

EMPATHETIC DESIGN:
How Elementary School Environments Designed to Reduce Stress
can Foster Inclusion of High Functioning Autistic Children

Robin Z. Puttock

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

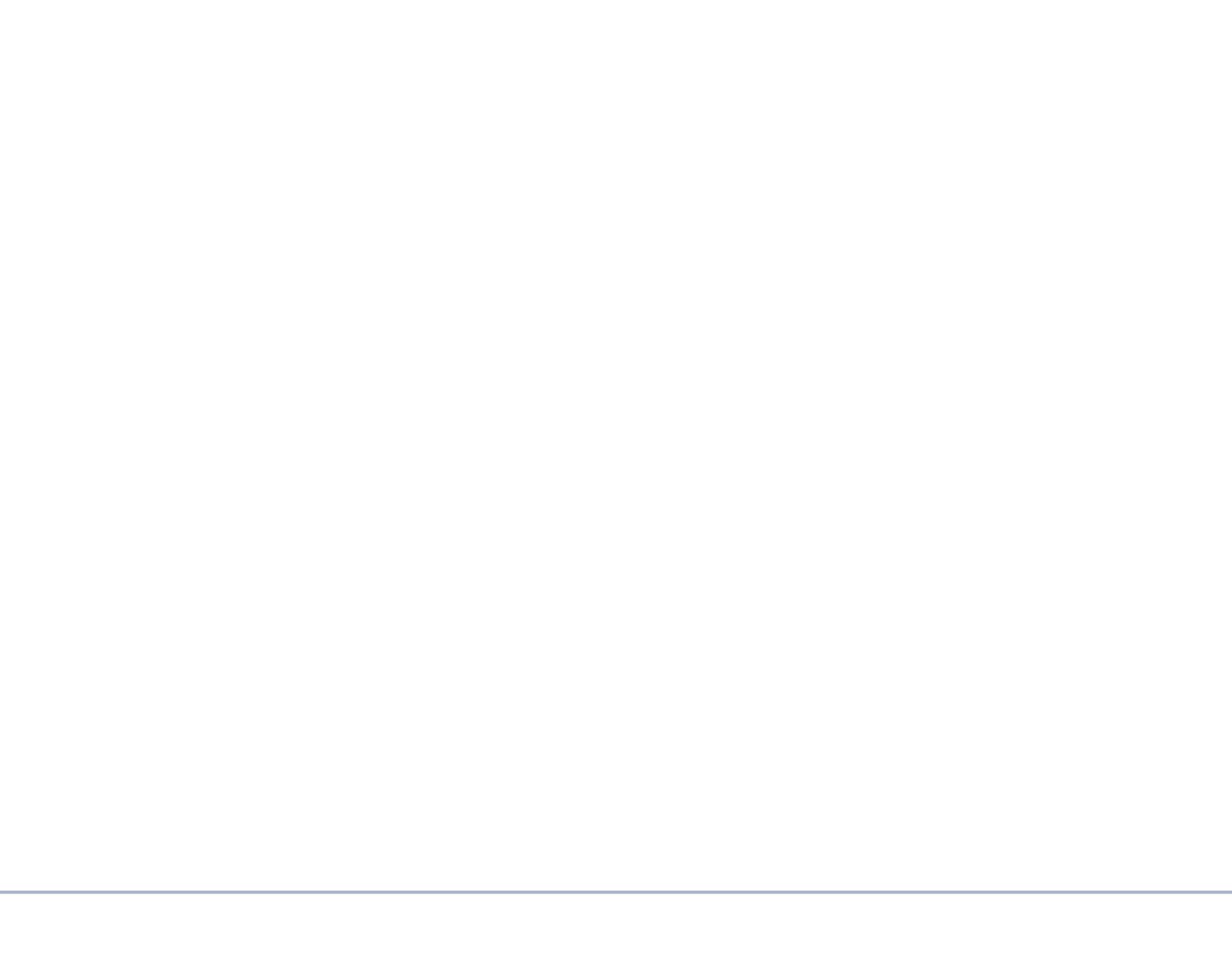
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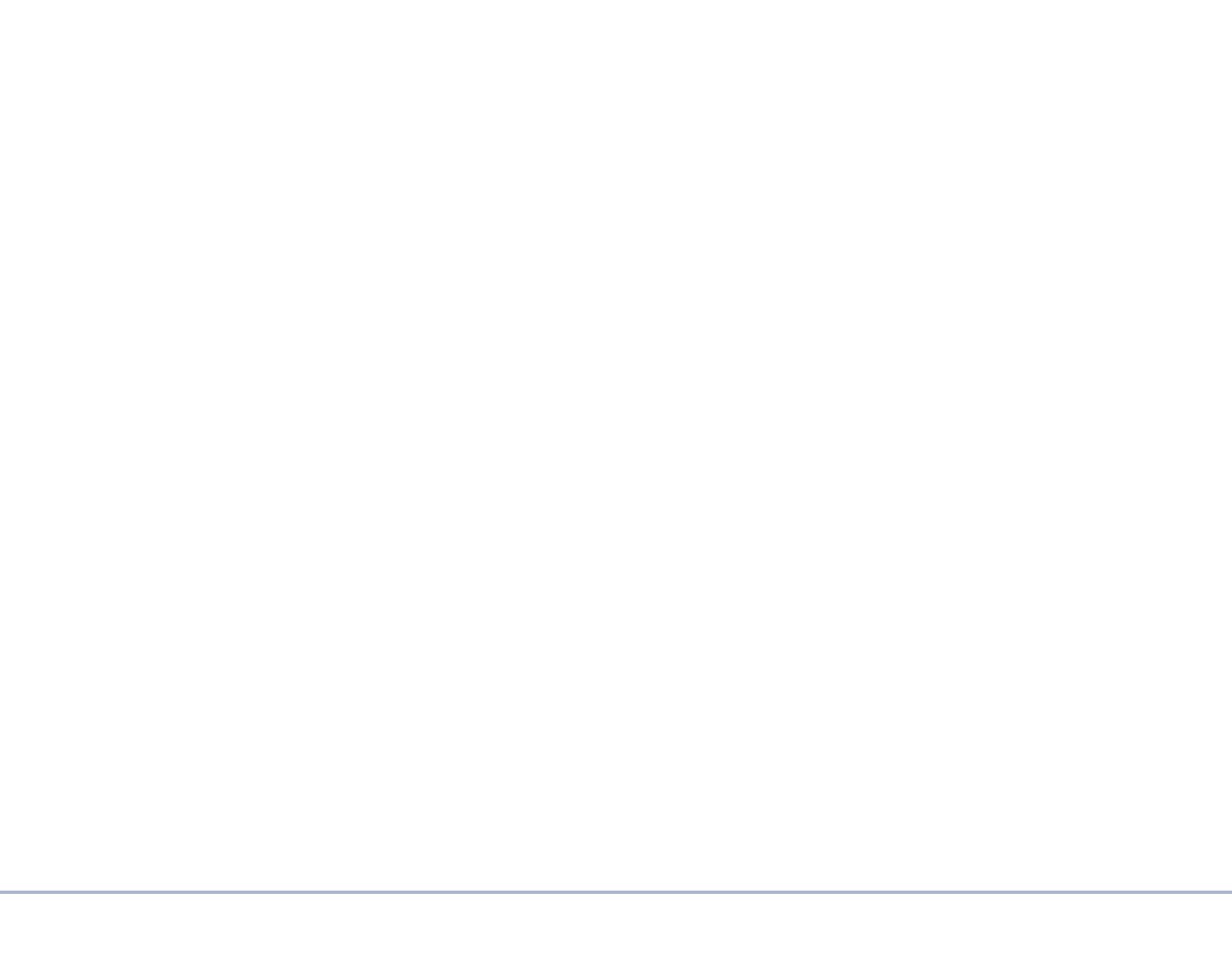


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Abstract

All people experience stress in their environments. The specific causes of stress vary from person to person as does one's ability to cope with each stressor. This thesis introduces the concept of Empathetic Design, a design strategy possible only when empathy for the inhabitant is achieved by the designer. An Empathetic Designer is able to identify environmental stressors and can employ appropriate design strategies that reduce stress. Though this strategy is meant to be applicable for all people in all environments, the scope of this thesis focuses on the design of elementary school environments. Specifically, the scope is limited to how Empathetic Design can reduce stress and foster the inclusion of high functioning autistic children in a mainstream educational environment. This thesis combines current learning theory and autism research with a visual exploration of building types from six periods of American school design. The hope is to create Empathetic Designers who will inform design of future elementary school facilities.

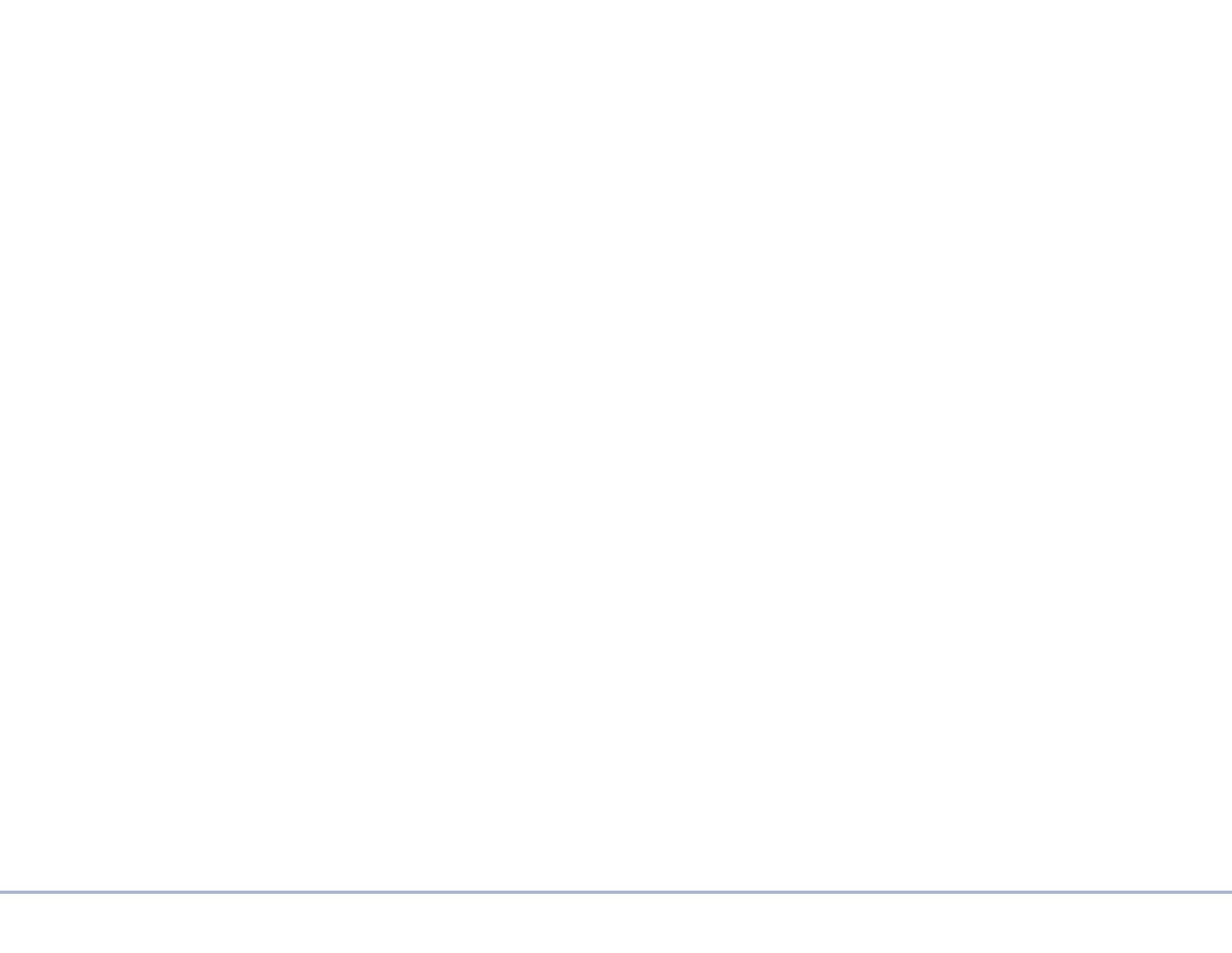


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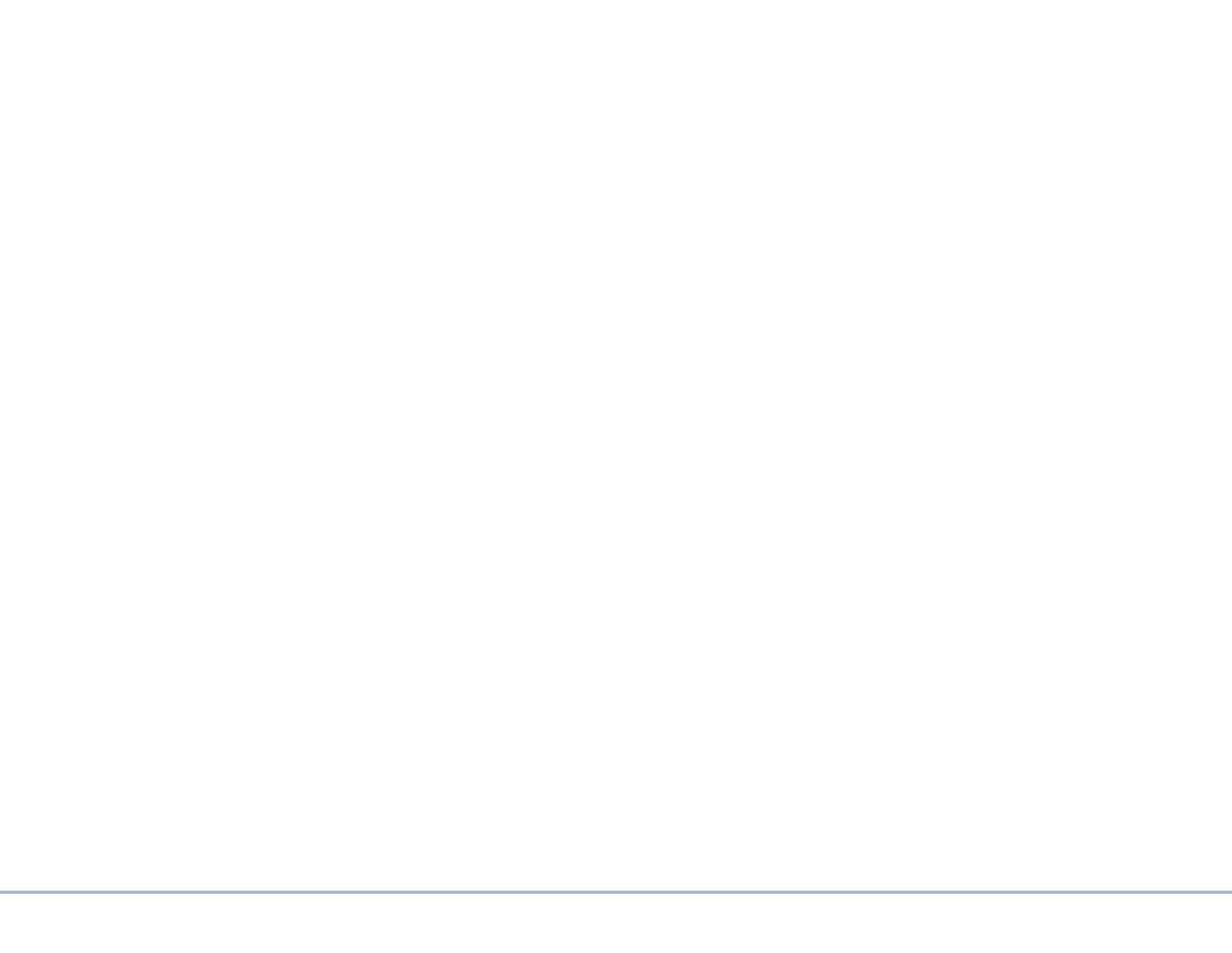
General Audience Abstract

All people experience stress in their environments. The specific causes of stress vary from person to person as does one's ability to cope with each stressor. This thesis introduces the concept of Empathetic Design, a design strategy possible only when empathy for the inhabitant is achieved by the designer. An Empathetic Designer is able to identify environmental stressors and can employ appropriate design strategies that reduce stress. Though this strategy is meant to be applicable for all people in all environments, the scope of this thesis focuses on the design of elementary school environments. Specifically, the scope is limited to how Empathetic Design can reduce stress and foster the inclusion of high functioning autistic children in a mainstream educational environment. This thesis combines current learning theory and autism research with a visual exploration of building types from six periods of American school design. The hope is to create Empathetic Designers who will inform design of future elementary school facilities.



Dedication

This thesis is the result of over twenty years of architectural education and practice, during which time I was fortunate to have learned from dozens of mentors. I would like to dedicate this effort to them. In addition, I would like to dedicate this thesis to my autism support network including God, family, friends, fellow parents, teachers, therapists and doctors from whom I receive daily strength that makes my personal journey possible.

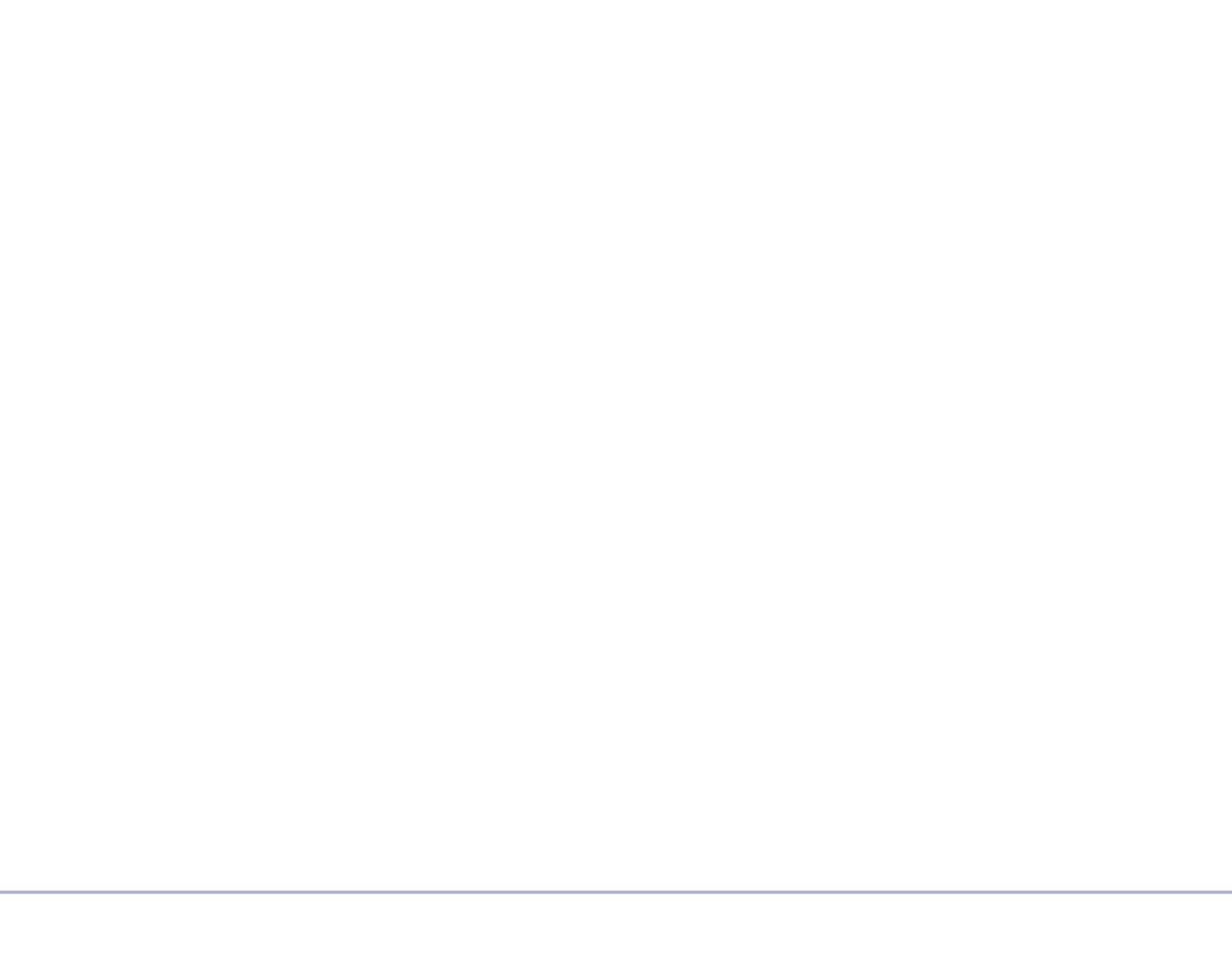


Acknowledgments

I would like to thank the young students identified by first name and last initial throughout this thesis, as well as their encouraging parents, who spent their precious time producing sketches conveying how they see the world around them and how they would like it to be.

I would like to thank my committee. I would like to thank Susan, my chair, for her guidance not only this past year but in the many previous years since my first time at the WAAC. I look forward to continuing this relationship for many years to come. I would like to thank Paul for his always extraordinary feedback. His comments inspired me to reach higher. I would like to thank Marcia for her expertise regarding empathy and for encouraging me to be more confident in my writing.

Finally, I would like to thank my family, for inspiring my dreams and providing the support required to chase them.



Preface

This thesis is the culmination of over twenty years of professional practice, over ten years of parenting a high functioning autistic child, and this past year of research combining the two. From the start of my thesis research, my goal was to produce a product that would have immediate value for a design team member involved in inclusive school design. That person could be a school administrator, a planner or an architect. From my experience as a school architect, I understand that we, as designers, don't always have the time to truly understand the needs of our unique users. In an effort to help designers understand the needs of a mainstreamed high functioning autistic student, my initial goal was to create a concise, yet powerful, document that would forever change the way designers design these inclusive environments.

However, due to the magnitude and complexity of this topic, the journey of the past year has produced not only this concise document, but a three volume thesis. Each volume provides unique insight into the thesis and when considered holistically, presents the Theory of Empathetic Design. Volume One is entitled "Empathetic Design: The Foundations and Fundamentals". As its title suggests, this volume presents foundational research spanning various topics including learning theory, autism diagnostic criteria, current inclusion research and history. Insight gained through this process is summarized in the final chapter of this volume entitled, "Empathetic Design Fundamentals". Volume Two, entitled "Empathetic Design: The Exploration", is a written and visual analysis of the authors' classification of the six main building types in American school design, examined through a present-day lens, to discover the environmental stressors and spatial strategies of school design. Volume Three, entitled "Empathetic Design: The Empathy Sketchbook" is the product that was envisioned at the beginning of this thesis year. It is meant to be a powerful, abridged, stand-alone document that can be perused by a designer over a cup of coffee or by a school administrator before a board meeting. It is a compilation of first hand testimony of high functioning autistic adults and children. The written descriptions are complimented by sketches drawn by high functioning autistic school children specifically to help research this thesis.

The end result of this effort is the Theory of Empathetic Design. Summarized, this theory suggests a strategy to design for the complexity inherent in human beings. By using high functioning autistic children in school environments as an example, this thesis shows the power of empathy that when used to design educational environments, can reduce stress in these children and foster inclusion.

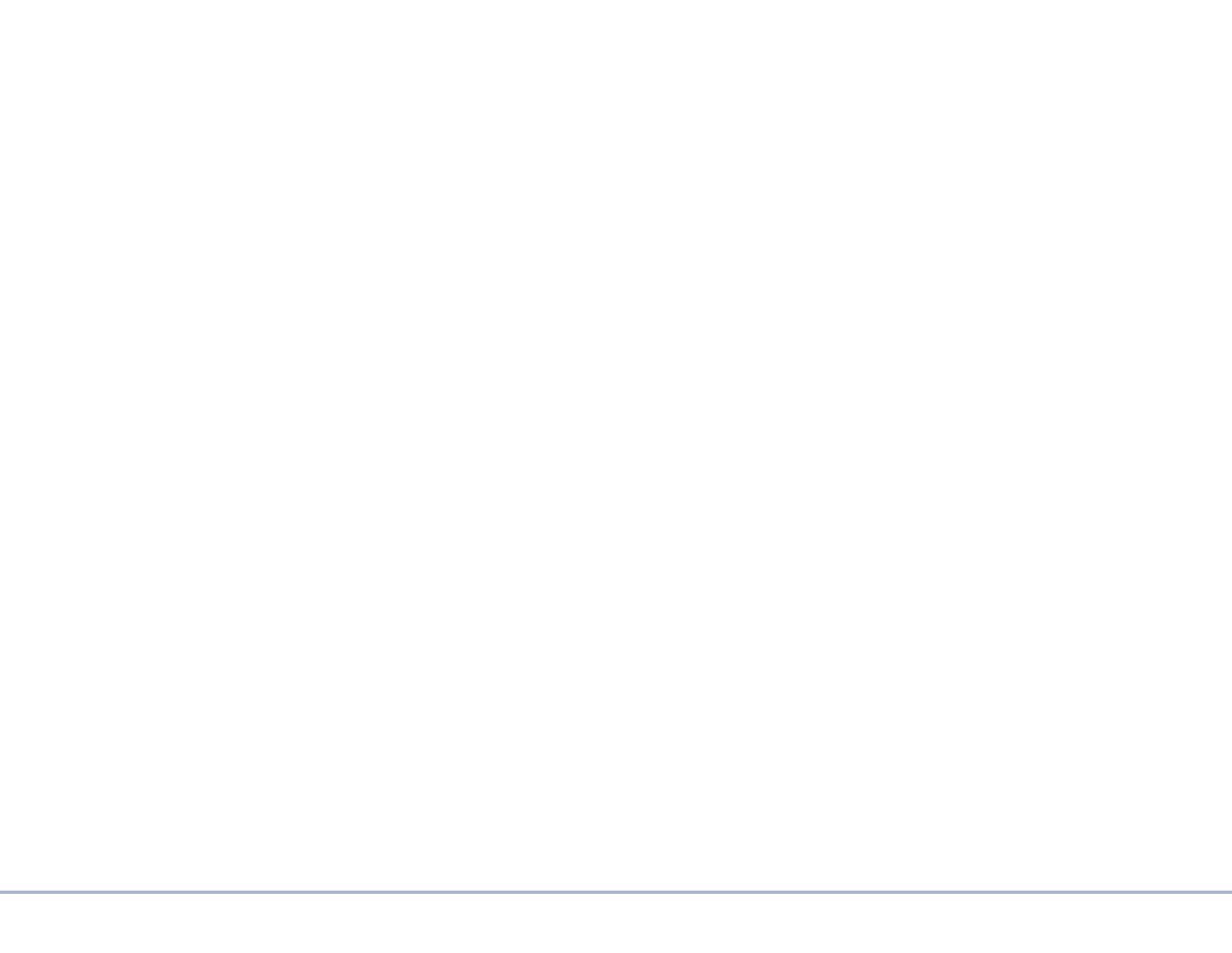


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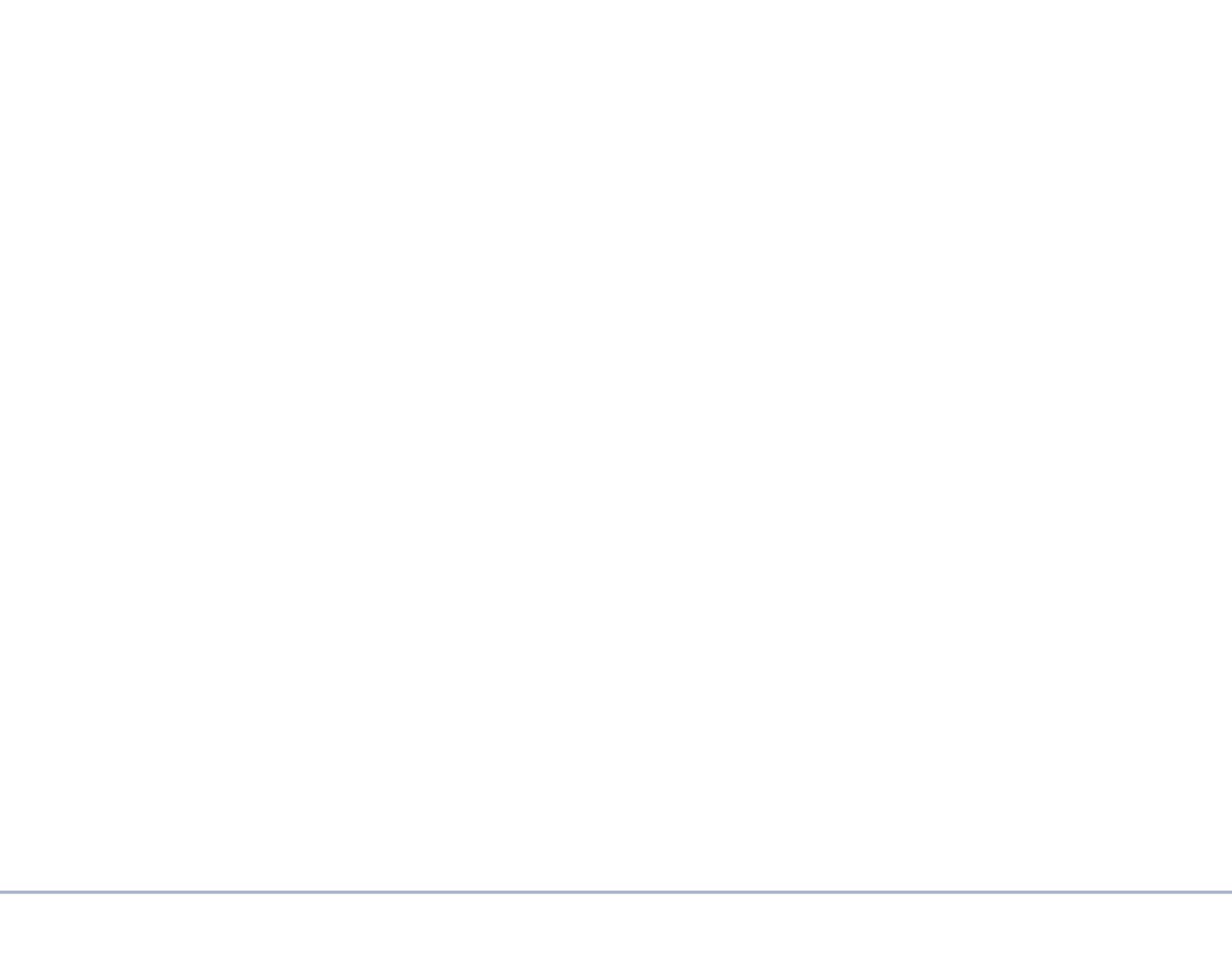
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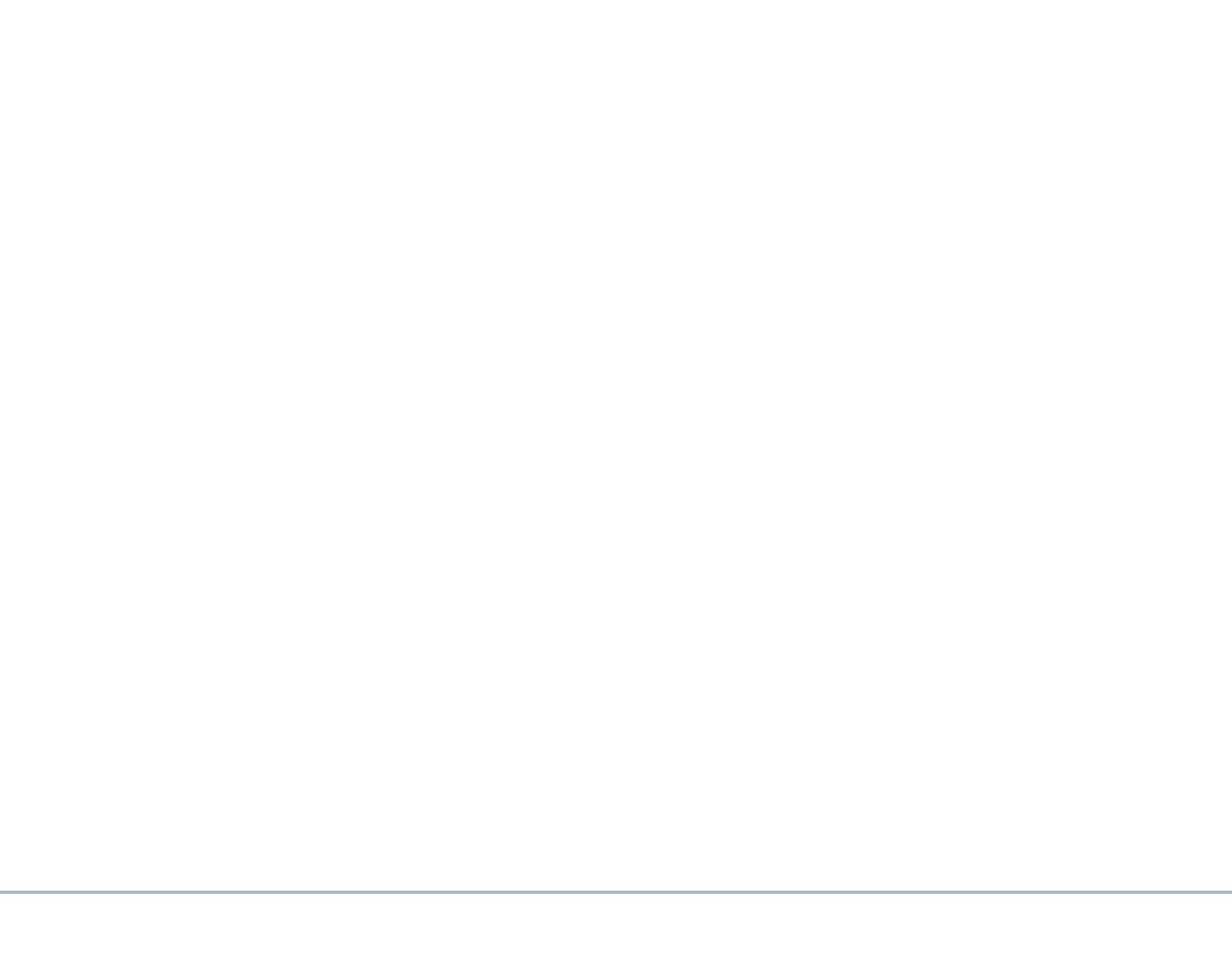
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Empathetic Design: Foundations and Fundamentals





Foreword

American school design has changed a great deal since its origins as a one room school house in the late 18th century. This evolution has been the result of social, political and economic factors as well as various learning theories and educational reform movements. Historically, these reform movements have addressed three interconnected concerns related to school design: first, the quality of the built environment and its relationship to the natural environment, second, the physical, emotional and mental health and well-being of its inhabitants, and third, the role that the school, as an institution, should play in society.

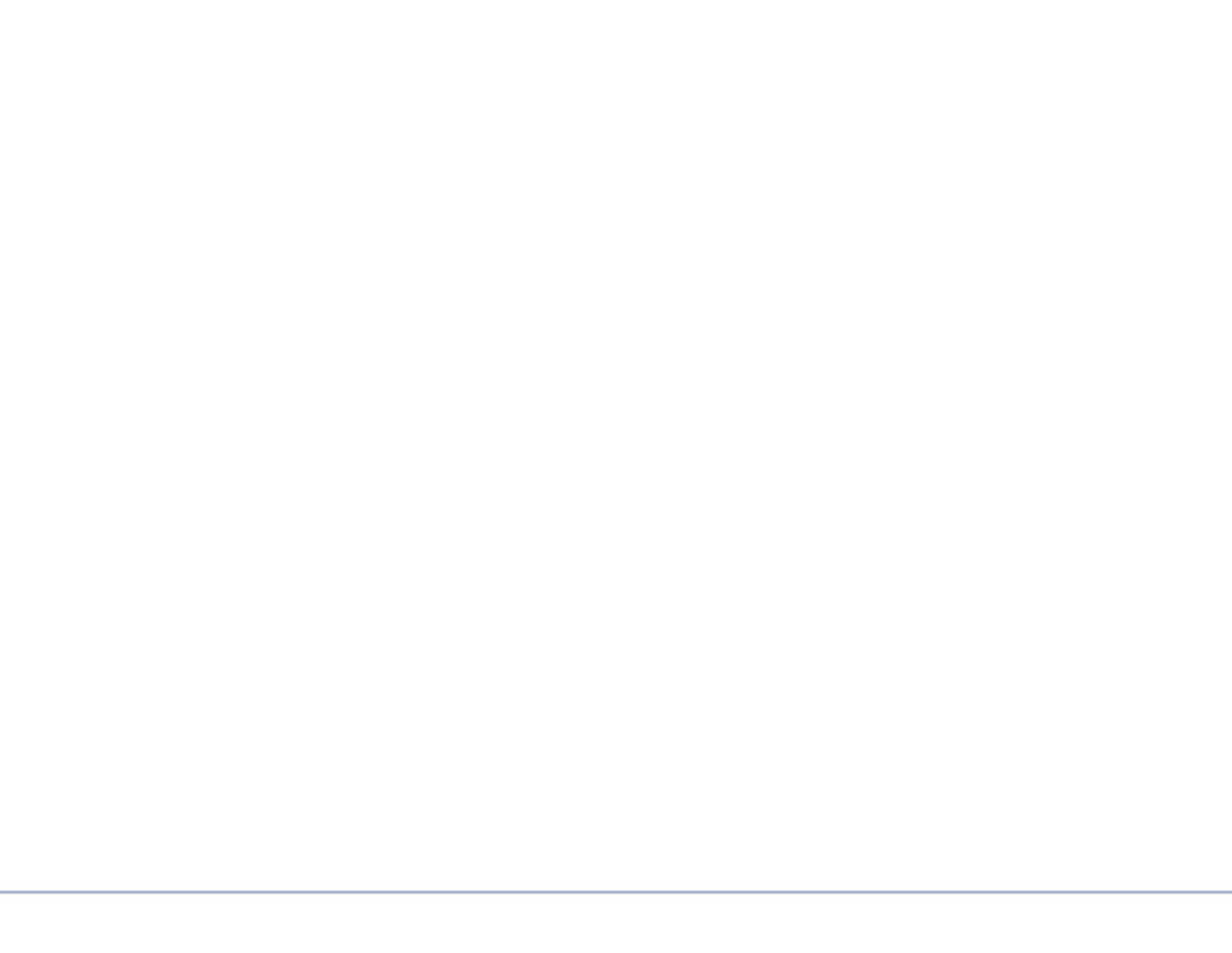
A designer needs to view educational environments holistically. A deep understanding of both building type history and learning theory, including both physical and social environmental theory is essential. These related issues are fundamental to successful design of educational environments, to life in general, and thus, need to be continually examined as society changes.

American schools are now facing an exponentially increasing population of children with a diagnosed Autism Spectrum Disorder (ASD). These children are characterized by deficits in communication skills, social skills and sensory processing capabilities. Although some children with ASD are not able to participate in a mainstream classroom setting due to their deficits, because ASD is a “spectrum”, some children with ASD, specifically those referred to as “high functioning” are included.

Typically, mainstream educational settings have a surprisingly significant amount of environmental stressors. These stressors have been classified by the author into three categories: sensory stressors such as the noise of HVAC equipment or glare from the sun; mental stressors such as changing classrooms; and social stressors such as a cafeteria filled with students and teachers. Children with coping skills can self-regulate and handle most of this stress so that it does not excessively affect their access to the curriculum or their behavior. However, children with High Functioning Autism (HFA) often lack the coping skills to self-regulate in these educational environments and therefore their stress is often manifested in behavioral outbursts which prevent their access to the curriculum.

The focus of this first thesis volume is to provide a foundational understanding of various topics that contribute to successful inclusion of HFA children in mainstream classrooms. These topics include learning theory, autism diagnostic criteria, current inclusion research as well as American school building type history. This volume also explores the role that empathy plays in design as related to each of these topics and how the achievement of empathy allows understanding of the Empathetic Design Fundamentals and provides a bridge between the designer and the needs of the inhabitant.





I. Introduction to Empathy

The title of this thesis is “Empathetic Design: How Elementary School Environments Designed to Reduce Stress Can Foster Inclusion of High Functioning Autistic Children.” Understandably, a large majority of this thesis is devoted to the investigation of the various topics mentioned in the subtitle: education, autism, inclusion, and environments. A foundational knowledge of these topics provides the understanding of the challenges encountered when High Functioning Autistic (HFA) children are included in mainstream educational environments. However, this thesis also proposes that empathy must be understood as it relates to all four of these topics in order to successfully design inclusive environments. This is the Theory of Empathetic Design.

Because empathy is the critical component in the Theory of Empathetic Design, it is vital to first understand what is meant by the term “empathy.” Therefore, this chapter briefly explores the etymology of the term, historical theories and current research regarding empathy, as well as how all of this can be interpreted when considering an autistic population.

The origins of the word “empathy” can be traced to the ancient Greek “empathia”. “Em” meaning “in” and “pathos” meaning “feeling”. In 1858, the term “Einfühlung” was coined by the German philosopher Rudolf Lotze. The term gained popularity in 1873 when Robert Vischer published *On the Optical Sense of Form*. In 1909, American psychologist, Robert Titchener coined the English word, empathy, as a translation of the German word “Einfühlung”. The Oxford English Dictionary (OED) defines empathy as “the ability to understand and share the feelings of another.”

Empathy is often confused with sympathy or compassion. However, the difference is striking as both sympathy and compassion have negative connotations and do not include the critical component of understanding. The OED defines sympathy as “feelings of pity and sorrow for someone else’s misfortune”. The OED defines compassion as “sympathetic pity and concern for the sufferings or misfortunes of others. Empathy’s Greek roots are “in feeling”, while sympathy’s Greek roots are “with feeling” and compassion’s roots are “suffer with”.



Robert Vischer's doctoral dissertation, *On the Optical Sense of Form*, proposed that "artistic appreciation may have its start in sensations, but in its succeeding physiological and psychological responses, it quickly passes through stages of feeling...the consummating stage of this process is Einfühlung (feeling into, empathy)" (Mallgrave 2013). Vischer goes on to describe this concept further in that it is the human ability to "project our own feelings into an object of aesthetic contemplation" (Mallgrave 2013). Vischer stated that the feeling of empathy transcended psychological activity alone. He believed it affected physiological properties as well including equilibrium, respiration and blood circulation (Mallgrave 2013).

Vischer, as well as several other German theorists in the mid to late 19th century, was primarily concerned with empathy as it related to a person's connection to art. However, in the following years, several psychologists began developing theories of empathy that explored a person's connection to another person. In the early 1900s, German psychologist Theodor Lipps studied how "we read the gestures of another person as an expression of their inner thoughts" (Mallgrave 2013) and published his findings as "Einfühlungstheorie" (Empathy Theory).

In the years since Theodor Lipps, countless theorists and researchers have explored the topic of empathy. This thesis highlights the work of three researchers whose work has been published in the past 6 years. Interestingly, all of these researchers have not only defined empathy in their own ways but have also each concluded that empathy can be learned.

In 2010, Dr. Brené Brown, a research professor at the University of Houston has stated that "empathy is a choice, a vulnerable choice, and in order to connect with someone, you have to first connect with that part of yourself that knows that feeling." She also has stated that "rarely can a response make something better. What makes something better is connection." Dr. Brown believes empathy can be strengthened with practice (Brown 2010).

Dr. Paul Parkin, a research professor at Utah Valley University, defines empathy as "the righteous struggle to try to stand in someone else's shoes, to try to see the world through their eyes and to try to feel what they are feeling". According to Parkin, "empathy doesn't make assumptions, it forges communication, it is inquisitive, non-judgmental, validating and compassionate". Parkin suggests that "we can cultivate our ability to give empathy; we can increase our capacity to receive empathy" (Parkin 2015).

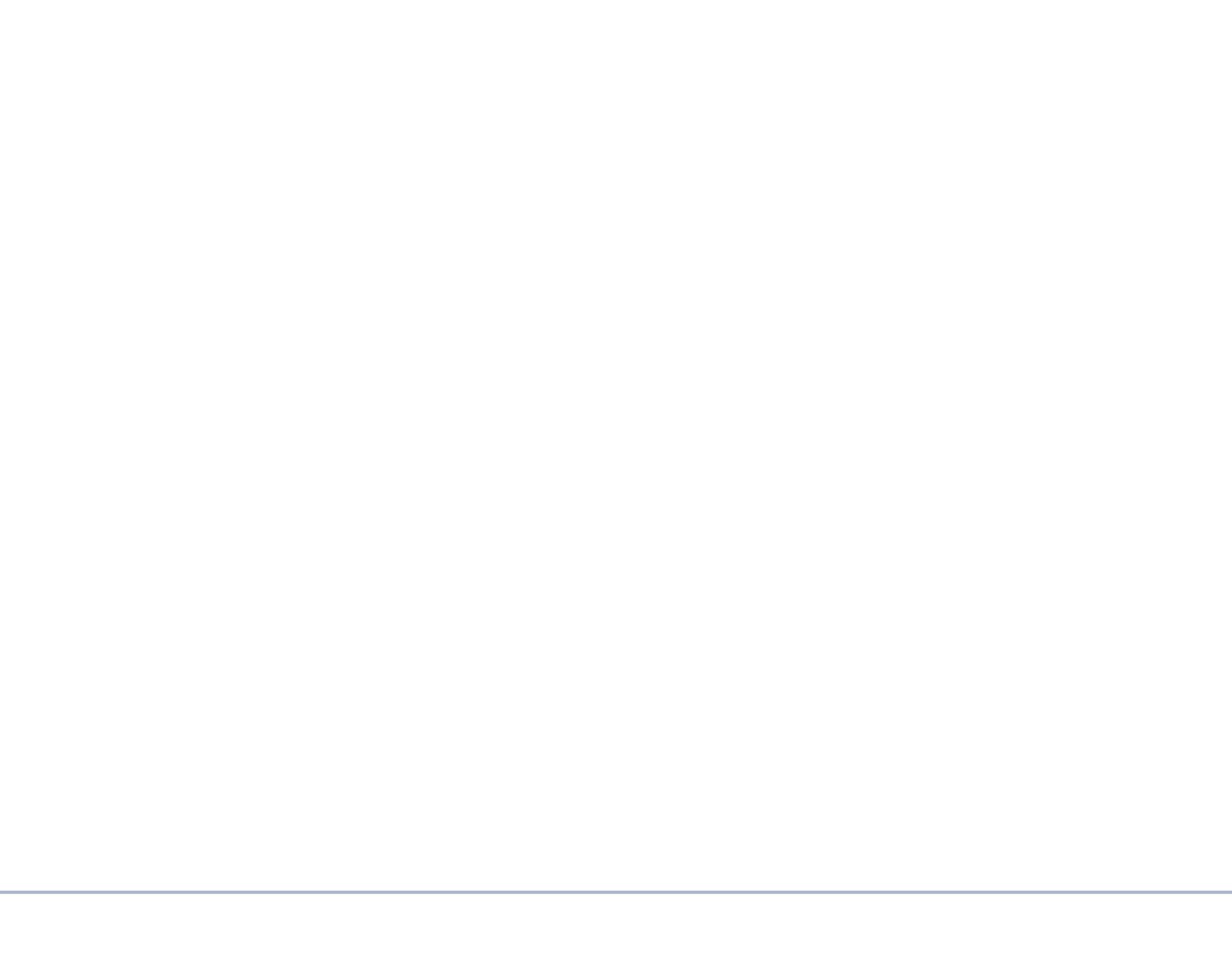
Dr. Helen Reiss, associate professor of psychiatry at Harvard Medical School has stated that the essence of empathy is “to see someone else’s pain”. She has focused her research on the empathetic connection between patients and psychiatrists. During sessions, both the patient and the doctor are monitored with skin conductance equipment that tracks physiological tracers such as heart rate and respiration and are video recorded. In one particular session, Reiss discovered not only that both she and her patient had similar physiological patterns during the session but that the patient’s data indicated high levels of anxiety during the session. Upon further study, Reiss found this anxiety correlated to specific body language during the session. Reiss pointed out these findings to her patient who enthusiastically responded that no one had ever seen her pain before. As a result, according to Reiss, she tailored her future therapy sessions with that patient according to both this new information and the new connection of empathy between them. As a result, both patient and doctor saw remarkable success in the therapeutic goals. Reiss concluded from this study, which included several other patients, that empathy is not something that you are either born with or without, but that it can be taught (Reiss 2013).

Reiss goes on to note that empathy can be gained for someone by noticing seven qualities either in that person or in yourself. She has developed an acronym describing these seven strategies which spells the word “empathy”: E-Eye contact, M-Muscles of facial expression, P- Posture, A-Affect, T- Tone of voice, H-Hearing the whole person, and Y-Your response, absorbing the feelings of others.

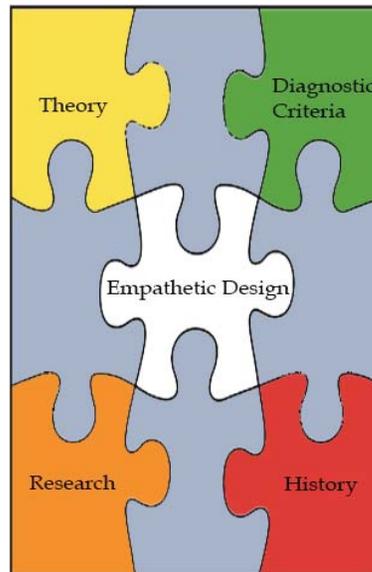
These are just three examples of work currently being done to further understand what empathy is and how it can potentially be learned. However, of critical importance given the focus of this thesis on the autistic population, it is worth noting that these findings show that empathy can be learned, are referring to a neuro-typical population. As this thesis will explore, autistic individuals perceive their environment differently than neuro-typical individuals. In addition, people with autism often have communication and social skills deficits. These deficits often manifest in inappropriate affect, also known as an apparent lack of empathy. Currently, it is not understood by the scientific community how or why this occurs.

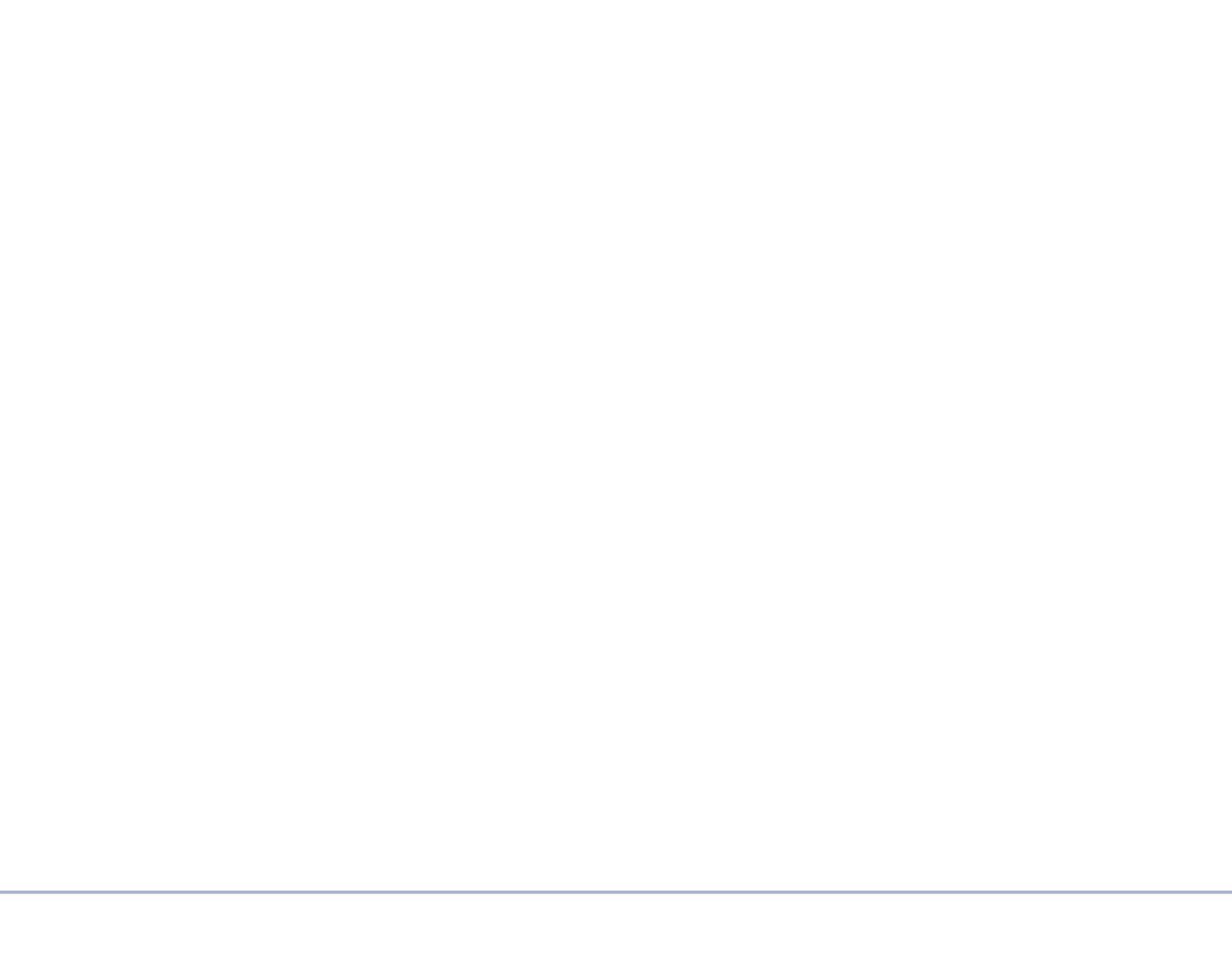
The irony of this thesis, Empathetic Design, is that it proposes a theory using empathy to design environments for a population that exhibits an apparent lack of empathy.





II. Foundations of Empathetic Design





A. Autism Spectrum Disorder (ASD) and High Functioning Autism (HFA)

An Empathetic Designer needs to first understand Autism Spectrum Disorder (ASD) and how High Functioning Autism (HFA) fits within the context of the ASD spectrum. This section of the thesis provides this information so that the reader can better understand what it is like to be autistic. By having empathy for an autistic student, a designer is one step closer to being able to design an educational environment that will reduce stress and foster inclusion for HFA students.

The U.S. Department of Education defines autism as “a developmental disability significantly affecting verbal and nonverbal communication and social interaction, generally evident before age three, that adversely affects a child’s educational performance. Other characteristics often associated with autism are engaging in repetitive activities and stereotyped movements, resistance to environmental change or change in daily routines, and unusual responses to sensory experiences.” The U.S. Department of Education uses the wording from the most recent version of the Individuals with Disabilities Education Improvement Act 2004 (commonly referred to as IDEA), which is federal legislation requiring special education services be available to children and youth with disabilities. This will be discussed further in a following section as a literature review of research pertaining to mainstreaming high functioning autistic children. This section focuses on the diagnostic criteria for ASD and HFA.



Diagnostic Criteria for ASD

The fifth edition of the Diagnostic and Statistical Manual of mental disorders (DSM-5), published in 2013, outlines the diagnostic criteria for ASD. The following is the full-text version of the DSM-5:

1. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history (examples are illustrative, not exhaustive, see text):
 - a. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.
 - b. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.
 - c. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.
2. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive; see text):

- a. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypes, lining up toys or flipping objects, echolalia, idiosyncratic phrases).
 - b. Insistence on sameness, inflexible adherence to routines, or ritualized patterns or verbal nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat food every day).
 - c. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g, strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interest).
 - d. Hyper- or hyporeactivity to sensory input or unusual interests in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement).
3. Symptoms must be present in the early developmental period (but may not become fully manifest until social demands exceed limited capacities, or may be masked by learned strategies in later life).
 4. Symptoms cause clinically significant impairment in social, occupational, or other important areas of current functioning.
 5. These disturbances are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and autism spectrum disorder frequently co-occur; to make comorbid diagnoses of autism spectrum disorder and intellectual disability, social communication should be below that expected for general developmental level.



In addition, the DSM-5 identifies 3 specific “levels” of severity, thus a general framework for the “spectrum”. Level 1 is generally accepted as HFA.

Severity level	Social communication	Restricted, repetitive behaviors
Level 3 "Requiring very substantial support"	Severe deficits in verbal and nonverbal social communication skills cause severe impairments in functioning, very limited initiation of social interactions, and minimal response to social overtures from others. For example, a person with few words of intelligible speech who rarely initiates interaction and, when he or she does, makes unusual approaches to meet needs only and responds to only very direct social approaches	Inflexibility of behavior, extreme difficulty coping with change, or other restricted/repetitive behaviors markedly interfere with functioning in all spheres. Great distress/difficulty changing focus or action.
Level 2 "Requiring substantial support"	Marked deficits in verbal and nonverbal social communication skills; social impairments apparent even with supports in place; limited initiation of social interactions; and reduced or abnormal responses to social overtures from others. For example, a person who speaks simple sentences, whose interaction is limited to narrow special interests, and how has markedly odd nonverbal communication.	Inflexibility of behavior, difficulty coping with change, or other restricted/repetitive behaviors appear frequently enough to be obvious to the casual observer and interfere with functioning in a variety of contexts. Distress and/or difficulty changing focus or action.
Level 1 "Requiring support"	Without supports in place, deficits in social communication cause noticeable impairments. Difficulty initiating social interactions, and clear examples of atypical or unsuccessful response to social overtures of others. May appear to have decreased interest in social interactions. For example, a person who is able to speak in full sentences and engages in communication but whose to- and-fro conversation with others fails, and whose attempts to make friends are odd and typically unsuccessful.	Inflexibility of behavior causes significant interference with functioning in one or more contexts. Difficulty switching between activities. Problems of organization and planning hamper independence.

This thesis focuses on HFA children, as described in the chart on the opposite page as Level 1, the least severe level. Research has shown that with supports in place, these children can be included in a mainstream educational environment and have access to the curriculum. This research is further described in this thesis as a literature review of mainstreaming HFA children. However, for the remaining portion of this section, the understanding gained from the chart on the opposite page will be used as a framework to explore what it is like to be a child with HFA functioning in an educational world that does not necessarily have adequate “supports in place”.

Causes of Stress in HFA Children

For the purposes of this exploration, the contents of the diagnostic criteria on the previous pages can be simplified into five main causes of stress for a child with HFA. These are: communication deficits, social deficits, flexibility deficits, restricted interests, and sensory integration deficits. Each of these is described below using personal accounts from HFA adults and children, in both written and graphic form.

