line, the grid creates larger spacing where the curves fan out. This allows for larger planes to access the build while maintaining a 34.5 meter span at the exterior wall distance.

The structural design for the main terminal area will be composed of a large spaceframe combined with columns that follow a grid-like pattern of 35 and 45 meter spacing. The ends are furthered strengthened above the security section as all walls by the security will be structural for additional support. The structure will be represented in the sectional drawings. The concourse follows a typical trapezoidal structure used in large spans such as Shenzhen Airport. However, the Shenzhen Airport's structure does not allow for clear open glazing along the archways. Therefore, arched bracings will be placed at 34.5 meter intervals to support the arch combined with columns placed along the 34.5 meter grid cross sectionally. The roof structure will be created from spatial framework with a distances between the two chord levels ranging from 3 to 6 meters. Truss members will be mainly hollow sections varying in diameter from 3 to 8 meters. In some areas, rectangular hollow sections will be allowed using profile sections made of flanges and webs with plate thicknesses adjusted to the structural requirements. Additional support structure will be found from strengthened elevator shafts and emergency exit stairways.

11: Grid Layout based on 787 flight limitations

FIGURE 12 GRID
GRID LAYOUT

FIGURE 14 SECOND FLOOR PLAN
DEPARTURES LEVEL

- 1. PARKING GARAGE
- 2. CHECK IN STATIONS
- 3. SECURITY AND SECURITY OFFICES
- 4. SUNKEN GARDEN IN TERMINAL
- 5. OFFICE AND ADMINISTRATION
- 6. TRANSFER BRIDGE
- 7. EXTERIOR SCULPTURE GARDEN

FIGURE 15 THIRD FLOOR PLAN
SHOPPING LEVEL

- 1. FOOD AREA AND MEZZANINE
- 2. OFFICES AND ADMINISTRATION
- 3. FOOD COURT ON SHOPPING LEVEL
- 4. MOVIE THEATRE
- 5. INDIVIDUAL SHOPPING STALLS

FIGURE 17 SECTION AA
CROSS SECTION

FIGURE 18 SECTION BB
LOBBY AND CHECK-IN

FIGURE 19 SECTION CC
CONCOURSE

FIGURE 20: PERSPECTIVE CONCOURSE SECTION

FIGURE 21: PARTIAL CROSS-SECTION

FIGURE 22: DETAIL GROUND PLAN

FIGURE 23: DETAIL 2ND FLOOR PLAN

FIGURE 24: DETAIL 3RD FLOOR PLAN

FIGURE 25: CONCEPTUAL 3D MODEL MASSING

FIGURE 26: EXTERIOR RENDERING

FIGURE 27: CONCOURSE RENDERING

EXTRA PERSEPCTIVES

FIGURE 28: CHECK IN LOBBY FROM GROUND LEVEL

FIGURE 29: CONCOURSE LOOKING TOWARD SECURITY

FIGURE 30: CONCOURSE FROM 3RD LEVEL

FIGURE 31: SUNKEN GARDEN AREA

CONCLUSION

1. Rendering of Final Model

As mentioned earlier, stress is not entirely bad. In certain places within the airport it can actually be quite beneficial. However, having too much constant stress is unhealthy and detrimental to the body. Since the airport is such a complex arrangement of stimulations, stress and anxiety are unavoidable, but can be reduced. Through combining the understanding the satisfaction-motivation theory alongside the attention restoration theory, an infinite amount of possibilities unfold where the environment can lead to a more therapeutic state.

The satisfaction-motivation theory allows for assessing the most essential needs required within an airport. Ensuring that the basics are provided, reduce the chances of dissatisfaction, impatience and stress. The techniques for the attention restoration theory rejuvenate the mental stamina of passengers also reducing the chances of mental fatigue, irritability and stress. Although the design is just a potential model, it has value in addressing the environmental psychology of individuals as they travel through built environments. The airport is an extreme example, but through analysing it, an understanding occurs where high transit hubs can be more than designed merely

for vehicles. This is much like the city, where the focus was oriented around cars and is now on revitalizing, welcoming and incorporating pedestrians. Built environments can often neglect the impact on people and through understanding psychology, architecture can be vastly effected. Newer airports are incorporating many innovative ideas of fascination into the built environments as a mode of comfort for travelers and they have received much praise. The case studies, for example, reveal a whole series of fascination and activities within the Changi airport as well as a waterfall feature within the Ottawa Airport. In the past, the only modes of fascination were of airplanes taking landing, taking off, and people moving. There is an alternative source of relieve which is retail but for a passenger that is on budget, there is little that can be done.

