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Masters
in Architecture
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Tectonic Interventions:
How can architecture serve as a learning tool?

A thesis submitted to:
Graduate School of the
University of Cincinnati
on 5/26/09

in partial fulfillment of the requirements
for the degree of:
Master of Architecture
in the School of Architecture and Interior Design
of the College of Design, Architecture, Art, and Planning

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ABSTRACT

Question

How can architecture serve as a learning tool? The manipulative educational materials found in Maria Montessori’s prepared environment encourage students to explore and learn, in a hands-on way, from their physical surroundings. Understanding is achieved once students attach language to a concept.\(^1\) Tectonic architecture,\(^2\) such as works by Patkau Architects and Carlo Scarpa, similarly reveals to the audience physical properties of the built environment, resulting in the *logos of techne* (production of discourse), of which Marco Frascari speaks.\(^3\)

Response

This thesis investigation takes place at the joint between contemporary and historic architectures, including their respective programs and materials. Studies of the above architects and correlating theory; writings about the Montessori Method; and interviews with instructors will inform the design of didactic\(^4\) architectural interventions.

Outcomes

The design will insert a Montessori program, for 15- to 18-year-olds, into the former Woodward High School.\(^5\) This facility was designed to support a traditional school system. Since Montessori developed her Method in reaction to more rigid pedagogies, this building will provide a compelling site for this study. The design will be presented with a series of hybrid model-drawings and described in a critical essay.

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\(^1\) Lillard, *Montessori Today: A Comprehensive Approach to Education from Birth to Adulthood*, 34-36

\(^2\) Kenneth Frampton defines tectonic as relating to an act of construction, making and revealing. He refers to the Greek word *tekton*, signifying a carpenter or builder. Frampton, *Studies in Tectonic Culture*, 3

\(^3\) Frascari, *Tell the Tale Detail. Theorizing a New Agenda for Architecture*, 500

\(^4\) Didactic: used or intended for teaching or instruction. *Random House Dictionary*

\(^5\) This downtown Cincinnati building has housed the School for Creative and Performing Arts since 1976. SCPA will soon move into a new building near Cincinnati’s Music Hall.
ACKNOWLEDGEMENTS

I would like to thank:

My parents, Ben and Linda Pisciotta; my studiomates, especially Mark Dorsey Kim Martin, Corey DiRutigliano, and Dave Kaldy; my thesis chairs, Rebecca Williamson, Vincent Sansalone and Terry Boling; the administration and teachers of North Avondale Montessori, Clark Montessori, and The School for Creative and Performing Arts; the Cincinnati Board of Education; and my Montessori teacher, Sudie Mason.
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[Education] is not acquired by listening to words, but in virtue of experiences in which the child acts on his environment. The teacher’s task is not to talk, but to prepare and arrange a series of motives for cultural activity in a special environment made for the child.”

—Maria Montessori, The Absorbent Mind⁶

⁶ Montessori, The Absorbent Mind, 8
TECTONIC INTERVENTIONS
INTRODUCTION

In *Rappel à l’ordre, the Case for the Tectonic*, Kenneth Frampton calls for a poetics of construction that is based in the act of making and revealing that is the tectonic. Frampton defines tectonic as relating to an act of construction and refers to the Greek word *tekton*, signifying a carpenter or builder. Similarly, Annette LeCuyer comments,

...the art of construction is revealed once again as a richly expressive language through which experience and meaning are communicated...the radical tectonic looks to construction itself...as the source of iconography.

Architects working with tectonic language hope users will learn about architecture through the clarity and exposure of architectural systems, such as structural and mechanical systems. Similarly, Maria Montessori’s pedagogy encourages students to learn directly from their physical surroundings, especially through specially designed learning materials, called manipulatives. By applying tectonic architectural devices to a Montessori school, the students and teachers are offered a physical didactic tool, appropriate for this educational system. The architecture, itself, becomes a Montessori manipulative.

Through interviews with Montessori teachers, visits to Montessori classrooms, and research of the Montessori Method, characteristics of the manipulatives and Montessori prepared environment are identified, in order to apply them to architectural interventions. Analysis of existing tectonically expressive projects also facilitates the development of a didactic architectural language. Further, this analysis will define parameters of an ideal architectural program for Montessori’s third plane of development, 12- to 18-year-olds. Though Montessori wrote about the needs of this age group, she did not develop a full curriculum for them. Therefore, this age range offers more room for interpretation.

