Improving the Air Travelers Experience Through Airport Design

by

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The purpose of this research is to understand what aesthetic and spatial conditions contribute to a passenger’s stress within an airport terminal. The atmosphere of the airport terminal typically promotes stress, increased tension, and negative emotional responses for the many millions of airport travelers. As Symonds (2012) states, “airports can be highly emotive places.” Air travel excitement can easily be replaced with high-stress levels the moment it looks as though one’s flight may be canceled, one may be running late for a flight due to a long security line, or one gets lost in the terminal due to poor directional signage. Although the recent coronavirus pandemic has temporarily caused a drastic reduction in air travel, it is expected that air travel will again reach its prior level of use when the pandemic subsides. Therefore, it is important to examine the relationship between airport design and its impact on the emotional experiences of air travelers. This research aims to understand (1) how stress levels are affected by various scenarios within the airport and (2) what conditions and features help to alleviate stress within the airport. To what extent can airport terminal design reduce stress among all travelers? More specifically, what design features within airport terminals have either a positive or negative impact on traveler stress? Multiple methods of gathering information included a literature review on airport terminal design, and related research on design elements that increase or reduce an individual’s stress level. Complementing the literature review was a survey completed by 88 air travelers, a focus group of six design experts, as well as previous information gathered through an interview pilot study of 42 air travelers. The survey of air travelers found that various areas within airport terminals had differential effects on stress levels. The most stressful area was the security checkpoint. Other design aspects such as additional seating, access to visual information, and access to live greenery resulted in stress reduction. Additionally, in contrast to an initial hypothesis, there were no differences in experienced stress between travelers who traveled less than 10 times/year and those who traveled more frequently (10+times/year). This suggests that universal design solutions addressing stress should be helpful to all travelers. The findings from this research resulted in design recommendations for improved security checkpoints as well as recommendations for the isUD certification program (innovative solutions for Universal Design) to improve the airport experience for all air travelers.
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Chapter 1. Introduction

Due to their large design scales, multiple programs, intricate circulation systems, and security protocols, airports are complicated structures. They pose organizational, logistical, architectural, and resource challenges for those involved in their design. Because airports are “particularly complex buildings,” their design should eliminate ambiguity and confusion, and instead, should address clarity of use, functional legibility, and route identification (Edwards, 2005). It is possible for airports within the U.S. to better serve users of all abilities by creating an atmosphere that supports positive experiences. Travelers are diverse in background, abilities, and interests. The uniqueness of each passenger impacts their experience in ticketing, through security, and into the terminal space. In other words, all travelers have ‘baggage’ that can’t be ‘checked’ upon arrival. The design of the airport terminal should address the diverse needs of travelers.

Since their beginnings in the 1920s, airports and air travel have grown exponentially; today there are over 5,000 in the U.S. Traveler satisfaction has become the primary design challenge accompanying this growth. Unfortunately, many airport administrations responded to travel increases with poorly planned terminal additions, ultimately hindering air travelers’ experience and satisfaction.

In response, this research uncovers how the intersection of architectural, service, and product design can work together in a compatible fashion to enhance the terminal experience for air travelers. The thesis examines various areas of the terminal space, otherwise known as the common area or connector that sits between the security checkpoint and the boarding gate. The purpose of this research is to understand what aesthetic and spatial conditions contribute to a passenger’s stress within an airport terminal. Through a review of literature, survey, and focus group, this research aims to uncover how stress levels are affected by various scenarios within the airport and what conditions and features help to alleviate those stresses.
Chapter 2. Literature Review

Overview

The objectives of this literature review are:

• to provide background information on airport design including history, typologies, and wayfinding;
• to identify key elements of the airport interiors, including signage, security, and waiting areas;
• to examine the emotional conditions of travelers, recognizing the airport as a high-stress environment; and,
• to identify design features that alleviate stress in airports.

Airport Design

History

The first airports in the United States were constructed in the 1920s and the first terminals in the 1930s (Savona, 1992). First-generation airport terminals were designed without gates, which gave passengers direct access to the plane. In the 1950s, second-generation terminals were constructed with gates due to the increasing demand for air travel. As the demand and jet size continued to grow, the third generation of terminals was introduced during the 1960s and 1970s (Gottdiener, 2001).

Terminal concourses are the channels that allow the free flow of passengers from plane to plane, ground transportation to flights and vice-versa, and from plane to baggage claim (Gottdiener, 2001). Unlike the previous terminal spaces that centralized passengers and functions in one area, concourses today are designed to meet the large, wide-bodied jets. This newer design resulted in longer walking distance for passengers within the concourse. These walking distances and the length of time passengers spend transferring is a key design flaw in many concourses. Walking distances of up to 1,000 feet are now considered acceptable (Gottdiener, 2001). As Gottdiener (2001) states, in response to these larger jets, many airports did not restructure with entirely new plans and design concepts. Instead, they simply pecked away at various portions of the terminal, without any integrating plan. Savona (1992) states, "the image of the airport
terminal has recently been undermined due to paste and fit policies of new expansions. This may explain the lack of excitement experienced by most air travelers in airport terminals” (pg. 65).

Edwards (2005) states that the functional and architectural design of terminals need to correspond to one another. In simple terms, the passenger terminal performs four main functions:

1. Facilitates a change of transport mode (from train to plane, from car to plane, etc.)
2. Processes passengers (ticket check, customs clearance, immigration control)
3. Provides passenger services of various kinds (shopping, toileting, eating, meeting and greeting, business and conferencing)
4. Organizes and groups passengers into discrete batches ready for journeys by plane

**FAA Terminal Design Approach**

The Federal Aviation Administration (FAA) publishes reports regarding design and planning standards for United States Airports. The FAA stated the following in their 1980 design report, Planning and Design of Airport Terminal Facilities at Non-Hub Locations:

“As the gateway to the community, it should reflect the character and aesthetic aspirations of its citizens. Artwork can be combined with the building design to give public spaces individuality and to present an image of the local culture and architectural heritage. Visual clues to the social and economic preoccupation of the region can be provided, and ethnic sensibilities and identification can be expressed. FAA programming criteria permit the use of ADAP grant-in-aid funds for incorporating expanded design art concepts and principles in airport terminal building projects. However, Federal participation in airport terminal development does not mean that any particular style of architecture will be imposed on the planner. Each community is free to select the architectural style and treatment that expresses local wishes and needs. An investment in the design of airport terminals can produce humane and pleasant places, improve the travel environment, and benefit the community. Qualified professional architects/engineers working with agreed-upon budgets and work programs can design Imaginative solutions that will be a source of civic pride while reflecting the functional parameters and flexibility necessary for a successful terminal”.

(150/5360-9 Planning and Design of Airport Terminal Facilities at Non-Hub Locations, 1980, pg. 27-28)
An updated 2018 version of the design report has since removed the previous statement and replaced it with the following information. Carrying out a similar goal of a terminal building that reflects local culture, the 2018 report, AC 150/5360-13A Airport Terminal Planning, additionally identifies social sustainability goals regarding the terminal space. Social sustainability objectives include:

- Prioritizing an aesthetic approach that creates a “sense of place” for building occupants, ideally one that is recognizable in the context of the built environment.
- Planning terminals that will have the essential features for building occupants’ well-being: high indoor air quality, excellent employee facilities, natural light, and a layout that will make the airport both a desirable place to work and a local destination.
- Evaluating how amenities between sterile and non-sterile areas affect how the community interacts with the airport and passengers’ interface with the local community.
- Including the local community in the planning process and building operation. This includes allocating spaces for local contributions (installations for local art or descriptions of distinctive aspects of the local area, etc.), and highlighting what the airport is doing to remain a good neighbor and local economic engine.

**Terminal Design**

The Building Research Board (BRB) collaborated with The Transportation Research Board (TRB) on a report on the future of airport passenger terminals. This report suggested key features that airport management should consider when designing terminals (Board and Transportation, 1989). The key features included:

- Markings and design of direction flow
- Location and sizing of passenger services and amenities
- Walking distances and adequate space
- Readily available and understandable information to help the flow of departures and arrivals
- Systems that aid mobility as a vital part of the terminal design
- Logical circulation patterns, reinforced by clear and consistent graphics and information systems
Studies show that the terminal plan is very influential on the experience passengers have while traveling. For example, a study by O'Neill (1992) found that floor plans are instrumental in the extent of ease or difficulty with which individuals can traverse a building. Simple plans were found to facilitate a 25% faster trip from point to point within the airport, meaning that passengers do not stop as much to determine their orientation. In support of this, Weisman's (1981) research suggests that the quantity and complexity of decision points, such as hallway intersections, negatively influence wayfinding, ultimately heightening a traveler’s stress level. In response, Bronzaft & Dobrow (1984) suggest that the simplicity and regularity of floorplans aid in people learning about the layout of the space.

Yoo (1993) also showed that spatial configuration, including aspects about layout geometry and organization of components in a setting, influences the way people relate to spaces in buildings, particularly, their perceived level of pleasantness. Physical variables within a building floorplan are perceived and stored as a cognitive map embodying a memory for individual places and an understanding of spatial relations. As a source of environmental stimulation, the physical properties of floorplan complexity are found to influence the users’ degree of stimulation, followed by their degree of pleasantness (Yoo, 1993).

**Airport Typologies**

Edwards (2004) states that five distinct terminal and pier concepts exist (see Table 1), each with its advantages and disadvantages, and each appropriate for different situations. The first is the central with piers type, which centralizes all facilities. The second is an apron or linear type, which allows for easy passenger orientation. The third is the remote or transporter type, which is ideal for shorter walking distances. Fourth is the central with satellites type in which security checks can easily be carried out at the entrance to each satellite. The fifth type is the unit terminal, which provides short distances between check-in and the boarding gate.
of the terminal plays an important role in defining the organization of movement (Edwards, 2004).

**Wayfinding**

Bogicevic et. al. (2016) emphasized the notion of wayfinding at the airport, which is achieved through functional spatial layout as some passengers experience great anxiety during their visit (Bogicevic, 2016).
Symonds (2017) quotes Symonds et. al. (2014) who defines wayfinding as the “Cognitive, social and bodily process and experience of locating, following or discovering a route through and to a given space” (pg. 1). The ultimate goal of a wayfinding system, as stated in a (2011) report by Harding, is to improve travelers’ efficiency. The report identifies an effective wayfinding system as having:

- Continuity
- Connectivity
- Consistency
- Terminology and message hierarchy
- Visibility and legibility
- Typography and symbology
- Format and color
- Placement

Through an efficient wayfinding system, travelers should feel less stressed and reassured when moving from point to point within the terminal. Weisman (1981) developed four classes of environmental factors thought to influence wayfinding:

1. Visual access to familiar cues or landmarks within or exterior to a building
2. The degree of architectural differentiation between different areas of a building that can aid recall and orientation
3. The use of signs and room numbers to provide identification of directional information
4. Plan configuration, which can influence the ease with which one can comprehend the overall layout of the building.

Tam (2011) states the importance of wayfinding within airport terminals and the commonality of travelers having difficulty locating their destination, despite the provided wayfinding aids. Tam identifies the lack of research on the appropriate location and placement of wayfinding aids. Tam proposed a model for facilitating the allocation of directional signs which includes: limiting walking distances, removing barriers, and limiting the number of directional signs at one decision point.

Hubregtse (2016) considers how artwork can be installed as landmarks to help with orienting oneself in the terminal and how they are sometimes used to draw passengers towards
consumer spaces. Subtle artwork, such as floor patterns and ceiling design, is an additional form of design that can influence the flow of travelers.

**Signage**

When moving through the terminal, decisions about where to go need to be made. More importantly, each decision has to be transformed into correct behavior in the right place. It is not simply enough to turn left, you must turn left at the appropriate intersection (Incorporated, Administration et al., 1996). Commonly, signage is used to compensate for the complex plan layouts of terminal buildings. Considering that air travelers are extremely time-sensitive, airports should provide strategic signage throughout the facility to decrease the likelihood of passengers feeling stressed or overwhelmed. Ideally, passengers should spend as little time as possible commuting between terminals and gates or attempting to identify information on signs (Edwards, 2004).

*Good wayfinding depends upon the presence of memorable physical elements and well placed, legible signs. Given that many travelers have impaired vision (perhaps as many as 10 percent of passengers have some form of visual disability), the design, location, and size of signs are crucial to the effective operation of an airport terminal.*

*(Edwards, 2004, p. 161)*

A study by (Fuller 2002), states that signs do not merely represent the airport, they are an important component of the overall terminal experience. Sign systems function as the information net for passengers, and provide identification, directional, informational, and regulatory information (Arthur and Passini, 1992). As they arrive at the airport, disembark from flights, or require a change of planes, passengers must be able to identify and process these types of information with ease and rapidity (Gottdiener, 2001).

Ultimately, it is the complexity of the plan that will determine the amount of signage needed. O'Neill's (2016) research suggests that at low levels of plan complexity, signage appears to be more of a distractor than an aid. This is primarily due to simple settings where signage causes more hesitations than settings without signage. As the floor plan complexity increases, signage becomes more effective in reducing hesitations.
Within airports, managing spatial flow is crucial. “An airport processes traffic: it is a machine for capturing and controlling flows at the most literal and abstract levels” (Fuller, 2002, pg. 233). She references the professional literature of Hart (1985) stating that airport signage has three major functions:

1. Direction and orientation: the direction and guidance of the flow of outbound and inbound traffic
2. Identification of locations: such as ticket counters, lobbies, baggage claim, gates, concourses, telephones, restrooms, car rentals, banks, and shops
3. Information: on arrival and departures, baggage delivery, government regulations, connecting transport, and special services such as car rentals, tourism, and conventions

Many terminals lack signage systems that are simple, intuitive, legible, and well organized, ultimately hindering the overall efficiency of the terminal (Gottdiener, 2001). To improve the clarity and understanding of signage, O'Neill (2016) conducted a study which found that between no signage, graphic signage, and textual signage, textual signage was the most effective in reducing wayfinding errors, such as backtracking and wrong turns. Fuller (2002) argues that graphical signage lessens the anxiety of unfamiliar terrains and replaces it with a familiar authority. Additionally, the design of the signs within the terminal should be consistent in size, color, lettering, and symbols. Consistency allows users to notice them readily (Fewings, 2001).

Given the various forms of signage that exist within an airport, “clustering” (Symonds, 2013) has become an issue that needs to be avoided. The issue here is that as various signs that exist begin to compete with each other spatially (Symonds, 2017). To avoid the issue of clustering, the solution is to create specific areas for each signage type. For example, advertising signage, should not be placed alongside directional or informational signage. Clear grouped areas for signage should be planned (Symonds, 2017).

**Summary**

Wayfinding and terminal design can have positive or negative influences on travelers from the moment they enter the airport to the moment they board their flight. Research, careful planning, and strategic design are necessary in creating an efficient and pleasant experience for travelers. Moreover, within the terminal and wayfinding design, there are also components of the
airport which act as stopping points that each air traveler is required to either pass through or observe in their journey through the terminal. Each of these components can have a negative influence on the air traveler based on how they are integrated into the design. Examples of these components include the security checkpoint and waiting at the gate.

Components of the Airport

Security Checkpoint

Security screening of passengers is an extremely important component of an airport terminal. The security screening area includes a checkpoint for identification inspection, walk-through metal detectors, and X-ray equipment for carry-on baggage inspection (Horonjeff, McKelvey, Sproule, & Young, 2010). According to a study by Bogicevic (2016) these measures can negatively affect travelers' experience with the increase in wait-time and crowding.

Security Design

As of 2002, security checkpoint design guidelines are limited to ambient conditions, such as lighting, acoustics, and temperature/humidity control (Snyder et. Al., 2002).

1. Acoustically designed checkpoints are necessary: Noisy environments can cause errors in communications, which could be problematic if a breach is occurring or for routine information dissemination. If the ambient noise level is so loud that the screeners cannot maintain focused attention, then errors are much more likely to occur.

2. Both ambient and task lighting conditions should be carefully designed at security checkpoints to avoid glare. While glass exterior walls are visually pleasing, they can cause significant temperature swings throughout the day. Additionally, the extreme luminance of the sun at certain times of the day can make it difficult to see images on the X-ray monitor or visual alarms on walk-through metal detectors.

Redden (2013) found that adding material that communicates effectively to travelers about what they are required to do improves the screening process. He proposed adding signage to the beginning of security, which offers a quick overview of what is expected. Signage should relay information about presenting IDs and boarding passes, removing electronics from baggage, emptying pockets, and discarding liquids prior to screening.
With the user in mind, lessons can be learned from Disney to better design airport security checkpoints. Neluheni (2005) suggests that the following six design considerations, which have been successfully applied by Disney Resorts, can transform congested travel into “serene” travel.

1. Form a Single Line: With a single line, “everyone’s waiting the same amount of time” and can be directed to one of the several checkpoints when they get to the front. The line will be long but will keep moving steadily.

2. Twist and Turns: Lines that snake through a lobby don’t seem as long as one that goes arrow-straight the length of a football field.

3. Timing Standard: Enough metal detectors and personnel are put at each airport terminal to maintain a goal of getting every passenger through in 10 minutes.

4. Information Availability: Passengers see TV monitors from the lines that will keep them better informed, if not entertained. They display advice like the need to take off jackets before arriving at the checkpoint. Sophisticated video loops can be developed to show passengers how to speed their way through the line.

5. Tables and Trays: Tables are available both before and after the metal detectors so passengers can get organized without holding up the line. The optimal tray will be able to accommodate passengers’ cell phones, laptops, and other possessions for X-raying.

6. Screener Courtesy: The new federal screeners should be trained not only for detecting bombs and weapons but also in how to make passengers feel more at ease with the process.

Because the TSA controls only the real estate populated by its screeners, and not the lines leading up to checkpoints or the gathering areas at the end, airports have begun working with the TSA to upgrade these areas, said Bob Blankenship, the assistant vice president for planning at DFW. A few airports have begun to address the security checkpoint design to better meet the needs of travelers through a more calm and hospitable design. Through a sponsorship from Marriott’s SpringHill Suites, the design is patterned after a hotel lobby; welcoming, soothing and familiar. “The new checkpoint has leather couches and chairs just before the queue starts. It uses directional audio speakers to entertain passengers waiting in line with a radio channel used in Marriott hotel lobbies, and then delivers instructions as they get closer to Transportation Security
Administration screeners, who won’t have to bark orders anymore” (McCartney, 2013, pg. 1). Addition design features of the new checkpoint include:

- New wall coverings with LED pastel-colored mood lighting and hanging pendant lights
- Flat-panel video monitors deliver airport messages and some advertisements
- Flat-screen televisions in the security line deliver estimated wait times for different points in the line.
- Bins for personal belongings, right, now echo the colorful nature images

Advanced Security Technologies

Regarding new technologies, Horonjeff (2010) reports that advanced identification verification technologies are being developed to enhance access control at airports. One area of new technologies is biometrics in which human body characteristics, such as fingerprints, eye retinas and irises, voice patterns, facial patterns, and hand measurements are being used for identity authentication purposes. Biometric devices typically consist of a reader or scanning device, software that converts the scanned information into a digital format, and a database that stores the biometric information for comparison.

Additionally, a study from Zhu and Wang (2020) proposes a new security identity verification process based on face recognition technology. The new process includes two important steps: (1) self-service centralized verification and (2) automatic face re-verification of passengers. The test results show that the process is effective and cost-efficient. The technology significantly reduces the rate of human error, dramatically relieves the workload of the security staff, and shortens the passenger's time spent at the identity checkpoint.

