

## ABSTRACT

Title of Thesis: DESIGNING FROM THE GROUND UP:  
EMPOWERING CHILDREN IN HEALTHCARE  
SPACE DESIGN

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2026

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Children in healthcare spaces experience low levels of autonomy, competence, and relatedness due to architecture designed around the medical equipment rather than the patient. This can negatively impact mental health and prolong physical recovery. While distraction-based design is commonly used to reduce stress, it fails to address the diverse personalities and developmental needs of pediatric patients. This thesis proposes a child-centered architectural approach to pediatric recovery spaces. Through analysis of patient surveys, contemporary healthcare design, and child-focused precedents such as schools, the research identifies key contributors to anxiety and opportunities for architectural intervention. The thesis culminates in a new pediatric recovery typology that integrates child-centric design from the earliest stages to create environments that are empowering, relatable, comforting, and playful for children ages 4 to 12.

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EMPOWERING CHILDREN IN HEALTHCARE SPACE DESIGN

by  
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Thesis submitted to the Faculty of the Graduate School of the  
University of Maryland, College Park, in partial fulfillment  
of the requirements for the degree of  
Masters of Architecture  
2026

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## Dedication

To my parents, for encouraging me to run even when I was scared to walk.

## Acknowledgments

A special thanks to Peter Noonan, Mohammad Gharipour, Britt Williams, Julie Gabrielli, Hooman Koliji, Marty Koelsch, and Michael Ezban, the professors and mentors who guided me through this process and pushed me at every turn to keep improving.

Thank you to Sarah Northern for getting her first grade class to draw some wonderful and inspiring dream hospitals. To Amanda Vite for knowledgeable understanding of the Self Determination Theory and guiding me towards Montessori school design. To Sodra Abrams for her insight of the nurse and staff perspective in hospitals.

Thank you to Ady Weng and Lilliana Resnik for helping me to take some brief reprise during this long and arduous process. Thank you to my siblings and parents for their endless support and undying confidence that I could complete my thesis.

Thank you to Melissa Johnsons, Katie Briller, and Lauren McNamara for bringing a smile to my face every day in studio. I am so incredibly proud and grateful to have been your classmate and friend.

And especially to Michael Abrams for your mentorship, wisdom, and eye for wonder. Without you, this project would not exist. Thank you.

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# Chapter 1: Introduction

## *Reorienting the Pedagogy of Pediatric Design*

Children are afraid of going to the doctors'. Nearly every person has experienced this growing up: the anxiety of sitting in the scratchy waiting room chair, the acid stench of cleaning alcohol in the air, bleach white walls staring back at you, an outdated magazine on the table, worn out by worried hands, and a little wooden bead roller-coaster toy sitting in the corner, unsuccessful in its purpose to distract you from the big scary needle waiting on the other side of the swing doors. From an adult's perspective, this is a bit of a dramatization, but it is much more realistic to the experience of a child. There are many contributing factors to a child's fear of going to the doctors', and though the building itself is often not the primary source, the majority of modern healthcare environments are not successful in dissuading this fear. Instead, they exacerbate it. There is a reason why the word "*clinical*" has gained a negative connotation. It is associated with spaces that are uninviting, apathetic, and utilitarian. The Oxford English Dictionary defines it as "coldly detached and dispassionate" and "treating a subject matter as if it were a case of disease..."<sup>1</sup> This second definition is in relation to how detail-oriented a clinical treatment can be, but it also begins to highlight the experience many people have in these environments: the hospital is treating the disease rather than treating the patient. People feel a lack of empathy, autonomy, and sometimes even safety in these places meant to heal them. That experience is often not the fault of the staff or result of the treatment, but the consequence of healthcare typologies as they have become more oriented around accommodating advancements

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<sup>1</sup> "Clinical, Adj. Meanings, Etymology and More | Oxford English Dictionary," accessed December 18, 2025, [https://www.oed.com/dictionary/clinical\\_adj](https://www.oed.com/dictionary/clinical_adj).

in medical technology rather than the comfort of their patients. Yet, the correction of this architectural pedagogy has been slow and continues to negatively impact children, one of the most vulnerable demographics.

Children are sponges, constantly absorbing knowledge, ideas, and experiences in order to grow and mature. Physical environments—including the built architectural environment—play a vital role in this process. They influence not only how they perceive and understand the world around them, but also how they perceive and understand themselves within that space. Middle schoolers learn through exploration and discovery of the world around them.<sup>2</sup> While young infants and toddlers learn through sensory exploration and movement.<sup>3</sup> For these very young children, they can even perceive their immediate physical environment as an extension of their own body.<sup>4</sup> If the clinical healthcare environment is opposing these behaviors, then the children could feel psychologically unfulfilled with consequences lasting into adulthood.<sup>5</sup> However, in recent years doctors, designers, and architects have become aware of these physiological consequences and have shifted towards more child-centric design in healthcare spaces.<sup>6</sup> These architectural explorations are still relatively new and often take the shape of additive measures placed in preexisting healthcare spaces. The playroom and colorful artwork are the most

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<sup>2</sup> “Built Environment Education (BEE) and Children’s Cognitive Development,” *International Union of Architects*, n.d., accessed December 18, 2025, <https://www.uia-architectes.org/en/mag/built-environment-education-bee-and-childrens-cognitive-development/>.

<sup>3</sup> “Piaget’s Theory of Cognitive Development: The Four Stages Explained,” accessed December 18, 2025, <https://www.structural-learning.com/post/jean-piagets-theory-of-cognitive-development-and-active-classrooms#:~:text=and%20formal%20operational-,His%20research%20into%20the%20mental%20structures%20underlying%20these%20stages%20has,in%20both%20psychology%20and%20education.&text=%E2%80%8D-,Piaget%20founded%20the%20International%20Centre%20for%20Genetic%20Epistemology%20in%20Geneva,of%20human%20intelligence%20and%20learning.>

<sup>4</sup> David Kennedy, “The Young Child’s Experience of Space and Child Care Center Design: A Practical Meditation,” *Children’s Environments Quarterly* 8, no. 1 (1991): 40, <https://www.jstor.org/stable/41514767>.

<sup>5</sup> Amanda Vite, Erika A. Patall, and Man Chen, “Relationships Between Experiences of Autonomy and Well(III)-Being for K-12 Youth: A Meta-Analysis,” *Educational Psychology Review* 36, no. 4 (December 2024): 2, <https://doi.org/10.1007/s10648-024-09967-x>.

<sup>6</sup> Bernie Carter et al., “The Concept of Child-Centred Care in Healthcare: A Scoping Review,” *Pediatric Reports* 16, no. 1 (February 2024): 115, <https://doi.org/10.3390/pediatric16010012>.

common examples. Though these elements are known to have a positive impact, they are placing a bandaid on a much bigger issue: the design around the patient is secondary to the design around the function. In order to truly create a space which is welcoming and comforting to the patients, their inclusion must be from the very beginning design phases. A good architect should place their feet in the non-slip medical socks of the children who will be using the healthcare space. And a great architect will translate from the child's perspective a healthcare space which is not only no longer scary, but is a fun place to be.

The question remains then, how can healthcare spaces be redesigned from a child's perspective? Asking them, first, is the logical answer. There are many studies, of which will be delved further into later in this paper, where patients and children have been interviewed about their experiences in hospital environments. This research will gather information as to what aspects of the physical environment produce negative outcomes according to the patients, and which improvement areas the patients have identified themselves. Second, one can look into the patient-centric designs currently being employed and evaluate to what degree these interventions are successful, integral to the large design, and applicable to children. Thirdly, the scope of design can be broadened beyond just healthcare. Schools, daycares, playgrounds, and many other typologies have employed child-centric design for much longer than healthcare spaces have. This paper shall distill the design aspects which create positive child centric design, primarily multisensory environment, child scale, biophilia, and spatial diversity, and explore how they can be applied in a cohesive design of a recovery clinic to promote play, comfort, and empowerment in children ages 4 to 12.

## *Clarifying Terms*

Healthcare is an extremely complicated topic, and architectural healthcare even more so. The majority of the terms used in this paper shall be defined as they are used, however this section of the paper is to address more general terms that shall be brought up repeatedly throughout.

Within this paper, “healthcare spaces” shall refer to any building typology with the programmatic function to administer medical treatment and diagnosis, particularly to pediatric patients. This includes local clinics, large hospitals, or recovery centers. This will not include addiction recovery centers or mental health centers and those facilities deal with much more complex conditions not typically treated at clinics and hospitals. The majority of the healthcare research gathered for this paper comes from studies done in hospitals as those have a larger patient base and their grander technological requirements have led to more clinical spaces.

“Additive” measures or methods in relation to current approaches to child-centric design in healthcare is a term coined by this author to emphasize how these approaches are often implemented post construction either through renovation or additions or do not take priority in the initial design phase. Some pediatric healthcare facilities do advocate for child-centric design but this author's critique is that their approaches are not the driving element of their design and therefore as less effective than they could be. Therefore, this author also refers to these approaches as a “band-aid,” especially if these are the only child-centric approaches used in the design.

“Child-centric design” refers to architectural elements and considerations which support children and patients within a space. These design elements may refer to the scale of space,



color, direction of views, etc. that are specifically chosen to be the most beneficial and interactive with children. This paper chooses to have a distinction between patient-centric, family-centric, and child-centric design, of which will be further discussed later. Though elements and methods may overlap between these different design approaches, this paper argues that there is a distinction between them and child-centric design is the approach which has had the least development in the architectural sphere but will have the most benefit for pediatric patients.

## Chapter 2: Literature Review

This chapter is a review and analysis of current academic literature surrounding pediatric healthcare and child centric design. Its purpose is to help set the stage for how and why pediatric architecture has become what it is known as today, what are the contributing factors and consequences of children's anxiety in healthcare spaces (the "Affliction"), what are the current architectural approach to help ease this anxiety and to what extent these are successful (the "Band-Aid"), and what other child centric design approaches can be learned from non-healthcare precedents (The "Treatment"). Through this review, this thesis seeks to understand architectural moves which can be defined as child-centric design and incorporated into pediatric architecture.

### *History of American Pediatric Healthcare Architecture*

#### Mid 1800s: House as Hospital

To first determine how and why healthcare architecture has become what it is today, it is important to understand its development and how past ideologies still play a contributing role to its design. Throughout most of history, there was not any dedicated children's space in hospitals, they occupied the same areas as the adults. Some of the first pediatric spaces were children's wards, beginning in the 1850s,<sup>7</sup> with the first American pediatric hospital founded in Philadelphia in 1855.<sup>8</sup> These early pediatric wards were often converted houses, as it was unlikely hospitals would have the space or funding to create a designated children's ward.

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<sup>7</sup> Lindsay Prior, "The Architecture of the Hospital: A Study of Spatial Organization and Medical Knowledge," *The British Journal of Sociology* 39, no. 1 (March 1988): 94, <https://doi.org/10.2307/590995>.

<sup>8</sup> David Sloane, "'Not Designed Merely to Heal': Women Reformers and the Emergence of Children's Hospitals," *The Journal of the Gilded Age and Progressive Era* 4, no. 4 (October 2005): 332, <https://doi.org/10.1017/S1537781400002747>.

Architecturally, they were highly domestic, residential scale buildings. This homely feeling was recognizable and comforting to the children and purposefully promoted by the women staff. Not coincidentally, many of these women were also social reformers who advocated for child dedicated spaces as they could help physically heal the children while also morally educating them.<sup>9</sup> These pediatric hospitals primarily took in children of working class immigrants whose living conditions in dense urban cities were contributing factors to the children's health. The hospitals framed themselves as safe havens for the children, but also as morally correct examples of society. This created a separation mentality between the hospital staff and the parents of the children, who represented the "outside" world.<sup>10</sup> In turn, early pediatric hospitals created highly restrictive access for the parents to see the children during treatment as they would "disrupt" the healing process.<sup>11</sup> In some cases, children were withheld from returning home for years because the staff perceived their living conditions as inappropriate.<sup>12</sup> This ideology of parents being unnecessary to the healing process of their children would carry on into the 20th century. Still, these first pediatric hospitals were a rare and exciting new typology combining institutional function with residential familiarity *specifically* for children. These women-run organizations did draw criticism from male healthcare professionals who thought they were "too much Christmas tree and not enough bookkeeping."<sup>13</sup> The following developments of pediatric architecture would seem overcorrect because of this criticism, becoming much more clinical rather than familial.

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<sup>9</sup> Sloane, "'Not Designed Merely to Heal,'" 336.

<sup>10</sup> Sloane, "'Not Designed Merely to Heal,'" 348.

<sup>11</sup> Sloane, "'Not Designed Merely to Heal,'" 348.

<sup>12</sup> Sloane, "'Not Designed Merely to Heal,'" 341.

<sup>13</sup> Sloane, "'Not Designed Merely to Heal,'" 352.

## Late 1800s: Nightingale Pavillion Plan

By the late 1800s, children's wards had found a place inside hospitals, but there was nothing architecturally different between them and adult wards. They both typically followed the pavilion plan design, spearheaded by Florence Nightingale who was proposing hospital designs to combat the prevailing miasmatic theory of disease.<sup>14</sup> The Pavillion Plan was made up of a long open floor, rectangular room to house multiple beds in clear view of the nurses. Windows were placed on either wall, ideally with one per bed to allow for the most natural sunlight and ventilation through the space. Porches and verandahs were also often included to provide additional space for patients to receive fresh air and daylight.<sup>15</sup> These wards lacked privacy and noise control, but were otherwise very bright, naturally ventilated, and social spaces.

Germ theory in the early 1900s brought the isolation cubicle to the children's ward. These cubicles broke up the open-floor layout of the pavilion plan, but did not provide much privacy as the dividers were often glass so nurses could still observe the patient. Instead, these boxes brought isolation and the feeling of being observed. During this time, windows also began to be sealed and mechanical ventilation used, so less fresh air and natural light was brought in.<sup>16</sup>

## 1900s to Modern Day: Family, Mega Hospitals, & Return to Clinic

By the 1920s, popular Freudian ideas of child development created criticism of isolation and instead promoted social spaces for children's interaction. Thus, the playrooms began to appear in pediatric hospitals.<sup>17</sup> In the 1960s, the importance of familiar presence was finally beginning to be recognized, particularly for mother-child relationships. Parental visiting hours

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<sup>14</sup> Prior, "The Architecture of the Hospital," 94.

<sup>15</sup> Prior, "The Architecture of the Hospital," 95.

<sup>16</sup> Prior, "The Architecture of the Hospital," 95.

<sup>17</sup> Prior, "The Architecture of the Hospital," 97.

became more flexible and mother divans were incorporated as spaces for bonding.<sup>18</sup> During this time, new technological advancements also encouraged and allowed for hospitals to expand in size. Mega hospitals, or block hospitals, with dense enclosed cores of complex programming and medical machinery became common. These hospitals took on the popular but disconnected international style.<sup>19</sup> Connection to context was lost as well as connection to people. The ideology of Le Corbusier took precedence, and the hospital became a machine.<sup>20</sup> Hospitals perfected the protocol of treating a disease, rather than the art of healing a patient. This megahospital typology reached a peak in the 1980s but received heavy criticism for its cold and insensate presence. Design once again began shifting back towards smaller, more community oriented clinics.<sup>21</sup> Today, healthcare architecture is battling between the remnants of block hospitals—creating highly specialized and centered zones of healthcare—and small pop up clinics for local service. There is a nostalgia for local, unthreatening medical practices, the *home as a hospital* of the mid 1800s. However, there is an undeniable need for the highly specialized, technologically advanced mega hospitals of the 1980s. From a programmatic and scale standpoint, these two typologies cannot be resolved together. However, from a standpoint of climate, atmosphere, and care, there is an opportunity for overlap in design.