1. Communication Deficits

The first cause of stress results from a deficit in communication skills that prevent a child from interacting effectively with their social surroundings. As we know, communication is a two way street. Successful communication allows us to tell others what we are thinking and feeling as well as provides us with the ability to understand and interpret what others are thinking and feeling. Children with HFA have deficits in both of these forms of communication. Imagine if you cannot understand the world you are living in. Experiences are confusing, unexpected and sometimes terrifying. To make matters worse, you cannot figure out a way to convey that you are struggling. Theresa Jolliffe, author of *Autism: A Personal Account*, describes her impression of reality:

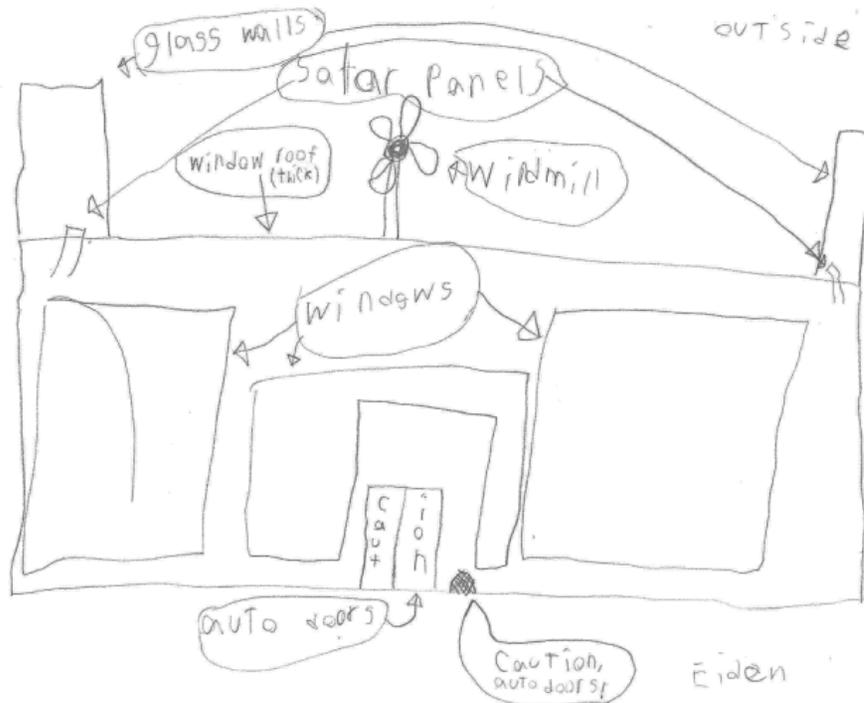
“Reality to an autistic person is a confusing, interacting mass of events, people, places, sounds and sights. There seem to be no clear boundaries, order or meaning to anything. A large part of my life is spent trying to work out the pattern behind everything. Set routines, times, particular routes and rituals all help to get order into an unbearably chaotic life. Trying to keep everything the same reduces some of the terrible fear. Life is such a struggle; indecision over other things that other people refer to as trivial results in an awful lot of distress - if someone says ‘We may go shopping tomorrow’ or ‘We will see what happens’, they do not seem to realize that the uncertainty causes a lot of inner distress.”



We can see in this description that ambiguous statements, often used by neuro-typical people, are very confusing. Autistic people prefer clear statements, preferably those without double meanings or hidden meanings as they require much less energy to decipher. Gunilla Gerlund echoes this sentiment in her book, *A Real Person: Life on the Outside*, by describing how she finds solace when confronted with this confusion:

“My consolation, my safe retreat in the world, was a brown armchair in one corner. I could just fit in behind it. With my face close to the back of it, I would stare into the upholstery so I could see every tiny little bit of it. I became absorbed in the brown material, in its threads, in the minute holes between the threads... There was no energy to be found there, but there was rest, a way of keeping my mouth shut and holding on to a little of the energy that had otherwise been spent in trying to understand what was incomprehensible, how everything hung together.”

Similarly, HFA children become stressed when they don't know where they are going in their school or who is in the spaces they are about to enter. An environment that communicates with them and for them is an example of a way to reduce this stress:



“The front doors should be automatic but there should be signs so people know. There should be lots of windows so you can see inside. Even the walls could be windows.”

Eiden A., age 9

"People should stay on their side of the hallway. The halls are always so crowded. There should be lines on the floor like there are on the street so you don't get trapped or have a collision. I'd like to see a calendar posted on the walls in case I forget what I am supposed to do each day. I also want to have options of things to drink while I walk."

Jared G., age 12



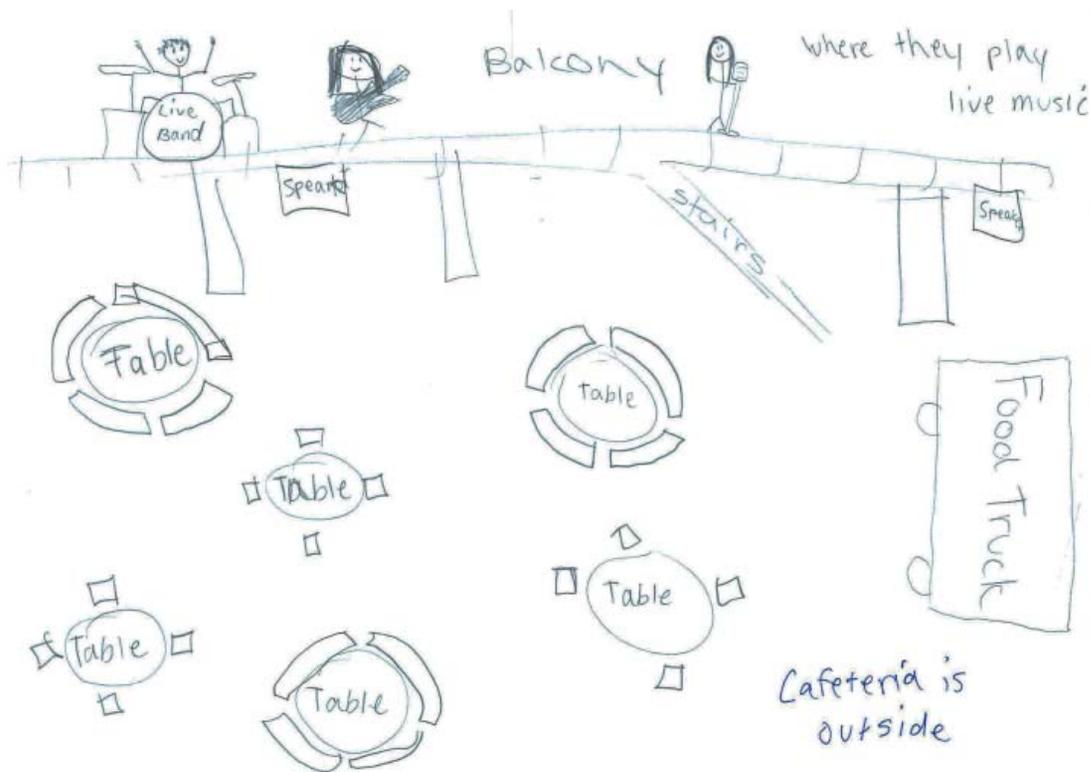
An Empathetic Designer understands that communication, both giving and receiving, is a source of great stress for HFA students. Attention must be paid to find ways for the environment to lessen the stress for these children, especially because of the significant amount of communication that is required in educational environments.



2. Social Skills Deficits

The second cause of stress results from social skills deficits. Again, because ASD is a spectrum, some children with HFA become sad or depressed when they realize that they are not able to have friendships. Others appear to have given up hope of having friends and express no interest in having relationships at all. Schipper Landschip, co-author of *Dubbelklik (Double Click)* describes the stress he feels when he is in social situations:

“Although I was glad they were here, I’m just as glad that they are gone and I’m alone again in all quietness. I love someone coming over, but each time I experience it as a field of tension: wanting to be around other people but not being able to cope with it.”



“There should be different chairs so different amounts of kids can sit at each place. If a band is playing, we don’t need to talk during lunch.”

Audrey P., age 11

Other HFA adults have expressed the stress endured as the result of society expecting them to make eye contact. This stress ranges from mild discomfort as described by John Elder Robison, author of *Look Me in the Eye*:

“I don’t really understand why it’s considered normal to stare at someone’s eyeballs.”

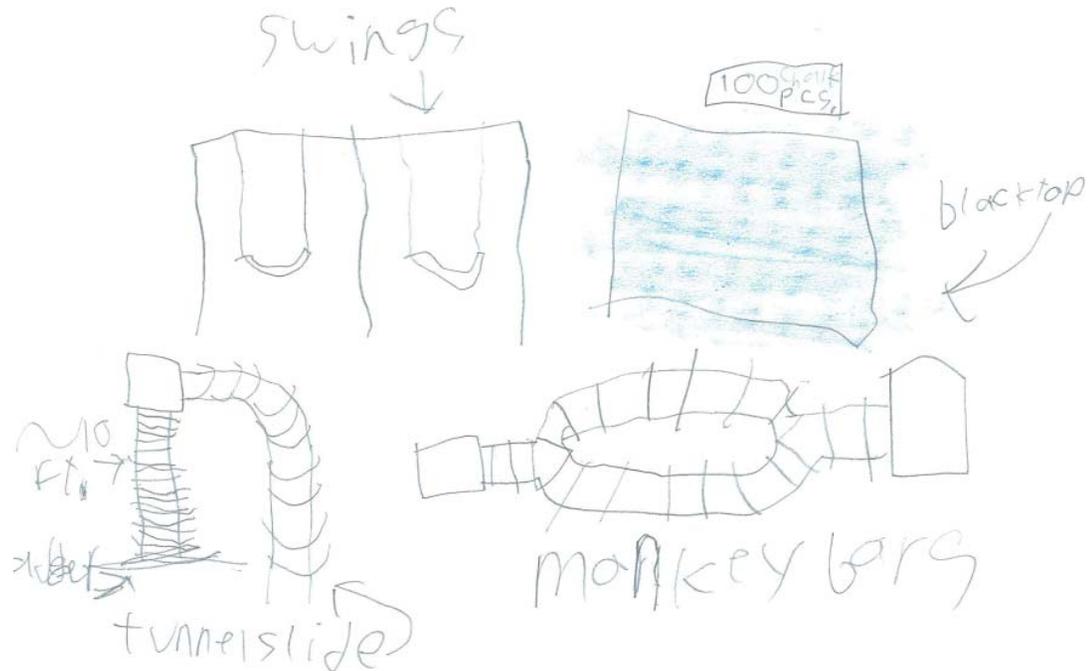
to agonizing pain as described by Luke Jackson, author of *Freaks, Geeks and Asperger Syndrome*:

“When I look at someone straight in the eye, I feel as if their eyes are burning me.”

Children in a school setting are confronted with social situations throughout the day. The sketches on this spread explore a couple of the most socially demanding times during the day, lunchtime and recess:

“The monkey bars should have two paths so I can read sitting on top of one side of the bars while other kids can swing by on the other side. I can be near them but not with them.”

Bobby L., age 11



An Empathetic Designer understands that social skills deficits are another great cause of stress for HFA students. The environment needs to offer a variety of ways to prevent, reduce and relieve stress for HFA students because social situations are an integral part of inclusive education.



3. Flexibility Deficits

The third cause of stress results from flexibility deficits. HFA children are rigid, schedule oriented, rule followers who find comfort in order and predictability. Dominique Dumortier, author of *Van een andere planeet (From a Different Planet)* describes her need to have defined boundaries:

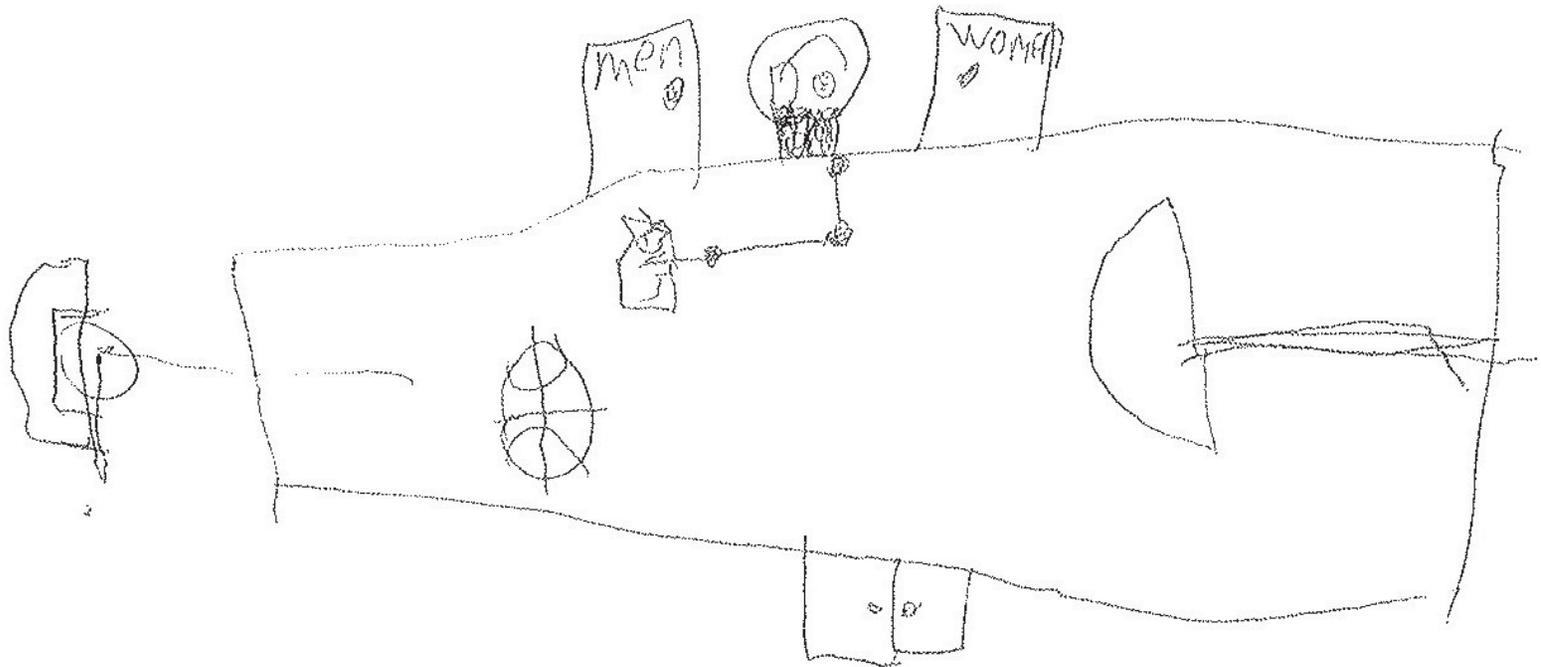
“Each activity has its own place, even at home. These fixed places provide me with the safety and structure which is so essential to me...When my fixed pattern is interrupted, life suddenly gets harder. It seems like I don’t remember how to do even the simplest things.”

This need for boundaries and predictability is evident in HFA children’s views of what their educational environments should be like:



“The teacher should stay in one place at the front of the room.”

Lulu C., age 7



“There should be painted lines and dots on the floor to show where kids need to stand to wait in line for the drinking fountain.”

Bobby L., age 11

An Empathetic Designer understands the desire for boundaries and predictability. An Empathetic Designer also understands that the world does not often accommodate this desire and thus a significant amount of stress is endured by HFA students in their educational settings. An Empathetic Designer recognizes that a balance must be offered.



4. Restricted Interests

The fourth cause of stress results from restricted interests. Often, children with HFA are not interested in what other children are interested in, or more typically, have intense, fixated interests on a finite number of subjects. This can cause stress in HFA children because typical environments, both physical and social, do not allow for such a narrow focus. Luke Jackson, author of *Freaks, Geeks and Asperger Syndrome*, describes this from his point of view:

“I can only speak for myself when I say that if one subject is on my mind or I am fascinated by something, then literally everything else is insignificant - I feel an overwhelming excitement in me that I cannot describe. I just have to talk about it and the irritation at being stopped can easily develop into raging fury.”

Understandably, this “raging fury” has no place in a classroom. However, this need to pursue one’s own interests does not dissipate when a child steps into their school:

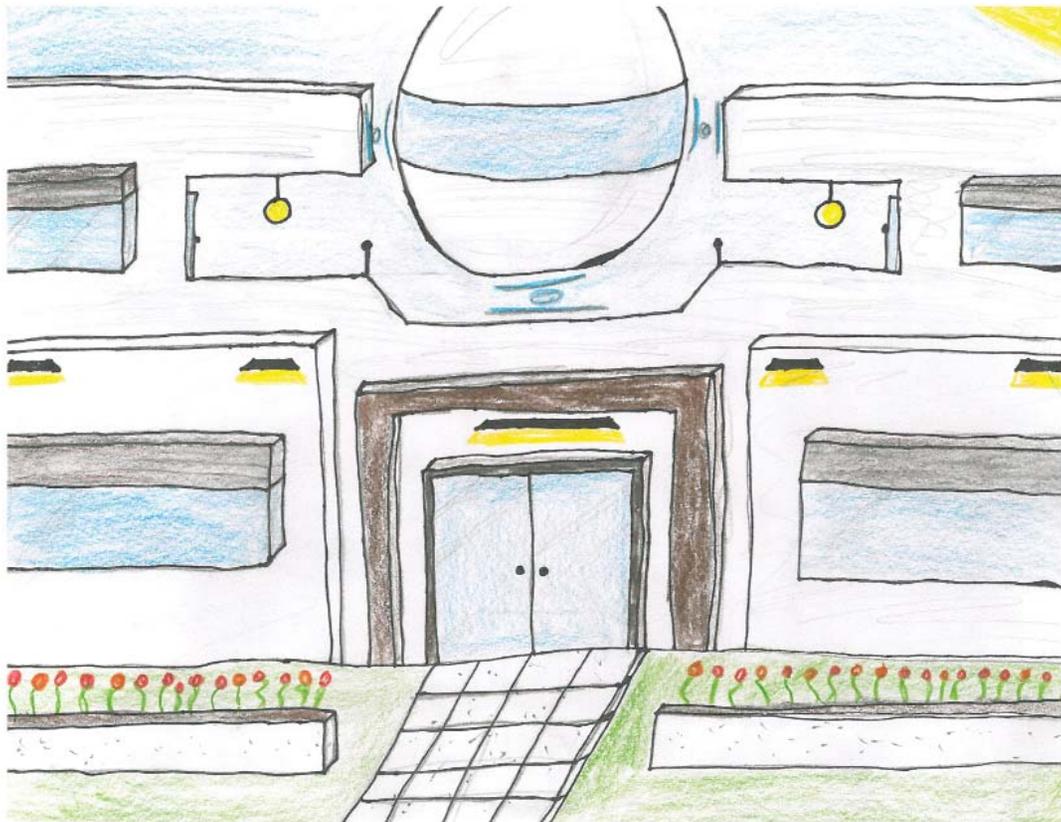


“There should be separate rooms for each subject. The subjects should be only chemistry, cosmology, math and recess. There should be a big lab for science experiments.”

Lulu C., age 7

“There should be flowers at the front so it is cheerful and plenty of windows and lighting. There should also be a sphere held in place by electromagnetism since the school is a science and technology school. The science classroom could be in the sphere or maybe a gardening center.”

Jared G., age 12



An Empathetic Designer understands that options need to be available in an educational environment. These options can be offered in a specific space, a classroom for example, when a student has the ability to choose and yet continue to receive the educational content. These options can also be spread throughout the environment, the school facility for example, when a student does not have the option to choose without disruption to the delivery of the educational content.

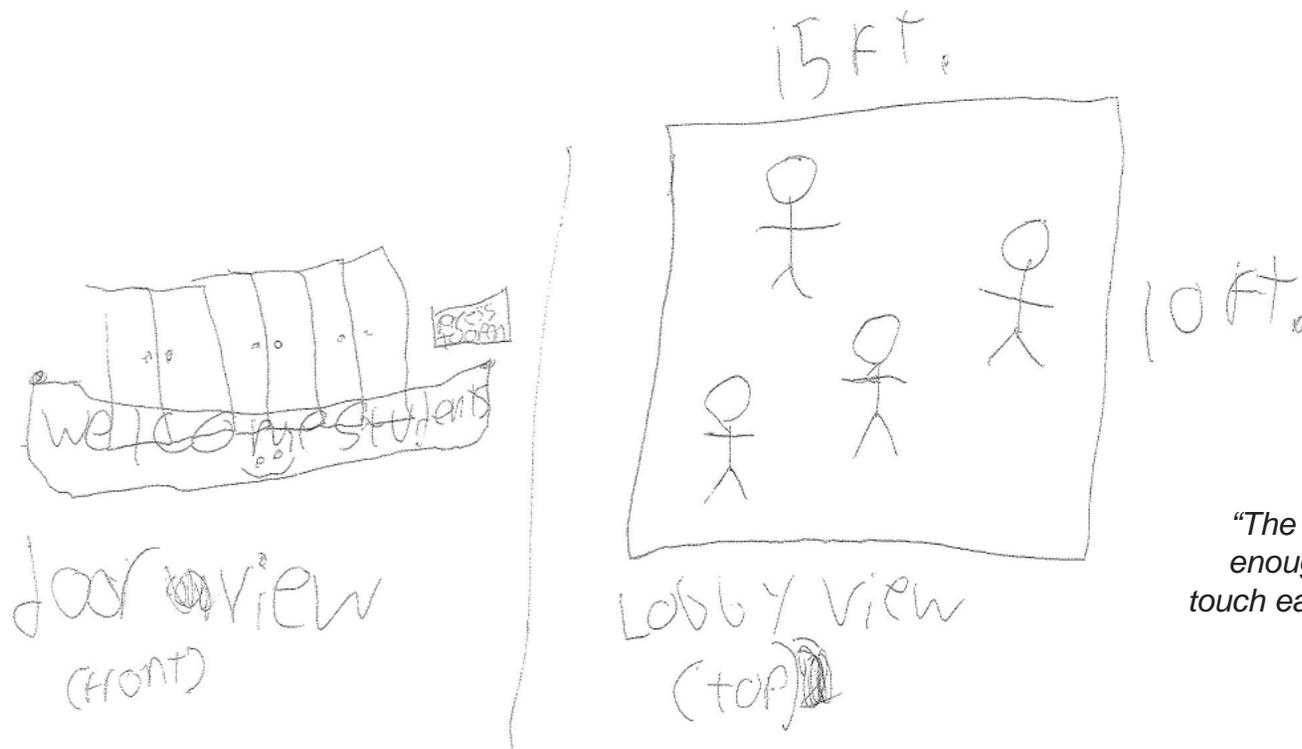


5. Sensory Integration Deficits

The fifth and final cause of stress results from sensory integration deficits. Integration deficits include hypersensitivity (high sensitivity to low level sensory inputs), hyposensitivity (low sensitivity to high level sensory inputs) and internal interference as described by Temple Grandin:

“It is likely that such a person has no idea of his body boundaries and that sights, sounds and touches are all mixed together. It must be like seeing the world through a kaleidoscope and trying to listen to a radio station that is jammed with static at the same time.”

Some HFA children experience elevated levels of stress when they touch others:



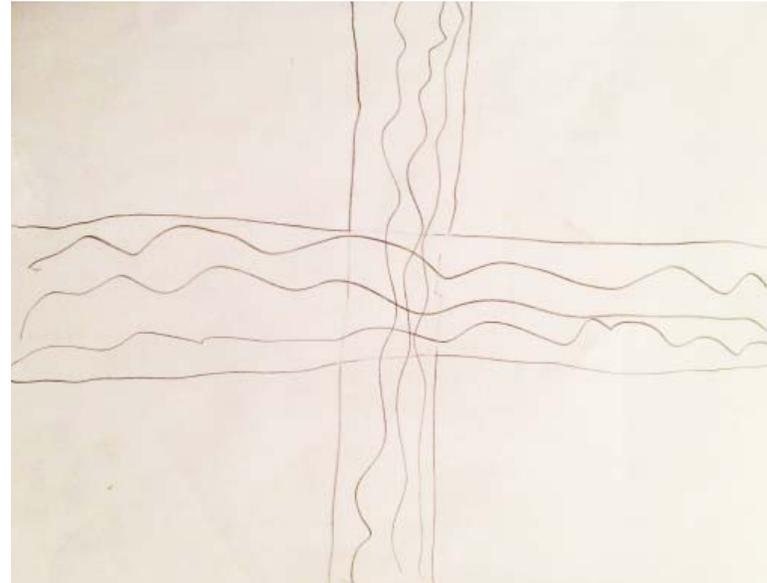
“The lobby should be big enough so no one has to touch each other when they walk in.”

Bobby L., age 11

Conversely, some HFA children crave sensory input when it comes to touch:

“I would like to swim from class to class. When I am swimming I don’t hear anything. I don’t talk to anyone. I love the way the water feels. And it’s just fun.”

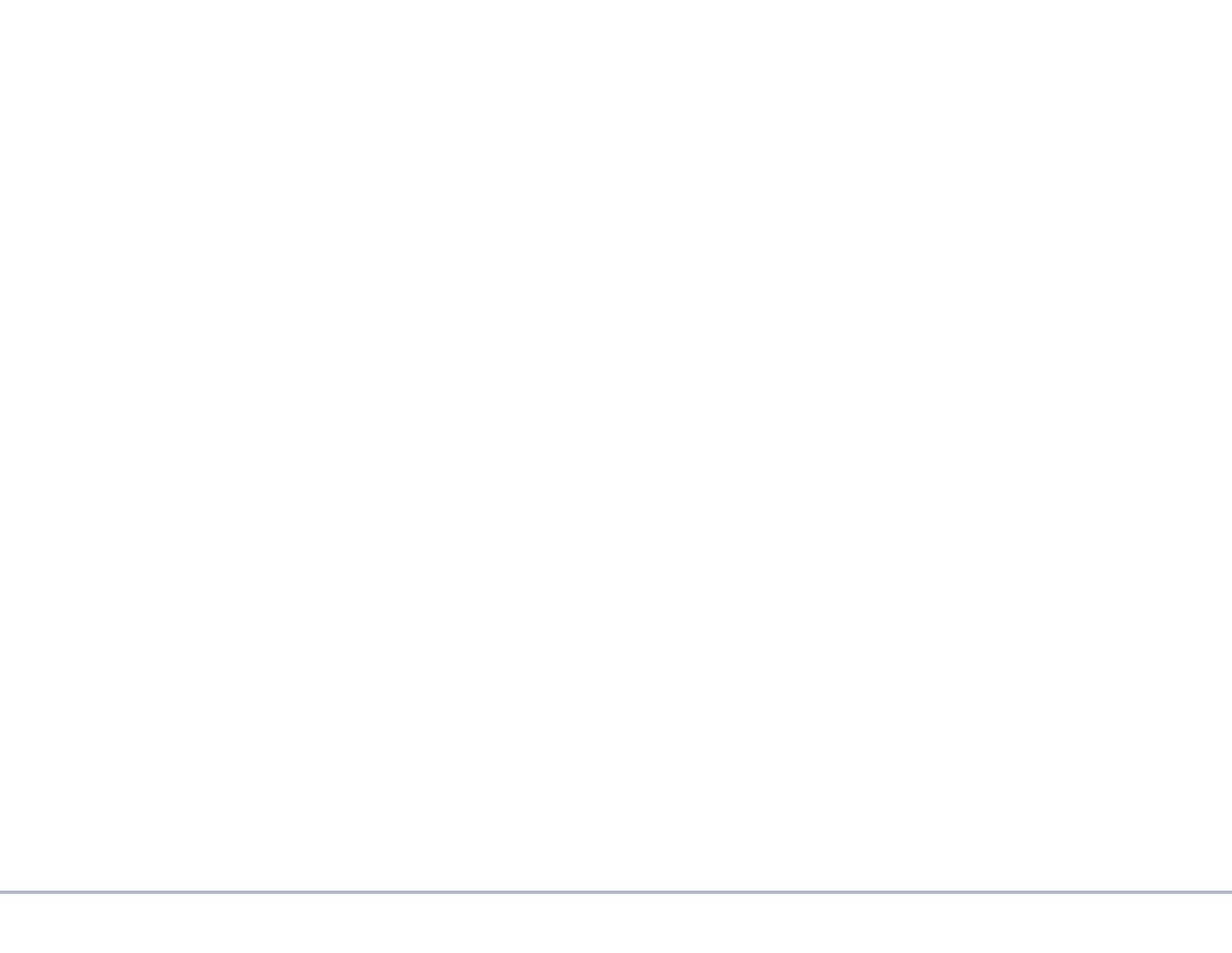
Justin P., age 11



An Empathetic Designer understands the complexity and contradiction regarding sensory input. Some HFA children crave sensory stimulation, some fear it, and some have trouble determining the difference. An Empathetic Designer understands one environment will cause stress for one HFA child while at the same time it will reduce stress for another. An Empathetic Designer understands the fundamental need for variety and options and that they are not the same.

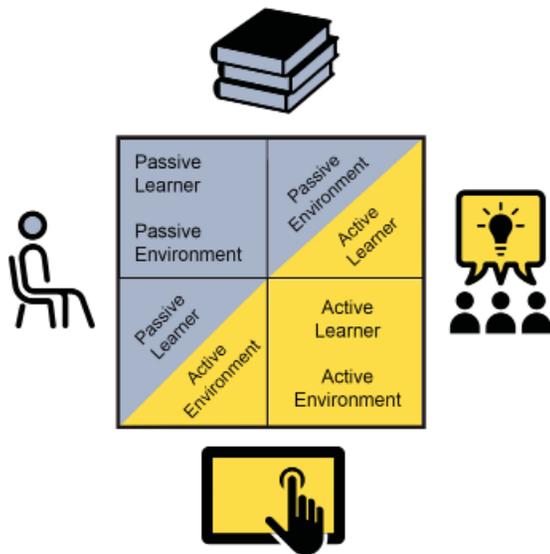
Children with HFA experience their environments differently than neuro-typical children. This section has summarized and highlighted the various ways both clinically and emotionally. The combination of methods provides a basic understanding regarding what it is like for children with HFA to function in the world. This understanding of autism, deepened with personal testimony, is the first component of the foundation of Empathetic Design.





B. Learning Theories and Progressive Educational Reform Precedents

In order to understand how to design an educational environment, certainly one inclusive of children with High Functioning Autism (HFA), an Empathetic Designer needs to understand the main learning theories and progressive reform precedents that have guided both pedagogy and the design of the built environment over the past century. Armed with this understanding, an Empathetic Designer can make more informed decisions about how best to produce a design that can influence a student's interaction with other students as well as with the built and natural environments. As expected, learning theory and progressive educational reform precedents from the past one hundred years are vast, complex and controversial. However, because these topics comprise only two of the several components of Empathetic Design, only a summary of each is provided in this thesis. In order to facilitate this abridged discussion, the various learning theories are presented using a flexible framework identified by Cathy Dent Read and Patricia Zukow-Goldring (1997) and summarized by Peter C. Lippman (2010). This framework can be used to compare theories mentioned in this thesis as well as other theories not mentioned and/or theories of the future. Following the learning theory summary, an overview is presented of the three main progressive educational reform precedents: Reggio Emilia, Montessori, and Waldorf.

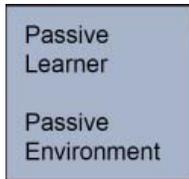


Dent Read and Zukow-Goldring proposed four ways that learning can take place. These ways are the four combinations of either an active or passive learner paired with either an active or passive environment. Lippman (2010) defines “active” as moving or affecting and “passive” as submissive or not participating. Lippman goes on to define “environment” as “physical, cognitive, social, emotional and transactive levels of any person’s setting” (2010).

The main learning theories of the past century can be classified according to this system. These theories include: genetic determinism, behaviorism, multiple intelligences, cognitive constructivism, social constructivism and practice theory (Lippman 2010). These theories are quite diverse and span from passive learner in a passive environment, as described with genetic determinism, to active learner in an active environment, as described with practice theory. A summary of each theory follows:



Learning Theories



The first theory, **genetic determinism**, is an example of passive learner / passive environment. This theory can be traced back to August Weisman in the 1890s, who was perhaps influenced by Charles Darwin's theory of natural selection. According to Lippman, genetic determinism assumes that "learner development is a direct result of genetic makeup" and its "acquisition is by chance" (2010). This theory is controversial because it concludes that the environment has no effect on the learner. Similarly, it states that the learner has no effect on its environment. According to Lippman, genetic determinism "fails to recognize the transactional relationship between the learner and the learning environment" (2010). This theory has been challenged significantly with research from the past ten years.



The second theory, **behaviorism**, is an example of passive learner / active environment. Behaviorism's roots come from the theories of John Locke who postulated that the human mind was a clean slate, waiting to be filled by the environment (1690). Lippman goes on to describe behaviorism as a presupposition "that learning is merely a change in observable behavior due to selective reinforcement of the individual's response to stimuli in the environment" (2010). This theory states that the ideal way to learn is through teacher delivered curriculum (active) which is absorbed by students (passive). Examples of the built form resulting from this theory are the one room school houses and the early traditional classrooms with rows of desks, bolted to the floor, focusing on a raised teacher's platform. The students are expected to listen and read and not interact with other students or with the teacher.



The next group of learning theories are examples of active learner / passive environment. These theories include the theory of multiple intelligences, cognitive constructivism and social constructivism. The **theory of multiple intelligences** was proposed by Howard Gardner in 1983. His theory provided “a framework for understanding the different intelligences that each learner possesses” (Lippman 2010). His theory included nine intelligences: linguistic, logical-mathematical, spatial, bodily-kinesthetic, musical, interpersonal, intrapersonal, naturalist and existential. According to Gardner, each person also learns differently and has unique talents. To simplify, Gardner believed a successful learning environment should be passive but address all intelligences, and thus the learner becomes active, seeking the portion of the environment that appeals to their own unique combination of intelligences. **Cognitive constructivism** differs from the theory of multiple intelligences in that cognitive constructivism theorizes that the learner actively seeks and gains experiences and those experiences, translated into cognitive perceptions and interpretations are the foundation of learning. Again, in cognitive constructivism, the learner is active and the environment is passive. Finally, **social constructivism** is similar to cognitive constructivism assuming that learning takes place from experiences. However, according to social constructivism, the experiences must result from social interactions, either historical, cultural or interactions with members of society.



The fourth and final combination in the Dent Read / Zukow-Goldring framework considers an active learner and an active environment. The most well known theory that falls into this category is **practice theory**. According to Lippman, practice theory “involves levels of participation and grounds in learning in a physical setting” (2010). Lippman also goes on to describe it as requiring “relations among people in activities in, with, and developing from the socially structured world in which they transact” (2010).



Progressive Educational Reform Movements

In addition to learning theory, an Empathetic Designer must be aware of the main progressive educational reform precedents: Reggio Emilia, Montessori, and Waldorf. These reform movements are also highly complex and do not fall neatly into any of the learning theory categories described on the previous pages. Therefore, only summaries have been included in this thesis to provide foundational knowledge required to understand Empathetic Design.

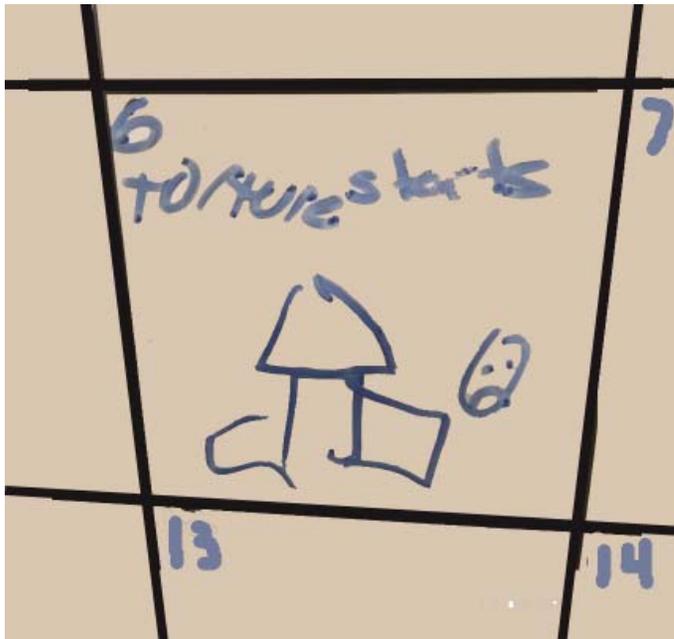
The Reggio Emilia approach was first implemented by Loris Malaguzzi in Italy in the 1950s. Main ideas of this approach include the idea that teachers are learners, learning is project based and the natural, built and social environments should all be part of the learning community.

The Montessori approach was first implemented by Maria Montessori in Italy in 1907. The main ideas of the Montessori method include the idea that teachers are guides, learning should be achieved at the student's pace and children are grouped in varying ages and abilities in order to foster supportive relationships.

The Waldorf approach was first implemented by Rudolf Steiner in Germany in 1919. The main ideas of the Waldorf method include the idea that the teachers are performers, learning should focus on three specific stages of child development (0-7, 7-14 and 15-21 years) and students should strive to create a "just and peaceful society" (Lippman 2010) .

Summary

An understanding of the learning theories and pedagogy reform precedents comprises a significant component of Empathetic Design. Because there is no single method, nor absolute proof, regarding how human beings learn, an Empathetic Designer must have an understanding of the main learning theories postulated and researched over the past century. This necessity is compounded by the fact that architects and psychologists have only recently begun to study how HFA children learn. It is not surprising that early theories based on this preliminary research suggest that HFA children learn differently from neuro-typical children. Perhaps this is why a large percentage of HFA children struggle in mainstream environments. As Paul Collins, author of *Not Even Wrong: Adventures in Autism*, writes:

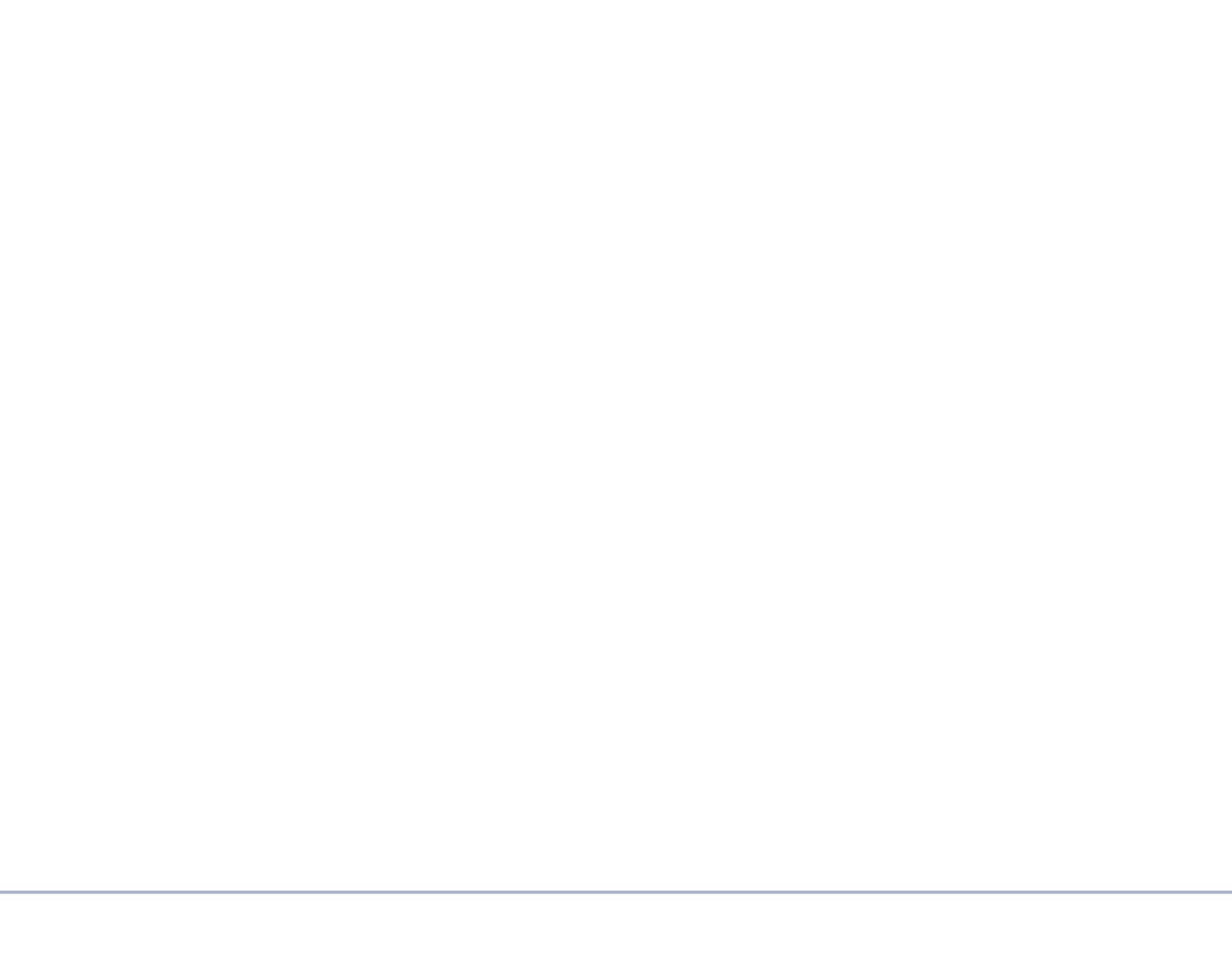


“Autists are the ultimate square pegs, and the problem with pounding a square peg into a round hole is not that the hammering is hard work. It’s that you are destroying the peg.”

This struggle is evident in the sketches of several HFA children who contributed to this thesis research. Perhaps the most gripping is a sketch drawn by 11-year-old Ella B. on her family’s whiteboard calendar on the space identifying September 6th, the first day of school.

Inclusive education should not be considered torture. A foundational knowledge of learning theory and HFA is a critical step toward becoming an Empathetic Designer.





C. Literature Review of Research - Mainstreaming High Functioning Autistic Children

Introduction

The previous two sections provide a foundation of learning theory and of Autism Spectrum Disorder (ASD). Most current learning theory acknowledges the influence of either an active learner or an active environment or in some instances, both. Therefore, when a learner has a disorder that affects perception and processing of the environment, one can only deduce that research must be done to better understand the intersection of learning theory and ASD. Specifically, this research must test how learning theory combined with our current knowledge of ASD should inform the design of inclusive educational environments.

This section explores the current theory and research regarding inclusive educational environments. Although this information is primarily from architects both in practice and in academia, it is supplemented with a wide variety of sources including school administrators, teachers, parents, architecture students, psychologists, educational professors, and writers. The focus of this section is on three methods currently being used to better understand how to design for people with ASD. These three methods include: analysis of recent built work of a leading architect in this field, analysis of two case studies using differing methodology, and finally, analysis of scientific research of existing facilities. Interestingly, each of these methods culminates in recommended guidelines. In fact, the research reveals hundreds of guidelines which can be overwhelming and confusing, even to a trained designer. In order to simplify these guidelines and maintain the emphasis on empathy, this section concludes with several examples of how the writings of adults with ASD, specifically focusing on their perceptions of the built environment, deepen our understanding of the well-intentioned guidelines and add to the foundation required to be an Empathetic Designer.



Inclusion Defined

Because the intention of this section of the thesis is to inform the reader of the current state of inclusive design analysis and theory, inclusion must first be defined. Inclusion is a complex and highly controversial word, the interpretation of which in and of itself can be considered to be on a spectrum. For some, inclusion means that all students are to be included in all environments, disregarding the effect on the student himself or his peers. For others, inclusion means that all students are to have equal access to the curriculum in the manner which is appropriate, even if that means a separate dedicated school that meets their specific needs. For yet others, it can mean a hybrid of the two previous interpretations, meaning that all students are to be included in the least restrictive environment, ideally in the same facility. For this thesis, the focus of which is fostering the inclusion of HFA students in educational environments, inclusion is defined using the US legislation, Individuals with Disabilities Education Improvement Act (IDEA), terminology. According to the IDEA, inclusion is the promotion of all pupils' presence, participation, acceptance and achievement in mainstream schools, where possible.

Review of Autistic Impairments

Because inclusion, as defined by the IDEA, is meant to include all students, and this thesis is considering only those with High Functioning Autism (HFA), it is beneficial to review the specific impairments of those with HFA in order to better understand the challenges for designing educational environments that are inclusive of those with HFA. Children with HFA have communication deficits, social deficits, flexibility deficits, restricted interests, and sensory integration deficits. All of these present challenges for a student with HFA in an educational environment and therefore, also present challenges to the designers of these educational environments. Keith McAllister, an architecture professor in England, has called these the "triad of challenges" (2010). The first challenge is the "differing severity of the autism inherent within the spectrum" (2010). Even when considering only HFA students in this thesis, defined as Level 1, there is still a great variety of sub-levels of severity within the high-functioning classification. The second challenge in the triad is the "varying and differing range of sensory difficulties of individual ASD sufferers" (McAllister 2010). Marijke Kinnear, Stijn Baumers and Ann Heylighen describe these sensory difficulties, which can occur for each of the senses as "hypersensitivity, hyposensitivity, and internal interference. Hypersensitive individuals

experience difficulties in processing even modest levels of light, colours, smells and textures...causing considerable stress, whereas hyposensitive people specifically look for these same stimuli” (2015). The third challenge in the triad considers the classroom setting itself, specifically, “how best to promote and bring change and subsequent independence for the ASD pupil in that environment” (McAllister 2010).

Research Methods

Building on the knowledge of the challenges associated with designing environments for students with HFA, this section examines three methods of analysis when considering current built projects tackling these challenges. A careful review and understanding of these related topics provides another layer of foundational knowledge required to become an Empathetic Designer.

Method 1: Architect Post-Occupancy Analysis

The first research method presented in this thesis is the philosophy, built work and resulting guidelines of *ga architects*, one of the leading architectural firms in the world designing educational environments for those with ASD. Having designed over a dozen education and residential facilities for children and adults with ASD, *ga architects* is committed to designing facilities that are “sensitive to the needs of the users and the carers” (Beaver 2006). Christopher Beaver, founding partner of *ga architects*, has stated that in order to do so, the brief has to “come from an understanding of the autistic mind; the things that are comforting and give a sense of security, a feeling of space where there are places for being alone and for socializing, an easily understood geography with no threatening or over-stimulating features. This understanding can only come with time and patient observation of how children and carers interact” (Beaver 2006). Beaver has formulated what he calls “key” issues based on post occupancy evaluations of his built projects. Most of these guidelines seem obvious, but they are viewed by clients as a starting point when developing the brief. In summary, these include: acoustics – noisy spaces are to be avoided, ventilation – must be sufficient and controllable by the users, heating – invisible and silent systems are preferred, lighting – avoid fluorescent lighting due



to the acoustic concerns and allow all lighting, natural and artificial to be flexible and controllable by the user, color – user defined balance between neutral, calming and stimulating, planning – simple layout, logical spatial adjacencies based on use and acoustics and elimination of corridors as much as possible, maintenance – use friendly materials that are easy and inexpensive to replace, cleaning – durable and easily cleaned surfaces, outdoor spaces – secure, flexible outdoor space, and wayfinding – curved walls and color coded (Beaver 2006).

According to *ga architects*, of equal importance to these “key” issues is the implementation of post-occupancy evaluations in order to continually test the designs. Some of the most informative data compiled to date for this firm has been from the post-occupancy evaluation of the Sunfield School in Stourbridge, UK. Teresa Whitehurst, a research and development officer at Sunfield School, published an article describing the pros and cons of the new project as well as comparing it to the previous facility. The data gained for the journal article was compiled from interviews with staff and administration before the move, right after the move and six months after the move. Several pros were consistently identified. First, the space design provided freedom and choice. For example, the sensory room is adjacent to the classroom so a child craving sensory input could easily move into that room. Second, the outdoor space was ample for flexibility. For example, a child could choose to ride a bike in the area provided and remain within the safety of the confined area. Third, the low window sills in carefully selected locations allowed views without climbing on furniture, a frequent occurrence in the previous facility. Fourth, the long and wide central spine is effective in terms of multi-use flexibility and clear building organization. Finally, the use of fabric and carpet, though maintenance challenges, contribute to a calm environment that fosters both student access to the curriculum and staff satisfaction. Of course, there were several lessons learned including improper carpet color selection to reduce the appearance of stains and hot spot lighting levels. Many of these issues were easily resolved. Those that were not as easy to resolve were noted and published in the hope of not being repeated by others. In summary, there is a lot to be learned from study of practicing architects in the field of autism-friendly design, both in terms of the quantifiable post-occupancy analysis performed but also in the evolving philosophies resulting from this evaluation.

Method 2: Case Study Analysis with Methodology Derived from Literature Reviews

The second method of analysis of current inclusive ASD built projects is case study analysis. This portion of the thesis highlights the work of two architects, Keith McAllister and Iain Scott. These architects employ slightly different methodologies but both use criteria derived from literature reviews to evaluate built environments and eventually culminate their study with a series of guidelines.

The first architect, Keith McAllister, is an architecture professor in Ireland. McAllister employed a three phase process in his case study research. First, he studied the literature related to ASD educational environments to produce a set of criteria. McAllister's literature review includes published works of practicing architects, architecture professors and students and users of autism facilities. He focuses his study on the work of two professionals, Vogel (2008) and Humphreys (2005). From these sources McAllister defines sixteen design criteria necessary in autism design. He further breaks these sixteen criteria down into "four category bands – control and safety, classroom character, classroom usage, and classroom physical factors" (McAllister 2010). The first category band, control and safety, includes the following four criteria: containment, good observation, safe, and non-threatening. The second category band, classroom character, includes the following four criteria: sense of calm/order, good proportion, non-distracting, and proxemics (personal space). The third category band, classroom usage, includes the following four criteria: flexible and adaptable, controllable (for pupil), predictable, and non-institutional. The fourth category band, classroom physical factors, includes the following four criteria: sensory-motor attuned, good quality acoustics, natural light, and reduction in detail (McAllister 2010). McAllister used these criteria when interviewing staff in nine classrooms in Northern Ireland. These nine classrooms had been renovated three years prior from general education classrooms into ASD-friendly classrooms. McAllister asked the staff to rank each of the sixteen criteria in terms of importance. The second phase of McAllister's research included the creation of a classroom design kit, based on the criteria and data from phase one, that the teachers in the nine classrooms could manipulate to make their "ideal" classroom. McAllister recorded the comments made by the teachers while they constructed the models and he photographed the models upon completion. He used this data to formulate sixteen design guidelines for ASD-friendly classrooms, phase three of his research.



McAllister's sixteen guidelines are:

1. Threshold and entrance – This guideline recognizes the importance of transition between chaos and calm, between noisy and quiet, etc.
2. Cloakroom provision – This guideline recognizes the importance of identifiable territory as well as an additional buffer between two environments.
3. Sight lines entering the classroom – This guideline recognizes the importance of focus. Sightlines are to be curtailed upon entry to inform what is to be the priority upon entry.
4. Visual timetable – This guideline recognizes the importance of routine and order. Space should be allocated for a prominent position of this timetable.
5. High-level glazing – This guideline recognizes the importance of natural light and the distractions that exterior views can cause.
6. Volumetric expression – This guideline recognizes the importance of different characters of teaching zones: low ceilings promote calm, high ceilings promote engagement.
7. Control – This guideline recognizes the importance of teacher control and ability to defuse stressful situations.
8. Access to classroom external play – This guideline recognizes the importance of dedicated outdoor play space. Access to this area can be via a transitional all-weather space such as a canopy.
9. Access to school playground – This guideline recognizes the importance of joining the wider school population if desired.
10. Quiet room – This guideline recognizes the importance of a separate identifiable area within the classroom for flexible uses.
11. Toilet provision – This guideline recognizes the importance of toilets within the inclusive classroom to minimize transitions into the corridor.
12. Kitchen – This guideline recognizes the importance of food preparation / delivery / wash-up within the inclusive classroom to minimize transitions into the corridor.
13. Floor area – This guideline recognizes the importance of personal space, equipment, and teaching zones to children with ASD.

14. Storage – This guideline recognizes the importance of reducing visual distractions and the need for additional equipment.
15. Computer provision – This guideline recognizes the importance of technological innovations in education.
16. Workstations - This guideline recognizes the importance of visual calm and quiet. Workstations should be equipped with side and back screen adaptability.

A cursory review of these guidelines reveals that most are fairly straight-forward and logical. However, upon deeper study, some complexities begin to appear. For example, guideline twelve proposes including the kitchen within the classroom space in order to minimize transitions. This seems reasonable. However, there are several issues with this guideline as an absolute. First, HFA children typically have heightened sensory awareness. Therefore, the smells and sounds generated by kitchen use can be distracting and stressful. Also, even though minimizing transitions is generally considered as a method to reduce stress for some of these students, the lack of movement can cause stress in others. This clearly exhibits what is meant by McAllister's "triad of challenges".

The second architect, Iain Scott, is a practicing architect in Scotland. Scott's literature review includes published works of local and national government agencies, practicing architects, and users of autism facilities. From these sources, Scott defines nine design criteria necessary in autism design. These nine criteria include: a comprehensible spatial structure, a variety of large and small spaces, user controlled environmental conditions, space designed to support autism teaching methods, balance security and independence, simple detailing, user involvement in brief creation and design process, appropriate use of technology, and appropriate technical specifications (Scott 2009). Scott uses these criteria to evaluate four schools in the United Kingdom. For each school, he identifies how the school addresses, or does not address, each criterion. His evaluation is written and uses photos to supplement. Obviously no single school successfully addresses each criterion, but as Scott maintains, there is much to learn from the exploration. Scott's resulting guidelines, or concluding comments, include two main ideas. First, there is a need for designers to understand how these criteria can be addressed successfully. And second, this information is not readily accessible to designers and it should be (Scott 2009).



Method 3: Scientific Research

The third method of analysis of current inclusive ASD built projects is scientific research. This section highlights the work of two architecture professors, Magda Mostafa of India and Rachna Khare of Egypt.

Magda Mostafa conducted a two-phase research study published in 2008. The first phase included data from a questionnaire given to care givers of autistic children who ranked the most influential architectural elements on autistic behavior. Autistic behavior can be influenced by social skills and communication deficits as well as sensory integration deficits. In order to simplify the study scope, Mostafa focused on behaviors resulting primarily from sensory integration deficits. Using the most common medical, therapeutic and educational interventions for autistic behaviors, Mostafa compiled six architectural factors that affect behavior: acoustics, visual (colors & patterns), visual (lighting), texture, olfactory, and spatial sequencing of functions (2008). Educators were asked to rank each of the six based on their level of influence on behavior. The second phase of the study scientifically tested the two most influential architectural elements from phase one, acoustics and spatial sequencing, on three specific autistic behaviors: attention span, response time and behavioral temperament. Acoustics was tested in two ways: affect on behavior and on speech and language acquisition. Insulation was used on the variable classroom to reduce both the background noise level and the echo ratio when compared to the control classroom. Spatial sequencing involved rearranging the interior of the variable classroom in such a way that promoted routine. For example, different “zones” were formed by walls and furniture in comparison to the open control classroom. Using these two architectural factors, the three specific behaviors were observed directly and with video recording. The tests were conducted during one academic year. The first semester studied the control situations outlined above and the second semester studied the variable situations. The results of this experiment showed “promising indications of the possible improvement of autistic behavior, as indicated by increased attention span, reduced response time and improved behavioral temperament using an altered architectural environment” (2008). The specific data to support this statement is presented in Mostafa’s 2008 paper, *An Architecture For Autism: Concepts Of Design Intervention For The Autistic User*.

This extensive data led Mostafa to produce a sensory design matrix and design guidelines as appendices to her paper. The top row of the sensory design matrix (below) identifies the five sensory issues, including the three possibilities of each (hyper, hypo and inference) as outlined earlier in this thesis. The left column of the sensory design matrix identifies four categories of architectural attributes (dynamic, quality, balance and structure) then further broken down into seventeen sub-categories (closure, proportion, scale, orientation, focus, symmetry, rhythm, harmony, balance, color, lighting, acoustics, texture, ventilation, sequence, proximity, routine). This matrix, propagated by both the data gained from the questionnaires and by the research done in the classrooms, produces a numbering system that is used to identify Mostafa's twenty-eight design guidelines. Each of her design guidelines is listed along with several suggested objectives for each type of user (i.e. hyper olfactory, hypo tactile, etc.) (2008). The main take away of this paper is the significant effort required to test just two of the seventeen sub-categories for just three of the seemingly infinite autistic behaviors due to sensory integration deficits - sensory integration deficits being only one of the deficits for autistic individuals. Therefore, Mostafa proposed this matrix and associated guidelines as a first step, outlining the extent of further research to be done. Interestingly, Mostafa used her sensory index theory to contribute to the design of the Advance Center for Special Needs in Qattameya, Cairo. In 2014, Mostafa published a paper illustrating how the index was used in the design of this facility. This paper suggests that when completed, post-occupancy evaluation of this facility can be used to not only further development of the sensory design theory but to also apply this theory to other building types. Mostafa suggests that the index can also be used as an audit index for existing facilities to enable efficient renovation work (2014).

		S E N S O R Y I S S U E																
		Auditory			Visual			Tactile			Olfactory			Proprioceptive				
		Hyper	Hypo	Inference	Hyper	Hypo	Inference	Hyper	Hypo	Inference	Hyper	Hypo	Inference	Hyper	Hypo	Inference		
ARCHITECTURAL ATTRIBUTE	Structure	Closure	1	2		1	2	1	2	1	2	1	2	1	2	1	1	
		Proportion	3	4	3	3	4							4	3			
		Scale	5	6	5	5	6	5	6	5					6	5	5	
		Orientation					7									7	7	
		Focus	8			8										8	8	
	Balance	Symmetry	9	10		9	10	9							9	10	9	
		Rhythm					11									11	11	
		Harmony				12	13	13	12							13	13	
		Balance				14	15	14							14		14	
	Quality	Colour				17	18			18								
		Lighting	19			19	20											
		Acoustics	21	21	21													
		Texture		22					22	23								
		Ventilation									24	25	24					
	Dynamic	Sequence				26	26	26		26						26	26	
		Proximity				27		27								27	27	
		Routine	28			28		28								28	28	



The second example of scientific research being used to analyze current inclusive ASD built projects is the work of Rachna Khare, an architecture professor in India. Her dissertation, *Designing Inclusive Educational Spaces for Autism*, develops a theory that eighteen detailed environmental design considerations enable students with autism (2009). These environmental design considerations, which Khare refers to as design parameters are: physical structure, visual structure, visual instruction, opportunities for community participation, opportunities for parent participation, opportunities for inclusion, opportunities for future independence, space standards, withdrawal spaces, safety, comprehension, accessibility, space for assistance, durability and maintenance, sensory distraction management, opportunities for sensory integration, flexibility, and monitoring for assessment and planning.

Khare uses a variety of research methods including researcher checklists of sixteen “educational setups”, eighteen autism expert surveys, and fourteen regular education expert surveys. The data compiled from these sources led Khare to modify the eighteen design parameters into design guidelines. These design guidelines identify six categories: site selection, site planning, building design, classroom design, outdoor play area, and landscaping and illustrate each category with suggestions regarding each of the eighteen design parameters. For example, the building design category 7.3 identifies a suggestion to include a room for parents to interact with other parents while waiting for a parent involvement activity to begin. This program requirement addresses the design parameter 7.3.5 “opportunities for parent participation”. There are hundreds of guidelines in Khare’s dissertation, a small portion of which are highlighted in this thesis.

The take away from the work of both Khare and Mostafa is that their research has generated guidelines that create a valuable starting point. However, the purpose of this thesis is to illustrate the importance of achieving empathy and applying it to the design. For example, regarding the example guideline mentioned above, rather than including a simple rectangular parent room to satisfy a programmatic requirement based on scientifically-based guidelines, an Empathetic Designer is able to understand why this parent room is important (as a source for parental support) and that understanding informs the design of the room.

Guidelines as a Starting Point

The guidelines as described on the previous page certainly present a fair amount of challenges. They are vast, seemingly contradictory to an untrained eye, and are too complex to be effective without exhaustive study. In addition, the guidelines have significantly less value, and could potentially be detrimental, if applied to design without first achieving empathy for the inhabitant.

However, for a variety of reasons, the guidelines generated by the various research methods identified above are certainly a starting point. The guidelines can “draw designers’ attention to certain aspects which they might fail to notice otherwise, thereby assisting them in asking some important questions to future users from the very first design phase” (Kinnear 2015). In addition, design guidelines can also assist autistic people to identify ways that the built environment can be better designed to reduce their stress by acting as a framework to overcome the issues caused by communication deficits (Kinnear 2015). And finally, the vast amount of guidelines alone supports the need to search for a more holistic solution for inclusive design. The required search has led to the Theory of Empathetic Design.

As shown in previous sections, one of the best ways for a neuro-typical designer to gain empathy for an autistic user is by studying the written words of adults with ASD who have been able to describe their impressions of the built environments that surround them. As previously stated, one of the main diagnosing criteria of HFA is communication deficits. Therefore, there is not a vast amount of writing from people with ASD, even less that describes thoughts and feelings related to the built environment. However, the limited available accounts recorded in various formats including autobiographies, diary entries, and pamphlets have contributed valuable content. In fact, several scholars have published papers describing autists’ perceptions and the processings of their surroundings.