To eliminate the need for additional hand security screening of luggage, certain United States Airports (Hartsfield-Jackson Atlanta International, Chicago O’Hare International, Baltimore International, etc.) are currently implementing new 360-CT scanning technology. The CT scanner, or computed tomography, is similar to those used in hospitals. This technology utilizes a three-dimensional X-ray technology, allowing TSA officers to view items from different angles, rotating the image 360 degrees (Sowell, 2020).

Concerning X-ray screening of passengers, Kenneth Dunlap, director of security at the International Air Transport Association, a global airline lobbying group, suggested a system in which travelers would stop only briefly to identify themselves before entering a tunnel where
machines would screen them for metals, explosives, and other banned items as they moved through. Many of the technologies that would be needed to drive a reliable walk-through security checkpoint are still laboratory prototypes. However, with global air traffic approaching 2.8 billion passengers a year and growing steadily about 5% a year, industry executives and security experts say a fundamental rethinking of today’s security checkpoints is inevitable (Clark & Mouawad, 2011).

Furthermore, Snyder et. al (2002) suggests that although new technologies aid in the effectiveness of threat detection, they must aim to be minimally intrusive, maintain individual privacy and dignity, and be designed with the user in mind.

### Waiting Areas

“Currently, waiting area spaces are dreary and claustrophobic, creating an environment that becomes oppressive when waiting for a flight” (Gottdiener, 2001, pg. 3). Waiting in an airport terminal is necessary to keep the flow of passengers controlled prior to departure. The duration is also used for the airport operation officers to prepare the aircraft for passengers to board. Aside from the procedural aspects, the waiting area is both an extension of a particular place, such as a city or country, and the last contact a person has with a particular city. Therefore, it is important to give passengers a positive view of a place through safe and comfortable waiting experiences (Pasaribu, et al. 2019).

**Arrangement**

At airports, the need for communication between companions and the need for personal privacy coexist (Zheng, 2014). Therefore, it is necessary to account for "personal space" and "territoriality" when designing for seats in airports (Lin, 2010). Zheng (2014) found that most travelers come with friends or family, therefore, a seating arrangement that allows for communication is important. In contrast, those who travel alone also need privacy. If they sit in the back rows, they feel more secure and comfortable because they can see all of the seats. The arrangement of seats must consider both the needs for communication and privacy, ultimately fulfilling different users' expectations. Additionally, Zheng’s (2014) survey shows that the presence of a good view influences a passenger’s seating selection. When travelers wait in seats, they like a visually appealing view such as scenery, posters, or crowds. Interesting views allow
travelers to enjoy their waiting time. Moreover, the arrangement and location of seats must give access to essential visual information, such as the flight number, current time, and the expected boarding time (Zheng, 2014).

Design

Fewing (2001) states that the small differences including height, width, shape, color, material, finishing, size, orientation, location, furniture, or groupings for travelers to choose and adjust should be based on their personal need. “The ability of the waiting area to accommodate different choices will probably increase the feeling of safety and comfort experienced by passengers” (Fewings, 2001, pg. 3).

The Denver International Airport (DIA) recently integrated a new seating design into their Southwest Airlines boarding gate that provides travelers with more personal space, armrests, comfort, and individual charging ports (Figure 1). The seating and accessories designed by Place® are meant to transform a mere airport seat into a compact, tidy office. "Our main goal was to improve the passenger experience not only by providing people with the latest technology but also by making the seat more comfortable," notes Julian Fentress, Director of Public Relations and Director of Product Design, Fentress Architects. For example, there is an additional 3 inches (7.6cm) between each seat. This additional personal space, along with the individual tablet armrest, lends a greater sense of privacy and increased utilization. "Passengers will feel less of a need to put their bags on the seat next to them. There is also room under the seat for bags," says Julian Fentress. The power option for the seats is a first for the airport, by providing two LED-lit USB ports and a standard power outlet at each seat (Figure 2). The power-to-seat ratio is greater than one-to-one (McCormick, 2015).
Figure 1: New Personal Space Seating at Denver International Airport
Place® seating design with tablet arms create even more personal space between seats so passengers can eat, work or play in comfort. Image credit: www.arconas.com.

Figure 2: Power Seating in Denver International Airport
Place® seating design where passengers can charge laptops, tablets, phones and gaming devices using Place’s integrated power units with AC and USB ports. Image credit: www.arconas.com.
Additionally, Lynn Gordon, Vice President of Airport Solutions stated that this next-generation seating design also blurs the line between concession and gate areas through its integration of seating and service design. Gordon continues, "the idea is that you can go up to a bar, get a beer, and go back to your seat. It is a nice concept for Southwest Airlines. You can enjoy your drink and sandwich, and you are right there at the gate within earshot of your flight boarding call. The seats don't take up extra space, but everyone has a place to enjoy their purchases. The potential revenue opportunities for airports are significant" (McCormick, 2015, pg. 1).

A study conducted by Zheng (2014) focused on the relationship between passenger seating and luggage at airport waiting areas. Zheng concluded that the ideal scenario would be for one seat to accommodate one piece of luggage. Additionally, the aisles between the seats must be wide enough for both user access as well as luggage. The most popular responses for “functions that a seat should provide,” were: a place to rest, space for luggage, good views, and near boarding gates. The most popular responses to a traveler's “expectation in seating design,” were: the ability to lay back, a comfortable material, space for luggage, and cleanliness.

**Summary**

Designers are responsible for signage that helps passengers to find their way, security checkpoints that employ strict safety protocols, and waiting areas that allow for lounging, working, and eating. Such responsibilities can contribute to neglect of the emotional wellbeing of air travelers when, in fact, the key to successful airport design is putting the passenger first. Research shows that airport terminals are high stress environments, due to a multitude of factors. The following section addresses a few of the high stress environments within the terminal, as well as findings of design elements that have been found to reduce stress.

**Emotional Wellbeing**

**High-Stress Airport Terminal**

As Symonds (2014) states, "airports can be highly emotive places" (pg. 2). Air travel excitement can easily be replaced with high-stress levels the moment it looks as though one's flight may be canceled, one may be running late for a flight due to a long security line, or one gets lost in the terminal due to poor directional signage. Gottdiener (2001) faults this
shortcoming to how airports have responded to air travel changes over the years. He explains airports have expanded to meet demand solely by accretion, leaving the spaces with dismal quality, ultimately adding to the stress of travel.

There are architectural opportunities to alleviate some of the anxieties associated with traveling. For example, terminal design that resists changes in levels, long corridors, and cramped arrival lounge areas results in fewer stress inducing environmental conditions (Edwards, 2005).

Architectural wayfinding design that aids orientation can reduce the psychological stress of airports. Navigational aids, which include both tactile and visual, can use, for example, floor surfaces, materials used on handrails, areas of bright color, and pools of more intensive light. The orchestration of these into a coherent whole can support the cognitive understanding of airport spatial hierarchies and their connecting routes (Edwards 2005).

Airport terminal designers need to ensure consistency in their signage systems, regardless of the company or airline involved. A single signage system for the exchange of ticketing between companies and a shared culture of travel information would do much to ease the stress of travel (Edwards 2005). A study by Fewings (2001) defends the case that airport terminal signage deserves more consideration than it has been afforded in the past. Getting lost is quite a traumatic experience for a passenger, especially if ‘fear of flying’ is also present (Fewings, 2001). According to Fewings, signs should do all of the following: direct, inform, control, and identify. In addition, they should:

- Reassure people that they are heading in the right direction
- Indicate walking time as an additional form of reassurance
- Be consistent in size, color, lettering, and symbols

Redden (2013) explored how airport security queues serve to prompt emotional responses for passengers and shape interactions with others. While airport security lines provoke emotion, they also highlight uncertainties, such as stress, anxiety, and confusion, especially for new or infrequent travelers (Bass, 2017). This could be due in part to not knowing what official documents to present, which line to choose, how many plastic bins to pick, or how to pack items (Redden, 2013). Additionally, the actions of metal detector agents such as pat downs and swabbing can cause anxiety. Redden documented that in some security areas, TSA officials have
shouted directives to travelers, increasing their anxiety, rather than communicating in a helpful tone (Redden, 2013).

Poor communication about airport security can leave travelers feeling anxiety, frustration, stress, and annoyance. Signage that explains step-by-step the process of security would prevent infrequent travelers from having to improvise (Redden, 2013). Sometimes, prohibited item signs are posted throughout security areas; however, travelers may not be exposed to these messages before getting in line. Once in line, little to no time is available to make adjustments (Redden, 2013).

The lines at the airport do not just mean waiting. They mean stress from detailed security screenings, fear of invasive pat-downs, and anxiety about getting through in time to catch a flight (Redden, 2013). A study by Snyder et. al (2002) suggests a solution to the long wait lines could be a method in which individuals stand on a moving walkway and are screened as they move through the checkpoint. Ideally, individuals could be screened with bags in tow. As security methods advance, safety will continue to be the utmost concern.

Therefore, to remove stress, Redden (2013) found that terminals should provide:
• Calmness and tranquility
• The presence of nature in public areas
• Natural finishes and materials wherever possible
• Spatial and organizational clarity
• Structure and light that express the patterns of use and functional hierarchies.

*Influential Design Elements*

The review of literature also provided an identification of elements in design that can be implemented within airport terminals to decrease the stress of air travelers. The elements of design that have been found to have a positive influence on traveler's stress include sound, art, color, access to nature, and lighting.

*Sound*

In a lecture given at TED Global 2009, sound and communication writer Julian Treasure presented ‘The Four Ways Sound Affects Us’ where he stated, “music is the most positive form of sound that affects our emotional state." He explained how sounds not only affect one’s
hormone secretions but also breathing, heart rate, and brainwaves. He explained that the tempo of waves is roughly the same frequency as a sleeping human's heart rate, associating the ocean sound, which is 12 cycles/minute (0.2 hertz), with stress-free settings. Fenko and Loock (2014) investigated the impact that ambient scent and music have on a patient's anxiety while in a waiting room. The authors found that ambient scent and music can reduce a patient's anxiety but should be used with caution. They state the caution because adding too much could potentially raise a patient's level of arousal, therefore, increasing their level of anxiety.

Art

Previous research suggests that the following design elements positively influence a high-stress environment. Nanda, Eisen, Zadeh, and Owen (2011) found that positive distractions such as visual art that depicts a nature scene could help to reduce anxiety and agitation, potentially enhancing the waiting experience. Nanda et. al. (2011) also concluded that simple visual interventions such as still and video art are both anxiety reducing and improve the waiting experience.

Color

Marberry (1995) states that light is essential for a healthy existence. Marberry also states that light and color are synonymous. Therefore, color is also essential for a healthy existence. Berry (2013) identifies the connection between a person's mood or stress and the psychology of color, and how it can affect mood behavior. One way in which Berry tests this hypothesis is by measuring the level of anxiety that an individual may face when interacting with colors on both the warm and cool spectrum. Berry’s study suggests that the utilization of warm colors was beneficial in the reduction of perceived stress.

Warm colors such as red, orange, and yellow are often referred to as exciting, whereas cool colors such as blue, blue-green, green, and purple colors are considered to be relaxing (Küller, 2009). Color and emotion have an influence on the quality of our lives. Moreover, color as one of the major design tools provides more legible interior spaces to people. It was reported that positive emotions tended to be associated with greater brightness and more saturated colors, while negative emotions tended to associate with lower brightness” Güneş (2020). Additionally, Gunes’ research shows that emotional responses to the principle hues such as green, blue and red
includes a positive emotional response. Regardless of the opinion that color does or does not have healing power, the fact remains that color does have meaning to most individuals.

Redden (2013) stated that when designing wayfinding solutions, color is often a powerful cue for situation context. For example, in the Luton airport, located in London, a color-based wayfinding system guides traveler’s in the appropriate direction within the security checkpoint. Color-coding establishes hierarchy and can more clearly differentiate areas (Fewings, 2001). Entryways, exits, and floors can use color-coding to signify a zone change or more easily define a space (Opara and Cantwell, 2014).

Access to Nature

"Biophilia" is the theory that humans have a biological need to connect with nature for the sake of their well-being and health” (Southan, 2013). Schweitzer, Giplin, and Frampton (2004) studied how elements of nature can help or hinder healing in the physical environment. Chawla (2012) defines biophilic design as something that connects people to nature and local landscapes through gardens, green views, green walls and roofs, indoor plantings, water, natural light, natural materials, and architectural forms derived from nature. Chawla explains that biophilic design takes green building to the next level in that it considers human emotion and connection to place.

Both interior and exterior tree planting help to filter out sunlight and provide the necessary tranquility to overcome stress (Edwards 2005). “It's much more than throwing a few plants and bushes around the terminal - it's about having views to greenery and incorporating greenery in a significant way throughout” (Southan, 2013, pg. 30). Southan emphasizes that degradation and alienation from nature are not inevitable consequences of modern life, but failures in how we have deliberately chosen to design buildings. Southan also suggests that naturalistic environments are supportive of recovery and that noisy, institutional, or urban environments, may contribute to increased stress. This research has influenced policy and identifies key aesthetic and functional considerations such as engendering a non-institutional atmosphere, distracting patients from stress and anxiety, helping people to navigate their way around, and fostering a sense of ownership and pride in users (Southan, 2013).

Regarding natural material choices, Zhang et al. (2016) demonstrated that more positive emotions were generated in environments using wood than environments that did not, and
participants in environments with wood suffered from less fatigue. Overall, non-wooden environments tended to produce a sense of tension and depression, resulting in a lower positive emotion. Wooden environments, on the other hand, were capable of regulating emotion, reducing the tension, and relieving negative emotions. When compared to rooms without wood, those with wood were considered as more comfortable environments, where the occupants enjoyed a more delightful sense of color, odor, and light. Similarly, Harumi et. al. (2017) studied the physiological effects of wood and found that “contact with wood is physiologically relaxing.”

How wood is utilized in the design is an essential consideration. Nyrud et. al. (2014) focused on the effects of natural elements, primarily wood, in a hospital room. Focusing on user preferences regarding the amount of wood used, Nyrud found that users preferred an intermediate amount of wood, with the floor, one wall, and furniture being made of wood. Nyrud suggests using wood within interior environments where there is a lack of views to the outside, or limitations to the use of indoor plants.

Lighting

Altimier (2004) found that views of nature and natural light can enhance healing. Fewing’s study (2001) states that people prefer a well-lit environment, as the eye can see further than in a dim environment, while also providing the passenger with a sense of security and relaxation. Likewise, light also acts as a wayfinding aid, which can be used through well-lit areas with windows. This concept is commonly used in certain areas of the airport to make one feel comfortable and welcome (Symonds 2014). Similarly, Bogicevic (2016) found that poor signage and lighting can induce anxiety in travelers and result in their dissatisfaction. As a result, it is important for designers to include well designed wayfinding systems, appropriate luminosity, and comfortable temperatures to reduce travelers’ stress and anxiety.

Conclusion

This research addresses the lack of attention devoted to airport terminal design regarding passengers’ stress levels. Since their inception in the 1920s, the number of U.S. airports has grown to over 5,000 today. Most airports have responded to the growth of air travel in an accretional manner through the gradual accumulation of additional construction projects. This approach has resulted in poorly planned terminal design, ultimately creating a negative
experience for air travelers. Moreover, within these terminals are key components, such as waiting areas, security checkpoints, and signage, which by nature all bring their own ‘baggage’ in terms of stress.

The literature review has provided evidence for the importance of airport design in influencing traveler experiences, especially those of stress or anxiety. Furthermore, this review of literature has built the framework for the next chapter which aims to uncover the high-stress areas within the airport along with the design features that contribute to this high-stress. The next chapter will describe the methods used to gather new information about level of stress in different locations within the terminal, and the importance of design components within those locations.
Chapter 3. Methodology

Overview

This is an exploratory mixed-methods research design that used a survey and a focus group to gather both quantitative and qualitative information. IRB approval was obtained prior to data collection.

The following methods were used to determine travelers’ levels of stress in various airport locations in order to identify specific issues relevant for design recommendations. These methods were:

(1) Surveys, where the purpose was to understand what aesthetic and spatial conditions contribute to an air traveler’s experience of stress within an airport. To this end, online surveys were completed by 88 air travelers.

(2) A focus group, which included a panel of six design faculty from the University at Buffalo Department of Architecture, further examined the specific types of spaces investigated in the survey. This included the identification of specific design features and their impact on inducing stress or promoting calmness.

Survey

It is important to note that the survey asked participants to respond to their airport experiences prior to COVID. (This research was conducted in 2020, during the COVID pandemic, and prior to the development of vaccines.) The objectives of the survey were to: (a) find out where in the airport stress levels are the highest; (b) identify how important different design features were in reducing traveler stress levels in various locations in the airport; and (c) obtain qualitative information about what conditions caused them stress, how they dealt with it, and what recommendations they could suggest for reducing stress levels. The survey can be found in Appendix B.

In order to understand what design elements contribute towards improving a traveler’s experience within the airport, participants were asked a series of questions.

- The first section asked about the number of air travel trips per year, prior to COVID. It was thought that the frequency of airline travel might reflect differences in responses to the survey. Additionally, participants were asked to identify their general stress level
when traveling through the airport terminal on a five-point scale from ‘no stress’ to ‘severe stress’.

- The second section asked the participants to rate and explain their stress levels in different situations within the airport on a five-point scale from ‘no stress’ to ‘severe stress’. These situations included moving through the security checkpoint, being at an intersection point, understanding signage, walking through the terminal, and waiting at the gate.

- The third section asked the participants whether or not they found various design elements within the airport to be important by rating each design element on a five-point scale from ‘not important’ to ‘very important’.

- The fourth section asked a set of open-ended questions regarding the participants’ previous airport experiences. They were asked about routines set in place to alleviate stress within the airport, their favorite airport, and their most and least favorite aspects of airports along with reasons for their responses.

- The fifth section was an open-ended question asking the participants to share their own design recommendations that would help improve their experience within the airport terminal.

**Survey Participants**

Potential respondents were recruited by a survey invitation sent to them by email from the researcher or by a sharing of the invitation through social media (a ‘snowball’ sampling approach). That invitation can be found in Appendix A. The original email went to a set of people known by the researcher, who had worked with them previously in an organization in which air travel was required.

The email invitation included a link to the electronic survey along with a short introduction as to the intent of the study, and a request for the recipient to share the survey with others. The single selection criteria were that the individuals were to be 18 years and older in order to participate. Otherwise, individuals of all abilities and travel frequencies from across the United States were encouraged to complete the survey. Recruitment for this survey did not favor or exclude any particular race, ethnicity, or religion.
Prior to beginning the survey, participants were asked to read a consent document that outlined the eligibility criteria. Before proceeding with the survey, participants were required to affirm that they meet the eligibility criteria and agree to participate in the survey. Participants’ responses were anonymous and no identifying information was collected by the survey. Moreover, recipients were informed that they could omit answers to any question, and/or could leave the survey at any time if they wished.

**Focus Group**

A focus group was conducted with a panel of six design faculty from the University at Buffalo Department of Architecture, to stimulate discussion on specific areas within the airport (seating, art, access to nature, signage, and the security checkpoint). The objectives of the focus group were to: (a) identify the design elements that they felt induced stress or promoted a sense of calmness, and (b) obtain qualitative information about what specific elements of design caused them stress, and what recommendations they could suggest for reducing that stress. In an effort to stimulate discussion, a total of 12 images representing various areas within the airport were displayed on the screen for a period of three minutes for each image. Discussion occurred during the display of each image. The images, along with the original transcript from the design experts, can be found in Appendixes D and E.