### Age of America's Hospitals

There is no current data available for the average age of an American hospital. However in 2014, the American Hospital Association recorded that the average plant age of a hospital—the age of its fixed assets such as infrastructure and facilities—was 11 years, an

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<sup>18</sup> Prior, "The Architecture of the Hospital," 99.

<sup>19</sup> Stephen Verderber and David J. Fine, *Healthcare Architecture in an Era of Radical Transformation* (New Haven London: Yale University Press, 2000), 13.

<sup>20</sup> Verderber and Fine, *Healthcare Architecture*, 17.

<sup>21</sup> Verderber and Fine, *Healthcare Architecture*, 14.

increase from 8.6 years in 1994.<sup>22</sup> A hospital's plant age is not reflective of its original date of construction as plant age is affected by new additions and renovations. These renovations happen on a near constant cycle in hospitals as 35% of their capital is dedicated to them.<sup>23</sup> The majority of these renovations are also to update the equipment, such as air ventilators and elevators, rather than the actual architecture.<sup>24</sup> Therefore, the vast majority of hospitals in America are using the architectural makeup from decades prior and lack the incorporation of much more recent child-centric designs.

## Historical Synthesis

The context for this thesis must contend with the complex history of American pediatric healthcare design. Its residential origins were not respected within the medical field, but its overcorrection to a clinical, institutional scale is now criticized today. Historically, there was a barrier placed between the child and parent, and though that barrier has now been dissolved, pediatric hospitals still often lack spaces specifically meant to include parents. Play areas were added early on to provide space and comfort to the child, but very little additional programming has been developed since. Recovery rooms have become more private in order to have sanitation, but also less sociable. Large windows and natural light have become less of a priority as block hospitals took over the typology, and natural ventilation—once considered vital to the healing process—has all but disappeared. A new healthcare typology which prioritizes the patient must learn and grow from these past criticisms and mistakes, evaluate which aspects are beneficial,

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<sup>22</sup> Brad Beauvais et al., "A Reason to Renovate: The Association between Hospital Age of Plant and Value-Based Purchasing Performance," *Health Care Management Review* 46, no. 1 (January 2021): 67, <https://doi.org/10.1097/HMR.0000000000000227>.

<sup>23</sup> Chris Dimick, "2025 Hospital Construction Survey Results | HFM Magazine," March 27, 2025, <https://www.hfmmagazine.com/2025-hospital-construction-survey-results>.

<sup>24</sup> Dimick, "2024 Hospital Construction Survey Results."

practical, and or sentimental. Through understanding the past, one can critique it while still incorporating its lessons.

### *The “Affliction”*

Now that the scene has been set as to how American pediatric hospitals have become what they are, one must contend with what the effects of those architectural decisions have been on children. There has been growing interest in academia to study children’s fears in healthcare spaces, their causes, and how to address them. However, this research is still developing and relies primarily on observations and qualitative data from surveys. This section of this literature review aims to clarify the types of stress children experience in healthcare spaces, what are the consequences of this stress, what are the triggering factors, and how common this issue is in children. In other words, this section aims to identify the "affliction" American pediatric architecture has on children.

### Prevalence

Fear of hospitals and doctors visits is extremely common, especially among young children. A survey in Finland found that 90% of preschoolers are afraid of at least one thing in a hospital.<sup>25</sup> A poll taken by the C.S. Mott Children’s Hospital at the University of Michigan found that 50% of the parents reported that their preschoolers were afraid of going to the doctor, 1 in 5 parents reported it was difficult to concentrate on what the doctor was saying because their preschooler was upset, and 1 in 25 parents had to postpone vaccines due to their child’s fear of

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<sup>25</sup> M. Salmela, E. T. Aronen, and S. Salanterä, “The Experience of Hospital-Related Fears of 4- to 6-Year-Old Children: Children and Hospital-Related Fears,” *Child: Care, Health and Development* 37, no. 5 (September 2011): 269, <https://doi.org/10.1111/j.1365-2214.2010.01171.x>.

the doctor.<sup>26</sup> There is even a condition called white-coat syndrome where individuals have elevated heart rate and blood pressure while in a healthcare environment. Extended periods of this elevated heart rate and blood pressure can result in white-coat hypertension. Though there is lacking data on the amount of children who experience basic white coat syndrome, there have been reports of 13% to up to 60% of children who experience white coat hypertension depending on demographic and anthropometric variables.<sup>27</sup> This data provides evidence that fear and anxiety is extremely common in children in healthcare environments. Simply being in the environment can heighten their emotional state.

### Causes of Fears

Healthcare environments can create many different sources of fear and anxiety in children. One study found that 60% of children experience anxiety and fear pre-operation due to factors such as loss of control, a non-familial routine, and surgical instruments.<sup>28</sup> Another study in Turkey interviewed 144 children, ages 7 to 18 who were hospitalized due to acute illness, about their fears.<sup>29</sup> In the study, more than half of the children had had a previous experience with hospitalization, and of those with this previous experience, 39.5% reported experiencing a hospital-induced fear.<sup>30</sup> This would be a fear created by the hospital environment or healthcare experience, such as injections or the operating room, rather than a fear of the illness or its symptoms. The most common hospital-induced fear was injections, followed by the physical

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<sup>26</sup> "Educate or Placate When Young Child Is Afraid of Doctor's Visits?," National Poll on Children's Health, October 15, 2018, <https://mottpoll.org/reports/educate-or-placate-when-young-child-afraid-doctors-visits>.

<sup>27</sup> Alexander Jurko et al., "White Coat Hypertension in Pediatrics," *Italian Journal of Pediatrics* 42, no. 1 (December 2016): 2, <https://doi.org/10.1186/s13052-016-0213-3>.

<sup>28</sup> Özlem Öztürk Şahin and Aysel Topan, "Investigation of the Fear of 7–18-Year-Old Hospitalized Children for Illness and Hospital," *Journal of Religion and Health* 58, no. 3 (June 2019): 1021, <https://doi.org/10.1007/s10943-018-0688-x>.

<sup>29</sup> Şahin and Topan, "Investigation of the Fear," 1011.

<sup>30</sup> Şahin and Topan, "Investigation of the Fear," 1016.



hospital environment, and staying away from home.<sup>31</sup> By having the children rank pre-made fear statements, the study determined the strongest fears the children experienced during hospitalization are undergoing an operation, staying away from the family during hospitalization, and worrying the family when they get an illness.<sup>32</sup> This begins to reveal how vital the presence of the family is to a child's anxiety levels. Even as healthcare facility design has shifted more towards a "child-centered" model in the 2000s, surveys from hospitalized children in the UK still report fears particularly about the ward environment.<sup>33</sup> These studies show that though fear of the hospital itself may not be more prevalent than fears of injections or injury, it is still a contributing factor to the child's state of duress during the experience.

Several studies from the 1980s to 1990s unveil the more abstract contributing factors to children's fear. These include fears of the unknown, unfamiliar faces, immobility, restricted activity, separation from significant others, loss of control, and disruption.<sup>34</sup> These are all experiences that a child can face while going through medical treatment. Though these experiences are more difficult to define architecturally, they can begin to inform the narrative, program, and sequences of interaction a building utilizes.

Commonalities can be found across these studies: children are afraid of being in an unknown or uncomfortable space, being away from a familial presence, painful things being done to them, and the uncertainty that comes from the lack of knowledge about the medical condition and its treatment process. This can be simplified down into loss of belonging, loss of control, and loss of knowledge.

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<sup>31</sup> Şahin and Topan, "Investigation of the Fear," 1015.

<sup>32</sup> Şahin and Topan, "Investigation of the Fear," 1011.

<sup>33</sup> Imelda Coyne and Joy Conlon, "Children's and Young People's Views of Hospitalization: 'It's a Scary Place,'" *Journal of Children's and Young People's Nursing* 1, no. 1 (May 2007): 2, <https://doi.org/10.12968/jcyn.2007.1.1.23302>.

<sup>34</sup> Coyne and Conlon, "Children's and Young People's Views of Hospitalization," 2.

## Self-Determination Theory

To better understand the complex causes of fears healthcare experiences have on children, one can look at it through the lens of the Self-Determination Theory (SDT). This theory proposes that individuals have three basic psychological needs: autonomy, competence, and relatedness. In this aspect, autonomy can be defined as experiences of volition, or being the origin of one's behaviors. Competence is the experience of adequacy. Relatedness is the experience of belonging.<sup>35</sup> It can be argued that all three of these psychological needs are diminished in typical healthcare situations. Children may feel a lack of competence due to not understanding the complex medical nature of their condition or being able to navigate through an unknown hospital environment. They may feel a lack of relatedness due to the often sterile and institutional typology of healthcare facilities. Finally, they may feel a lack of autonomy due to treatment because of their age, restrictions on movement because of a medical condition or spatial limitations, or actions being done to them (such as an operation or an injection) outside of their control. The Self-Determination Theory defines the criteria of psychological needs which are vital to children and their developing mental state, and it is these needs that current healthcare environments don't fulfill.

## Consequences

The consequences of the fears and anxieties created by the hospital environment can have lasting effects, long after the child has been discharged. 83% of children ages 4 to 6 are reported to suffer from different kinds of anxiety symptoms post-hospital stay.<sup>36</sup> Illness and

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<sup>35</sup> Vite, Patall, and Chen, "Relationships Between Experiences," 2.

<sup>36</sup> Salmela, Aronen, and Salanterä, "The Experience of Hospital-Related Fears," 269.

hospitalization can produce negative effects in young children such as restlessness, loss of appetite, and sleep disorders. In older children this can manifest as touchiness, aggressiveness, and fear. Anxiety and fear were the most common response in hospitalization and appear more frequently in children than adults. This anxiety and fear can extend the recovery period and increase the need for painkillers and sedative drugs.<sup>37</sup> Hospitalization can also disrupt a child's typical routine or sense of normalcy. Their separation from school, family, and friends may begin to impact their social relationships.<sup>38</sup> The perceived lack of autonomy that children can feel in healthcare environments can lead to unhealthy coping mechanisms such as passivity, cognitive deficits, sadness, lowered self-esteem, and lowered assertiveness. This can manifest as learned helplessness, where children who experience uncontrollable events may then expect that they cannot control events or outcomes in the future.<sup>39</sup> This expands the consequences from physical health into that of mental health as well. Children younger than 7 are not yet able to understand the origin of illness or medical conditions as caused by infection or other factors. Instead, they may see their illness as a punishment from an anonymous outside force because of their own faults.<sup>40</sup> Research has shown that the average onset of mental illness disorders worldwide is 14.5 years old, and well-being or ill-being experiences in childhood has significant association to well or ill-being outcomes in adulthood.<sup>41</sup> A meta-data analysis was done on 90 reports of autonomy-need-satisfaction—or individual's perception of having autonomous experiences—and autonomy need-frustration—their perception of lacking autonomous experiences—with children in kindergarten through 12th grade. The analysis found that there was a statistically significant

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<sup>37</sup> Şahin and Topan, "Investigation of the Fear," 1012.

<sup>38</sup> Şahin and Topan, "Investigation of the Fear," 1012.

<sup>39</sup> Sandra A. Sherman, Mardelle McCuskey Shepley, and James W. Varni, "Children's Environments and Health-Related Quality of Life: Evidence Informing Pediatric Healthcare Environmental Design," *Children, Youth and Environments* 15, no. 1 (2005): 198, <https://doi.org/10.1353/cye.2005.0063>.

<sup>40</sup> Şahin and Topan, "Investigation of the Fear," 1012.

<sup>41</sup> Vite, Patall, and Chen, "Relationships Between Experiences," 2.

positive relationship between autonomy-need-satisfaction in children and their wellbeing (good mental health), and a statistically significant positive relationship between autonomy-need-frustration and their illbeing (bad mental health). This means that the frustration children feel due to a perceived lack of autonomy negatively affects their wellbeing.<sup>42</sup> These results were statistically the same across gender and age of the children.<sup>43</sup> When children are placed in healthcare situations which remove their autonomy, it negatively affects their physical, social, and mental wellbeing. These early childhood experiences will then have lasting consequences into adulthood.

### Architectural Climate

Not every cause for fear and anxiety in healthcare situations originates from the built-healthcare environment. However, the built environment influences our emotions and perceptions. The architecture of healthcare environments often exacerbates the stress and anxiety that children are already experiencing. This is due to the fact that most healthcare architecture, especially at the scale of hospitals, is focused on treating the condition, not the patient. The constantly advancing technology, program adjacency requirements, and often high status clients—such as government officials and hospital corporations—make a healthcare architectural project extremely complex.<sup>44</sup> These architects not only need to balance effectiveness of facilities with efficiency of programming, but they also need to appease clients who may perceive the architect's credibility in healthcare expertise to be lower than their own.<sup>45</sup> It is difficult to argue against the statement that “the client is always right” when the client is a doctor trying to save

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<sup>42</sup> Vite, Patall, and Chen, “Relationships Between Experiences,” 24.

<sup>43</sup> Vite, Patall, and Chen, “Relationships Between Experiences,” 26.

<sup>44</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 206.

<sup>45</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 205.

lives. A qualitative survey given to healthcare architects found that they perceive their design autonomy, or creative decision making, as decreasing.<sup>46</sup> Many of these firms relied heavily on their previous experience in the typology to win and then go onto design projects. Clients are often expecting these firms to already have all of the knowledge required to design a healthcare facility, therefore these firms are not extending resources to go out and gain new knowledge to apply to their design thinking. As one architect in the survey put it, “[We] do not have enough time for behavioral observations. [We] would like to visit other facilities but have to fit into a schedule or budget.” Another commented, “When you need [research], it's too late.”<sup>47</sup> Over the years, this type of attitude and expectation has created a culture where healthcare spaces have become a highly monotonous, ambiguous, repetitive typology. The survey does report that evidence-based design is increasing. These firms are starting to hire researchers to help gather the information the architects themselves do not have time to.<sup>48</sup> This is a step in the right direction for architects to assess the current conditions of the built healthcare environment and begin improving upon it, however this is still a slow process and will not catch up with the current speed of projects for a while.

### *The “Band-Aid”*

The problems and consequences of conventional healthcare design have been extensively studied and recorded, and many contemporary healthcare architects and institutions are aware of them. Therefore, there have been efforts in architectural healthcare design to move away from the “medical knowledge” domain of design—design focused on technology and efficiency to

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<sup>46</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 206.

<sup>47</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 201.

<sup>48</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 206.

treat the illness—and more towards the "environmental psychology" domain of design—design focused on support and enhancing quality of life to treat the patient.<sup>49</sup> Ulrich was one of the primary advocates for this design method and he proposed that a supportive design should allow patients to have a “sense of control in physical and social surroundings, access to social support, and access to positive distractions in physical surroundings.”<sup>50</sup> Though architectural design has explored increasingly new ways to provide patient support through the environmental psychology perspective, this thesis argues that these design elements are primarily added after the fact rather than integrated at the beginning of the design. It is much easier and cheaper to attach a few patient-centric design choices at the end of a design process, or to renovate a few small rooms of an existing hospital, than try to remake the typical healthcare design process from the ground up. Current healthcare architects are hesitant to make the environmental-psychology domain of design more of the focus than the medical knowledge one. With the complexity and risks of large scale healthcare projects, this is reasonable. However, this often leads to patient-support design to become like a band-aid, providing shallow comfort without addressing the true root causes of the affliction. This section of the literature reviews aims to clarify what the wants and needs of the children are in healthcare environments, what methods are being done in current design to address them, and to what degree are these methods successful.

### Patient, Family, and Child Centric Care

In the mid 20th century, patient-centric care began to arise as healthcare professionals recognized the psychological needs and benefits of personal autonomy in the healthcare process. Patient-centric care is a holistic approach to healthcare where the patients are treated as unique

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<sup>49</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 197.