These accounts present a complex and “varied image” (Kinnear 2015) which is a highly valuable resource to an Empathetic Designer. A careful review of these written accounts will reveal themes such as the built environment can provide physical stability and predictability to those with ASD and that the world is “deeply sensory” and “mentally



challenging” (Kinnear 2015). Other themes include that the built environment can foster independence and self-esteem and can carry meaning through developed theories in the minds of those with ASD. These themes are complex and each could be the focus of an individual thesis. This thesis will not focus on analysis of the many themes that can be derived from careful study of these works but will instead focus on the realization that empathy can be achieved from careful study of this testimony.

One way to study this testimony is by using it in combination with the guidelines that have been produced from other forms of research. This thesis will explore two examples using this method.

Empathetic Cafeteria Design

The first example explores Rachna Khare’s 7.3.9 guideline “Provide withdrawal spaces...in socially demanding spaces like classrooms, cafeteria, multi-purpose hall” (Khare 2010) and then uses personal testimony from Dominique Dumortier, author of *Van een andere planeet (From a Different Planet)*, to help design a school cafeteria space with empathy. After reading Khare’s guideline, a school designer might understand that a large, open cafeteria is not an ideal solution for all students and that a withdrawal area should be considered. The designer might propose an adjacent classroom or perhaps a portion of the media center for a withdrawal space for these students because of their location, size and acoustic properties. This thought is supported by Dumortier’s testimony regarding what open spaces feel like:

“I don’t like to find myself in an open plain – certainly not in crowded places, such as a marketplace, nor in calmer places, such as a meadow. When I’m standing in the middle of such an open space, I have to keep an eye on too many things at the same time. Sudden movements can occur unexpectedly, all over the place, and each time, I try to prepare for them, but it never works.”

This description, especially regarding the crowded spaces, is most likely already understood by most neuro-typical designers as these feelings are not uncommon among all people. However, the key to Empathetic Design is to dig deeper into how a HFA person experiences their surroundings. Dumortier goes on to describe locations for eating:

“I always need to eat dinner at the table. Even if I eat in front of the TV or couch once in a while, I get in trouble. Nothing seems clear anymore and inevitably, the day will come that I just don’t want to eat anymore...because eating no longer has a fixed place...If this happens with several things at once, my life becomes almost unlivable.”

This second description describes the effects of using one space for more than one use and/or conducting one use in more than one space might not be as widely understood by neuro-typical designers, even those familiar with guidelines. However, after reading this gripping account, an Empathetic Designer will know not to consider an adjacent classroom nor media center for a withdrawal space at lunch time. The Empathetic Designer will have multiple layers of understanding, going far beyond the single example provided here regarding the confusion of mixed-use spaces at his/her disposal. These layers of understanding, when considered holistically, as only an Empathetic Designer can, will inform the Empathetic Designer of possible designs that will reduce stress for the user at lunchtime.

Empathetic Classroom Design

This next example uses Rachna Khare’s 7.4.15 guideline “Minimize sensory distractions by painting the entire environment with a muted colour, by limiting the amount of visual “clutter”, by placing sheets / curtains to cover shelves of classroom materials and visually distracting equipment, by storing unnecessary equipment / materials in another area” (Khare 2010). After reading this guideline, a school designer might understand that the classroom should be simple, efficient, and organized. The designer might propose a storage closet of sufficient size for all of the large, visually distracting equipment. This design is supported by the testimony of Schipper Landschip, co-author of *Dubbelklik (Double Click)*. He describes his minimalistic strategy below:

“I don’t own a single cupboard, just four small shelves which ensure that the few things I do have are always visible. If I put things in cupboards, I’d simply forget I have them. I don’t have a refrigerator, a stove, a washing machine or even a bed, just the absolute minimum of furniture, all fold-up. I sleep in a sleeping bag which I put away each morning and my clothes are in a trunk.”



However, much like the previous example, further testimony enriches our understanding. Landschip describes a group home he visited:

“The life in that home was reduced to nothing but efficiency. When they guided me around the house, there was nothing that showed me that there were already four people living there. No sign of someone’s personality...nothing. Just rooms filled with sterile furniture and a feeling of neatness. It was frightening.”

Again in this example, the first description, which can be compared to a school classroom, provides insight that is perhaps already understood by a school designer, certainly one who is familiar with current guidelines. The second description, that of the effects of a purely sterile environment, might not be as widely understood by neuro-typical designers, even those familiar with guidelines. However, after reading these descriptions, an Empathetic Designer knows that there is a delicate balance between a stressful visually-stimulating classroom and a frightening sterile classroom. Again in this example, the experienced, Empathetic Designer has multiple layers of understanding, going far beyond the single example provided here regarding the balance of visual sensory input. These layers of understanding, when considered holistically, as only an Empathetic Designer can, will inform the possible designs that will reduce stress for the student during content delivery.

Summary

There are just two of the countless educational examples that can be illustrated using the plentiful guidelines gained from the research outlined in the beginning of this section. The guidelines proposed by Rachna Khare and others highlighted in this thesis are well constructed and extensive. Thoughtful study of the guidelines reveals that there are levels of complexity within each set of guidelines, particularly Khare’s, that are simply not able to be understood by a superficial examination of each guideline in isolation. In addition, Khare’s guidelines are a vital step in the evolution of Empathetic Design. Without the guidelines, this exploration as briefly illustrated in the previous two examples would not be possible.

This section has explored the current theory and research regarding inclusive educational environments. Three methods are currently being used to better understand how to design for people with ASD. Each of these methods has culminated with recommended guidelines. These guidelines, which are quite valuable and comprehensive, are only a beginning. Not only must we test and challenge these guidelines, but we must also use them empathetically, from the viewpoint of the ASD user. One of the best ways to learn empathy for an individual with ASD is by studying the written work of people with ASD. It is this empathetic understanding that must further inform the guidelines derived from the three methods described in this section. The two quotes below summarize the importance and challenges of this work to be done.

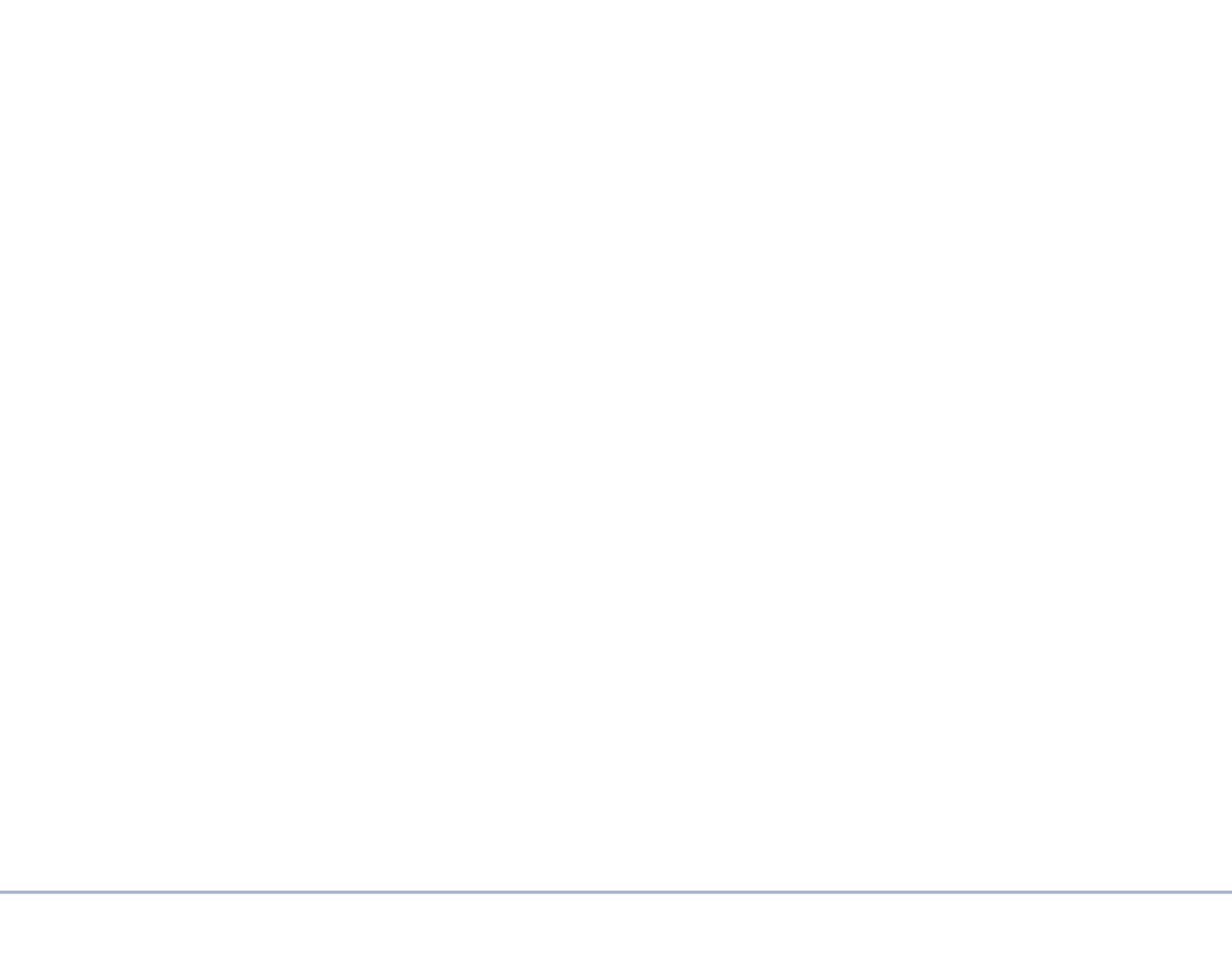
“Autism is a way of being. It is pervasive; it colors every experience, every sensation, perception, thought, emotion, and encounter, every aspect of existence.”

-Jim Sinclair, author of *Don't Mourn For Us*

“It seems that most people view this inner autistic World as dismal grey, as a dungeon without windows. To me, it is a rainbow prism. It can be a world of bright fragments, like stained glass. It is a place which many children don't wish to leave. It is a home.”

-Jasmine Lee O'Neil, author of *Through the Eyes of Aliens*





D. History of the Building Types of American School Design

This section presents the final piece of Empathetic Design education - an analysis of the built form itself. Although Empathetic Design applies to all environments, the scope of this thesis includes only educational environments. Therefore, the analysis of built form in this thesis also considers only educational environments, specifically schools serving elementary age populations in American history. In order to analyze this vast quantity of information, the design of American schools over the past two centuries has been classified by the author into six building types. In addition, a typical school day has been classified by the author into six components of a school day typically associated with stress in students. This stress is caused by the environment and has been classified by the author into three categories: sensory stressors, mental stressors and social stressors. The resulting exploration, summarized in this section and presented in its entirety along with the analysis in Volume Two of this thesis, consists primarily of folio pages resulting from the thirty-six matrix combinations of the six building types and the six school day experiences. Each of these folio pages explores environmental stressors and spatial strategies of the specific building type during the specific experience of the day, all from the viewpoint of a current day mainstreamed HFA student. The spatial strategies have also been classified by the author into three categories; strategies that offer individual control, physical activity and calming surroundings. In addition, in the conclusions section of Volume Two, an analysis of the folio pages provides further insight regarding how each built form during each daily experience both introduces and alleviates stress. This is the final foundational layer in the education of an Empathetic Designer.



Buidling Types

Below is a summary of the six school building types. Please note that each school building type presented in this thesis is a general classification by the author and typically spans multiple historical periods due to social, economic, and political factors.

Early Traditional

These schools are more commonly known as one room school houses and were built between the late 1700s and the 1930s. By nature of their design and the populations they served, these schools were typically in rural settings, surrounded by nature. They were simple in design and organization and the content was delivered by the teacher. Learning was passive and there was limited student interaction. These one room school houses typically served between 45-60 children. Children in these schools would remain seated in fixed seating, arranged by age, for most of the day, participating in recreational activities during lunchtime, physical education and recess periods.

Traditional

These schools were formal, symmetrical, multi-story schools, typically built in urban areas between the late 1800s and the 1930s. These schools served between 400 and 700 students and consisted primarily of classrooms, though later schools of this building type introduced other programmatic features such as auditoriums and recreation rooms. Similar to the schools of the Early Traditional type, classroom seating in the traditional schools was also fixed, class sizes ranged between 45-60 and the content was delivered by the teacher with limited student interaction. Transitions between classrooms were accommodated by wide corridors and rest room facilities were typically included within the building. Ceiling heights were high and natural daylighting was provided in all spaces. Children enjoyed physical education and recess on school property but typically walked home for lunch.

Early Modern

These schools were typically one story, suburban schools designed between 1920 and 1960 to reflect the ideals of the progressive educational reform movement. The neighborhood schools accommodated walkers, bicycles, cars and buses. The Early Modern facilities were more residential in scale than those of the Traditional type and served fewer students, typically about 300. These sprawling buildings were organized by grade level, with kindergarten

classes being more isolated and self contained. Student interaction was incorporated into the design of the schools, from the design of the classrooms to the design of the exterior play areas. Class sizes were reduced to about 25-30 students per class and the furniture was moveable. This made small grouping instruction possible. Gymnasiums, playgrounds, and covered patios were included in the design to foster recreational opportunities.

Experimental

These schools were built between 1960 and 1980 and reacted to various conditions during that time including population decrease, security concerns, energy concerns and special education legislation. As a result, these schools introduced various combinations of the following: open plan, windowless classrooms, team teaching, and multi-age grouping, most of which were evaluated as unsuccessful for various reasons in the years after they were constructed. Teachers during this period were seen as guides for each child to pursue their own individual education. Scale and size of the facilities varied greatly during this period. These schools were located in rural, suburban and urban areas.

Green Renewal

These schools were built during the 1990s and 2000s as a reaction to the unsuccessful open plan, windowless Experimental schools during the prior decades. This building type used recent technological advances in the green industry such as green roofs, photovoltaics, storm water management, and sun control to renew interest that environmental design could be successfully integrated with pedagogy and mental health. Energy modeling became a main driver of the design and emergence of the U.S. Green Building Council's LEED building rating system contributed to political support of energy efficient buildings.

Modern

These schools are being built beginning in the 2010s and have resulted from a combination of exponential advances in technology, environmental criticism of the schools of the Green Renewal era, mental health awareness and pedagogical changes including project based learning and collaboration. Architectural designs now consider higher standards of environmental design including net zero and net positive energy and water as well as post-occupancy follow-up documentation requirements. Technological innovations allowed for successful integration of open space planning.

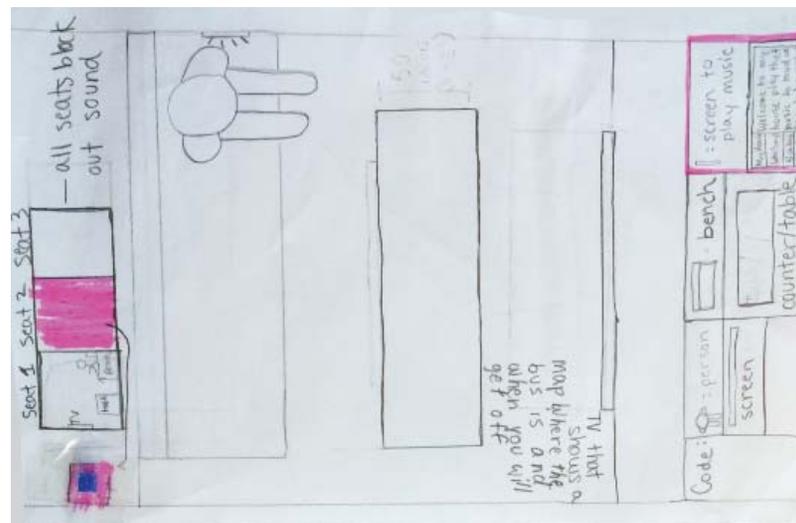


Experiences of the School Day

In addition to the six school building types, this thesis also examines the components of a typical school day for an elementary school student. Below is a summary of the six experiences of a student's day that cause stress based on the research presented in the previous chapters.

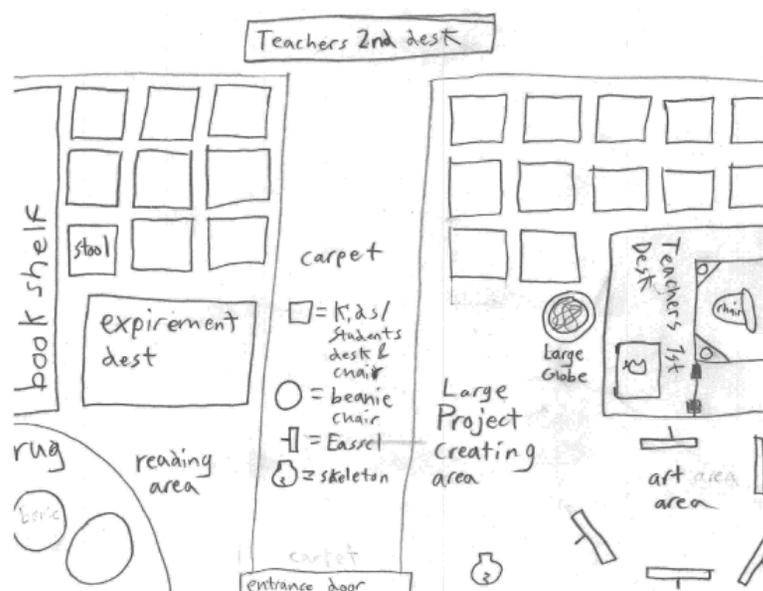
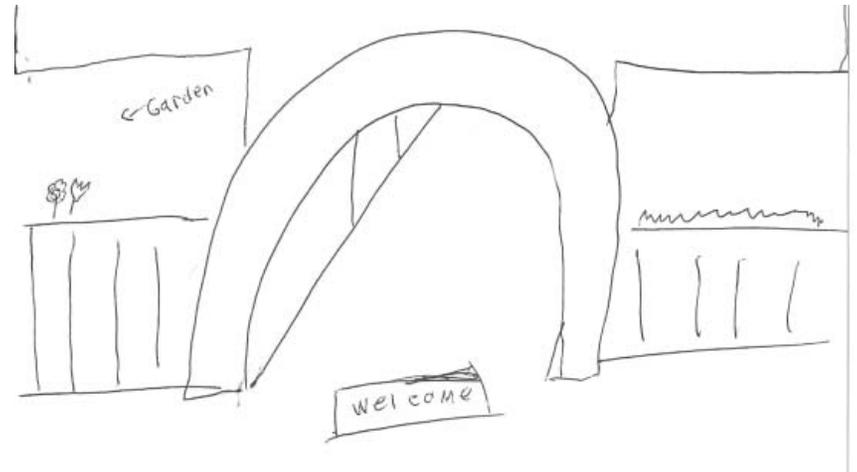
Approach

The approach is defined as the experience as the student approaches the school environment. This includes the approach to the site, either as a pedestrian, cyclist, car rider or bus rider. It also includes the approach to the main entrance of the school. This can be stressful, for example, for a child with HFA who has social skills deficits and might experience anxiety resulting from the experience of the approach. Also, a child with HFA might experience stress as a result of the variety of sensory stimulation that surrounds a school environment at the beginning of the day. In the sketch below, Audrey P., age 11, stresses the importance of a bus seat design that helps block out sound and personal equipment to convey the location of the bus in relationship to the school.



Arrival

The arrival is defined as the experience as the student enters the school building. It includes all portions of the journey from the front door until the student reaches the first location where content delivery occurs. This can be stressful, for example, for a child with HFA who has flexibility deficits and has to endure the lack of structure and unexpected events occurring during the arrival process. Patrick L., age 18, identifies a garden and a welcome mat at his ideal school entry.



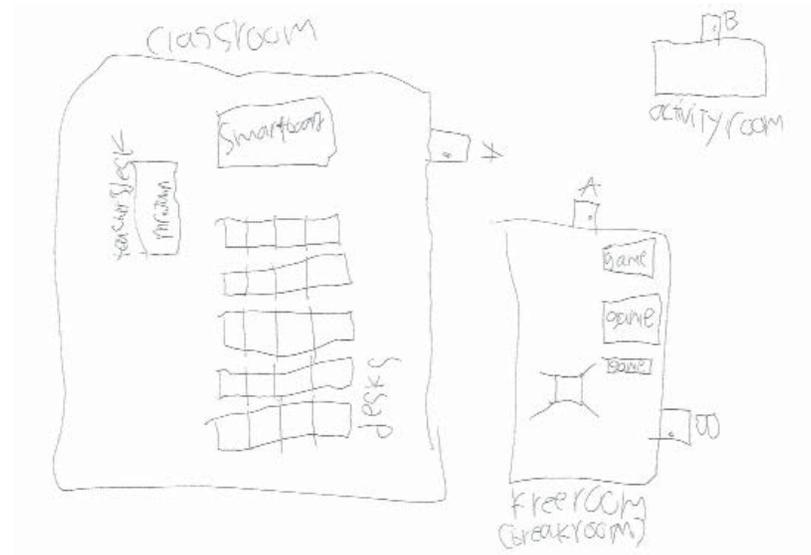
Content Delivery

Content delivery is defined as the experience of exposure to learning content. This can be the core subjects including math, science, history, language as well as additional content including the arts. This can be stressful, for example, for a child with HFA who has restricted interests and is faced with the challenge of not being in control of the content. This can also be stressful for a child with HFA with communication deficits because a large part of content delivery relies on two-way communication. Jared G., age 12, identifies his preference for each activity to have its own place. Even the teacher should have different desks for different functions.



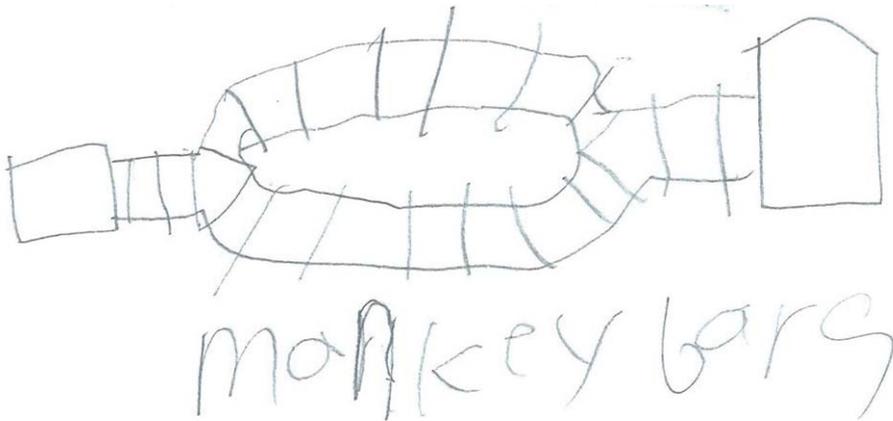
Transition

Transition is defined as the experience that occurs between the content delivery and/or recreation. This can include switching classes, visiting the restroom, and time spent waiting for the next activity to begin. This can be stressful, for example, for a child with HFA with flexibility deficits and needs to endure waiting in an unstructured setting. Bobby L., age 11, would like the rooms to connect with doors only, not corridors.



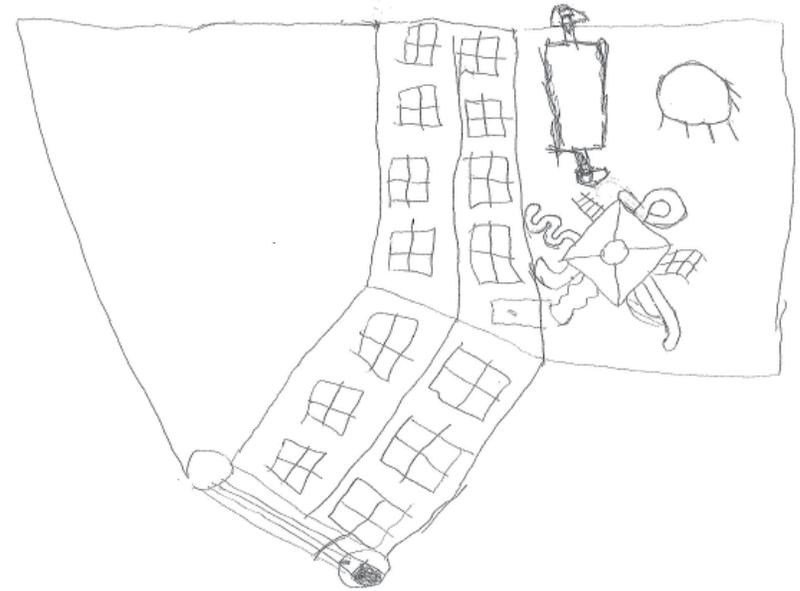
Recreation

Recreation is defined as the experience as the student eats lunch or snack, plays during recess and participates in physical education. It is typically a time of the day with less structure than content delivery as defined above. This can be stressful, for example, for a child with HFA with social skills deficits because a large portion of the time spent in this category involves social interaction. Bobby L., age 11, would love for the monkey bars to have two paths so he could sit on top of one and read while other kids can climb around him.



Departure

Departure is defined as the experience as the student leaves the school. This includes leaving the last space occupied during the school day, leaving the school building itself and leaving the school site. This can be stressful, for example, for a child with HFA who has flexibility deficits and has to endure the lack of structure and unexpected events occurring during the departure process. Justin P., age 11, would like to jump on the trampoline after school gets dismissed and before he goes home.

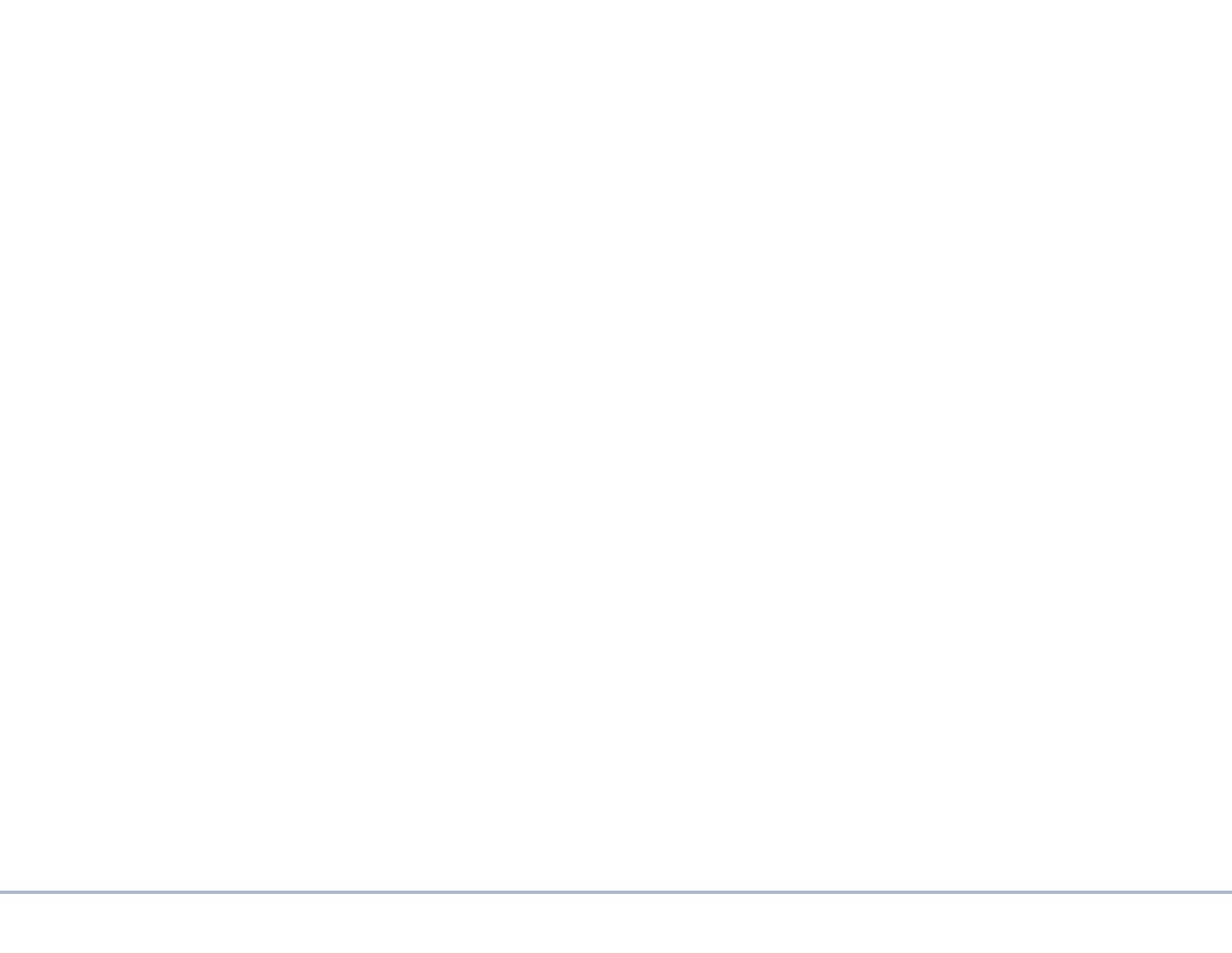


Conclusions

This section includes only a summary of what is explored in Volume Two. That volume, titled *Empathetic Design: The Exploration*, as its title suggests, explores the critical role empathy plays when analyzing the data in an effort to become an Empathetic Designer. In short, the analysis concludes, as expected, that because of the “triad of challenges” presented to designers when designing environments for children with HFA, no single school can be absolutely successful in providing an environment that prevents, reduces and relieves stress for these students. It also concludes that no single school day be engineered to do the same. However, the exploration was not without success. The vast knowledge discovered during the exploration process, particularly regarding the environmental stressors and spatial strategies, is a vital layer to understand. Once this layer is understood, empathy can be applied, again using the testimony of HFA adults and children to produce a deeper understanding that can be effectively communicated as Empathetic Design.

This process of applying empathy to knowledge has been detailed in each of the four topics described in this thesis thus far. Each of these topics, highlighted by a section of this thesis: autism diagnostic criteria, learning theory, current inclusion research, and history of building types, have been explored and then woven with HFA testimony to deepen the understanding of the topic by achieving empathy for the HFA child. It is critical to understand that knowledge alone is not sufficient to design inclusive environments for HFA children. Empathy is the bridge to successful inclusive design.





III. Empathetic Design Fundamentals

The four previous sections have provided the foundation needed to become Empathetic Designers. Diagnostic criteria of Autism, learning theory, current mainstreaming research and history of school building types are critical topics to understand when designing inclusive environments. In addition, each of these sections has explored the critical role that empathy plays in the theory of Empathetic Design, but...

How does this translate into actual design?

This section translates the Theory of Empathetic Design into Empathetic Design Fundamentals.

To be clear, the term “Fundamentals” has been chosen with much consideration. “Fundamentals” differ from “guidelines”. Guidelines, specifically the guidelines presented in this thesis, typically answer the questions “What?” and “Where?” For example, educational guidelines for inclusive environments answer questions like: What rooms should be located where? What colors should the walls be painted? What finish materials should be used? Where should the storage be located? Guidelines define specific ways to achieve the intended result. In this thesis, the guidelines resulting from the mainstreaming research tend to outline the rules that should be followed in order to include High Functioning Autistic (HFA) children in mainstream classrooms. In addition, the mere quantity of guidelines generated to date are cumbersome and thus, not effective.

Fundamentals answer the questions “Why?” and “How?” Fundamentals are holistic. Empathetic Design Fundamentals come from a deep understanding of the challenges faced in a built environment where the perceptions and the processed information vary with each individual with HFA. A familiarity with the research design guidelines is essential to this understanding, but of equal importance is an understanding that guidelines are only a starting point. This concept can be illustrated with a review of the topics covered so far in this thesis.



In the first section of this thesis, diagnostic criteria for Autism Spectrum Disorder, and specifically HFA is described. In the second section, learning theory is explored. These sections, when considered together, illustrate that most current learning theory acknowledges the influence of the active learner and/or the active environment, thus when a learner has a disorder that affects perception and processing of the environment, the relationship of these two topics will yield theories postulating the best ways to design mainstream educational environments for children with HFA.

$$\begin{array}{ccccc} \text{Learning} & & + & & \text{An Understanding of} & = & & & \text{Mainstreaming} \\ \text{Theory} & & & & \text{ASD / HFA} & & & & \text{Educational Theory} \end{array}$$

One can continue this logic by reviewing the third section of this thesis, inclusion research, which, in summary, equates to:

$$\begin{array}{ccccc} \text{Mainstreaming} & & + & & \text{Research} & = & & & \text{Design Guidelines} \\ \text{Educational Theory} & & & & & & & & \end{array}$$

The fourth section of this thesis references the analysis in Volume Two which shows that:

$$\begin{array}{ccccc} \text{Design Guidelines} & & + & & \text{An Analysis of School} & = & & & \text{Comprehensive Environmental} \\ & & & & \text{Building Types} & & & & \text{Stressors and Spatial Strategies} \end{array}$$

Each section emphasizes the importance of personal testimony to gain empathy for the inhabitant of the designed environment. This final section introduces Empathetic Design Fundamentals that are evident only when empathy is applied to this comprehensive exploration of stressors and strategies evident in built work from the past two centuries when evaluated with an understanding of present day learning theory, ASD / HFA knowledge and mainstreaming research.

$$\begin{array}{ccccc} \text{Comprehensive Environmental} & & + & & \text{Empathy} & = & & & \text{Empathetic Design Fundamentals} \\ \text{Stressors and Spatial Strategies} & & & & & & & & \end{array}$$

Summary of Empathetic Design Fundamentals

When empathy is gained, an Empathetic Designer understands not only “what” and “where” stress is caused but also “why” and “how”. Therefore, the following Empathetic Design Fundamentals are organized into three categories based on the empathetic understanding of the three ways that HFA individuals experience stress.

1. Design strategies that prevent the introduction of stress
 - a. Ensure safety (supervision, durable materials)
 - b. Prioritize spatial sequencing
 - c. Integrate thresholds between all programmatic variations
 - d. Present clear circulation and wayfinding

2. Design strategies that reduce the amount of stress introduced
 - a. Provide individual control over
 - accessible hypo / hyper sensory equipment
 - social grouping arrangements
 - volumetric properties of individual environments available
 - available views
 - personal storage options

3. Design strategies that relieve the built-up stress accumulated over time
 - a. Provide access to nature
 - b. Provide variety throughout the school day
 - hypo / hyper sensory environments
 - social grouping settings
 - volumetric properties of environments
 - available views
 - community storage options
 - finishes (institutional vs. domestic)

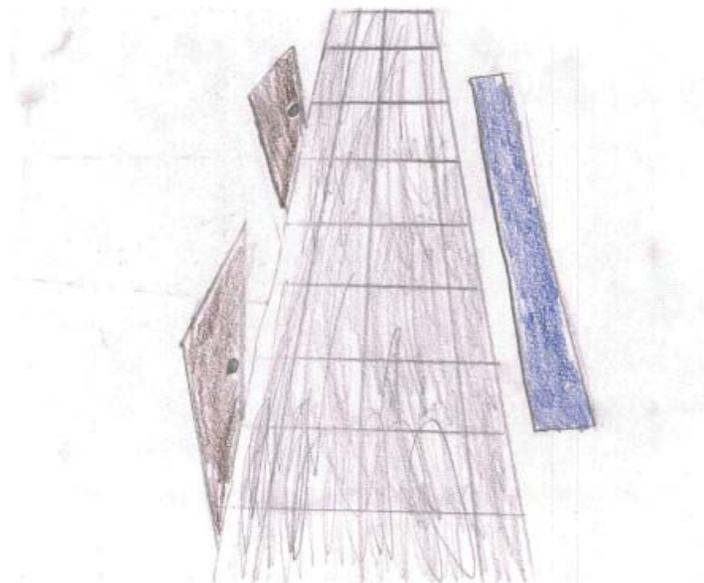


Design Strategies that Prevent the Introduction of Stress

The first category, to prevent stress from being perceived by the HFA student, is the most ideal scenario to reduce environmental stress. There are four main strategies in this category. First, and of highest priority is safety. This can mean a great deal of things including securing the facility as HFA children are more prone to escapism than neuro-typical children. It can also mean specifying durable finish materials, furniture, and equipment. Finally, it can mean ensuring equal amounts of observation, supervision and independence in a suite layout.

The second strategy listed above is “prioritize spatial sequencing”. This also has a variety of meanings. It can mean locating noisy areas adjacent to other noisy areas and quiet areas adjacent to other quiet areas. It can also mean providing spaces in between noisy areas and quiet areas to ease the transition between programmatic spaces. This strategy can obviously be applied to all of the senses as kitchen smells for example can be quite objectionable to HFA children trying to concentrate in a math class. Along the same lines, thresholds should be integrated into the design between all programmatic variations. This can be as simple as a hand washing station at the entry of an eating area to reinforce the programmed use of the space or a coatroom between a noisy corridor and a quiet classroom to lessen the perceptible shift in acoustics. It can also be a place to sit in a corridor as shown in the sketch below.

The final strategy in the category of preventing stress is to present clear circulation and wayfinding. This, however, can be a balancing act. Long straight corridors are easy to understand and observe, however, they can also cause anxiety. In addition, wayfinding that can appear to clarify spatial relationships to a neuro-typical child can be very confusing to a child with HFA. Both of these scenarios, as well as countless others, highlight the need to become very familiar with the needs of the user, to truly understand their perceptions and work with them. Guidelines are not flexible in this regard. Fundamentals have the ability to be applied holistically.

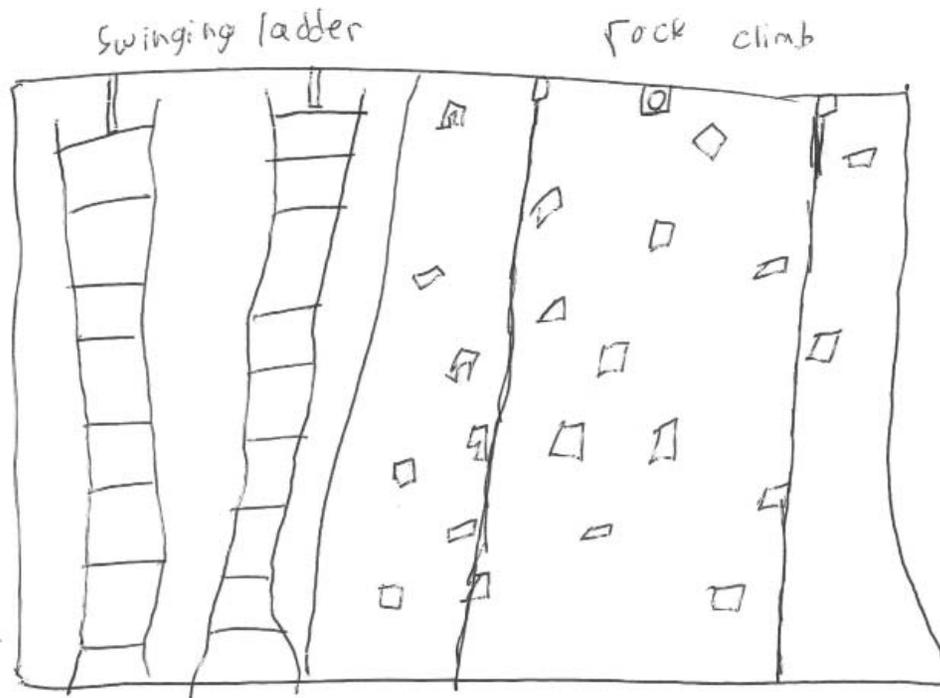


“There should be places to sit in the hallway.”

Andrew G., age 9

Design Strategies that Reduce the Amount of Stress Introduced

The second category includes design strategies that reduce the amount of environmental stress perceived by the child. Some level of environmental stress is unavoidable in all children. The difference between neuro-typical children and children with HFA is that children with HFA lack the coping skills to reduce their own stress level. HFA children have a triad of social, communication and sensory deficits that prevent successful stress reduction. Neuro-typical children can commiserate with a friend, problem solve with a teacher and/or do not even notice sensory stressors. The most effective way to reduce environmental stress in HFA children, and thus help compensate for their deficits, is to provide them with individual choice and control. Thus, once the environmental stressor is identified by the HFA child, they can be empowered to change their individual surroundings to reduce or eliminate the stressor. This can be accomplished in many ways. For children seeking additional sensory input, personal equipment can be provided to the child. For children seeking a reduction in sensory input, access to a place of refuge can be made available upon demand. Another example of this strategy might be to provide a variety of eating environments, ranging from small to large, from noisy to quiet, from dim to bright, etc. In addition, for children who would like to sit by themselves or in smaller groups, moveable seating and/or a variety of social grouping options can be provided. Sometimes, even a variety of seating designs can be beneficial in reduction of stress.



Another strategy that can be made available to a student is the availability of a variety of individual volumetric environments. For example, this can include the opportunity to sit in a cozy window seat or to stand on a raised platform, both within the confines of a classroom and not disturbing the content delivery. Another example could be a choice of play equipment at recess providing opportunities to elevate above the ground plane as seen in the sketch to the left. Also worthy of notation is the artist's desire for swinging movement while engaging in the climb.

"I'd like to exercise here."

Patrick L. age 18



A fourth strategy in the category of reducing perceived stress can include a student's ability to change his or her view. This could mean moving to a different desk facing a wall to minimize distractions or the option of closing a shade or blind to avoid exposure to glare. A final option stems from a HFA child's desire for order and predictability. The appropriate strategy in this instance is to offer a variety of personal storage options. Some children need all clutter to be out of sight. Other children will forget where their supplies are if they are not visible and organized. Some students get anxious when they think that another student can gain access to their possessions. Therefore a variety of open, closed and lockable storage is ideal.

How exactly these strategies are best employed is, again, not something that can be resolved with guidelines. Fundamentals help resolve these needs holistically.

Design Strategies that Relieve the Built-up Stress Accumulated Over Time

The final category includes strategies to relieve stress that builds up during the day due to environmental stressors that cannot be avoided with personal choice and control in the moment they are perceived. These stressors can include being required to eat at a certain time, learn math at a certain time, endure a loud fire drill, or the smell of the air being circulated by the HVAC system. There are two main strategies that are beneficial in reducing this type of built-up environmental stress.

The first strategy is to provide ample and frequent access to nature. Much has been written about this relationship and it is widely agreed upon to reduce built-up stress. It is even more effective if the child is engaged in exercise while outdoors.

The second strategy is to provide ample access to a variety of environments throughout the school day. The strategies presented in this category, variety, will appear to be similar to those of the previous category, individual control, however, the strategy of variety can be used when the child does not have control over their immediate environment, but must endure the stress until it can be relieved. The thought is that the more varied the offered environments are during the day, the better the chance that an HFA child will be able to identify with a stress relieving environment during at least one time during the day. Therefore, being exposed to different environments can be beneficial to the overall reduction of stress build-up. Examples of this strategy include providing a combination of hypo and hyper sensory environments. This can include a big, noisy gymnasium and a quiet alcove in a library. Each child is required

to attend physical education and library each day, but the environments are very different. Another strategy is to provide a variety of social group settings. For example, physical education classes can be quite large and pull out special education instruction is typically small class sizes. A third strategy would be to provide a variety of volumetric environments. For example, the corridors might have high ceilings and the classrooms might have low ceilings. A fourth strategy is to provide a variety of views. Perhaps an art classroom can provide views to nature and a reading class can provide only clerestory views. A fifth strategy would be to provide a variety of community storage options for community displays and equipment. This can translate into a portion of the classroom storage to be exposed while other classroom equipment, such as computer carts, etc. can be concealed in an adjacent storage closet. A final strategy related to this final category of variety is finish selections. In terms of maintenance and security, the user will have a strong opinion regarding the finishes to be used on a project. However, there is still room for variety. Understanding the testimony of several adults with autism there is a delicate balance between neat and institutional or between chaotic and domestic. The finishes need to strike a balance between the two and again, a deep understanding of the specific user must exist in order to be successful.

The multiple strategies above have highlighted the Empathetic Design Fundamental describing the need to provide a variety of environments. Specific guidelines have not been provided. The methods will be evident for each project based on the designers' empathetic understanding.

Conclusion

The above Empathetic Design Fundamentals have been generated from a thorough and thoughtful evaluation of the previous four section topics of this thesis. The fundamentals expand upon the current available design guidelines to include a layer of empathy regarding how the stressors are perceived and how best to strategize the reduction of the perceived stress as well as how to successfully process the stressor that exists with the goal of reducing and/or eliminating it. Due to the triad of deficits, HFA can be the cause of altered perception and processing and, at times, can present seemingly insurmountable challenges in an elementary school environment. However, an empathetically designed educational environment can greatly reduce the stress on children with HFA and thus foster inclusion in a mainstream educational setting. More aspirationally, an empathetically designed environment can inspire joy. It can instill calm. It can rejuvenate. It can foster engagement. I believe that the research and findings found in this thesis will teach and inspire future designers to understand and use empathetic strategies of design that will foster inclusion.



IV. Conclusions

This thesis has presented data on a wide variety of topics and viewpoints to inform and describe the need for empathy. All of this data has been presented with the single goal of drawing attention to the need for empathy when designing educational environments for high functioning autistic (HFA) children in order to foster inclusion in mainstream classrooms. This thesis would not be complete without addressing the question, “Why is this important?”

According to the Center for Disease Control (CDC) in 2014, more than 3.5 million Americans are living with autism, 650,000 of whom have HFA. In addition, according to the CDC in 2010, the number of diagnosed cases of autism and HFA has increased between 6-15% each year since 2002. This rise in diagnosed cases has led to increased awareness and research funding related to ASD. Perhaps the most important knowledge gained from this research to date is the documentation that early intervention can reduce lifelong care costs of those with autism by 2/3. (Jarbrink 2007). This is critical, not because of costs, though that is of course important, but because this data reflects the impact that early intervention can make in the life of a child with ASD, and therefore in the life of a child with HFA. Early intervention methods include therapy, social skills training and strategies to reduce stress in order to prevent manifestation of other mental disorders such as bipolar disorder and schizophrenia. I believe access to these early interventions, some of which can be introduced through empathetic design of inclusive elementary educational environments, will enable children with HFA to have an increased likelihood of becoming self-sufficient adults. That is why this thesis is important.

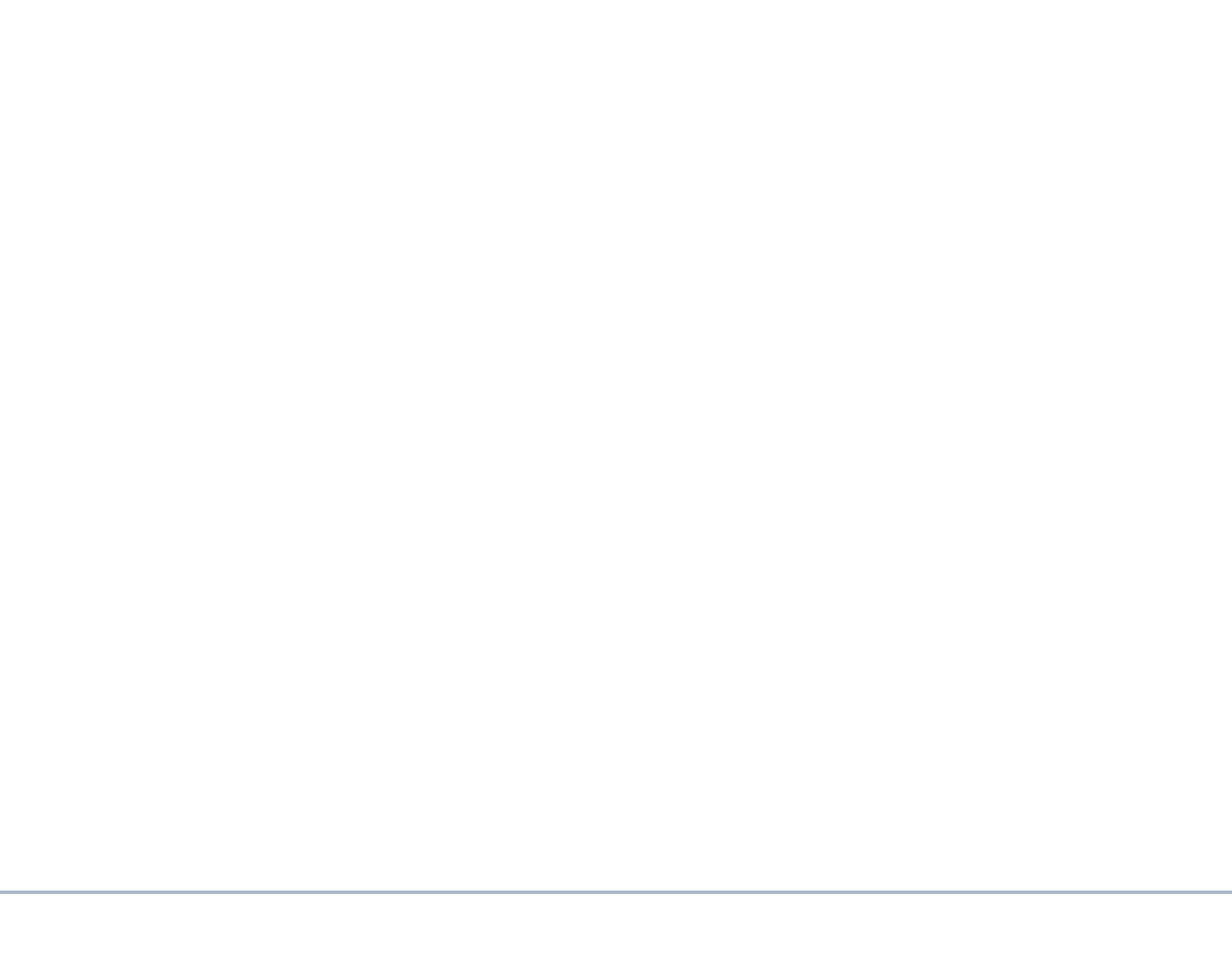
In addition to the reasoning regarding why this thesis topic is important, there are two main conclusions that are gained from this thesis. First is the importance that designers, and specifically architects, learn how to be empathetic designers for their users. Architects are trained to be problem solvers and know that the first step in designing is getting to know the needs of the inhabitants. However, as stated numerous times throughout this thesis, due to communication deficits of young children with HFA, knowing the needs of a student with HFA is not obvious nor gained without effort. Perhaps the biggest irony of this thesis is that the designer needs to use empathy when designing for a population who typically displays deficits in communicating empathy. The effort required to achieve this empathy is great, but it is achievable. As Christopher Beaver states, “the heart of the brief cannot be written down. It has to come from an understanding of the autistic mind; the things that are comforting and give a sense of security, a feeling of space where there are places for being alone and for socializing, an easily understood geography...This understanding can only come with time and patient observation of how children and carers interact” (Beaver 2006).

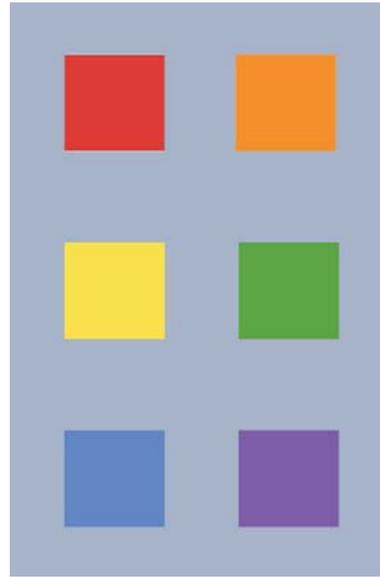
The second conclusion gained from this thesis is that taking this empathetic approach to design will make the architecture better for everyone. This thesis has presented this theory using the population of HFA children in educational environments. However, this theory is not limited to this specific population and environment alone. It is applicable to all inhabitants of all environments. The charge of architects is to build this bridge between the inhabitants and the environment with empathy.

“A bridge can be built between one world and the other, just like that, offering a valuable gift.”

Loes Modderman, co-author of *Dubbelklik*







Empathetic Design: The Exploration



Foreword

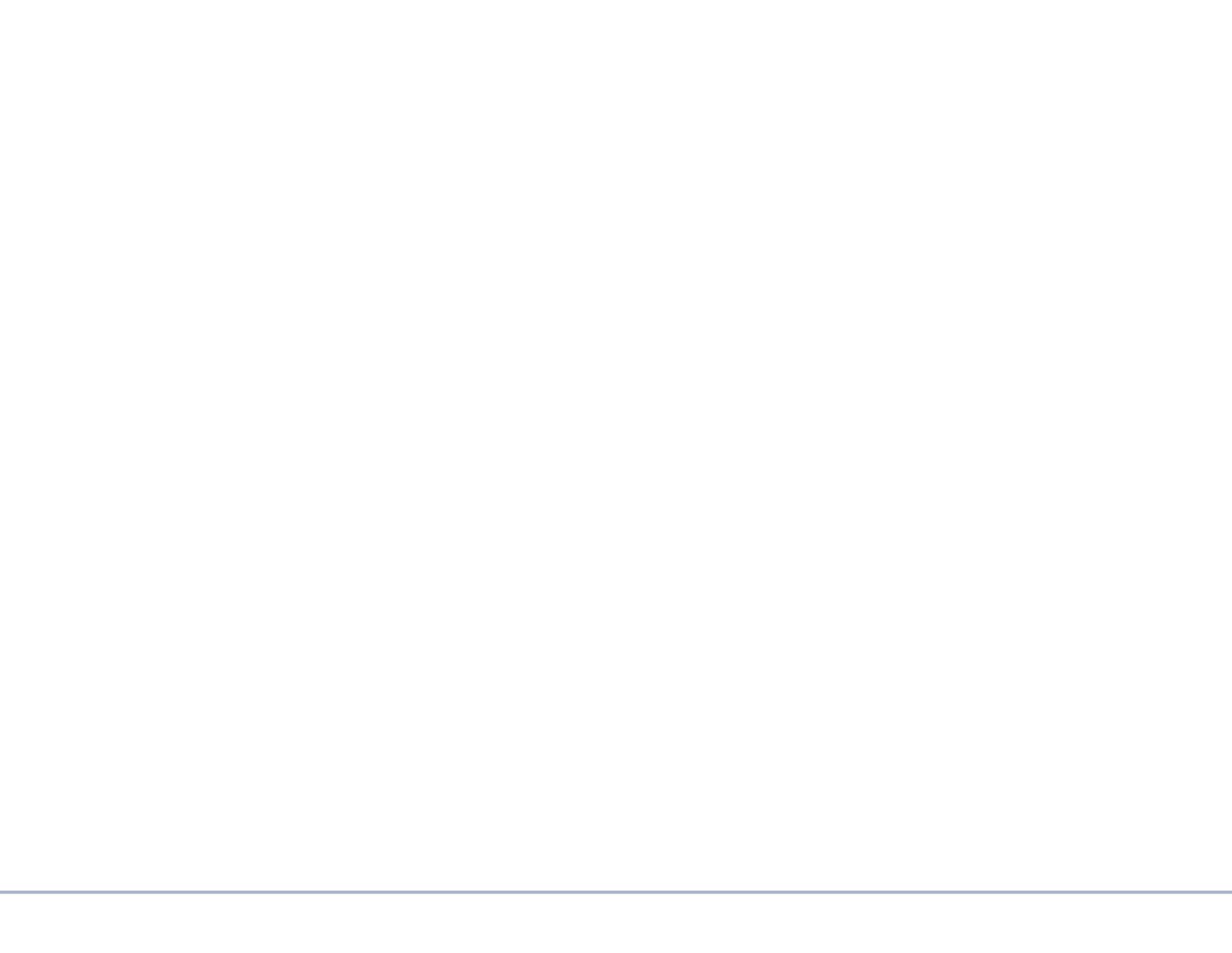
The title of this thesis is “Empathetic Design: How Elementary School Environments Designed to Reduce Stress Can Foster Inclusion of High Functioning Autistic Children.” As stated in the preface of Volume One, the initial goal of this thesis was to create a product that would have immediate value for a design team member involved in inclusive school design. The intent was to harness the power of empathy and create a concise, yet powerful, document that would forever change the way designers design these inclusive environments.

Initially, the format of this thesis was to be a single volume presenting the Theory of Empathetic Design and was to include an “empathy document” as an appendix. Four topics would be researched and presented to support this theory. These topics included education, autism, inclusion, and elementary school environments. However, being an architectural thesis, one of these topics of study, elementary school environments, stood out through the course of research and analysis as having the highest level of potential to support this thesis from an architectural perspective. This topic’s potential was significant, not only because it could be conveyed in both written and graphic formats, but also because it integrated knowledge of all four topics required to understand Empathetic Design. Therefore, as a result of this examination into elementary school environments, a separate thesis volume has been produced specifically dedicated to its exploration. This book, Volume Two, is titled: “Empathetic Design: The Exploration”.

Because the topic of “elementary school environments” is quite broad, the research has been limited to American school building types, and specifically the author’s own classification of these schools into six building types. A description of the six building types is included in Volume One. These types are: Early Traditional, Traditional, Early Modern, Experimental, Green Renewal and Modern. Each building type has been analyzed in this thesis from the viewpoint of how it might cause and/or relieve stress for a current day high functioning autistic child. The causes of stress are identified as environmental stressors and are classified by the author into three categories: sensory stressors, social stressors and mental stressors. The stress relieving strategies are identified as spatial strategies and have also been classified by the author into three categories: strategies that provide opportunity for individual control, physical activity and calming surroundings. Through analysis of the stressors, it became evident that the causes of stress occur primarily during six components of a child’s school day. A description of the six components of a child’s school day that cause stress is also included in Volume One. These components are: Approach, Arrival, Content Delivery, Transition, Recreation and Departure.

The sheer magnitude of analysis potential in this matrix of combinations between school building types and components of the day, specifically in terms of environmental stressors and spatial strategies and the potential for further discovery soon became clear. The challenge was going to be in how the data and analysis could be presented so that the fundamental philosophy of this thesis, the power of empathy, could be internalized by the reader. The presentation of this material must foster further individual discovery beyond the analysis performed by the author. The best way was to make the presentation interactive. Loose folio sheets, each containing one combination of a school building type and a component of a child’s school day would become The Exploration. The title, The Exploration, is meant to have a double meaning. It is meant both to be the result of the author’s thesis “exploration” as well as the “exploration” potential for the reader to gain additional knowledge and understanding for the high functioning autistic student in an inclusive educational environment. The reader will be able to manipulate the folio pages in different arrangements to compare and contrast the data. It is my belief that the active process of exploration will translate into empathy.





I. The Exploration: Empathetic Design in an Educational Environment

This exploration, presented as an appendix, is the culmination of research into the six school building types evident in American history as classified by the author. The examination of these six building types has been combined with an evaluation of six stressful times during a school day for a high functioning autistic child. The hard copy of this volume includes the Exploration as loose folio sheets. Each of the thirty-six folio pages identifies a combination of one building type and one time of day. In addition, each folio page highlights both the environmental stressors due to this building type and time of day as well as several successful spatial strategies that relief these stressors as evident through a present day lens. The loose folio page format is intended to foster further exploration and analysis through the discovery of arrangement.