The following chapter presents the findings from these methods.
Chapter 4. Results & Discussion

Overview

The data analysis employed both qualitative and quantitative methods. Frequency of air travel, average stress levels, feature importance, and demographic information were all analyzed quantitatively. The open-ended survey responses and focus group comments were analyzed using a qualitative content analysis approach to identify patterns and commonalities within the responses.

Survey

The survey examined the opinions and stress levels of 88 air travelers. The responses were examined to determine their perceptions about various conditions within the airport. Results for participant demographics, stress levels for different terminal locations, the importance of security checkpoint design features, and design recommendations for airport improvements are discussed below. Additional survey results can be seen in Appendix C.

Participant Demographics

Among the survey participants (n=88), 72 participants responded to the question regarding gender identification. The results show that 21 participants identified as male and 51 identified as female (see Figure 3). The most common age group, accounting for 50% of the participants, was 18-29 years old (n=37) (see Figure 4). The majority of the participants (n=44) reported using air travel 1-4 times a year (see Figure 5). Lastly, 72 participants responded to the final demographic question, which asked participants to specify if they had: a physical/mobility limitation, visual limitation, cognitive condition, or emotional condition. Of the 74 responses, 28 participants identified as having a condition or limitation. Of those 28 participants, the category of emotional conditions (e.g., bipolar disorder, anxiety disorder, depression, paranoid personality disorder, etc.) was the most common (n=18) (see Figure 6).
The results showed that there were no statistically significant differences between the two groups of flyers (n=85) (1-4 flights/year; n=44 versus 5+ flights/year; n=41) in terms of their level of stress in different areas of the airport. In general, reported stress levels for all locations were relatively low, being in the low to moderate range. The most important finding to note is that moving through the airport generally and moving through the security checkpoint were the areas of highest reported stress levels (see Figure 7).
When providing explanations for this question (Q3 Other: If you feel stress in any of these situations, please explain), respondents spoke the most on three areas: waiting at the gate, understanding signage, and moving through the security checkpoint. A qualitative analysis was utilized for the open-ended explanations. Those explanation categories are displayed below (see Table 2), by their corresponding locations and ranked based on the level of occurrences in the examples provided by the respondents.

<table>
<thead>
<tr>
<th>Area</th>
<th>Points of stress</th>
<th>Occurrence</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security</td>
<td>Inconsistent procedures</td>
<td>10</td>
<td>11.63%</td>
</tr>
<tr>
<td></td>
<td>Long lines/wait times</td>
<td>5</td>
<td>5.81%</td>
</tr>
<tr>
<td></td>
<td>Holding up the line</td>
<td>3</td>
<td>3.49%</td>
</tr>
<tr>
<td></td>
<td>Presence of security agents</td>
<td>2</td>
<td>2.33%</td>
</tr>
<tr>
<td></td>
<td>Pulled aside for additional screening</td>
<td>2</td>
<td>2.33%</td>
</tr>
<tr>
<td></td>
<td>Separate security checkpoints</td>
<td>1</td>
<td>1.16%</td>
</tr>
<tr>
<td></td>
<td>Taking out and putting away items</td>
<td>1</td>
<td>1.16%</td>
</tr>
<tr>
<td>Signage</td>
<td>Clear signage at intersection points</td>
<td>3</td>
<td>3.49%</td>
</tr>
<tr>
<td></td>
<td>Understanding signage</td>
<td>2</td>
<td>2.33%</td>
</tr>
<tr>
<td></td>
<td>Walk times</td>
<td>1</td>
<td>1.16%</td>
</tr>
<tr>
<td>Waiting at the gate</td>
<td>Finding a seat</td>
<td>4</td>
<td>4.65%</td>
</tr>
<tr>
<td></td>
<td>Hearing information</td>
<td>3</td>
<td>3.49%</td>
</tr>
<tr>
<td></td>
<td>Crowding during boarding</td>
<td>3</td>
<td>3.49%</td>
</tr>
<tr>
<td></td>
<td>Having an outlet available</td>
<td>2</td>
<td>2.33%</td>
</tr>
<tr>
<td></td>
<td>Seating layout</td>
<td>1</td>
<td>1.16%</td>
</tr>
</tbody>
</table>

Table 2: Situational Stress Examples
(36 people provided 43 examples)
Importance of Design Features in the Security Checkpoint

To further explore participants’ responses at the security checkpoint, the survey asked respondents for their opinions on the level of importance of having specific features in this area. It is important to note that all respondents reported relatively high levels of importance for all issues in the security area. When comparing the two groups of flyers (n=88) (1-4 flights/year; n=44, 5+ flights/year; n=44), there were two questions in which the different flyer groups reported different levels of importance. The first comparison is in regard to having a touchless screening process, meaning that travelers would not need to remove items (clothing, shoes, electronics, etc.). Figure 8 shows that those who flew more frequently said that it was more important to have a touchless screening process, than those who were less frequent flyers. The second comparison is in regard to understanding what they were supposed to do. The results show that those who flew less felt it more important to hear the same screening instructions on repeat than those who flew more often.

Figure 8: Importance of Design Features within the Security Checkpoint

Design recommendations to Improve Their Airport Experience

In closing, the survey asked participants an open-ended question to identify specific design recommendations that would improve their experience within the airport. The responses
are ranked based on the number of comments (n=65) made by 57 respondents. The most common design recommendations included having clear and legible signage, access to private areas, access to nature, charging outlets, and improving the security checkpoint (see Table 3).

<table>
<thead>
<tr>
<th>Design Recommendation: Improving Airport Experience</th>
<th>Occurrence</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear and legible signage</td>
<td>15</td>
<td>26.32%</td>
</tr>
<tr>
<td>Access to private areas</td>
<td>9</td>
<td>15.79%</td>
</tr>
<tr>
<td>Access to nature (greenery, natural sunlight, views to the outside, etc.)</td>
<td>7</td>
<td>12.28%</td>
</tr>
<tr>
<td>Charging outlets</td>
<td>7</td>
<td>12.28%</td>
</tr>
<tr>
<td>Improve crowded security checkpoint</td>
<td>7</td>
<td>12.28%</td>
</tr>
<tr>
<td>Comfortable seating</td>
<td>6</td>
<td>10.53%</td>
</tr>
<tr>
<td>Adding artwork</td>
<td>4</td>
<td>7.02%</td>
</tr>
<tr>
<td>Distanced seating</td>
<td>4</td>
<td>7.02%</td>
</tr>
<tr>
<td>Noise control</td>
<td>2</td>
<td>3.51%</td>
</tr>
<tr>
<td>Open environment, increased visibility</td>
<td>2</td>
<td>3.51%</td>
</tr>
<tr>
<td>Seating choices (rockers, sofas, etc.)</td>
<td>2</td>
<td>3.51%</td>
</tr>
</tbody>
</table>

Table 3: Design Recommendations to Improve the Airport Experience
(57 people provided 65 examples)

**Focus Group**

The focus group viewed 12 different images of airport locations (see Appendix D for all images). The images represented five categories (access to nature, seating, signage, security, art). Figure 9 shows the main ideas that emerged from the discussions of each category. Each design feature (represented by 2 or more images) was discussed in terms of features that promoted stress or promoting calmness.
<table>
<thead>
<tr>
<th>Category</th>
<th>Image</th>
<th>Calmness</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Seating</strong></td>
<td></td>
<td>Soft surfaces</td>
<td>Pattern on the carpet</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Various types of seating choices</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ability to create clusters</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Variety of orientation of seating</td>
<td></td>
</tr>
<tr>
<td><strong>Art</strong></td>
<td></td>
<td>Makes the path of travel enjoyable and fun</td>
<td>Long stretch with minimal change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Visual and auditory waves</td>
<td>Sound can be loud</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Provides a distraction from the fact that you’re underground</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Meditative space</td>
<td></td>
</tr>
<tr>
<td><strong>Access to nature</strong></td>
<td></td>
<td>Sound of waterfall</td>
<td>Possibility of obstructed views</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Variety of spaces to sit or stand</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emulates a natural environment</td>
<td></td>
</tr>
<tr>
<td><strong>Signage</strong></td>
<td></td>
<td>Information is provided from different vantage points</td>
<td>Repetitive information</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Color spikes stress</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Too much text</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Too much information</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Information is crowded</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td></td>
<td>N/A</td>
<td>No clear lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Floor pattern is distracting</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Crowding</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Seeing too much at once</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Minimal counter space</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stress from people to rush</td>
</tr>
</tbody>
</table>

Figure 9: Summary of focus group results

For **seating**, the results show that the soft surfaces and various seating types promoted calmness, whereas the pattern on the carpet induced stress. For the **art** category, the results show
that the visual and auditory waves promoted calmness, whereas the long span of walking with minimal change induced stress. For **access to nature**, the results show that the idea that this design emulates nature promoted calmness, whereas the possibility of obstructed views induced stress. For **signage**, the results show that the idea that information is provided from different vantage points promoted calmness, whereas the repetitive information and color of the sign induced stress. Lastly, for the **security** category, the results show that nothing about this image promoted calmness, however, the lack of crowd control, floor pattern, and limited counter space all induced stress.
Chapter 5. Recommendations & Conclusions

The results of this study provided valuable insights for addressing the research question, “How can airport design improve the experience and satisfaction of air travelers?” This chapter will discuss three components: (1) the use of research findings to develop new isUD solutions; (2) the development of design proposals for airport security checkpoints, based on the research; and (3) implications for research and final conclusions.

Part 1: Use of research findings to develop isUD solutions

The research found that there were no significant differences in general stress levels between frequent and infrequent flyers. Thus, any changes made in the design should benefit all. Based on this conclusion, the research findings were used as a basis to develop additional design solutions for the isUD certification program (innovative solutions for Universal Design). Universal design (UD) is a design process that enables and empowers a diverse population by improving human performance, health and wellness, and social participation (Steinfeld and Maisel, 2012). The isUD certification program is the first certification program for Universal Design. It includes over 500 practical UD solutions and facilitates Universal Design at all stages of a project, from the design process to policies and practices. The solutions are organized into nine areas (Design Process, Space Clearance, Circulation, Environmental Quality, Site, Rooms and Spaces, Furnishings and Equipment, Services, and Policies), which are based on years of extensive research and practice and guided by the Goals of Universal Design (UD) (Steinfeld and Maisel, 2012).

Based on this research, the author developed thirty new evidence-based design solutions. These solutions came from three thesis sources: (1) peer-reviewed literature, and findings from the (2) survey, and (3) focus group material. Each solution is followed by the corresponding superscript numbers signifying the method(s) of research which helped to develop each evidence-based design solution. Thirteen of the design solutions will become a new section in the current isUD set of solutions for security checkpoints, as checkpoints are not currently included in the certification program. Moreover, to aid in the certification of isUD for airports, 17 design solutions were developed by the author to supplement existing isUD sections related to Rooms and Spaces; Waiting Areas, Circulation; Signage, Circulation; Wayfinding, and Furnishings and Equipment (see Table 4).
### Table 4: Design solutions for isUD

#### New Section; Security Checkpoints:

1. Security checkpoint displays information on the screening process for passengers who are waiting in line (i.e., infographic instructions, video instructions, etc.). 1,2,3
2. Instructions regarding the screening process are displayed prior to the start of the security line. 1,2,3
3. Security checkpoints are equipped with checkpoint signs provided at a height to be seen from all points of the security process. 3
4. Security checkpoints are equipped with “hands-free” biometric scanners. 1,2
5. Security checkpoints are equipped with a “TSA Prep Stop” or similar preparation area. 1,2
6. Where provided, transportation security agents are trained to direct passengers in the movement from one checkpoint to another. 2
7. Security checkpoints are equipped with seating both pre, and post-security screening. 2
8. Security checkpoints are equipped with tables at multiple heights both pre, and post-security screening. 1,2
9. Security checkpoints are equipped with a floor marked queuing system to assist the agents in directing passenger movement. 3
10. Design the Line: Art and greenery are integrated into checkpoints to reduce traveler stress. 1
11. Passengers are screened in tow on moving walkways to assist in the flow. 1
12. Security checkpoints are acoustically controlled. 1
13. Security checkpoints are equipped with lighting design that aids in the viewing of screeners and images. 1

#### Rooms and Spaces; Waiting Areas:

1. All fixed seating areas provide individual electrical charging ports. 2,3
2. The arrangement of seating meets various user expectations (privacy, cluster seating, etc.). 1,2,3
3. Seating is oriented to accommodate views of art or the outdoors. 1,3
4. The location of seats provides access to all pertinent visual information. 1
5. Waiting areas are equipped with floor markings to indicate boarding process orientation and appropriate distancing. 3
6. Seats allow for various seating positions. 1
7. Sound and/or music is played at 12 cycles/minute (0.2 hertz). 1
8. Every seat allows the space accommodation of one piece of luggage. 1
9. The aisles between the seats must be wide enough for both user access and luggage. 1,3

#### Circulation; Signage:

1. All signs utilize a consistent design in terms of language(s), graphics, size, color, and grouping. 1
2. On directional signage, provide distances and times to get to destinations. 2
3. Create specific grouped areas for each type.¹

*Circulation; Wayfinding:*
1. Plan configuration is simple and easy to comprehend.¹
2. Floors use color-coding to signify a zone change to more easily define a space.¹,³
3. Wayfinding systems include visual access to familiar cues or landmarks in and outside the building (i.e., art, sculpture, waterfall, exterior views, etc.).¹,²,³
4. Subtle floor markings and patterns influence the flow of travelers.¹

*Furnishings and Equipment; Furniture and Surfaces:*
1. Natural materials are integrated throughout the terminal.¹,³
2. Live greenery is integrated into the interior and exterior environments.¹,²,³
3. Plants are organized in a manner to aid in directional flow.³

**Part 2: Design proposals for airport security checkpoints**

In addition to the isUD solutions discussed above, this thesis presents two design proposals. The first design proposal (Figure 10) includes simple design elements to improve the existing checkpoint area we know today. This proposal only focuses on the design elements; thus, the screening process itself was not addressed.

![Figure 10: Design Proposal 1: Design Elements to Improve Today's Checkpoint](image-url)
Imagine yourself positioned at the very beginning of the security checkpoint (A), beginning in the bottom right-hand corner of the drawing. The first design proposal begins with a security preparation area. This preparation area allows passengers to easily meet security guidelines, equipped with security instructions, additional counter and seating space, and an area for a group to gather. Trees are strategically designed throughout the checkpoint in an effort to reduce traveler stress (B). While waiting in line, information on the screening process is displayed for the travelers (C). Also, to provide travelers with the knowledge of what is to come, checkpoint signs are provided at a height to be seen from all points of the security process (D). Continuing through the checkpoint line, there are security agents in place to direct the flow of passenger traffic from the waiting line to the security screening area (E). This design is also equipped with a manual gate to be managed by the agents to further control passenger movement (F). To further assist the agents in directing passenger movement, a floor marked queuing system is in place (G). Moving forward, the screening process is now complete, and it is now time to gather your belongings. Additional counter space is provided post-security screening (H). Dividers can also be used to provide a sense of privacy and personal space for passengers. Finally, to further assist travelers in gathering and regrouping, seating is provided after exiting the security screening (I).

The second design proposal (Figure 11) was developed in response to new security technologies on the market that TSA is beginning to implement for testing. This design is equipped with a biometric scanner, mass temperature reading, and lastly, an X-ray scanner. Additional details and drawings regarding both design proposals can be found in Appendix F.
Again, imagine yourself positioned at the very beginning of the security checkpoint, beginning in the bottom right-hand corner of the drawing. The first part of this design proposal includes a manual gate to be managed by the agents to control traveler movement (A). This design also includes the hands-free biometric scanner for identification (B). These biometric scanners would reduce the handling of personal items by travelers and promote a faster flow. Within the area for temperature and X-ray scanners, recommendations are that passengers are screened in tow on moving walkway to assist in the flow (C). Floor markings are placed to indicate appropriate distancing (D). Art and greenery are integrated within the line to reduce traveler stress (F).

Although neither design is more important than the other, design proposal 1 is more realistic in regard to scale and ease of implementation. The first design proposal includes changes that can be easily added to enhance the experience in today’s checkpoint design. Design proposal 2 was created to demonstrate how some of the same design solutions can be utilized with advanced security technologies, as well as how these new technologies are design solutions.
themselves. It is recommended that features in both designs be developed and tested prior to the installation in airports to further explore their impact on the experience and satisfaction of air travelers.

Part 3: Implications for Research and Final Conclusions

This study unlocked the opportunity for an array of future studies to further examine the relationship between airport design and stress. The following information addresses limitations to this research, along with recommendations as to how these limitations might be overcome in future work.

The first limitation to this research is that it focused specifically on the areas from the security checkpoint through to the boarding gate areas, and how the various design features in those areas impacted passengers. The survey results found that travelers’ general stress level within the airport was higher than any one specific location within the airport, other than at the security checkpoint. This may be due to the overall stress level being heavily influenced by the high-stress security checkpoint, a lessening of traveler stress as they move successfully through security to other parts of the terminal, or due to exterior elements such as roadways, rental car areas, parking garages, etc., which too can all contribute to travel stress.

• **Recommendation:** More detailed study of stress levels in these other areas within the airport would be useful. The detailed information about each area only asked about the importance of various features, not whether or not they had an impact on stress levels in those areas.

Another potential area for exploration has to do with individual differences in experiential stress, which was not explicitly explored in this research. The survey results showed the overall average stress level amongst survey participants (not differentiated as being high or low anxious) was found to be low to moderately low throughout various locations in the airport.

• **Recommendation:** Further research is needed to explore individuals who experience high to severe stress levels within airports or similar environments. Individuals who experience higher levels of stress and anxiety may be more sensitive to design elements throughout the airport. Therefore, if the airport design is meeting the needs of those who are on the high end of the spectrum in regard to stress and anxiety, in theory, the design should be beneficial to all air travelers across the spectrum.
A third limitation to this study is user disability in that it does not specifically focus on individuals with physical or cognitive limitations. Although a portion of the survey respondents did report having a physical or cognitive limitation or condition, it was neither a focus of this study, nor a significantly sized population. Therefore, limited statistical conclusions can be drawn from this date set regarding users with disabilities.

- **Recommendation:** Future research should explore the user group of individuals who report having a cognitive condition or physical limitation. This user group may experience stress differently than what was reported in this study. This would allow for the development of additional design solutions, which based on previous evidence, is predicted to have a positive influence on all air travelers.

A fourth limitation to this research is that the focus was on the air traveler experience and understanding how design can better influence their comfort and satisfaction throughout the airport. However, beyond the air traveler, there are multiple stakeholders to consider when designing for airports such as employees, TSA agents, pilots and flight attendants, among others.

- **Recommendation:** Future research should investigate the multiple stakeholders that exist in regard to stress in airports. For example, employees and TSA agents may experience stress within an airport differently than air travelers. Therefore, investigating airport design through the lens of these multiple viewpoints would be beneficial for all.