<sup>50</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 197.

individuals and are empowered to be a part of their medical decision making process.<sup>51</sup> The patients wanted to feel like people, not problems to be solved. However, patient centric care was focused primarily around adults. Children were not yet considered individuals. The next development came in family-centric care as parents were slowly allowed to have more of a presence in children's wards. This form of care groups the child with the family unit, recognizing the importance of a familiar presence to the comfort and healing process of a child, but also putting the child in a passive role to the parents' decision making.<sup>52</sup> Architecturally, this manifests as parent fold out beds in children's recovery rooms and small kitchenettes where parents can prepare food brought from home. Around 1990 with the implementation of the UN Convention of the Rights of the Child, child-centric care began to appear. This concept acknowledges the important role that the family and parents play in the child's life, but recognizes the children as their own persons and active participants in their own care. In this way, it is much more similar to patient centric care, but also acknowledges that children experience illness and disability differently than adults and their care environment should reflect that. Though child centric care has been developing since the 90s alongside family centric care, it is still a relatively new concept and only loosely defined in academic literature.<sup>53</sup> In the last 140 years of pediatric healthcare design, the perspective of the child has only come into true consideration in the last 30 or so years, and designers have struggled to distinguish the child's experience and needs from that of adult patients or their family unit.

Current architectural interventions in healthcare design can often be characterized as following one of these three care-types. They can be patient-centric, and therefore applicable to adult and children patients, such as more private recovery rooms and biophilic design. They can

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<sup>51</sup> Carter et al., "The Concept of Child-Centred Care in Healthcare," 114.

<sup>52</sup> Carter et al., "The Concept of Child-Centred Care in Healthcare," 115.

<sup>53</sup> Carter et al., "The Concept of Child-Centred Care in Healthcare," 114.

be family-centric and therefore provide support to the child as an extension of the family unit, such as places for parents to occupy within the hospital to stay with their child such as the mother's divan or modern day parent pull-out couch. Finally, they can be child-centric, the rarest and most aloof design interventions. These almost always follow Ulrich's method of positive distraction, such as the playroom or artwork aimed towards young children. These distraction methods do have positive outcomes, which is why they are continually implemented. They can prompt play and social interaction which is vital to encouraging children to become more open about their emotions and state of mind, as seen with a 1968 study where children were given dolls to play the role of doctor themselves before tonsil surgery.<sup>54</sup> The physical space of a place area provided the opportunity for the children to act out the treatment they were about to undergo, but from the perspective of the doer rather than the receiver. They helped to fulfill their need for competence and autonomy. However, distraction design originates as an adult perspective towards a child, not a child's perspective of themselves. Adults aim to distract children from negative emotions or experiences. Children aim to explore, imagine, and understand their physical environment. They can find that through play, but they are not looking for distraction, they are looking for understanding. Play is also not the only way children interact or try to understand their environment. Exploration by physically moving through the environment and tactile engaging with it is another way they create a sense of relatedness to their environment, and therefore understanding. These different modes of interaction change depending on the child's age and developmental stage.<sup>55</sup> A playroom may benefit a 5 year old, but less so for an 11 year old. In fact, this can actually have negative consequences if the only child-centric architectural interventions in a hospital are aimed towards a very narrow age group.

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<sup>54</sup> Madeline Petrillo, "Preventing Hospital Trauma in Pediatric Patients," *The American Journal of Nursing* 68, no. 7 (July 1968): 1469, <https://doi.org/10.2307/3420893>.

<sup>55</sup> "Piaget's Theory of Cognitive Development" and "Built Environment Education."



Older children may feel left out or even infantilized by very kiddush toys and artwork.<sup>56</sup>

Patient-centric and family-centric design interventions can be utilized to help shape a healthcare environment more focused around the wellbeing of the children's patients, but child-centric design needs to be further developed in order to truly accommodate the children as unique individuals with unique experiences and needs.

### Accommodating the Patient

Different methods of patient centric design should be considered and analysed on how they can be adapted to pediatric patients. One study with the Brazilian Healthcare System provided a survey to the staff of a pediatric hospital for their feedback as to what they wanted to see improved in order to provide more patient autonomy.<sup>57</sup> The feedback included ideas such as the ability to personalize recovery rooms, soothing music, more cheerful decorations, and children sized wheelchairs.<sup>58</sup> However, there was pushback against the hospital and medical professionals against any major child-centric interventions since there is such a high turn over rate of children and certain medical rooms were used by the entire hospital. This study aimed to approach redesign through a child-centric lens, but only addressed the caretaking staff, not the parents or the patients themselves. In the end, all of the design interventions that were considered possible to implement were distraction based.<sup>59</sup> Another study at a Swiss hospital looked into temporary or mobile interventions to create multisensory spaces for the children. They found that spaces when engaging multiple senses and creating an “atmosphere” can help build a “common

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<sup>56</sup> Maíra Longhinotti Felipe et al., “What Is a Restorative Hospital Environment? Environmental Meaning, Affective Stress Restoration and Physical Attributes in Pediatric Inpatient Rooms,” *Children, Youth and Environments* 27, no. 1 (2017): 21, <https://doi.org/10.1353/cye.2017.0024>.

<sup>57</sup> Da Rosa, Brust-Renck, and Tonetto, “Designing Hospital Environments to Improve the Psychological Wellbeing of Pediatric Patients,” *Children, Youth and Environments* 31, no. 3 (2021): 99, <https://doi.org/10.7721/chilyoutenvi.31.3.0098>.

<sup>58</sup> Da Rosa, Brust-Renck, and Tonetto, “Designing Hospital Environments,” 103-107.

<sup>59</sup> Da Rosa, Brust-Renck, and Tonetto, “Designing Hospital Environments,” 105.

unifying reality between the subject [patient] and the object [hospital].”<sup>60</sup> In other words, the children can feel present within the space, not excluded from it or diminished by it. This study provided murals of nature scenes and ipads to play music and films, once again leaning into child-centric distraction design. However, they also began to expand into patient centric by providing reachable lamps by each bedside for the children to adjust themselves and textiles LED privacy panels around the bed. The adjustability of the lamps and privacy panels provided the patient with more autonomy and control of their immediate environment.<sup>61</sup> The textile material aided in sound dampening as well as providing a soft tactile surface for the children. This tactile nature lends the panel design to be more child-centric and it is also designed for comfort, rather than distraction.

## Wayfinding

Another method of patient-centric design is wayfinding. An observation study at a pediatric hospital found that confusing wayfinding can increase anxiety and stress of parents and children in the healthcare environment. Radial plans, as the one in the study, shorten travel time for nurses but can be extremely confusing for the patients and visitors who are less familiar with the hospital.<sup>62</sup> This leads back to the Self Determination Theory component of competence. If the children and family members feel incompetent in just finding the correct room, then they are already experiencing a negative psychological impact by just walking through the hospital.

Within this study, children patients were asked to draw cognitive maps of the hospital, and their

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<sup>60</sup> Ute Ziegler, “Multi-Sensory Design as a Health Resource: Customizable, Individualized, and Stress-Regulating Spaces,” *Design Issues* 31, no. 1 (January 2015): 56, [https://doi.org/10.1162/DESI\\_a\\_00309](https://doi.org/10.1162/DESI_a_00309).

<sup>61</sup> Ziegler, “Multi-Sensory Design,” 58.

<sup>62</sup> Barbra Brown, Holly Wright, and Craig Brown, “A Post-Occupancy Evaluation of Wayfinding in a Pediatric Hospital: Research Findings and Implications for Instruction,” *Locke Science Publishing Company, Inc., Journal of Architectural and Planning Research*, vol. 14, no. 1 (Spring 1997): 48, <http://www.jstor.org/stable/43029243>.

drawings revealed that the central nurses station acted as an important landmark, and could draw their room in relation to it, but struggled to depict radial hallways or where they lead to.<sup>63</sup> This showed that the children's navigation was limited just to those two points, even though the hospital had additional amenities such as a playroom. The study found that the best wayfinding tactics from a patient point of view were 90 degree corridors, large signs hanging from ceilings with consistent terms or symbols, landmarks such as nurse stations, and information desks.<sup>64</sup> The study also found that it was important to have a triangulation of tactics. One solution for wayfinding would not work for every visitor coming through the hospital, so two or three different methods to aid in wayfinding was the most beneficial.<sup>65</sup> This connects back to the idea of adapting to an individual's needs. Just like how one method of wayfinding will not work for everyone, one child-centric option such as a playroom will not work for all kids. A range of diverse spatial accommodation should be employed at every level to accommodate a wide range of patients and their specific needs.

## Biophilia

The most well known design intervention to promote well being in any patient, not just children, is biophilia. A study by Ulrich helped pave the way for this concept. The results found that patients with a view of nature had about a 1 day faster recovery time, reported having negative reactions  $\frac{2}{3}$  times less, required less potent pain medication post operation, and had slightly lower scores for post surgery complications.<sup>66</sup> Since this study, biophilia has been a strong design component in patient centric healthcare architecture. Kenneth Hapland, a

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<sup>63</sup> Brown, Wright, and Brown, "A Post-Occupancy Evaluation of Wayfinding," 45.

<sup>64</sup> Brown, Wright, and Brown, "A Post-Occupancy Evaluation of Wayfinding," 50.

<sup>65</sup> Brown, Wright, and Brown, "A Post-Occupancy Evaluation of Wayfinding," 49.

<sup>66</sup> Roger S. Ulrich, "View Through a Window May Influence Recovery from Surgery," *Science* 224, no. 4647 (April 1984): 420–21, <https://doi.org/10.1126/science.6143402>.

landscape architect, notes that hospital gardens can become the heart of the hospitals, utilized by patients and staff alike as a retreat from the stressful atmosphere and a place to gather as a community.<sup>67</sup> Another landscape architect, David Kamp, designed therapeutic gardens. He explained how the repetitive action of tending to land and the psychological connection and responsibility to the land built around that action helped refugees recovering from trauma. Gardening provided an opportunity for meditation, reflection, and creation, so the individuals could address their own past while still feeling hope for a promising future.<sup>68</sup> Another patient centric garden that he designed took into consideration all of the small changes from normalcy that healthcare treatment or disabilities can impose on a person. The pavers were designed to be smooth for those tethered to an IV. Door thresholds needed to be low enough for individuals in wheelchairs or with mobility issues to cross easily. There were also opportunities in these accommodations, such as engraving braille poems into the required handrails. Physical therapy lessons could be incorporated into reaching down to tend to different levels of garden beds.<sup>69</sup> These hospital gardens provided social, physical, and mental healing opportunities, not just for the patients but for everyone a part of the facility.

### Accommodating the Family Unit

Adopt a room was one study which redesigned two pediatric recovery rooms and compared the patient and parent experience in them with two control recovery rooms. The redesigned rooms included larger private bathrooms, beds for the parents to stay with the

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<sup>67</sup> Kenneth Helphand, "Prescribing the Outdoors: A Model Hospital Garden," *Foundation for Landscape Studies, SiteLINES: A Journal of Place*, vol. 15, no. 1 (Fall 2019): 10.

<sup>68</sup> David Kamp, "Nature, Design, and Health: A Personal Overview," *Foundation for Landscape Studies, SiteLINES: A Journal of Place*, vol. 15, no. 1 (Fall 2019): 6, <https://www.jstor.org/stable/26767358>.

<sup>69</sup> Kamp, "Nature, Design, and Health," 7.

children, and food storage.<sup>70</sup> This shows a mix of patient and family centric design through the additional privacy and space to accommodate the family unit. The food storage was particularly interesting because it provided a new opportunity for comfort by being able to have home cooked meals with them at the hospital. Though the experiment could not find a statistical difference in physical recovery between the redesigned and control recovery rooms due to sample size, the majority of the patients and families preferred the redesigned room.<sup>71</sup> Though family-centric design did originate prior to child-centric, it still can often fall through the cracks during the design process. Family members can be seen as a temporary or visitor presence in the healthcare space. They are not necessary for the functionality of the treatment like the staff and they are not the ones being treated like the patient. However, this exclusion of the family from the healthcare relationship is a remnant from the social reform era. A study on hospitalized preschool children in Finland found that the presence of family was the most prominent coping mechanism.<sup>72</sup> Another study found that parental healthcare satisfaction plays a role in the child's stress response. Therefore, the more visibility stressed the parent appears, the more stressed the child will become in response.<sup>73</sup> One UK pediatric hospital created a "parent lounge" out of a modified storage closet where a child's parent could recollect themselves privately from the rest of the hospital and their own child.<sup>74</sup> This shows a rare instance where family-centric design is actually separate from the child. Parents and family members in these situations are often under large amounts of stress themselves, and often need their own space to grieve and express their emotions without concerning their child. Comforting and accommodating the family unit can be

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<sup>70</sup> Mardelle McCuskey Shepley et al., "Pediatric Inpatient Room Experience," *Children, Youth and Environments* 22, no. 2 (2012): 50, <https://doi.org/10.7721/chilyoutenvi.22.2.0047>.

<sup>71</sup> Shepley et al., "Pediatric Inpatient Room Experience," 61-62.

<sup>72</sup> Şahin and Topan, "Investigation of the Fear," 1021.

<sup>73</sup> Felipe et al., "What Is a Restorative Hospital Environment?" 30.

<sup>74</sup> Judy Ann Rollins, "The Influence of Two Hospitals' Designs and Policies on Social Interaction and Privacy as Coping Factors for Children With Cancer and Their Families," *Journal of Pediatric Oncology Nursing* 26, no. 6 (November 2009): 345, <https://doi.org/10.1177/1043454209339734>.

incredibly beneficial to the emotional response of the child. There are opportunities in contemporary healthcare design to accommodate the family unit, beyond just a pull out bed, without overshadowing the child.

Only in recent history has patient centric design been incorporated into hospitals, and for children it is even newer. Many of the lessons and implementations for patient centric design can be included in child-centric, such as privacy, biophilia, control over immediate environment, and wayfinding. Support of family centric design through accommodation of the family unit within the hospital space can also build a positive environment for the child. However, child centric design is still relatively limited to distraction methods. Toys, playrooms, and colorful artwork can have positive effects for the children, but they become less effective the older the child is, especially if they are child-emblematic, or aimed towards a certain maturity level.<sup>75</sup>

Personalization and scale of space are known to help increase a child's sense of relatedness, but are often considered too difficult or too permanent to implement into healthcare design.

Therefore, current pediatric healthcare design is beginning to develop a design language around child-centric design, but it has yet to become a fully conceptualized typology. In order to gather more information on how to shape child-centric design, one must look outside of the realm of healthcare.

### *The “Treatment”*

This thesis proposes that child centric healthcare design should start from the ground up. This means integrating the child's perspective in the early design phase, not as additions after the major design move have been determined. As there is very limited research directly asking

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<sup>75</sup> Felipe et al., “What Is a Restorative Hospital Environment?” 21.

children for their input on healthcare design, this literature review will expand to other typologies that more easily fall under child-centric design, such as schools and daycares. Studies through these typologies can help fill in the gaps left unaddressed by the healthcare literature.

First, it is helpful to reflect and summarize what has been learned through the previous sections. Contributing stressors to children in healthcare environments are the fear of the unknown—either of the treatment or hospital space—isolation from friends and family, and lack of perceived autonomy over one's own body and physical environment. The Self Determination Theory sets up the psychological goals of autonomy, relatedness, and competence in order to prompt wellbeing in the child. Methods to achieve these goals are further elaborated by Ulrich as social support, environmental control, and positive distractions. Multisensory design, familiar residential typology, personalization of space, and child scale equipment are all ways to promote relatedness for the child but difficult to implement in late stage design. Previous explorations into patient centric design have focused on promoting privacy, control of light and sound, wayfinding, and biophilia. Family centric design has resulted in the accommodation of the family unit in the recovery room as well as private parental spaces away from the child. Child centric design has been primarily focused on distractions through colorful artwork, toys, and playrooms. These spaces can be beneficial for the social interaction of the child and emotional development, but do not accommodate wider emotional responses or older age ranges. These child centric design choices often originate from historical precedent in pediatric healthcare or what parents, staff, and architects assume will benefit the child from their perspective. Therefore, there is only one question left to ask, what does the child want?