Exploration Building Type Summary



Early Traditional ■ Traditional ■ Early Modern ■ Experimental ■ Green Renewal ■ Modern

South Pass City School House

South Pass City, Wyoming
1870

Architect: Unknown

Classification: Early Traditional



Agassiz Grammar School

Jamaica Plain, Massachusetts
1893

Architect: Edmund M. Wheelwright

Classification: Traditional

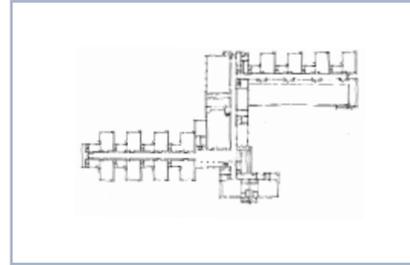


Crow Island School

Winnetka, Illinois
1940

Architects: Perkins, Wheeler and Will and
Eliel and Eero Saarinen

Classification: Early Modern



Mt. Healthy Elementary School

Columbus, Indiana
1972

Architect: Hardy Holzman Pfeiffer Associates

Classification: Experimental

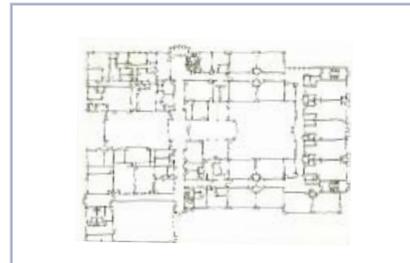


Great Seneca Creek Elementary School

Germantown, Maryland
2006

Architect: Grimm + Parker Architects

Classification: Green Renewal

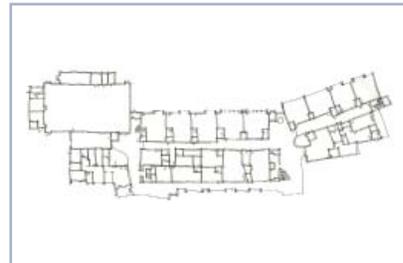


Discovery Elementary School

Arlington, Virginia
2015

Architect: VMDO Architects

Classification: Modern

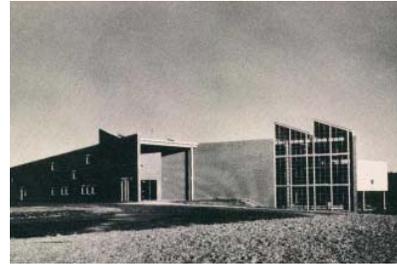


Each school in this Exploration was carefully selected based on several criteria. These criteria include schools that best exemplify the qualities of the building type classification, have sufficient available documentation for analysis, represent the geographic diversity of America, are sited in a variety of rural, sub-urban and urban environments, and finally, schools that have records of longevity in school operation. This sampling is not intended to be comprehensive nor scientific. This thesis uses this small sampling as a starting point for analysis of environmental stressors and spatial strategies. In some instances, a single school did not have sufficient documentation for all folio sheet analysis. In those cases, additional documentation from other schools has been incorporated.



Exploration Building Type Summary

Early Traditional ■ Traditional ■ Early Modern ■ Experimental ■ Green Renewal ■ Modern



All images on this summary folio sheet are also included on various other folio sheets and are noted in the List of Figures included in this volume.

This folio page is a summary of six American school building types as identified by the author. This classification facilitates an analysis of the environmental stressors on high functioning autistic children in educational environments. In addition, this classification presents the spatial strategies employed by these building types that reduce stress in these children in order to foster inclusion. Although these building types span American history, the analysis is from a present day perspective. Analysis of these folio pages is meant to be a personal journey taken by the reader. These pages are loose in order to foster discovery through arrangement and re-arrangement of the pages. This discovery will lead to understanding. Understanding will lead to empathy. Empathy will lead to successful inclusive design.

Approach - Early Traditional



South Pass City School House, Wyoming - 1870

Environmental Stressors



Sensory Stressors

- No covered entry, exposed to elements of sun, rain, wind, while waiting for teacher to admit students
- Dark in early winter mornings



Social Stressors

- Very few students, limited opportunities to make friends
- Children wait outside until teacher opens the door
- Mixed age groupings



Mental Stressors

- Required to arrive at school on time

Spatial Strategies



Individual Control

- Options regarding walking path taken to school



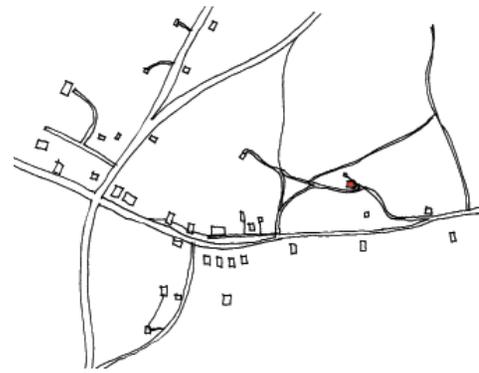
Physical Activity

- All students walked to school, some from as far as 5 miles away

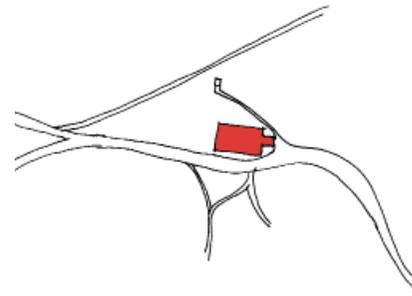


Calming Surroundings

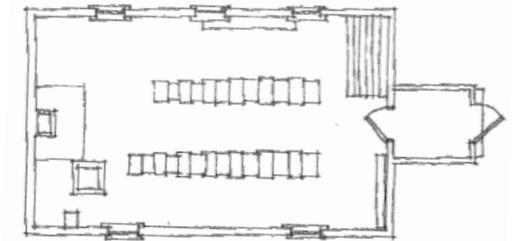
- Surrounded by nature
- Recognizable main entry
- Natural materials used on building exterior
- Neutral color selections
- Layout of the school is apparent upon approach
- Residential scale



Vicinity Plan
003



Site Plan
004



Floor Plan
005

Figure 002

Approach - Early Traditional

South Pass City School House, Wyoming - 1870



Figure 001

The South Pass City School House, when used as a school, was accessible by students by walking paths from the east and west. The school house is located midway up a hillside on the rolling hills of rural South Pass City, Wyoming. Being a one room school house, the scale of the school is small. From the school house, one can see views of nature in every direction. The city of South Pass is quite small, consisting of scattered single story buildings. The school house is built of natural materials, primarily wood. On the east side of the building, there is a single entrance door into a small vestibule as shown above.

Approach - Traditional



Agassiz Grammar School, Massachusetts - 1893

Environmental Stressors



Sensory Stressors

- Exposed to elements of sun, rain, wind when waiting for bell to ring



Social Stressors

- Children wait outside until the bell rings



Mental Stressors

- Large scale building
- Formal architecture
- Required to arrive at school on time
- Over 500 students entering the building at the same time

Spatial Strategies



Individual Control

- Options regarding walking path taken to school
- Design included multiple ways to access school building
- Covered entries provide places to wait prior to entry



Physical Activity

- All students walked to school



Calming Surroundings

- Covered entries provide transition into school building
- School starts at the same time each day, predictable
- Views of nature
- Recognizable main entry
- Natural materials used on the building exterior
- Neutral color selections
- Layout of school is apparent upon approach
- Staggered approach to the building due to the play area availability before school



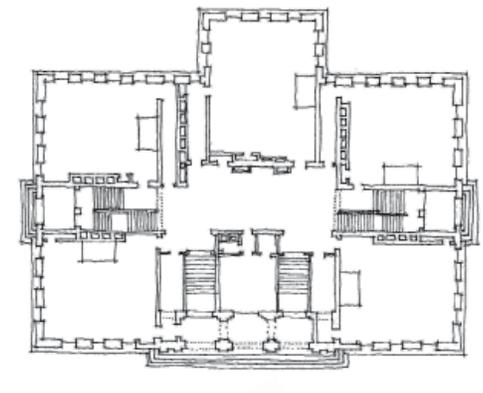
Figure 007



Vicinity Plan
008



Site Plan
009



Floor Plan
010

Approach - Traditional

Agassiz Grammar School, Massachusetts - 1893

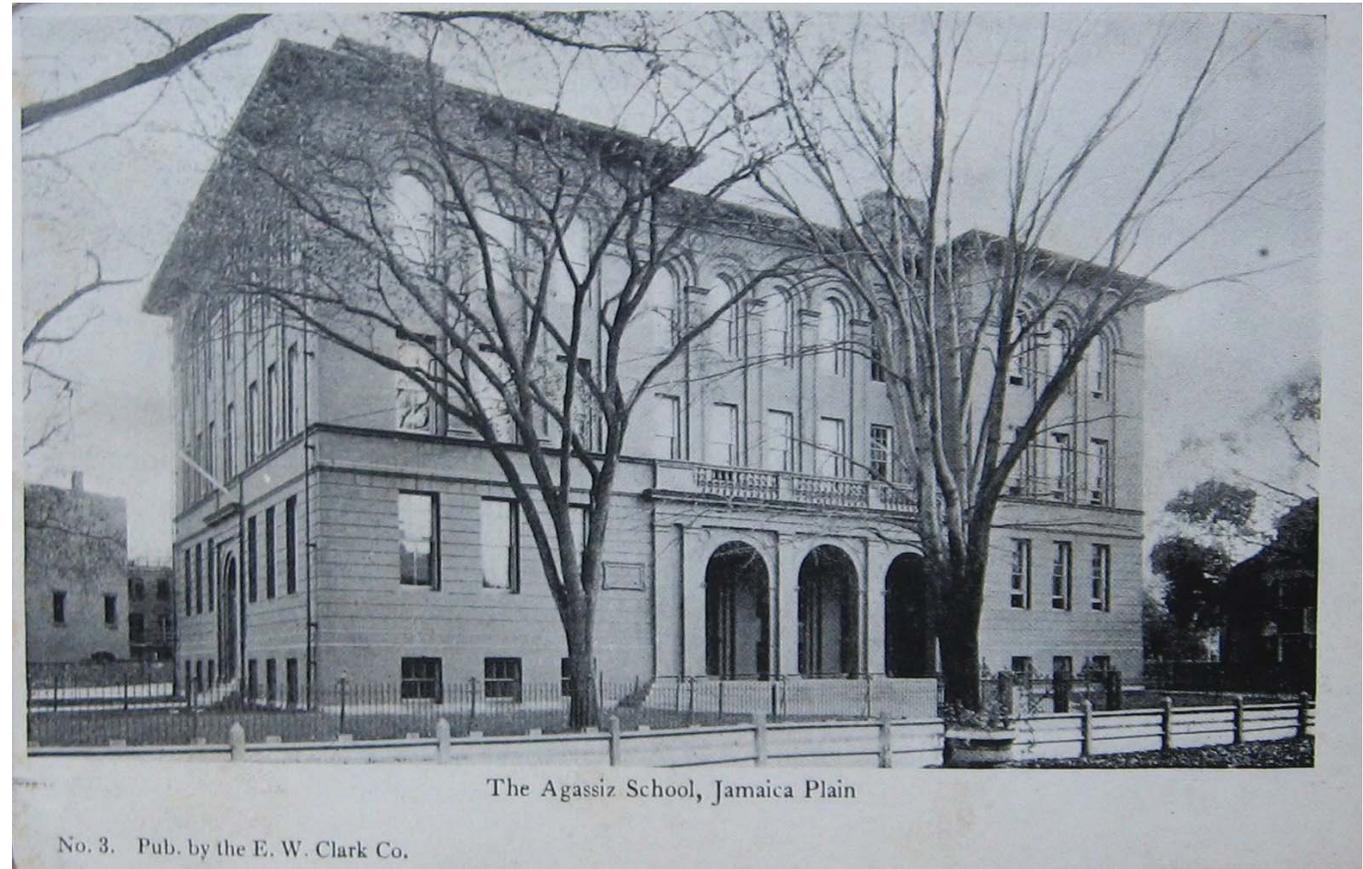
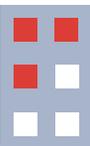


Figure 006

Agassiz Grammar School was a three story school with a basement located on a corner lot in an urban area of Boston, Massachusetts called Jamaica Plain. It was located in a buffer zone between a commercial area of Jamaica Plain and a residential neighborhood to the north. About 560 students walked to school from the surrounding neighborhood. The exterior of the school was formal, symmetrical and of a large scale for the neighborhood. The building was made of brick with terra cotta trim and a slate roof with copper gutters and downspouts. The property was fenced and included grassy areas as well as dirt areas for play. Students were encouraged to play on school grounds prior to entering the building in the morning when the bell rang. There was a northern exposure balcony over the main entry doors.

Approach - Early Modern



Crow Island School, Illinois - 1940

Environmental Stressors



Sensory Stressors

- Smell of bus fumes at entry due to proximity of bus loop



Social Stressors

- Social stress of school bus, unstructured time



Mental Stressors

- Required to arrive at school on time

Spatial Strategies



Individual Control

- Design includes multiple ways to access school building
- Options regarding walking path taken to school
- Covered porch provides a place to wait prior to entry



Physical Activity

- Walking and biking to school are options



Calming Surroundings

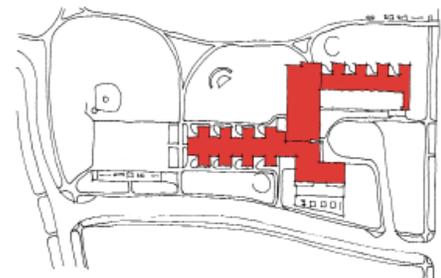
- Residential scale
- Predictability of drop off lanes
- School starts at the same time each day, predictable
- Views of nature
- Clear main entry identified by large clock tower
- Covered entry provides transition into school building
- Natural materials used on the building exterior at the front entry
- Color selections mostly neutral at main entry
- Staggered approach to the building due to the play area availability before school



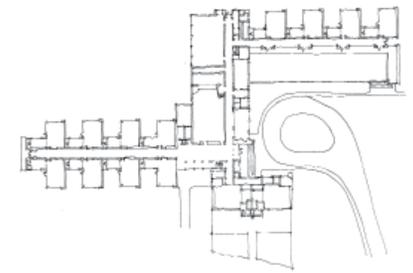
Figure 012



Vicinity Plan
013

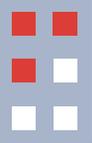


Site Plan
014



Floor Plan
015





Approach - Early Modern

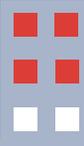
Crow Island School, Illinois - 1940



Figure 011

Crow Island School is located on a suburban residential neighborhood site in Winnetka, Illinois. Children walk and ride bikes to school. In addition, the school has one main drop off for cars and buses. Staff parking is provided on the street with angled parking. The single vehicular drop off has a significant amount of cue space for morning drop off. The main entrance is identified by an elegant, off-center clock tower, a contrast to the relatively small scaled school building. The entry is also framed by a generous stair leading to the shelter of a covered porch. The original design allowed for many entrances, including through the primary school play terrace and each of the individual classrooms. However, due to security concerns, the school now uses the main entrance for the general population and a secondary entrance for the kindergartners to the right.

Approach - Experimental



Mt. Healthy Elementary School, Indiana - 1972

Environmental Stressors



Sensory Stressors

- Sensory stimulation from almost 700 students arriving at the same time, most of whom are using the same entrance
- Smell of bus fumes at entry due to proximity of bus loop



Social Stressors

- Almost 700 students arriving at the same time
- Social stress of school bus, unstructured time



Mental Stressors

- Limited choice regarding entry procession
- Large scale building
- Entry is farthest point from the street entrance, not easily visible on approach
- Limited transition provided by entry sequence
- Required to arrive at school on time
- Layout of school is not apparent upon approach

Spatial Strategies



Individual Control

- Little to no control



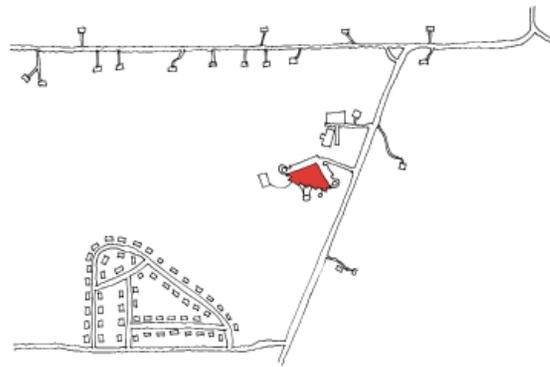
Physical Activity

- Little to no physical activity during approach, all students arrive by bus

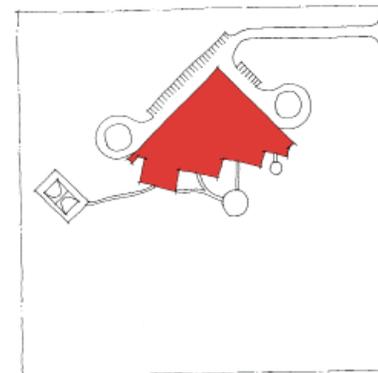


Calming Surroundings

- Predictability of drop off lanes
- School starts at the same time each day, predictable
- Views of nature
- Neutral color selections
- Long approach for buses to main entry provides transition



Vicinity Plan
018



Site Plan
019



Floor Plan
020

Figure 017

Approach - Experimental

Mt. Healthy Elementary School, Indiana - 1972

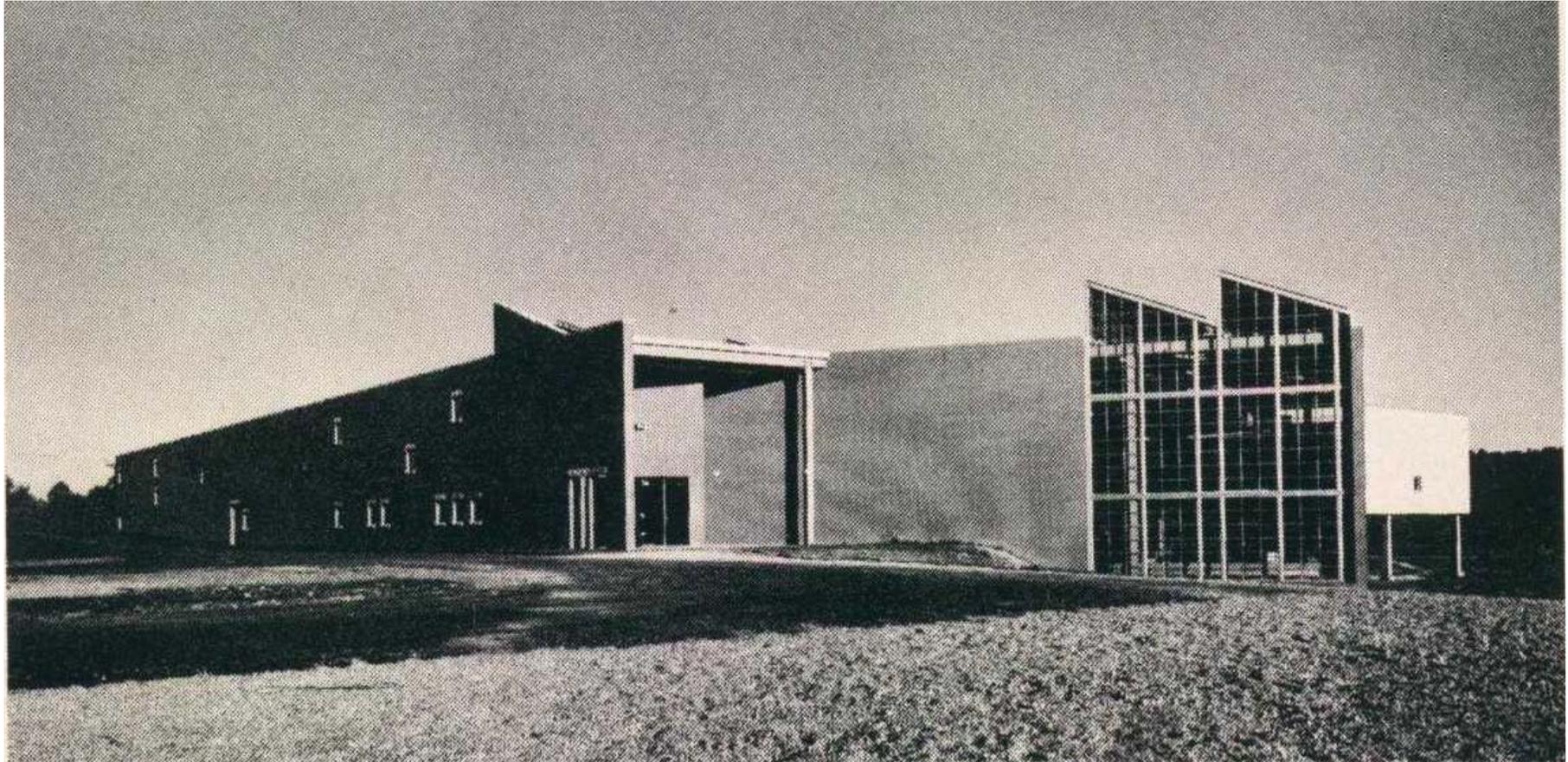
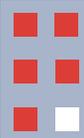


Figure 016

Mt. Healthy Elementary School is located on a gradually sloping sixteen acre site in rural Columbus, Indiana. Two of the facades are brick and have relatively minimal window openings trimmed with limestone lintels. The remaining third side of the triangular shaped school reveals the complex geometric forms of the open space plan inside, shown on the right side of the image above. Because the school is in a rural area, all of the students arrive to the school by bus, thus the need for two bus loops in the original site design. The school has two entrances; the main entry for the general school population as shown above, and a secondary entry for the kindergartners on the opposite side of the school. The main entry is a fairly large scale, double height form with a sculptural canopy.

Approach - Green Renewal



Great Seneca Creek Elementary School, Maryland - 2006

Environmental Stressors



Sensory Stressors

- Car honking in drop off loop
- Sensory stimulation from over 700 students arriving at the same time using the same entrance
- Smell of bus fumes at entry due to proximity of bus loop
- Glare from copper panels



Social Stressors

- Over 700 students arriving at the same time
- Social stress of school bus, unstructured time



Mental Stressors

- Limited choice regarding entry procession
- Large paved area in front of school highly visible during approach
- Large scale building
- Required to arrive at school on time
- Formal architecture

Spatial Strategies



Individual Control

- Canopy provides a place to wait prior to entry
- Choice of walking, biking, bus or car
- Options regarding walking path taken to school



Physical Activity

- Walking and biking to school are options



Calming Surroundings

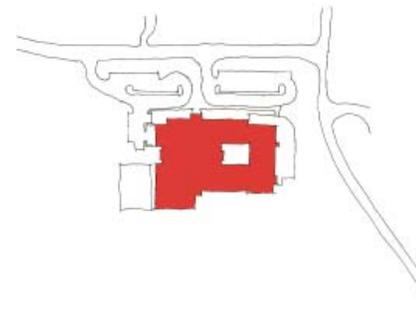
- Clear main entry identified by large canopy
- Predictability of drop off lanes
- Shaded / shelter of entrance canopy
- Canopy provides transition into school building
- School starts at the same time each day, predictable
- Views of nature
- Recognizable main entry



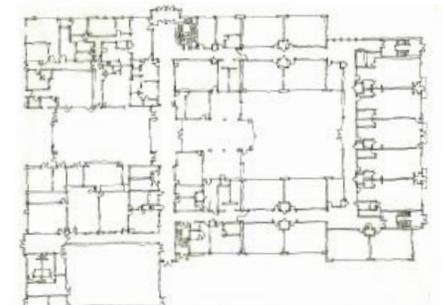
Figure 022



Vicinity Plan
023



Site Plan
024



Floor Plan
025



Approach - Green Renewal

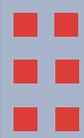
Great Seneca Creek Elementary School, Maryland - 2006



Figure 021

Great Seneca Creek Elementary School is located on a relatively flat corner lot in a residential neighborhood in Germantown, Maryland. It is a two story school and has a significant presence in the neighborhood. It is adjacent to a wetlands area and therefore has a significant amount of views to nature. Students arrive on site by walking, bicycling, car and bus. All of these methods of approach lead to one main entry. The main entry is north facing and has a bowed entry canopy reducing the scale of the two story entry to more of a residential scale. The materials of the school are brick and copper and aluminum paneling. There is a significant amount of signage visible upon approach to the school due to the large number of vehicles arriving at the site in one general location. However, the bus and car drop off lanes are isolated from each other and from the staff parking for safety reasons.

Approach - Modern



Discovery Elementary School, Virginia - 2015

Environmental Stressors



Sensory Stressors

- Car honking in drop off loop
- Sensory stimulation from over 700 students arriving at the same time, most of whom are using the same entrance



Social Stressors

- Over 700 students arriving at the same time
- Social stress of school bus, unstructured time



Mental Stressors

- Layout of the school is not apparent as one approaches due to the topography
- Limited choice regarding entry procession
- Required to arrive at school on time

Spatial Strategies



Individual Control

- Canopy provides a place to wait prior to entry
- Choice of walking, biking, bus or car



Physical Activity

- Walking and biking to school are options
- Climb hillside to get to main entry



Calming Surroundings

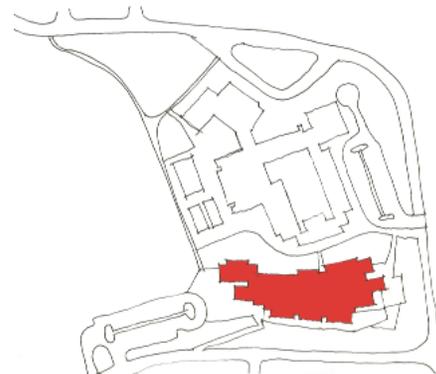
- Bus fumes isolated to secondary entrance at remote drop off
- Clear main entry identified by large canopy
- Predictability of drop off lanes
- Long approach/transition for the cars to main entry
- Large grassy/plated area along approach
- Shade / shelter of entrance canopy
- Canopy provides transition into school building
- View of play fields during approach
- School starts at the same time each day, predictable
- Natural materials used on the building exterior
- Color selections mostly neutral at main entry with minimal bold color at the oculus in the canopy for interest / sensory stimulation
- Recognizable main entry



Figure 027



Vicinity Plan
028



Site Plan
029



Floor Plan
030





Approach - Modern

Discovery Elementary School, Virginia - 2015



Figure 026

Discovery Elementary School is located on the corner of two residential streets in Arlington, Virginia. It shares a site with a middle school. Discovery Elementary School is located on a sloped portion of the site and as a result, consists of several one and two story levels in order to maintain a more residential scale. The corner includes signage identifying the elementary school and middle school main entrances. The hillside is also planted with a variety of tree species. Students arrive on site by walking, bicycling, car and bus. There are separate car and bus drop off loops and a system of sidewalks. Walkers, bike riders and car riders are all encouraged to enter through the main entrance on the west side of the school. Bus riders enter through a secondary entrance as this bus loop is shared with the middle school. The main entrance is identified by a large entrance canopy.

Arrival - Early Traditional

South Pass City School House, Wyoming - 1870

Environmental Stressors



Sensory Stressors

- Limited light on overcast days
- Glare from the two southern windows
- Varying light levels based on window spacing
- Air circulation from operable windows only
- Drafty
- Little control over thermal comfort



Social Stressors

- Children wait outside until teacher opens the door
- Mixed age groupings



Mental Stressors

- Teacher in control of when day begins
- Limited views to outside for those not near a window
- Belongings hung up on wall, exposed

Spatial Strategies



Individual Control

- Little to no control



Physical Activity

- Limited movement once in classroom



Calming Surroundings

- Residential scale
- Clear organization, simple building, no signage required
- Transition provided by vestibule
- Views to outside by children seated next to windows
- Natural materials used inside, mostly pine
- Sounds and smells of wood burning stove

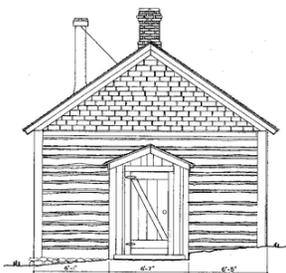
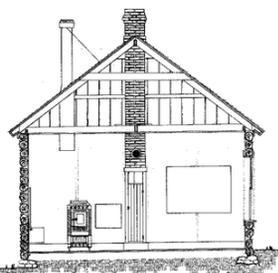
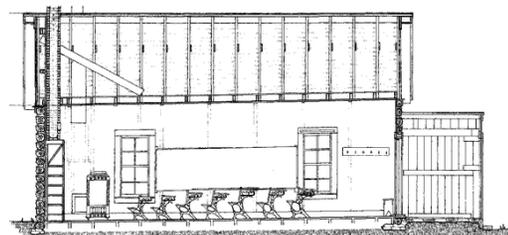


Figure 032



033



034



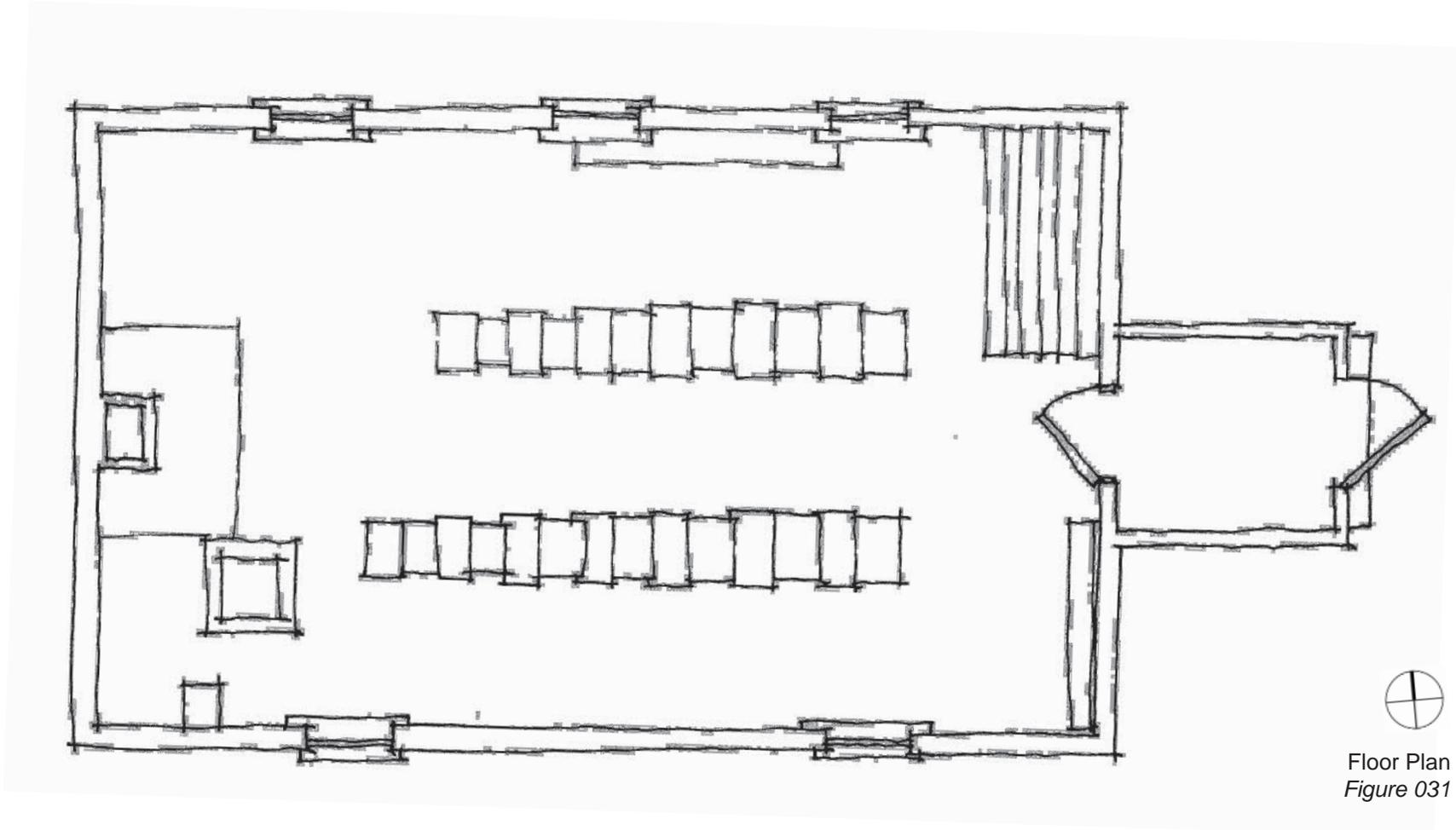
035



036

Arrival - Early Traditional

South Pass City School House, Wyoming - 1870



The design of the South Pass City School House is a simple form. One enters through the vestibule on the east side of the school. Upon entry, the students and the teacher would hang their belongings on pegs located on the perimeter walls. The teacher would walk to the front of the class to her desk while the students would file in and sit according to age, youngest in the front, oldest in the back. Because students typically attended school during the winter months when their help was not needed on the family farm, the teacher arrived quite early to start a fire in the wood burning stove. Students were expected to fetch the fire wood and water upon their arrival.

Arrival - Traditional

Agassiz Grammar School, Massachusetts - 1893

Environmental Stressors



Sensory Stressors

- Glare in stairways and hallways
- Tall, narrow windows distribute natural light unevenly
- Noise created by fans which provided only ventilation
- Plaster ceilings provide little acoustic control
- Lavatories ventilated by "natural" method
- Loud bells would ring to signal the start of the school day
- Drafty
- Over 500 students arriving at the same time, a good deal of sensory stimulation
- Limited light on overcast days
- Little control over thermal comfort



Social Stressors

- Crowded staircases leading to classrooms
- Children wait outside until the bell rings



Mental Stressors

- Scale of entry
- Belongings hung up in wardrobe, exposed

Spatial Strategies



Individual Control

- Choice of entries
- Moveable translucent curtains in original design



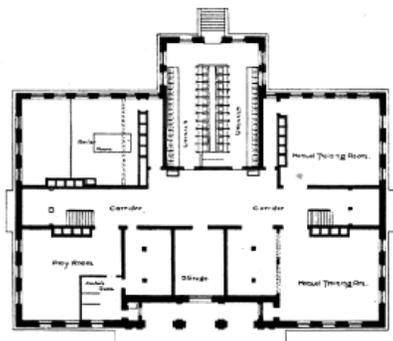
Physical Activity

- Climb stairs to arrive at classroom

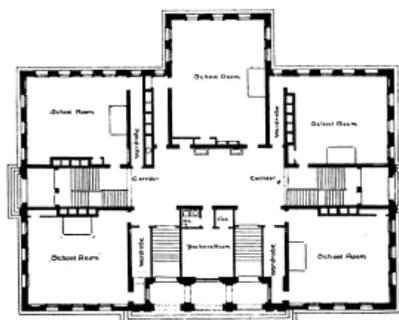


Calming Surroundings

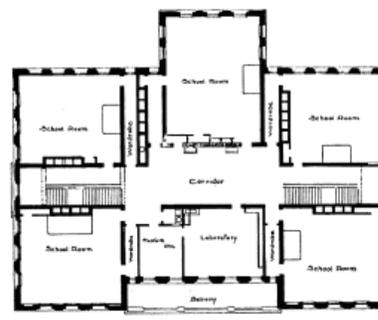
- Indirect radiant heating relatively quiet
- Every stair, hallway and wardrobe received natural light and had access to views
- Natural materials at entry porches: terra cotta, marble and blue stone
- Natural materials in hallways, ash walls
- Olive green paint on all walls
- Predictable schedule
- Clear organization
- Time to determine path while climbing the interior entry stairs
- Generous transition to classroom provided by the wardrobe



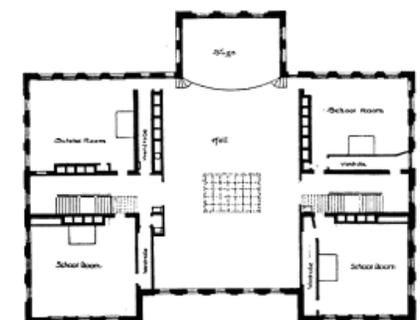
Basement Floor Plan
Figure 038



First Floor Plan
039



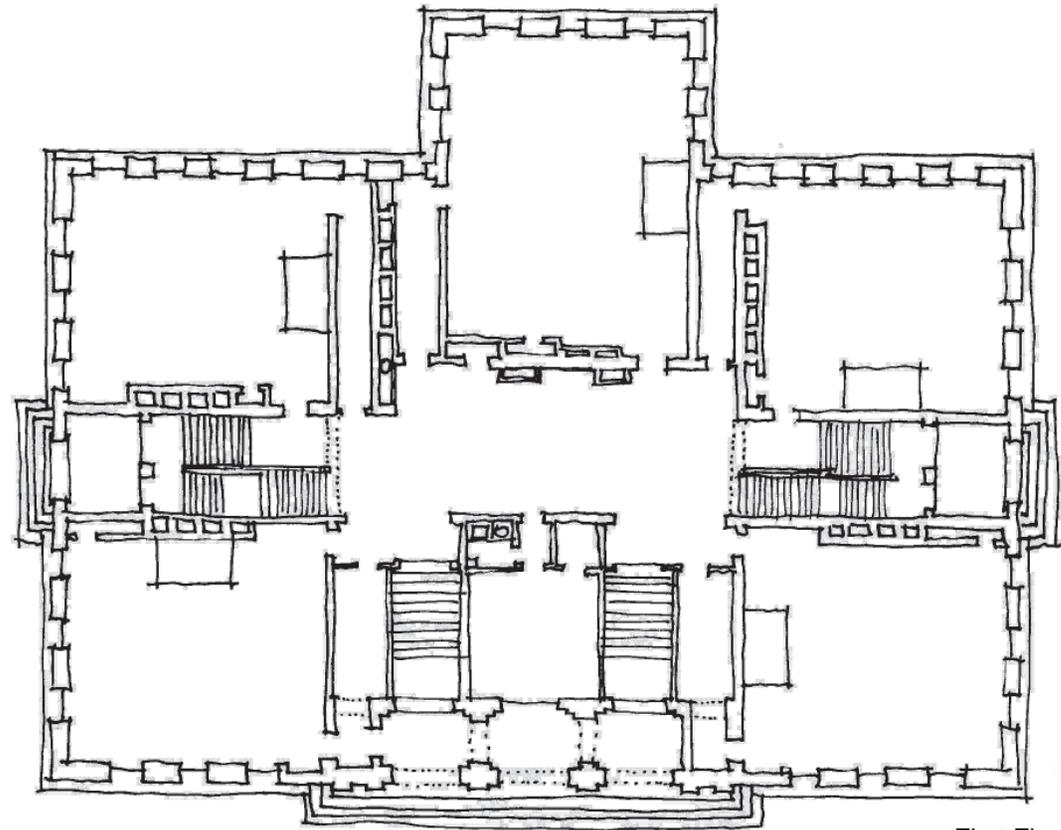
Second Floor Plan
040



Third Floor Plan
041

Arrival - Traditional

Agassiz Grammar School, Massachusetts - 1893



First Floor Plan
Figure 037

Agassiz Grammar School was located on a corner lot. Students were permitted to enter the building through any of the three first floor entrances, all of which included several exterior stairs. All entry sequences included a covered outdoor vestibule. Once inside the school, students were to climb ten more stairs to arrive at the first floor level main lobby space. The school building included three stories and a basement. All classrooms on each level were located directly off the main circulation corridor which was flanked on both sides by the two main stairways. All spaces were 12'-15' tall. Consideration was given to aid the smallest children in their arrival to their classrooms as the kindergarten and first grade classes were on the first floor. Students were expected to leave their personal belongings in the walk-through wardrobes prior to entry into the classroom.

Arrival - Early Modern



Crow Island School, Illinois - 1940

Environmental Stressors



Sensory Stressors

- Odors possible from imperfect ventilation system
- Glare from eastern exposure into main lobby
- Little acoustical control in the corridors



Social Stressors

- ...



Mental Stressors

- Little transparency into rooms adjacent to corridor
- Quick decision required upon entry regarding direction to walk
- Little transition from corridor into classroom

Spatial Strategies



Individual Control

- Kindergartners can use separate entrance
- Designed to have choice of entries
- Each student gets his or her own locker or cubby



Physical Activity

- Walk through the corridor to arrive at classroom



Calming Surroundings

- Residential scale
- Natural materials in the corridors, brick and wood
- Fireplace in the entry lobby corridor
- Clear organization once familiar with path
- Natural daylight is plentiful in the corridors
- Long linear vista views common in circulation path
- Younger children have unique entry into the building
- Predictable schedule
- Potted trees in the lobby



Figure 043



044



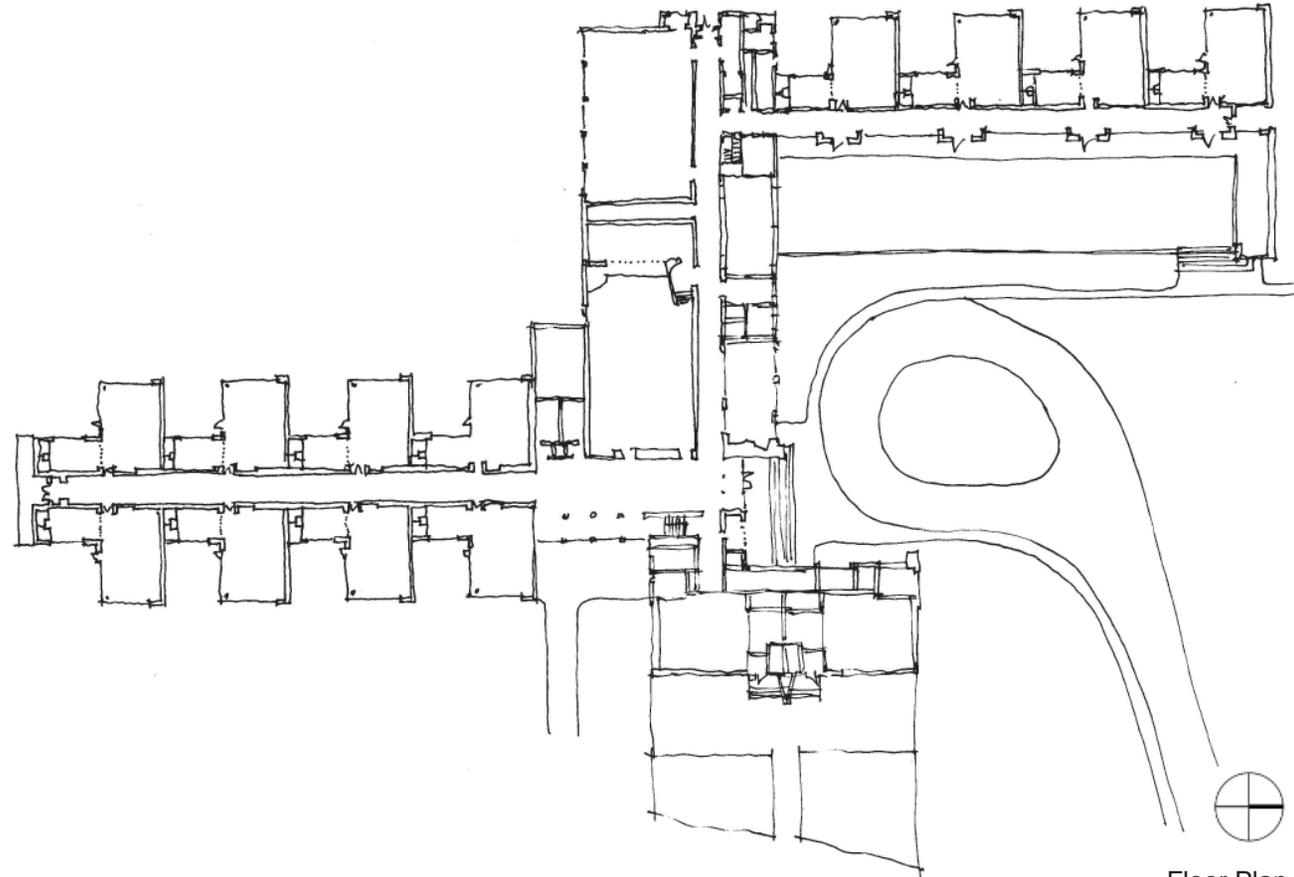
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046

Arrival - Early Modern

Crow Island School, Illinois - 1940



Floor Plan
Figure 042

Crow Island School is located on a wooded lot adjacent to a public park. It is a one story brick structure with a basement level. The front entrance is identified by an off-center clock tower and a wide set of stairs, allowing for the basement level to have natural day lighting. Upon entrance into the building, one is greeted by an informal “living room” space, emphasizing the residential scale and design of the school facility. The corridors connecting the program spaces are 9-foot tall, a drastic reduction from the traditional school corridor ceiling heights of 12-15 feet. The design of the school is organized by a central “public use” spine from which three classroom wings emerge, one of which being the kindergarten wing with its own entrance. The other two wings are organized by grade level.

Arrival - Experimental



Mt. Healthy Elementary School, Indiana - 1972

Environmental Stressors



Sensory Stressors

- Almost 700 students arriving at the same time, a good deal of sensory stimulation
- Noise from fluorescent fixtures in corridors
- No acoustic isolation of a corridor
- Lots of bold colors upon arrival
- Ventilation and thermal comfort challenges in volume space
- Glare from skylights



Social Stressors

- Almost 700 students arriving at the same time



Mental Stressors

- Large school with no separation
- Limited natural materials visible during arrival sequence

Spatial Strategies



Individual Control

- Kindergartners can use separate entrance
- Each student gets his or her own cubby
- Variety of ceiling heights in the arrival sequence



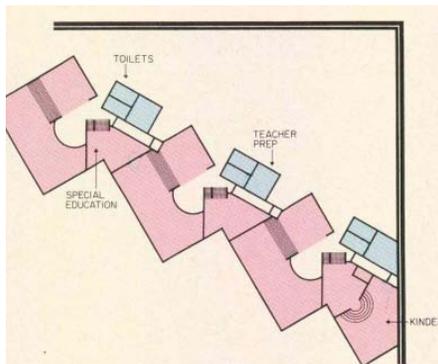
Physical Activity

- Walk through the school to arrive at cluster
- Six levels in each cluster, separated by stairs

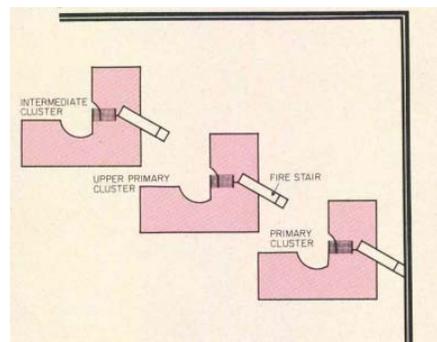


Calming Surroundings

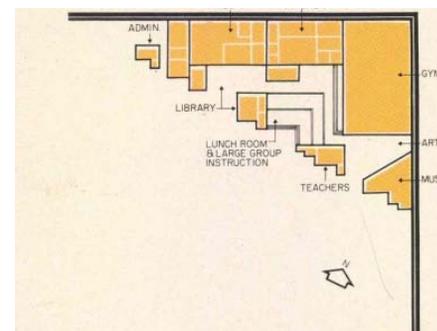
- No bells ringing
- Ample opportunity for transition as view and vistas are significant inside building
- Clear signage and way finding graphics
- Natural daylight is plentiful in the corridors via clerestory lights
- Circulation is clear and orienting upon arrival
- Younger children have unique entry into building
- Predictable schedule
- Long linear vista views common in circulation path
- Nodes providing relief in circulation path
- Sound absorbing carpet used, effective in some spaces



Lower Level Plan
Figure 048



Upper Level Plan
049



Main Level Plan
050



Spatial amalgam
Composite Plan
051

Arrival - Experimental

Mt. Healthy Elementary School, Indiana - 1972



Floor Plan
Figure 047

The original plan for Mt. Healthy Elementary School included one main entrance for grade level students and one secondary entrance for kindergartners. Upon arrival at the main entry, students encounter the administration area with partial height partitions, an indicator of the open forms that will follow upon further discovery. In addition, standing at the main entry lobby, students can see all the way through to the opposite side of the building, which doubles as the kindergarten entry. The undefined spine of the building is 24'-6" high and provides access to each of the four educational clusters. Each of the three grade level clusters are clearly identified by large letters: "A", "B" and "C". The kindergarten cluster is identified with the complete lower case alphabet.

Arrival - Green Renewal



Great Seneca Creek Elementary School, Maryland - 2006

Environmental Stressors



Sensory Stressors

- Over 700 students arriving at the same time, a good deal of sensory stimulation
- Loud bells signal the start of the school day
- Noise from fluorescent fixtures in corridors



Social Stressors

- Over 700 students arriving at the same time



Mental Stressors

- Bells ring 10 minutes prior to start of day and then again at start of day
- Large school with many rooms
- Little transparency into rooms adjacent to corridor - little opportunity for transition
- Limited natural materials visible during the arrival sequence

Spatial Strategies



Individual Control

- Multiple options to arrive at classroom, interior loop design
- Each student gets his or her own locker or cubby
- Time to unpack built into daily schedule
- Variety of ceiling heights in the arrival sequence



Physical Activity

- Walk through the corridor and/or up stairs



Calming Surroundings

- Clear way finding and graphics
- Natural daylight plentiful in the corridors, central courtyard
- Circulation is clear and orienting upon arrival
- Ventilation and low VOC design results in limited odors
- Predictable schedule
- Building HVAC highly commissioned and regulated
- Lenses on light fixtures to prevent hotspots
- Long linear vista views common in corridor design
- Nodes providing relief in corridors
- Sound absorptive ceiling tile in corridors
- Mural of nature, calming colors at entry lobby
- Open stair at entry for student use



Figure 053



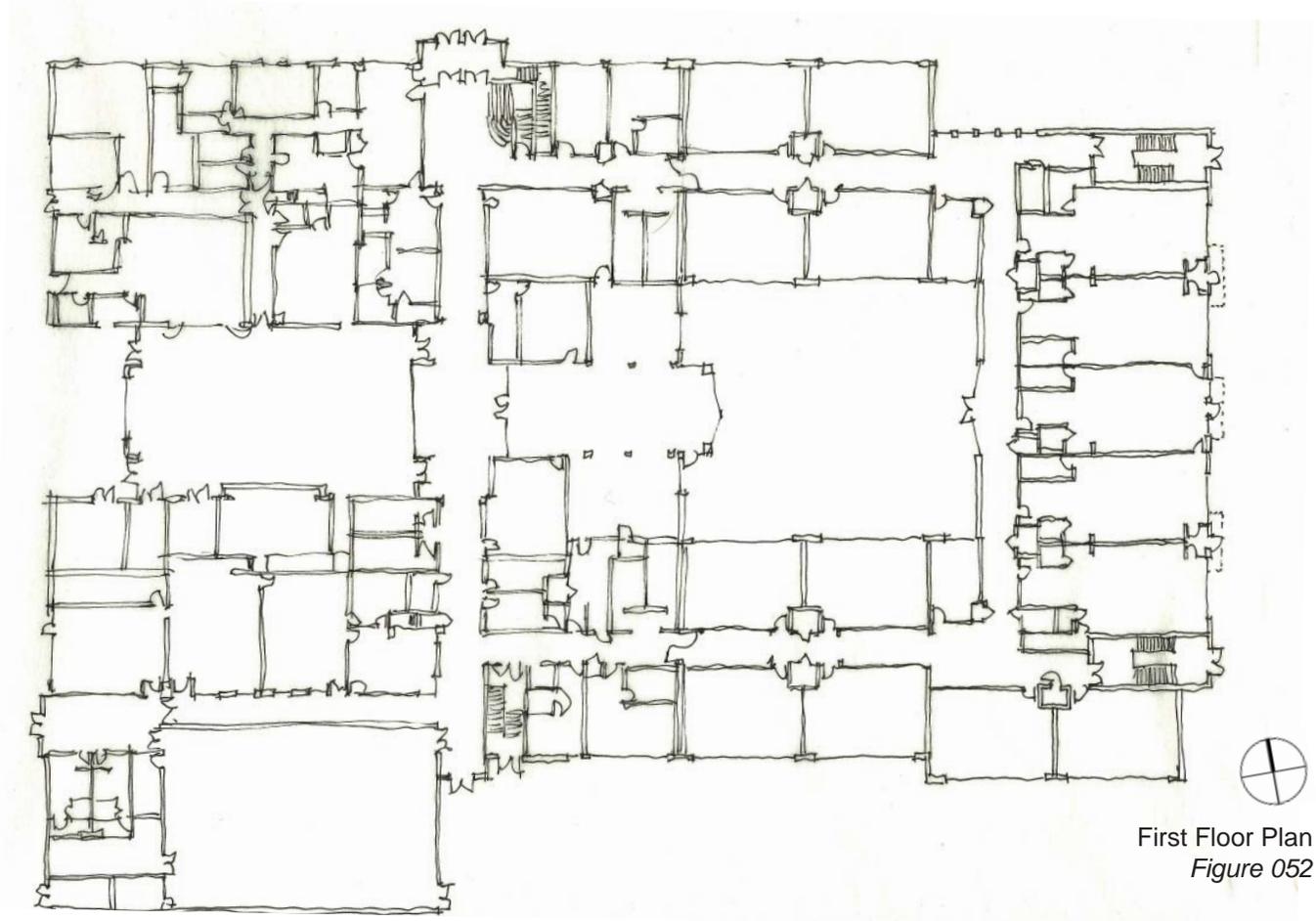
054



055

Arrival - Green Renewal

Great Seneca Creek Elementary School, Maryland - 2006



The main entrance to the Great Seneca Elementary School is sheltered by a large metal entrance canopy. The main entry doors admit students to the school facility and while school is in session, visitors are directed to enter the facility through the main office for security reasons. Once inside the building, one encounters a long, main hallway terminating in views to the exterior. This is the organizing two-story spine of the building. Two levels of classrooms, grouped by grade level are on the east side and one level of more public, noisy, after hours uses such as the cafeteria, gymnasium and music suite are located to the west. The circulation is simple and predictable.

Arrival - Modern



Discovery Elementary School, Virginia - 2015

Environmental Stressors



Sensory Stressors

- Over 700 students arriving at the same time, a good deal of sensory stimulation
- Significant glare at the south facing front indoor entry sequence.
- Loud bells signal the start of the school day
- Smells from breakfast perceivable due to the open cafeteria



Social Stressors

- Over 700 students arriving at the same time



Mental Stressors

- Bells ring 10 minutes prior to start of day and then again at start of day
- Large school with many rooms



Spatial Strategies

Individual Control

- Multiple options to arrive at classroom, interior loop design
- Variety of ceiling heights in the corridors and arrival sequence
- Each student gets his or her own locker or cubby
- Time to unpack built into daily schedule
- Option to sit and read prior to entry into classroom
- Refuge options in corridors



Physical Activity

- Walk corridor, up stairs and ramps, slide down the slide



Calming Surroundings

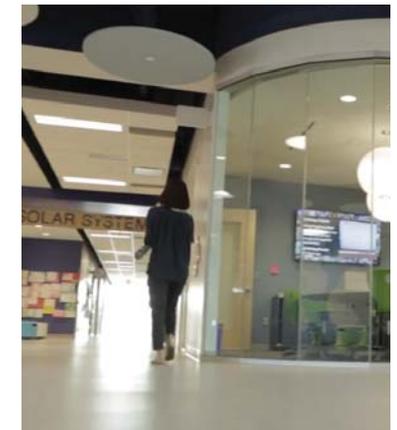
- Clear way finding and graphics, clear circulation, orienting
- Natural daylight is plentiful in the corridors
- The levels act as thresholds between spaces
- Ventilation and low VOC design results in limited odors
- Views of trees during arrival at main entry corridor
- Younger children take unique path upon entry into building
- Building HVAC highly commissioned and regulated
- LED fixtures in corridors, less noise than fluorescent fixtures
- Lenses on light fixtures to prevent hotspots
- All rooms have windows providing views prior to entry
- Long linear vista views common in corridor design
- Windows providing transparency at nodes in corridors



Figure 057

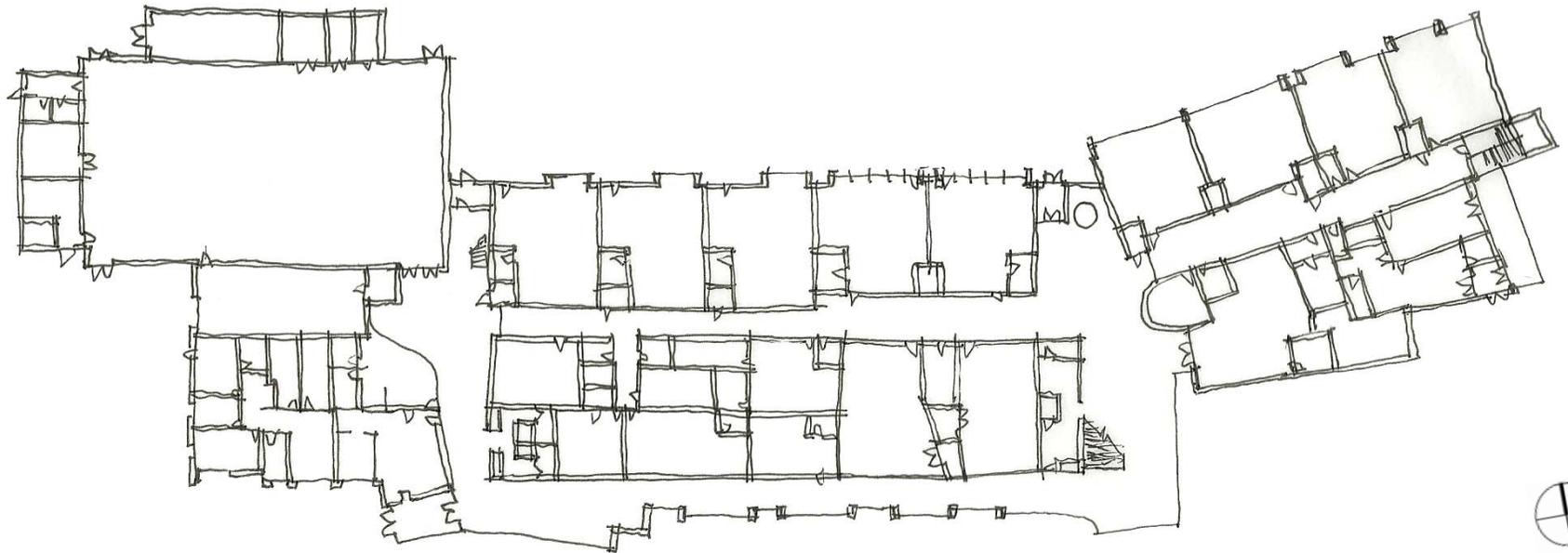


058



059

Discovery Elementary School, Virginia - 2015



Main Level Plan
Figure 056

The main entrance to the Discovery Elementary School is sheltered by a large entrance canopy made of wood and includes an oculus trimmed in red metal. The main entry doors admit students to the school facility and while school is in session, visitors are directed to enter the facility through the main office for security reasons. Once inside the building, one encounters a linear view of both the stairs leading to the lower kindergarten floor level and the main level corridor terminating with natural light as seen through the upper level of the cafeteria. The colors are bright and fairly neutral. Signage and way finding strategies are clear and lead older students to their classrooms on the upper level. The building is organized by grouping the grade levels, the youngest children on the lowest level, the oldest on the upper level. Central open stairs and a slide are the main vertical circulation, while fire stairs and elevators provide additional vertical circulation options.

Content Delivery - Early Traditional



South Pass City School House, Wyoming - 1870

Environmental Stressors



Sensory Stressors

- Limited light on overcast days
- Glare from the two southern windows
- Varying light levels based on window spacing
- Air circulation from operable windows only
- Drafty
- Little control over thermal comfort
- Little relief from smells of classmates
- Noise from outside transmitted through walls / windows



Social Stressors

- Limited social interactions
- Corporeal punishment
- Humiliation of punishment
- No choice in seating location
- Mixed age groupings



Mental Stressors

- Teacher in complete control of students
- Limited views to outside for those not near a window
- No control over environment
- No opportunity for refuge in classroom

Spatial Strategies



Individual Control

- ...