**Final Conclusion**

The question, “How can airport design improve the experience and satisfaction of air travelers?” aims to explain the dynamic between the terminal space and the negative impact on the air traveler. What design elements in the airport terminal negatively influence the travelers experience, stress, and overall well-being, and by contrast, what elements of design help to reduce stress and improve their experience? Through this exploration, the research found that the security checkpoint is the highest rated stress area within the airport, primarily due to inconsistent procedures and long wait times. In response to this finding, design proposals 1 and 2, along with the newly developed isUD design solutions for the security checkpoint, are intended to improve the overall airport design, with the goal of reducing travelers’ stress.
Finally, the research finding that found no significant differences in general stress levels between frequent and infrequent flyers, suggests that every successful change made in the design should benefit all. Both the new isUD design solutions and two design proposals developed in this thesis should help to guide airport design in the direction of improving the airport terminal experience for all air travelers.
References


AC 150/5360-9 (Cancelled) - Planning and Design of Airport Terminal Facilities at Non-Hub Locations Document Information Share Print (pp. 27-28, Rep.). (1980). Federal Aviation Administration.


Lin, C. C. (2010). The study of personal space in different selecting behaviors of created public chairs. The graduate school of industrial design, National Cheng Kung University.


Appendix A

Survey Recruitment Email

Improving the Frequent Air Travelers' Experience through Airport Design

My name is Alexis Donnelly, and I am a graduate student in the Department of Architecture at the University at Buffalo.

I am seeking volunteers who are at least 18 years of age to participate in a brief survey about improving the frequent air travelers’ experience through airport design.

I am conducting a survey from people who have traveled through airports in the period of time BEFORE the COVID-19 pandemic. You are being contacted because of your experience in using frequent air travel. Your participation in this study will help to understand what aesthetic and spatial conditions might have an impact on a passenger’s wellbeing within an airport terminal. The findings in this research will help to identify spatial and aesthetic conditions within the airport terminal that could improve the experience for air travelers in the future.

The survey should take approximately 10 minutes to complete. If you have any questions regarding this research, please feel free to contact me at (716) 783-5088 or alexiszi@buffalo.edu

If you know others who travel in airports frequently (prior to COVID), please feel free to pass along this survey link. https://www.surveymonkey.com/r/ImprovingAirportDesign.

Thank you,
Alexis (Ziegler) Donnelly

Click the button below to begin the survey.

Begin Survey
Appendix B

Electronic Survey

**Adult Consent to Participate in a Research Study**

Investigator: Alexis Donnelly

The following is a short summary of this study to help you decide whether or not to be a part of this study. More detailed information is listed later on in this form.

Why am I being invited to take part in a research study?
You are being invited to take part in a research study because you are at least 18 years of age and an English speaker.

What should I know about a research study?
- Someone will explain this research study to you.
- Whether or not you take part is up to you.
- You can choose not to take part.
- You can agree to take part and later change your mind.
- Your decision will not be held against you.
- You can ask all the questions you want before you decide.

Why is this research being done?
The purpose of this research is to understand what aesthetic and spatial conditions contribute to a frequent air travelers’ low-stress, positive experience within an airport terminal.

How long will the survey last and what will I need to do?
You will be asked to complete a brief survey about your frequency of air travel pre-COVID-19 pandemic followed by questions about your stress levels in various scenarios within the airport.
More detailed information about the study procedures can be found under “What happens if I check yes, I want to be in this research?”

Is there any way being in this study could be bad for me?
The risks to joining this study are minimal.
More detailed information about the risks of this study can be found under “Is there any way being in this study could be bad for me? (Detailed Risks)”

Will being in this study help me in any way?
There is likely no direct benefit to you for participating in this study, but it will help to establish future design solutions for airports in an effort to decrease anxiety and stress levels of travelers.

What happens if I do not want to participate in this research?
Participation in research is completely voluntary. You may choose not to enroll in this study.

Detailed Information: The following is more detailed information about this study in addition to the information listed above.

Who can I talk to?
If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at (716) 783-5088 or e-mail alexiszi@buffalo.edu.
This research has been reviewed and approved by an Institutional Review Board (“IRB”). An IRB is a committee that provides ethical and regulatory oversight of research that involves human subjects.
You may talk to them at (716) 888-4888 or e-mail ub-irb@buffalo.edu if:
- You have questions about your rights as a participant in this research
- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

How many people will be studied?
We expect about at least 100 air travelers from across the United States.

Who can I talk to?
If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at (716) 783-5088 or e-mail alexiszi@buffalo.edu.
This research has been reviewed and approved by an Institutional Review Board (“IRB”). An IRB is a committee that provides ethical and regulatory oversight of research that involves human subjects. You may talk to them at (716) 888-4888 or e-mail ub-irb@buffalo.edu if:
- You have questions about your rights as a participant in this research
- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
- You want to get information or provide input about this research.

How many people will be studied?
We expect about at least 100 air travelers from across the United States.

What happens to the information collected for the research?
All data files will be kept by the researcher and protected by passwords. Data will be securely stored in the University at Buffalo School of Architecture and Planning share drive, and will only be accessible to members of the thesis committee. No other access will be allowed. Identities of subjects will be kept confidential.

Participant’s statement of informed consent:
“I am at least 18 years of age. I have read and understood the explanation provided to me and voluntarily agree to participate in this study. I understand that this study is referring only to pre-COVID-19 conditions. I certify that I am a frequent traveler, meaning that I travel five or more times a year.”

(Clicking “Next” implies your consent to join this study. Thank you.)
Section 1: Frequency & History of Air Travel Before COVID.

This section will gather information about your travel experience and frequency before COVID-19. It includes a set of questions that will ask you to rate your stress level in different airport conditions before COVID-19. Select the response that best describes your level of stress in each scenario.

1. In the last 5 years, before COVID-19: On average, how many times a year did you use air travel?
   - 1-4
   - 5-9
   - 10-14
   - 15-20
   - 20+

2. When you were moving through airports (before COVID-19), what was your general level of stress within an airport? Move the slider dot across the scale to indicate the level of your response.
Section 2: Your stress levels at different areas in the airport

This section asks you to rate your stress levels in different situations within the airport before COVID-19. It includes a set of short answer questions for you to describe your stress level in each specific situation.

3. Please rate your level of stress in each of the following conditions within the airport before COVID-19.

<table>
<thead>
<tr>
<th>Situation</th>
<th>No Stress</th>
<th>Mild Stress</th>
<th>Moderate Stress</th>
<th>High Stress</th>
<th>Severe Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moving through the security check point.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>At an intersection point</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Understanding signage</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Walking through the terminal</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Waiting at the gate</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

If you feel stress in any of these situations, please explain.

[Blank space for answer]
Section 3: Importance of Design Elements

This set of questions will ask you whether or not you agree with the importance of various design elements within the airport.

4. When walking through the **security checkpoint**, it is important to...

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>...avoid tightly packed security lines.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...have a simplified process for checking I.D.'s</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...have a touchless screening process, with no need to remove shoes, clothing items or electronics.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...have an open area with clear sight-lines, allowing you to anticipate where to go next.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...have views of artwork when passing through.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...have a low noise level.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...hear the same screening instructions on repeat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...see images of the security screening process.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other (please specify)


5. When moving **throughout the terminal**, it is important to have...

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>...a low noise level.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☐</td>
</tr>
<tr>
<td>...comfortable seating options.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
</tr>
<tr>
<td>...a space that allows you to do work.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...a space where you can charge electronics.</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...a private space to rest.</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...access to greenery.</td>
<td>☑</td>
<td>☐</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...access to natural sunlight.</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...an open area with clear views to surroundings, signage, food options, restrooms, etc.</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...peaceful music.</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...calming colors.</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>...artwork such as sculptures, paintings and/or murals.</td>
<td>☑</td>
<td>☐</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
</tbody>
</table>

Other (please specify)
6. When observing **signage**, it is important for signs to...

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>...be large with legible text.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...use identifiable icons for information such as baggage claim, transportation, restrooms, etc.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...use color to differentiate categories (ex. restrooms=red, gates=blue, concourses=green, etc.)</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...have text which contrasts with the background of the sign.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...stand out from their surrounding environment.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...provide a time estimate for walking from Point A to Point B (ex. current location to your gate).</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>...be located at every decision point.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

Other (please specify)
7. When at a **gate**, it is important to have...

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>...seating that is separated from</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>strangers.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...comfortable seating.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...accessible seating.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...views to the outside.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...access to a natural light.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...a low noise level.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...an open area with clear views to</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>surroundings, signage, food options,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>restrooms, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...clear views to the information</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>desk and/or screen.</td>
<td></td>
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<tr>
<td>...a space where you can charge</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>electronics.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...a space that allows you to do</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>work</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Other (please specify)
Section 4: Previous Airport Experiences

The next set of questions asks you for your opinions based on your previous airport experiences, and recommendations you might have for airport changes.

8. As a frequent traveler before COVID, what routines (if any) did you have in place to make the airport experience less stressful?

9. What is the name of your favorite airport?

10. Please describe your favorite airport, and what about that airport makes it your favorite?

11. Please describe your most favorite aspects of airports, and explain why.

12. Please describe your least favorite aspects of airports, and explain why.
Section 5: **Your Design Recommendations**

The purpose of this research is to develop design solutions that will contribute to an air travelers’ low-stress, positive experience within an airport terminal.

In addition to your previous more specific comments, this section is asking if you have further design recommendations regarding the improvement of airport terminal design.

13. What **design recommendations** do you have that would help improve your experience within the airport?
Section 6: Demographics

This information will be used to see if different groups of people have different experiences in airports. Remember, all information you provide in the survey is confidential and anonymous. Responses will be analyzed only as group responses.

If you do not feel comfortable answering any of the following questions, you are able to skip and submit the survey.

14. What age group do you fit into?
   - 18-29
   - 30-41
   - 42-53
   - 54-65
   - 66-77
   - 78-89
   - 90 and above
   - Prefer not to answer

15. What do you identify as?
   - Male
   - Female
   - Non-Binary
   - Prefer not to answer
16. In order to better understand how people with different conditions experience airport terminals, please indicate if you have any of the following conditions. Remember, your answers are confidential and anonymous. Check 'yes' or 'no' for each choice. If you prefer not to answer, you can select that response instead.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Yes</th>
<th>No</th>
<th>Prefer not to answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical/Mobility Limitation? (e.g. are under 4 feet tall, require the use of a wheelchair, power wheelchair, scooter, cane, or braces, physical limitations to use of your arms or hands, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Limitation? (e.g. complete blindness, blurred vision, limited peripheral vision, macular degeneration, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cognitive Conditions? (e.g. ADD, ADHD, Autism Spectrum Disorders, Epilepsy, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Conditions? (e.g. Bipolar Disorder, Anxiety Disorder, Depression, Paranoid Personality Disorder, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you answered yes, use the examples given to further identify your condition and/or limitation.
THANK YOU for participating in this study!

If you have any questions, have additional information you would like to provide, or would like a summary of the survey results, you may reach Alexis Donnelly by email at alexiszi@buffalo.edu.
Appendix C

Survey Results

This appendix includes both the qualitative verbatim responses of the survey respondents for each open-ended survey question and quantitative results for scaled questions. They are shown for two groups of respondents: those who flew fewer than 5 times/year and those who flew 5 or more times per year.

Question 3: Moving throughout the terminal: If you feel stress in any of these situations please explain.

<table>
<thead>
<tr>
<th>Q3-Other: Moving throughout the terminal: If you feel stress in any of these situations, please explain.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4 YEARS: 15 OF 44 People Responded</td>
</tr>
<tr>
<td>Always worried about holding up the line at security. Trying to remember what the latest security things are. I think signage at many places in many airports has been improving. I hate finding a seat at the gate, it always seems crowded. Also have difficulty hearing announcements.</td>
</tr>
<tr>
<td>Always worry about safety, possible terrorism, plane crashing etc.</td>
</tr>
<tr>
<td>Due to my physical disabilities, a wheelchair has always been supplied. I'm grateful; but other travelers have not always been the same.</td>
</tr>
<tr>
<td>I’m often worried that I will not hear an important announcement while seated at the gate or that there has been a gate change that I’m unaware of at larger terminals.</td>
</tr>
<tr>
<td>If I were running late to my flight, that’s when I felt the stress. If I was on time/early I would feel no stress at all. For me, it’s easy to navigate airports when not rushed.</td>
</tr>
<tr>
<td>Intersections are stressful because I want to keep up with the flow of traffic while paying attention to signage. McCarran Airport terminal D is a terrible example of this. Security checkpoints are stressful because of the presence of TSA. I prefer airports where TSA stay behind a counter.</td>
</tr>
<tr>
<td>Just anxiety of getting to the safest part of the airport is just my thinking (past security).</td>
</tr>
<tr>
<td>Large crowds in some places, not enough seating by gates, not enough outlets</td>
</tr>
<tr>
<td>Looking for proper signage is important especially when changing terminals for connecting flights.</td>
</tr>
<tr>
<td>Making sure my back issues don’t flare up</td>
</tr>
<tr>
<td>Security lines can be long, I’ve missed a flight, it’s uncomfortable even though I’m thankful for high security. When traveling alone I become stressed in unfamiliar surroundings especially airports, obviously one is there to move through quickly you don’t go to an airport to relax signage and intersections need to be well marked. Remarkably I’ve never had a problem navigating even large airports alone, yet I realize how stressed I’ve become at those times reflecting on the survey question.</td>
</tr>
<tr>
<td>Security: Stress related to others not knowing procedures due to unclear signage, inconsistent rules, inefficient queues, and security theatre. Waiting at gate: inefficient seat layout, crowding, lack of tables, lack of electrical outlets, useless information over PA system mixed with important info.</td>
</tr>
</tbody>
</table>
The majority of my stress comes from missing boarding. No matter how early I arrive, I worry that I will not be able to find my gate or will not find a restroom close enough to the gate to use it before boarding. Signage causes me stress when it isn’t clear where my gate is, or worse, when there are separate security checkpoints for each terminal that are not clearly identified.

Walking through the terminal and understanding signage causes me mild stress because every airport is so different. I am afraid of not finding the right gate or being late because I went somewhere, I was not supposed to. Waiting at the gate causes me stress because on certain flights you cannot pick your seats (i.e. Southwest Flights). I always like to sit in the front of the plane with a window seat and it causes me stress not being able to be one of the first board and get a seat I don't like.

While going through security, I worry about holding up the line. While understanding signage, I worry about not finding my gate.

Table 5: 1-4 Years: Situational Stress Explanations

| Q3-Other: Moving throughout the terminal: If you feel stress in any of these situations, please explain. |
| 5+ YEARS: 23 of 44 people Responded |
| Crowds and rude people |
| Generally, wait in long lines at airports in larger cities, which can be unsettling. |
| Getting pulled aside or getting my bag pulled aside for additional screening, mainly because I get to the airport only minutes before my plane boards, so there’s no time to spare. Waiting at the gate area, I’m usually worried there won’t be space for my bag. |
| I don't like feeling rushed at the security check point. I don't like feeling like I am going to be late if the security line is too long. I don't like worrying about whether my carryon bag will get in the overhead. |
| I find the entire airport/flight experience stressful. |
| I generally feel stressed when the area is crowded beyond the capacity that it can handle. For the signage, I don't get stressed if the signage properly leads the way to e.g., different terminals or baggage claim area. But I am highly stressed when the signage does not properly direct you to the location that you are looking for (e.g., lounge) and make you wander around. This is critical because most of the time you are carrying a heavy bag or luggage with you. Moving through the security checkpoint is always stressful because of the long line and wait times, as well as procedures it takes (i.e., take off shoes, put the electronic devices in the right format, interacting with the guards, etc.). |
| In particular I found the Phoenix Airport very unfriendly. Long distances between terminals, few options for food or shopping for sundries, poorly lit and flight information boards were sparse. I also had an exceptionally stressful transfer at LAX where there was little assistance from anyone to make a connecting flight in a different terminal when the airline was at fault for the late arrival of my inbound flight. |
| Inconsistency of TSA. I’m an airline employee, one airport will accept my badge, another won’t and have me fully screened. It’s the uneducated portion of TSA workers that’s frustrating. |
| It really depends on the situation. The worst case is trying to make a connection when the first plane is late. I could tell you stories.... |
It’s too many people packed together in one space. Security is typically the worst because travelers never seem to understand the process and TSA agents aren’t friendly.

Large groups

Mostly due to the chance that I may have to spend more time than I allotted for

Normal frustration usually involving other travel incompetence

Passing through a security check point usually includes an unpredictable length of time.

Security check- taking out and putting in the valuables.

Security checkpoints always seem to be an unnecessary maze. Especially when not busy. Walking through the terminal you never know how far of a walk or how long it will take to get it between gates/terminals when making connections.

Signage is not always clear and direct. Security lines can be backed up due to minimal staffing.

Stress arises when gates are changed, people gather in front of the gate door if the airlines don't establish specific lines or when gates are arranged side by side at the end of a terminal causing huge crowds of people which hinders the ability to hear or move to the gate door easily.

Stress at security is usually related to the length of the line, the access to precheck and the I consistencies of procedures from airport to airport. Stress at the gate is due more to the boarding process than anything but also to the lack of seating in the gate area.

The only time I feel mild to moderate stress is when I’m running late for my flight.

Too crowded and not enough time between flights to make it to the next gate ... These delays were due to airline maintenance and mishaps out of passenger’s control.

TSA is very inconsistent. I’ve gotten through with water bottles, pocketknives and other contraband on accident before. Sometimes I have to separate my laptops in TSA precheck and other times I don’t.

Uncertainty was one of the biggest factors that impacted stress. As an Arab American, I have seen that the way I dress holds a lot of impact on whether I will receive a bomb screening or be patted down. Having more screens displaying the status and location of flights was another determinant in stress. Airports that lack clear signage and updated flight status were conducive to stressful travel.

Table 6: 5+ Years: Situational Stress Explanations

**Question 4: When walking through the SECURITY CHECKPOINT, what else is important?**

**Q4 OTHER: When walking through the SECURITY CHECKPOINT, what else is important?**

1-4 YEARS: 4 OF 44 People Responded

A larger number of security checkpoints with a slower pace would be helpful.

I always like to see multiple scanners open so the line can disperse a bit once IDs & boarding passes are checked. This gives more time to take off shoes or remove liquids and electronics if required.
The agents are always just shouting at you what needs to be done. There should be simple clear signs, that are consistent, so everyone knows what to expect. The announcements they offer are usually useless: e.g., how to properly pack your liquids: If I'm already in line at security, it's a bit late for instructions on how to pack. The queue is also inefficiently set up with no place to sit to take off shoes, etc. so it bottlenecks. Very little space to place stuff on counter to remove laptop, etc., and the conveyer belts don't go far enough so you need to stand there with your stuff to push it in when you could be going through the screeners.

When u prescreen don't out people who have not prescreened in this line.

Table 7: 1-4 Years: Design Importance of the Security Checkpoint Explanations

| **Q4 OTHER: When walking through the SECURITY CHECKPOINT, what else is important?** |
| **5+ YEARS: 3 of 44 people Responded** |

As an airline employee, I think it’s still important to remove clothing items so that potential plastic weapons or any other of those items that will not go off during a metal detector can still be visible or seen, or put through the conveyor belt for inspection

Having the comfort of TSA precheck along with CLEAR (sometimes the TSA PRE line is even long) has reduced the stress of traveling and having to arrive early.

It would be nice to have signage relating the procedural expectations for passing through security specific to the airport since it seems they are different at every airport. Getting instruction as you approach the conveyor belt can be stressful.

Table 8: 1-4 Years: Design Importance of the Security Checkpoint Explanations

**Question 5: When moving through the TERMINAL, it is important to have**

Figure 12: Design Importance of the Terminal
Fish tanks!

I love airports that use artwork to differentiate themselves from others. To me, calming colors would be light blue and light yellow.