The current configuration of the former Woodward High School building lacks internal and external community spaces and does not engage

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7 Frampton, *Rappel à l’ordre, The Case for the Tectonic. Theorizing a New Agenda for Architecture*, 519
8 Frampton, *Studies in Tectonic Culture*, 3
9 LeCuyer, *Radical Tectonics*, 16
TECTONIC INTERVENTIONS

the landscape, all important considerations for this age group, according to Montessori. While addressing these issues, interventions will architecturally expose the tectonics of the historic and new elements of the school.
INTRODUCTION
DIDACTIC ARCHITECTURE: TECTONICS

For Frampton and Marco Frascari, the transition between elements, that is, the joint, is the essence of architecture. Decisions that designers make about the construction of a work will be reflected in these details, especially if these details are revealed to the users. Thus, the logic of the construction, what Frascari calls “the logos of techne,” itself produces discourse and meaning.

Montessori designed manipulatives pertaining to four different areas of learning: practical-life, sensorial, mathematics, and language. The sensorial materials reflect the facts of the world and make abstract concepts (such as big and small) concrete. Students fully learn a concept when they are able to attach language to it. This process enables them to enter into the discourse about the physical world of which Frascari speaks.

Construction and Structure

Frampton brings attention to the dialectic relationship inherent in building with mass walls versus light frames. A synthetic discussion of Heidegger’s positioning of humans under the sky and on the earth, and Semper’s architectural origin hypothesis, outlined in The Four Elements of Architecture, emphasizes this contrast of earth-bound mass and sky-reaching frame. Frampton states, “framework tends toward the aerial and the dematerialization of mass, whereas the mass form is telluric, embedding itself deeper into the earth. The one tends towards the light and the other towards the dark.” Because of its Greek origins in carpentry, Semper uses the work tectonic to refer to frame construction, while he uses stereotomic to refer to masonry construction. Yet, the word tectonic has come to have a more general meaning “pertaining to building or construction” and “indicates a structural and material probity...a poetics of construction.”

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10 Frascari, Tell the Tale Detail. Theorizing a New Agenda for Architecture, 500
11 Lillard, Montessori Today: A Comprehensive Approach to Education from Birth to Adulthood, 34-36
12 The four elements include: earthwork (mound), hearth, (framework and) roof, and enclosing membrane. Frampton, Rappel à L’ordre. Theorizing a New Agenda, 516
13 Ibid., 522
14 Ibid., 520
For Frampton, the transitions of architecture, such as those from stereotomic base to frame constitute the very essence of architecture. The joint is “the nexus around which the building comes into being and is articulated as a presence.” Marco Frascari, in his essay *Tell the Tale Detail*, describes the detail as embodying a dialogue between the techne of logos (the production of discourse) and the logos of techne (discourse of production). In other words, the detail can express its construction, while also giving order and meaning to the whole. The detail generates understanding. In the Beaux-Arts tradition, architects produced analytiques. In these drawings, the details play the central role and there is a dialogue among parts. Architects could depend on their craftsmen to interpret the drawings into a coherent construction, so these drawings were intended to convey the relationship between the parts and the entire building. As contemporary building techniques have evolved, however,

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1. Brion Cemetery models. Elements shown in photograph are emphasized. Carlo Scarpa

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15 Frampton, *Rappel à L’ordre. Theorizing a New Agenda*, 522
16 Frascari, *Tell the Tale Detail. Theorizing a New Agenda*, 500
architecture is no longer constructed from customized cut stone, for example, but built up from components. Vittorio Gregotti comments, “One must admit that the organic unity of the techniques used to build Gothic cathedrals was incomparably higher, more refined, consistent...Gothic architects transformed materials into architectural facts; we assemble products.” 17 Designers must be attentive to reconnecting details to the human experience, as LeCuyer observes, “the detail, rather than being systematic and self-referential in its adoration of technology, becomes empathetic, evidence of the hand and mind inflecting construction conventions toward particular conceptual ends.”18

Carlo Scarpa worked directly with craftsmen during the construction of his designs. While the Beaux-Arts architects used analytiques, Scarpa often used a model kit of parts (fig. 1), such as the Brion Cemetery models, to convey part-to-whole relationships to builders. Certain parts, for example