Physical Activity

- Movement for the younger children included cleaning the classroom and washing the black boards
- Movement for the older students included fetching the firewood and water
- All students were brought to the benches for small group instruction
- Students could be dismissed to use the latrine outside and a little bit up the hill



Calming Surroundings

- Residential scale
- Views to outside for children seated next to windows
- Natural materials used inside, mostly pine
- Predictable transitions to recess and lunch
- Sounds and smells from wood burning stove
- Multiple exposures - day lighting and ventilation

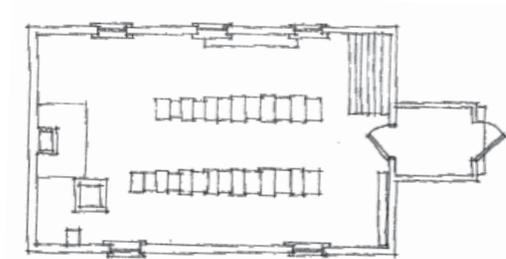


Figure 061



062



063



064

Content Delivery - Early Traditional

South Pass City School House, Wyoming - 1870



Figure 060

The educational content at the South Pass City School House was delivered primarily in the school house building. All students were in the same room and sat in fixed seating by order of age, the youngest students at the front and the oldest students in the rear. There was typically one teacher who administered to all the students. Because there was no indoor plumbing or heat, the older students were typically in charge of getting the firewood and the water needed for the day. The younger students typically cleaned the school house interior including washing the chalkboards. Educational content consisted of reading, writing and arithmetic and was spoken by the teacher or written on the blackboards. Students were expected to repeat the information until the content was memorized. The teacher would bring small groups of students to the benches to administer more individualized lessons while other students read silently at their desks. Corporeal punishment was part of the content delivery, typically the result of disrespecting the teacher, whispering to classmates or not doing the assignments.

Content Delivery - Traditional



Agassiz Grammar School, Massachusetts - 1893

Environmental Stressors



Sensory Stressors

- Limited light on overcast days
- Glare possible when curtains are open
- Tall, narrow windows distribute light unevenly
- Air circulation from operable windows only
- Drafty
- Little control over thermal comfort
- Little relief from smells of classmates
- Noise from adjacent stairs transmit to classrooms
- Noise from outside transmitted through walls / windows



Social Stressors

- Limited social interactions
- Corporal punishment
- Humiliation of punishment
- No choice in seating location
- 40+ children in a class



Mental Stressors

- Teacher in complete control of students
- Limited views to outside for those not near a window
- No control over environment
- No opportunity for refuge in classroom

Spatial Strategies



Individual Control

- ...



Physical Activity

- Minimal physical activity while in class
- Students could be dismissed to use the rest rooms in the basement
- Movement through the school for other content delivery courses



Calming Surroundings

- Predictable location of classrooms
- Window shades controlled by teacher
- Views to outside for children seated next to windows
- Natural materials used inside, mostly wood wainscoting
- Concealed storage in wardrobe, minimize clutter
- Multiple exposures, day lighting and ventilation

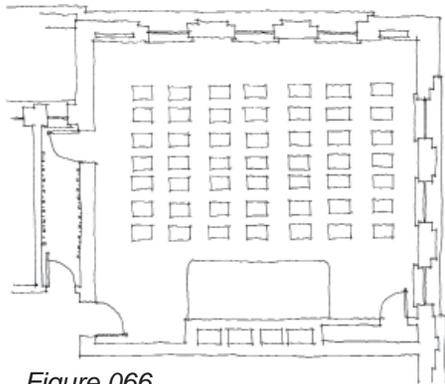


Figure 066



067



068



069

Content Delivery - Traditional

Agassiz Grammar School, Massachusetts - 1893



Figure 065

Agassiz Grammar School opened in 1893 as a school for boys in grades 1-3. Soon after opening, it became a co-ed school for grades K-6. The classrooms were large and the ceilings were 12' high. The windows had sill heights at 3' above the finished floor to prevent students from distraction, but the head heights went to the ceiling to admit as much natural day lighting as possible. There was natural light admitted in every classroom, typically from at least two exposures. Glare was controlled with translucent shades. The finishes of the classroom included plaster ceilings and walls with ash wainscotting. Chairs and desks were bolted to the floor. The teacher's desk was on an elevated platform in front of the classroom. Content was delivered by the teacher orally and through use of the chalkboards mounted to the perimeter walls. Students were to recite and write until the knowledge was memorized. Physical discipline was used on students.

Content Delivery - Early Modern



Crow Island School, Illinois - 1940

Environmental Stressors



Sensory Stressors

- Glare possible when curtains are open
- Noise of moving desks and chairs
- Noise created by ceiling mounted heating unit
- Noise created by student interaction



Social Stressors

- Student / student interaction fostered by pedagogy
- Student / teacher interaction fostered by pedagogy



Mental Stressors

- Physical transitions between teaching areas inside the classroom and in the outdoor classroom spaces
- Unpredictability of curriculum delivery
- Unpredictability of furniture layout

Spatial Strategies



Individual Control

- Lightweight, moveable furniture
- Choice of seat - chair, window seat, floor
- Sliding doors between main space and smaller work space
- Student grouping options available in the form of classroom
- Variety of space sizes within the classroom
- Sink and water fountain in classroom for student use
- Moveable translucent curtains, operable windows



Physical Activity

- Movement between centers in the "L" shaped room
- Movement between the indoor and outdoor classrooms



Calming Surroundings

- Access to nature in outdoor classrooms, story circles
- Each classroom has small, sheltered, landscaped courtyard
- Multiple exposures, natural day lighting and ventilation
- Low window sills provide views of forested, natural setting
- High window heads provide abundant natural day lighting
- Zoned, recessed incandescent lighting
- Indoor / outdoor connection
- Indoor and outdoor nooks provide meditation options
- Natural materials - pine walls and window seating
- Personal rest rooms in every classroom
- Domestic scale, child size chairs, low ceiling height - 9'-2"
- Sound absorptive materials - ceiling, curtains, carpeting
- Concealed storage in rooms, corridor lockers to reduce clutter
- Refuge options in classrooms

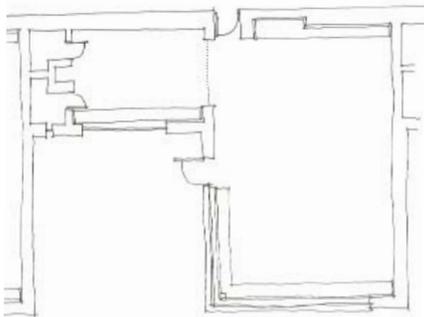


Figure 071



072



073



074

Content Delivery - Early Modern

Crow Island School, Illinois - 1940



Figure 070

The educational content at Crow Island School is delivered primarily in the classroom unit. The classroom unit form is an “L” shape and also includes a unique outdoor courtyard for each classroom. The main portion of the “L” shaped classroom, shown above, is comprised of an open floor plan with large operable windows on two elevations to allow for diverse learning activities. A smaller portion of the classroom, also a flexible space, shown on the reverse, can be separated from the main space by moveable glass doors. Because the thinking of the time was swiftly moving towards a more child-centered pedagogy, one in which the teacher attended to each individual students’ needs, the furniture throughout the indoor classroom is child-size and moveable, the teachers desk is not the focus of the space, and the room is a residential scale. Each classroom also includes its own sink area and rest room. The unit is viewed as a self-contained village for the 25 - 30 children who attend each day. The classrooms in this school are grouped into “neighborhoods” according to the age of the students.

Content Delivery - Experimental



Mt. Healthy Elementary School, Indiana - 1972

Environmental Stressors



Sensory Stressors

- Glare from south facing clerestory windows
- Noise from open classroom concept, moveable furniture
- Noise created by HVAC system, fluorescent light fixtures
- Noise created by student interaction
- Limited ventilation, no accessible operable windows
- Open storage in classrooms, visual clutter
- Team teaching can involve over 90 students
- Shadows from overhangs and hot spots from artificial lighting



Social Stressors

- Student / teacher interaction fostered by pedagogy
- 30 students per class, 90 per team, 180 per cluster



Mental Stressors

- No physical transitions between teaching areas inside the classroom
- Unpredictability of curriculum delivery
- No accessible operable windows
- Large scale of space
- Unpredictable location of cluster groups
- No views of nature from inside the clusters
- Limited "territory", no desk ownership in predictable location
- Unpredictability of furniture layouts
- Teacher's desk not in predictable location

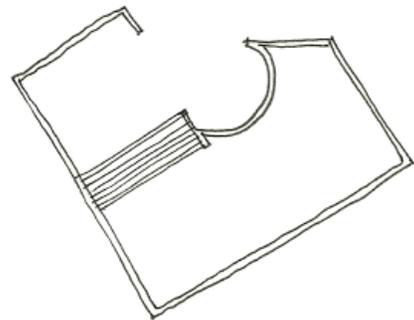


Figure 076



077



078



079

Spatial Strategies



Individual Control

- Lightweight, moveable furniture
- Choice of seat - chair, floor
- Choice of seat location in the classroom
- Student grouping options available in the layout and form of classroom: individual, small group and large group options
- Curriculum control
- Refuge opportunities
- Variety of space sizes within the cluster



Physical Activity

- Movement between three educational centers on three different levels per grade in each cluster
- Stair forums for content delivery provide an option to move up and down stairs while receiving content
- Movement through the school for other content delivery courses



Calming Surroundings

- Personal rest rooms in Pre-K and Kindergarten classrooms
- No bell schedule
- Variety of flooring textures
- Refuge options in cluster forms

Content Delivery - Experimental

Mt. Healthy Elementary School, Indiana - 1972



Figure 075

Mt. Healthy Elementary School is an open plan school. Educational content is delivered in four multi-level clusters by grade level. The kindergarten cluster is located on its own level to provide some acoustical separation. Each cluster has six unique levels which can house up to 30 students each. One of these levels is an amphitheater for individual reading, as well as small and large group instruction. The stairs can also serve as work surfaces as shown above. The furniture is moveable to allow for flexibility. The teacher is seen as a guide for each child to pursue their own education. There are no school bells or prescribed amounts of time for each lesson or subject area. The students pursue the projects that interest them. The design of the school includes exposed structure and color-coded mechanical and electrical systems which encourage curiosity in the students. The purpose of this pedagogy is to create life long independent learners.

Content Delivery - Green Renewal



Great Seneca Creek Elementary School, Maryland - 2006

Environmental Stressors



Sensory Stressors

- Glare possible when blinds are open
- Noise of moving desks and chairs
- Noise created by HVAC system
- Noise created by student interaction
- Noise created by fluorescent light fixtures
- Lighting is controlled by occupancy and day lighting sensors
- Limited natural ventilation
- Open storage in classroom, visual clutter



Social Stressors

- Student / student interaction fostered by pedagogy
- Student / teacher interaction fostered by pedagogy



Mental Stressors

- No physical transitions between teaching areas inside the classroom and in the outdoor classroom spaces
- Unpredictability of curriculum delivery
- No opportunity for refuge in classroom form

Spatial Strategies



Individual Control

- Lightweight, moveable furniture
- Choice of seat - chair, floor
- Student grouping options available in the layout and form of classroom: individual, small group and large group options
- Sink and water fountain in classroom for student use
- Lockable storage options
- Operable windows, blinds on windows
- Options in curriculum delivery
- Each classroom has individual thermal control including operable windows



Physical Activity

- Movement between educational centers in the classroom
- Movement between the indoor and outdoor classrooms
- Movement through the school for content delivery courses



Calming Surroundings

- Low window sills provide views of forested, natural setting
- High window heads provide abundant natural day lighting
- Personal rest rooms in Pre-K and kindergarten classrooms
- Sound absorptive materials - ceiling treatment, carpeting
- Class pets provide interaction with animals
- Natural materials - wood casework
- Access to nature in outdoor classrooms
- Clocks visible in every classroom
- Ventilation and low VOC design results in limited odors

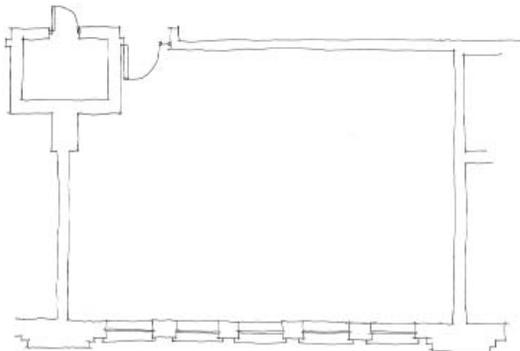


Figure 081



082



083



084

Content Delivery - Green Renewal

Great Seneca Creek Elementary School, Maryland - 2006



Figure 080

The educational content at Great Seneca Creek Elementary School is delivered primarily in the classroom unit. The classroom unit form is a rectangular shape with windows typically along one wall. The furniture is moveable, most of the storage is concealed, and the teacher's desk location is flexible. The room finishes are all light colors to reflect the light. A portion of the classroom is covered with an area carpet. There are boards mounted to the perimeter walls for display, writing and interaction with technology. The content delivery spaces vary in orientation based on location in the school, square footage based on grade level, and mechanical system based on use of the space. The lighting system is controlled by occupancy and day lighting sensor technology. A percentage of the windows are operable and the amount of adjustment is controlled for safety and security reasons. Most schools of this era take advantage of the outdoors as additional classroom space. Technology plays an increasing role in the curriculum, however, the rapid innovation typically outpaces the flexibility built into the infrastructure.

Content Delivery - Modern



Discovery Elementary School, Virginia - 2015

Environmental Stressors



Sensory Stressors

- Open storage in classrooms, visual clutter
- Team teaching can involve over 50 students
- Noise created by moveable furniture
- Technology component provides additional noise in classroom
- Noise of air movement of HVAC system
- Noise from student interaction
- Glare possible when shades are open
- Limited natural ventilation



Social Stressors

- Student / student interaction fostered by pedagogy
- Student / teacher interaction fostered by pedagogy



Mental Stressors

- No physical transitions between teaching areas inside the classroom and in the outdoor classroom spaces
- Unpredictability of curriculum delivery
- Limited "territory" (own desk in predictable location) due to furniture design, flexibility required
- Teacher's desk not in predictable location
- Unpredictability of furniture layouts

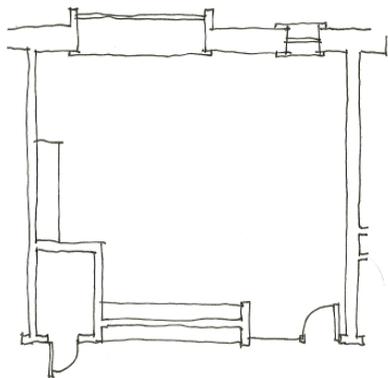


Figure 086



087



Spatial Strategies

Individual Control

- Choice of seat design, location and view
- Choice to work collaboratively or alone
- Individual thermal control including operable windows
- Lockable storage options
- Shades on interior and exterior windows
- Sinks in classrooms
- Make own food in the teaching kitchen
- Options in curriculum delivery
- Refuge opportunity
- Lightweight moveable furniture



Physical Activity

- Chairs spin, swivel, roll, rock, etc.
- Grouping options in classroom allow for movement throughout the classroom and team areas
- Stair forums for content delivery provide an option to move



Calming Surroundings

- Views of nature through large windows, low sills, high heads
- Variety of textured seating options, natural materials
- LED lights with lenses to reduce glare
- Most classrooms have northern exposure, minimal glare
- Ventilation and low VOC design results in limited odors
- Safe, observable refuge options available
- Personal rest rooms in Pre-K and kindergarten classrooms



088



089

Content Delivery - Modern

Discovery Elementary School, Virginia - 2015



Figure 085

The educational content at Discovery Elementary School is distributed in almost every space available to the students. Variability, flexibility and adaptability are main drivers of the school design. For example, in terms of variability, classroom walls are built of metal studs and drywall so as to be easily moved in future years as requirements evolve. In terms of flexibility, technically advanced moveable partitions, operated by a single teacher as shown on the reverse, transform spaces from single classrooms to team teaching environments. Finally, in terms of adaptability, the furniture can move, forming large and small groups or individual work spaces. In addition, the classrooms have glass on their corridor walls to allow for students to use the collaborative spaces in the hallways. The exterior environment offers opportunities to explore outdoor education including the solar lab on the roof and bio-retention overlooks in the front yard.

Transition - Early Traditional



South Pass City School House, Wyoming - 1870

Environmental Stressors



Sensory Stressors

- Exposure to elements when walking to outhouse
- Sensory issues associated with outhouse



Social Stressors

- Only one outhouse



Mental Stressors

- Only one outhouse
- Minimal transitions during the day
- Teacher in control of transitions

Spatial Strategies



Individual Control

- None



Physical Activity

- Transition to morning and afternoon recess and lunch
- Transition to use the outhouse with permission



Calming Surroundings

- Transition to outhouse, recess and lunch in nature
- Domestic scale
- Natural materials

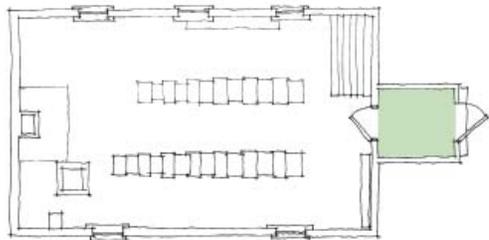


Figure 091



092



093



094

Transition - Early Traditional

South Pass City School House, Wyoming - 1870



Figure 090

South Pass City School is a one room school house with a vestibule on the east facade and an outdoor latrine about fifty feet up the hillside. The commencement of the school day was announced by the teacher ringing the school bells. The opportunities for transition for these students were limited. They included getting up from their seats to clean the school room or fetching firewood or water. They also included using the latrine, with permission, and leaving the room for recess and lunch periods. Occasionally, students would be called to the benches for small group instruction. Other than those occasions, students remained seated in their chairs which were bolted to the floor.

Transition - Traditional



Agassiz Grammar School, Massachusetts - 1893

Environmental Stressors



Sensory Stressors

- Group toilet rooms in basement, natural ventilation only
- Noise of wood floors in corridors
- Glare in stairways
- Noise from fans in corridors
- Plaster ceilings provided little acoustical control
- Over 500 students transitioning at the same time



Social Stressors

- Group toilet rooms only option
- Toilet rooms remote in basement
- Waiting outside content delivery classrooms for previous class to leave
- Impossible to access for physically disabled



Mental Stressors

- Group toilet rooms in basement
- Teacher in control of transitions
- No activities in corridors while waiting to be admitted into the next class
- Limited options of environment in corridor
- Large scale building feel

Spatial Strategies



Individual Control

- Choice of rest room stall



Physical Activity

- Travel to the basement for access to toilet rooms
- Travel multiple floors for various educational content and recess



Calming Surroundings

- No toilet room odors on main levels
- Natural light in stairways, corridors and toilet rooms
- Views to nature in stairways, corridors and toilet rooms
- Use of natural materials in the corridors and stairways
- Clear, highly predictable floor plan
- Uniformity of stair design

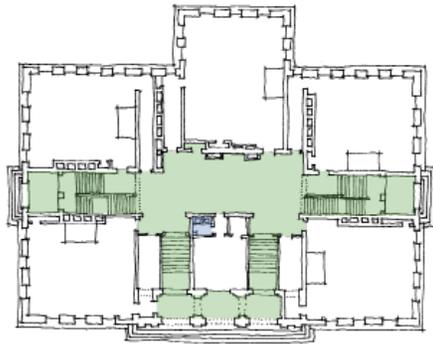


Figure 096



097



098



099

Transition - Traditional

Agassiz Grammar School, Massachusetts - 1893

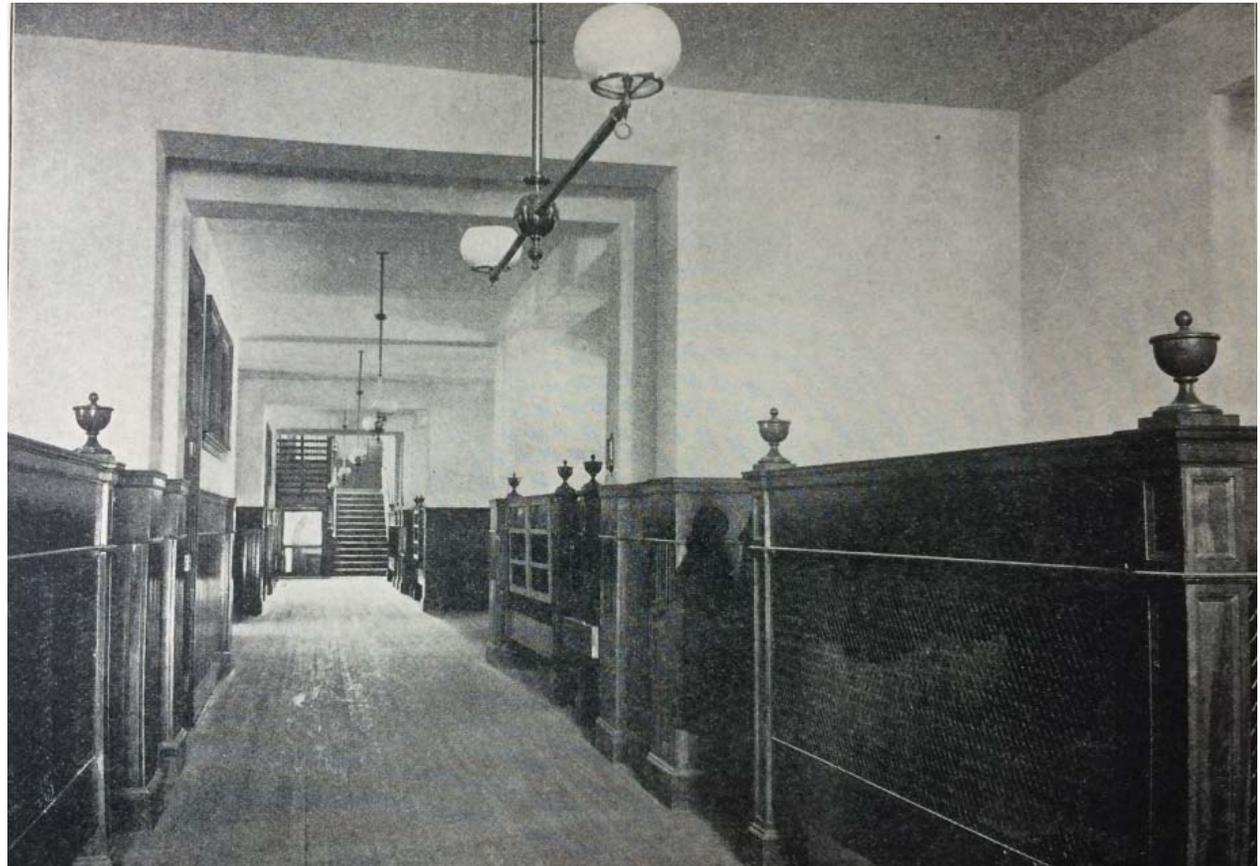


Figure 095

Agassiz Grammar School was a highly organized plan of classrooms, stairs and corridors. The only function of the corridors and stairs was as circulation for the school. The students remained in their classrooms most of the school day. The only exceptions were to go home for lunch, to go to the bathroom in the basement group toilet rooms, to attend an assembly in the auditorium on the third floor or to attend a specialty class in the playroom or laboratory. Transitions would occur when the bells rang. Corridors were 16' - 20' wide to accommodate the 200 students per floor of the school. There were two sets of stairs to accommodate the students and provide redundancy in case of fire. There were two dedicated staff toilets, one on the first floor for all of the teachers to share and one on the second floor for the master of the school.

Transition - Early Modern



Crow Island School, Illinois - 1940

Environmental Stressors



Sensory Stressors

- Noise of lockers in corridors
- Glare from skylights
- Noise from the students walking between classes and waiting to enter their classes
- Fire alarm drills, tornado drills



Social Stressors

- Waiting outside of content delivery classes



Mental Stressors

- Unpredictability of curriculum delivery in hallways
- Visual clutter of displays
- No activities in corridors while waiting to be admitted into next class
- Limited options of environment in corridor

Spatial Strategies



Individual Control

- Lockers in the corridor
- Each classroom has own rest room



Physical Activity

- Movement opportunity between classrooms and other content delivery areas
- Movement opportunity between indoor and outdoor classrooms



Calming Surroundings

- Views of nature
- Access to nature
- Natural light
- Domestic scale
- Natural materials
- Natural materials on the interior, rose colored brick and Ponderosa pine
- Natural light provided by skylights
- Fireplace in the entry lobby corridor
- Dedicated rest rooms for each classroom

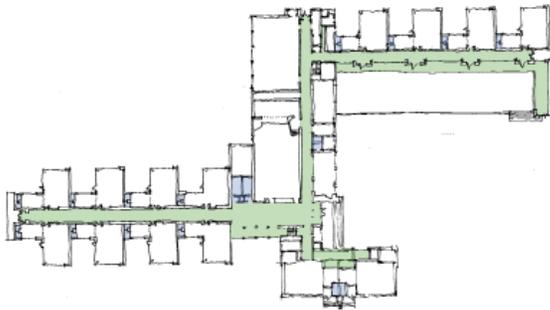


Figure 101



102



103



104

Transition - Early Modern

Crow Island School, Illinois - 1940



Figure 100

Crow Island School is a simple plan in which the corridors find inspiration from the classroom design. The same pine panelling used in the classroom for display is also used in the corridors to distinguish the entrances to each classroom as shown on the reverse. The corridors house the student lockers, a recent innovation of this era, which helped to reduce the visual clutter in the classrooms. The corridors are used for circulation between classrooms and other content delivery areas as well as for small group pull-out as shown above. Some of the corridors are single loaded and receive natural light from windows to the exterior while others are double loaded and receive natural light via skylights as also shown on the above.

Transition - Experimental



Mt. Healthy Elementary School, Indiana - 1972

Environmental Stressors



Sensory Stressors

- Glare from clerestory
- Noise created by HVAC system
- Noise from fluorescent light fixtures
- Noise in open space from the large amount of students walking between classes and waiting to enter their classes
- Fire alarm drills, tornado drills



Social Stressors

- Almost 700 students in the school - crowded spaces during transitions



Mental Stressors

- Large scale building feel
- Industrial feel of finishes
- Visual clutter
- Few corridors, seemingly random pathways

Spatial Strategies



Individual Control

- Individual determines transition between core content areas
- Refuge opportunities
- Choice of bathroom stall



Physical Activity

- Movement between three educational centers on three different levels per grade in each cluster
- Stair forums for content delivery provide an option to move up and down stairs while receiving content
- Movement opportunity between clusters and other content delivery areas and recess



Calming Surroundings

- No bell schedule
- Dedicated toilet rooms per cluster
- Personal rest rooms in kindergarten cluster
- Sound absorptive materials - carpet
- Natural light in circulation areas from clerestory windows
- Way finding signage



Figure 106



107



108



109

Transition - Experimental

Mt. Healthy Elementary School, Indiana - 1972



Figure 105

Mt. Healthy Elementary School is an open plan school and thus has few defined corridors for transition. The four clusters which are grouped around one main multi-use space are designed to be self contained units. The students leave their cluster for large group instruction and to eat lunch, both in the multi-use space. They also leave their cluster for their “specials” which include music, art, library and physical education. Movement throughout the school is facilitated by a strong color palette and signage plan. The kindergarten cluster has rest room facilities within its cluster while the grade level students have toilet facilities adjacent to their cluster.

Transition - Green Renewal



Great Seneca Creek Elementary School, Maryland - 2006

Environmental Stressors



Sensory Stressors

- Glare from courtyard exposure
- Noise created by HVAC system
- Noise from fluorescent light fixtures
- Fire alarms, code red drills, tornado drills, etc.
- Loud bell signalling transitions
- Noise in hallways from the large amount of students walking between classes and waiting to enter their classes
- Fire alarm drills, tornado drills, code red drills, etc.
- Noise of lockers in corridors
- Smells from open rest rooms



Social Stressors

- 740 students in the school - crowded corridors during transitions
- Large group toilet rooms with no doors
- Group hand washing stations in corridors
- Waiting outside of content delivery classes



Mental Stressors

- No activities in corridors while waiting to be admitted into next class
- Limited options in environment of corridor
- Large scale building feel
- No refuge opportunities in corridors
- Industrial feel of finishes

Spatial Strategies



Individual Control

- Option of paths to take to get to a rest room
- Choice of drinking fountain heights
- Choice of bathroom stall



Physical Activity

- Movement opportunity between classrooms and other content delivery areas, might include stairs



Calming Surroundings

- Personal rest rooms in Pre-K and kindergarten classrooms
- Sound absorptive materials - ceiling treatment
- Ventilation design and material selections made to reduce unpleasant odors
- Natural light in corridors from central courtyard
- Indoor / outdoor connection created by courtyard
- Thermal comfort provided by HVAC system
- Organized circulation
- Access to nature
- Views of nature

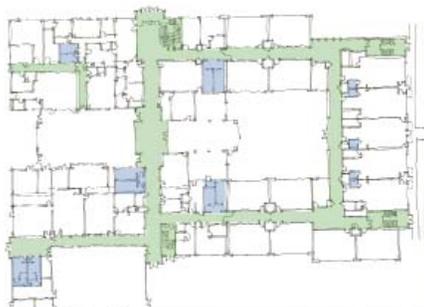


Figure 111



112



113



114

116

Transition - Green Renewal

Great Seneca Creek Elementary School, Maryland - 2006



Figure 110

Great Seneca Creek Elementary School is organized into two environments, the two level classroom space and the single level, more public spaces. The transition area between these two environment is a two story corridor. This corridor, like the other corridors, are primarily used for circulation and for cueing. At occasional points, there are views to the exterior, such as into the central courtyard, or more generous nodes that provide glimpses into other spaces such as the cafeteria on the reverse. The rest room facilities for the older children are located along these corridors and are open; they do not have doors separating them from the corridors. Drinking fountains and handwashing stations are located at the thresholds into the rest room facilities. Rest room facilities for the younger children are located within the classrooms.

Transition - Modern

Discovery Elementary School, Virginia - 2015

Environmental Stressors



Sensory Stressors

- Glare possible when shades are open
- Noise of moving tables and chairs in the hallways
- Noise created by HVAC system
- Noise created by student interaction
- Fire alarms, code red drills, tornado drills, etc.
- Loud bell signalling transitions
- Music played during transitions
- Fire alarm drills, tornado drills
- Noise from the large amount of students walking between classes and waiting to enter other content delivery classes



Social Stressors

- Student / student interaction fostered by pedagogy
- Student / teacher interaction fostered by pedagogy
- Over 700 students in the school - crowded corridors during transitions



Mental Stressors

- Physical transitions between teaching areas inside the classroom and in the corridor collaboration spaces
- Unpredictability of curriculum delivery in hallways
- Unpredictability of hallway shape due to moveable partitions between the classrooms and the hallways

Spatial Strategies



Individual Control

- Lightweight, moveable furniture in the corridors
- Choice of seat - beanbags, window seat, floor, nooks
- Student grouping options available in the hallways
- Variety of space sizes and activities within the transition areas and while waiting to switch classes
- Choice of bathroom stall, drinking fountain heights
- Refuge opportunities
- Choice of paths to take to get to a rest room



Physical Activity

- Movement between levels with stairs and slides
- Movement between the indoor and outdoor classrooms
- Movement between classrooms and other content delivery areas and recess



Calming Surroundings

- Low window sills in corridors provide views of natural setting
- High window heads in corridors provide abundant natural day lighting
- Nooks provide meditation options
- Natural materials - wood casework
- Personal rest rooms in Pre-K and kindergarten classrooms
- Sound absorptive materials - ceiling treatment
- Ventilation design and material selections made to reduce unpleasant odors
- Thermal comfort provided by HVAC system
- Views of and access to nature
- Way finding signage



Figure 116



117



118



119

118

Transition - Modern

Discovery Elementary School, Virginia - 2015



Figure 115

Discovery Elementary School is built into the hillside and as a result has three levels. The children are grouped on levels by grade, the youngest children on the lowest level. The levels of the building are named in increasing order of magnitude, such as “backyard”, “forest” and “galaxy”. The levels are also each color coded as part of the way finding strategy. The hallways provide the required circulation, but also include generous spaces for small group and individual learning, places for waiting and views to the outdoors. Bathrooms are located in the classrooms for the younger children and are in centrally located areas adjacent to passively supervised open spaces for the older children. The stairways are used not only to transition between levels but are also used for content delivery and recreation.

Recreation - Early Traditional



South Pass City School House, Wyoming - 1870

Environmental Stressors



Sensory Stressors

- Lunch smells resulting from eating in schoolhouse



Social Stressors

- Lunch and recess provided social interaction opportunities, wanted or otherwise
- Mixed age groupings



Mental Stressors

- Teachers choice regarding indoor or outdoor lunch
- Inclement days spent entirely in one room except for rest room breaks

Spatial Strategies



Individual Control

- Choice of recess games
- Choice to play in groups or alone
- Choice of grouping for lunch if outdoors
- Shaded or sunny areas
- Meditation options outside during lunch and recess



Physical Activity

- Two fifteen minute recess breaks during the day and one hour lunch break
- Active games like tag were popular
- Free play options during recess



Calming Surroundings

- Recess and lunch breaks outdoors when deemed suitable by the teacher
- Access to nature during recess



Figure 121



122



123



124

120

Recreation - Early Traditional

South Pass City School House, Wyoming - 1870



Figure 120

For the purposes of this exploration, recreation activities include lunchtime, physical education and recess. Students at the South Pass City School House enjoyed two fifteen minute recess periods, one in the morning and one in the afternoon, as well as a one hour break for lunch. The students could eat lunch in the classroom or outside, upon the discretion of the teacher. During the early days at South Pass City School House, there was no physical education. During outdoor recess, the children would play active games like “tag” or more passive games like marbles. Playgrounds as shown on the reverse rose in popularity in the early 1900s.

Recreation - Traditional



Agassiz Grammar School, Massachusetts - 1893

Environmental Stressors



Sensory Stressors

- Playroom in the basement, less natural light
- No acoustical control in playroom
- Minimal ventilation in playroom



Social Stressors

- Social interaction opportunities provided at recess, wanted or otherwise
- Mixed age groupings



Mental Stressors

- Physical education content determined by teacher
- Return from lunch on time

Spatial Strategies



Individual Control

- Choice of recess games
- Choice to play in groups or alone
- Choice of quiet or loud areas at recess
- Shaded or sunny area options
- Meditation options outside during recess
- Typically a choice of playground equipment



Physical Activity

- Physical education opportunity
- Sensory play equipment providing risk, vestibular input, etc.
- Movement opportunities at recess, lunchtime and during physical education
- Free play option during recess
- Opportunity to walk home for lunch



Calming Surroundings

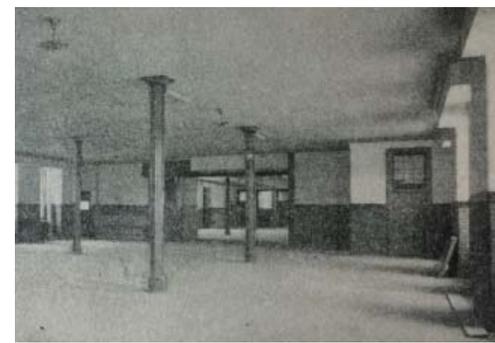
- Recess and lunch breaks outdoors when deemed suitable by the teacher
- Casual eating at home, not “managed” eating



Figure 126



127



128



129

122

Recreation - Traditional

Agassiz Grammar School, Massachusetts - 1893



Figure 125

For the purposes of this exploration, recreation activities include lunchtime, physical education and recess. Although Agassiz Grammar School students went home for lunch, they enjoyed physical education and recess on school property. Physical education consisted of playing physical games in the basement playroom and doing exercises adjacent to the desks in the classrooms as shown on the reverse. Most schools of this era, either in urban or suburban areas, had a space adjacent to the school allocated for play. Students could play there before school and after school as well as during recess times.

Recreation - Early Modern

Crow Island School, Illinois - 1940

Environmental Stressors



Sensory Stressors

- Difficulty maintaining thermal comfort in gymnasium
- Noisy gymnasium
- Glare from southern exposure clerestory windows
- Lunch smells resulting from eating in the classroom



Social Stressors

- Student / student interaction fostered by pedagogy
- Student / teacher interaction fostered by pedagogy
- Social interaction opportunities provided at recess, wanted or otherwise



Mental Stressors

- Physical education content and location determined by teacher
- Return from home on time

Spatial Strategies



Individual Control

- Typically wide variety of choice of playground equipment
- Choice of quiet or loud areas at recess
- Shaded or sunny area options
- Meditation options outside during lunch and recess
- Choice of recess games
- Choice to play in groups or alone



Physical Activity

- Sensory play equipment providing risk, vestibular input, etc.
- Movement opportunities at recess, lunchtime and during physical education
- Free play option during recess
- Educational program regarding physical fitness
- Opportunity to walk home for lunch



Calming Surroundings

- Views of nature from classroom while eating
- Access to nature during recess
- Access to nature as an option during physical education
- Meditation options outside during lunch and recess
- Natural light in gym
- Casual eating, not "managed" eating



Figure 131



132



133



134

Recreation - Early Modern

Crow Island School, Illinois - 1940



Figure 130

For the purposes of this exploration, recreation activities include lunchtime, physical education and recess. Crow Island School does not have a formal cafeteria as students were expected by the educators and the designers to either go home for lunch or eat in their classrooms. In regards to physical education and recess, Crow Island School has a gymnasium as well as a wide variety of outdoor play spaces. The spaces available to the students include individual, unique courtyards for each classroom, hard and soft play fields, mulched playgrounds and patios and terraces, both covered and uncovered. These spaces are used for recess as well as outdoor classrooms, specifically in the amphitheater and circular spaces designed as outdoor gathering spaces.

Recreation - Experimental

Mt. Healthy Elementary School, Indiana - 1972

Environmental Stressors



Sensory Stressors

- Noise created by student interaction in the open floor plan of the cafeteria and gymnasium
- Noise from fluorescent light fixtures
- Difficulty maintaining thermal comfort in large open spaces
- Cafeteria smells emitted via the open plan
- Bold colors typically part of designs of this era, especially in these spaces
- Multiple lunch periods while students in adjacent open classrooms



Social Stressors

- Student / student interaction fostered by pedagogy
- Student / teacher interaction fostered by pedagogy
- Social groupings at tables during lunch
- Almost 700 students in the school - crowded open cafeteria



Mental Stressors

- Unpredictability of how the space will be used
- Few corridors, seemingly random pathways
- Little access or views to nature
- Limited natural light, very few windows
- Limited connection to outdoors in the curriculum
- "Managed" eating
- Little to no refuge options

Spatial Strategies



Individual Control

- Typically wide variety of choice of playground equipment
- Choice of loud or quiet areas
- Choice to play in groups or alone at recess
- Choice of grouping at lunch
- Choice of games at recess



Physical Activity

- Sensory play equipment providing risk, vestibular input, etc.
- Movement opportunities at recess, lunchtime and during physical education
- Free play option during recess
- Educational program regarding physical fitness

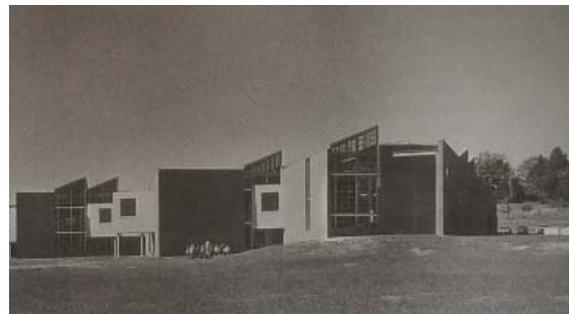


Calming Surroundings

- Sound absorptive materials - some cafeterias carpeted due to their multi-use function; however, this absorptive quality sometimes outweighed by the acoustics of the open floor plan



Figure 136



137



138



139

126

Recreation - Experimental

Mt. Healthy Elementary School, Indiana - 1972



Figure 135

For the purposes of this exploration, recreation activities include lunchtime, physical education and recess. Mt. Healthy Elementary School is an open plan school. Like many other schools of the time, it is inward focused, organized around a large central multi-use space. The photo above shows this space being used as the cafeteria. It is also used for large group instruction. Mt. Healthy Elementary School has a gymnasium which is partially open to the school as shown on the reverse. This concept is one of the many experimental concepts employed at Mt. Healthy Elementary School. Outdoor playground equipment design was also quite experimental during this time. Much of the play equipment of this era is now considered as occupational therapy equipment, successfully meeting the sensory needs of children.

Recreation - Green Renewal

Great Seneca Creek Elementary School, Maryland - 2006

Environmental Stressors



Sensory Stressors

- Noisy cafeteria, even with the acoustical treatment in the ceiling
- Noisy gymnasium, even with the acoustical treatment in the ceiling and on the walls
- Smells in cafeteria
- Difficulty maintaining thermal comfort in large open spaces of cafeteria and gym
- Noise from fluorescent light fixtures
- Little to no refuge options
- "Safe" playground, limited risk or vestibular input
- Noisy light fixtures in gymnasium
- Glare in cafeteria
- Cafeteria smells remain when space used for assemblies



Social Stressors

- Student / student interaction fostered by PE pedagogy
- Student / teacher interaction fostered by PE pedagogy
- Over 700 students in the school - crowded cafeteria during multiple lunch periods
- Social groupings during lunch, no flexibility



Mental Stressors

- "Managed" eating
- Physical education only offered 2 times a week
- Recess only 1/2 hour each day
- Physical education content and location determined by teacher
- No natural light in gymnasium
- Confusion of multiple functions in the same space



Figure 141



142



Spatial Strategies

Individual Control

- Choice of quiet or loud areas at recess
- Shaded or sunny area options
- Meditation options outside during lunch and recess
- Choice to play in groups or alone
- Choice of grouping for lunch
- Choice of recess games
- Choice of playground equipment



Physical Activity

- Movement opportunities at recess, lunchtime and during physical education
- Free play option during recess
- Educational program regarding physical fitness and health



Calming Surroundings

- Views of nature from cafeteria seating
- Access to nature during recess
- Access to nature as an option during physical education
- Meditation options outside during lunch and recess



143



144

Recreation - Green Renewal

Great Seneca Creek Elementary School, Maryland - 2006



Figure 140

For the purposes of this exploration, recreation activities include lunchtime, physical education and recess. There are several playground areas on the property, each designed for a specific age group. The playgrounds at Great Seneca Creek Elementary School include play equipment typical of this era. Parents' and school administrators' concern for safety guided the design. Rounded corners and little risk were the primary drivers of the design as shown above. Students attend physical education class either in the windowless gymnasium or on the adjacent fields. The students eat lunch in the cafeteria which doubles as the main assembly room for the school. Depending on the grade level, students eat lunch before or after recess.

Recreation - Modern

Discovery Elementary School, Virginia - 2015

Environmental Stressors



Sensory Stressors

- Noisy cafeteria, even with the acoustical treatment in the ceiling
- Noisy gymnasium, even with the acoustical treatment in the ceiling and on the walls
- Smells in cafeteria spread to rest of school since it is an open plan
- Difficulty maintaining thermal comfort in large open spaces of cafeteria and gym



Social Stressors

- Student / student interaction fostered by PE pedagogy
- Student / teacher interaction fostered by PE pedagogy
- Over 700 students in the school - crowded cafeteria during multiple lunch periods



Mental Stressors

- Physical education only offered 2 times a week
- Recess only 1/2 hour each day
- Physical education content and location determined by teacher

Spatial Strategies



Individual Control

- Seating options in cafeteria, casual, group, individual
- Moveable furniture in cafeteria
- Choice of indoor or outdoor seating for lunch
- Choice of textures, mulch, rubber, turf
- Choice of motion in playground equipment
- Choice of quiet or loud, shaded or sunny areas at recess
- Choice to play in groups or alone, choice of games at recess



Physical Activity

- Movement opportunities at recess, lunchtime and during physical education
- Free play option during recess
- Sensory playground equipment capable of providing significant vestibular input for those students seeking it
- Educational program regarding physical fitness and health



Calming Surroundings

- Abundant natural light in cafeteria and gymnasium, glare effectively controlled by shading
- Texture options in cafeteria seating
- Fan in gymnasium to provide air movement
- Natural materials - large logs in one of the playgrounds, trees integrated into playgrounds, wood canopy at cafeteria porch
- Views of nature, access to nature during lunch, recess and PE
- Meditation options outside during lunch and recess
- Each classroom on the lower level has sheltered courtyard



Figure 146



147



148



149

Recreation - Modern

Discovery Elementary School, Virginia - 2015



Figure 145

For the purposes of this exploration, recreation activities include lunchtime, physical education and recess. Discovery Elementary School has a cafeteria that is not physically separated from the school. It has a variety of furniture options as shown on the reverse. In addition, a significant portion of the seating is located under the shelter of a large wooden canopy. Finally, it is adjacent to a turf play area that, unlike a typical grass play area, can be used even after a rainy morning. There are several playgrounds surrounding the school, each with unique play equipment and ground surface material. The play equipment provides vestibular input as shown on the reverse. The gymnasium has a large south facing clerestory ribbon window as well as a large ceiling fan to provide air movement. The physical education program also uses the adjacent turf fields, which they share with the middle school.

Departure - Early Traditional



South Pass City School House, Wyoming - 1870

Environmental Stressors



Sensory Stressors

- Students were to walk home in a variety of weather conditions



Social Stressors

- Evident which students needed to serve detention
- Lack of supervision at dismissal



Mental Stressors

- Minimal transition from departure of the classroom to leaving the building
- Uncertainty of dismissal time

Spatial Strategies



Individual Control

- Options regarding walking path home



Physical Activity

- All students walked home, some as far as 5 miles
- Opportunity to help the teacher set up for the next day, carrying water, firewood
- Opportunity to play outside after school



Calming Surroundings

- Rural, natural setting during the walk home



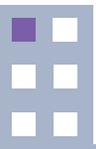
Figure 151



152



153



Departure - Early Traditional

South Pass City School House, Wyoming - 1870



Figure 150

At the end of the school day, the teacher of South Pass City School House would dismiss the students. However, some students would stay behind to help the teacher prepare for the next morning, to receive extra help or to serve a detention. The students and teacher would pick up their belongings, which were hung on the pegs on the wall and leave the building the same way they entered, through the vestibule. Once outside, the students would stay near the school to play for a while or begin their walk home. Some students lived in the nearby town, as shown on the reverse, while others had up to five miles to walk before arriving back home.

Departure - Traditional



Agassiz Grammar School, Massachusetts - 1893

Environmental Stressors



Sensory Stressors

- Students were to walk home in a variety of weather conditions
- Dismissal bells
- Crowded, noisy corridors and stairways leading to three exits



Social Stressors

- Lack of supervision at dismissal



Mental Stressors

- Over 500 students leaving at the same time

Spatial Strategies



Individual Control

- Options regarding walking path home
- Options regarding which door to use for exit



Physical Activity

- Exit Stairs
- All students walked home
- Opportunity to play outside after school



Calming Surroundings

- Predictable school dismissal time
- Views of nature during walk home

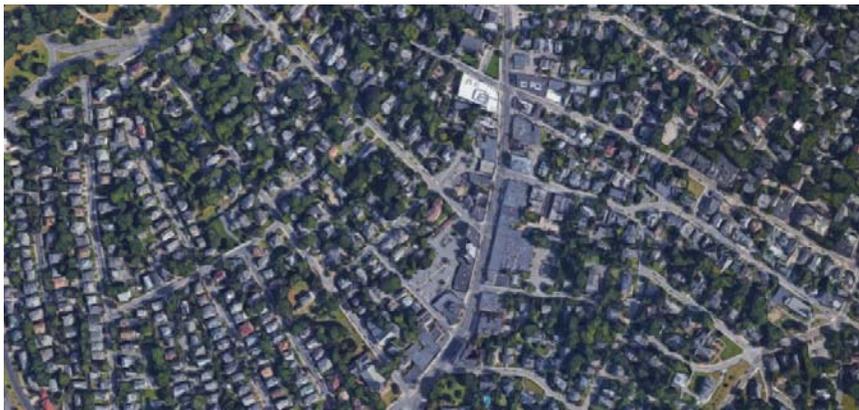


Figure 155



156



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Departure - Traditional

Agassiz Grammar School, Massachusetts - 1893



Figure 154

The end of the school day at Agassiz Grammar school was signalled by the school bell. At that time, all of the students would enter the coat rooms, gather their belongings and then exit the building through the wide corridors and stairways. The students had their choice of three exits to use, all of which required multiple stairs to get to grade level. All children walked home but could choose to stay on school grounds to play after school. Most children lived within two miles of the school.

Departure - Early Modern

Crow Island School, Illinois - 1940

Environmental Stressors



Sensory Stressors

- Bus fumes noticeable due to the single bus and car loop at main entry
- Bell and loud speaker signalling dismissal
- Noise from cars and buses



Social Stressors

- Groups get dismissed together
- Social stress of school bus, unstructured time



Mental Stressors

- Anxiety of waiting

Spatial Strategies



Individual Control

- Students have the choice where to wait to be picked up
- Students have the choice which route to walk home
- Refuge options, places to wait
- Choice of viewing platform, high or low
- Choice of exit from building



Physical Activity

- Some students walk home



Calming Surroundings

- Possibility to wait outside if weather permits
- Afternoon shade at main entry
- Trees surrounding bus loop
- Shelter from wind at the exit patio
- View of cars in cue for pick-up
- Predictable dismissal time

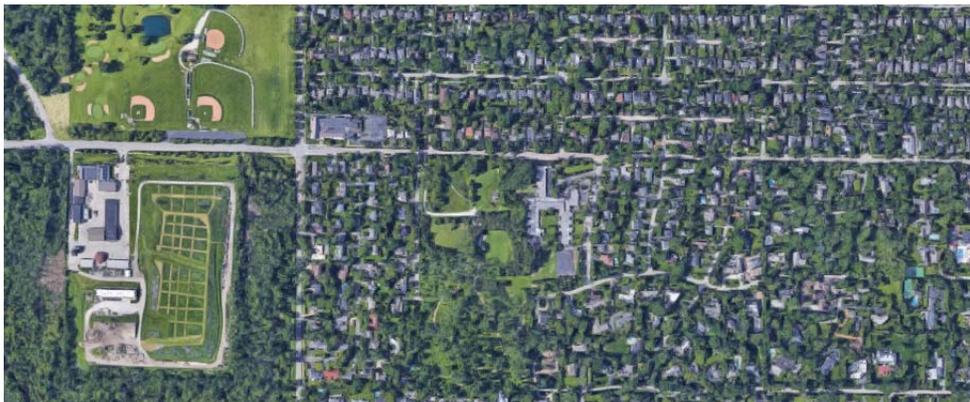


Figure 159



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161

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Departure - Early Modern

Crow Island School, Illinois - 1940



Figure 158

Crow Island School offers a variety of choices when it comes to departure. As designed, students were expected to depart from the school twice a day, once for lunch and once upon the completion of the academic day. With time, the practice of lunch dismissal has faded, but the wide variety of departure options remain. The students can be dismissed from their classrooms, from their grade level patios or from the main entrance. Being a neighborhood school, some of the children can walk home. Some, however, require vehicular access home. In these instances, covered porches are provided at every exit, including those with a view of the vehicular pick-up loop as shown above.

Departure - Experimental



Mt. Healthy Elementary School, Indiana - 1972

Environmental Stressors



Sensory Stressors

- Sensory stimulation from almost 700 students leaving at the same time, most of whom are using the same entrance
- Smell of bus fumes at exit due to proximity of bus loop to waiting area
- Exposure to elements while waiting for the bus



Social Stressors

- Almost 700 students leaving at the same time
- Social stress of school bus, unstructured time



Mental Stressors

- Limited choice regarding exit procession
- Limited transition provided from class areas to the exteriors
- Unpredictability of bus schedule
- Large paved area at bus waiting area

Spatial Strategies



Individual Control

- ...



Physical Activity

- Distance from class area to main exit



Calming Surroundings

- Predictability of bus location
- School dismissal at the same time every day, predictable
- School site is surrounded by nature, views while waiting and from the bus



Figure 163



164



165

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Departure - Experimental

Mt. Healthy Elementary School, Indiana - 1972



Figure 162

Mt. Healthy Elementary School is an open plan school and was not designed with a bell system as the curriculum was intended to be fluid. As a result, at dismissal, the students gather their belongings, line up in their class areas and then proceed to one of the two main exits from the building. One exit is for the general population and one was designed to be used by the kindergartners. Mt. Healthy is in a rural area of Indiana and as a result, most of the students take a bus home after school. As shown in the photo on the reverse, two bus loops and associated bus parking dominate the paths students take upon exiting the school. The students wait on the sidewalks and do not have the benefit of a covered waiting area. In addition, because of the bus schedule, children do not have the choice to stay after school to play outside.

Departure - Green Renewal



Great Seneca Creek Elementary School, Maryland - 2006

Environmental Stressors



Sensory Stressors

- Sensory stimulation from over 700 students leaving at the same time
- Smell of bus fumes at exit due to proximity of bus loop to waiting area
- Sensory stimulation in assembly “holding areas”
- Dismissal bells



Social Stressors

- Over 700 students leaving at the same time
- Social stress of school bus, unstructured time



Mental Stressors

- Multi-modal transportation complexity at exit
- Unpredictability of bus schedule



Spatial Strategies

Individual Control

- Choice of walking, biking, bus or car
- Students have the choice which route to walk home



Physical Activity

- Option to walk or bike home



Calming Surroundings

- Predictability of bus and car pick up locations
- School dismissal at the same time every day, predictable
- School site is surrounded by nature, views while waiting and from the bus
- View of cars in cue for pick-up

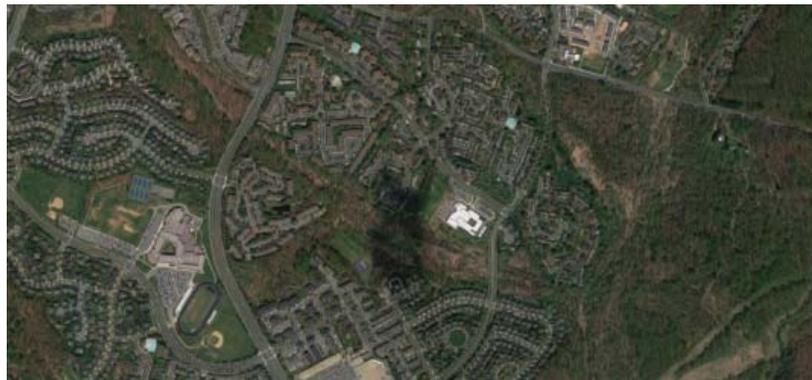


Figure 167



168



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Departure - Green Renewal

Great Seneca Creek Elementary School, Maryland - 2006



Figure 166

Great Seneca Creek Elementary School offers several options when it comes to departure. Students can exit the building through a variety of doors and can leave the school site using a variety of transportation modes. However, due to the amount of students at the school and security concerns in effect since the design of this school, these options require the design to be used in a variety of ways during dismissal. For example, when the first dismissal bell rings, students travel from their classrooms to various assembly areas throughout the school and wait for further instructions. These instructions can include walker / biker dismissal, car rider dismissal, extended day dismissal and bus rider dismissal. Bus rider dismissal is further broken down by bus number as these large schools often have at least a dozen buses serving the facility at dismissal.

Departure - Modern

Discovery Elementary School, Virginia - 2015

Environmental Stressors



Sensory Stressors

- Sensory stimulation from over 700 students leaving at the same time
- Sensory stimulation in assembly “holding areas”
- Dismissal bells



Social Stressors

- Over 700 students leaving at the same time
- Social stress of school bus, unstructured time



Mental Stressors

- Multi-modal transportation complexity at exit
- Unpredictability of bus schedule

Spatial Strategies



Individual Control

- Choice of walking, biking, bus or car
- Students have the choice which route to walk home



Physical Activity

- Option to walk or bike home
- Hillside provides additional exercise opportunities



Calming Surroundings

- Predictability of bus and car pick up locations
- School dismissal at the same time every day, predictable
- School site is surrounded by nature, views while waiting and from the bus
- View of cars in cue for pick-up
- Canopy provides shelter while waiting to be picked up
- Buses are on other side of site to avoid inhalation of fumes
- Canopy provides transition from school to exterior

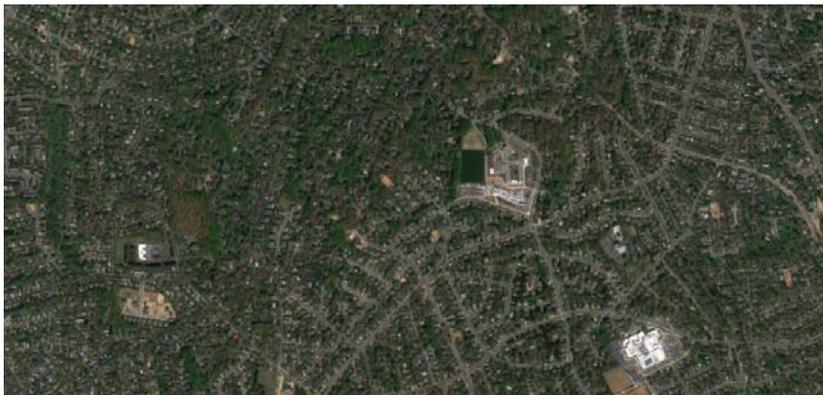


Figure 171



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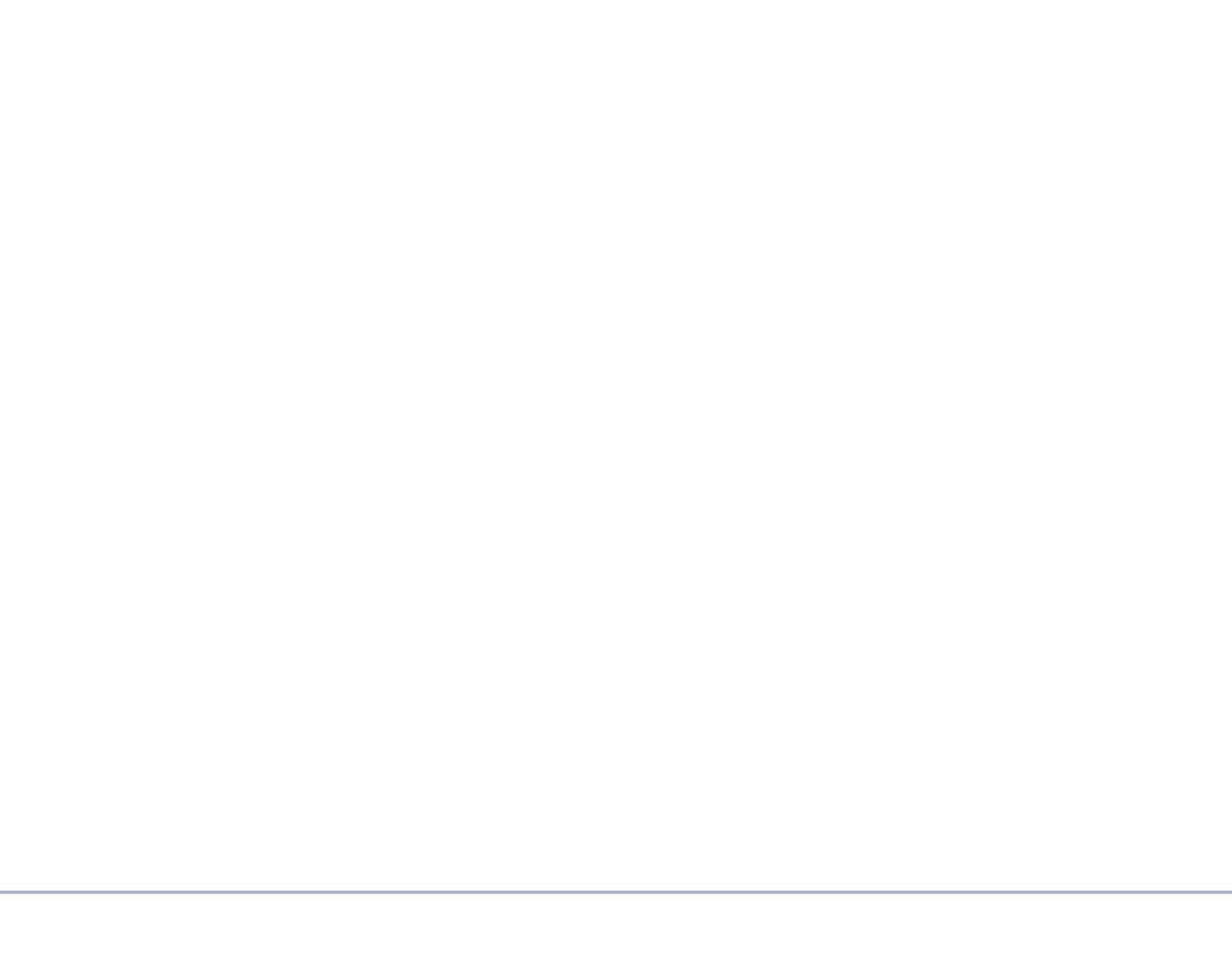
Departure - Modern

Discovery Elementary School, Virginia - 2015



Figure 170

Discovery Elementary School offers several options when it comes to departure. Walkers, car riders and bikers exit the building through the main exit. Students riding the bus exit the building from the east doors adjacent to the shared bus loop with the middle school. The main exit procession includes a long canopy that shelters the students from the weather as well as provides a learning opportunity on sunny days. The canopy contains an oculus and the light has been tracked and marked on the sidewalk below. The canopy also provides a transition between the indoors and the outdoors. Because the school is located on a hillside, a student is exposed to abundant views of nature as he/she exits the building and site.