Within this project, there are many types of techniques that are used as examples for transforming elements of the airport into less threatening and more welcoming spaces. Kristen Wier made it clear through sharing how the psychological remedies within the airport can be partially controlled through the characteristics and experience of the building. The buildings process renders itself vulnerable to criticisms regarding the lack of concern for human relations within the context of architectural walls and boundaries¹. Allowing for natural green spaces, adequate sunlight and sufficient activities provides the airport with a vibrant dynamic. This creates a place to be comfortable in, especially With recent events of the ice storms in North America delaying flights for weeks and stranding passengers within airports growing more aggressive, agitated, stressed and uncomfortable, it has become clear that the built environment does have a large impact on man and human psychology. With more frequent ice storms and delays in the last few years. The inadequacy of space can be resolved while providing all of the necessary daily satisfactions, including access to a large open exterior space.

This design serves as a model using a small selection of many similar possibilities to create a pleasant environment. With the airport becoming a more predominant method of transportation and with intentions for a much larger spectrum of air transit, the airport cannot be overlooked. Especially since it serves as the gateway into and out of cities, which acts as a key locational identity. With airports becoming a significant design focus once again, I believe it

is important to understand key values of the airport process which will allow for optimal passenger experience. This can be achieved by presenting delight rather than mere satisfaction and in reaction, providing an experience that can potentially be more therapeutic and healthy to the transit experience.

(Endnotes)

- 1 Weir, K. (2013). Design in Mind: Psychologists can help to design smart, sustainable spaces for the 21st century. Nov. Vol 44: 50.

Bibliography

- Andersen, Peter A. 2008. *Nonverbal communication: Forms and functions*. 2d ed. Long Grove, IL: Waveland.
- Bitner, M.J. (1992), "Servicescapes: the impact of physical surroundings on customers and employees", *The Journal of Marketing*, Vol. 56 No. 2, pp. 57-71.
- Burgoon, Judee K., Laura K. Guerrero, and Kory Floyd. 2010. *Nonverbal communication*. 3d ed. Boston: Allyn and Bacon.
- Bowler, D. E., Buyung-Ali, L. M., Knight, T. M., & Pullin, A. S. (2010). "Asystematic review of evidence for the added benefits to health of exposure to natural environments." *BMC Public Health*, 10, 456. (Accessed March 2014) <http://dx.doi.org/10.1186/1471-2458-10-456>
- Cadotte, E.R. and Turgeon, N. (1988), "Key factors in guest satisfaction", *Cornell Hotel and Restaurant Administration Quarterly*, Vol. 28 No. 4, pp. 45-51.
- "Changi Airport Case Study", (2014). Accessed June, 2014. <http://www.airport-technology.com/projects/changi/>.
- Chen, F.Y. and Chang, Y.H. (2005), "Examining airline service quality from a process perspective", *Journal of Air Transport Management*, Vol. 11 No. 2, pp. 79-87.
- Correia, A.R., Wirasinghe, S. and De Barros, A.G. (2008), "Overall level of service measures for airport passenger terminals", *Transportation Research Part A: Policy and Practice*, Vol. 42 No. 2, pp. 330-346.
- Dumont, M., Beaulieu, C. (2007). "Light Exposure in the Natural Environment: Relevance to Mood and Sleep Disorders", *Sleep Medicine* 8, 557-565.
- Fodness, D. and Murray, B. (2007), "Passengers' expectations of airport service quality", *Journal of Services Marketing*, Vol. 21 No. 7, pp. 492-506.
- Fuller, J. and Matzler, K. (2008), "Customer delight and market segmentation: an application of the three-factor theory of customer satisfaction on life style groups", *Tourism Management*, Vol. 29 No. 1, pp. 116-126.
- Fuller, J., Matzler, K. and Faullant, R. (2006), "Asymmetric effects in customer satisfaction", *Annals of Tourism Research*, Vol. 33 No. 4, pp. 1159-1163.
- Gehl, J. (2010). *Cities for people*. Washington, DC: Island Press.
- Gehl, J. (2010). *How to study public life*. Washington: Island Press.