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17 Gregotti, Inside Architecture, 52
18 LeCuyer, Radical Tectonics, 20
the ziggurat concrete detail (fig. 2), repeat throughout the project. With Montessori manipulatives, students can pull elements out of a system, allowing for comparison between elements, as well as understanding of an element’s role in the system (fig. 4). With the Golden Beads manipulative (fig. 3), single beads accumulate into strings of ten, which constitute plates of one hundred, and those form cubes of one thousand. This building of ones, tens, and hundreds introduces the decimal system. Like Frascari’s details, the part gives order and meaning to the whole. The system and its parts depend on each other for coherence.

Frascari cites Hermann von Helmholtz’s investigation into perception and understanding of architecture. It is not enough to perceive; we must analyze the relationship of the parts, in order for architecture to become a vehicle of knowledge. According to the Montessori Method, human beings have tendencies towards certain behaviors, including exploration, imagination, manipulation, repetition, precision and communication, that allow them to adapt.19 The Montessori manipulatives foster these behaviors so, ultimately, individuals may be not just well adapted to their situation, but able to transform it, as well. This cycle of tendencies in honing skills and understanding is similar to Helmholtz’s ideas about successive optical perception of the environment, where each point of focus is surrounded by a blurry field. When the eye moves, the focus shifts. Helmholtz emphasizes, however, that the details in focus only acquire meaning when they are part of a process of “association and comparison and through a set of geometric relationships.”20

Louis Kahn, in a poem celebrating Scarpa’s work, writes “Beauty/the first sense/Art/the first word/then wonder/then the inner realization of Form/the sense of wholeness of inseparable elements...”21 When asked about Montessori and architecture, Anne Delano Steinart, a teacher at Clark Montessori High School stated, “find a way to generate wonder and nurture it—that’s what high schoolers need...What if the environment wasn’t always what it seemed and had a sense of discovery?”22

In Strange Details, Michael Cadwell recognizes the local qualities of

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19 Lillard, Montessori Today, 11
20 Frascari, Tell the Tale Detail, Theorizing a New Agenda, 505
21 Ibid., 506
22 See Anne Delano Steinart’s comments in Appendix I
Scarpa’s Fondazione Querini Stampalia Bridge (fig. 5). The soft thud of feet walking on the wood contrasts with the experience of walking on the typical stone bridges of Venice, the spacing of the slats allows flickers of light to reflect through from the canal. However, he expresses confusion over the structural path of the handrails on the arch of the bridge.\textsuperscript{23} From the teak to the strut, to the steel, to the double struts, the path is legible. But then the strut curves and disappears under the slats (fig. 6). Yet, what he does not acknowledge is the difference in connection of the struts at the abutment, where the steel meets stone. The hiding of the joint at the arch accentuates the lightness at these points, while the joint at the abutment emphasizes the bearing path to the ground. Though this detail could have been more successful had the abutment risen, like a Semperian earth mound, to meet the frame of the strut, the bridge is highly structurally and functionally rational and expressive.

An interesting feature, noted by Kenneth Frampton in *Studies in...

\textsuperscript{23} Cadwell, *Strange Details*, 17
Tectonic Culture, is its asymmetry.24 One end of the bridge has to be low enough to clear the doorway to the building, while the other side allows gondolas to pass under. This results in a step path with two wooden treads on the high side and five on the other. Additionally, Frampton notes that three of the treads lie flush with the surface of the bridge or bank, blurring the perceived boundary between span and threshold and extending the joint.

Scarpa interpreted local culture and worked closely with craftsmen. Such a hands-on approach and combination of science and vernacular is appropriate for adolescents in the third plane of development—what Montessori referred to as Erdkinder, or “land children.”25 David Kahn states, in Pedagogy of Place: Using the Prepared Environment for the Third Plane:

The Erdkinder definition of place refers to the larger economic, ecological, geological, social, political, and spiritual possibilities of the

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24 Frampton, Studies in Tectonic Culture, 302
25 Montessori, From Childhood to Adolescence, 95
immediate surroundings. Place is a context to which the adolescent feels he or she both belongs and contributes...the adolescent has the ability to abstract place—to perceive all at once its ecological and cultural features, its history, its present functioning, its related literacy, its convergent meanings, its future possibilities.26