II. Conclusions

The folio pages contained in this volume, “Empathetic Design: The Exploration” are a tool to help explore the critical role empathy plays in becoming an Empathetic Designer. As stated numerous times in this thesis, knowledge is a critical first step in this journey. These folio pages contain a vast amount of data and analysis to provide this knowledge. However, as also stated numerous times in this thesis, the bridge to successful inclusive design lies in empathy. As a result, analysis of these folio pages is meant to be a personal journey taken by the reader. They are loose to foster discovery through arrangement and re-arrangement of the pages. This discovery will lead to understanding. Understanding will lead to empathy. Empathy will lead to successful inclusive design.

However, in an effort to begin a dialogue between design team members regarding inclusive design using empathy, the following conclusions as a result of this exploration are offered:

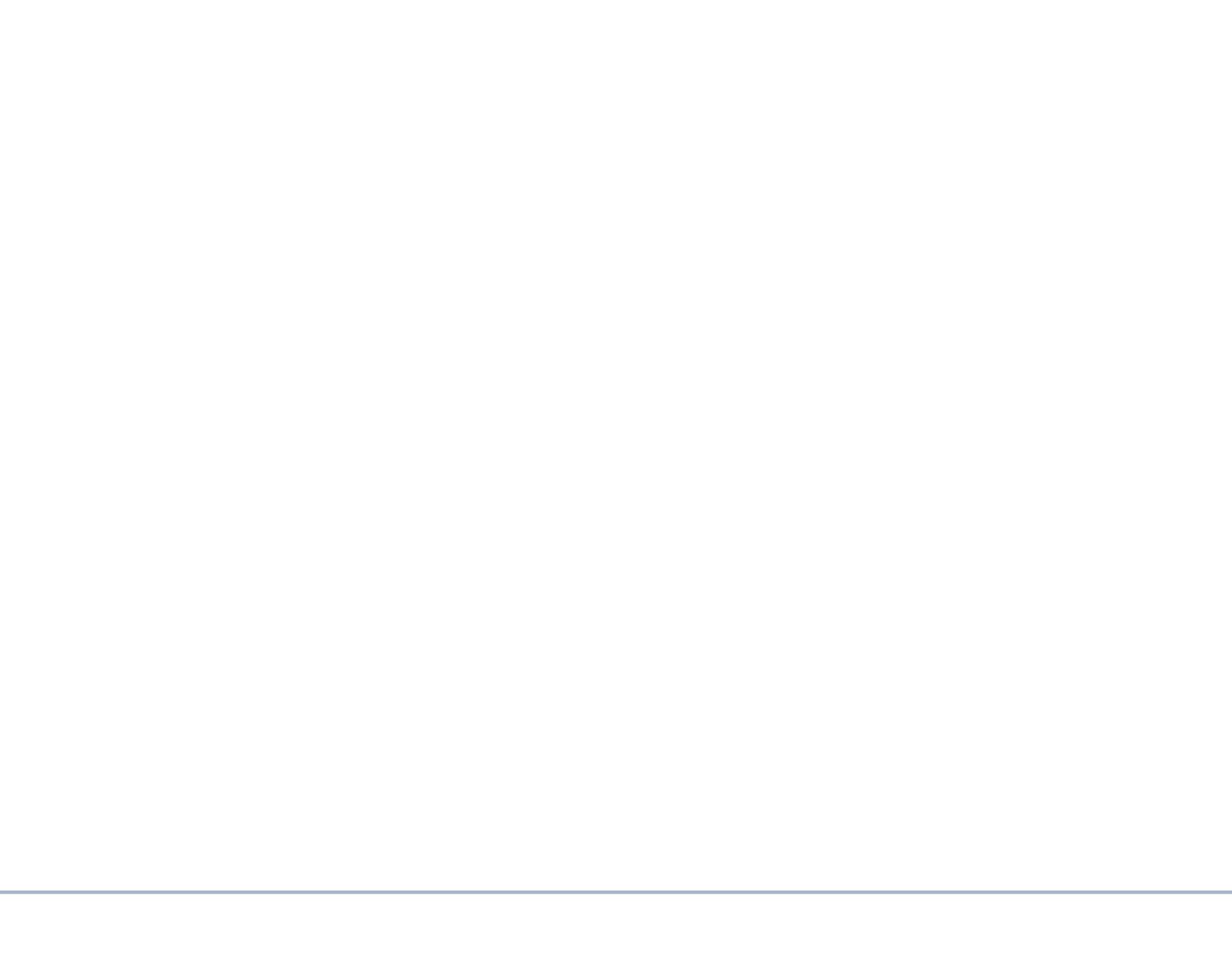
- As expected, no single school building type can be absolutely successful in providing an environment that prevents, reduces and relieves stress for high functioning autistic (HFA) students.
- Similarly, no single school day can be engineered to do the same.
- The challenges design professionals encounter when designing for HFA populations are great. These challenges include the fact that HFA individuals exhibit a variety of deficits. Some HFA individuals have social skills deficits while others have communication deficits. Some HFA individuals exhibit flexibility deficits or restricted interests. Some HFA individuals have sensory integration deficits. Some have only two or three of these qualities while others have all five. In addition, some HFA individuals have a variety of deficits within each category. For example, one HFA individual might have hypo-sensory sensitivity while others might have hyper-sensory sensitivity. Designing for this great diversity in population is complex. There can be no single “one-size fits all” approach.

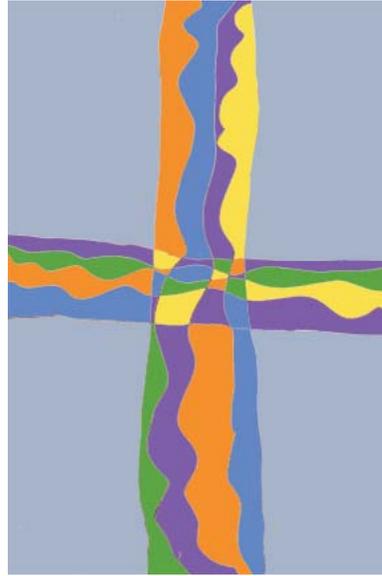


- The exploration reveals both strengths and weaknesses in each building type and daily component combination. The following are only a small sampling of these stressors and strategies evident in careful review of the folio pages:
 - The Early Traditional / Approach folio page explores qualities that might appeal to some HFA students. For example, a visit to the rest room facilities requires a brief walk through the outdoors. This might provide a relief to a HFA student who was dealing with the stress endured from content delivery not related to his/her restricted interests. However, this same visit might require a walk through weather conditions that are out of his/her control. This could be a stressor as a result of flexibility deficits.
 - The Traditional / Content Delivery folio page explores qualities that might offer stress relief to some HFA students. For example, chairs bolted to the floor might be a relief to an HFA student who has social skills deficits because there is not an expectation to interact with other students. However, the same chairs that are bolted to the floor can be a stressor to a HFA student who is a sensory seeker and desires movement opportunities during content delivery.
 - The Early Modern / Arrival folio page explores qualities that might appeal to the flexibility deficits of some HFA students. For example, the classrooms are grouped by age and therefore “make sense” to an HFA student with flexibility deficits. However, the same layout produces corridors that can be confusing to HFA students with communication deficits.

- The Experimental / Transition folio page explores qualities that might offer stress relief to some HFA students. For example, each classroom grouping has their own adjacent toilet facilities. This avoids the social stress of large group toilet rooms. However, this same concept introduces stress to other HFA students who are sensitive to sensory issues, particularly those of sound and smell.
- The Green Renewal / Departure folio page explores qualities that might appeal to HFA students. A variety of pick-up methods and pathways are offered to allow children with flexibility deficits to depart the building according to their preference. However, these same methods can introduce stress for other HFA children who have sensory issues and are forced to walk past idling buses and cars along their walk home.
- The Modern / Recreation folio page explores qualities that might offer stress relief to HFA students. For example, a wide variety of outdoor recess equipment is offered. However, this school also has a multi-purpose room that combines the use of eating with the use of play and performance. This confusion of use creates stress in some HFA students.
- The 6 folio page examples on this spread briefly explore only a fraction of the complexities that are revealed when one considers the variety of deficits in an HFA student and compares them to a variety of environments. This complexity exemplifies the need for the fundamentals that are presented in Volume One.



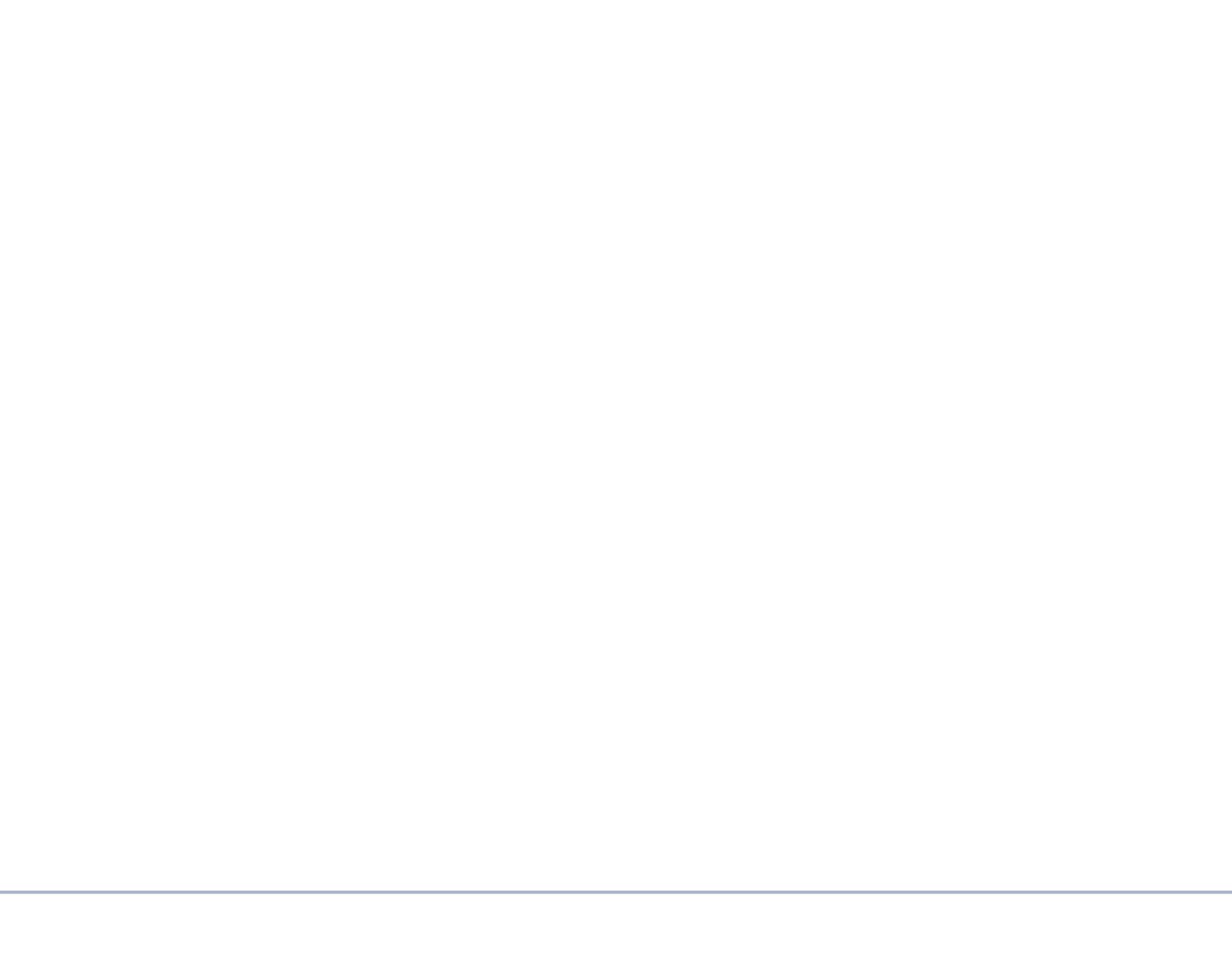




Empathetic Design: The Empathy Sketchbook

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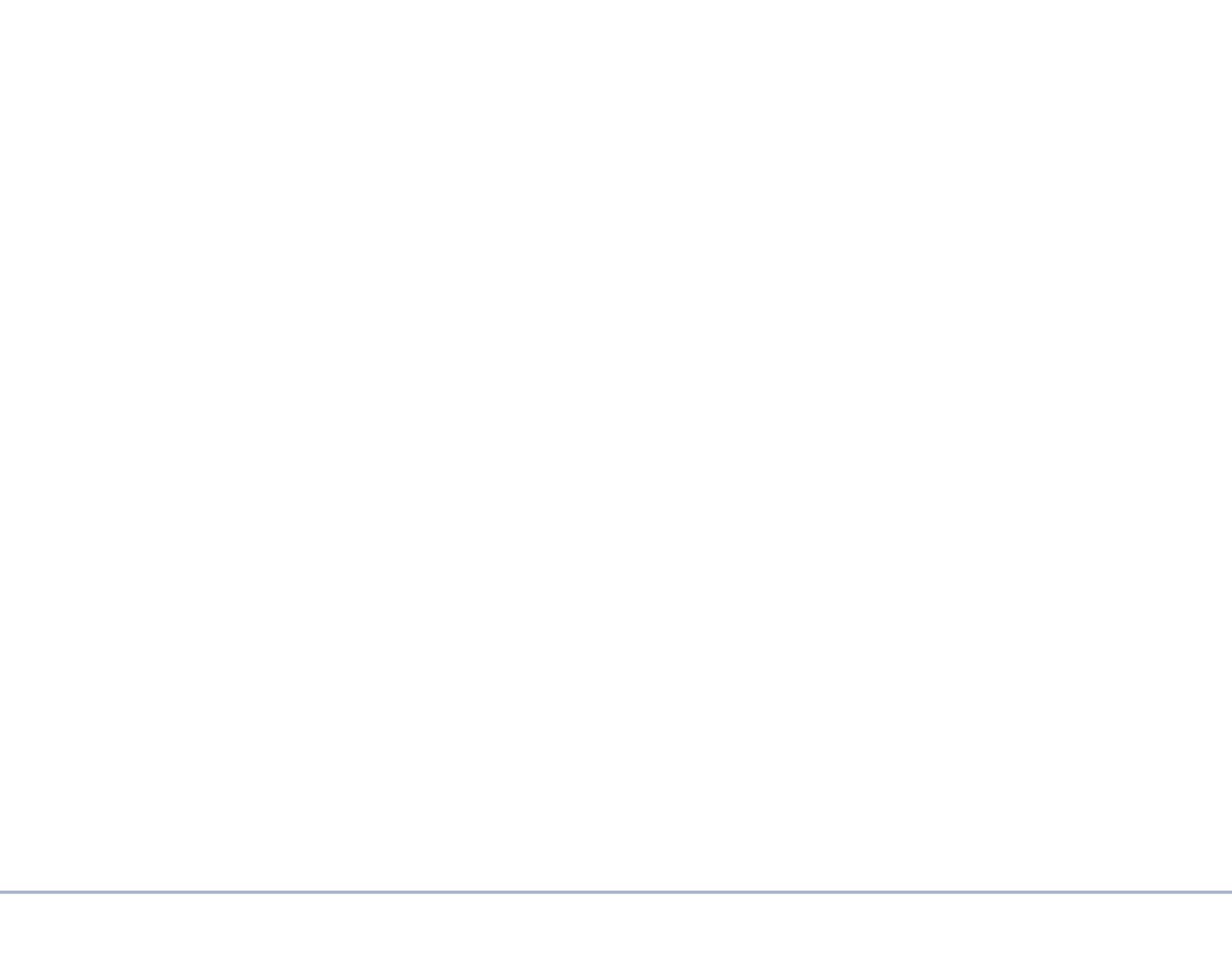


Foreword

This sketchbook is the culmination of over twenty years of professional practice of architecture, over ten years of parenting a high functioning autistic child, and research in the pursuit of a Master of Architecture degree. This “Empathy Sketchbook” is the final volume of a three-volume thesis entitled *“Empathetic Design: How Elementary School Environments Designed to Reduce Stress Can Foster Inclusion of High Functioning Autistic Children.”*

This sketchbook is a compilation of words and sketches, and firsthand testimony of high functioning autistic adults and children. The sketches were drawn by high functioning autistic children specifically for my research.

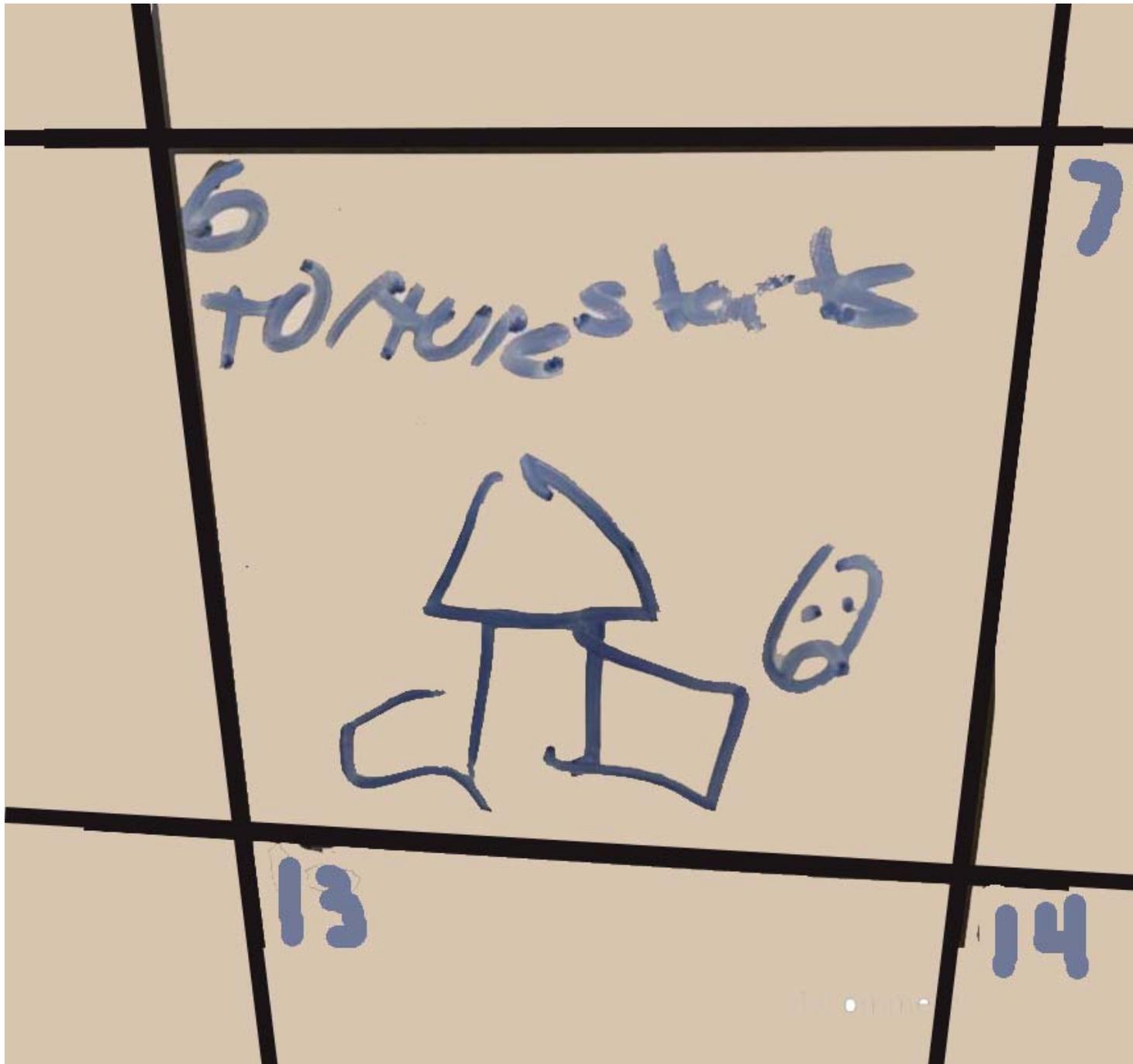
The intended audience for this sketchbook is school designers, administrators and planners. From experience, I know that there is never enough time to understand all the needs of all of the users. It is my hope that this sketchbook will efficiently and effectively provide this understanding of high functioning autistic children to forever change the way schools are designed. It is my hope that the testimony in the following pages will create Empathetic Designers.



I. Empathy Sketchbook

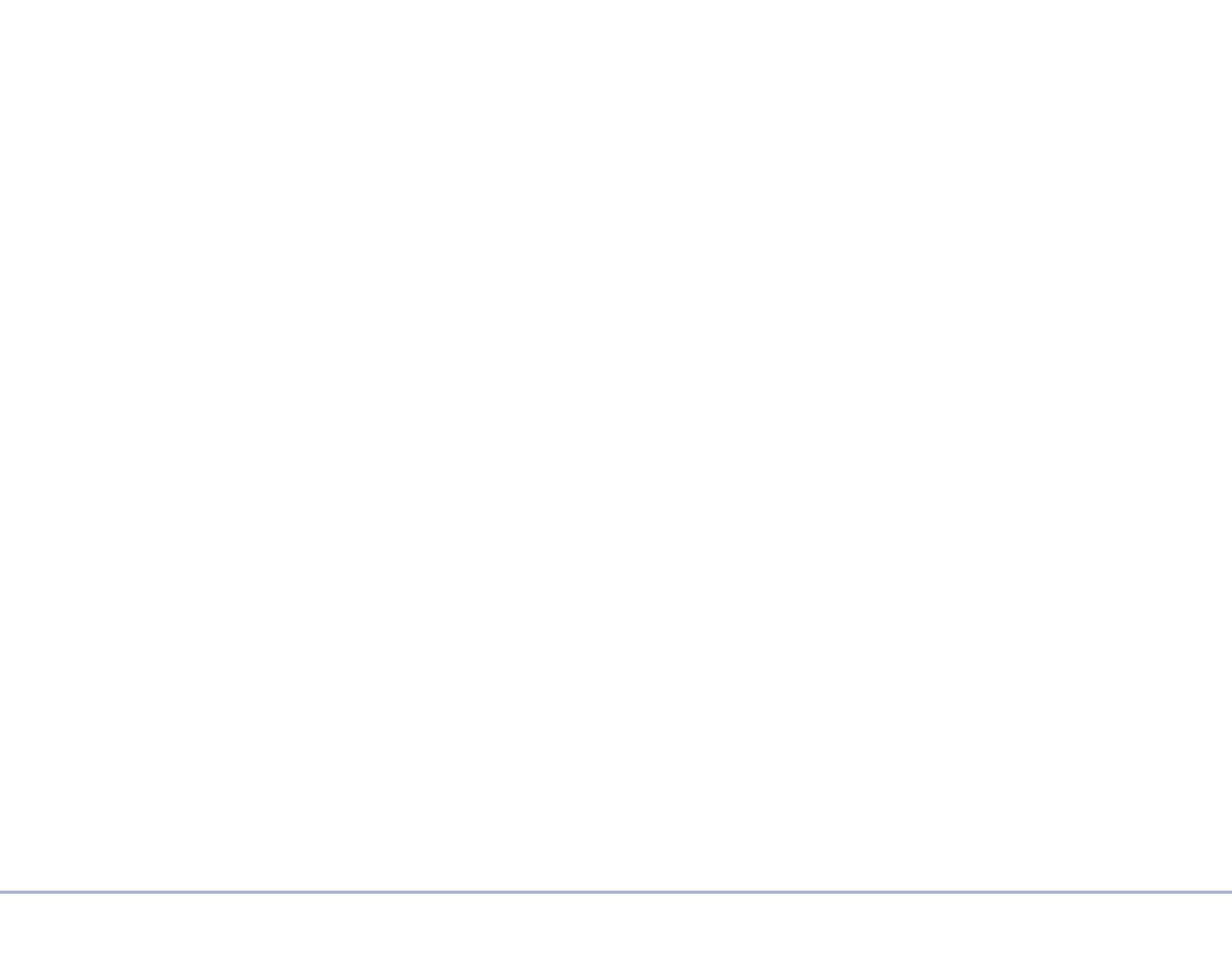
“Autists are the ultimate square pegs, and the problem with pounding a square peg into a round hole is not that the hammering is hard work. It’s that you’re destroying the peg.”

Paul Collins, author of *Not Even Wrong: Adventures in Autism*



A sketch on the family whiteboard calendar on September 6
(The first day of school)

Ella B., age 11



“Reality to an autistic person is a confusing, interacting mass of events, people, places, sounds and sights. There seem to be no clear boundaries, order or meaning to anything. A large part of my life is spent trying to work out the pattern behind everything. Set routines, times, particular routes and rituals all help to get order into an unbearably chaotic life. Trying to keep everything the same reduces some of the terrible fear. Life is such a struggle; indecision over other things that other people refer to as trivial results in an awful lot of distress - if someone says ‘We may go shopping tomorrow’ or ‘We will see what happens,’ they do not seem to realize that the uncertainty causes a lot of inner distress.”

Theresa Jolliffe, author of *Autism: A Personal Account*



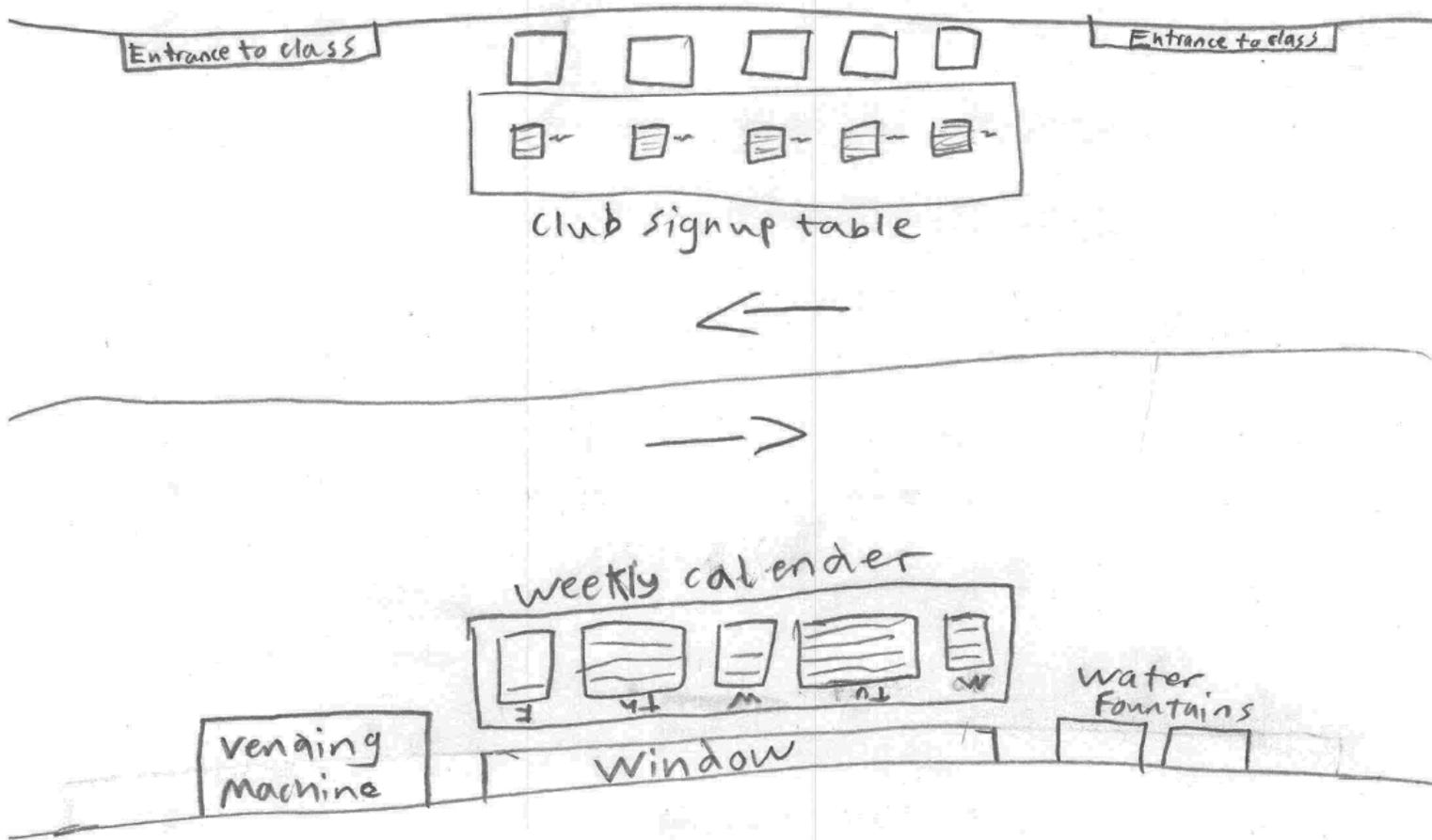
“The teacher should stay in one place at the front of the room.”

Lulu C., age 7, *sketch of her “Dream Classroom”*



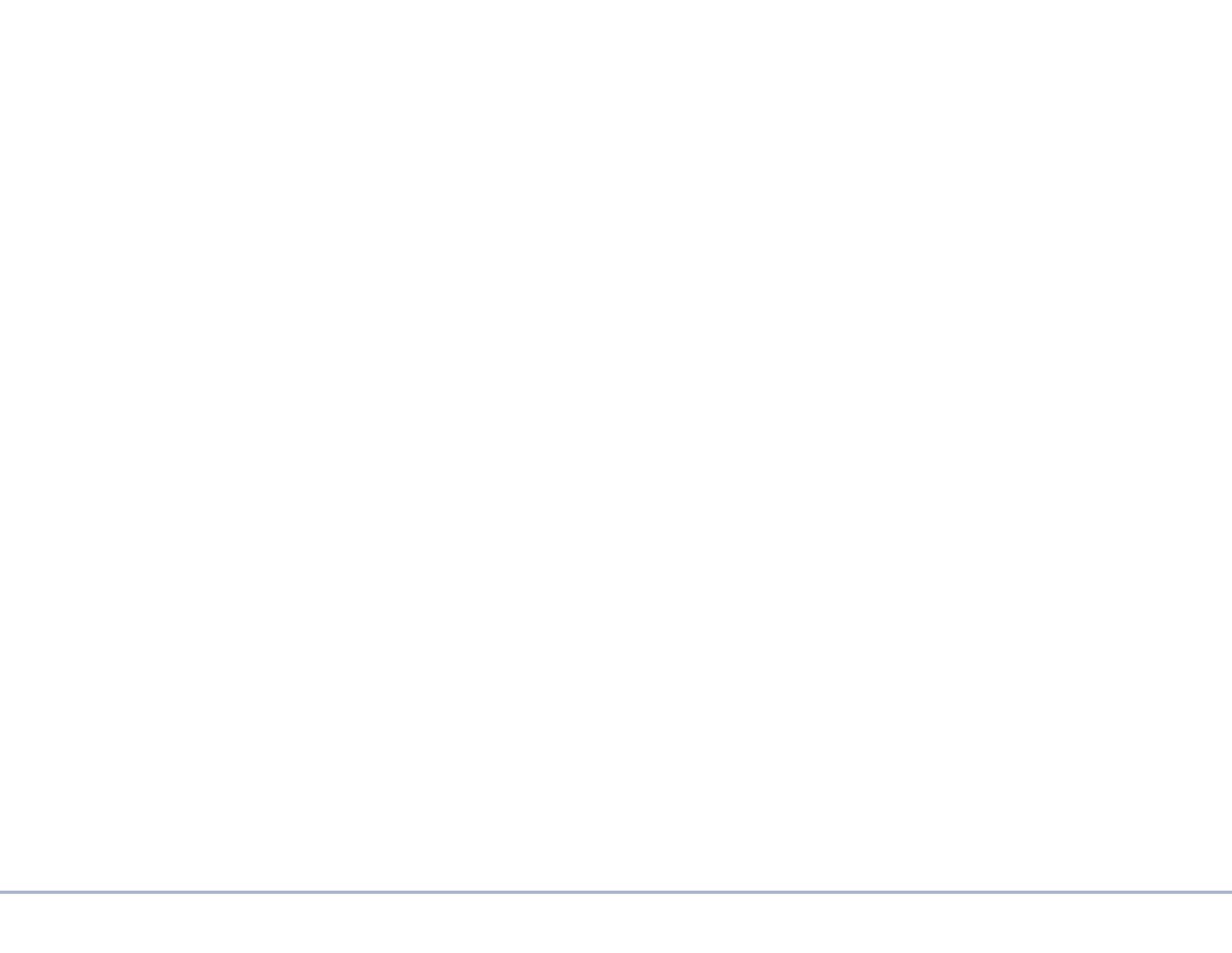
“The front doors should be automatic but there should be signs so people know.
There should be lots of windows so you can see inside.
Even the walls could be windows.”

Eiden A., age 9, *sketch of his “Dream School”*



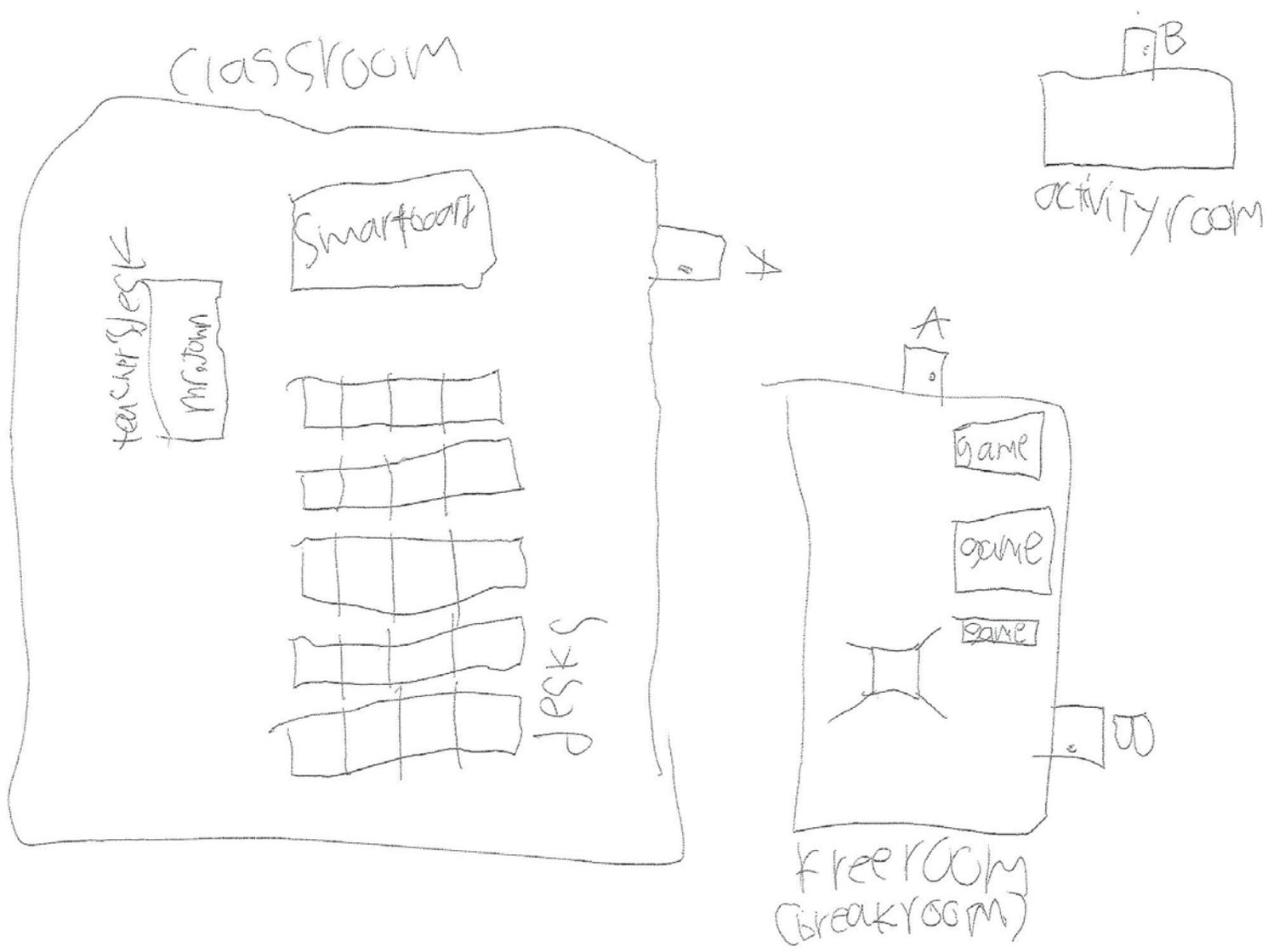
“People should stay on their side of the hallway. The halls are always so crowded. There should be lines on the floor like there are on the street so you don’t get trapped or have a collision. I’d like to see a calendar posted on the walls in case I forget what I am supposed to do each day. I also want to have options of things to drink while I walk.”

Jared G., age 12, *sketch of his “Dream Hallway”*



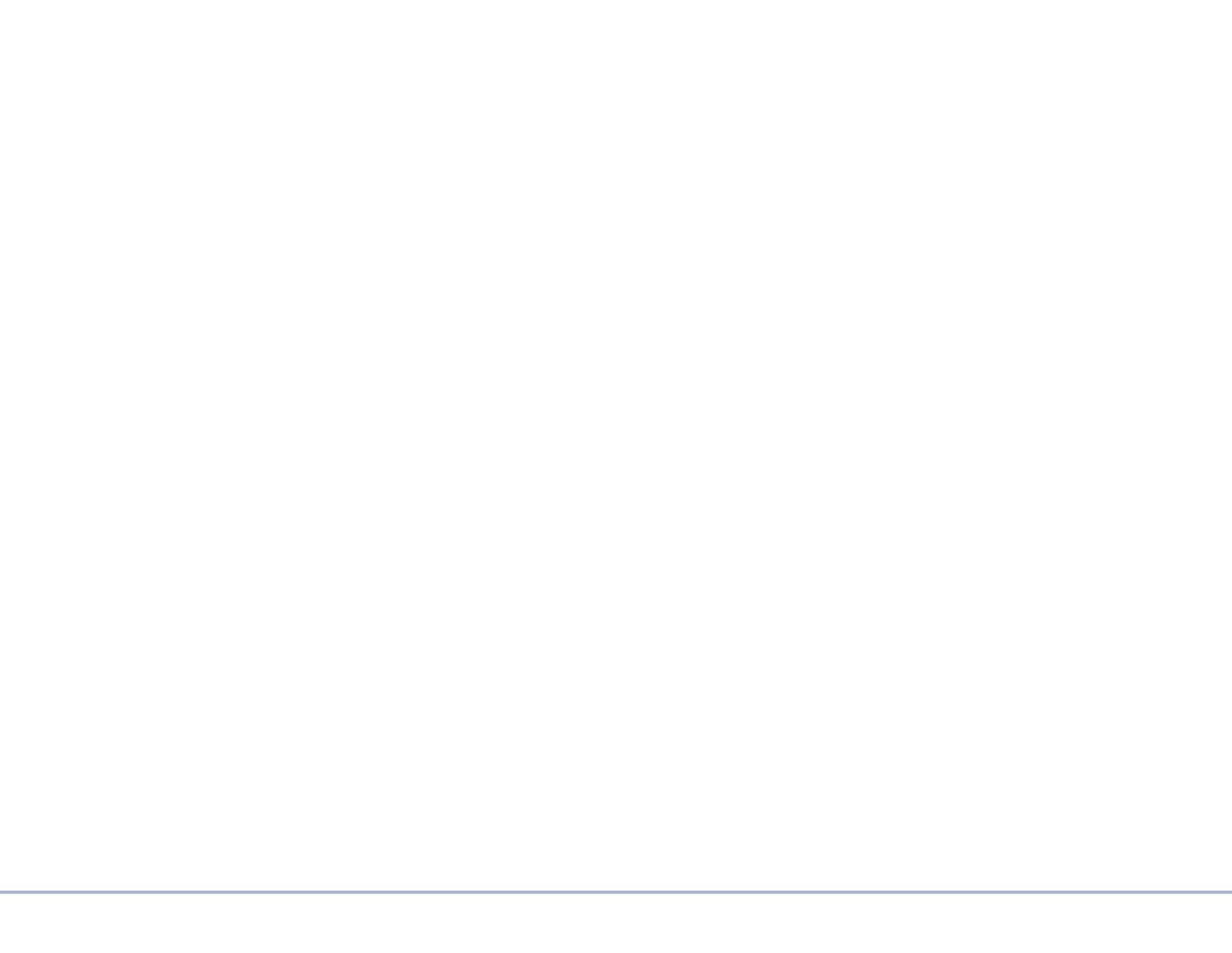
“Although I was glad they were here, I’m just as glad that they are gone and I’m alone again in all quietness. I love someone coming over, but each time I experience it as a field of tension: wanting to be around other people but not being able to cope with it.”

Schipper Landschip, co-author of *Dubbelklik (Double Click)*



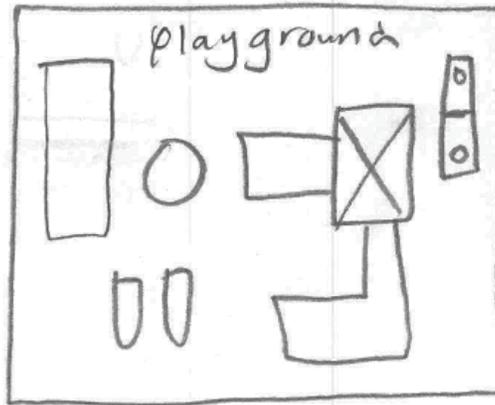
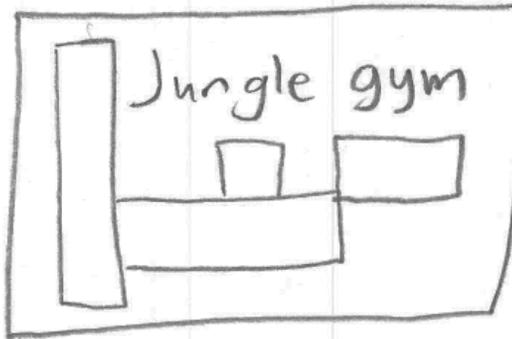
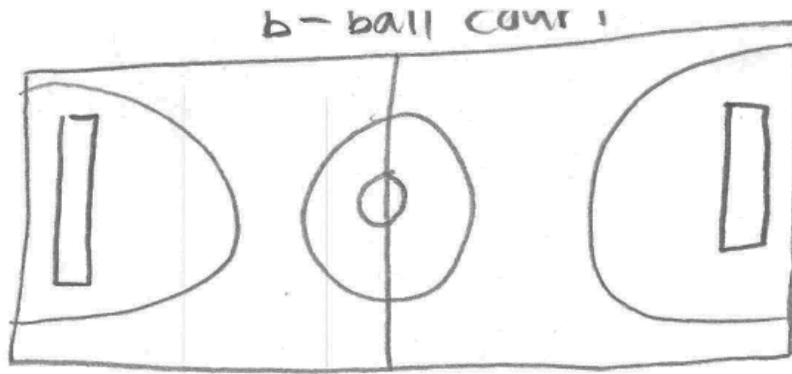
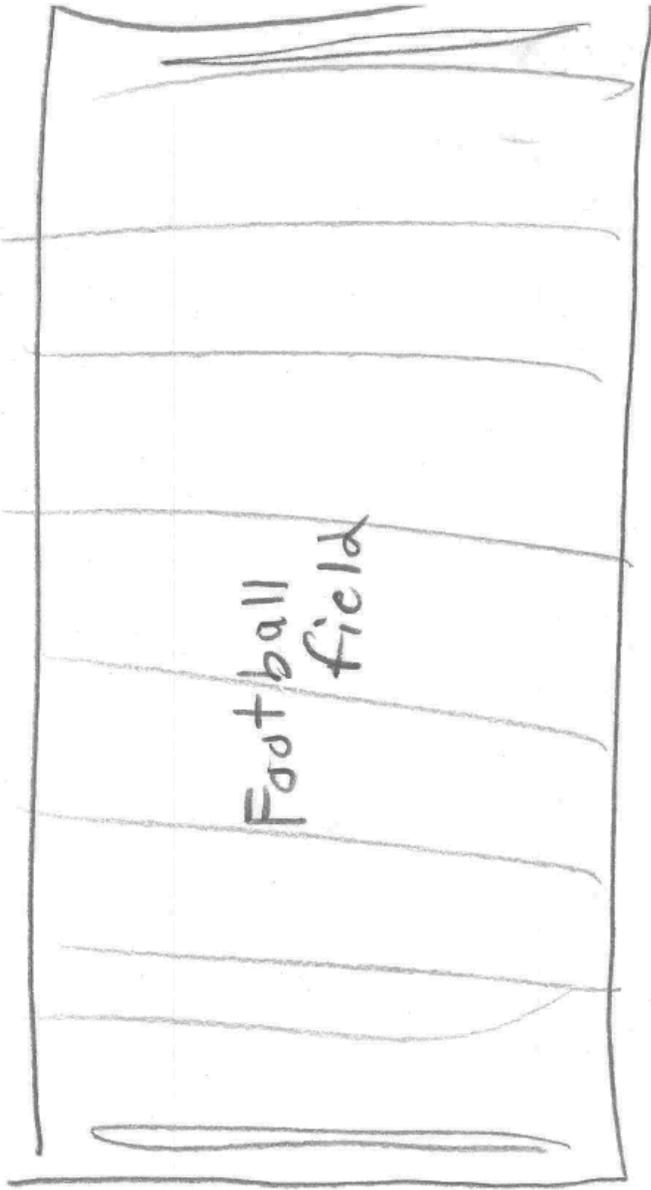
“The activity room is where you talk to people.
The doors could line up so you don’t need hallways.”

Bobby L., age 11, *sketch of his “Dream School”*



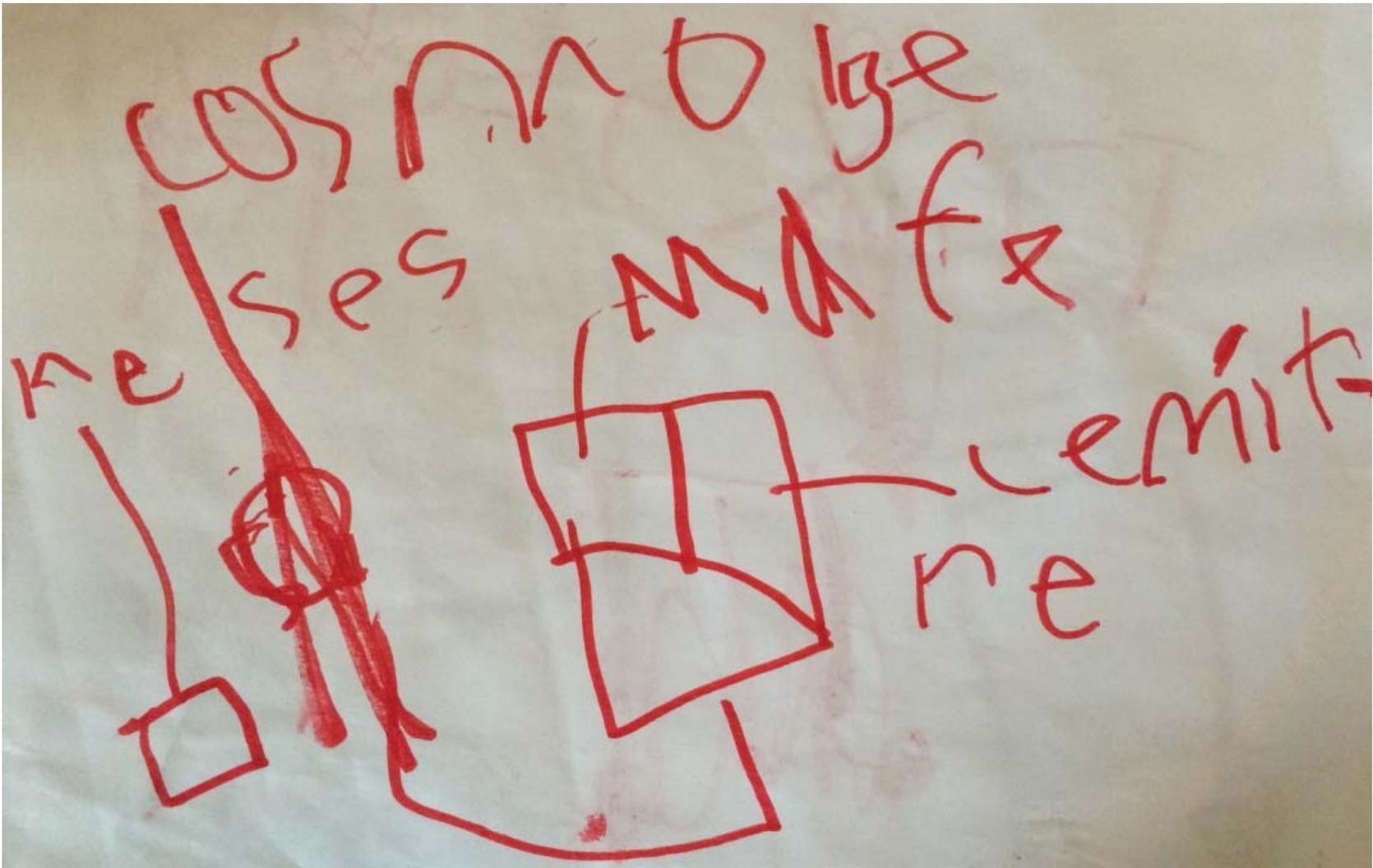
“Each activity has its own place, even at home. These fixed places provide me with the safety and structure which is so essential to me...When my fixed pattern is interrupted, life suddenly gets harder. It seems like I don't remember how to do even the simplest things.”

Dominique Dumortier, author of *Van een andere planeet*
(*From a Different Planet*)



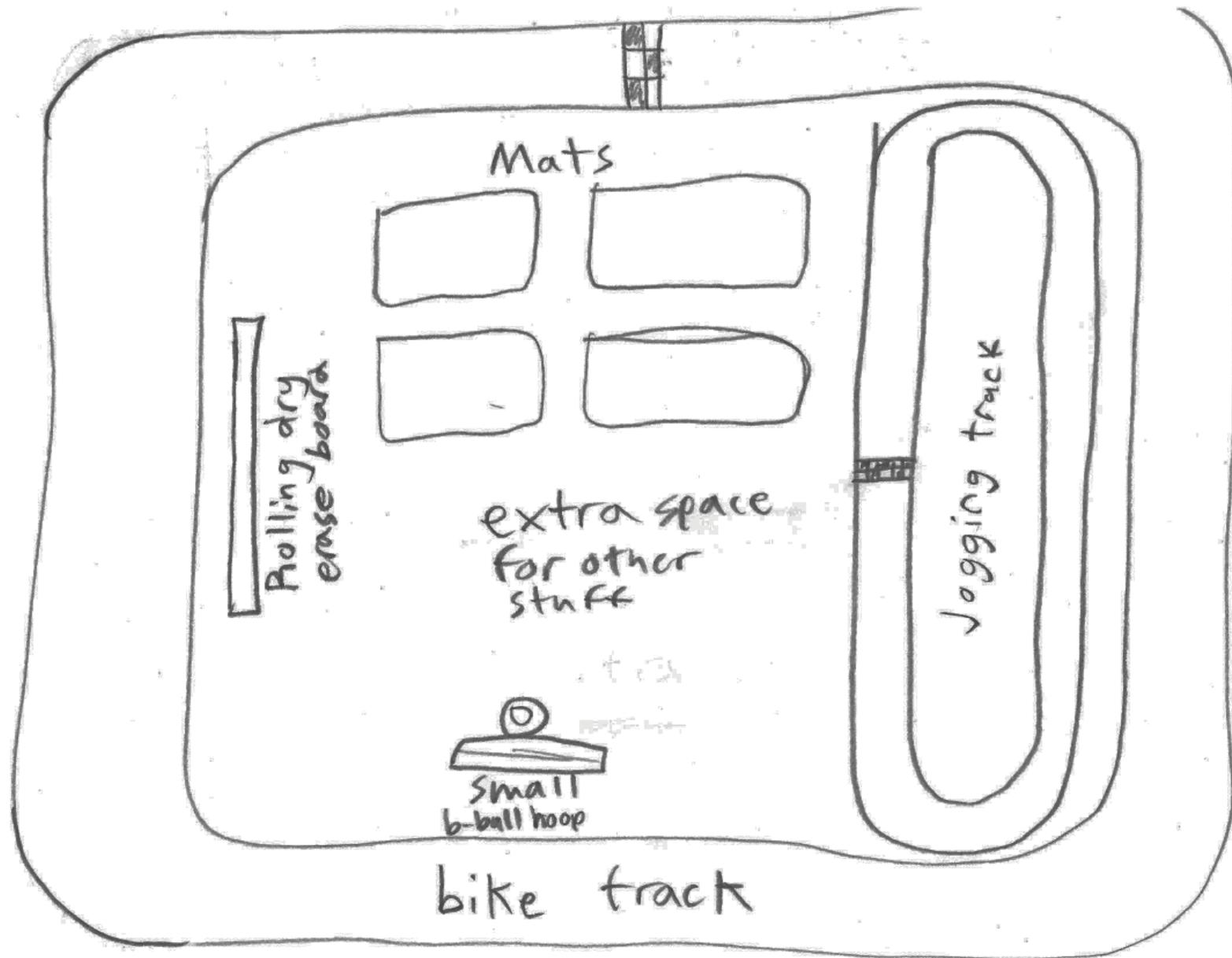
“Most schools have either a soccer field or a football field.
I’d like a school with one of each.
That way you don’t play soccer on the football field.
Each outside activity should have its own area.”

Jared G., age 12, *sketch of where he’d like to play*



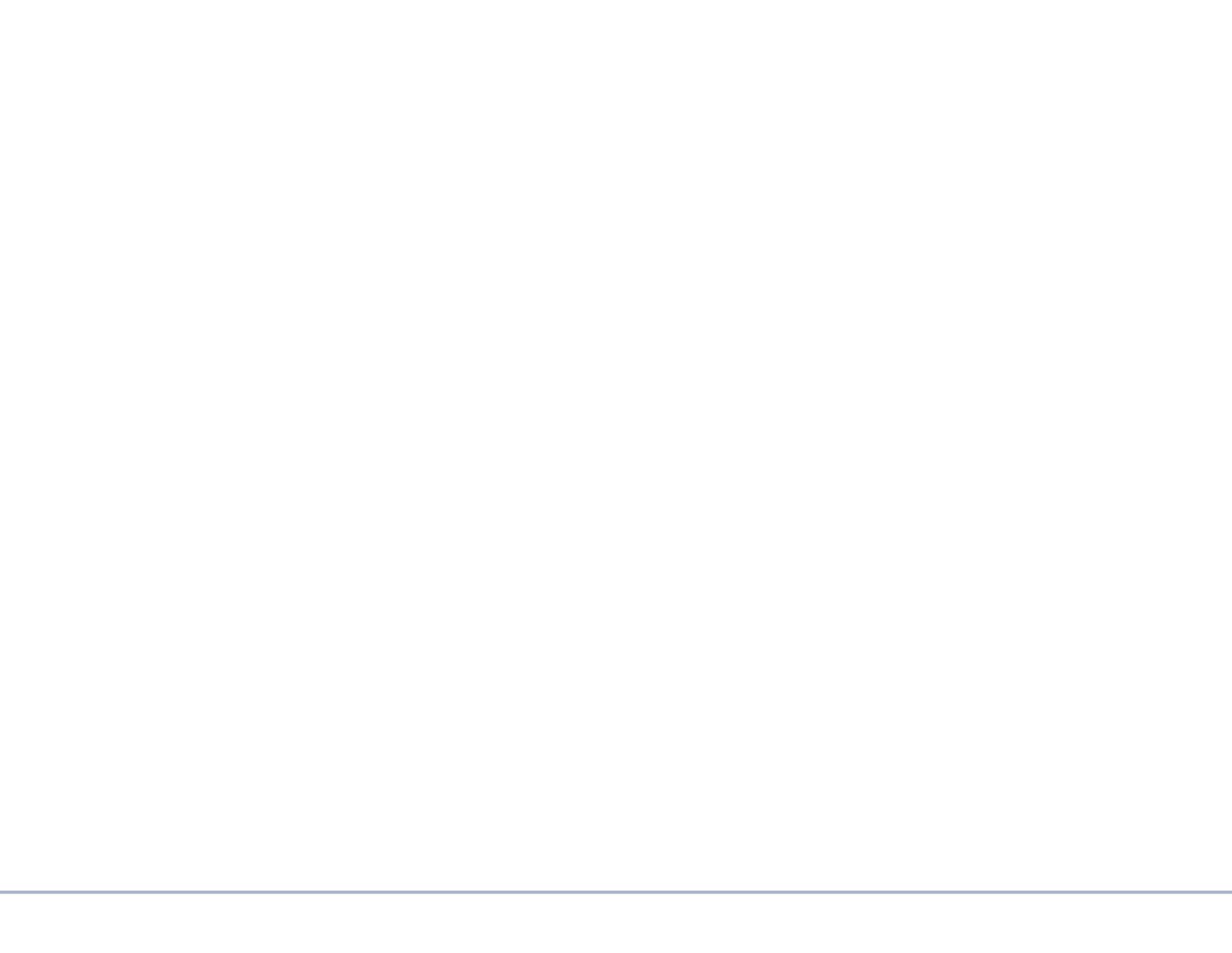
“There should be separate rooms for each subject. The subjects should be only chemistry, cosmology, math and recess. There should be a big lab for science experiments.”