## Child Drawings of Ideal Hospitals

A study conducted in Finland had roughly forty children in a pediatric ward draw their ideal hospital and describe it to the researchers. The method of drawing could be considered highly interpretive, but it allows young children who may not be able to verbally articulate their feelings or ideas to express them in an alternative format.<sup>76</sup> The majority of the children drew their ideal hospital as the exterior of a building. The second most prominent drawing was the interior of a room with objects and people. The least common drawing was of just people.<sup>77</sup> This shows that though most children associate hospitals as an architectural space, some associate it with people, particularly parental figures. Some children drew the hospital building as larger and blocky with many cars and ambulances outside. A few of these drawings also included stormy weather and bars on the windows, suggesting that the children were drawing from previous experience rather than creating an imaginary ideal place. Others drew a more residential sized house with curtains and a pitched roof. Lots of windows were seen in every exterior drawing and playgrounds appeared multiple times. Symbols such as red crosses appeared on the buildings and nurses to identify and associate them with the hospital, and the nurses were often depicted in very colorful uniforms and smiling as they tended to the patients.<sup>78</sup> The interior rooms that children drew often included entertainment items such as TVs, video games, books, aquariums, and even ball pits. This shows how "distraction" or play items are important to the children. Animals such as fish, cats, and horses were also a common theme.<sup>79</sup> This suggests children's desire to be with pets or have animal companions within the hospital, either for entertainment (such as the aquarium) or for comfort. The results from this study can be highly interpretive and

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<sup>76</sup> Tiina Pelander, Kimmo Lehtonen, and Helena Leino-Kilpi, "Children in the Hospital: Elements of Quality in Drawings," *Journal of Pediatric Nursing* 22, no. 4 (August 2007): 334, <https://doi.org/10.1016/j.pedn.2007.06.004>.

<sup>77</sup> Pelander, Lehtonen, and Leino-Kilpi, "Children in the Hospital," 336.

<sup>78</sup> Pelander, Lehtonen, and Leino-Kilpi, "Children in the Hospital," 337.

<sup>79</sup> Pelander, Lehtonen, and Leino-Kilpi, "Children in the Hospital," 338.



only represent a small sample size of children. However, it does show how children are perceptive of current hospital environments and the presence of nurses and parents with them during the visits. What goes beyond the typical and travels into the ideal is the bright colors, abundance of entertainment options, melding into familiar house-typologies, and inclusion of animals. None of the children's ideas, beside maybe the ballpit and horse, are fantastical or impossible to recreate. Since the children were prompted to draw an “ideal” rather than their imaginary hospital, they might have ended up depicting something they would consider to be more possible in reality. Still, this study shows how children want to push the boundaries of what typical healthcare spaces look like.

This survey was repeated by the author with a first grade class. The students were given a sheet of paper and instructed to draw their “dream” hospital. The children were also told that their “dream hospitals” could be as crazy or imaginative as they wanted, in hopes to avoid the confusion from the previous study. Surprisingly, the students still drew fairly familiar hospital-like buildings, as big square and rectangular blocks with ambulances and crosses. There were themes across the drawings such as rainbows and colorful exteriors, flowers, videogames, playgrounds, and water slides which appeared in many of the drawings. One student drew the front of the hospital to have separate doors, one for “adults and teens” and the other for “kids, babies, and toddlers” suggesting a desire to have separate or at least specific design for different age groups. The drawings created by the students cannot be used as quantitative evidence for certain design elements, but they can be used as inspiration for elements of design such as fun water-play areas, colorful facades, and child-specific zones.



Fig. 1 First Graders Drawings of their "Dream Hospital" collected by Author

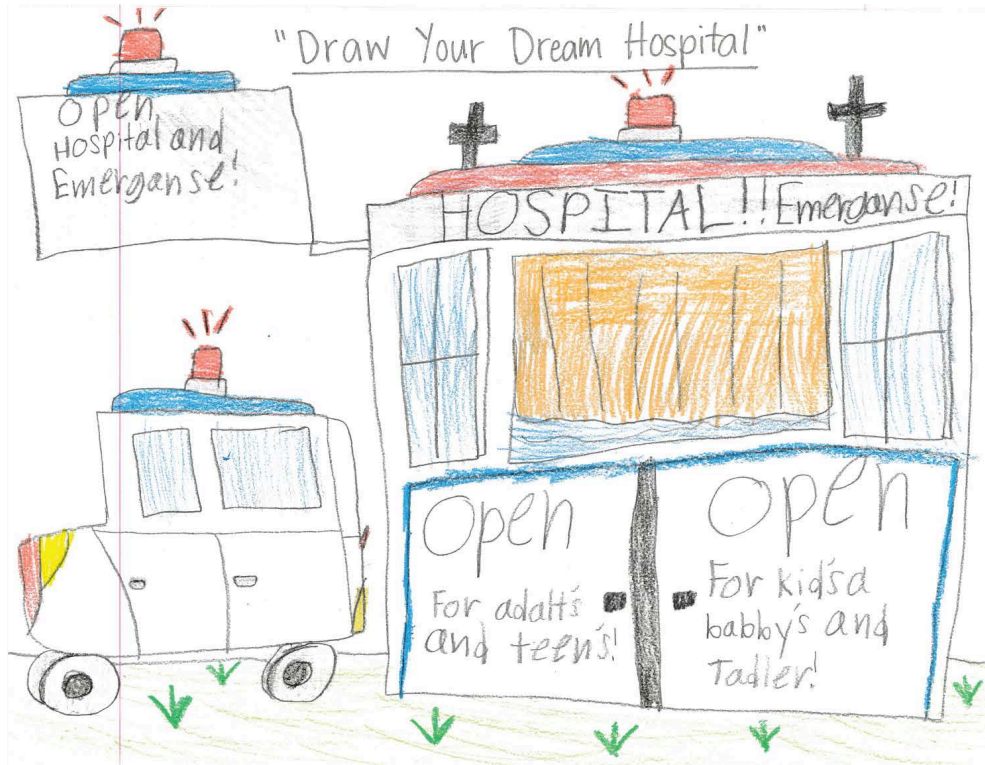


Fig. 2 First Grader Drawing of their "Dream Hospital" with separate doors for age groups, collected by Author

### Child Centric School Design

Schools are where children spend the vast majority of their time on a day to day basis. This has created an abundance of literature focused on child-centric design in school. One study found that providing children with the opportunity to take part in the design of their educational space helped to diminish stress, absenteeism, and self-efficacy.<sup>80</sup> Outdoor spaces are incredibly important, not only from a biophilic standpoint but also for social and recreational activities. Natural environments promote unstructured and imaginative play among children.<sup>81</sup> It is where they can feel the most free. Outdoor spaces also provide educational opportunities about the

<sup>80</sup> Laura Healey Malinin and Rosie Parnell, "Reconceptualizing School Design: Learning Environments for Children and Youth," *Children, Youth and Environments* 22, no. 1 (2012): 14, <https://doi.org/10.1353/cye.2012.0048>.

<sup>81</sup> Sara Berti, Ada Cigala, and Nima Sharmahd, "Early Childhood Education and Care Physical Environment and Child Development: State of the Art and Reflections on Future Orientations and Methodologies," *Educational Psychology Review* 31, no. 4 (December 2019): 1000, <https://doi.org/10.1007/s10648-019-09486-0>.

environment, agriculture, and physical health. Early childhood educational care environments are designed to be specifically child-scale, have a variety and appropriateness of materials, spatial definition, cozy areas, cleanliness, and a sense of safety.<sup>82</sup> Children can detect when a space feels undermaintained, unclean, or unsafe and that can negatively affect their perception of the space and their comfort level in it.<sup>83</sup> A study with UK middle schoolers had them rank different spatial and programmatic aspects of their school. The results showed that the children were the most concerned with the facilities of the school such as the bathrooms, food, and furniture. This was rather surprising since it is a somewhat mundane category, but the children considered it highly important. This could reflect how the children appreciated facilities that were clean, functional, and reflected a level of maintenance and care across the school. They also believed that the building's exterior appearance and visibility from the road was important. This could reflect that the children are conscious of how the school is perceived by the community, and a nicer looking building can create more pride among the students. The students also commented how they wanted more food options, outdoor seating and shelters, and even a swimming pool and skate park.<sup>84</sup> These additional amenities reflect how the children prioritize more entertainment, recreational, and comfort activities. Children at the middle school level were able to recognize the importance of the functions of the building itself and appreciated when the building was well cared for and functioned well. Additional entertainment and recreational activities were brought up by the children but these did not rank at the same level of importance as facility management.

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<sup>82</sup> Berti, Cigala, and Sharma, "Early Childhood Education," 1010-1011.

<sup>83</sup> Rokhshid Ghaziani, "An Emerging Framework for School Design Based on Children's Voices," *Children, Youth and Environments* 22, no. 1 (2012): 126, <https://doi.org/10.1353/cye.2012.0031>.

<sup>84</sup> Ghaziani, "An Emerging Framework for School Design," 135.

## Chapter 3: Methodologies

Research methodologies are critical to this thesis in order to better understand the perspective of the patient (the children) and the requirements of programming (healthcare). Both are highly complex, and no one solution can fit either perfectly. Though I have personal experience as a child in hospital environments, that experience is from over a decade ago. As I have grown into an adult, my perspective on these experiences has changed and developed. Hospital's approaches to child-centric care have also changed and developed since my time in a hospital. Therefore, it is critical to delve into these topics with more recent precedents that have qualitative and quantitative data. This creates a factual framework to apply more subjective design aspects onto. The purpose of research is to better understand the issue, the patient, and the programming in order to translate it into application.

### *Dialectics*

This paper shall take the Dialectics approach to research methodology by defining both sides of the argument and then synthesizing them into a singular conclusion.<sup>85</sup> For this thesis in particular, the argument is around the design of pediatric healthcare spaces. This paper's thesis is that good pediatric healthcare design should originate from the perspective of the children, be incorporated early in the design process, and create a space which treats the patient, not the disease. The "antithesis" or counter argument, would then be against changing the status quo of pediatric healthcare design: functionality of the medical equipment and systems should be the

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<sup>85</sup> Ray Lucas, *Research Methods for Architecture* (London, England: Laurence King Publishing, 2016), 41.

primary driving factor in design and additive measures for patient comfort afterwards are sufficient to the children's physiological needs. Though more recent healthcare design has been leaning towards patient centric design, the functionality, technology, and adjacency requirements of large healthcare spaces still take priority in design. There are positive and negative consequences to both arguments. Healthcare design which focuses on functionality over humanity is apathetic with harmful psychological consequences. Yet healthcare design which pleases the patient but is functionally inefficient is ultimately an unusable space. A solution to this problem must be a healthcare space which can physically heal the patient without psychological detriment. Fun and functional are not opposites and can coexist in a design. The solution comes not from disregarding functionality entirely, but placing it at a lower hierarchy in the design process.

### *Scope of Project*

There is, admittedly, a limit to the scope of work feasible for this thesis project. As this author is a master student with no previous design experience in healthcare spaces—and in the professional world that is a specialty reserved for specific firms with decades of experience—this thesis project will not be designing at the scope of a hospital. The technological and adjacency requirements for hospital design are far too complex to unravel within this project. Achieving a realistic, detailed project at the scale of a hospital is also not feasible by a single designer. However, one of the goals of this project is that its architectural design framework can be applied to larger future healthcare typologies. For now, this thesis project will explore child-centric pediatric design at the scale of a large clinic and recovery center. This new hybrid typology

proposed by this thesis will include programming for long term in-patient recovery as well as outpatient clinic programming. This way, this typology can serve its local community as a pediatric clinic and serve children from a wider district who need long term recovery treatment. It will act as a “mini hospital” if you will, by serving long term and short term patients. This way the new design approaches in in-patient and out-patient areas can be translated into larger scale hospitals later. However, this new typology will not house the highly specific, technological programming such as surgical units or MRI machines because of their very restrictive coding and sanitation requirements. However, this new typology will be located adjacent to a larger hospital so it has access to these resources and children whose treatment requires this type of technology may still come to the recovery clinic afterward. Other medical programs such as exam rooms and treatment rooms will be included as these are still spaces where children may feel fear and anxiety but they have more opportunities for redesign.

## *Site & Fieldwork*

This thesis project shall choose a real world site to design and propose a theoretical recovery clinic. Choosing an existing site opens the opportunities to pull from real world context, history, and communities. As healthcare spaces are often associated with the international style and lacking a connection to their community, reestablishing this connection through research and analysis of a real community will be vitally important. Multiple sites across Maryland were analysed through digital resources such as Google Earth and census data. The site selection criteria at this stage was primarily quantitative and included proximity to a pediatric hospital, proximity to an elementary school, distance from other local clinics, percentage of children in



neighborhood populations, and accessibility by public transportation and emergency vehicles. The amount of local green space was assessed qualitatively. This criteria was ranked across the sites in order to narrow down to the final selection. A site visit was performed at the final candidate site in order to gather photographic imagery of the local context and perform on site sketching.

### *Precedent Studies*

Architectural precedents were analysed as a part of the research process in order to discover and understand architectural methods of shaping space and promoting child-centric design. Ten precedents were originally gathered from a range of time periods, countries or origin, and typologies in order to cast a wide net of possible inspiration and learning opportunities. Landscape proceedings from Marie Antoinette's Hameau de la Reine to facade and residential precedents such as Gaudi's Casa Mila were researched at this stage. Documentation and imagery was gathered of these precedents for future reference. From these ten, five precedents were chosen for a more in depth analysis. Hand drawn diagramming and data collection of square footage and occupants was conducted. Of these five, one was a medical precedent and the other four were schools or daycares which used child-centric design. These precedents helped define methods of child-centric design to be incorporated into conceptual testing of the project.

### *Interviews*

Informal interviews were conducted with teachers and pediatric nurses in order to gain a better qualitative understanding on how children interact with their environment. These



interviews were either conducted via Zoom or an emailed questionnaire. These interviews were expressly informal and not meant to gather any hard quantitative data but rather to learn about different perspectives and individual experiences. One of the most interesting comments from an interviewed 6th grade teacher was that her students much preferred seeing their own work displayed in her classroom than previous students' work. There was more of a sense of pride and connection seeing their own work displayed than feeling as if they had to compare themselves to previous students. This experience was not the same across the board as another teacher for high schoolers displayed previous students' work without creating a sense of competition or comparison.<sup>86</sup> There is no correct answer that can be drawn from these responses and experiences, but through architectural design, one can attempt to replicate one of these experiences either by providing areas that children can personalize and display their own art or a space meant to display work or remember previous patients.

The interview with an ICU nurse enlightened the staff perspective of pediatric hospital spaces. Particularly on how there often is not space considered for the larger family unit, such as siblings who may be brought along when parents are visiting a child. It was also explained how staff break spaces can be very small to support a large number of nurses, doctors, support staff, as well as sometimes parents of patients when they need a more private space to occupy.<sup>87</sup> Therefore, this thesis will look into including more staff-specific spaces and family accommodation spaces into the programming.

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<sup>86</sup> Marie Sinnicki, "Middle School Teacher Interview," interview by Shannon Sinnicki, December 4, 2025, Zoom Interview.

<sup>87</sup> Sofia Abrams, "NICU Nurse Interview," interview by Shannon Sinnicki, January 8, 2026, Zoom Interview.

## Chapter 4: Precedent Studies

For this thesis, I chose five projects for an indepth precedent analysis. Other projects have been a part of the research process for this thesis, however these five projects received a deeper analysis because of their unique and innovative ways of designing around children. The first precedent is a hospital addition and demonstrates a new innovative way to organize complex healthcare programming. The rest of the precedents are schools or daycares, as these typologies more often have the freedom to design around children without the burden of healthcare programming. The second precedent plays with layers of light, color, and visibility. The third precedent explores simple massing to create a shelter of space. The fourth precedent employs overlapping modules to build interaction between distinct spaces. The fifth and final precedent demonstrates a response to site and material in its design. Each of these precedents achieve these secondary goals in service to better cater to the children occupying the spaces. The child is the core of each of these precedents.