Though their designs are aesthetically very different from Scarpa’s work, Patkau Architects also concern themselves with local culture and builders, as well as tectonic expression. In the Seabird Island School, the side of the building facing the Native Salish community becomes a porch with a colonnade of long wooden members which gesture toward the sky. The wood frame is joined by steel plates and supported laterally by cables, the repetition of which has a lyrical quality. Traditionally, the Salish people organize their communities around boardwalks, and the porch references this. When talking about Patkau Architects’ work, Patricia Patkau states:

26 Ludick, Pedagogy of Place: Using the Prepared Environment for the Third Plane, 152
Our buildings often utilize devices such as juxtaposition—contrasting scales, or playing mass against void or line, for example. Increasingly, we also tend to differentiate elements within building assemblies, expressing the role of each element, either directly or through representation, so that the nature of the construction and the forces which act upon it are evident.27

Like Montessori manipulatives, elements in Patkau Architects’ trabeated designs are visible as part of a system. Large columns of the Seabird School support a heavy timber framed canopy, through which the viewer can trace load paths (fig. 7, 8). The increasing forces require larger members (or more frequent members) that can handle the load. Trabeated structures, therefore, follow a big, bigger, biggest pattern (fig. 11). Montessori sensorial materials help students draw “comparative relationships”28 in characteristics such as

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27 Patkau Architects: Selected Projects 1983-1993, 14
28 Lillard, Montessori Today, 14
length, volume, weight, and color intensity (fig. 9,10). These comparisons develop accessible and meaningful patterns from impressions of the physical world.29

In reference to the clients’ culture, the columns, themselves, are reminiscent of totems or trees of the region. The project also advanced the technical skills of the community. Members of the Salish community were constructing the building, and its geometry was beyond their expertise. The architects built a detailed framing model to explain the system to the community builders (fig. 12).

The Garthwaite Center for Science and Art at the Cambridge School of Weston, designed by Architerra, was considered a teaching tool from the beginning of the design process. Students and faculty were directly involved in developing elements of the project. Ellen Watts, principal of Architerra, comments “the greatest challenge—and hopefully greatest achievement—was

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29 Lillard, Montessori Today, 14
to produce a project that is educational for the students. Exposed heavy timber framing was utilized expressly to reveal the structure of the building to the students.

Similarly, in Clark and Menefee’s Lucy Daniels Foundation and Preschool, the structure of the building was exposed (fig. 13) where possible and simple materials were used “so that children could understand the material and parts.” A large steel beam, supported by steel wide flange columns, crosses through the classrooms and provides a didactic structural element and a datum that links the independent rooms (fig. 13-15). A transom window above built in cabinetry shows the beam extending the length of the building. Students are then able to understand the structural importance of the beam in their own room, as well as in the entirety of the building.

In another project by Patkau Architects, the Strawberry Vale School, the

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30 Navin, A Teaching Tool for the Ages. Environmental Design and Construction, 33
31 Jensen, Clark and Menefee, 171
structure and construction are fully expressed and exaggerated in the public zones, while a quieter approach is taken in the classrooms, where the structure is clad with plaster. At points, the trabeated structure extends beyond the plaster, forming an overhang which is visible through the windows (fig. 16). This interplay between revealed structure and cladding is reminiscent of Louis Kahn’s Yale Center for British Art, where steel and wood cladding pull back to show the concrete structure (fig. 17). Here, the conceptual relationship between the wood and concrete is particularly complex. Cadwell comments:

The oak panels maintain the measure of the column’s grid and the concrete’s formwork. Yet this is not a stable relationship. Kahn’s office detailed the oak to make it appear thick; it pushes in front of the concrete columns that slip back in deference. Which is the structure, and which is the infill? ...Wood was there first, after all, as it always is with a concrete building. Wood formwork provides the voids that
In Banco Popolare di Verona, Scarpa makes a similar move with a dropped ceiling that pulls back to expose concrete column capitals (fig. 18). The division of the ceiling plane also accentuates the structure, as Frampton explains, “the suspended nature of the plaster ceiling is made manifest through its subdivision into fairly large areas by seams that not only impart scale to the expanse of the overall soffit, but also return the eye to the salient points at which the concrete column heads come through the plaster to lie flush with the ceiling.”