- Gordon, Alastair. (2008). *Naked Airport: A Cultural History of the World's Most Revolutionary Structure*. Chicago. Metropolitan Books, Henry Holt and Company, Ltd. Print.
- Hamilton, K., Watkins, D. (2009). *Evidence Based Design For Multiple Building Types*. John Wiley & Sons Inc. Hoboken, New Jersey. Print.
- Helbig, T., Kamp, F., (2014). "New Terminal 3 for Shenzhen Bao'an Airport: a 1250m long structure", http://www.knippershelbig.com/sites/default/files/pdf/new_terminal_3_shenzhen_boa_an_airport_th_fk1.pdf. Accessed 23 October 2014.
- Herzberg, F., Mausner, B. and Snyderman, B.B. (1959), *Motivation to Work*, Transaction Publishers, New Brunswick, NJ.
- Jeon, S. and Kim, M.-S. (2012), "The effect of the servicescape on customers' behavioral intentions in an international airport service environment", *Service Business*, Vol. 6 No. 3, pp. 279-295.
- Jones, N., (2011). "CPP Stress and Airport Traveling", <http://www.slideshare.net/CPPUK/stress-and-airport-travelling#>
- Kaplan, S., & Berman, M. G. (2010). "Directed attention as a common resource for executive functioning and self-regulation", *Perspectives on Psychological Science*, 5, 43-57. <http://dx.doi.org/10.1177/1745691609356784>
- Kaplan, R., & Kaplan S. (1989). *The Experience of Nature: A Psychological Perspective*. New York, NY: Cambridge University Press.
- Kaplan, R. (1993). "The Role of Nature in the Context of the Workplace", *Landscape and Urban Planning*, 26: 193-201.
- Kaplan, S. (1995). "The Restorative Benefits of Nature Towards an Integrative Framework", *Journal of Environmental Psychology*, 15: 169-182.
- Kent, S., McClure, L., Crosson, W., Arnett, D., Wadley, V., Sathikumar, (2009). Effect of Sunlight Exposure on Cognitive Functioning Among Depressed and Non-Depressed Participants: A REGARDS Cross-Sectional Study. *Environmental Health*, 8:34, 1-14. <http://www.ehjournal.net/content/pdf/1476-069X-8-34.pdf>
- Kloos, Martin. Maar, Birgitte. (1996). *Schiphol Architecture: Innovative Airport Design*. Amsterdam. ARCAM. Print
- Lazarus, R. S. (1966). *Psychological Stress and the Coping Process*. New York: McGraw-Hill.
- Levitt, E. (1980). *The Psychology of Anxiety*. Hillside, N.J.: L. Erlbaum Associates.
- Lu, V. "New Pickering Airport Plans Leave Farmers in Limbo," *Toronto Star*, October

- 10, 2013, accessed May 15, 2014, <http://torontostar.newspaperdirect.com/epaper/viewer.aspx>.
- Mackerron, G., and Mourato, S. (2013). Happiness is greater in natural environments. *Global Environmental Change*. Online before in print: <http://dx.doi.org/10.1016/j.gloenvcha.2013.03.010>
- Matzler, K. and Sauerwein, E. (2002), "The factor structure of customer satisfaction: an empirical test of the importance-grid and the penalty-reward-contrast-analysis", *International Journal of Service Industry Management*, Vol. 13 No. 4, pp. 314-332.
- Mead, N., (2008). "Benefits of Sunlight: A Bright Spot for Human Health", *Environmental Health Perspect.* April; 116(4):160-167.
- Montgomery, C. (2013). *Happy City: Transforming Our Lives Through Urban Design*. British Columbia: Doubleday Canada Ltd. Print.
- Morita, E., Fukuda, S., Nagano, J., Hamajima, N., Yamamoto, H., Iwai, Y., Nakashima, T., Ohira, H., Shirakawa, T. (2007). "Psychological Effects of Forest Environments on Healthy Adults: Shinrin-Yoku (Forest-Air Bathing, Walking) As a Possible Method of Stress Reduction", *Journal of the Royal Institute of Public Health*. 121: 54-63.
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2011). Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being. *Journal of Happiness Studies*, 12, 303-322. <http://dx.doi.org/10.1007/s10902-010-9197-7>
- Oliver, R.L., Rust, R.T. and Varki, S. (1997), "Customer delight: foundations, findings, and managerial insight", *Journal of Retailing*, Vol. 73 No. 3, pp. 311-336.
- Ottawa Airport Site. (2014). Accessed May 2014. <http://ottawa-airport.ca/corporate/about-us/airport-master-plan>
- Pearman, Hugh. (2004). *Airports: A Century of Architecture*. London: Laurence King Publishing Ltd. Print
- Powell, Kenneth. (1992). *Stansted: Norman Foster and the Architecture of Flight*. Great Britain. Fourth Estate Ltd. Print
- Rapoport, A. (1976). *The Mutual Interaction of People and Their Built Environment: A Cross-Cultural Perspective*. Aldine, Chicago. Print.
- Rouge Park. "Our History", (2013). <http://www.rougepark.com/about/history.php>.
- Rowley, J. and Slack, F. (1999), "The retail experience in airport departure lounges: reaching for timelessness and placelessness", *International Marketing Review*, Vol. 16 Nos 4/5, pp. 363-376.
- Spielberger, C. (1976). *Emotions and Anxiety: New Concepts, Methods, and*