Lulu C., age 7, *sketch of her “Dream School”*



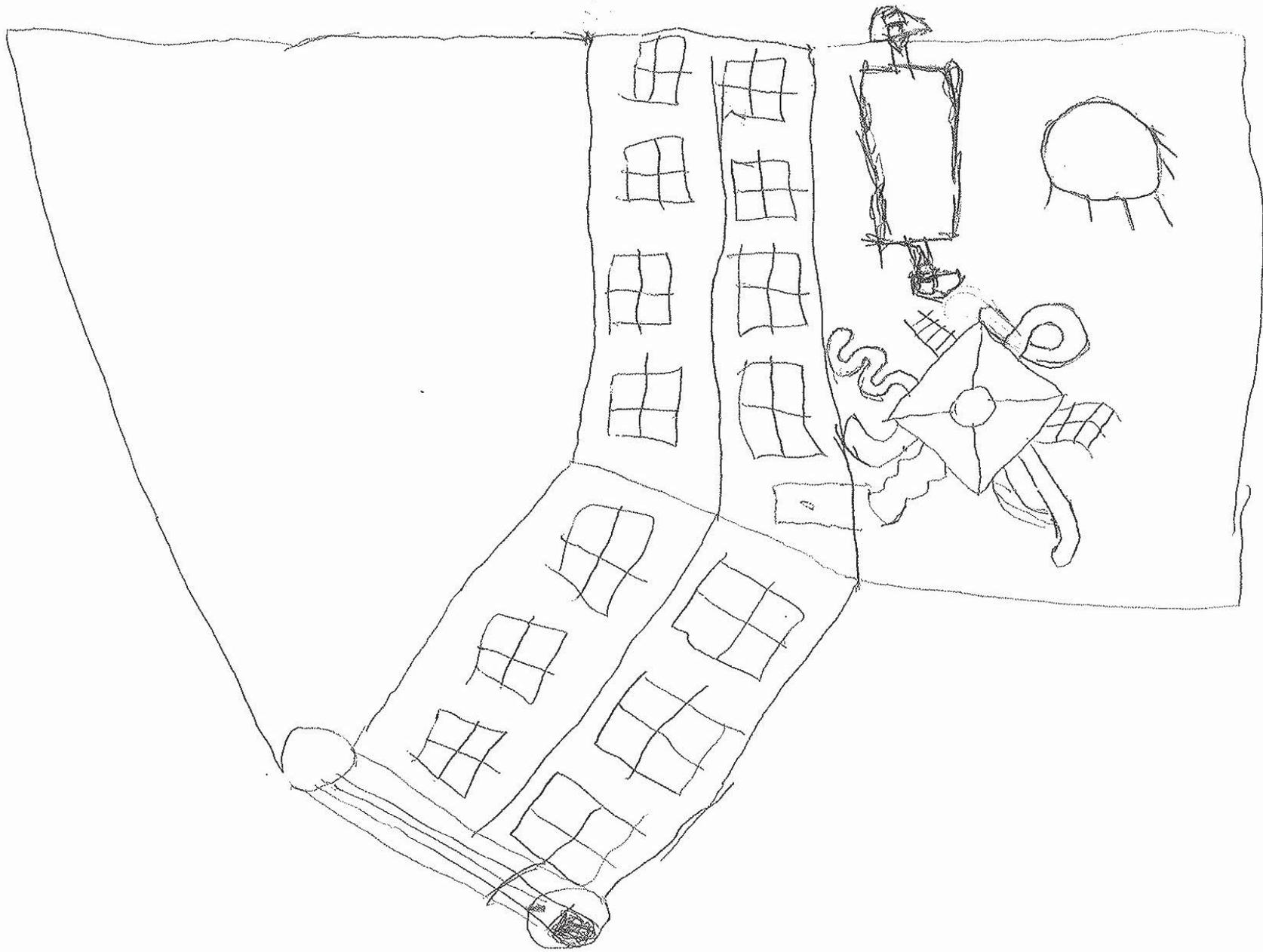
“Each place in the gym should have its own activity. There should be railings beside the bike track. The whiteboard should be on wheels so it can move to where the teacher needs to teach.”

Jared G., age 12, *sketch of where he'd like to exercise*



“My autism makes things shine. Sometimes I think it is amazing but sometimes it is sad when I want to be the same and talk the same and I fail. Playing the piano makes me very happy. Playing Beethoven is like your feelings – all of them – exploding.”

Mikey Allcock, 16-year-old who was non-verbal until age 10



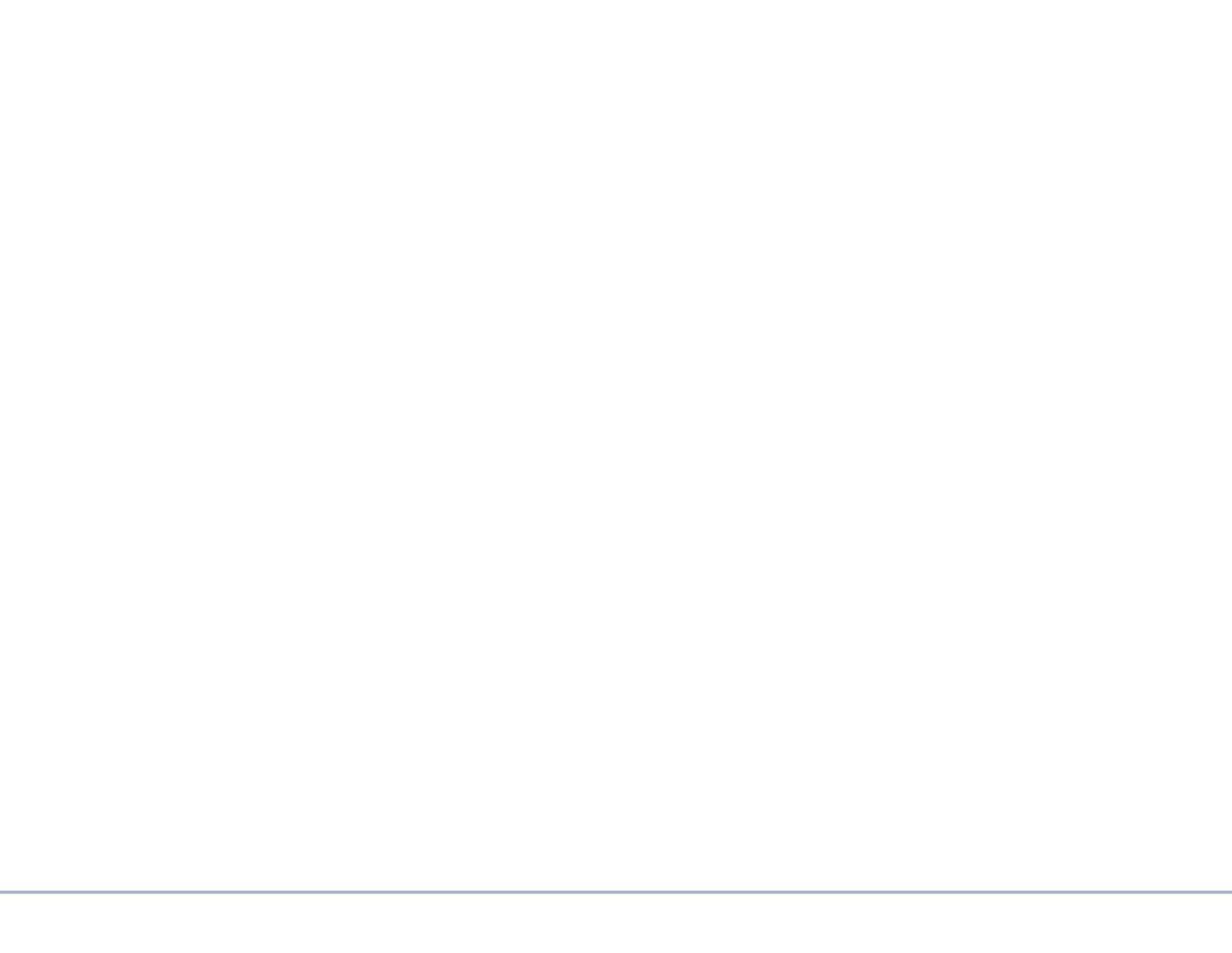
“Schools need trampolines.”

Justin P., age 11, *sketch of his “Dream School”*



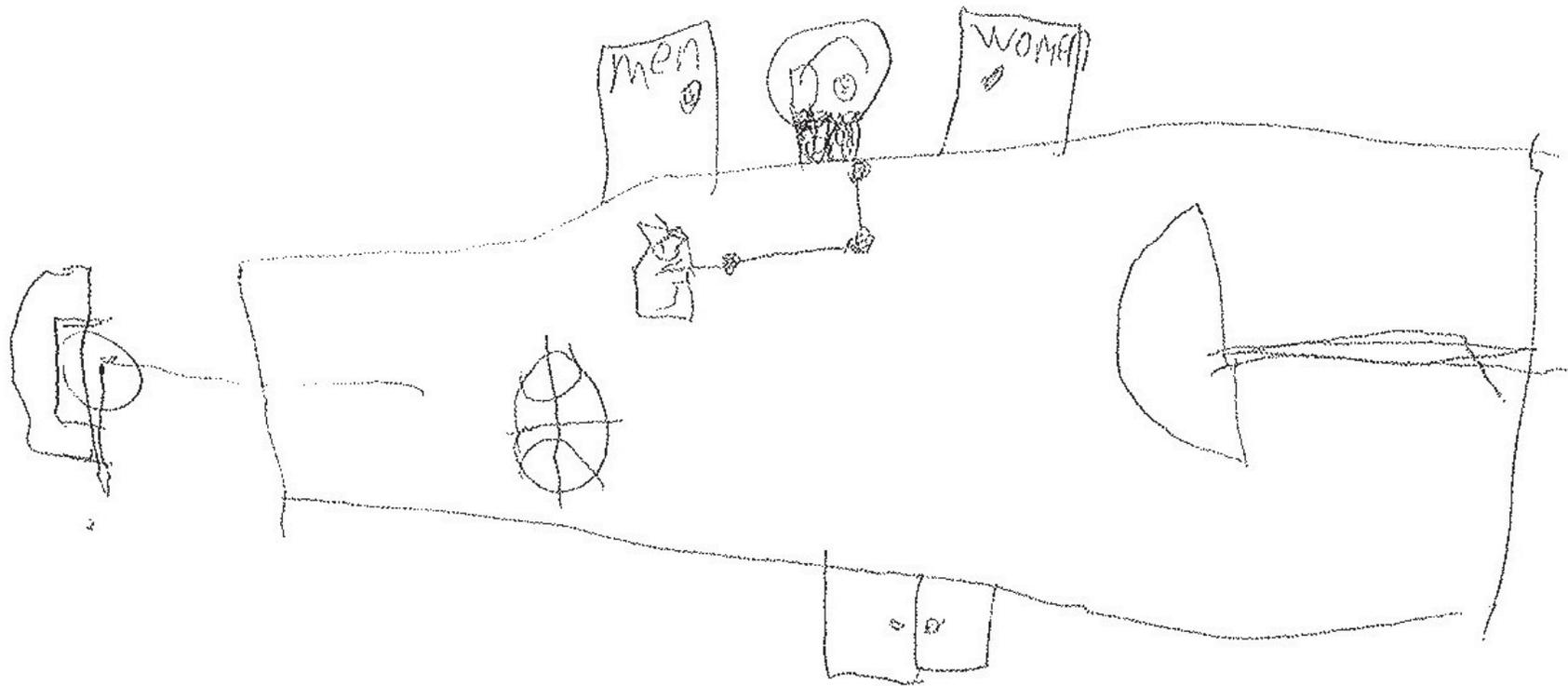
“I wish schools could have roller coasters. The best part is when you hold up your hands right before you go over the top. You go slow, then really, really fast!”

Andrew G., age 9, *sketch of his favorite place*



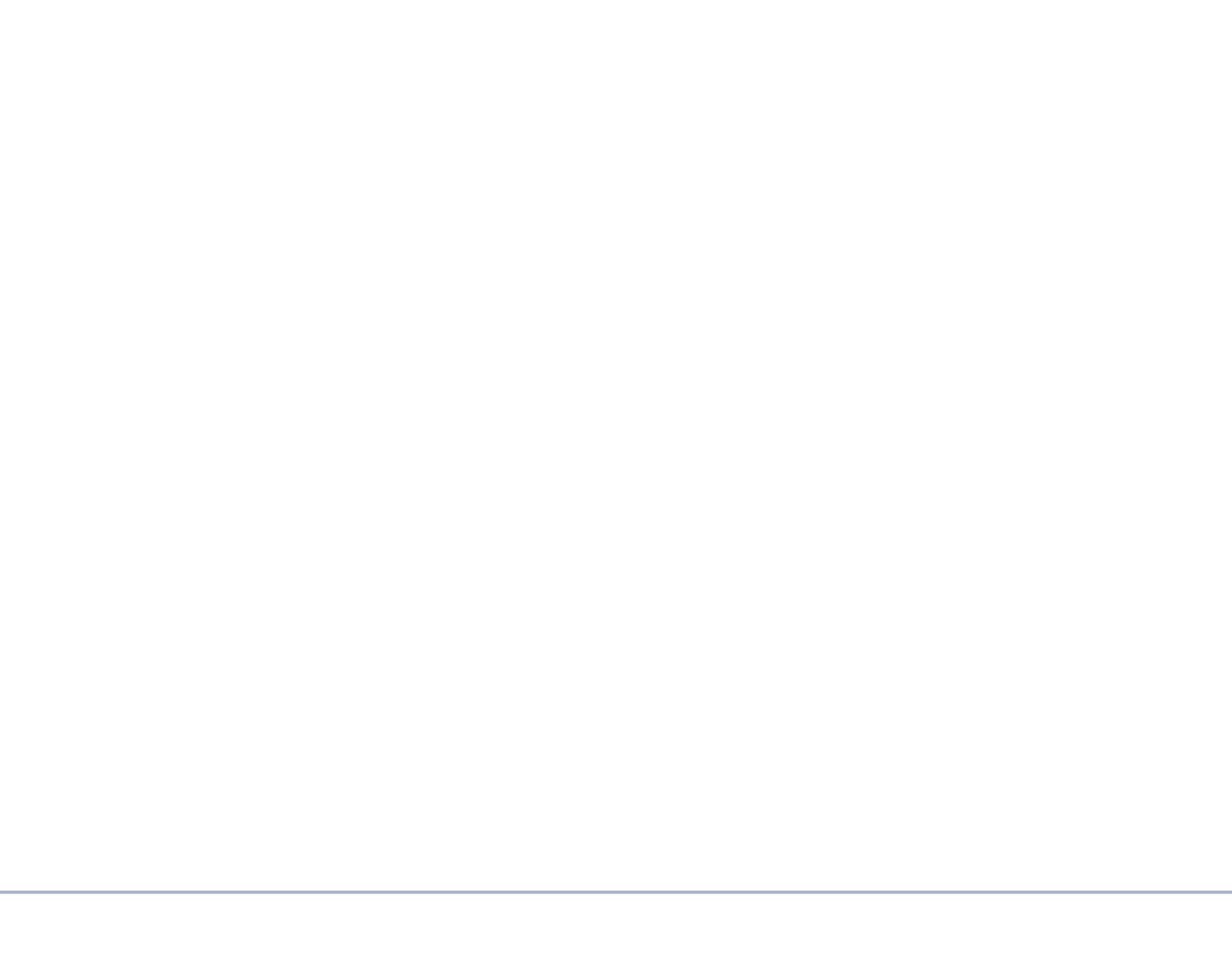
“I can only speak for myself when I say that if one subject is on my mind or I am fascinated by something, then literally everything else is insignificant - I feel an overwhelming excitement in me that I cannot describe. I just have to talk about it and the irritation at being stopped can easily develop into raging fury.”

Luke Jackson, author of *Freaks, Geeks and Asperger Syndrome*



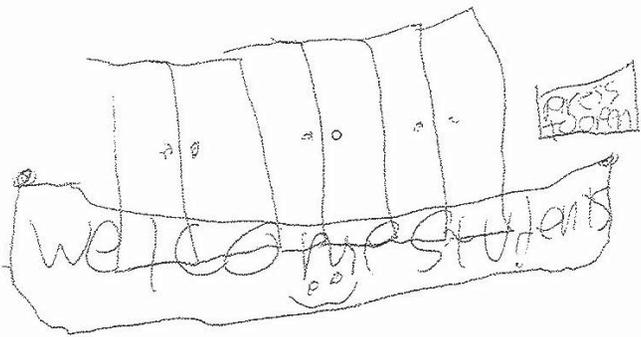
“There should be painted lines and dots on the floor to show where kids need to stand to wait in line for the drinking fountain.”

Bobby L., age 11, *sketch of the gym of his “Dream School”*

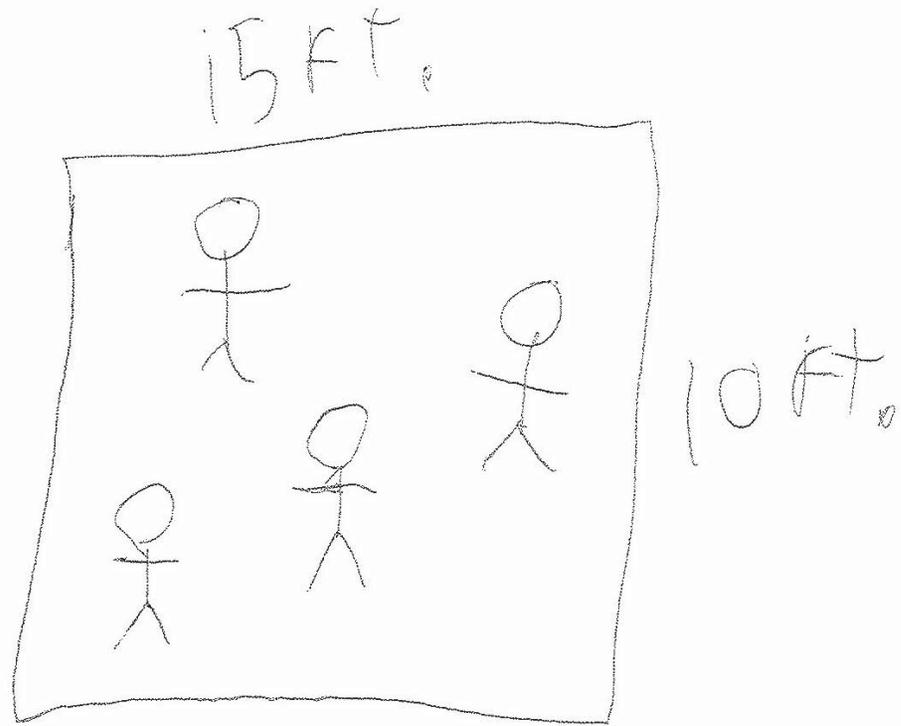


“It is likely that such a person has no idea of his body boundaries and that sights, sounds and touches are all mixed together. It must be like seeing the world through a kaleidoscope and trying to listen to a radio station that is jammed with static at the same time.”

Temple Grandin, *describing internal interference*



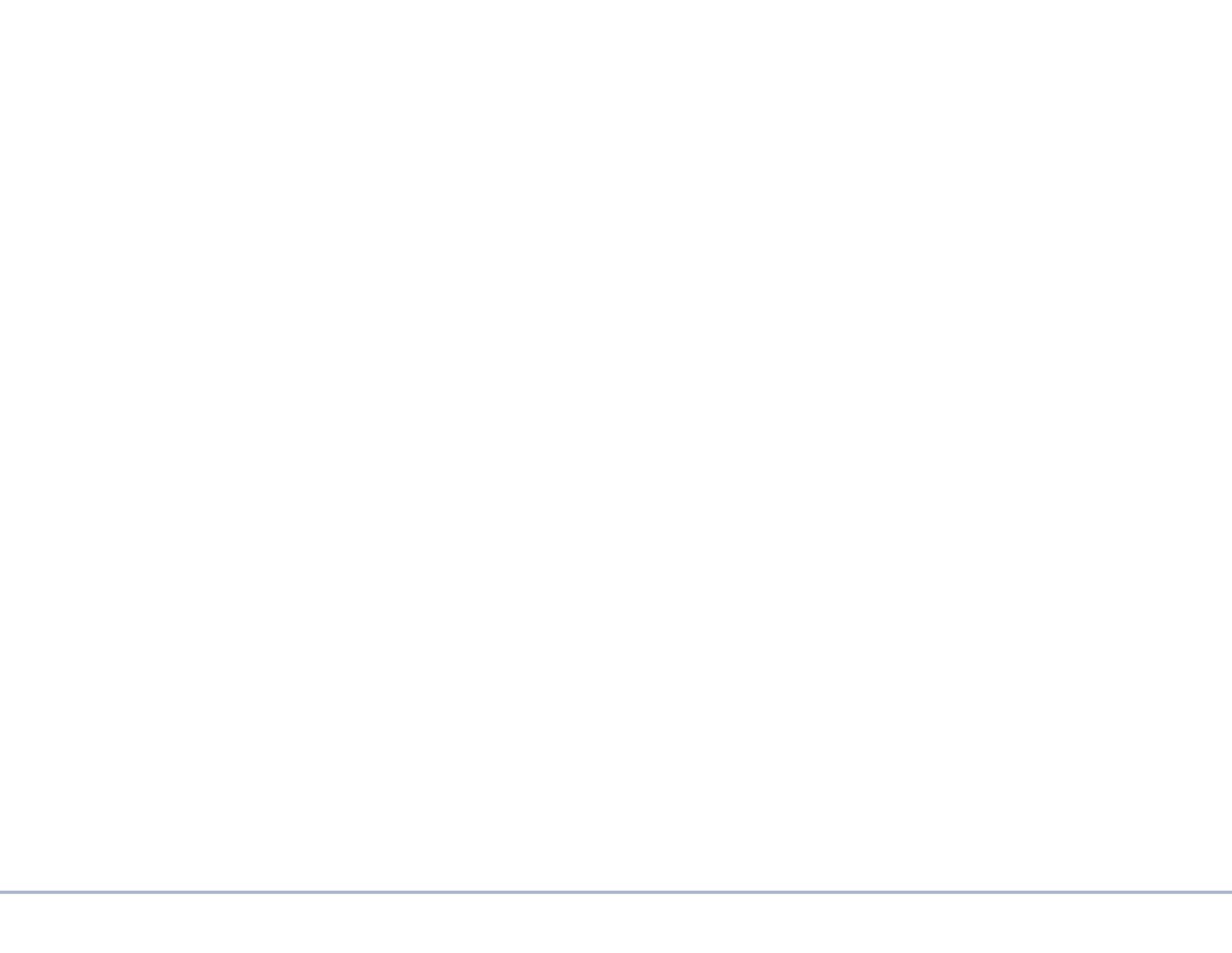
door view
(front)



Lobby view
(top)

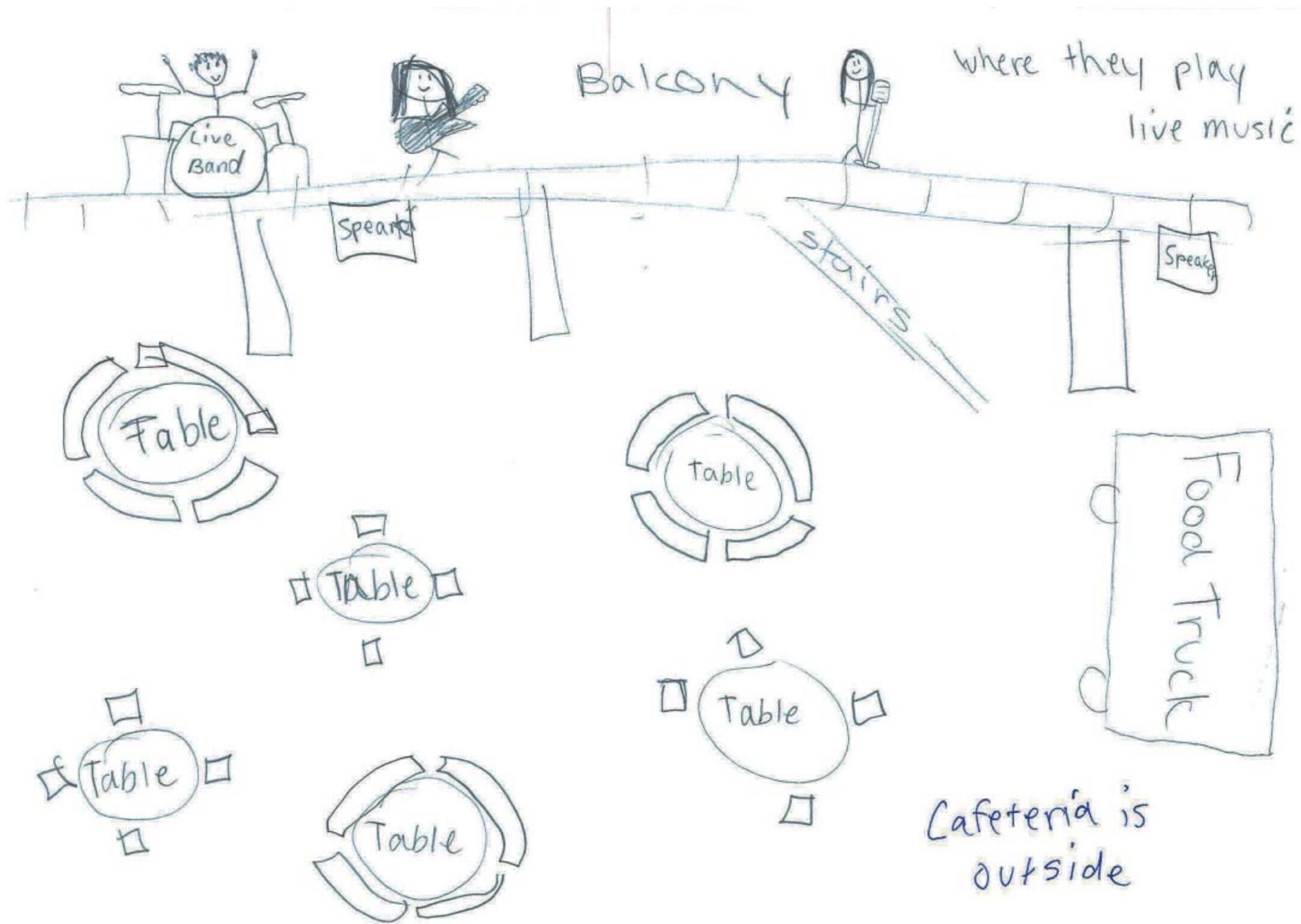
“The lobby should be big enough so no one has to touch each other when they walk in.”

Bobby L., age 11, *sketch of the entrance of his “Dream School”*



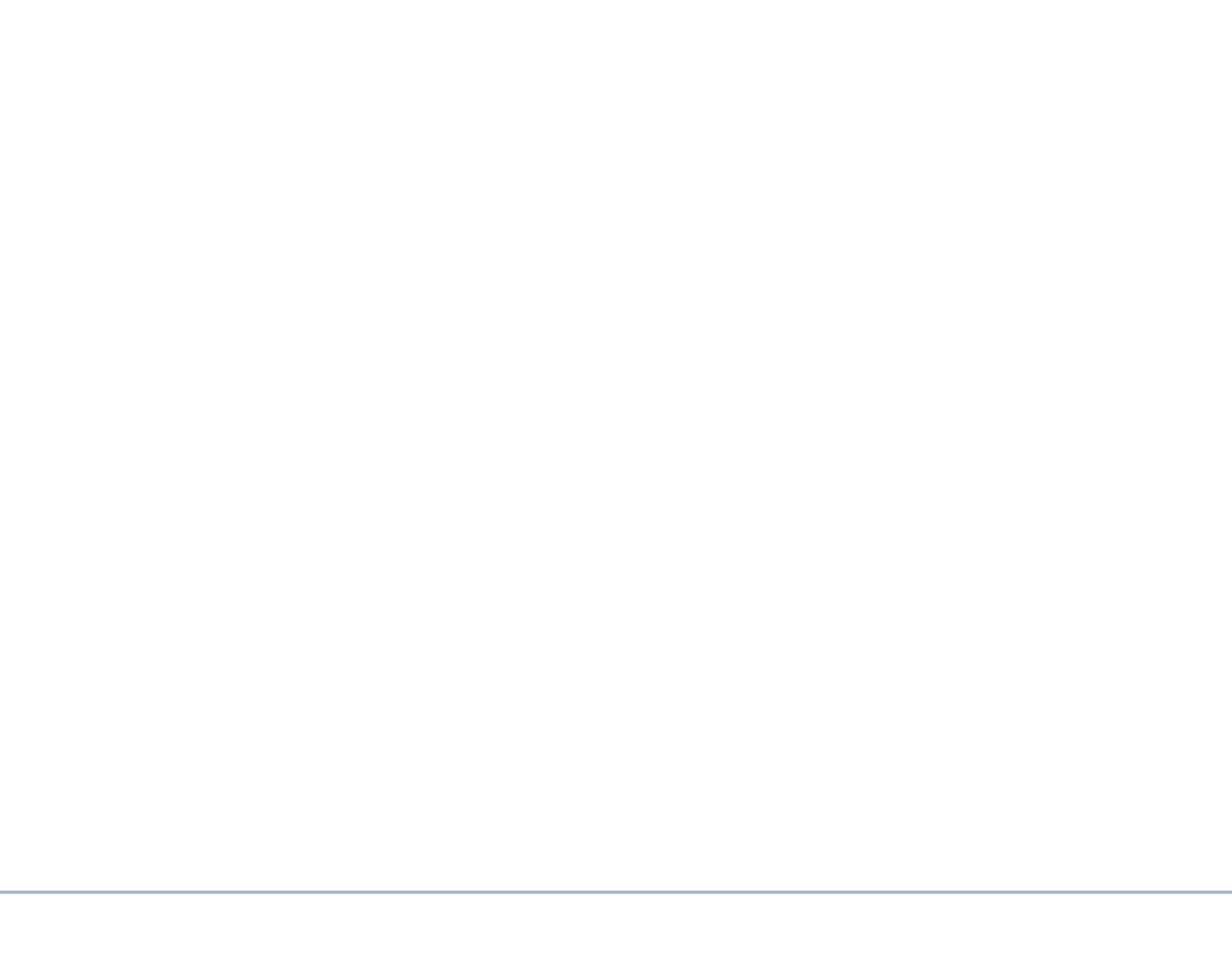
“Vibrant waves of sequenced patterns emerged in my head whenever I looked at musical notes and scores. Like pieces of a mysterious puzzle solved, it was natural for me to see music and its many facets as pictures in my head. It never occurred to me that others couldn’t see what I saw.”

Dr. Stephen Shore, author of
Beyond the Wall: Personal Experiences with Autism and Asperger Syndrome



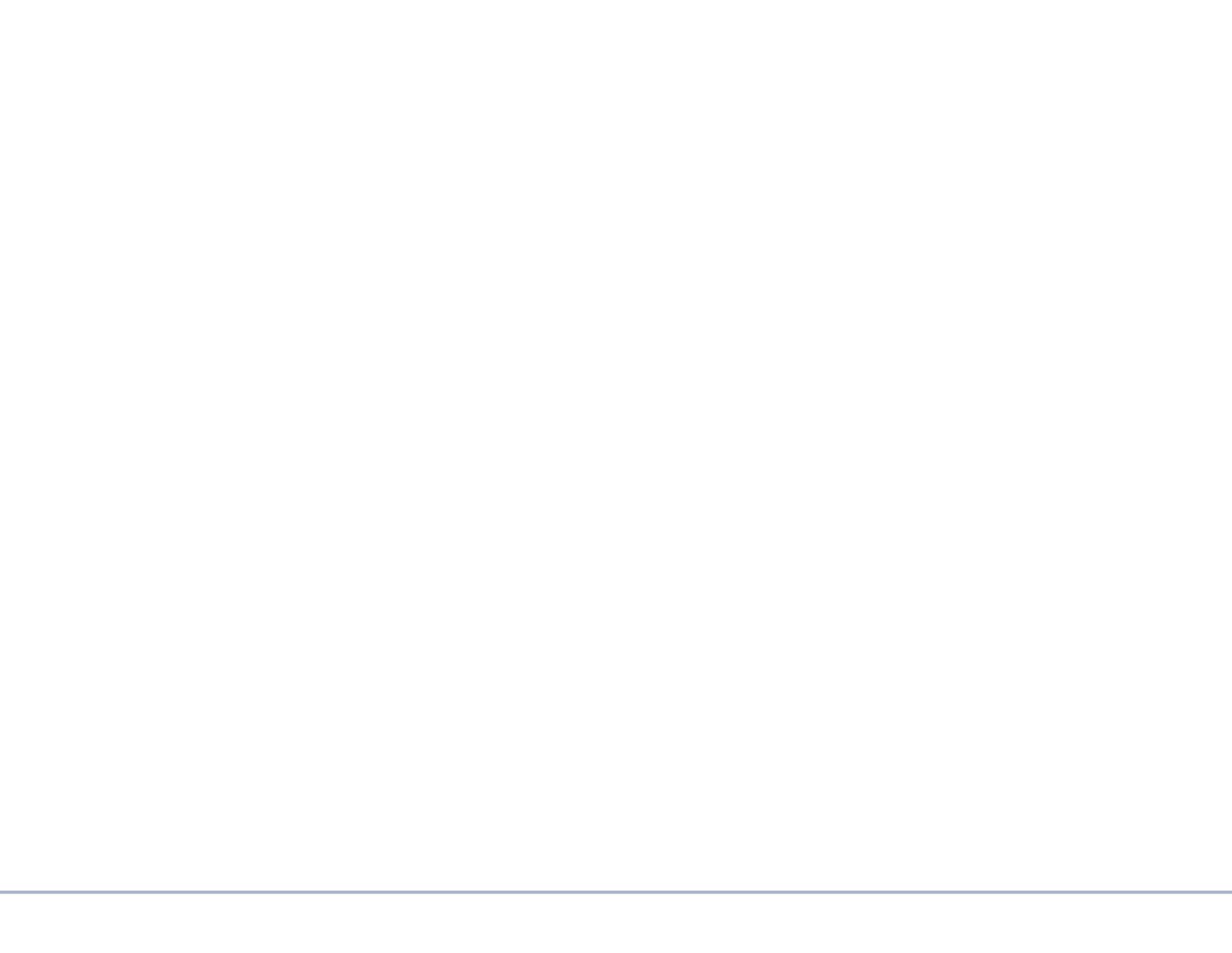
“There should be different chairs so different amounts of kids can sit at each place.
If a band is playing, we don’t need to talk during lunch.”

Audrey P., age 11, *sketch of where she’d like to eat at school*



“I don’t really understand why it’s considered normal to stare at someone’s eyeballs.”

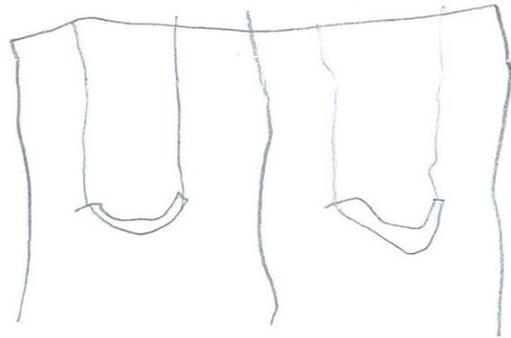
John Elder Robison, author of *Look me in the Eye*



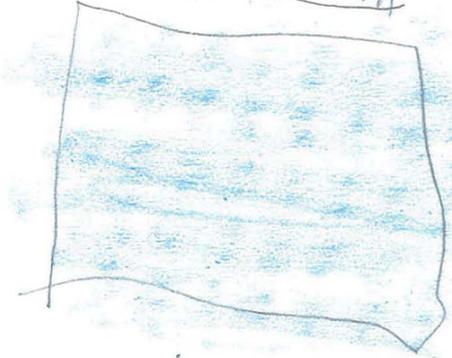
“When I look at someone straight in the eye, I feel as if their eyes are burning me.”

Luke Jackson, author of *Freaks, Geeks and Asperger Syndrome*

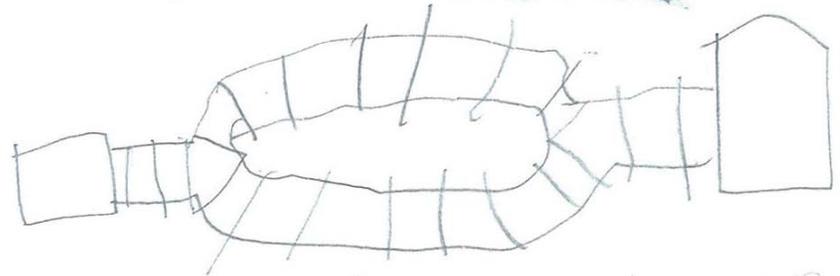
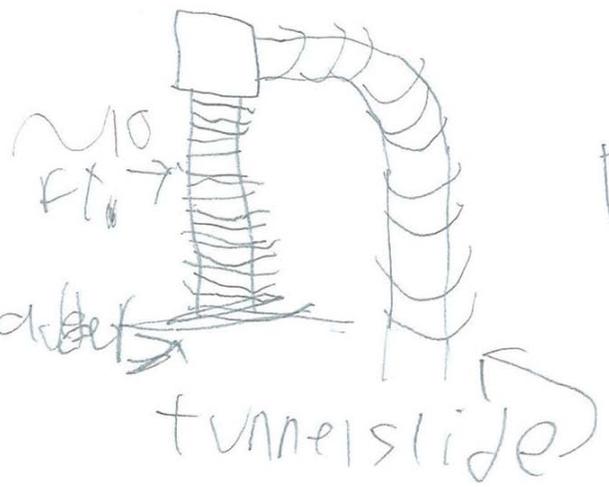
Swings



100 Chalk
Pcs



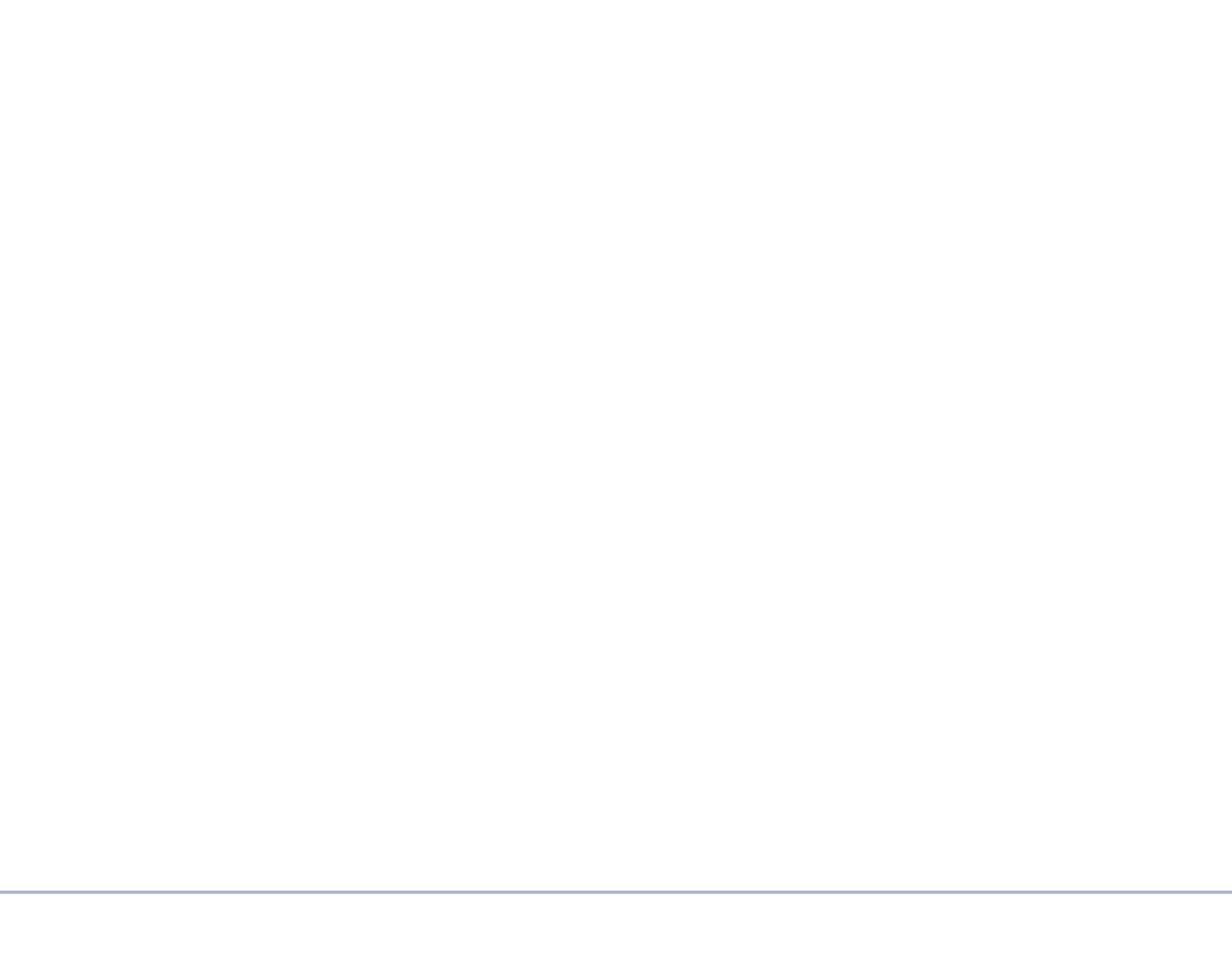
blacktop



monkey bars

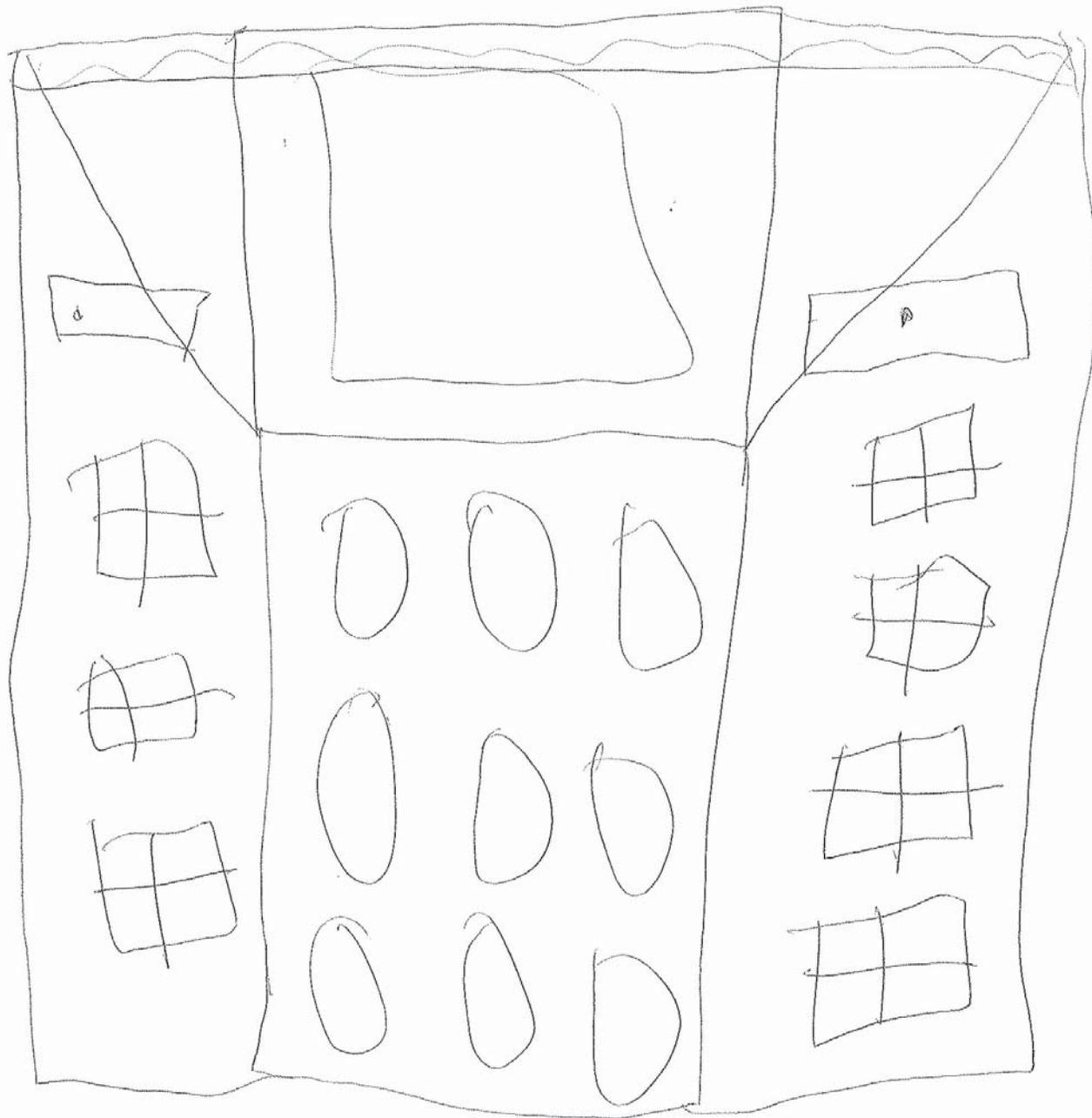
“The monkey bars should have two paths so I can read sitting on top of one side of the bars while other kids can swing by on the other side.
I can be near them but not with them.”

Bobby L., age 11, *sketch of the playground of his “Dream School”*



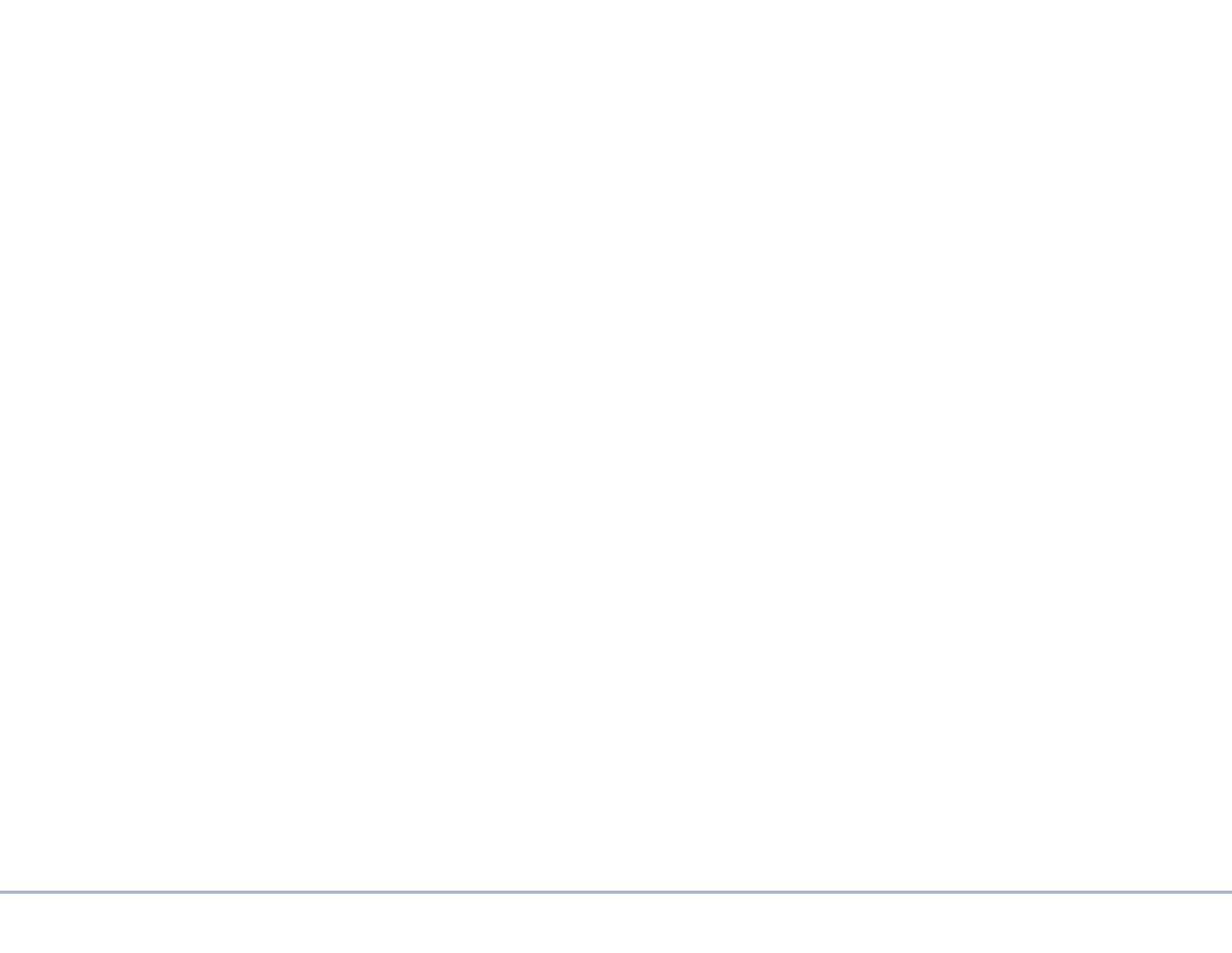
“It seems that most people view this inner autistic world as dismal grey, as a dungeon without windows. To me, it is a rainbow prism. It can be a world of bright fragments, like stained glass. It is a place which many children don’t wish to leave. It is a home.”

Jasmine Lee O’Neil, author of *Through the Eyes of Aliens*



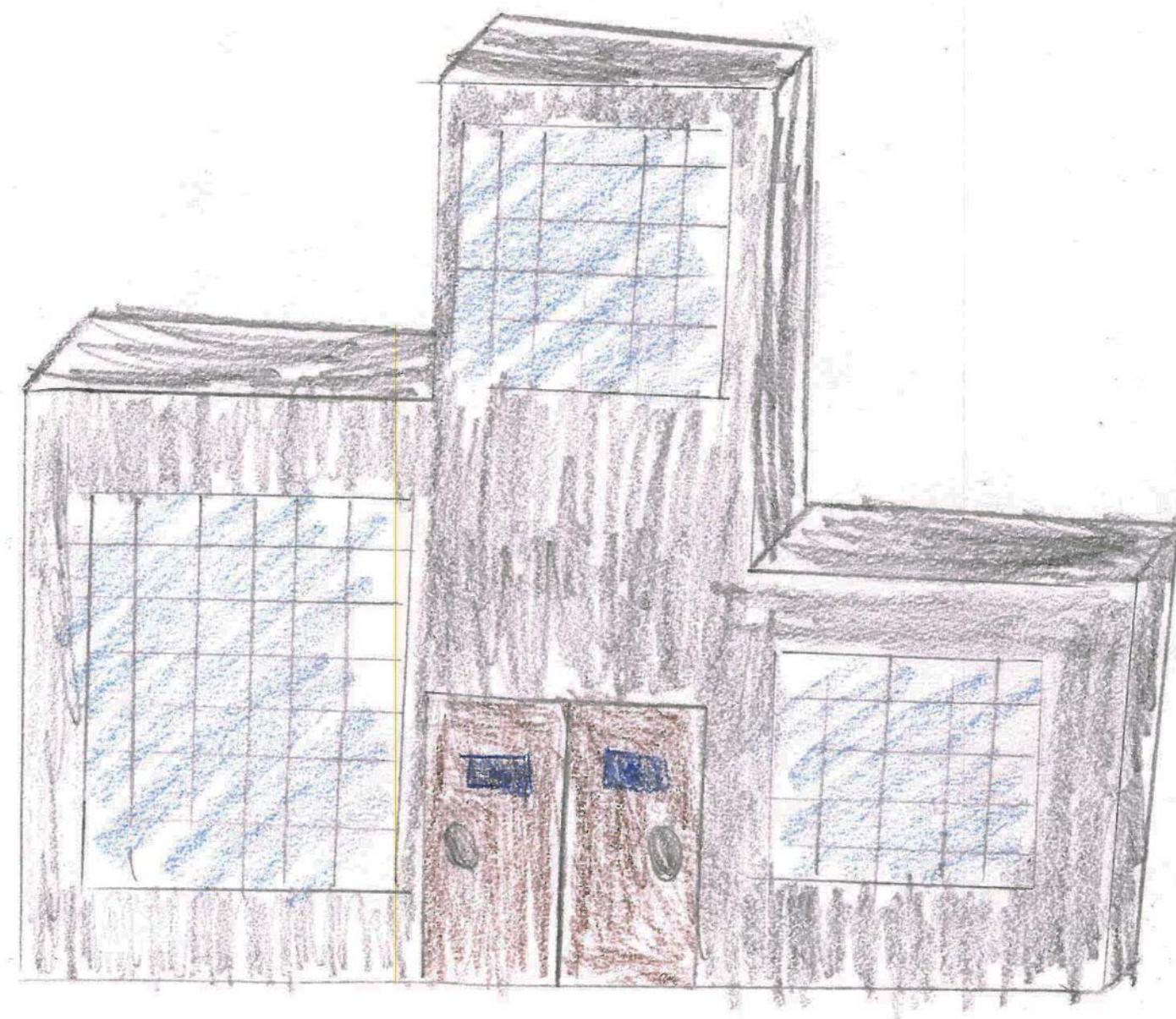
“There should be interior windows on both sides of the classroom so that I can see into the other classrooms but not hear them.”

Justin P., age 11, *sketch of his “Dream Classroom”*



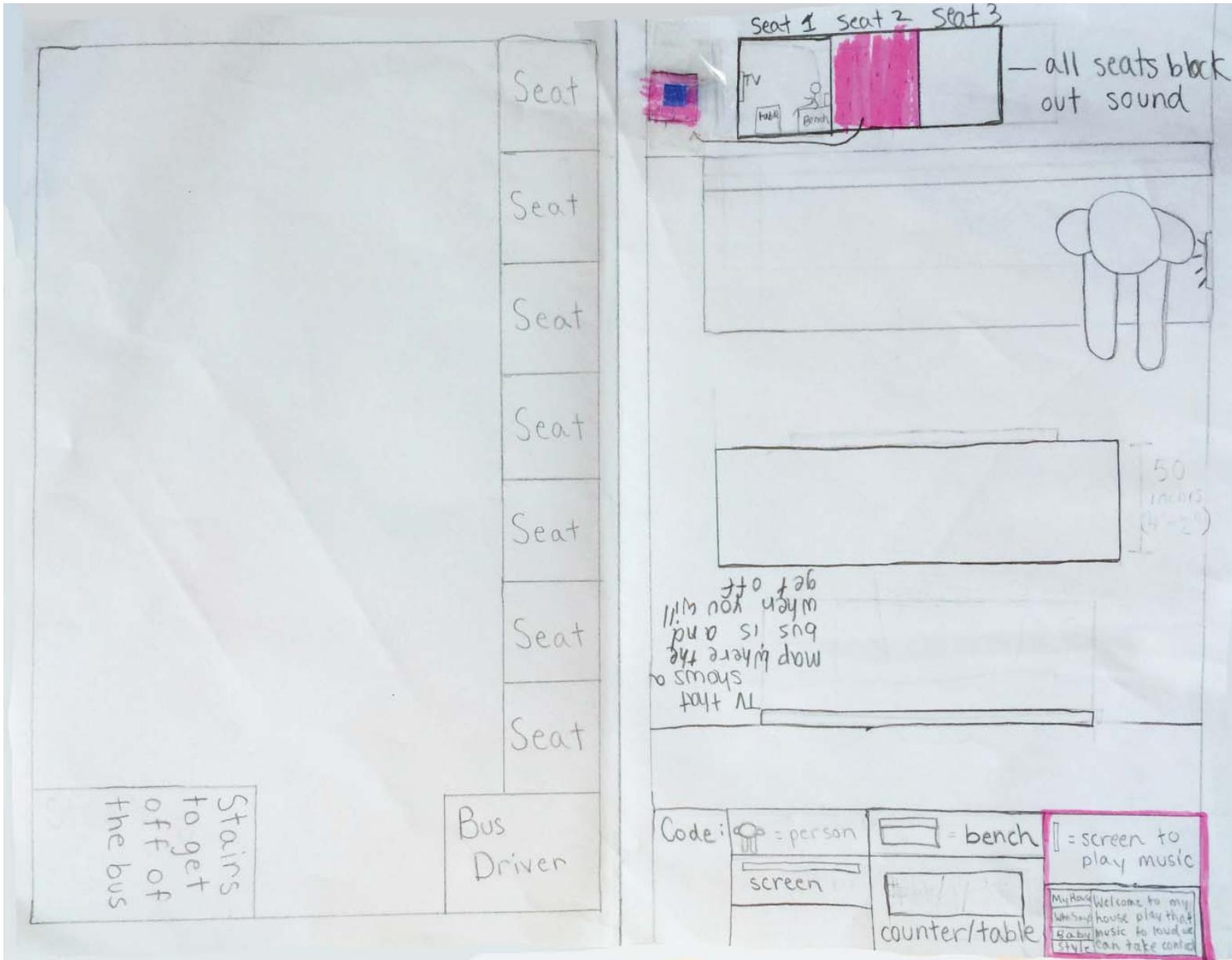
“I don’t like to find myself in an open plain – certainly not in crowded places, such as a marketplace, nor in calmer places, such as a meadow. When I’m standing in the middle of such an open space, I have to keep an eye on too many things at the same time. Sudden movements can occur unexpectedly, all over the place, and each time, I try to prepare for them, but it never works.”

Dominique Dumortier, author of *Van een andere planeet*
(*From a Different Planet*)



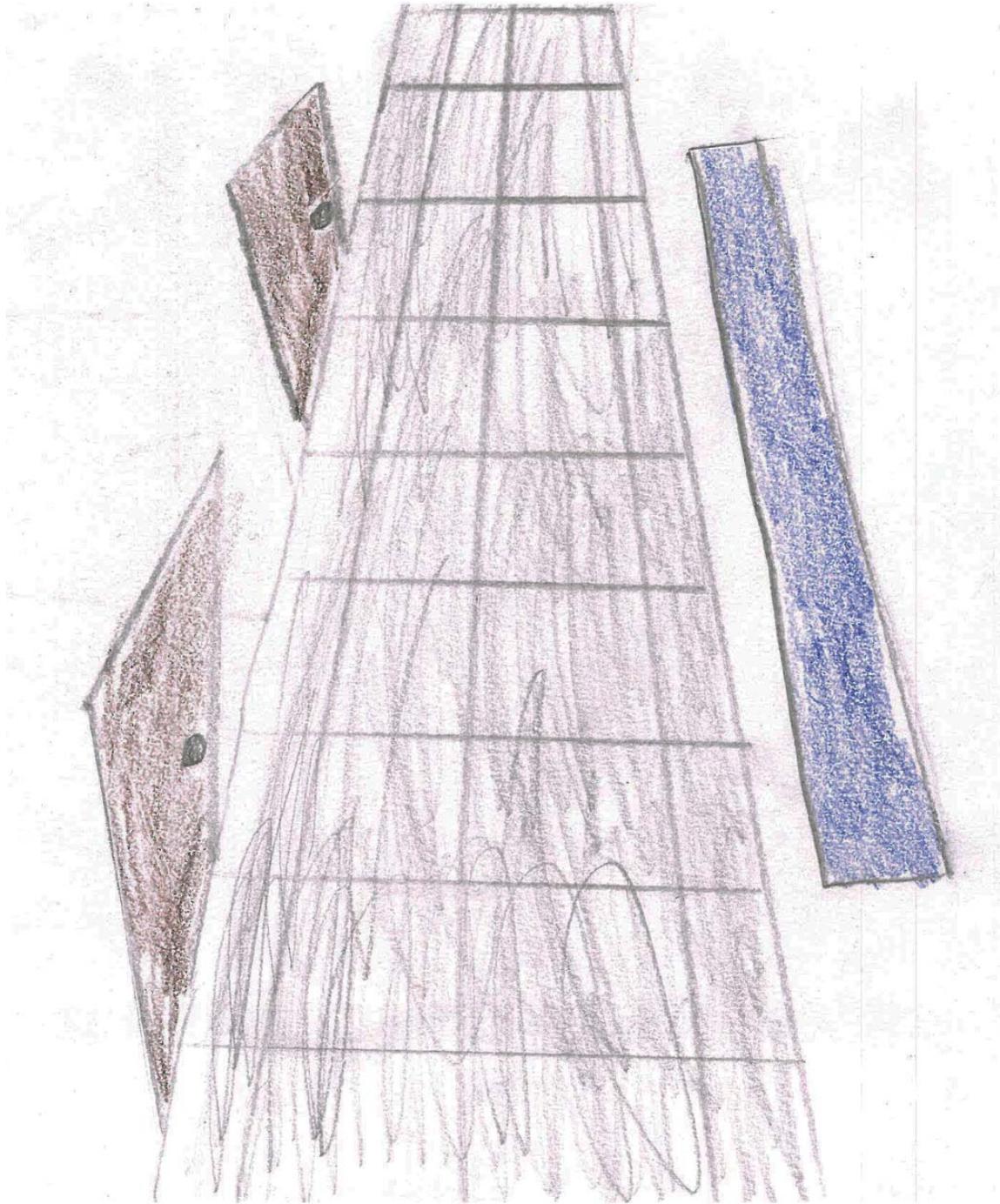
“The school should have different size spaces inside it. There should also be lots and lots of windows. In fact, it would be great if you could see through it so much that it was invisible.”