Table 9: 1-4 Years: Design Importance of the Terminal Explanations

Affordable food/beverage and travel options available for purchase

Artwork and nice colors are good, but this is subjective...one person's calming colors are another's annoying banality.

Location of the airport should play a part in natural lighting and external views. For example, if the airport is in an industrial area, I would think it more important to improve internal beauty.

My favorite airports are the ones with outdoor patio and seating options. Delta sky clubs are notorious for these design options. Music is not necessary in the terminal as most people listen to their own headphones unless there is a live musical performance. Detroit and Atlanta often have live music in multiple spots in the terminals.

SFO terminal 2 should be a great case study for you. They just finished a renovation and have open visual air spaces, local restaurants and markets, piano music and everything flows and easily accessible, and artwork.

Table 10: 5+ Years: Design Importance of the Terminal Explanations

**Question 6: When observing SIGNAGE, it is important to have**

![Figure 13: Design Importance of Signage](image-url)

---

63
Q6 When observing SIGNAGE, what else is important?

**1-4 YEARS: 1 OF 44 People Responded**

I wouldn’t want the time between places to be specified because people walk at different speeds. But a map with nearby amenities would be nice, especially in larger airports.

Table 11: 1-4 Years: Design Importance of Signage Explanations

**Q6 When observing SIGNAGE, what else is important?**

**5+ YEARS: 3 of 44 people Responded**

Digital screens are very helpful when locations/procedures have the potential to change.

I think it definitely would help if airport signage was standard worldwide as they do in Europe, with colors and similar types of signs. An example of this is stop signs in the US have a octagonal red shape, you see this similarity throughout the world.

Without signage navigation through airports would be impossible. The more ... the better.

Table 12: 5+ Years: Design Importance of Signage Explanations

**Question 7: When at a GATE, it is important to have**

Q7: When waiting at a GATE, it is important to have:

- **...a space that allows you to do work.**
- **...a space where you can charge electronics.**
- **...clear views to the information desk and/or screen.**
- **...an open area with clear views to surroundings, signage, food options, restrooms, etc.**
- **...a low noise level.**
- **...access to a natural light.**
- **...views to the outside.**
- **...accessible seating.**
- **...comfortable seating.**
- **...seating that is separated from strangers.**

Figure 14: Design Importance of the Gate
Q7 When at a GATE, what else is important?

Table 13: 1-4 Years: Design Importance of the Gate Explanations

<table>
<thead>
<tr>
<th>Routines</th>
<th>Occurrence</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrive early</td>
<td>32</td>
<td>55.17%</td>
</tr>
<tr>
<td>Preparing for security ahead of time</td>
<td>24</td>
<td>41.38%</td>
</tr>
<tr>
<td>Purchasing food and/or drinks</td>
<td>8</td>
<td>13.79%</td>
</tr>
<tr>
<td>Acquire Pre-Check (TSA, Clear, etc.)</td>
<td>6</td>
<td>10.34%</td>
</tr>
</tbody>
</table>

Table 14: 5+ Years: Design Importance of the Gate Explanations

“Charging outlets now can be installed directly underneath the seats. I don’t think it’s important to have to do work at the gate because most businesspeople have lounge access, so they go to the lounge or a private area for that.

Most disabled passengers are in wheelchairs. There is usually an excess of accessible seating that goes unused.

Restrooms near gates are great especially when you know you’re boarding soon and only have 3 mins. Comfortable seating is beautiful for long layovers or overnight stays in airports due to cancellations. Views to monitors with current news or upgrade information is always nice too.

Table 15: Summary of Participant Airport Routines
(# of People Making Comments=59)(# of Examples=70)

“Arrive early. Always have ID and boarding pass handy when going through security. Use electronic boarding passes (less fumbling with papers)”

-Participant (10+ flights/year)
Q8 OTHER: Before COVID, what ROUTINES (if any) did you have to make the airport experience less stressful?

1-4 YEARS: 32 of 44 People Responded

<table>
<thead>
<tr>
<th>Routine Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A space in my travel for COVID (mask, sanitizer etc.....)</td>
</tr>
<tr>
<td>all documentation in one area</td>
</tr>
<tr>
<td>Arrive approx. 1.5 hours before my flight, be to my gate early to reserve a seat, go to the bathroom, get a snack, etc.</td>
</tr>
<tr>
<td>Arrive at the airport 2 hours before</td>
</tr>
<tr>
<td>Arrive early</td>
</tr>
<tr>
<td>arrive two hours early</td>
</tr>
<tr>
<td>Arriving early, having identification readily available, planning out airport experience</td>
</tr>
<tr>
<td>Be early! Pack or plan meals, scope out map ahead.</td>
</tr>
<tr>
<td>Be organized, have all necessary paperwork out and ready</td>
</tr>
<tr>
<td>Bringing hand wipes with me, headphones, own pillow, blanket and food</td>
</tr>
<tr>
<td>Get their early</td>
</tr>
<tr>
<td>Get to airport as early as I possibly, make sure my wallet was handy for security check, have my ticket handy</td>
</tr>
<tr>
<td>Getting there well before my flight.</td>
</tr>
<tr>
<td>Have all needed paperwork and ID easily stored away. Arrive with enough time to get through security but not too much time where you are sitting around bored and uncomfortable</td>
</tr>
<tr>
<td>I always arrive early for my flight, so I have plenty of time to go through security. Once through security, I locate my gate. Next, I identify the closest restroom. I double-check travel information like gate number and departure time. If I intend to eat before my flight, I always eat once past security and before finding a seat. Then I choose a seat with an outlet if at all possible. If no outlet-adjacent seats are available, I will find a seat with space between myself and strangers. I am more concerned about being able to see my gate from my seat than about sitting in the allocated area for my gate. I make every attempt not to leave my seat until shortly before boarding, at which time I will use the restroom and stand near the gate until my group is called.</td>
</tr>
<tr>
<td>I always arrived 2-hours before a flight, usually got coffee or food before the flight in the airport, used the restroom because I hate using the one on the plane.</td>
</tr>
<tr>
<td>I get there so early. And I take my sweet time going through the stressful bits.</td>
</tr>
<tr>
<td>Just make sure to give yourself time</td>
</tr>
<tr>
<td>Leave my home 3 hours before departure to allow for travel time, security time, time to the gate, and when boarding actually starts.</td>
</tr>
<tr>
<td>Making sure to get to the airport early enough that I didn't have to stress about missing my flight.</td>
</tr>
<tr>
<td>Minimal luggage. Arrive early</td>
</tr>
<tr>
<td>Music</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Pack light and roller bags! Lots of stuff in carryon: food, books, electronics, meds, extra clothes, etc.</td>
</tr>
<tr>
<td>Pack light with stuff you need in reach, arrive early.</td>
</tr>
<tr>
<td>Precheck tickets</td>
</tr>
<tr>
<td>Prepare identification ahead of time and pack properly</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Show up early. Have all IDs and tickets ready to be shown.</td>
</tr>
<tr>
<td>Storing needed documents in accessible pockets of baggage.</td>
</tr>
<tr>
<td>Wear slip on shoes. Carefully review carry-ons. Limit items - pack light</td>
</tr>
<tr>
<td>Wearing slip-on shoes with socks. Keep my ID and phone easily accessible. Limit my carry-on’s</td>
</tr>
<tr>
<td>When going through security, I would already have taken off shoes belt watches etc. to go faster. Can’t stand not being prepared.</td>
</tr>
</tbody>
</table>

Table 16: 1-4 Years: Airport Routine Explanations

| Q8 OTHER: Before COVID, what ROUTINES (if any) did you have to make the airport experience less stressful? |
| 5+ YEARS: 32 of 44 people Responded |

- TSA pre-check and Clear
- Advanced knowledge of where I was going as well as timing between gates.
- Arrive 1 hour before - don’t check baggage.
- Arrive 2 to 2 1/2 hours before departure
- Arrive early to ensure extra time for lines / security
- Arrive early, go to gate to check departs time or delay, get food.
- Arrive early. Always have ID and boarding pass handy when going through security. Use electronic boarding passes (less fumbling with papers)
- Arrive to the airport 2 hours prior
- Arrived 2 hours prior to flight
- Be on time
- Check in online to save time, pack snacks for my special diet so I don’t have to worry about finding appropriate food, be dressed in layers so I’m neither too hot or cold, have Clorox wipes to clean my airplane seat.
- Coordinates drop off and pick up with a friend Avoid checking a bag
- Enough time to arrive so I wouldn’t miss my flight
- For airline employees we go through our own access portal called KCM, so that was really nice but it’s inconsistent between airports unfortunately. One airport would require me to be in uniform while the other doesn’t, but the letter of the law states that I don’t have to be in uniform to go through. That’s a TSA matter specifically. Definitely airport lounges are good, especially American Express so that I can be away from the majority of people and still have a nice environment that is clean access to food and drinks all at no cost
- Got TSA Pre-Screening because the security line is always the worst part about being in the airport.
- I just make it easy to take out the electronic devices at the security checkpoint and have space available with the small baggage to put the device in after the check-in process. So I would not have to carry heavy stuff throughout the terminal. Download music or videos in advance so I would get less distracted from surroundings.
I organized my luggage to be able to pull out liquids if needed. I would make sure my phone was charged and my boarding pass/ID/passport was easily accessible. I would wear comfortable shoes and leave at least 1.5 hours early depending on the airport.

I would stop for food and drink alcohol. I would arrive at my Gate as my zone was boarding to avoid being in the crowded gate area and possibly not finding a seat.

Know the rules ahead of time and pack bags accordingly.

Last time I flew I missed the first 3 flights and then made the last one. I made sure I had my boarding pass before I got to the airport.

Pack my carry on according to TSA and federal regulations. Google distance to airport and always allow me 30 min for TSA.

Pack pertinent documents so they are readily accessible yet secure.

Packing with planning, entertainment options- books, music, etc.

Plan to buy a coffee or a snack.

Precheck and early morning flights.

Show up 2 hours before.

TSA pre check, electronics off before security.

Use noise canceling ear buds. Carry an empty refillable water bottle through security. Carry lightweight backpack. Sit at an empty gate across from or next to gate assigned to my flight. Find a table service restaurant and grab a table against a wall, or a food hall with a large quantity of seating.

With Nexus pass I have TSA preferred status...a huge benefit. I do not check luggage, even if I am away for a month...an issue missing from the survey. I fit everything into a small rollaway and knapsack. I empty my pockets before getting in the security line.

Table 17: 5+ Years: Airport Routine Explanations

**Question 9: What is the name of your favorite airport?**

<table>
<thead>
<tr>
<th>Airport Name</th>
<th>Airport Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albany International Airport</td>
<td>ALB</td>
</tr>
<tr>
<td>Allentown Lehigh Valley Intl Airport</td>
<td>ABE</td>
</tr>
<tr>
<td>Hartsfield-Jackson Atlanta International Airport</td>
<td>ATL</td>
</tr>
<tr>
<td>Hartsfield-Jackson Atlanta International Airport</td>
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<tr>
<td>Hartsfield-Jackson Atlanta International Airport</td>
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<td>Hartsfield-Jackson Atlanta International Airport</td>
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<td>Hartsfield-Jackson Atlanta International Airport</td>
<td>ATL</td>
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<tr>
<td>Baltimore Washington International Airport</td>
<td>BWI</td>
</tr>
<tr>
<td>Baltimore Washington International Airport</td>
<td>BWI</td>
</tr>
<tr>
<td>Buffalo Niagara International Airport</td>
<td>BUF</td>
</tr>
<tr>
<td>Buffalo Niagara International Airport</td>
<td>BUF</td>
</tr>
<tr>
<td>Buffalo Niagara International Airport</td>
<td>BUF</td>
</tr>
<tr>
<td>Charlotte Douglas International Airport</td>
<td>CLT</td>
</tr>
<tr>
<td>Charlotte Douglas International Airport</td>
<td>CLT</td>
</tr>
<tr>
<td>Name of Favorite Airport</td>
<td>Abbreviation</td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Charlotte Douglas International Airport</td>
<td>CLT</td>
</tr>
<tr>
<td>O'Hare International Airport</td>
<td>ORD</td>
</tr>
<tr>
<td>Chicago Midway International Airport</td>
<td>MDW</td>
</tr>
<tr>
<td>John Glenn Columbus International Airport</td>
<td>CMH</td>
</tr>
<tr>
<td>Denver International Airport</td>
<td>DEN</td>
</tr>
<tr>
<td>Detroit Metropolitan Airport</td>
<td>DTW</td>
</tr>
<tr>
<td>Detroit Metropolitan Airport</td>
<td>DTW</td>
</tr>
<tr>
<td>Barcelona Airport</td>
<td>BCN</td>
</tr>
<tr>
<td>Flagstaff Airport</td>
<td>FLG</td>
</tr>
<tr>
<td>Jackson Hole Airport</td>
<td>JAC</td>
</tr>
<tr>
<td>John F. Kennedy International Airport</td>
<td>JFK</td>
</tr>
<tr>
<td>LaGuardia Airport</td>
<td>LGA</td>
</tr>
<tr>
<td>Copenhagen Airport</td>
<td>CPH</td>
</tr>
<tr>
<td>Long Beach Airport</td>
<td>LGB</td>
</tr>
<tr>
<td>Mc Carran International Airport</td>
<td>LAS</td>
</tr>
<tr>
<td>Kansas City International Airport</td>
<td>MCI</td>
</tr>
<tr>
<td>Orlando International Airport</td>
<td>MCO</td>
</tr>
<tr>
<td>Orlando International Airport</td>
<td>MCO</td>
</tr>
<tr>
<td>Orlando International Airport</td>
<td>MCO</td>
</tr>
<tr>
<td>Murray Island Airport</td>
<td>MYI</td>
</tr>
<tr>
<td>Nashville International Airport</td>
<td>BNA</td>
</tr>
<tr>
<td>Palm Springs International Airport</td>
<td>PSP</td>
</tr>
<tr>
<td>Philadelphia International Airport</td>
<td>PHL</td>
</tr>
<tr>
<td>Philadelphia International Airport</td>
<td>PHL</td>
</tr>
<tr>
<td>Phoenix Sky Harbor Airport</td>
<td>PHX</td>
</tr>
<tr>
<td>Salt Lake City International Airport</td>
<td>SLC</td>
</tr>
<tr>
<td>Amsterdam Airport Schiphol</td>
<td>AMS</td>
</tr>
<tr>
<td>San Francisco International Airport</td>
<td>SFO</td>
</tr>
<tr>
<td>San Francisco International Airport</td>
<td>SFO</td>
</tr>
<tr>
<td>Tallinn Airport</td>
<td>TLL</td>
</tr>
<tr>
<td>Tampa International Airport</td>
<td>TPA</td>
</tr>
<tr>
<td>Tampa International Airport</td>
<td>TPA</td>
</tr>
<tr>
<td>Toronto Pearson International Airport</td>
<td>YYYZ</td>
</tr>
<tr>
<td>Toronto Pearson International Airport</td>
<td>YYYZ</td>
</tr>
</tbody>
</table>

Table 18: Name of Favorite Airport
**Question 10: Please describe your favorite airport and what about that airport makes it your favorite?**

<table>
<thead>
<tr>
<th>Q10 Other: Describe your favorite airport, and what about that airport makes it your favorite?</th>
<th>1-4 YEARS: 21 of 44 People Responded</th>
</tr>
</thead>
<tbody>
<tr>
<td>A lot of natural light, a playground, acoustic treatments at every gate and every dining space. Art installations. Unique design for several of the gates.</td>
<td></td>
</tr>
<tr>
<td>Airports I have liked in the past had comfortable waiting areas and easy access to food and beverages for layovers. Once you checked in and passed security you felt you didn’t need to worry about anything anymore (where your baggage might end up, communication about flight delays, etc.)</td>
<td></td>
</tr>
<tr>
<td>Because being here is the start of every Disney vacation of course!!!!</td>
<td></td>
</tr>
<tr>
<td>Clean, peaceful, quiet, friendly staff, small</td>
<td></td>
</tr>
<tr>
<td>Ease of getting from gate to gate and signage</td>
<td></td>
</tr>
<tr>
<td>Easy to navigate and a lot of food options</td>
<td></td>
</tr>
<tr>
<td>Everything is made simple, large areas to wait</td>
<td></td>
</tr>
<tr>
<td>good directions</td>
<td></td>
</tr>
<tr>
<td>Good food and lots of space</td>
<td></td>
</tr>
<tr>
<td>I like that the airport has a lot of natural light and wide-open spaces.</td>
<td></td>
</tr>
<tr>
<td>I like the new Dubuque airport because it is small and easily navigated.</td>
<td></td>
</tr>
<tr>
<td>It is a small airport that is never busy; it's easy to get from parking to the terminals.</td>
<td></td>
</tr>
<tr>
<td>It was modern. Artwork was everywhere. I believe it’s a model for future air travel. They had yoga rooms etc. it was almost like a hotel that airplanes pulled up to</td>
<td></td>
</tr>
<tr>
<td>Lots of natural light, a wide variety of food options</td>
<td></td>
</tr>
<tr>
<td>Many different food options</td>
<td></td>
</tr>
<tr>
<td>McCarran International Airport because it is decked out in decorations and features that reflect Las Vegas. I love the “they really went that far” factor.</td>
<td></td>
</tr>
<tr>
<td>Not crowded, not a huge airport, variety of food options, quick security checkpoint, lots of areas for phone charging</td>
<td></td>
</tr>
<tr>
<td>Orlando - MCO (traditions and know you are at a great place)</td>
<td></td>
</tr>
<tr>
<td>Orlando airport! Easy to navigate. Buffalo is also a small and convenient airport as well!</td>
<td></td>
</tr>
<tr>
<td>Personnel</td>
<td></td>
</tr>
<tr>
<td>Rocking chairs, shopping, bars and it’s big but friendly and bright and easy to get through.</td>
<td></td>
</tr>
<tr>
<td>Small and easy to find gates. No multiple terminals, not big.</td>
<td></td>
</tr>
<tr>
<td>Small no pay parking</td>
<td></td>
</tr>
<tr>
<td>Small old school</td>
<td></td>
</tr>
<tr>
<td>Smaller, easy to navigate, easy to follow directions, less people/noise and stress</td>
<td></td>
</tr>
<tr>
<td>The airport is set up so that once you get through security it is a large square with each side labeled by letter. This was great because if you got lost you were just going to lap right around to where you needed to be. They also had many food options, restrooms, and signs. There were also a lot of windows so you could see the views of the mountains outside.</td>
<td></td>
</tr>
</tbody>
</table>
The terminal isn't as divided as airports such as LAX and it is an open and easy flow around.

Table 19: 1-4 Years: Description of Favorite Airport

<table>
<thead>
<tr>
<th>Q10 Other: Describe your favorite airport, and what about that airport makes it your favorite?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5+ YEARS</strong>: 34 of 44 people Responded</td>
</tr>
</tbody>
</table>

Bright, wide open spaces, several places to work, eat and charge devices. Unique architecture with clear signage. Several places to shop.

Chicago, big beautiful modern.
Clear signage, linear planning.

Despite being in a foreign country with a different language it was easy to figure out where you’re going. It’s easily accessible from the city center. The security process was almost enjoyable with friendly attendants giving instructions. It was a fast process as well. The terminals are easily accessible as well.

Easy access to all terminals and a variety of quick dining options at each terminal. Large clean restrooms.
Easy directions, cleanliness, fast paced

Extremely clean and easy to navigate!
I believe that the cleanliness, access to light, food options, charging ports, and walkways are good. Could be improved with more signage.