- Applications. Hillside. N.J.: L. Erlbaum Associates. New York
- Sulzmaier, S. (2001), *Consumer-oriented Business Design: The Case of Airport Management*, Physica-Verlag HD, New York, NY.
- Thomas-Emberson, Steve. (2007). *Airport Interiors: Design for Business*. Great Britain. John Wiley & Sons Ltd. Print.
- Torres, E. and Kline, S. (2013), "From customer satisfaction to customer delight: creating a new standard of service for the hotel industry", *International Journal of Contemporary Hospitality Management*, Vol. 25 No. 5, pp. 642-659.
- Tsunetsugu, Y., Park, B., Ishii, H., Hirano, H., Kagawa, T., Miyazaki, Y. (2007) *Physiological Effects of Shinrin-Yoku Japan*. *Journal of Physiological Anthropology*, 26(2):135-142.
- Ulrich, R.S. (1993). Biophilia, Biophobia, and Natural Landscapes. In Kellert, S.A. & Wilson, E.D. (EDS). *The Biophilia Hypothesis* (pp. 74-137). Washington, DC Island Press/Shearwater.
- Ulrich, R.S., Simons, R.F., Losito, B.D., Fiorito, E., Miles, M.A., & Zelson, M. (1991). Stress Recovery During Exposure to Natural and Urban Environments. *Journal of Environmental Psychology*, 11: 201-230.
- Webb, M., Finotti, L. (2014). *Mark Magazine*. April-May. Issue: 49. Pp.120-129
- Weir, K. (2013). Design in Mind: Psychologists can help to design smart, sustainable spaces for the 21st century. Nov. Vol 44: 50.
- Young, R. (2013). Environmental Psychology Overview. In Ann H. Huffman & Stephanie Klein (Eds.) *Green Organizations: Driving Change with IO Psychology*. (Pp. 17-33) New York: Routledge.

List of Illustrations

Chapter 1

1. Terminal 2 Dublin Airport. (2010). ARUP Architects. http://www.arup.com/~media/Images/Projects/T/Terminal2_Dublin_Airport/Terminal2_900x600.ashx?mh=800&mw=1000 (accessed July 2014).

Chapter 2

1. Gordon, Alastair. (2008). *Naked Airport: A Cultural History of the World's Most Revolutionary Structure*. Chicago. Metropolitan Books, Henry Holt and Company, Ltd. Print. Pg220.
2. Images and diagrams made by the Author.
3. Images and diagrams made by the Author.
4. Images and diagrams made by the Author.

Chapter 3

1. Sponge Slip, Sunken Park. (2014), Accessed December 1, 2014. <http://archinect.com/news/gallery/61860335/0/sponge-parks-sand-dunes-may-boost-resilience-to-storms#>
2. Images and Digrams made by the Author.
3. Times Square NYC. <https://platanitos.com/producto?id=2660303186>. (Accessed August 2014).
4. Times Square NYC. <http://walls4joy.com/wallpaper/95771-New-York-City-cities>. (Accessed August 2014).
5. Wind in Leaves. <http://www.myhomelifemag.com/2012/09/19/season-change-checklist>. (Accessed August 2014).
6. Georgia Aquarium. <http://www.georgiaaquarium.org>. (accessed August 2014).
7. Devetaki Cave, Bulgeria. <http://www.dystalgia.com/wp-content/uploads/Devetashka-cave-Bulgaria-02.jpg> (accessed August 2014).
8. Mellisani Cave, Greece. Stunning Nature of Melissani Cave, Greece. <http://iliketowastemytime.com/stunning-nature-of-mellisani-cave-greece> (accessed August 2014).
9. Ice Caves, Chile. Top 15 Unbelievable Places in the World That Really Exist. <http://themysteriousworld.com/top-15-unbelievable-places-in-the-world-that-really-exists/> (accessed August 2014).
10. Tsunetsugu, Y., Park, B., Ishii, H., Hirano, H., Kagawa, T., Miyazaki, Y. (2007) Physiological Effects of Shinrin-Yoku Japan. *Journal of Physiological Anthropology*, 26(2):135-142.
11. Tsunetsugu, Y., Park, B., Ishii, H., Hirano, H., Kagawa, T., Miyazaki, Y. (2007) Physiological Effects of Shinrin-Yoku Japan. *Journal of Physiological Anthropology*, 26(2):135-142.
12. Municipal Offices of LACQ Region Gilles Bouchez. <http://www.formakers.eu/project-905-gilles-bouchez-architecture-municipal-offices-of-the-lacq-region>. (Accessed August 2014).