### *Moseley Foundation Institute*

The Lisa Dean Moseley Foundation Institute for Cancer and Blood Disorders is a part of a new addition to Nemours Children's Hospital in Wilmington, DE, designed by HDR and completed in 2025. The Moseley Foundation Institute itself takes up only one floor of the new addition at about 28,000 square feet. Its programming is divided into two areas: the patient support and staff



Fig. 3 Lisa Dean Moseley Institute Foundation addition to Nemours Children's Hospital.

support. The patient support programming—such as 24 private patient bedrooms and patient-hubs, each designated for social interaction or recreation for different age groups—are organized around the perimeter of the leaf-shaped floor plan.<sup>88</sup> All of these rooms received exterior windows and are easily connected by a long coordinator which loops around the entire floor. Every four patient rooms are grouped in a color coded neighborhood, with a hub area connecting them. The hubs include the Great Room where patients and families can play crafts or watch movies, designated Teen Hangout Room, the Rec Room which operates as a mini gym for physical therapy, the Backyard which is a playroom for autoimmune comprised patients and therefore has limited access, and the Playroom which is available to all younger children.<sup>89</sup> Nemours Children Hospital has a clear value for family-centric design. They acknowledge how important the family unit is to pediatric care so their programming choices are meant to allow for the patient and their family to follow a similar home-life routine.<sup>90</sup> Therefore they also include a family kitchen open for patients and their families to cook and eat meals together and an attached family-suite to one of their patient rooms, so family members can stay long term if the need arises.

The staff support areas, such as the lab station, offices, meeting rooms, nurse bedrooms, and locker room, are located within the core of the plan.<sup>91</sup> All of these spaces are either accessed by the perimeter looping hallway or a pair of simple cross hallways through the center. Earlier design plans show a much more complex series of radial hallways crossing through the middle

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<sup>88</sup> “Lisa Dean Moseley Foundation Institute for Cancer and Blood Disorders at Nemours Children’s Hospital | HDR,” accessed December 19, 2025, <https://www.hdrinc.com/portfolio/lisa-dean-moseley-foundation-institute-cancer-and-blood-disorders-nemours-childrens>.

<sup>89</sup> “Lisa Dean Moseley Institute | Beyond Medicine | Nemours,” accessed December 19, 2025, <https://www.nemours.org/well-beyond-medicine/the-moseley-institute.html>.

<sup>90</sup> “Lisa Dean Moseley Foundation Institute for Cancer and Blood Disorders,” accessed December 19, 2025, <https://www.nemours.org/services/center-for-cancer-and-blood-disorders/cancer-locations/lisa-dean-moseley-delaware.html>.

<sup>91</sup> “Lisa Dean Moseley Institute | Beyond Medicine | Nemours.”

core, which would have provided faster access to either side of the plan.<sup>92</sup> However, this layout was changed in favor of the simpler cross, so that the hallway through the centre could also be used by patients and families to cut across. Remnants of the more complex circulation are absorbed by the team-centers, or large circular meeting rooms with passages connecting them, so nurses are still able to take shortcuts through the core to the other side of the plan.



Fig. 4 Moseley Institute Foundation older plan. Drawing by HDR Architects.

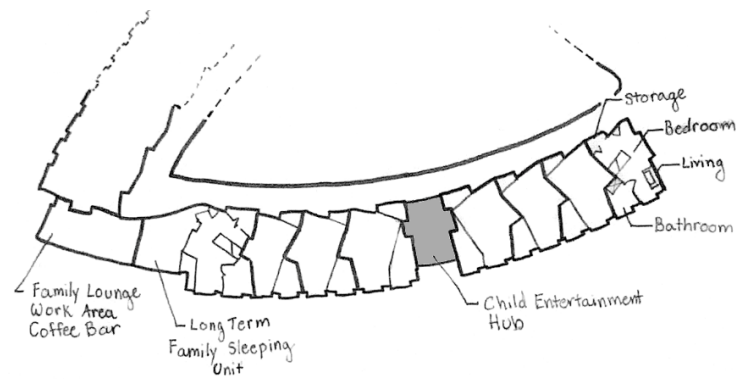


Fig. 5 Moseley Institute Foundation newer plan. Drawing by HDR Architects.

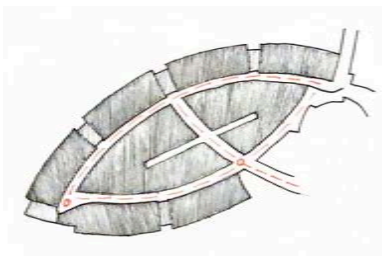
One of the most interesting aspects of the plan is how the patient rooms become jigsaw like modules which puzzle piece together around the perimeter. There are almost no right angle walls in the patient's room. Instead, the side wall slants so that the bed is angled with its feet towards the door. This angles the patient away from the window but allows for easier access to transfer the patient to the bed or for nurses to attend them. The private bathrooms then become a notch closer to the window side of the room. Along the corridor, the walls slant inward wherever a door to a patient's room is. This allows for a more private entry into the space and opportunity for sitting nooks carved into the walls. These nooks then become informal places for children to read, socialize, or even meet with doctors without feeling over exposed. Though the Moseley Institute still largely uses very sterile and hard materials, they express playfulness in the forms of

<sup>92</sup> "Lisa Dean Moseley Foundation Institute | HDR."

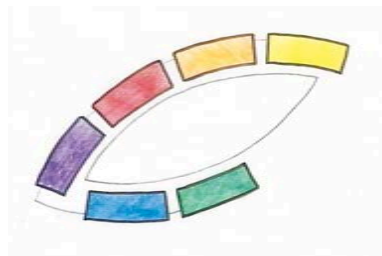
fun colors and swooping shapes. And though there are no green or outdoor areas for these children on the fifth floor, the communicable hubs have large floor to ceiling windows overlooking the large campus. The diverse family-centric programming and the simple but effective layout of programming and circulation make the plan supportive of both the family and patient needs as well as the staff to function as a hospital.



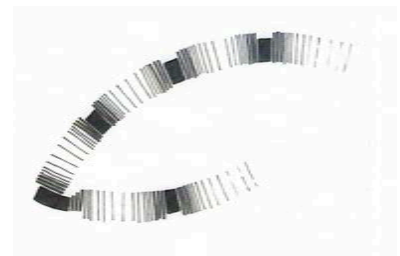
Illus. 1 Interlocking Program.



Illus. 2 Circulation Ring.



Illus. 3 Color Coded Neighborhoods.



Illus. 4 Social Hubs.

## *Els Colors Nursery*



Fig. 6 Els Colors Central Courtyard. Photo by Eugeni Pons.



Fig. 7 Kaleidoscope Hallway. Photo by Eugeni Pons.

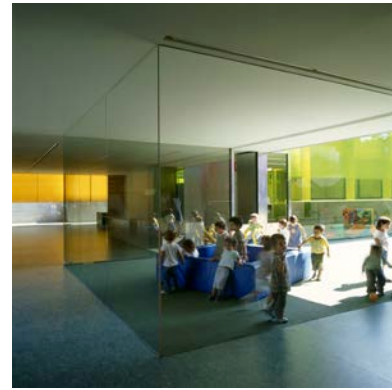


Fig. 8 Intersection between courtyard and corridor. Photo by Hisao Suzuki.

The Els Colors Nursery located in Barcelona Spain was completed by RCR Architects in 2004.<sup>93</sup> While the Moseley Institute catered towards children between the ages of zero to eighteen,<sup>94</sup> the Els Colors Nursery is designed for toddlers, or children three years old or younger.<sup>95</sup> The building itself is on a much more urban corner site, located across from one of the few green areas in its neighborhood, a historic cemetery complex on top of a hill. The long rectangular massing of Els Colors mimics the cemetery complex, but adds a playful twist by stacking one of the bars on top of two others, like children stacking blocks. The most prominent feature of Els Colors is, of course, its multicolor glass block facades. The plan of the building is made up of very simple rectangular classroom modules, but the different color glass helps children, who would be too young to read, navigate to their classrooms. The Moseley Institute uses a similar color coding for its wayfinding as well. The children's classrooms are given warm tones of red, orange and yellow. The staff and service programming is then given purple and

<sup>93</sup> "Built Works and Projects," RCR Arquitectes, accessed December 19, 2025, <https://www.rcrarquitectes.es/en/arquitectura-i-paisatge/obra-construida-i-projectes/>.

<sup>94</sup> "Lisa Dean Moseley Institute | Beyond Medicine | Nemours."

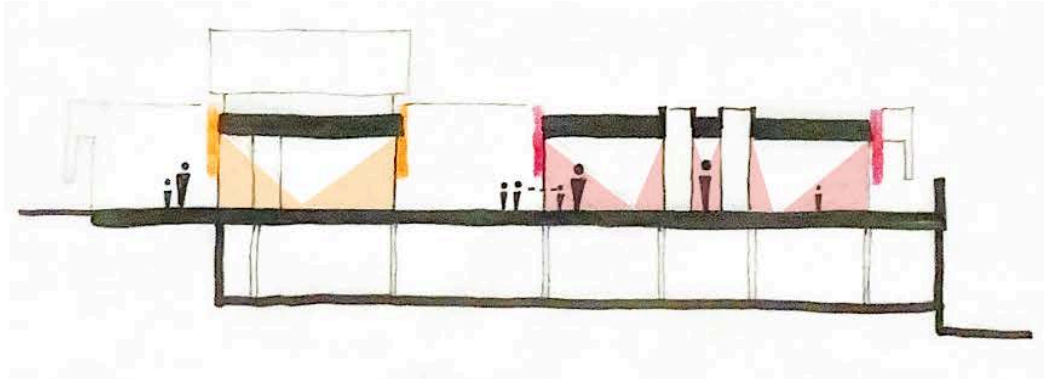
<sup>95</sup> "Built Works and Projects," RCR Arquitectes.

black tone glass, so it fades into the background.<sup>96</sup> The main circulation hallway, colored orange, connects the two classroom cross bars while separating the classroom side from the staff side. A children's play yard becomes the space in between and projects into the circulation hallway by means of a transparent glass box, so the separation between interior and exterior becomes near nonexistent at this juncture. The color glass is also scaled to the height of a child. A transparent glass wall acts as the true envelope, going from ceiling to floor, while the color glass acts as a shading and visibility feature of the facade, stopping just short of where a child's eye level would be. This allows for the children to see into the courtyards and have open discovery of the world around them, while adults have a slightly more obstructed view. The colored glass is still transparent enough for teachers to properly supervise the children on the courtyard side while it is frosted opaque as a privacy layer on the street facing side. Along with the interior coordinator of the North-West bar, the color glass becomes the wall material separating the classrooms on either side of the corridor. Light floods in from a skylight above, dispelling into this corridor and creating a kaleidoscope effect of multicolors when looking from one end to the other. Though *Els Colors* is designed to be as open and multifunctional as possible in order to give creative freedom to the children. However, its material palette of glass and galvanized steel make it appear a little untouchable. Even the play courtyards are coated with rubber, though the children have access to some green space because of the cemetery across the street.<sup>97</sup> *Els Colors* does not offer much in the way of the other senses, but visually it is incredibly imaginative and considerate of the scale of the child.

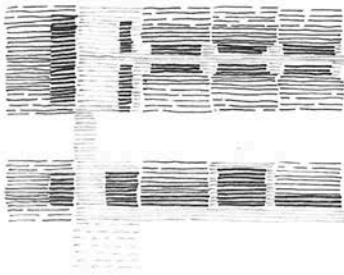
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<sup>96</sup> Arian Mostaedi, *Preschool & Kindergarten Architecture* (Barcelona: Carles Broto, 2006), 24.

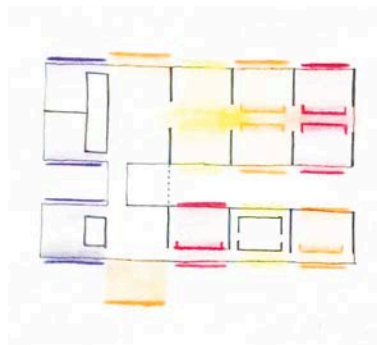
<sup>97</sup> Mostaedi, *Preschool & Kindergarten Architecture*, 18.



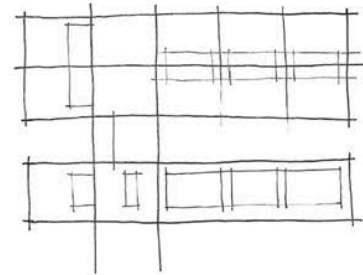
Illus. 5 Cross Section - Child vs Adult Views.



Illus. 6 Depth of Natural Light.



Illus. 7 Color Coded Classrooms.



Illus. 8 Regulating Grid.

## *Fuji Kindergarden*

Fuji Kindergarden is located in Tokyo, Japan, and was designed by Tenzuka Architects in 2007.<sup>98</sup> The kindergarden houses around 600 students, ages two to six.<sup>99</sup> Fuji is another corner urban site, however the massing takes on a drastically different form than Els Colors. Fuji Kindergarden takes on the shape of an oval with a 130 foot long courtyard in its center. Though there are a few smaller additional buildings apart of the kindergarden, the oval houses the majority of the classroom and play spaces. It is a simple, one story building, but its roof is

<sup>98</sup> "Fuji Kindergarden | Educational Buildings," Tenzuka Architects, accessed December 19, 2025, <http://www.tezuka-arch.com/english/works/education/fujiyochien/>.

<sup>99</sup> India Block, "Tokyo Kindergarden by Tenzuka Architects Lets Children Run Free on the Roof," *Dezeen*, October 2, 2027, <https://www.dezeen.com/2017/10/02/fuji-kindergarden-tokyo-tezuka-architects-oval-roof-deck-playground/>.



occupyable, nearly doubling the amount of space for children to play. The building is not a perfect circle, but rather elongated to better fit the shape of the site. It has five separated classrooms on the ground floor, with four entry points carefully offset from each other so circulation never shoots straight through the building but rather is caught in its interior courtyard. The architects wanted the kindergarten to function as a village, buzzing with interaction and activity, with easy connections between the different spaces and children.<sup>100</sup>



Fig. 9 Fuji Kindergarten aerial view. Photo by Katsuhisa Kida / FOTOTECA.



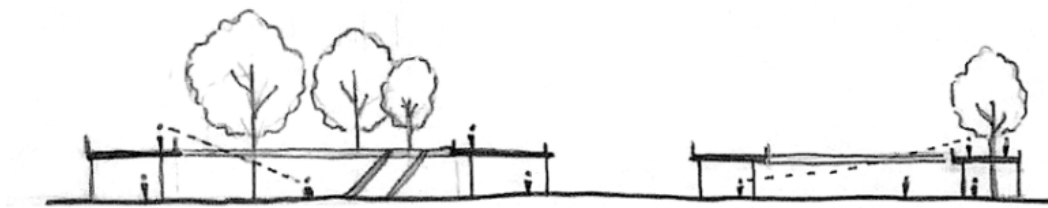
Fig. 10 Rooftop playground. Photo by Tezuka Architects.

Fuji's walls are primarily glass storefront on both sides, however the central courtyard and sliding doors favor interaction inward. All of the classrooms face each other around the courtyard, building a sense of community and protectiveness. The sliding doors allow for the spaces to bleed into each other, so the classroom activities can become "white noise" for the children rather than creating separation for silence.<sup>101</sup> The span of the courtyard also allows for views to its roof terrace, so there is interaction between the ground and upper level. This is further emphasized by the slides connecting them and the trees which puncture through the building and sprout out from the roof. The roof provides an outward interaction for the children. They can gaze outwards the neighborhood and city beyond while being safely elevated above

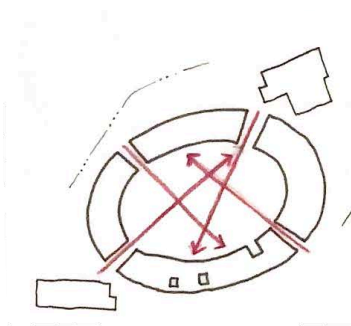
<sup>100</sup> "Fuji Kindergarten | Educational Buildings," Tezuka Architects.