I have multiple favorite airports. However, MCI is quick and easy to get through security and to your gate

I would say it’s my favorite mostly because I have traveled there most frequently so I am comfortable with directions and where I need to be.

It has easy access to all points. Clear description of directions. Open seating and several selections for food. Has rocking chairs by the window for relaxing.

It's big and provides a lot of travel options because of its size. It is walkable and easy to navigate, I don't have to take trams or shuttles to different sections of the airport, it's essentially a very long, straight line.

It’s big but has a lot of food options and stores to shop in when having a long layover.

large, open and great views

Love being able to see the amazing views of the New York City skyline when taking off and landing.

Many choices
Nice and spacious as well as the views of the different artwork.
Not too big and has good food options. It isn’t too confusing, and the security usually isn’t too busy.
Not too large, easy navigation

Plenty of ways to get to gates, clean, good layout
Quick security lines, charging stations, access to healthy food choices

Relative quiet. Good food options. Ability to occupy comfortable food area seating until just prior to flight.

Rustic western style in the baggage claim area. View of the mountains. Very simple layout.
San Francisco airport has the money and infrastructure to create a very open and clean, modern space, all while providing amenities for lounges and markets and fresh food and relaxation areas.

Small No travel between gates Security lines have always been a manageable size and not backed up Seems to be staffed appropriately

So many foods, and luxury options. Stores, bars, charging ports for electronics. Plenty of room.

Super small but I liked the displays of local artisans. In larger airports I like to have a variety of shops instead of the same vendor in 5 locations.

The bar with the live music

The outside and palm trees when walking between terminals

The sheer size, food options, and the tunnel between concourses A and T is designed like a rainforest.

The terminal is a giant straight line with a train that runs above the terminal with 3 stops. Two on each far end and one in the middle. Includes 3 delta lounges and tons of bars and food options. Even a Westin for overnight stays.

Toronto - very efficient at the security checkpoint. Have diverse seating options. Seats very comfortable. Buffalo - Since it is a small airport, it is less crowded; therefore, shorter wait times at the security checkpoint and shorter travel distance inside the terminal.

Very easy to navigate. Easy access in and out of airport. I use this airport most often.

You actually feel good in that airport. It is very very quiet...no PA announcements...just at the gates when the planes are about to depart. Lots of amenities. Incredibly good connections to the city - a robotic train with station under the airport.

Table 20: 5+ Years: Description of Favorite Airport
**Question 11:** Please describe your **most favorite aspects of airports and explain why.**

The survey asked participants to identify their most and least favorite aspects of airports in an open-ended response. For favorite aspects of the airport, of the 65 comments, there were a total of 79 aspects mentioned by respondents (see Figure 6). The most frequently mentioned aspects included the food and bar experience, clear signage and good wayfinding, and views and access to nature. In regard to participants’ least favorite aspects, of the 68 comments, there were a total of 104 aspects mentioned by respondents (see Figure 7). The most frequently mentioned aspects were security, confusing information, crowds, and the layout and seating availability at gates.

<table>
<thead>
<tr>
<th>Favorite Aspects</th>
<th>Occurrence</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food/bar experience</td>
<td>17</td>
<td>26.15%</td>
</tr>
<tr>
<td>Clear signage &amp; good wayfinding</td>
<td>14</td>
<td>21.54%</td>
</tr>
<tr>
<td>Views and access to natural environment</td>
<td>9</td>
<td>13.85%</td>
</tr>
<tr>
<td>Comfortable seating</td>
<td>8</td>
<td>12.31%</td>
</tr>
<tr>
<td>Shopping</td>
<td>7</td>
<td>10.77%</td>
</tr>
<tr>
<td>Quick and easy security</td>
<td>6</td>
<td>9.23%</td>
</tr>
<tr>
<td>People watching</td>
<td>5</td>
<td>7.69%</td>
</tr>
<tr>
<td>Quiet space</td>
<td>3</td>
<td>4.62%</td>
</tr>
<tr>
<td>Outlets</td>
<td>3</td>
<td>4.62%</td>
</tr>
<tr>
<td>Art/displays of the area</td>
<td>3</td>
<td>4.62%</td>
</tr>
<tr>
<td>Workspace</td>
<td>2</td>
<td>3.08%</td>
</tr>
<tr>
<td>Walking</td>
<td>2</td>
<td>3.08%</td>
</tr>
</tbody>
</table>

Table 21: Summary of Most Favorite Aspects  
(# of People Making Comments=65) (# of Examples=79)

**Q11 Other: Please describe your MOST FAVORITE aspects of airports and explain why.**

**1-4 YEARS: 29 of 44 People Responded**

- plants, quiet, calming, restful, comfortable chairs, clean
- Airport restaurants and bars because it is a unique experience
- Baggage drop-off, instructions, etc.
- Clear signage is the most important thing that affects my comfort in airports, followed by frequent restrooms.
- Comfortable seating, adequate outlets for charging electronics, easy to understand signs
- Comprehensible signage, easy indicators, fun food/drink environments
- Ease of navigation. Close bathrooms and places to eat.
- Easy navigation throughout (not far walking distances to the checkpoints, gate, etc.)
- Food and drinks
### Q11 Other: Please describe your MOST FAVORITE aspects of airports, and explain why

<table>
<thead>
<tr>
<th><strong>5+ YEARS: 35 of 44 people Responded</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Airports that are quiet, have natural environments within view of waiting areas, spacious seating areas, decent food, good walking areas for exercise, convenient connections to public transit, pleasant restrooms</td>
</tr>
<tr>
<td>Artwork or statues that show off the city, history, area, animals and nature. It piques your interest about what makes each place unique.</td>
</tr>
<tr>
<td>Car rental agencies onsite (no need to take shuttle or walk far).</td>
</tr>
<tr>
<td>Clearly marked terminals, easy access to information regarding arrival and departure</td>
</tr>
<tr>
<td>Easily understood layout. Good=single central ticketing/security space with multiple concourses of equal length. Spaces away from crowds and noise.</td>
</tr>
</tbody>
</table>
Easy to navigate, not chaotic
Favorite ... the American Airlines Club
Food options, architecture, easy n and out
Good food options, short security process
Has good live music
Having a variety of places to eat which provide spaces to sit an work while charging your devices. Lots of windows for natural light. Wide moving sidewalks throughout the terminals that expedite movement from terminal to terminal and gate to gate. Seating at gates that offer options for charging your devices.
I enjoy airports that have displays of some of the history of the area.
I like the touchless check in and ability to check bags with a tablet to save time. I also like to be able to get through security quickly and easily.
I mainly fly out of large hub airports, not the small ones, so the fact that gates are close together that go to different destinations around the world
I think a combination of food options, shopping, and natural light are essential to a pleasant experience while traveling.
It's easy to navigate. It has those people walker machines that help speed up the process of getting down the long halls. I also was impressed with Las Vegas's airport because the common walkway areas are so wide and easy to walk around.
Knowing you are going on a fun trip
Like to see the different history or claims to fame of each city
Local gift options as I often buy them on my way home!
Love food courts in airports because they provide a variety of options for everyone. Love when there's seating areas that provide clear views of the runway. It's exciting to see planes taking off and landing.
Most favorite aspect would be the organization of security and separation from security and the gates.
Outdoor patios and relaxation rooms. During layovers it’s nice to go outside and get a breath of fresh air and take a look at the runway. Also, there are relaxation rooms with massage chairs and recliners to sleep in.
People watching
Shopping options
staying at a lounge when they have a nice clean area at the airport.
The food and store options, love to see the different areas products
The people watching. One sees such a cross-section of humanity and human behavior.
There are plenty of bathrooms all around you.
Things like the rocking chairs in Charlotte, the variety of shops in Chicago, and great food options in BWI
Variety of choices, ease of movement
Variety of food selections and easy access to food. Easy to navigate with clear signage and space to walk and sit.
Viewing spots near the gate!
Walking around to see different amenities and shops

Table 23: 5+ Years: Most Favorite Aspects of Airports
**Question 12:** Please describe your least favorite aspects of airports and explain why.

<table>
<thead>
<tr>
<th>Least Favorite Aspects</th>
<th>Occurrence</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security</td>
<td>22</td>
<td>21.15%</td>
</tr>
<tr>
<td>Confusing information</td>
<td>13</td>
<td>12.50%</td>
</tr>
<tr>
<td>Crowds</td>
<td>12</td>
<td>11.54%</td>
</tr>
<tr>
<td>Gate layout and seating availability</td>
<td>12</td>
<td>11.54%</td>
</tr>
<tr>
<td>Long walking distances</td>
<td>10</td>
<td>9.62%</td>
</tr>
<tr>
<td>Lack of food options</td>
<td>8</td>
<td>7.69%</td>
</tr>
<tr>
<td>Long lines/wait times</td>
<td>7</td>
<td>6.73%</td>
</tr>
<tr>
<td>Narrow walkways</td>
<td>5</td>
<td>4.81%</td>
</tr>
<tr>
<td>Bathrooms</td>
<td>4</td>
<td>3.85%</td>
</tr>
<tr>
<td>Excess/loud noise</td>
<td>4</td>
<td>3.85%</td>
</tr>
<tr>
<td>People rushing</td>
<td>3</td>
<td>2.88%</td>
</tr>
<tr>
<td>Lack of cleanliness</td>
<td>2</td>
<td>1.92%</td>
</tr>
<tr>
<td>Baggage claim</td>
<td>2</td>
<td>1.92%</td>
</tr>
</tbody>
</table>

Table 24: Summary of Least Favorite Aspects of Airports
(# of People Making Comments=68) (# of Examples=104)

**Q12: Please describe your LEAST FAVORITE aspects of airports and explain why.**

**1-4 YEARS:** 32 of 44 People Responded

- A lot of people (foot traffic)
- Being surrounded by stressed people is the most stressful. Having a place to retreat (that doesn’t require a club membership) would be good!
- Everything is the same. Gate seating not arranged efficiently, or sized for the planes, attendants that don't know how to use the mic - should just be automated for boarding, and of course all the other people standing around like sheep.
- Gate separation and transportation to get there
- Getting throwing security
- Going through security, waiting in long lines while carrying luggage.
- Grumpy people, garbage, lines
- Hate waiting at Gates, especially with luggage. Long layovers are hard because it is difficult to move from gate, to food, to getting exercise.
- Inability to access amenities because they are in different terminals.
- Lack of instructions, impatience of staff.
- Lines
- Long lines, disorganization
- Long walks between terminals
Many terminals with bus/train transportation to each one because if you're on a time crunch that can be what makes you miss a connecting flight.

My least favorite aspect of airports is the baggage claim. So many times my travel companions have gotten their luggage and I haven’t and convince myself my bag got lost. I wish there was a way to track where your bags are exactly.

My least favorite aspects of airports is that some of them can feel very dirty.

Narrow walkways that make people bump into each other. When there is nowhere to be comfortable in a long layover. Difficult layouts that are hard to navigate make me too nervous to stray from my gate.

Other people who hold up security line by not being prepared
Overcrowded gates and excess noise.
Overwhelming and stressful
People not complying with TSA agents, slowing everything down. Not being prepared to show tickets.
People who go to the gate too early
People rushing, no clue where you are going and no knowing if I should walk or tram or what because how long does it take to get between terminals????
People who are dressed like slobs, people who don’t control their children, and getting screened
Security and finding gate- always a hassle and slightly stressful
Security checkpoint
The food, signage and stress levels with security
The middle seat in an airplane
The worst part of airports is unconnected terminals where if you go through the wrong security line, you have to exit and go through the proper security line. This costs valuable time and is plain irritating to have to jump through the security hoops twice. The next biggest problem is seating without outlets nearby. With the ubiquity of personal electronics as flight entertainment, outlet seating should be the standard.
Too large and confusing signage
Uncomfortable and minimal seating because you feel you can’t escape from strangers. Far walks to bathroom because you are often leaving your travel partner to watch over bags, etc.
Waiting long periods of time in line for security, lack of outlets
When they are too big and when connecting flights are not close to my arriving gate.

Table 25: 1-4 Years: Least Favorite Aspects of Airports

| Q12: Please describe your LEAST favorite aspects of airports and explain why. |
| 5+ YEARS: 35 of 44 people Responded |
| Announcements that repeat and when they are dirty |
| Baggage claim is the worst and security check is a close second. |
| Bathrooms !!! |
| Baton Rouge- just very small and not standardized screening process due to size |
| Carpeted walkways are impossible to roll suitcases on. Public restrooms are awful to use. I always use the private lounge restrooms but often aren’t available to the average consumer traveler. Cell phone calls rooms are nice to have private conversations. Hearing people talk to other people bothers me lol. |
Charlotte airport is my least favorite by far, cramped conditions, narrow hallways filled with people. Limited food options, not high-class clientele.

Construction
Crammed, loud, no pre check
Crowded security, and different rules at each airport. Some airports you have to take off your shoes, some you don’t. Some you have to remove all electronics from bags, some you don’t. Some you have to take off your watch, some not. Inconsistency
crowdedness. long wait times and long lines. long-travel inside the terminal
Crowds, close seating, availability of staff to help if needed, lack of signage or confusion of signage. I find at times the signage is not clear.
Difficult to understand layout. Bad=1960's short concourse with its own security connected to a more modern, but also pre-9/11 long concourse with retrofitted security.
Gate areas too close together.
Hates all the line and hate having to arrive to the airport early, only to wait.
Having to take car rental shuttles, TSA Precheck lines that are at far end of terminals, having to walk very long distances between gates.
I dislike having to walk from one end to the other for a connecting flight when many layover times are an hour or less. Going through customs is almost always very long and tedious.
Least favorite is on a busy travel weekend it can get confusing where to enter security.
Long lines everywhere, long walkways from the center point from the train to the gate
Narrow terminals making it difficult for two-way walking traffic.
Noise, crowding, poor food, difficult connections to public transit or poor public transit, crowded restrooms and food service
Not knowing where to go sometimes when you get off your flight. Which way to go for baggage claim.
One without a Starbucks
Parking fees at large airports and offsite car rental return.
Poor lighting, lack of food options, and dirty bathrooms
Really long walks to the exit or gates, insufficient security lines, nowhere to do work on a computer
Rude people
Security
Security and a lack of airport employees available to answer questions and guide travelers where signage is lacking.
Security is very nerve racking and getting to your terminal can be confusing. Also finding a place to put your carry on in plane can be stressful.
Security lines
The gate seating. So close together and very uncomfortable.
The main issue with PHL is that the common areas are narrow so walking can be annoying if there are crowds of people. Also, the ceilings are lower compared to other airports I have been in, I prefer high ceilings. MCO and EWR are my least favorite airports. MCO is way too crowded for how they are designed with only two security checkpoints for the high volume of tourists - not ideal and security lines are really long as a result. EWR is poorly designed, reminds me of flower stems, you have to wait in a very narrow corridor to go through security before getting to the terminal to wait for your plan. The extremely narrow corridor is a space shared for entering and exiting travelers so it's very snug. Then once you get to the heart of the flower, i.e., the terminal, there are few options for food and drink and so the restaurants are all crowded, and you feel like claustrophobic because you can't leave because you don't want to endure the stem security line. It's an awful airport that I have only experienced once. I have heard bad stories about parking there too, I made work pay for elite parking because I had to fly to Vancouver and there weren't many options.

The unknown distances between gates/terminals. Makes it hard to plan if you have enough time between flights for a food or bathroom stop.

They all seem to create so much hassle.

Table 265+ Years: Least Favorite Aspects of Airports

Question 13: What design recommendations do you have that would help improve your experience within the airport?

Q 13. What DESIGN RECOMMENDATIONS do you have that would help improve your experience within the airport?

<table>
<thead>
<tr>
<th>A more open environment....... sections broken - off for example: East /West destinations.......(not running to a gate on the other side of the terminal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access you quiet areas, cleaner surroundings, clean lavatories, maybe fish tanks...more people to help Like a guide, helper or customer service agent I literally feel so alone and scared. The employees are typically like a pack of wolves!</td>
</tr>
<tr>
<td>Acoustic treatments and improved legibility of signage.</td>
</tr>
<tr>
<td>Adding more seating at gates so you don't have to rush right to your gate if you want to sit down while you wait for your flight. Also, the addition of more greenery and natural sunlight would make the experience more enjoyable.</td>
</tr>
<tr>
<td>All of the “importance” idea questions were great! Access to natural light, calming signs, etc. all were great ideas that I would love to see in future airports!</td>
</tr>
<tr>
<td>Better gate connections</td>
</tr>
<tr>
<td>Better layout of arrivals and departures screen. Its a lot of info so it’s hard to look for your specific flight. If there was somehow a way to make that screen less congested</td>
</tr>
<tr>
<td>Better signage with legible icons that the general public would understand</td>
</tr>
<tr>
<td>Buffalo is fine. It could usage signage pertaining to the airlines and which direction. For example, all delta flights are to the right and American to the left.</td>
</tr>
<tr>
<td>Can’t really come up with any</td>
</tr>
<tr>
<td>Designs of the city of the airport you are at</td>
</tr>
<tr>
<td>Easy to read direction signs</td>
</tr>
</tbody>
</table>
High ceilings, greenery and frequent air circulation to keep air fresh. Small comfortable seating areas that feel private but allow easy access to gate and screens monitoring flight status. I’ve always liked the chairs that have charging ports. A place that you can separate yourself from the terminal hustle and bustle when you have a long layover but still have access to updated flight information.

Keep the gates for each airline close. They tend to spread out based on size of plane.

Large, understandable signs in many spots around the airport.

Making it more welcoming and open space.

Maybe more family areas separate from others especially business travelers or seniors.

More areas along waiting lines where one can set down their luggage. More comfortable seating areas.

Fewer neutral color palettes and sterile material choices.

More cozy nooks with comfortable furniture and easy access to display screens to show when your flight is boarding. I might even suggest each gate having its own closed lounge, make it feel like a series of living rooms. Better use of message boards and announcements. Quiet zones.

More outlets near seating around gate.

More places to relax.

No ideas.

Outlet seating as standard. Ability to transfer between terminals once through security. Plenty of restrooms (I tend to fly during off-hours and encountering closed restrooms near my gate is too common). Clear signage coupled with open spaces so the signage can be seen from a distance. Clearly identifiable symbols on signage are paramount because they help inform travelers without being inhibited by language barriers and do not rely on color, which not everyone can distinguish.

Outlets

The massiveness of airports sometimes feels like a mall. I’d rather spend long layovers in a small, quiet space.

To improve airport design, I would suggest requiring a universal signage system used by airports, finding a way to color code different terminals inside airports because they all look the same, and requiring all air ports to have a silent place to get work done incorporating in its lay out.

Where possible, lower counters.

- wide common areas to accommodate high volume of travelers - proper signage - good selection of restaurants - charging stations - artwork

A bit more separated seating. Also, a locker system for cabin luggage near the gate. It will help a lot if traveling alone.

A variety of seating options. Whenever you can score the rare club chair or rocker, you feel like you've won the lottery. How cool would it be to have a gate with some booths of 4 chairs sharing a table like on a train? And those standup work counters would be so much better with charging stations and stools. Separate in and out circulation flows as much as possible. Reduce need to crisscross (bathrooms on both sides of a concourse, food options and stores on right side).

Again, my best advice would be to look at San Francisco terminal 2, Or Sydney international Airport is quite nice as well with large open food hall areas, quick transit on trains to get to where you need to go, and a very welcoming and streamlined approach.