13. Louisiana Sports Hall. <http://www.livegreenblog.com/sustainable-architecture/louisiana-state-museum-and-sports-hall-of-fame-by-trahan-architects-8888>. (Accessed August 2014).

14. Images and Diagram made by Author.

15. Images and Diagram made by Author.

Chapter 4 Man and the Built Environment

1. New York City and Central Park Aerial View. Flickr.com. (accessed June 2014).

2. Drawing and Diagram made by Author

Chapter 5 Case Studies

1. Shenzhen Airport, Fuksas Architect. <http://sfwallpaper.com/r/architecture>. (Accessed July 2014).

2. Shenzhen Airport Exterior Entranceway. <http://trends.archiexpo.com/projects/shenzhen-baoan-international-airport-inauguration>. (Accessed, July 2014).

3. Shenzhen End of Terminal View. <http://trends.archiexpo.com/projects/shenzhen-baoan-international-airport-inauguration>. (Accessed, July 2014).

4. Shenzhen Ceiling Design. <http://trends.archiexpo.com/projects/shenzhen-baoan-international-airport-inauguration>. (Accessed, July 2014).

5. Shenzhen Airport Plan. http://www.theplan.it/1/index.php?option=com_content&view=article&id=5955%3Anuovo-terminal-del-shenzhen-baoan-in-te&Itemid=246&lang=en. (Accessed, April 2014).

6. Helbig, T., Kamp, F., (2014). "New Terminal 3 for Shenzhen Bao'an Airport: a 1250m long structure", http://www.knippershelbig.com/sites/default/files/pdf/new_terminal_3_shenzhen_boa_an_airport_th_fk1.pdf. Accessed 23 October 2014.

7. Changi Airport 300m Wall. http://luznatural-ianta.blogspot.ca/2012/03/http-www_27.html. (Accessed, August 2014).

8. Changi Airport 5 Gardens. <http://www.hobbyjalandasia.com/2014/03/hal-yang-bisa-dilakukan-di-changi.html>. (Accessed, August 2014).

9. Changi Airport Check in. <http://www.todayonline.com/singapore/terminal-4-be-test-bed-new-concepts-t5>. (Accessed, August 2014).

10. Ottawa Airport Canoe Feature. <http://www.dev.ihcdstore.org/?q=print/138>. (Accessed, October 2014).

11. Ottawa Airport Waterfall Feature. <http://forum.skyscraperpage.com/show-thread.php?t=149245>. (Accessed October 2014).

12. Ottawa Airport Check-In. <https://www.flickr.com>. (Accessed October 2014)

13. Ottawa Airport Case Study: Base image from: Alex Fiori, Alex Preiss, Jake Murray, Audrey Caron, Andrej Iwanski, Natalia Ospina, Alison Burgess

14. Ottawa Airport Terminal Side. <http://listvogue.com/2014/09/07/top-10-biggest-international-airports-in-canada>. (Accessed, October 2014).

Chapter 6 Pickering Site Analysis

1. Rouge Park. <http://greenmetropolis.ca/torontos-best/green-gatherings-september-in-toronto>. (Accessed, July 2014).
2. Images and Diagrams made by Author.
3. Images and Diagrams made by Author.
4. Images and Diagrams made by Author.
5. Images and Diagrams made by Author.

Chapter 7 Design

1. Images and Diagrams made by Author.
2. Blow, Christopher. Airport Terminals. Oxford: Butterworth-Heinemann Ltd. Print. c1991.
3. Images and Diagrams made by Author.
4. Images and Diagrams made by Author.
5. Images and Diagrams made by Author.
6. Images and Diagrams made by Author.
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Conclusion

1. Images and Diagrams made by Author