<sup>101</sup> Block, "Tokyo Kindergarten."

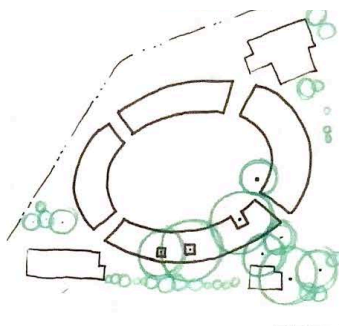
ground level. The roof terrace becomes a space for exploration as the children can climb on the trees or gaze down into classrooms from the skylights. The skylights themselves are scattered almost randomly, like how a child would scatter blocks across the floor while playing. In such a simple shape, strict repetitive order would become boring for the children, so small moments of surprise make every space unique. This is most clearly seen in the trees, which were preexisting to the site, sprouting through the building. The architects wanted to have interaction with nature as well as between children, so moments such as the trees and waterfall gutters were meant to be touched and learned tactically.<sup>102</sup> Fuji Kindergarten does not have very complex programming, or very much privacy for the children, instead it relies on simplicity and connection. The oval becomes a protective shelter, a unifier of space, a terrace to the world beyond, and a playful endless runway for the children to take full advantage of.



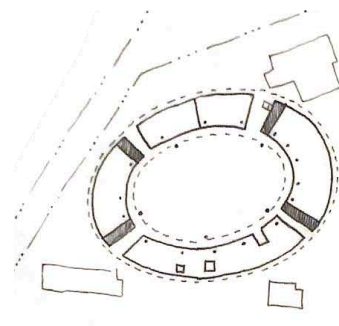
Illus. 9 Cross Sections - Views to Roof.



Illus. 10 Entry & Intersecting Paths.



Illus. 11 Dissolving into Nature.



Illus. 12 Capping Poche.

<sup>102</sup> Block, "Tokyo Kindergarten."

## *Apollo Schools*

The Apollo Schools are the oldest precedent including in this in depth analysis. They were designed by Herman Hertzberger in the 1980s, Amsterdam.<sup>103</sup> Hertzberger was renowned for his work on De Drie Hoven, a hospital and housing facility for elderly



Fig. 11 Apollo School Amfri and sit steps.

individuals with mental and physical disabilities. His main concept behind that work was to focus on the unit of a person and their interactions in daily life.<sup>104</sup> That same care was given to his Montessori school project, this time for a much younger user. The Apollo Schools are two separate buildings, nearly identical in their nine square modular units, only slightly changing based on their orientation to the sun. In the nine square system, the four corners become L-shaped classrooms with windows on two sides, the middle squares on every facade become either circulation or service space, and the center square becomes a grand atrium (or “Amfi” as the school refers to it), connecting all of the floors.<sup>105</sup> Similar to Fuji Kindergarten, this core becomes the center for interaction, circulation, and wayfinding for the building. The floors themselves are offset, so classrooms are available at every half floor. This allows for more interaction between the classrooms across the atrium. Little nooks used as study desks project into the atrium at its corners, offering small observatory spaces for the children. At the bottom level of the atrium are the wooden sit steps, a new way of shaping space popularized by

<sup>103</sup> “Montessori Architecture,” accessed December 19, 2025, <https://montessori-architecture.org/repertoire/apolloscholen/>.

<sup>104</sup> “Herman Hertzberger > De Drie Hoven Elderly Housing | HIC,” May 11, 2024, <https://hicarquitectura.com/2024/05/herman-hertzberger-housing-for-old-and-disabled-people/>.

<sup>105</sup> “A Special Building,” Willemspark School, <https://willemsparkschool.nl/een-bijzonder-gebouw/>.

Hertzberger.<sup>106</sup> He was interested in how children interact tactically with their environment, particularly how steps for an adult can act as tables, chairs, or even stages for children.<sup>107</sup> The stairs became an important feature for Hertzberger in the Apollo Schools, and their stepping can be seen in the windows of the facade and even the pushing of the massing to create terraces on the roof level. The main entrance into both schools is at their second floor, or piano nobile as Hertzberger was pulling from the Italian villa typology, so the children climb up these grand exterior staircases everyday to go to class.<sup>108</sup> These stairs are also one of the few instances Hertzberger uses curves in these buildings. The rest of the organization follows strict orthogonal lines, except for the entry stairs and the vaulted skylights over the atrium. He plays with curves in these very specific moments to create investing and more communal areas. Hertzberg also intentionally uses exposed concrete structure and CMU bricks in his design. Rather than covering up the construction of the building, he uses its lines intentionally as decoration. Joint systems between columns and beams become moments of ornamentation. The exposed brick and mortar joints allow for children to trace its construction and understand the scale of the building by the scale of its parts. This creates a relatability aspect between the child and the structure, even when he is using a material as plain as CMU. The Apollo Schools show how sections can play a key role in interaction, and modules do not need to have strict straight lines, their overlaps can become opportunities for smaller scale interactions.

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<sup>106</sup> Katie Cregean, "Key Projects by Herman Hertzberger," *Dezeen*, December 6, 2011, <https://www.dezeen.com/2011/12/06/key-projects-by-herman-hertzberger/>.

<sup>107</sup> Adam Wood, "Interview with Herman Hertzberger (2017): Architecture as Visual and Social Connection," *Architecture and Education*, August 29, 2017, <https://architectureandeducation.org/2017/08/29/interview-with-herman-hertzberger-2017-architecture-as-visual-and-social-connection/>.

<sup>108</sup> Hidden Architecture, "Apollo Schools," *Hidden Architecture*, June 24, 2024, <https://hiddenarchitecture.net/apollo-schools/>.



Fig. 12 Children playing on steps. Photo from *Herman Hertzberger*, by Robert McCarter. Published by nai010, 2015.

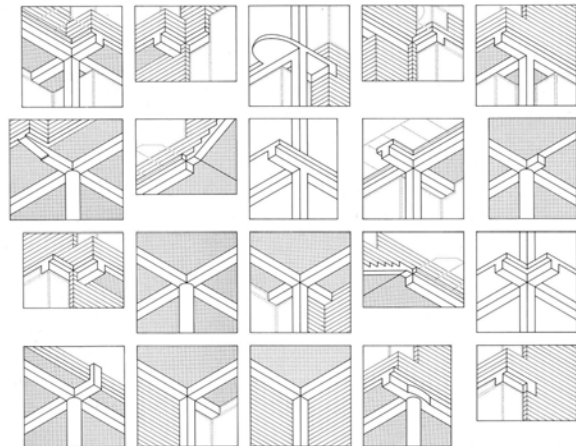
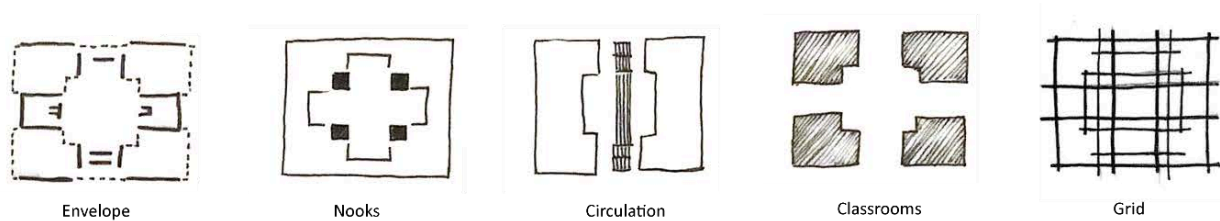


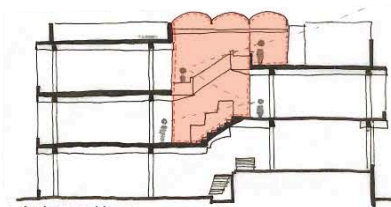
Fig. 13 Joinery details. Drawing by Herman Hertzberger.

For a healthcare typology where children will likely be facing difficulty with movement and the transportation of hospital beds and wheelchairs will need to be taken into account, a prominence of stairs seems illogical. In contemporary architectural design, there can feel like a categorization between who will use the stairs and who will use the elevators, and catering towards one type of person will result in the other demographic being pushed aside. On top of this, elevators leave little room for playful design. Architects can fall into patterns where monumental stairs take center stage and small convenient elevators are pushed to the side. Or lobbies house big boxes of high speed elevators, but these are purely places for circulation not social interaction. Hertzberger shows that stairs can be places for play, discovery, social interaction. In my own experience post-operation as a child, the stairs leading outside my house were a great challenge I could not face on my own. They were hard concrete with no railing and could be dangerous even though they were just a few steps down. While the stairs to the second floor of my house were never a challenge because there were walls and railings to lean on and the carpet made it possible to crawl up them if I wanted to. These stairs even became a part of my own physical therapy routine. Elevators are still a necessity for this typology, but that does

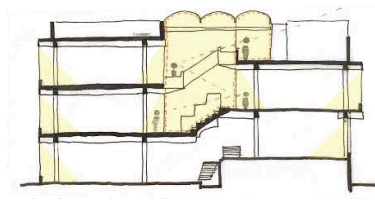
not mean that stairs become the enemy by default, they just need to be designed with care and attention.



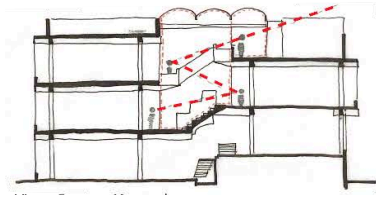
Illus. 13 Plan Series.



Illus. 14. Atrium as Heart.



Illus. 15 Light Floods into Core.



Illus. 16 Views Bounce Upward.

## *Imagine School*

The final in depth precedent is the Imagine School by Gradoli and Sans Architects in Valencia Spain, completed in 2023.<sup>109</sup> Out of all of the precedents, the Imagine School has the most complex massing at first glance. Its roof shapes are unique, rippling forms on every elevation. Some areas have large brick domes, others tilted green roofs and projected angular balconies, and there are even sun and wind towers sprouting up from it. However, the Imagine School roughly uses a repeated module, like almost all of the other precedents analysed. The classrooms are made up of slightly wedged rectangles, opening up towards a terrace overlooking the nearby ravine. Between each classroom is a light and wind well that they can open doors into and look across at each other. These classrooms are organized along a slightly curved spine,

<sup>109</sup> "Imagine Montessori School (Phases I+II)," Gradoli & Sans Architects, <https://www.gradolisanz.com/proyecto/colegio-imagine-montessori-school-fase-iii/>.



following the flow of the topography and ravine. This connection back to nature, not only visually but physically, played a key role in the design. The entry into the school is from a foot bridge built across the ravine specifically to its entrance. The green roof also plays into the naturalness of the school as its plants are meant to grow over its edges so the building becomes part of the rolling landscape around it.



Fig. 14 Imagine School Terraces. Photo by Mariela Apollonio.



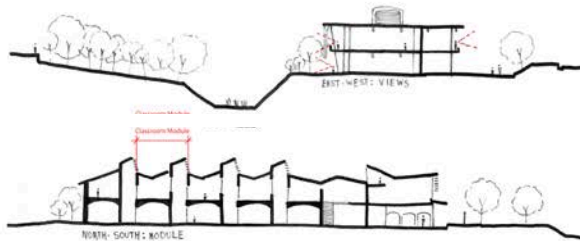
Fig. 15 Classroom interior. Photo by Mariela Apollonio.



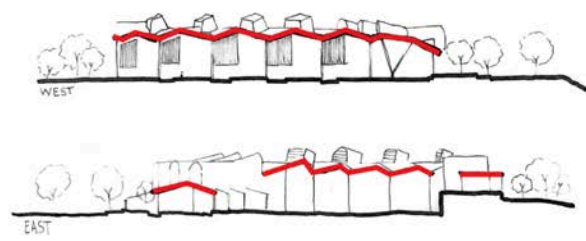
Fig. 16 Classroom patio. Photo by Mariela Apollonio.

The Imagine School is a material marvel. It utilizes mass timber for its primary structure, with wooden plank interiors on the upper floors. Steel is used to support large terraces and shading screens for plants to grow along. Brick becomes the main element of the ground floor and shapes the domes of the kindergarten classrooms to the south. And tile textured concrete appears in moments along the foundation and retaining walls. Nearly all of the material is acting as structure and all of it is exposed and touchable. The bricks, especially, have vertical ridges creating long textured wells of alternating coursing patterns. Similar to the Apollo Schools, this aids in the child's understanding of the building's construction and its relatability in scale. Imagine School takes it a step further by designing a pallet of natural, locally sourced materials,

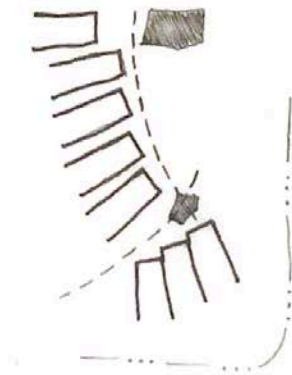
and texturizing them so the children are invited to touch and explore.<sup>110</sup> The Imagine School embraces nature in its forms and materiality while keeping a relatively simple pattern in plan.



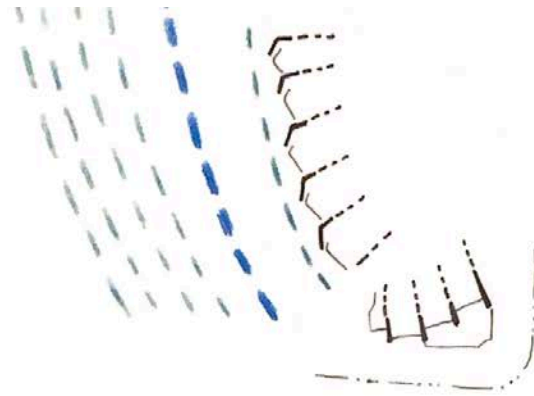
Illus. 17 Section Series, Top: Views. Bottom: Towers.



Illus. 18 Elevation Series, Shifting Roof Forms.



Illus. 19 Outward Facing Classrooms.



Illus. 20 Massing Follows Ravine.

## Conclusion

These precedents each approach child-centric design through ways that correspond to their context. The Moseley Foundation Institute is a new addition to an existing hospital campus, so it can explore curvilinear floor plans and circulation but restraints itself on material palette and tactile exploration. Els Colors Nursery is a much more condensed site so its creativity captures the light above and plays with color and visibility at toddler's heights. Yet it too keeps to an easily-cleanable material palette. Fuji Kindergarten brings nature into the space and proves a

<sup>110</sup> "Imagine Montessori School by Gradolí & Sanz Arquitectes: Learning Through Space," *ArchEyes*, May 14, 2025, <https://archeyes.com/imagine-montessori-school-by-gradoli-sanz-arquitectes-learning-through-space/>.