In Patkau Architect’s Clay and Glass Museum, the first floor is constructed of reinforced concrete, clad with brick veneer. At window and door openings, the layers of the walls are revealed. This stereotomic base

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32 Cadwell, Strange Details, 171
33 Frampton, Studies in Tectonic Culture, 331
supports the steel frame and timber deck of the second floor, the construction of which is visible from below (fig. 19). According to John Patkau, of Patkau Architects, “the construction of the gallery interiors is not abstract: building materials are directly expressed; details reveal the layers of construction—the building up of roof and wall assemblies—and articulate the relationships of materials to each other.”

Mechanical Systems

In Rappel à l’ordre, the Case for the Tectonic, Frampton discusses Louis Kahn’s and Frank Lloyd Wright’s tendencies to divide architectural spaces into servant and served zones. He comments that Kahn and Wright share a

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34 Patkau Architects, 72
...concern for the expressive rendering of mechanical services as though they were of the same hierarchic importance as the structural frame. Thus the monumental brick ventilation shafts of [Kahn’s] Richards’ Laboratories are anticipated, as it were, in the hollow, ducted brick bastions that establish the four-square monumental corners of [Wright’s] Larkin Building. However dematerialized, there is a comparable discrimination between servant and served spaces in Norman Foster’s Sainsbury Centre of 1978 combined with similar penchant for the expressive potential of mechanical services. And here again we encounter further proof that tectonic in the twentieth century cannot concern itself only with structural form.35

This celebration of mechanical systems continues to be an important element of tectonic expression, especially in educational facilities attempting to utilize the architecture to educational ends.

In Patkau Architect’s Strawberry Vale School, exposed ductwork

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35 Frampton, *Rappel à L’ordre. Theorizing a New Agenda*, 525
follows the major steel beam in the main public space ceiling, where the structure is extremely expressive. Scarpa uses a similar device, although a completely different aesthetic. In Fondazione Querini Stampalia (fig. 20), Scarpa directs visitors diagonally across the space from the entrance to the garden. This movement is reflected in the garden entrance columns, one of which is parallel to the axis of the hall and the other rotated ninety degrees. The placement of the radiators in the space mimics the columns. The two by the entrance follow the axis of the gallery, while the radiator by the garden is perpendicular. The radiators “are used to quicken and deflect circulation through the space.” In other words, the gestures of the mechanical system and the structure emphasize each other.

For a student center renovation at Tulane University, VJAA installed dramatic water walls and pendulum paddle fans that serve to temper humidity

36 Frampton, Studies in Tectonic Culture, 305
37 Frampton, Studies in Tectonic Culture, 321
and heat (fig. 21). The water walls in the Lavin-Bernick Center for University Life fill a double-height space and act as a sculptural element. The central plant supplies the water, which is cooler than the surrounding air and thus absorbs heat.38

At the Garthwaite Center for Science and Art, “the design was aimed at...revealing exactly how the building conserves energy, modulates sunlight, manages wastewater, infiltrates stormwater, integrates renewable and recycled materials, and maintains thermal comfort,” comments Watts, principal at Architerra.39 To this end, the school features a gallery of mechanical systems, where users and visitors may read educational signage and peer through interior windows to view the inner workings of the boiler and heat recovery systems, as well as waste composters.

When designing Fuji Kindergarten (fig. 22), a new Montessori school in Tokyo, Tezuka Architects follow an even more interactive approach—capturing student’s imaginations by engaging them intensely with the physical world. For example, pull strings switch lights on and off in order to enforce a more direct correlation between action and effect. These fixtures also define work zones. The client and head of Fuji Kindergarten, Sekiichi Kato, states:

We want to set against the virtual world a real world that can be experienced as directly as possible. You close the door because there's a draught. Similarly, by turning on a tap [in the outside courtyard], children learn that they can control the volume of water and that they’ll get wet feet if they leave it on too long...the building is a plaything and also a tool that’s instrumental in the children’s development.40

Kato and Tezuka architects, therefore, argue strongly for the architecture, itself, to be a major element in the development of students, by appealing to student’s inherent exploration of their environment in the development of intelligence. By shaping their own environment, by testing its limits, pushing on it, and feeling its weight, students learn, on a macro scale, some of the same lessons that the Montessori manipulatives teach on a micro scale.