Better seating with the opportunity to pit your feet up and recline !!
Better utilize the window space at gates, like a coffee house, with a long countertop running along the windows and comfortable seating and charging stations. Add small swing tables on the arms of the gate seating like you have in Delta Sky Club or Admiral's Club. Widen the moving sidewalks or add additional sidewalks in lanes.

Colors that hide wear and tear. Clean lines, calming colors, comfortable seating.

Comfortable seating different than straight chairs Add couches, rockers, yoga location with music playing,

Counter height workspaces, electronic food ordering. Canine units at security lines make it move really fast

I like when an airport reflects the area where it is located. Lighting that is neither too bright or too dark.

I would love a system to get from one far gate to the next efficiently and effectively without worrying about waiting for busses or trains. A trolley car system like they have at Disney’s haunted mansion would be cool to load into to take you to closer to your next gate.

Increased visibility and signage are extremely important to pleasant travel. In addition, a security screening process without officers and instead civil servants would decrease stress.

Larger monitors displaying connecting flight information. So, you don’t have groups of people crowding around and blocking the path while reading the small TVs trying to find their flight/gate/departure time.

Less crowded security check points, bigger check in areas, more seating at gates, more food options.

Lots of charging points, 24/7 restaurants
Make bathroom stalls longer to accommodate baggage. OUTLETS. Table seating. More space between rows of seating so people aren’t tripping over bags to get to a seat, no tarmac deplaning, no stairs.

Modernize the TSA checkpoint procedure.

More influential either modern or new aged.

More restrooms with room for your luggage in the stall
More security and customs lines for quicker turnover time. I do like the extra artwork and lights like Detroit airport for example
More security lines at peak times to eliminate waiting
More work places and places to charge your electronics. Easier signs to make it less confusing on where you need to go.

Provide outdoor areas with seating within the terminal, really good signage plan and more unisex bathrooms.

Reduce the noise (including eliminating PA announcements), convenient public transit without leaving the airport, reduce the crowding

Seating and smoking sections (a patio to smoke) as well as greenery

Shorter walkways from center point to the end which could mean lesser gates in a terminal. Streamlined and easier security process

Signs, better instructions on gates/terminals/baggage claim.

The follow of the TSA lines

The most walkway as possible
When you travel and get to an airport that you are not familiar with, I want to know the location that I am standing when I get off the plane. If the signage is not clear, I just follow the direction that other passengers are headed without confidence. I just want to know how long I have to travel to get to the baggage area and to get out of the terminal, also have confidence in the direction that I am heading. If I have to transfer, I want to know how easy it is, where I should head to use, for example, air train, or how far is the other terminal so I would not miss the next flight.

You mentioned access to greenery, that would be the best idea to have an open outside area or courtyard to get fresh air. They have cigarette smoking areas for outside but nothing for a healthy habit or relaxing space. Sometimes when you’re delayed going outside is a great way to spend the extra time that’s not surrounded by smokers or cars.

Table 27: Participant Design Recommendations to Improve their Airport Experience
Appendix D

Focus Group Images

Figure 15: Focus Group Image 1: Seating 1

Figure 16: Focus Group Image 2: Seating 2

Seating area at SeaTac International Airport to stimulate discussion on seating design regarding stress.

Figure 17: Focus Group Image 3: Seating 3

The waiting area and Singapore Changi Airport was used to stimulate discussion on seating design regarding stress. Image courtesy of https://airport-world.com/new-poll-reveals-the-worlds-best-airports-for-a-snooze.
Art installation in the Sacramento International Airport was used to stimulate discussion on art regarding stress. Image courtesy of https://www.9wood.com/projects/sacramento-international-airport-landside-terminal/.
Figure 19: Focus Group Image 5: Art 2

Art installation at Chicago O’Hare International Airport used to stimulate discussion on art in airports regarding stress.

*Image courtesy of [https://www.chicagobusiness.com/], [greg-hinz-politics/ohare-passenger-traffic-90].*
Greenery located in Terminal 4 at Singapore Changi Airport was used to stimulate discussion on accessibility to nature regarding stress. 

Figure 21: Focus Group Image 7: Access to Nature 2

The Long Beach Airport terminal was used to stimulate discussion on accessibility to nature regarding stress.

*Image courtesy of [http://relmstudio.com/work](http://relmstudio.com/work).*
Singapore Changi Airport was used to stimulate discussion on accessibility to nature regarding stress.


Figure 22: Focus Group Image 8: Access to Nature 3
Figure 23: Focus Group Image 9: Signage 1

Signage at Charlotte Douglas International Airport used to stimulate discussion on signage information regarding stress.

Image courtesy of https://www.rosendin.com/project/charlotte-douglas-airport/.
Figure 24: Focus Group Image 10: Signage 2

Signage at John F. Kennedy Airport used to stimulate discussion on signage information regarding stress.

*Image courtesy of https://www.photos-videos.net/tag/jfk-airport-history/*.
Security checkpoint at Denver International Airport used to stimulate discussion on security checkpoint design regarding stress.

*Image courtesy of https://www.denverpost.com/2016/07/18/tsa-checkpoint-times-have-dropped-at-dia-across-nation/*.
Security checkpoint at Denver International Airport used to stimulate discussion on security checkpoint design regarding stress. 
Appendix E

Focus Group Transcript: Responses to Images Shown to the Focus Group

Author: So now we are going to move into the fork focus group portion of the presentation. For this focus group, one image will be displayed on the screen referencing a specific design feature in the proposed examples. The goal is to stimulate discussion for the following airport features for each image. I'm asking that you do not compare to the previous image but share your thoughts and feedback about what specific features in the image induces stress or promotes the feeling of calmness for you. With respect to your time, there will be a three-minute time limit per image, and we will be looking at a total of 12 images. With that being said, Is there anyone that objects to participating in this focus group?

Author: OK, so moving on, the question that I would like you to think about when looking at each image is what about these images calms you or invoke stress before we begin, are there any questions.

Author: So, we are first going to talk about seating.

Author: And I will have a timer going.

Seating 1:

Participant 1: I think from a timing perspective, it's just there's nobody there and I can choose my seat. And there's a view out.

Participant 2: I like the side tables. And that there's a mix of armrests and no armrests. I don't really like armrests when I'm sitting at the airport.

Participant 3: Yeah, there's not a variety of different seating types, though. It's really quite constrained so there are ways I can sit in different ways. Plus, I'm always in the prospect that it does fill up there, there it will be quite tight seating.
Participant 1: Following on that. If you were there with a family. I don't travel very much with a family anymore but say I had a whole family with kids and stuff, then you can't really get kind of place to yourself because there'll be people moving around. And that wouldn't be a way to kind of get everybody together and keep them with a little privacy.

Participant 3: Yeah, it's all one open space rather than allowing you to sit within or choose spaces of different sizes. So not only the seating choice but also space choice. I agree with the comment about there's a view out and then as a result daylighting. And it appears to be a relatively evenly lit space, which also tends to be calming rather than high contrast

Participant 1: There are charging points at every seat.

Participant 2: Yeah, that calms me. You know you can charge and the wood floors. I also really like the details, um, which I do not see much in airports. So, I think overall, I would feel pretty good sitting in this area. But yeah, it makes a big difference that no one is there.

Participant 4: I like this space between the seating because one of the points of stress for me is if I've got my wheely at the aisles is the space between the seating is too narrow. I'm always kind of tripping over people so it's nice to have space between so that you have a kind of a free and clear path for your luggage.

Participant 1: And then it's a conflict between what I said before about having clusters places where families can get together and be kind of mark their own territory but the openness of this and in many different ways you can get in and out makes it easier to get in line and to get back and forth, wherever you're going when it's crowded.

Participant 3: This is the last thing related to choice. All of the seating basically is in the same direction or orientation. So, I can face toward the window or face back toward the space and kind of always parallel to both.

Participant 5: Is that stressful or calming?

Participant 3: Stressful. I want more choice.
Participant 1: Yeah, I agree. Because you might want to just not look at everybody after waiting for hours and just look outside and you can't do that. You're always seeing activity and other people

Author: Alright, we are going to move on to the next image.

Seating 2:
Participant 4: Speaking of...

Participant 1: Exactly what we were just talking about. Nice to be able to look out and away from the business now rocking chairs are great because they're calming. You can move them around so you can create a cluster of seats. You can see that over on the left there.

Participant 2: I just feel the opposite about this image because it looks very crowded to me and it kind of stresses me out because like the furniture is movable and it can go anywhere and all of the way that the furniture is designed is just sort of busy.

Participant 3: I feel more stressed. I know we're not supposed to compare. I feel stressed in this image, more than I feel calm in this image and the I agree with the comments about like the furniture organization. It feels rather cluttered to me and then I imagine that with more stuff in the space, it's going to feel even more so. There's an aesthetic piece to this for me, which I hate rocking chairs and airports. I just think it's stupid. It's an aesthetic choice for me. It just doesn't make sense in the context of space like that. But the view is what is particularly stressful for me, you know, watching planes. Come and Go is ok for a little bit of time, but just the endless asphalt world stressful.

Participant 1: I don't know, for we should be interacting with each other. But I think the reason why it looks cluttered is because of the nature of the seatbacks with the bars, and I think that's also it recalls being in a prison. You know, there's an association is a visual Association there. And I also think another thing that adds to the stressful appearances that shiny floor staring into the sun. You know, so it's not going to be very comfortable. It's going to be over overheated and noisy because of the hard surfaces.

Participant 2: I think the flexibility of the seating is for me. It's the worst because especially if you're traveling alone, or I don't. I just don't. I generally like some space around me, and you can't trust that somebody won't pull it chair close to you.
Participant 1: Yeah, I think the issue there is like on a beach. You know, you go in the beaches empty when you get there, and you put down your blanket and then like an hour later. You don't have any landmarks to market territory that

Participant 2: Yeah, exactly.

Participant 1: Was. It's not like a parking lot with lines painted. So, there's no way to organize that would seem to be protective of territory.

Participant 3: Yeah, and building on that, if this spatial organization and system continues for quite some time than I would have concern also about thermal comfort, because I can imagine it's, you know, either highly cooled or based on the system, or it with the sun is very hot and you can't get to a place of do adjust your own thermal comfort.

Author: Okay, we're going to move on to the next image.

Seating 3:

Participant 1: Well, to me this is a lot cheerier. The softer surfaces, lack of reflections and all the different types of furniture to me or more friendly and give you the option of moving around. If you get tired of one type of seat and you can still move these so you can create seating clusters. So, I think this is a friendlier than the last.

Participant 2: And I think this would sound quieter. I think the acoustics would be better. So, it would feel calmer, one thing that really stresses me out is not being able to hear things in the airport that you're supposed to hear because you're paying attention to other things. And even if this isn't right at your gate at least you don't have so much background noise.

Participant 1: And I think I think that spiral kind of seating can't be moved. So that means if you really are worried about people crowding up with you, you can just go there and protect yourself that creates a secure a territory that you know you're not going to have people in the
Participant 3: I'll put the color aside for a minute and say that I appreciate the variety of seating and not because of the color, but the different types of seating. And again, variable degrees to which you could move things, some of them offer a place for a laptop or a phone. Others are just kind of more temporary like seating again a variety of different orientations for view the lighting is relatively even in the space. And again, I think, to an earlier point about being with a family or traveling with kids. I think this again is not a comment about the color, but because of the type and variety of seating and the ability to move some of the things, but not in a significant way I could imagine this space would largely still maintain a certain degree of organization and be calming, you know that the organization would probably be fairly stable, but some things would move around again to be able to accommodate different family structures. Now on the color side the carpet versus the seating choice that stresses me out.

Participant 2: Big time.

Author: Is the wide variety of colors? Is it the contrast?

Participant 3: I can deal with the variety of colors in the seating, but that on that carpet. Oh my god.

Participant 1: it doesn’t bother me that much, but I think it's a personal it's a personal thing. But I do want to point out a couple of things about one thing about the carpet. In a lot of airports, the carpet is one monotonous color and it's often very easy to get stained because of that the carpets like these. The stains might not show up as much. So, the bothers me. When a place looks dirty. Now, it might be clean, but the permanent stains can’t come out of the carpet. So, I think it's really important to have a carpet system that can be replaced. You know, like carpet squares that can be replaced and when they get really soiled and same thing with furniture and that's one of the things that might bother me about this place is the furniture is going to be hard to maintain it's going to get dirty and that bothers me a lot. And one thing I like about the I like the I like the fact you have light from above. I think that that makes you feel like you're outdoors. So, I think that's a calming feature. And I like the fact that you can see into other aspects of the terminal other places. It's permeable. Even though it's in the middle of a terminal. It looks like their views out and there’s natural light.

Author: Okay, okay, we're going to move into art. So, remember, the question is to discuss about your calmness and levels of stress.

Art 1:
Participant 2: Okay, I'm just indifferent to it. I mean, you notice it. And I think it'd be great because you can say, like, meet me at the rabbit or let's meet at the rabbit. Um, but, and I, I like that. There's nothing else. There's, I mean it's the focal point, it's not too busy. It's just the rest of it. So that's so that's nice but I don't I don't love it or hate it as a standalone piece. And I don't think it evokes any sort of stress.

Participant 1: I think large, monumental sculptures like this are good for landmarks. So that helps with way finding because often in a terminal a lot of the places are all the same and having different pieces like this can be helpful for way finding.

Participant 1: It something to talk about too it’s unusual. And it has recalls a, you know, it's dynamic. And it and it makes you, it's going to be a conversation piece. How is it built? Why so big, a rabbit. What's I never saw I never saw a rabbit that's orange. It looks geometric but it's natural. So, it's going to provoke a lot of discussion, which I think is good distraction from the from what's going on around.

Participant 2: Yeah, I agree with that. In that sense, I think it probably does decrease stress, but

Participant 3: I'm with Krista’s first first comment I’m relatively indifferent, stress and calmness don't seem to apply so much here I've got other criticisms that have to do with the relationship of the art to the architecture and the choice between the two. But that, you know, that's a relatively finicky thing that really isn't about stress to me.

Participant 1: That's kind of helpful to for way finding in it. You can see it from two different floors. So, it helps you to understand where you've been and where you're going.

Participant 4: It's a good orientation device I, you know, if I were in the baggage claim and there was this big giant rabbit looking like it was coming down on me. Then I might get worried that it would fall. I know it won't. But, you know, the, the, the implication is that this thing is moving. And if I were underneath that it would make me feel uncomfortable. So, my comment towards the question is whether or not I feel stress or calmness about art depends upon what the art is and how it is, where it is located.
Author: Thank you, we're going to move on.

**Art 2:**

Participant 2: Yeah, I love this. When I've been when I've been there. I really enjoy this part.

Participant 1: I've been there many times and it really makes the journey from one place along in this area. It's very long stretch and it makes it a little faster. It's fun.

Participant 2: So, I would say decrease it decreases, my stress.

Participant 1: And this is interactive too because it changes color and light changes as you move forward.

Participant 4: And there's a lot of SAT, you know, there's that kind of wavy sound that's kind of New Age way the sound. I like I've been here many times too and I basically look forward to going through this transition space. So, I would say that it's relaxing because of the way that it sets up both visual and auditory wave that seemed to kind of rush back and forth.

Participant 3: The frequent traveler. And so, I think that the first time you know it was entertaining and it was something new. And it wasn't the usual I'm totally underground and have no access to anything. And I'm totally and you know some solid cave. And so, it offers an alternative to that world. I think but the novelty seems to have worn off and it has a bit of a cheese factor to it that I think it's slightly tilt stressful to me rather than calming and I would say even the first time I experienced it. It was more novelty. Didn't necessarily invoke stress as much as maybe wonderment doors or something else. I think the sound does have a little bit of a calming effect. But it also furthers the cheese factor.

Participant 1: I agree with what Kory said, and I also think, I think this goes on too long. I mean you you're immersed in it. And then it just keeps going and going in I think that, and it doesn't really change that's not enough change in it. I mean, the colors change, but it's not as it's not like
having different images. You know, like recognizable images in my flash on the screens or stuff like that. And so, it's in like Kory said it's the same thing every time you go. So, after a while. It's just, sort of, oh, when is this over. And the other thing is, then it actually is quite loud and it's hard to talk to somebody when you're in there.

Participant 3: It also feels stuck in a point of time it feels unsettling to me that. It conveys a certain image that this is an old, dated airport.

Participant 1: Yeah, it's not it's not like Michelangelo's David either that has the last thing.

Participant 3: Increases the stress, a little

Author: Okay. So, going back to your comment about how it keeps going on and on. And there's not much change. Would you say that that was stressful?

Participant 1: I don't know if it's stressful. It's maybe more, a little annoying you know it's like, Oh, we got to go through this again. I'd rather talk about business or what we have for supper, you know,

Participant 4: I disagree. I think I usually am traveling alone. And I like the repetition, because it's kind of meditative. I understand what you're saying about it being David and, you know, little cheesy, but I still love that kind of going through this minute I think I think of it as meditative space.

Participant 1: Yeah, I guess. Because of the repetition. I’m speaking to it as someone who’s married to an artist and gets criticism in my ear about it when we go through. But also, you know, I've seen a lot of installation art and this is not the greatest right it's not, it's not like it's profound. It's not really. And that's one of the problems with airport art in general, it tends to be like kind of surface kind of stuff. It's not like really meaningful deep-thinking art and I think that's because the airport. People don't want to offend anybody so they don't want to have something that might actually be more meaningful. They just want to distract people.

Author: Okay, we're going to move on to access to nature and just keep in mind that we are still just talking about stress and what makes you calm
Participant 2: I love the trees. I love any kind of greenery indoors and that that relaxes me for sure.

Participant 1: I think these trees look sad. You know, it's dark the dark ceiling. The you know they're stuck in the middle of the seating area seating areas, not the seating is not arranged in relationship to the to the interior landscape and the just sort of there alone right they're not, it's not like a natural landscape to just sort of like put their like potted plants. Big potted plants.

Author: And how does that make you feel in relation to stress and being calm.

Participant 1: I think it's sort of halfway there. It's sort of like they try they tried, but they were, they didn't really put the effort in to make a really nice natural landscape so that I don't know. It's okay, it's better than nothing right? Take the trees away and even worse.

Participant 5: I like the Zen. Meditative repeated all in one line that appeals to me.

Participant 2: Yeah, and I think having things with heights. It just even though you're not really separated. It gives you a little bit of a sense that you have your own space. And it breaks. I mean, airports have such a high ceiling, it breaks that up a little bit.

Participant 1: That definitely improves if you know if you just imagine these not there. There's a reason why they put them there.

Participant 3: Yeah, I'm trying to. Puzzle through and get to where you know I'm imagining myself here and where I am on the continuum of stress and calmness. I'm probably somewhere in the middle. There are attributes that are, you know, fine that that I agree with that have been mentioned, but you know I may be nudge, a little bit closer to the stress side of things, because I feel, I feel sad for the trees. And, you know, they just don't belong here and again. In the context of the carpet. But they belong outside and they're going to drop leaves and there you know
there's just a number of things where it doesn't make sense for a plant or potted tree of this kind to be inside. And so, my stress has to do with the ill logic of the situation.

Participant 1: Yeah, that's because they're like there's a solid ceiling. There's no natural light coming from above, which you would find out in nature. So, it's a cognitive dissonance.

Author: Okay, we're going to move on to the next nature image.