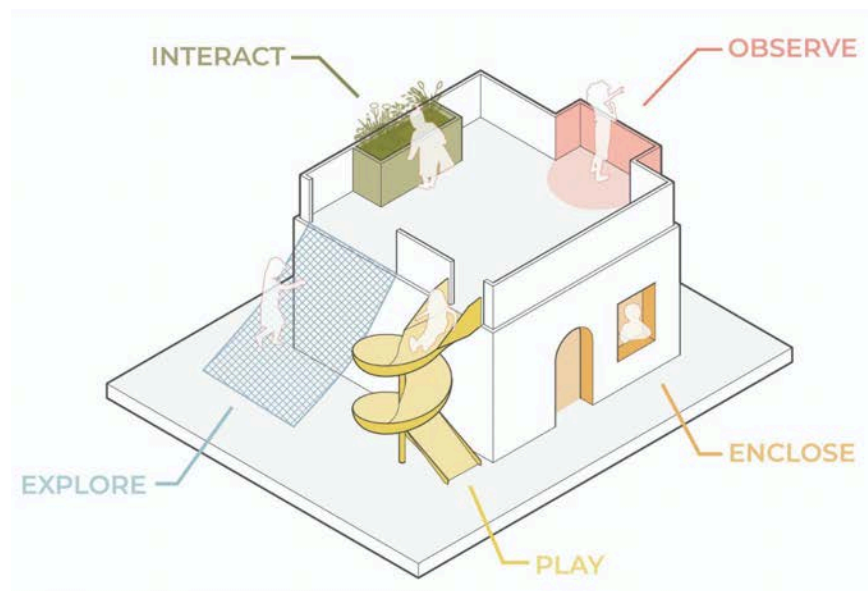
unique form can be placed in an urban context but its program consists of just five rooms. The Apollo Schools explore how overlapping modules can create child scale moments supported by materials and structure, yet its concrete material is less suited for today's sustainability movement. The Imagine School blends learning with nature and finds ways to make structure into organic forms but it is also blessed with a relatively rural site, fit for a school but less so for a healthcare facility. There becomes a challenge then, to try and blend these precedents together. To have the programmatic efficiency and privacy of the Moseley Foundation Institute, with the sheltering yet playfulness of Fuji Kindergarten, the connection to nature and materiality of the Imagine School, the child-scale mindfulness and visibility tactics of Els Colors Nursery, and the interactive heart and structural intelligibility of the Apollo Schools. There is a conflict of privacy versus interaction, cleanliness versus tactility, embracing nature versus consistency with urban form, and fulfilling the program versus playing with the form. None of these challenges presented by the precedents require one to win out over the other, but their incorporating into each other must be carefully understood, and in the end, must be for the benefit of the child.

#### Enclose, Observe, Explore, and Interact

The types of child-centric spaces that these precedents create can be distilled into four types: enclose, observe, interact, and explore. The first two, enclose and observe originate from design for children with special needs. Particularly, David Kamp's design tactics for his healing gardens. Enclosure brings the building down to the child scale, creating a sense of privacy and protectiveness. Observation allows for a space where a child can pause to visually understand a situation before they physically enter it.

The other two originate from how different age ranges engage with their environment, particularly from Piaget's theories of cognitive development.<sup>111</sup> Younger children see their immediate physical surroundings as an extension of their own body, and they come to understand their environment by physically touching and interacting with it.<sup>112</sup> Older children learn about their environment by physically moving through the space, exploring around corners, diving under tables.

Each of these four design elements can be a form of play for a child, but they also can each provide a space for support of more negative emotions. This gives the child the opportunity to choose how they want to use the space: to express happy emotions or negative ones. Therefore, by incorporating these spatial aspects of enclose, observe, explore, interact as well as play, we can create a child-centric environment.



Illus. 21 Interact, Explore, Observe, Enclose, and Play Diagram

<sup>111</sup> "Piaget's Theory of Cognitive Development: The Four Stages Explained."

<sup>112</sup> Kennedy, "The Young Child's Experience of Space," 40.

## Chapter 5: Program

The purpose of the program for this thesis is to focus on treating the patients first, as people and individuals, not simply as embodiments of their condition. The main program elements will focus on providing comfort, privacy, community, and play for children. Medical support programs will be included, but this will be limited to general support areas, not highly specific technological or medical programming. Site and adjacency to larger institutions may permit for more clinical and technical programs, such as surgery suites, to be within an attached or nearby preexisting building. This will allow for the program development of this project to take the opposite route that healthcare architecture firms typically follow, which is focusing on the technological requirements and functionality of space.

The program for this thesis will be split into four user groups: the family, the patient, the staff, and the community. It is important to create a distinction between the family unit and the child patient since a goal of this project is to increase the autonomy of the child in healthcare spaces while still providing support to the family. This distinction will allow for programming meant specifically for parents and guardians separate from their child, such as parent lounges, for activities or expressing emotions they do not wish their children to see. Though there will be distinct separation between some of the programming for privacy, interaction between the three user groups should be encouraged. For instance, social spaces for children to play with their peers, dining spaces where children can eat with their families, and exam rooms which offer privacy that creates a sense of comfort, not alienation from the rest of the clinic. Though there may be some programming closed off to the children, such as staff only areas, the children should never feel trapped or isolated to just their recovery room. Community program will be

included to offer social interaction between patients and their peers as well as between the health center and the larger community. This will help ground the health center in the local neighborhood so it may act as a community asset rather than a separate and imposing institution.

### *Programming Precedents*

For the medical spaces, this thesis will use the Moseley Foundation Institute as a rough guide for square footage and ratio between patient rooms, communal spaces, and administration programming. The Moseley Institute is the in depth precedent which relates to healthcare programming as well as long term in-patient treatment. This precedent is also attached to a larger hospital, so the Institute itself does not house much highly technical programming beyond general support. The Mosley Institute has 24 in-patient beds and a total area of 28,000 square feet. This will be the starting point of this thesis's program and shall evolve in order to best suit the chosen site. The Institute's unique patient-hubs will be added as a programming element to this project. This thesis will also be using the International Health Facility Guidelines to help determine program elements required for long term inpatient support and their recommended square footages. The Kitchen and Dining Room areas shall be increased from the IHF's recommendation to encourage more social activities in these spaces. According to the IHF Guidelines for in-patient units, 35% of the programming square footage should be used for circulation.<sup>113</sup> This high percentage will allow for wider coordinator widths to accommodate mobile beds, equipment carts, and larger vertical circulation. Additional patient, family, and child-centric programming inspired by examples from the literature review shall also be included

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<sup>113</sup> "Part B: Health Facility Briefing & Design Inpatient Unit – Long Term Care," International Health Facility Guidelines, n.d., 20, [https://www.healthfacilityguidelines.com/ViewPDF/ViewIndexPDF/iHFG\\_part\\_b\\_long\\_term\\_care](https://www.healthfacilityguidelines.com/ViewPDF/ViewIndexPDF/iHFG_part_b_long_term_care).

such as the parent lounges and agriculture gardens. Program elements unique to this project include the Auditorium, Library, and Indoor Park Atrium to incorporate more community connections and biophilic elements during the colder seasons. The Waiting Room has also been divided into public, private, and semi-private areas to express the spatial diversity aspect of this area. These programming spaces will be connected and likely overlap but should accommodate different needs of the children.

## Chapter 6: Site Selection & Analysis

A site can act as one of the most influential features of an architectural project. This thesis will be highly reactive to the chosen site, in order to ground the project in the local context so the health center may be a part of the community, rather than imposed upon it, like how the block hospitals of the past were. The factors for choosing a site for this project were: closeness to a local pediatric hospital, distance from other neighborhood clinics (so that the health center is not duplicating an already existing clinic in the area), closeness to local schools, accessibility via public and private transportation, and closeness to local green space if the site itself cannot support a large outdoor garden area. The search for sites was also focused around the Washington Metropolitan Area so that the site could be visited in person during the thesis development.

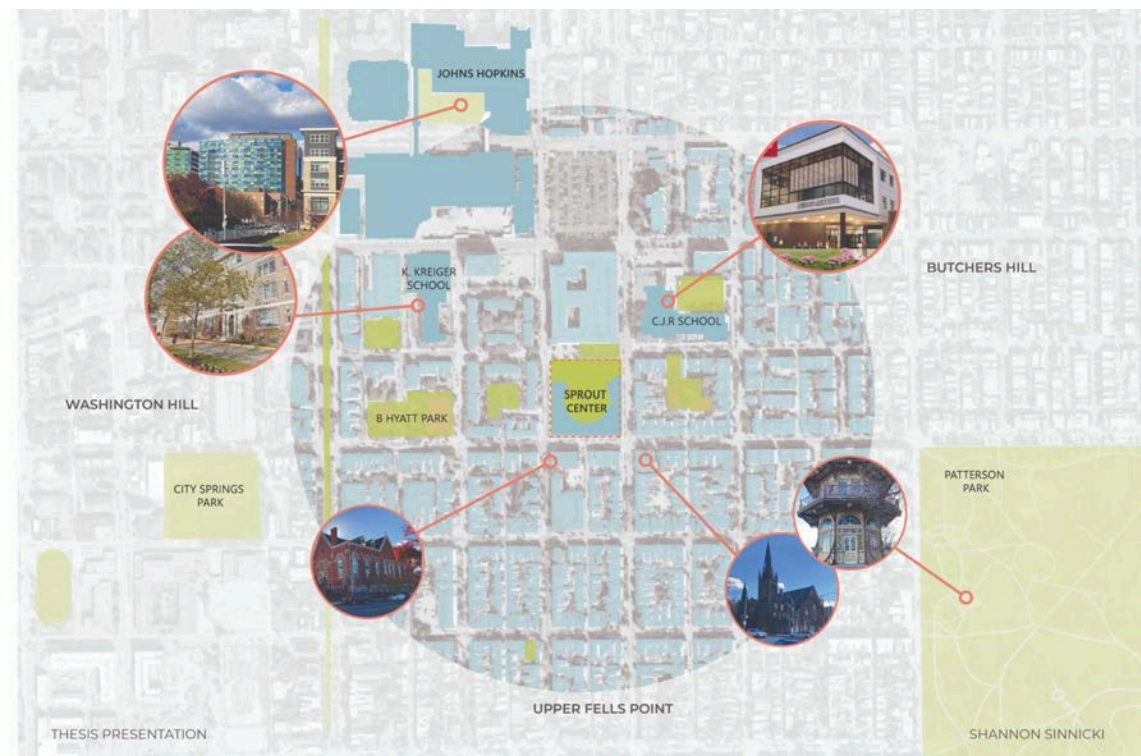
### Site History

The site chosen for this thesis project was 1 N Wolfe Street, in Baltimore MD. This site is currently an empty green field, with a hill on the north east side created from leftover dirt from the construction of the apartment complex to the north. The site originally was historic row homes, like the fabric which makes up the neighborhood of Butchers Hill to the east. The block was then redeveloped along with the blocks to the west in the neighborhood of Washington Hill as a part of urban development projects as smaller two to three story gable row houses. Around 2007, the site along with the block to the north were bought, the houses demolished, and the street between them—East Fairmount Ave—was closed. A mixed used apartment complex was built on the northern block, with a small maintenance parking lot and dog park placed on the now

closed street between. The chosen site, however, was never developed and has remained as a vacant, fenced off lot, for the last 20 years.



Fig. 17 Site Development over the years. Images from Google Earth.



Illus. 22 Site Analysis Diagram



This site was chosen not only for its adjacency to Johns Hopkins but also to two neighboring schools. The Kennedy Krieger school to the west is for children with special needs and the Commodore John Rodgers school to the east is a brand new elementary and middle school. This school has been in the area for a while, but is recently being updated with an entirely new building.<sup>114</sup> This new building will have its main entrance facing the intersection on the diagonal, pointing directly towards the site. By being close to these schools, children in long term recovery at the center have the opportunity to attend class half day and stay connected with their peers. A more urban site also allows for the children's health center to be more integrated with the rest of the community, rather than a building off on its own separate campus.



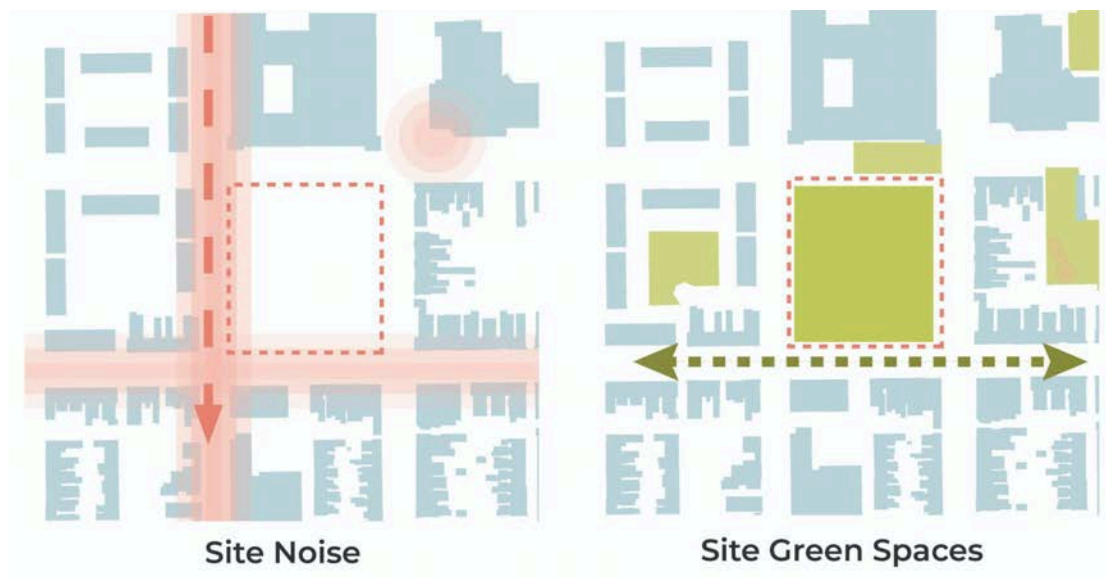
Illus. 23 Site Synthesis Diagram

<sup>114</sup> "Commodore John Rodgers Community Meeting 012926," March 24, 2026, [https://baltimore21stcenturyschools.org/sites/default/files/commodore\\_john\\_rodgers\\_community\\_meeting\\_012926\\_4.pdf](https://baltimore21stcenturyschools.org/sites/default/files/commodore_john_rodgers_community_meeting_012926_4.pdf).



## Site Analysis

There are also two main axes which run along the site. Most of the car traffic is coming south from Johns Hopkins along N. Wolfe Street (the road to the west of the block). This road also has a bus stop at the Southwest corner of the site. Therefore, this axis creates the noisiest side of the site, while also acting as the main entrance for vehicular traffic and patients from Johns Hopkins. Many neighborhood parks such as City Springs Park, Betty Hyatt Community Park, and Patterson Park are located along East Baltimore street running east and west along the bottom of the site. This road therefore acts as the main community axis along the site, as many pedestrians walked along E Baltimore Street between these public park areas.



Illus. 24 Site Noise and Green Space Diagrams.

The site itself is roughly 3 acres in size, which is far more than enough space to allow for the health center programming as well as an onsite green space. This also allows the opportunity to have a public green space, which can be used by the neighborhood when the more private green space is closed off specifically for patient use. Additional public programming for this green space includes an outdoor amphitheater to replace the one being removed by the

Commodore John Rodgers new building, a community garden since the neighborhoods are within a food desert, and an outdoor community plaza, since there are green park spaces within walking distance but not many outdoor community event spaces. The site also has a 16 to 18 ft grade change from west to east. This can be resolved outside the building through the amphitheater, but will need to be resolved within the building itself as well.

## Chapter 7: Conceptual Testing

The overall design of the building went through many iterations throughout the design process. Massing was tested on different sides of the site. Different oval and circular interior garden shapes were developed. Different programmatic elements and circulation pathways were explored along the interior edge facing inwards towards the garden. The consistent design elements throughout the schemes were using the building massing along the street edge as a protective barrier for an interior garden, using the public green space as an east/west connector between the two neighborhoods, and placing the more clinical programming closer to N. Wolfe Street with the more direct connection to Johns Hopkins while the library and family spaces were placed more along the quieter eastern side of the site.