Andrew G., age 9, sketch of his “Dream School”



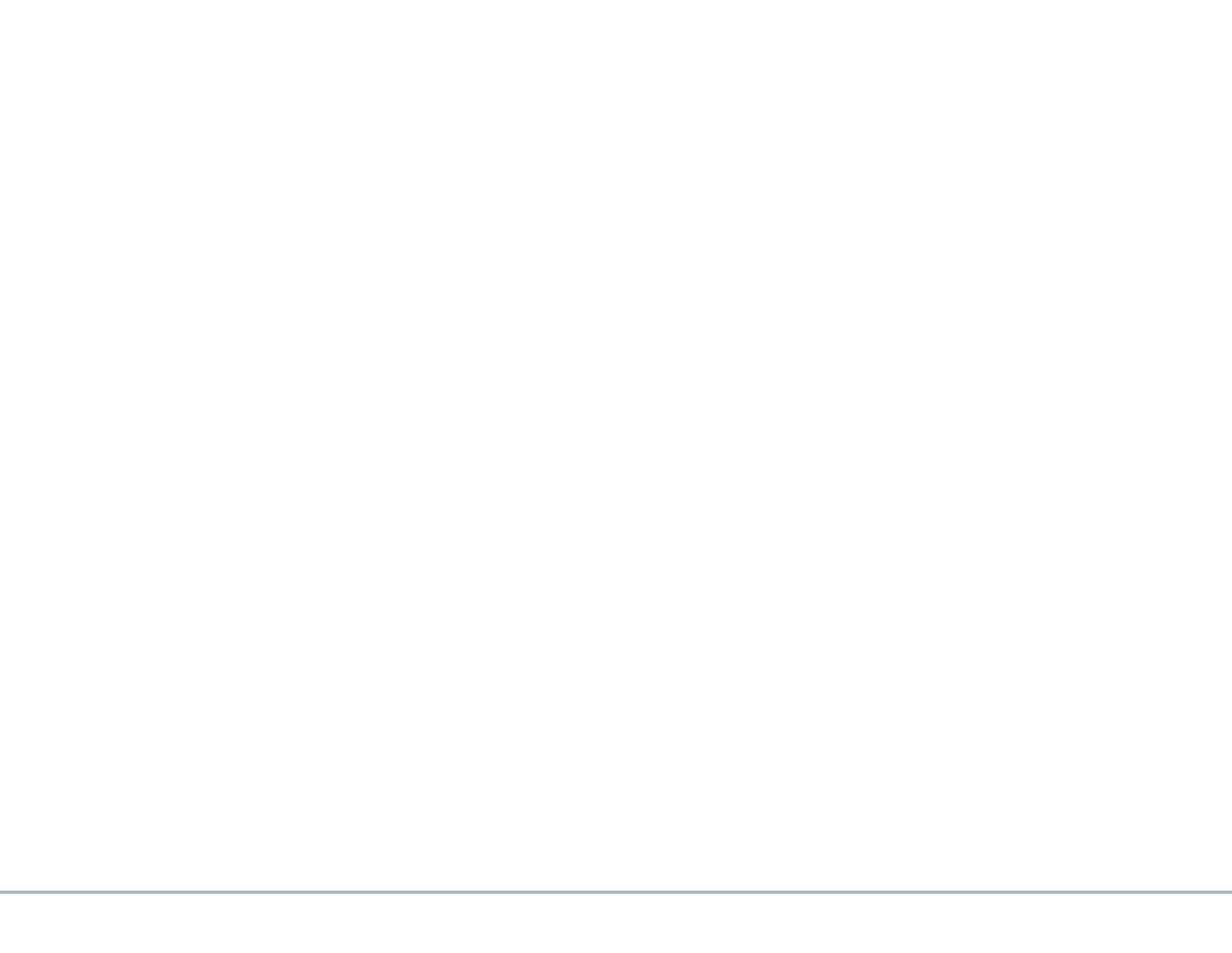
“Each student should have their own seat that blocks out sound. I’d like the TV to show a map of where the bus is and where you will get off. The TV should also play music.”

Audrey P., age 11, sketch of how she’d like to get to school



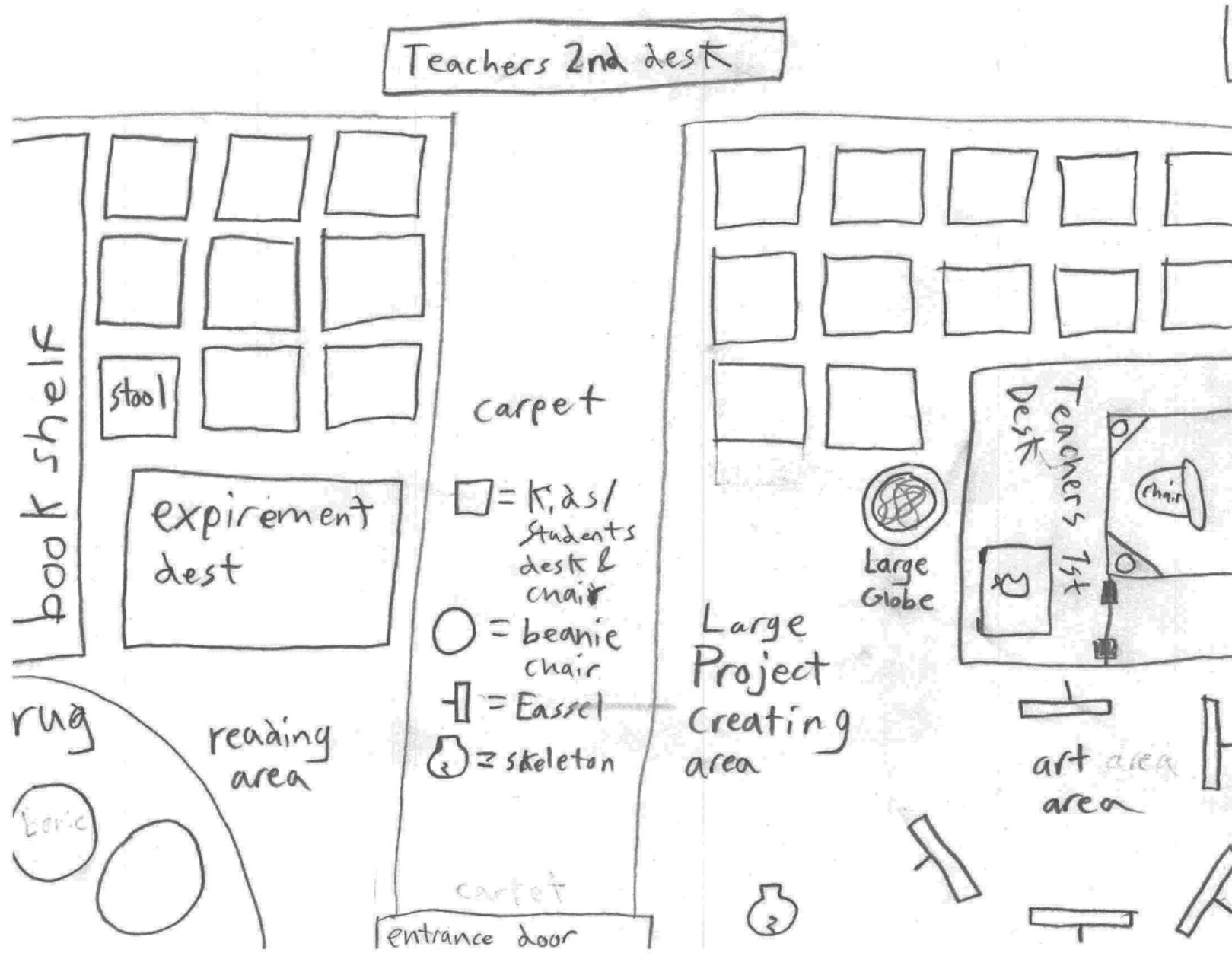
“There should be places to sit in the hallway.”

Andrew G., age 9, *sketch of what he'd like the hallways to look like*



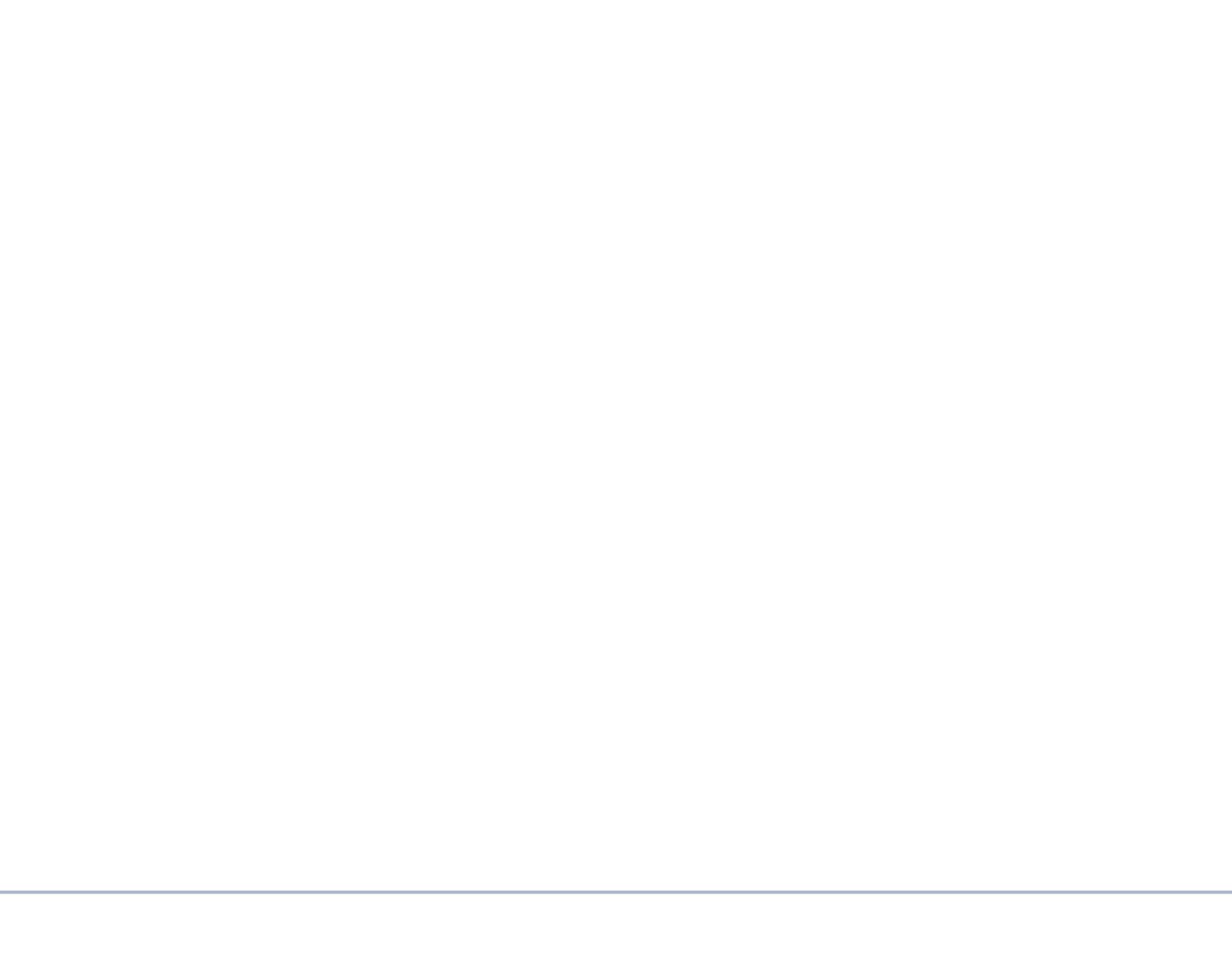
“I always need to eat dinner at the table. Even if I eat in front of the TV or couch once in a while, I get in trouble. Nothing seems clear anymore and inevitably, the day will come that I just don’t want to eat anymore...because eating no longer has a fixed place...If this happens with several things at once, my life becomes almost unlivable.”

Dominique Dumortier, author of *Van een andere planeet*
(*From a Different Planet*)



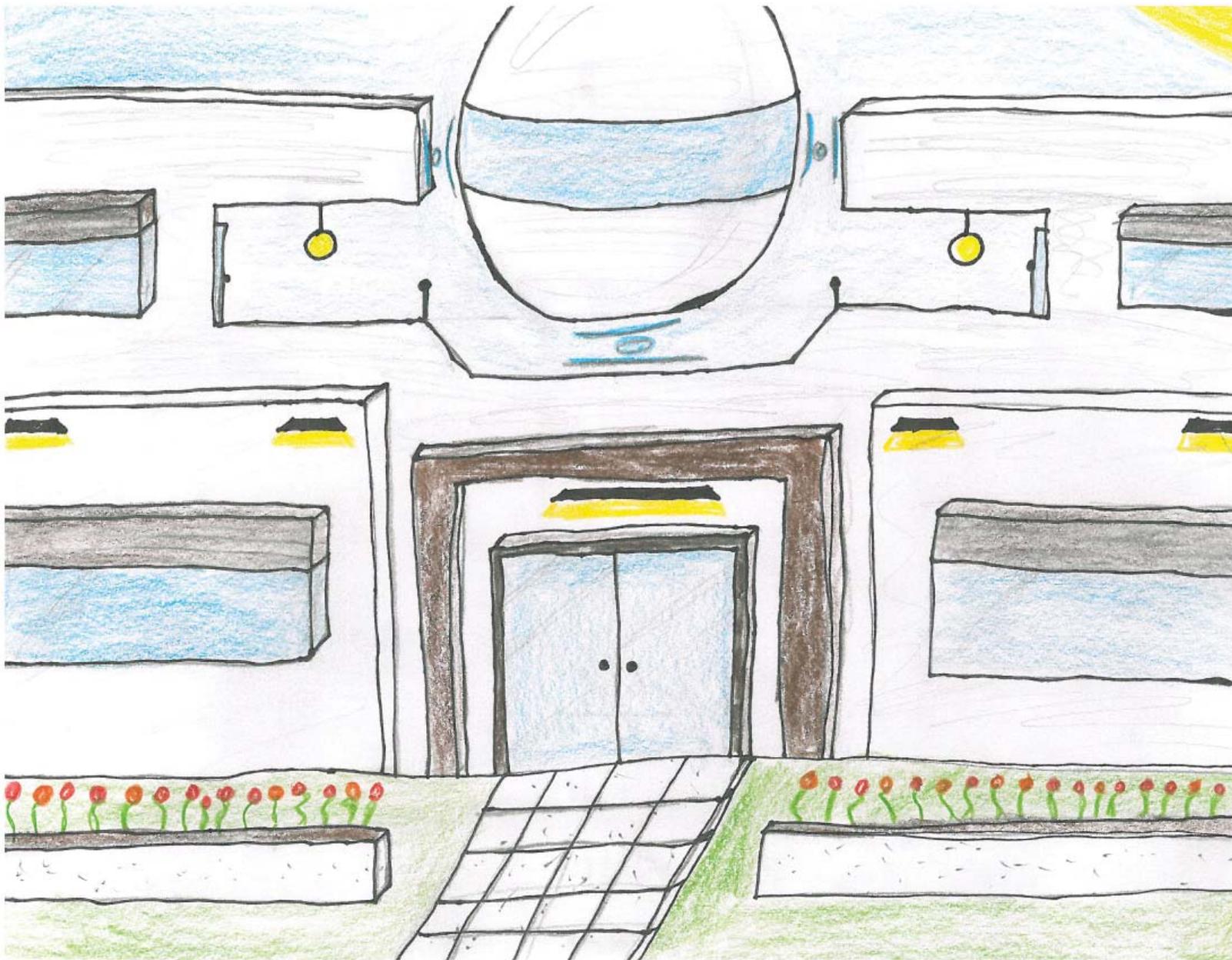
“There should be a place for each topic. Experiments should take place at the experiment area. There should be a place to make large projects and a place for art projects. There should be an area for reading. The teacher should have two different desks, one with its own light, the other one with a lifting panel with brackets so only the teacher can sit at it. The teacher can work at one desk and put her stuff on the other desk.”

Jared G., age 12, *sketch of his “Dream Classroom”*



“The life in that home was reduced to nothing but efficiency. When they guided me around the house, there was nothing that showed me that there were already four people living there. No sign of someone’s personality...nothing. Just rooms filled with sterile furniture and a feeling of neatness. It was frightening.”

Schipper Landschip, co-author of *Dubbelklik (Double Click)*



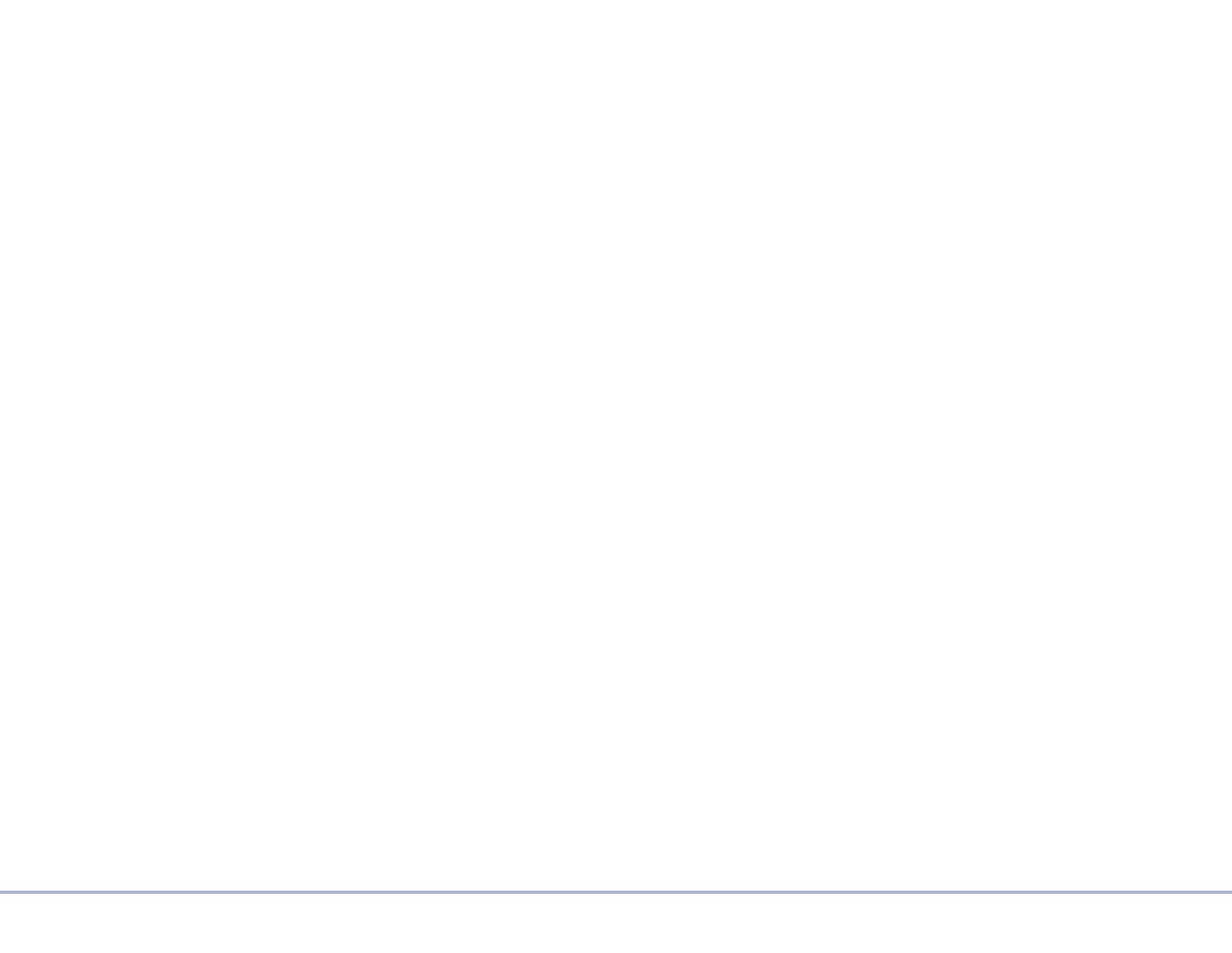
“There should be flowers at the front so it is cheerful and plenty of windows and lighting. There should also be a sphere held in place by electromagnetism since the school is a science and technology school. The science classroom could be in the sphere or maybe a gardening center.”

Jared G., age 12, *sketch of his “Dream School”*



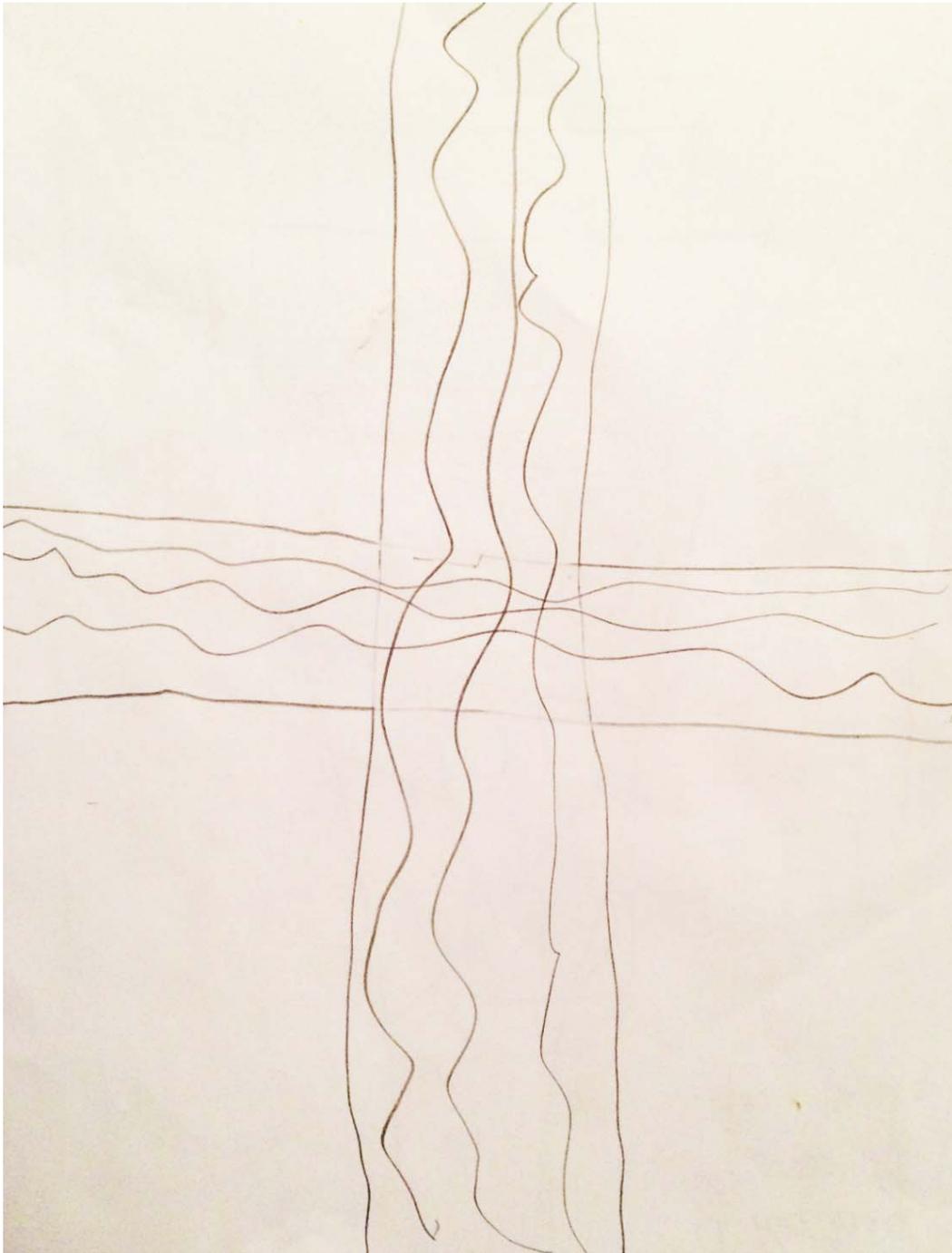
“The front door of a school should be welcoming.”

Patrick L., age 18, *sketch of the front door of his “Dream School”*



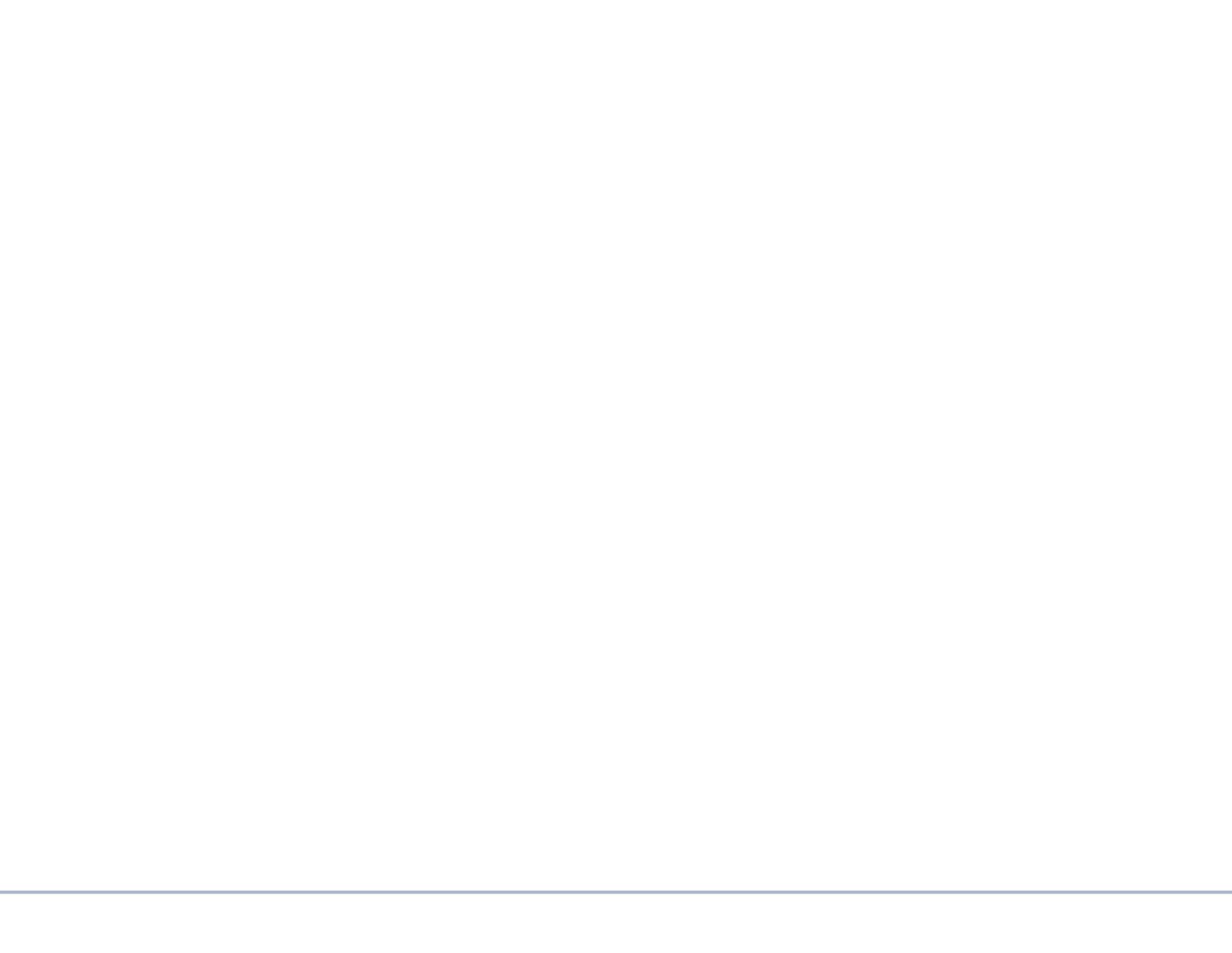
“My consolation, my safe retreat in the world, was a brown armchair in one corner. I could just fit in behind it. With my face close to the back of it, I would stare into the upholstery so I could see every tiny little bit of it. I became absorbed in the brown material, in its threads, in the minute holes between the threads...There was no energy to be found there, but there was rest, a way of keeping my mouth shut and holding on to a little of the energy that had otherwise been spent in trying to understand what was incomprehensible, how everything hung together.”

Gunilla Gerlund, author of *A Real Person. Life on the outside*



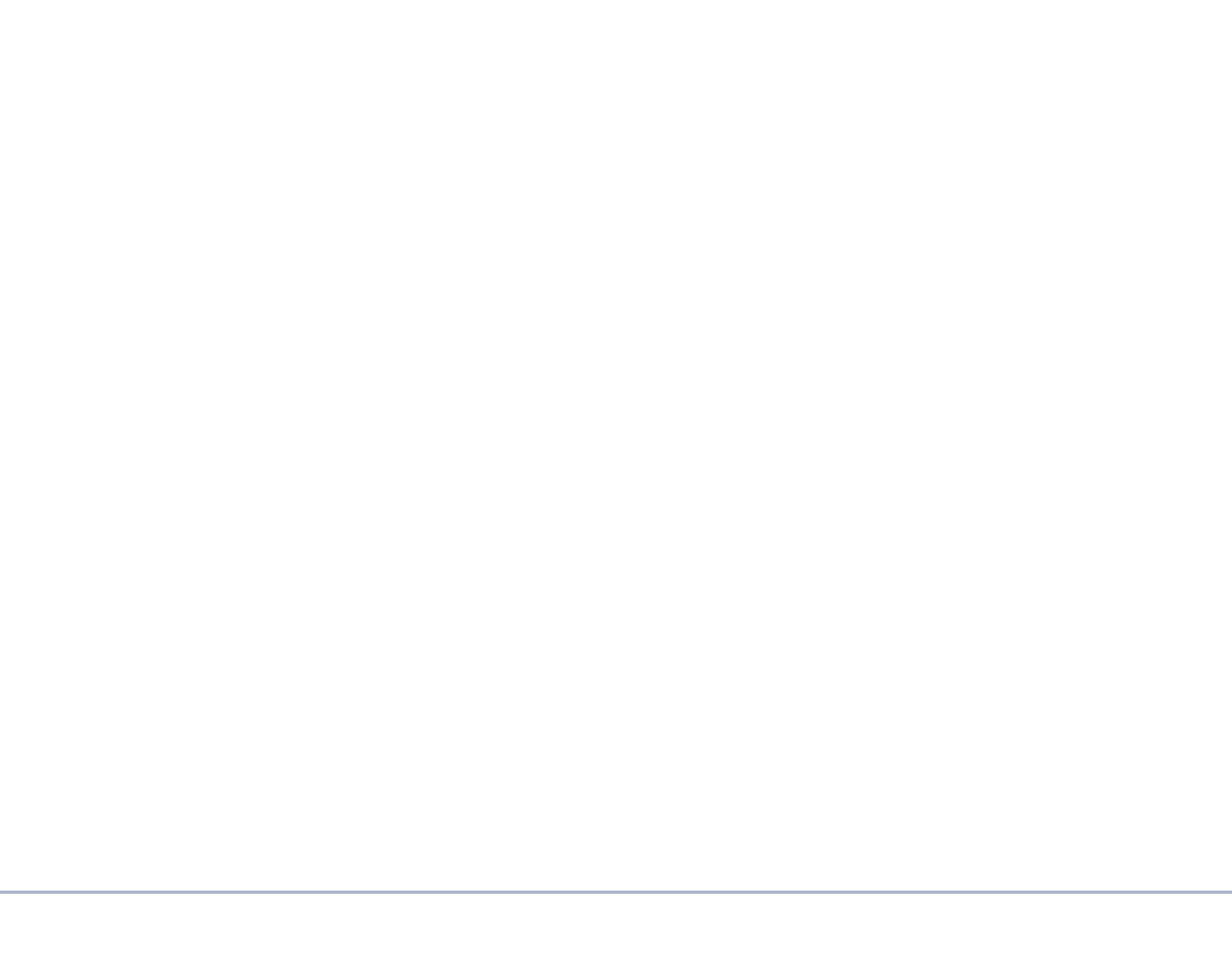
“I would like to swim from class to class. When I am swimming I don’t hear anything.
I don’t talk to anyone. I love the way the water feels.
And it’s just fun.”

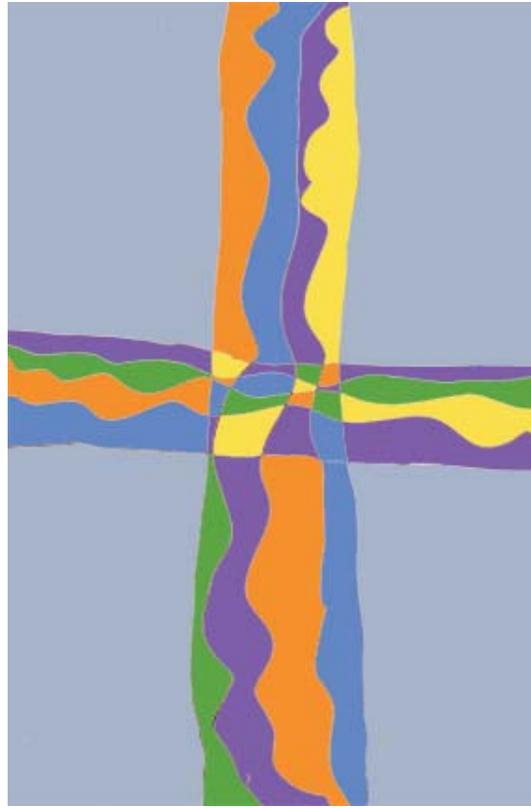
Justin P., age 11, *sketch of how he’d like to move between classes*



“Autism is a way of being. It is pervasive; it colors every experience, every sensation, perception, thought, emotion, and encounter, every aspect of existence.”

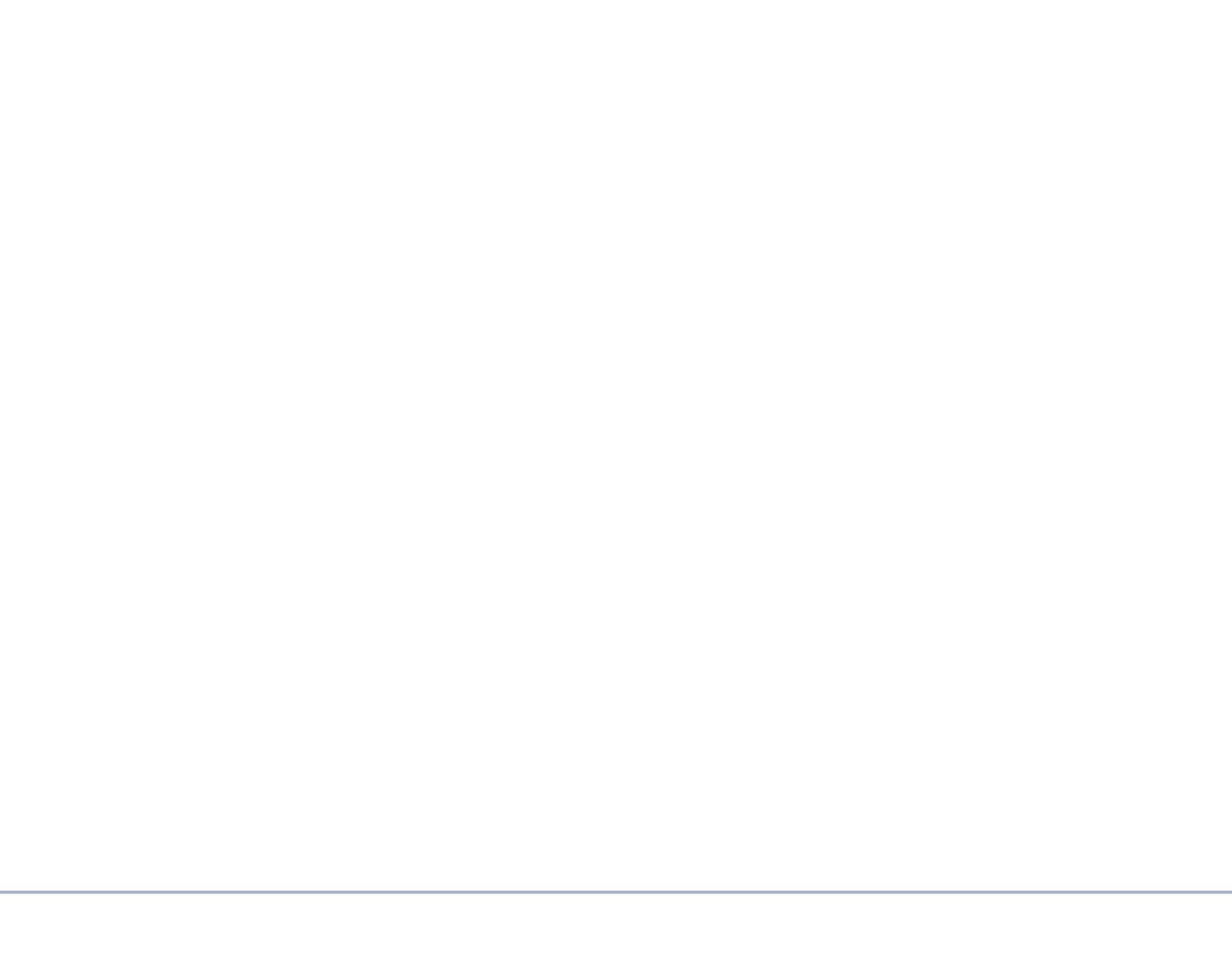
Jim Sinclair, author of *Don't Mourn For Us*





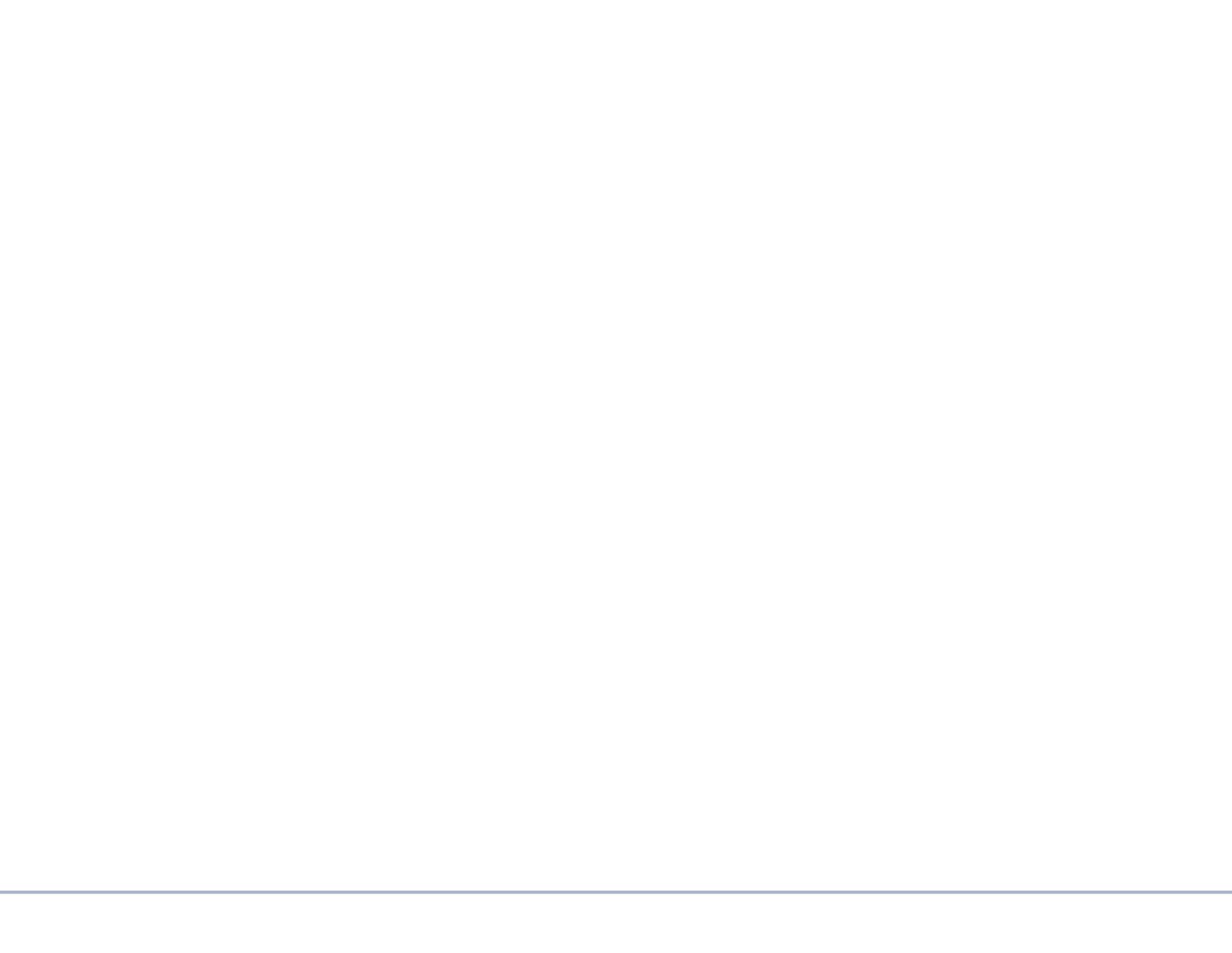
“A bridge can be built between one world and the other, just like that, offering a valuable gift.”

Loes Modderman, co-author of *Dubbelklik*



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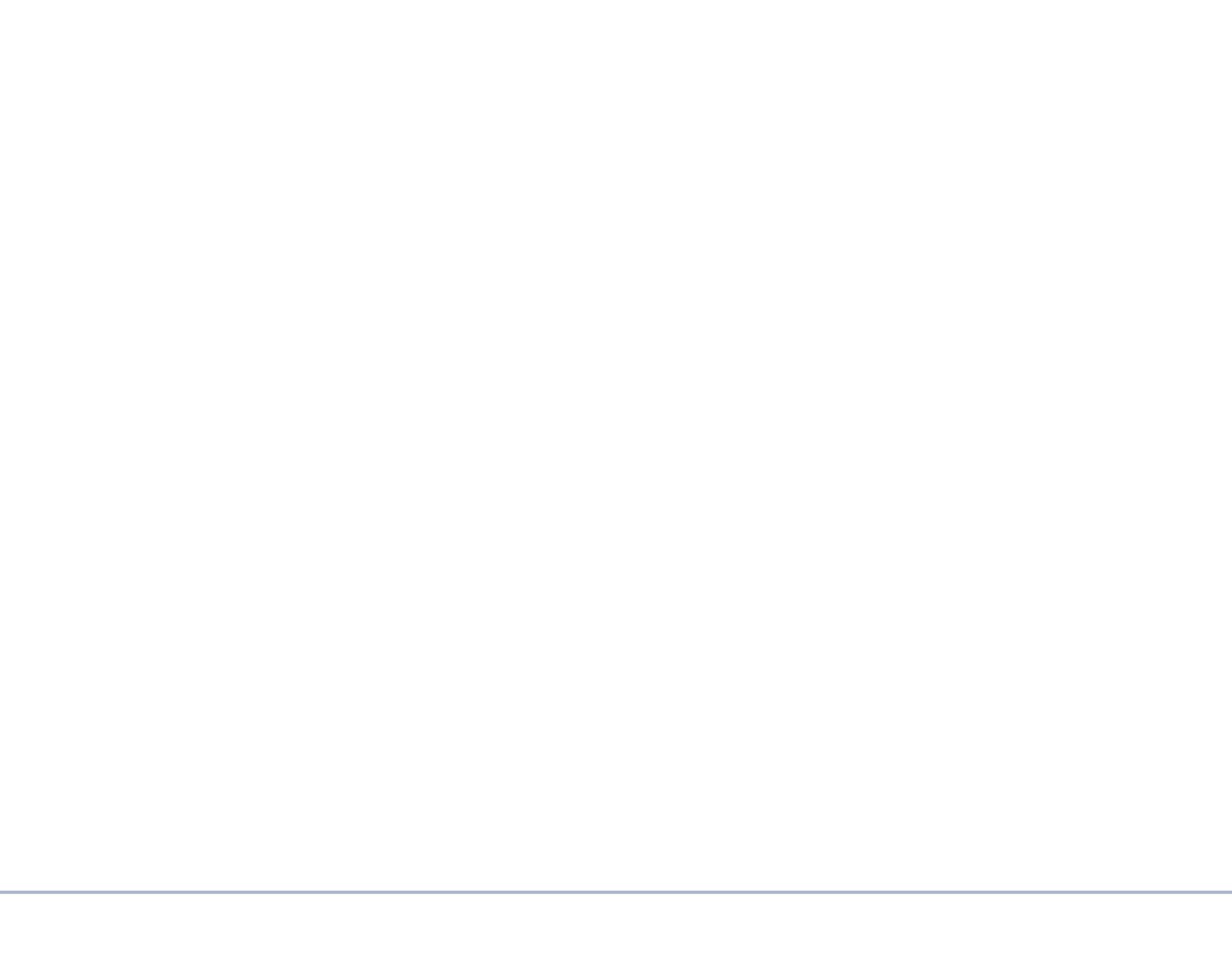
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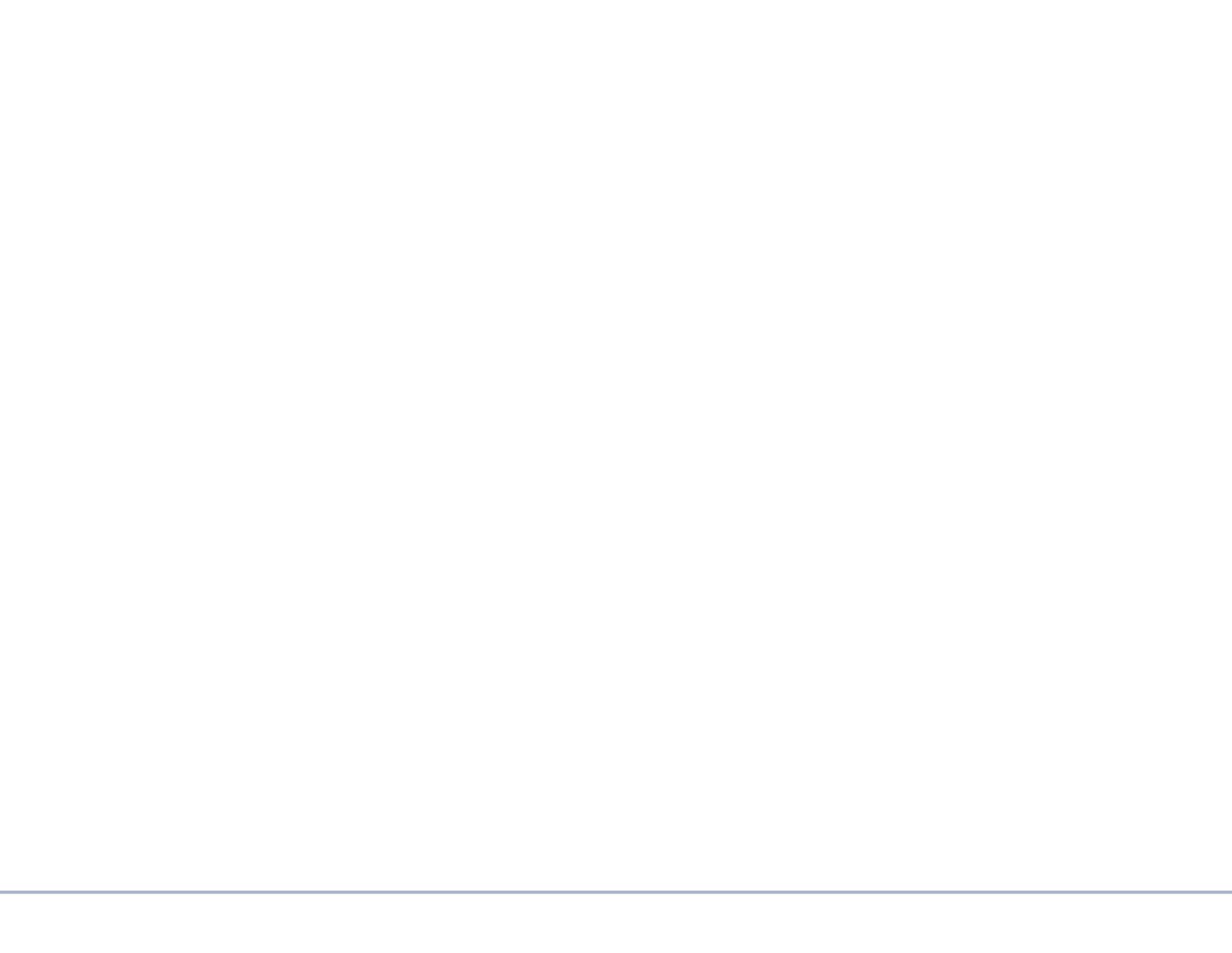
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- 150 South Pass City School House, photo, <http://www.flickriver.com/places/United+States/Wyoming/South+Pass+City/search/>
- 151 South Pass City School House, aerial photo, www.google.com
- 152 South Pass City School House, photo, <http://www.flickriver.com/places/United+States/Wyoming/South+Pass+City/search/>
- 153 One room school house Grundy County, Iowa, photo, <http://www.onlyinyourstate.com/iowa/ia-schools-1900s-different/>
- 154 Agassiz Grammar School, photo, <https://www.flickr.com/photos/cityofbostonarchives/5527038024>
- 155 Agassiz Grammar School, aerial photo, www.google.com
- 156 Agassiz Grammar School, photo, <http://rememberjamaicaplain.blogspot.com/2008/12/old-homestead.html>, colored by author
- 157 Traditional school playground, photo, <http://chicagowevideo.weebly.com/the-middle-class-response.html>
- 158 Crow Island School, photo, <http://www.winnetkahistory.org/gazette/schools-celebrate-anniversaries/>
- 159 Crow Island School, aerial photo, www.google.com
- 160 Crow Island School, photo, <http://www.winnetkahistory.org/gazette/schools-celebrate-anniversaries/>
- 161 Crow Island School, photo, <https://www.winnetka36.org/crowisland/photogallery>

- 162 Mt. Healthy Elementary School, photo, <http://andresalvador.smugmug.com/keyword/indiana%20columbus%20architecture;healthy/>
- 163 Mt. Healthy Elementary School, aerial photo, www.google.com
- 164 Mt. Healthy Elementary School, photo, <https://eng.archinform.net/projekte/5760.htm>
- 165 Mt. Healthy Elementary School, photo, <http://52weeks.rickyberkey.org/2011/10/30/week-38/>
- 166 Great Seneca Creek Elementary School, photo, <http://www.montgomeryschoolsmd.org/schoolodex/schooloverview.aspx?s=02340>
- 167 Great Seneca Creek Elementary School, aerial photo, www.google.com
- 168 Great Seneca Creek Elementary School, photo, <http://www.jamesposey.com/portfolio/proj-k12-03.aspx>
- 169 Great Seneca Creek Elementary School, photo, <http://www.montgomeryschoolsmd.org/schools/greatsenecacreekes/slideshow.aspx>
- 170 Discovery Elementary School, photo, <http://www.vmdo.com/discovery-elementary-school.html>
- 171 Discovery Elementary School, photo, aerial photo, www.google.com
- 172 Discovery Elementary School, photo, <http://www.vmdo.com/discovery-elementary-school.html>
- 173 Discovery Elementary School, photo, <http://www.vmdo.com/discovery-elementary-school.html>

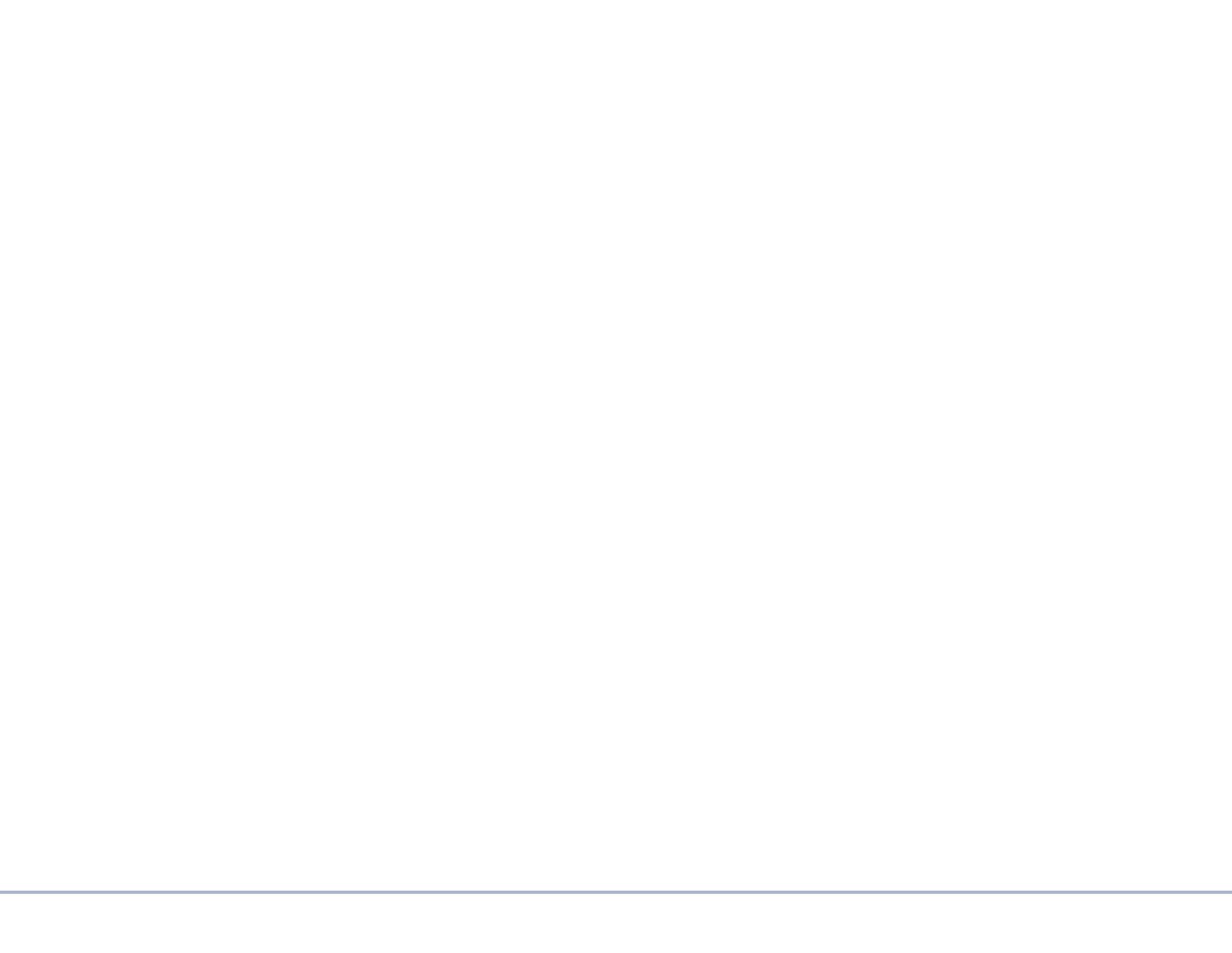
The source of the icons for the environmental stressors and spatial strategies on each folio sheet are from www.nounproject.com and drawn by the following: Sensory Stressors - Roberto Chiaveri, Social Stressors - Ferran Brown, Mental Stressors - Sergey Demushkin, individual Control - Dalpat Prajapati , Physical Activity - Dominique Vicent, Calming Surroundings - Mihael Tomic. The icons were colored by the author.



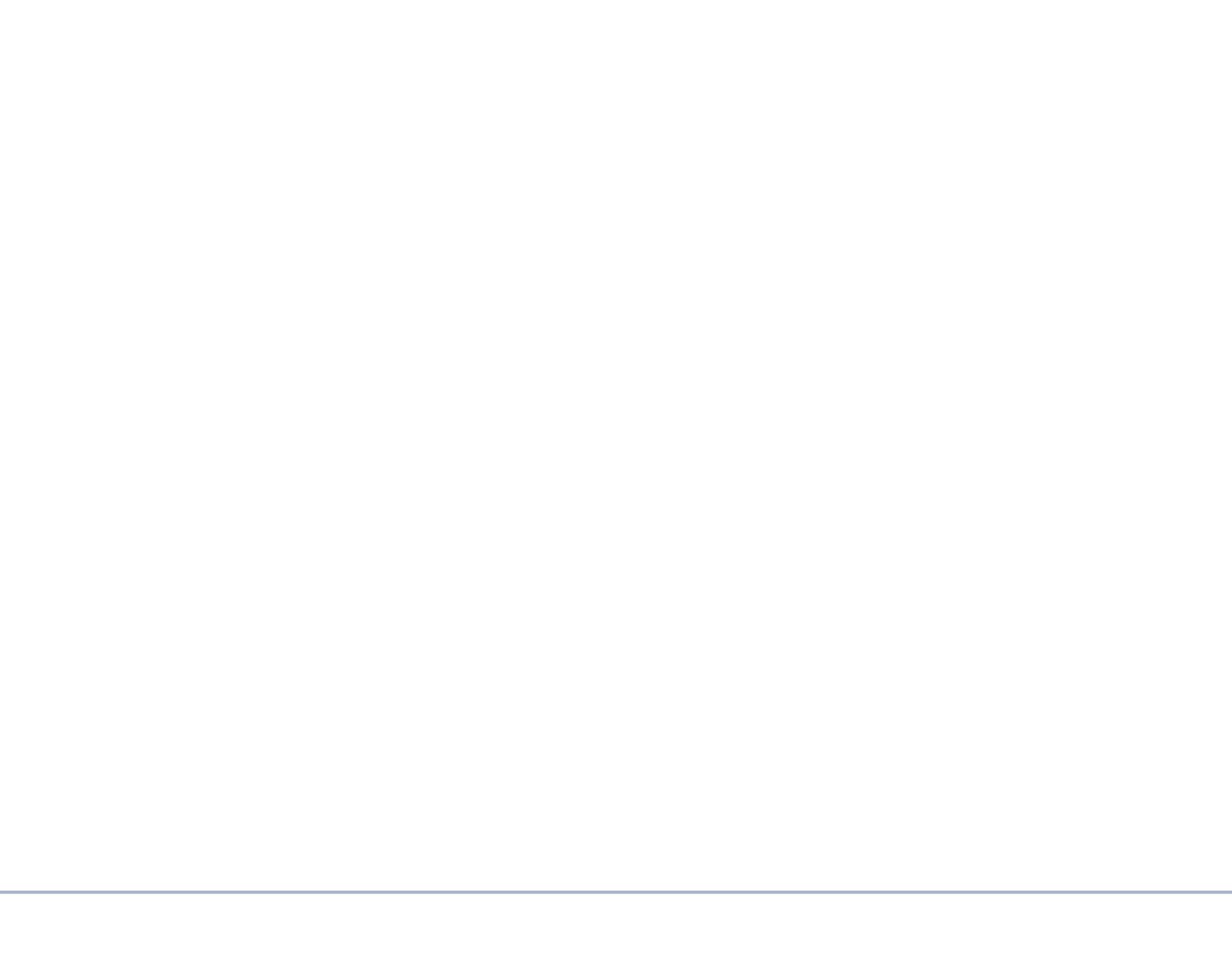
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