**Access to Nature 2:**

Participant 1: Oh, this is outdoors. Right. To me this, this has more. This is more appropriate and more what you would expect. It doesn't have that dissonance. But it's also kind of gratuitous, you know, like it's almost like somebody planned this only in plan where they say put a little spot here and put another spot there and I'll put another spot there. It's like to rationally planned. It's like a Cartesian landscape with plants. Which is better than no plans, but still doesn't really convey a really nice natural landscape over an end there on the side along the edge, it looks better than right here where the picture was taken.

Participant 2: Yeah, it's a little more organic looking towards the left but overall, I just think in general, adding any kind of greenery is helpful. This is nice because it is outside, but I agree with that that it could be a little bit more organic looking at looks a little bit choppy, the way that it is, and obviously there are issues, maybe from cooking hazards and not paying attention, those plants are a little low, but I think that it's nice seeing the trunks of the trees as you're walking through even if you can see the tops of them.

Participant 3: I think I'm, again, you know, in the middle but slightly towards stressed then then toward calm. One thing that would change that for me is if the seating was again, we're if we're talking about the landscape. If the seating was closer to the trees or integrated in a way with the landscape, rather than as objects that are placed really where people are walking that would bring me toward call. So, I would actually prefer to sit over on that left hand side, where the trees are and if seating was there, then I get this shade the tree has some meaning of that some kinship with it and then that would feel calming to me.
Participant 1: I agree with that.

Participant 2: And I also think it would be nice. I mean, you probably can. It's hard to tell. But if there are large stones to sit on, especially if you are traveling with kids. But even if I was by myself. I think it would be nice to just sit on the ground, but even now in airports, it's kind of nice to be away from people. And so, I think that would also be nice just incorporating some landscape. But you can also sit on.

Author: OK, moving onto the next access to nature image.

Access to Nature 3:

Participant 1: Yeah. Well, I've seen it. I read a lot about this airport and it; it just looks fantastic. It's like, it's like a you know, it's like a huge botanical garden. So it's in the water. Obviously, a waterfall is very I think calming and a very important central feature. And you can see how people are drawn to it to just lots of people just watching

Participant 2: Yeah, I would say initially. That looks beautiful. And I would love it, but I wonder how loud that waterfall is that would be my only like a concern. Yeah, just in general way finding around it looks, but you can't see the whole airport. So, it could be very I'm sure it's very well done. But the waterfall. And yet, the first thing I think of is that probably very loud.

Participant 1: Yeah, that could drown out all kinds of conversation. Maybe that's okay. If the rest of the airport has quiet spaces in it. One thing that Nick rack. of it. She always points out when you have indoor gardens is the fat fact that they have to be really maintained. Well, are you going to get mold into get mold and other things like there'll be birds in here and insects and I remember the conservatory at Niagara Falls and it close it down because he was infested with rats and cockroaches? You know, so, these companies, if they don't have the money to maintain this, it could be a real disaster. But I think Singapore has that and they have the ethic to do it.
Participant 3: I was going to say I lean calm on this one. Because I imagine a variety of different places. I could go to attenuate what the sound is and sound level, you know, if I can. Talk back into some spaces where there's maybe greenery overhead, it would diminish the sound that's coming. And I also the expansive view, to be able to see different things that are going on, and I would be able to position so that you know I could imagine if I was spending. If this, you know as an international terminal and I'm spending hours there waiting for something I could move to different locations. Whether I wanted distant view or more intimate view depending upon if I was waiting for the next train or waiting for you know something else and to be able to see both people as well as this element, plus the landscape plus than the drain. You know, I can, I can move to a place where the view and the sound would be to whatever I'm trying to achieve.

Participant 1: And I think that the dominance of green and water in this scene is on the side of the world is its dominant than the natural environment is dominant air, including the flooring, which is kind of like a, like what it looks like stone and I think that makes this work if there were less plants, it, it might be a very over scaled environment. But when and that's another interesting thing about if you look off into the distance. You can see these this is a really huge space. And so you really would feel like you're outdoors here because it's so vast and you could see it'd be like in a jungle and, you know, feel like Tarzan there, you know, Tarzan and Jane swinging on the vines because you have these vistas, and you'd be able to see this waterfall from pretty far away you can see people up on the bridge. Looking at it from fired from a distance.

Participant 1: So, it's pretty kind of neat. You can see that you have this this stuff, which I nice natural environment would have, you know, that had some typography to it, some significant changes in typography. So, it really does get across what it's like to be in a in a wonderful kind of natural environment.

Author: So, going off that really quickly before we move on and what Participant 3 said about not having views and having the choice of views. In regard to stress is there too many trees here that obstructed views that would stress you or as Participant 3 said and having the choice of views or privacy and would make you feel calm. Do you do you lean towards either of those or do you agree with the both of them?

Participant 1: I think it has both it has places where you can hide and I'm not really sure about that, because security is a big issue in an airport and it may not have places where you can hide out and get away from everything, but the natural environment certainly reduces the scale. The scale would be overwhelming without all these natural features, it would be like being in a sci-fi movie, you know, the dystopian future.

Participant 2: I also think, depending where it is in the airport makes a big difference. So, this is someplace that's beyond security or and there are different offshoots to the different gates and different terminals, then this might be not overwhelming, in the sense that it's okay that it's a little bit that you don't see, they don't have sight lines to where you're going, because maybe there's signage before this entire section. So, you kind of have an overall idea of where you need to go before you even reached this point. I think it could be done so that it's not overwhelming, but it would. I think the sightlines their most important, you know, insecurity, so that you know
when you have to start taking your shoes off or whatever. And when you're approaching a specific gate. So, I think it's more about placement than one answer the other right

Author: Okay, thank you. We're going to move into signage now. So please, just keep in mind we're talking about calmness and stress.

**Signage 1:**

Participant 1: Too much

Author: Too much graphic images?

Participant 1: Too much all in the same in one view, it's just it just so you can't take it all in and you're going to you might easily miss important information because can't

Author: So just to clarify, there's, it's not that there's too much on the signage. There's too much in the whole your periphery. OK.

Participant 1: Yeah, okay too many signs.

Participant 3: Yeah, I feel, I feel stress for the same reasons. Plus, the way this is organized on the sides. You're like always in the path of travel so that if you do need to take in key information. There's no way to pause to take in that information without being run over by everyone.

Participant 1: Just from a design perspective, it also is kind of a useless kind of set aside because everything is in

Participant 2: Everything.
Participant 1: All they needed was a big arrow.

Participant 2: I was thinking the same thing. And even the signs beyond that arrow pointing straight ahead to

Participant 1: It's very curious that they have those yellow signs for the restrooms. And yeah, you know it's interesting because they don't have restrooms up on the blue side. It's interesting. They only have the yellow ones that say must have been added on because I forgot to put them up in the blue ones.

Author: Can we talk about the content that's on the signs?

Participant 1: It looks like they had trouble with the commercial interests wanted to have more visibility.

Participant 2: Yeah, I don't think that like while it's all important information. I don't think it all needs to be in the same plane.

Participant 1: It's repeated. Why is it repeated. I mean, it's the same stuff repeated.

Participant 2: I think that some of the icons are very clear. I don't think the, I mean, the airline asst one is clear, but it's kind of busy. I think that sign for this to the right is a lot to take in, with the icons and the text.

Participant 3: So, if this if this is a hub where you're meant to go gate to gate, and it's a very few numbers of people who are exiting or doing other things, then there's a certain rational and calming nature that the Gates is the centered information. And that's the most important information. If, however, this is an end destination Regional Airport, you know, then things are I would want the exit to be that most important information center. So, my answer calming or stressful depends on the nature of exactly what this airport is

Participant 1: I think it would be stressful no matter what because if you are looking because everything is competing with each other. So, you'd have to sort it all out.

Participant 2: Exactly. Nothing is dominance

Participant 1: Yeah, there's no hierarchy of information based on what's important and what isn't.

Author: So just to point out a few things. One, you don't need to decide whether or not this image is stressful or calming you can find aspects within the image that calm you or aspects of the image that invoke stress. It doesn't have to be one decision. And the other thing I wanted to point out was the if we can just talk about the center sign if there's anything specific on the center sign that speaks out to you that you notice?
Participant 2: Oh, walk time. Sorry, I didn't see that. I think that helpful to have that information, but I also wouldn't even if I were walking through the airport. I don't even think I would read that or look at it. I would just look at the gates.

Participant 1: Yeah, it's really hard to see that.

Participant 2: And I think that sort of just adds to why, it's a little bit stressful.

Participant 1: I think that kind of information might be better on you. Are there map, you know, out in front of this that sort of where you use to orient yourself from one point to another. And so, I again the debt, providing too much information at once here like seems like it could do it with different kinds of signs provide different kinds of information.

Participant 2: And yeah. And to that point. I think it's also the Starbucks and the other vendors signs and then the signs. Beyond that, you see, because when you're walking. You're always sort of looking at what's furthest ahead, not necessarily what's right over your head. Because you want to know if that's where you're heading in the right direction, but I yeah so overall, in general, I think kind of all of it stresses me out. Because it's just all there to see and it's too much and like Participant 2 said you can't you're right in the middle of the walkway, so you can't really slow down or stop.

Author: All right, we're going to move on to the next image.

**Signage 2:**

Participant 2: I feel the same about this. Overwhelming and stressful.

Participant 1: There's also this repeated information. So, you like you see the same information, but from a different vantage point, and I think this could have been done better without repeating it. For example, you could have a pylon you could have a pylon where you could see the sides so when you were coming at it from two different directions, you'd see only one sign, but you could see it from different angles.
Participant 2: And the yellow color. Well, it's noticeable. It is also sort of harsh because it's almost like caution. Sort of spikes here like stress levels immediately.

Participant 3: Yeah, and the lighting is not handled well on the signage because of the glare.

Author: Participant 2, I met your first comment you said it's the same. It's too much. Is it too much text too much information at one time?

Participant 2: I think it's too much text and too much information. And I think that the arrows with it. It's all too crowded like the arrows, the icons in the text are also close to each other.

Participant 1: Yeah, it is very space very crowded and part of that has to do with the Spanish, the two language. So, having two languages is good, but maybe it could have been done in two different signs or something.

Participant 2: Or spaced out more.

Participant 1: Definitely, yeah.

Author: Now looking at signs would you prefer to look at graphic images or text image.

Participant 1: Depends on whether I understand the language. Though I mean if I were in a foreign country in and the language obviously would want to see the symbols. You know, where if I didn't speak the language. And if they didn't have English, but where they have English. I don't think I need the symbols.

Participant 3: I think it also for me it's contextual on a couple of ways. It depends on what the information is so like gates see 62 to 64 I need the 62 to 64 a plane taking off doesn't do me any good. Some of the information I don't need whereas baggage. Okay, I would be able to decipher that relatively quickly. You know that baggage claim. I don't need. I don't need the words the icon is sufficient. So, it depends on the information, the other contextual piece again matters to me whether this is designed is something I've got to take in the information quickly because I'm on the move. Or whether I'm seated and stationary and can take in information slowly. If it's information slowly than I would prefer the big picture kind of map plus them to be able to read the information and decipher it whereas icons are more helpful if I'm moving quickly.

Participant 1: I think the really big problem with this sign here is that there's a lot of extra words. So, like gates. Why do you need gates? All they need is a sign that says gates and then put the number with the direction, and you don't need to repeat gates. But there's also other stuff mixed in with it. So, I think actually that the design is kind of mixed up because it's very important information on it is, it's hard to find, for example, shuttle to A & B gates. And then it says shuttle departs at gates C 60. So, then you have to go and find out. So, then you have to look up at the top and see where’s gate C60? There's really important information in here that is hidden because they've mixed up a number of different types of information. They could have had just a sign, with just the gates, and then they could have had shuttle sign you know transportation sign
with ground transportation and shuttle transportation and then they could have had just a baggage claim, you know, like, three different type signs mounted all together maybe might work better and this business of shuttle to A and B gauge shuttle departs against C 60 that's a very complicated decision making. What does that mean, I mean, I got to go to a and b.? But then I have to go to see in order to get a and b. So that's a very confusing information, maybe that maybe that belongs on a very special sign to explain

Participant 3: And I think in an airport. You need little bits of information as you make the journey, rather than trying to keep in your mind, everything that you're supposed to do in a place, especially if it's unfamiliar. So actually, you don't need the word just to build on whatever was saying you don't need shuttle to you just need a A and B gates right now. And once you get close to wherever the next places where the shuttle is then you give the information shuttle here. Rather than all of the other information. So, I agree that editing would be helpful and thinking more carefully about when you need the information

Participant 1: Yeah, this I mean this sign really basically just says go to gates. The see gates right C 60 through C70 that's basically all the sign says.

Participant 2: To answer your question about icons and I think Korea's right. I think it depends on one how the icons are drawn because sometimes it is much easier to quickly understand that and restrooms are always. An easy one to pick out. But I do think sometimes for gates and things. It's not helpful to have the icon. It's just busier.

Author: OK-now moving onto security. Just a reminder, we are focusing on calmness and stress.

Security 1:

Participant 2: Very stressful. Don't like that kid on the ground. In general, this is so stressful. Yeah, I don't like this at all. But I think the grid on the floor is making it more stressful. I think, obviously, there's no clear lines, really. I mean, you can kind of tell that people are in line, but sometimes too much vision. Sometimes being able to sleep too much is also stressful, even though it's helpful to look ahead and see where you're going, I think, in a way, if there is some
amount of distraction or something blocking you from seeing every single line. Um, I think that would make this a little bit easier to take in.

Participant 3: Yeah, I project myself to ground level. And I think it's even more stressful.

Participant 2: But like if at the, at the start of any of those security lines there was like a taller sign or some sort of taller object to identify and break it up a little bit more so that you could easily sort of understand where every how everything is laid out.

Participant 1: That was held at the ground level. You could have there could be there just to is to like everybody saying you can see just too many people too much crowding, but it doesn't have to be that way because they could be walls that define slots for each of the security thing. So, you once you get out of the main line, then you know where you are and you just stay in that in that zone and you don't see anything else. And a lot of security areas like this would have to wear the line ends with a security line ends it be a door and you go through that door and then you would only see the area that you're going through the immediate area going through that would reduce the reduce the visual noise and the also the sound does it, it's going to be very noisy.

Participant 3: Know there's, there's the visual stress of this and the kind of way finding peace of this. And again, imagining myself in this system and it wouldn't be definitely stressful but then also looking at this from. Basically, the activities that occur from a security standpoint, I think that adds to the stress more the, the amount of counter space in the queue ahead of time to, you know, be able to put your belongings in, you know, that's very rushed we've been in those situations where you know there's a whole bunch of, you know, there are all kinds of people waiting behind you. You're trying to push the person ahead of you to get, you know, and because of the minimal space and I look at the, the, you know, with kids and so forth becomes even all the more challenging and stressful.

Participant 1: And then the other thing is they got all these cards with the buckets that are there right in where people are and those are being moved around and brought back replenish so this is dissolve this maintenance stuff going on in the same space where people are trying to interact, rather than putting that in in a in an in a in a staff area, you know, a staff. So, you're bringing you're bringing the buckets to the end of the line. But those people who are doing that don't have to interact and rub shoulders with the people that are getting ready to go through.

Author: We're going to move on to the last image. This is our last security image and the last image of the focus group.
Participant 2: Again, overwhelming similar to this is always the worst part two is like getting everything on quickly and not having any space to do it, and sometimes other people's bags come out before years or whatever. So I think adding more space at the end would be helpful. I also think adding feeding is helpful closer to the end of this security. I think often the benches are too far. So, if people need to bend down to put their shoes on, they have to walk sort of far. But also, the floor is a little bit distracting. Similar to the start of security. It was distracting. So, I think this is stresses me out gives me a feeling of stress.

Participant 3: I agree. There is, you know, one little spot of seating here and that would be helpful. I would feel better going through that line, then I would be others that you know I'm hopping on one leg, trying to put shoes on and whatever to get to seating somewhere, which I don't know where it is outside the image. But I agree. There's just, there's just, it's so hurried and there's just not enough landing strip at the end here.

Participant 1: Yeah, these benches are in in the wrong spot to they should be out a way. So, people take their stuff and bring get it out of the congested area, they just creating the bottom

Participant 3: I don't necessarily mind that I prefer the proximity, but I take the point if their space enough in between each of the each of the lines to allow the seating to be more integrated within the system because then all I have to do is turn around and set things now.

Author: How would your stress level or your opinions change if you are traveling with someone vs. by yourself?

Participant 2: I almost always had traveled by myself this past winter I traveled with my daughter for the first time and she was only a few months old. And it was very difficult because she like pooped all over right before we went through security. And there is nothing around that like I couldn't do anything. So, I was also by myself like with her. Like just benches, just anything to like to put something down so that you're not putting it on the floor even like setting a child like
It feels a little if it's a baby. It feels weird to put them on the floor. But when you're in that situation, you can't. You know, I didn't have this issue. I was just carrying her in a pack so like I think I can only imagine you have older you have more than one kid you have older kids who are like, you know, running around, it's hard to they're also overwhelmed because there's so many people and so much noise. So, anything to like separate at the end to have a breaking point where you don't have to immediately go towards your gate, and you can collect yourself put everything in your pockets. I think that's lacking and so many airports.

Participant 1: I think the general issue with this these spaces. Is that they’re designed for high productivity of the workers and really not designed for the passengers.

Participant 1: It just gives you the feeling that your product that's being processed dehumanizing

Participant 6: I don't know if it's related to the space, but I get anxious because every airport has different rules and what you need to take out and what you need to do so I always get anxious about my shoes off, she's on plastic bag with my toiletries out or in computer out or in? Like every and so I'm ill prepared, someone who, like me, who wants to be prepared and like get the flow and not cause you know a jam in the line if I do something wrong, and then I get flustered because they're yelling at me and I did. Something wrong. So, it's the rules before that causes my anxiety and what am I supposed to do to be prepared.

Participant 1: Yeah, it is very frustrating that the rules are different from new report there doesn't make any sense.

Author: Alright so that concludes the focus group and the entire presentation. So, thank you for your time. I'm just going to open up to any questions or final comments.
Appendix F

Security Checkpoint Design Boards

Security Design Proposal 1
This proposal includes simple design elements to be added to the existing checkpoint area we know today. Therefore, the screening process will not be addressed until the second design proposal.

Security Checkpoints are equipped with...
…information on the screening process for passengers while waiting in line.
…checkpoint signs to be provided at a height to be seen from all points of the security process.
…a floor marked queuing system to assist the agents in directing passenger movement.
…seating to be provided both pre- and post-security screening.

A preparation area allowing passengers to easily meet security guidelines. Equipped with security instructions, counter space, seating space, and areas for a group to gather.

Security agents are in place to direct the flow of passenger traffic from the waiting line to the security screening area.

Additional counter space is provided post-security screening. Dividers can be used to provide a sense of privacy and personal space for passengers.

Figure 27: Security Checkpoint Design Solution Board 1
Security Design Proposal 2
This proposal is in response to new security technologies on the market that TSA is beginning to currently implement for testing. This design is equipped with a biometric scanner, mass temperature reading, and lastly, an x-ray scanner.

Security Checkpoints are equipped with...
...a concept called Design the Line: art and greenery are integrated into the design to reduce traveler stress.
...intentional lighting design to allow for appropriate viewing of screeners and images.
...acoustically controlled environments.

Security checkpoints are equipped with “hands-free” bio-metric scanners to reduce the handling of personal items by travelers and promote a faster flow.

Passengers are screened in tow on moving walkway to assist in the flow. Floor markings are used to indicate appropriate distancing.

Figure 28: Security Checkpoint Design Solution Board 2