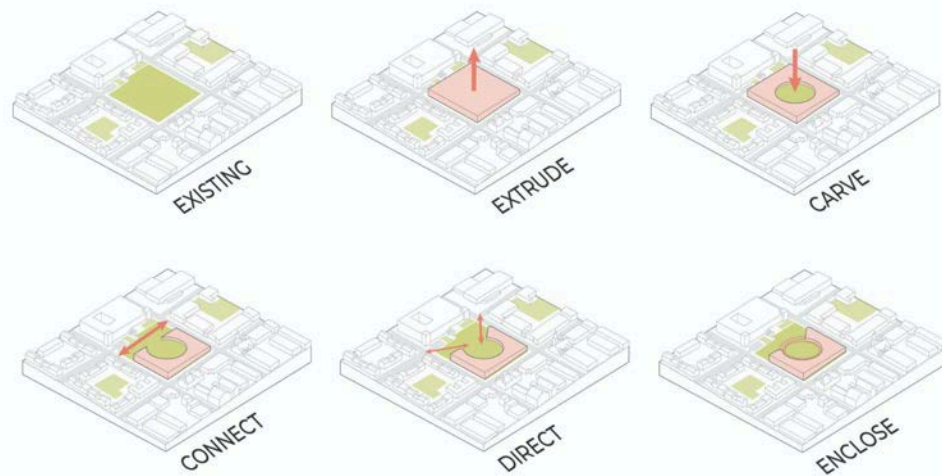


Illus. 25 Process Drawings of Garden and Early Plan.

### Massing Development

The final massing developed on the site is as follows: first, the block is extruded to create a protective wall for the noise along the west and south. Then the center is carved away to create a sacred garden, a safe haven in the middle of the city. The building is then pulled back along the north side of the site to make a public green connection between the two neighbors of Butchers

Hill and Washington Hill. The building is then angled inward to direct views into the garden and back out to the middle school and Johns Hopkins. Finally, a terrace re-encloses the garden creating that protective hub and distinguishing the public and more private park spaces. This creates the final massing for the project's Sprout Children's Health Center.



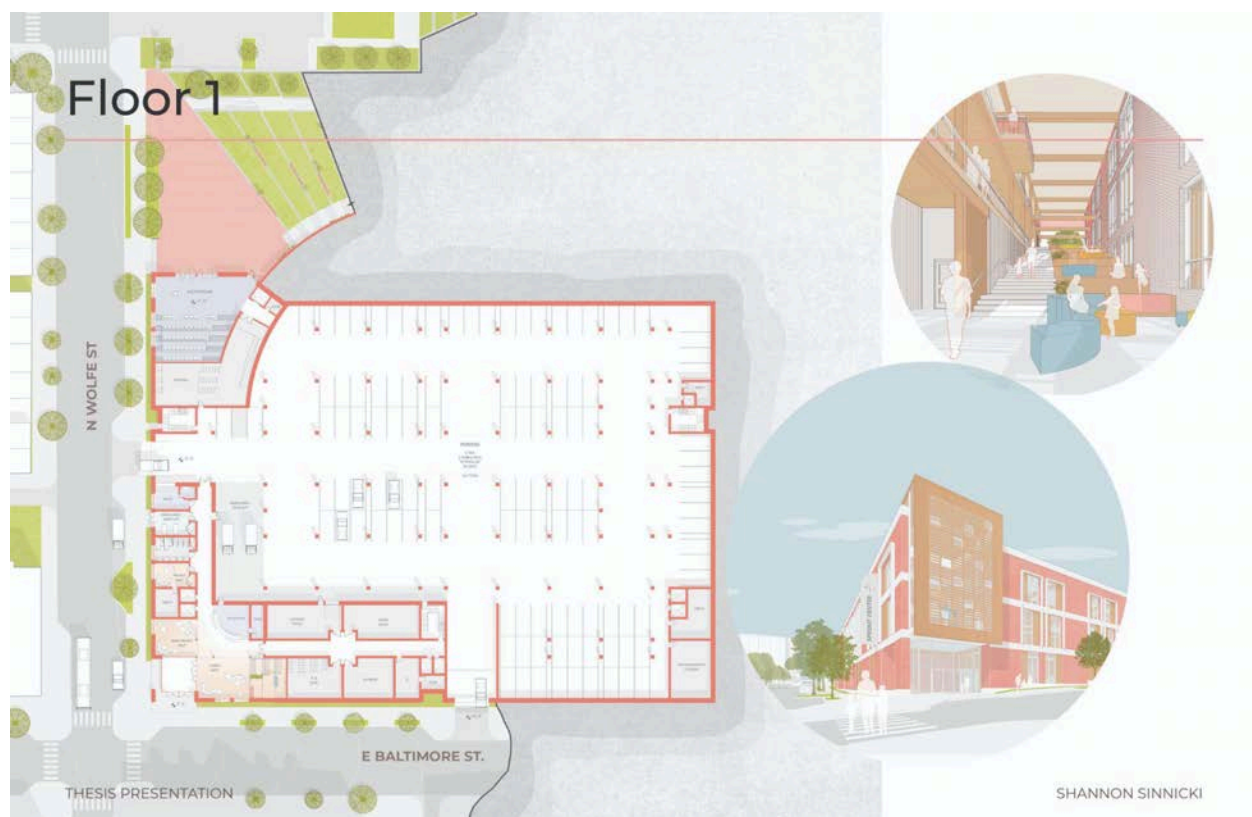
Illus. 26 Massing Development diagram.



Illus. 27 Sprout Children's Center Site Isometric

## Sprout Children's Health Center Design

The first floor is on level with the west side of the site and acts as the main ambulance drop off from Johns Hopkins and the main lobby entry into the clinic. This lobby includes the spatial choice aspect by having a private, semi private, and public play waiting rooms so children with different emotional experiences can choose which space to occupy. The public play waiting room includes the sit steps which climb up onto the second floor into the interior Park Atrium. This space acts as an indoor green space for biophilia during the winter as well as a play scape area with climbing nets and projected balconies.

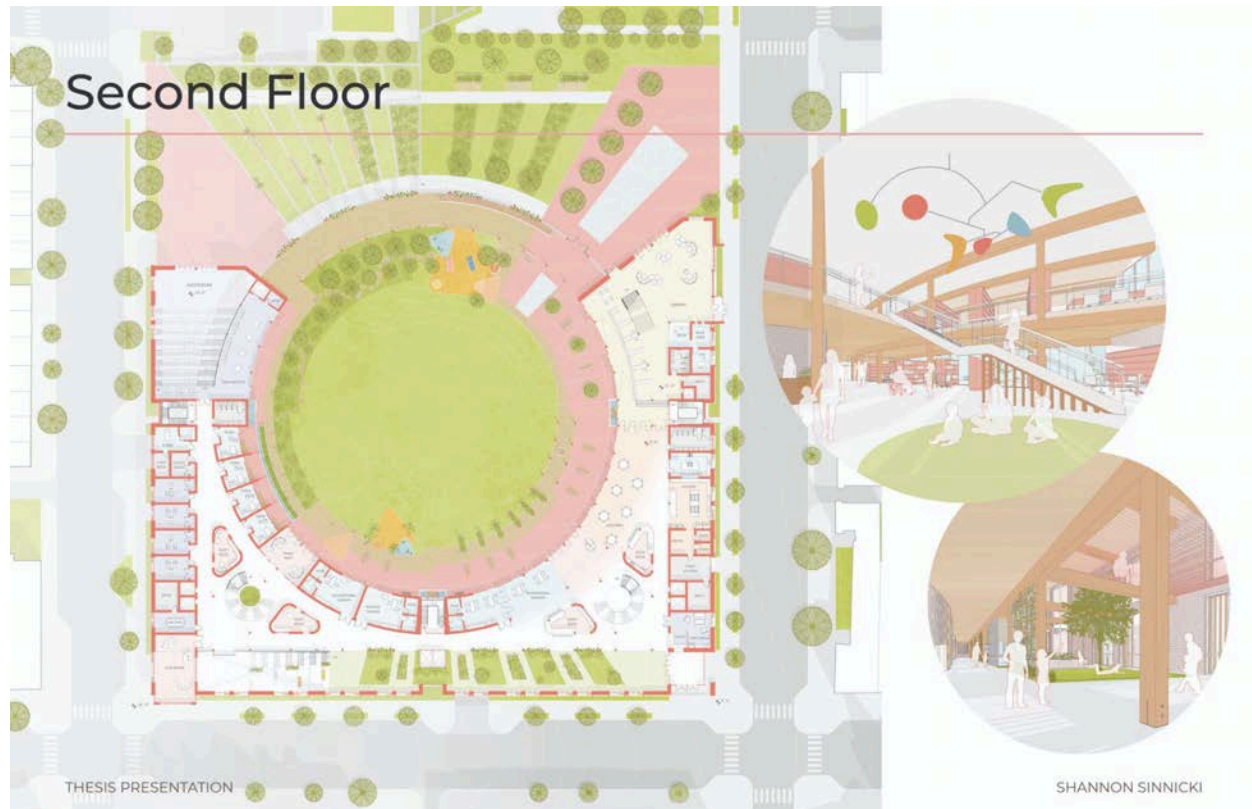


Illus. 28 First Floor Plan with perspective of Sit Steps (above) and Front Entrance (below).

The second floor is on grade with the east side of the site and contains the majority of the programming including the exam rooms, therapy rooms, cafeteria, and public library. The library acts as a community anchor to help ground the health center in the neighborhood and provide a



space for social connection. The exam rooms utilize spatial choice and interaction. They each have an outdoor porch area protected by a short garden retaining wall with a water feature so if a child is feeling overwhelmed in the exam space, they can choose to move outside. There are also quiet nooks located on this level which are enclosed, child specific spaces, either for overwhelmed children to have their quiet spaces or for siblings of patients to wait.

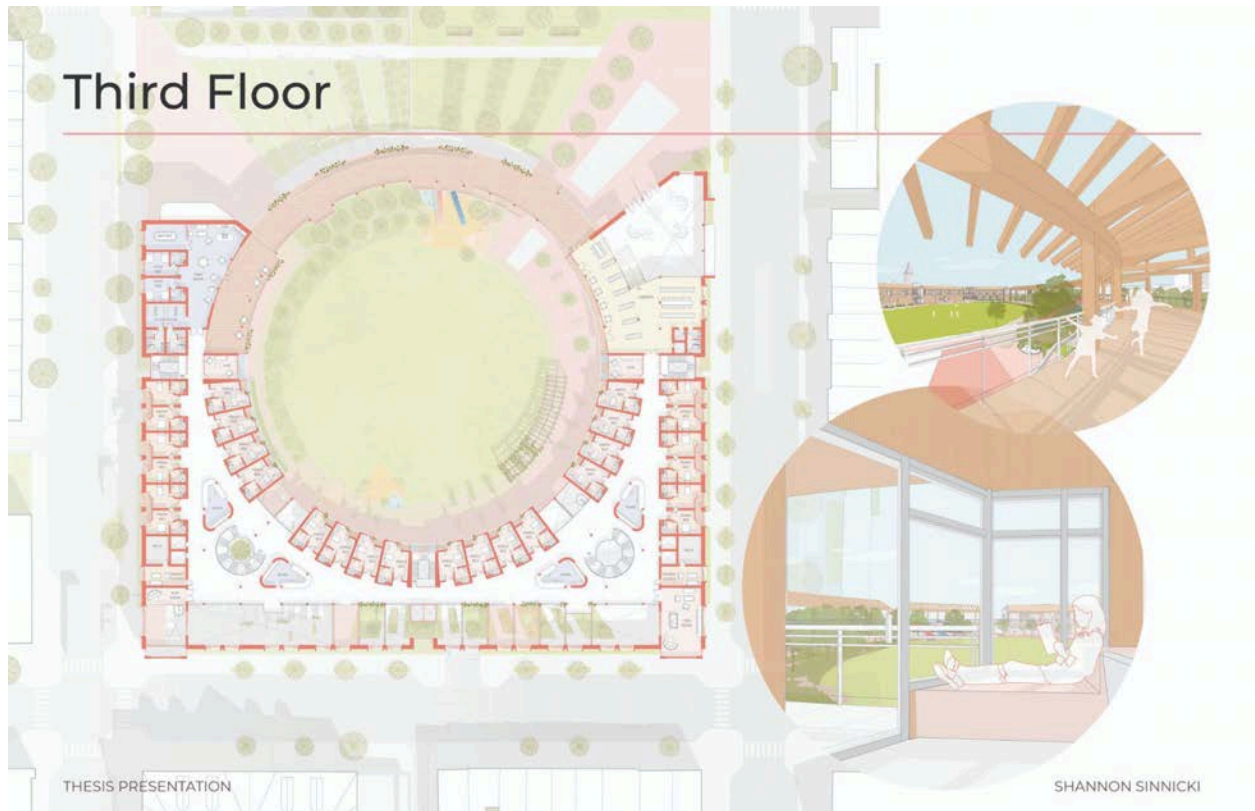


Illus. 29 Second floor plan with perspectives of Library (above) and Atrium Park (below).

The second floor also includes the garden. All of the programming along the interior circle opens up into the interior courtyard, blending the interior and exterior space. The garden programming is organized along a circle, so children can explore from space to space without getting lost. The spaces within the garden are ordered from loudest to quietest around the circle. To the north adjacent to the entry from the school is the playground, the loudest outdoor space. Continuing clockwise, the library and cafeteria open up onto the garden with outdoor gathering

spaces. Garden spaces are located outside of the recreational therapy room so children can garden as a form of physical and recreational therapy. Exam rooms have their more private porches, enclosed with the elevated garden wall. As the garden becomes the meadow area with raised grasses and flower beds, the walk becomes a quiet and more meditative space until you reach the north side again in the grove underneath the terrace.

The third floor houses the patient beds. There are individual patient beds facing inwards to the garden and pairs of family accommodation beds along the east and west sides. These can house a child patient with their parents next door, house a larger family unit staying with their child who is in a private bedroom, or both be converted into patient beds by closing off the interior passage. The nurse stations become the new nooks on this level. They face down the hallways so each station views a group of 4 to 6 patient beds. The interiors of these nurse stations are painted to act as wayfinding landmarks, so a child can travel from nurse station to nurse station to navigate. The bedrooms are designed around enclosure and views. I looked at the standard patient bed from the International Health Facility Guidelines and then reworked the architecture to be better focused on the patient. The exterior wall with the window was bent inward so that the child has better views from their bed. They don't have to move their head as far to see outside. This also allowed for the parent zone to be moved away from the window. Typically, the parent zone is on one side of the patient bed and the nurse zone is on the other, this can create a sense that the patient is trapped in their bed. By moving the family space away from the window, allows for the child to have control over that space and feel like it belongs to them.



Illus. 30 Third floor plan with perspectives of terrace (above) and patient room view (below).



Fig. 18 Final Boards. Image from Author



## Chapter 8: Conclusion

The overall comments from the jury of the final defense were positive. The main points of critique were the exterior facade and entry sequence. The majority of the design intent went towards the interior garden and rooms facing it, so with further development that same level of intent can be applied towards the rest of the project. The radial geometry of the circle could be applied to the two main entry corners, so that visitors can immediately see the interior garden upon entry. The height and levels of the garden could be played with as well, such as the sinking part or all of the garden so it could be partially viewed or accessible from the parking garage below. This would make the parking garage a less scary and more enjoyable space for people who are visiting. The garden space could also act as a large rainwater capture device, filtering rainwater down below the parking garage into a large cistern to be used for the bathrooms or even the splash park. It's very exciting to see the next steps of development in this project and where it could go moving forward.

One healthcare architect commented on the current design climate as “When you need [research], it's too late.”<sup>115</sup> This author disagrees. It's not too late. It's never too late. Just as our knowledge of medicine and technology is continually growing, so should also our knowledge of people and how our architecture is shaping their healing journey. That journey can be fun and playful, but it can also be scary. So it's important to create opportunities for children to not just be patients and not just be children, but to be themselves.

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<sup>115</sup> Kim and Shepley, “Healthcare Architects’ Professional Autonomy,” 201.

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