38 Moe, Integrated Design in Contemporary Architecture, 118
39 Navin, Teaching Tool. Environmental Design and Construction, 34
40 Tezuka, Kindergarten in Tokio, 191
Interventions

According to Ignasi de Solà-Morales Rubió, the relationship between a new intervention and existing architecture changes depending on the “meaning of historic architecture and the intentions of the new intervention.”41 Not only does the new element physically interact with the old, it also interprets it. For the Modernists, this interaction resulted in contrast, often depicted in collages. Le Corbusier commented, “the new modern dimensions and the showing to advantage of historic treasures produce a delightful effect.”42 These architects, especially those of the Bauhaus, utilized ideas of Gestalt theory to assert that meaning is produced through “juxtaposition, interrelation, and contrast of fundamentally heterogeneous shapes, textures, or materials.”43

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41 Rubió, From Contrast to Analogy: Development in the Concept of Architectural Intervention. Theorizing a New Agenda for Architecture, 230
42 Rubió, Contrast to Analogy. Theorizing a New Agenda, 231
43 Ibid., 232
contrast to this approach, architects, such as Scarpa and Rafael Moneo, have chosen to interpret existing architecture through analogy. While Moneo’s addition to the Bank of Spain mimics the historic architecture to the point that the addition is nearly imperceptible, Scarpa’s renovation of the Museo di Castelvecchio is more complex and narrative.

Scarpa mediates between an existing structure and a new program, through both subtle and significant alterations. The seven major galleries on the first floor were already connected by vaulted openings, but Scarpa connects them with a large steel beam that supports the new concrete floor, above (fig. 23). Large windows, framed in steel, bring light in from the southern side and contrast with the heavy bearing walls. The floor of these galleries is clad in alternating bands of concrete and stone, that pulls away at the wall junction to reveal the original floor, below. At points, Scarpa reveals elements of the old construction through a sensual interplay between new and old plaster. For the majority of the interior, existing fake frescoes were removed and walls were
covered in neutral textured plaster. On the façade, however, Scarpa carves out rectangles of the new plaster to reveal old plaster and brick, underneath (fig. 24). Scarpa later repeats this approach at the Luigi Marzoli Weapons Museum at the Castle Brescia, where new plaster cuts away to reveal the brick bearing wall, below (fig. 25). Balconies, which offer connections between galleries and sequenced views of the old structure, are constructed from wood and steel which contrast with the surrounding masonry walls. Working with the Brescia city council, sixteenth and nineteenth century structures were demolished in order to open views to the boundary wall and vertical structures of the keep, while also unearthing Roman artifacts.

Scarpa’s drawings (fig. 26) reflect an iterative and collaborative approach toward working with existing buildings. Since his projects often progressed through a building over a period of time, the versions and marginalia equipped

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44 Beltramini, Carlo Scarpa: Architecture and Design, 144
45 Beltramini, Carlo Scarpa, 254
Scarpa with a set of tools to deal with uncovered elements during construction, as well as different possibilities for transformation.

Norman Foster’s reconstruction of the Reichstag represents a combination of contrast and analogy (fig. 28). From the front, the building appears much the same. The old façade was retained and the new dome mimics the old one in size and proportion. The interior, however, has been almost completely altered. Though the new dome and renovation offer greater transparency of the government to its citizens—a significant success for Berlin’s inhabitants—the gutting of the interior has been a source of criticism for this work. Like Scarpa, Foster utilizes contrast between the stereotomic original structure and new framed elements.

Where Foster has been criticized as insensitive to the historical significance of the interior of the Reichstag, complete demolition is, unfortunately, a common solution to old buildings that don’t meet current needs. Due to new mandates on classroom square footages, Cincinnati Public Schools are undergoing a major overhaul of school facilities. For example, in
the winter of 2009, CPS tore down North Avondale Montessori, in preparation for the new North Avondale Montessori (Fig. 27), which will be built on the site. Though the school was not recognized as historically important, it was solidly constructed of concrete in an Art Deco style. Rather than renovating existing buildings, CPS has found it cheaper and easier to raze school buildings and construct new structures on the same property.

At the other end of the spectrum from demolition lies preservation. Though the approach can be appropriate and educational in certain circumstances, it can also prohibit effective use of a building, especially as cultural practices change.

Alterations to existing buildings must also take into account the practical aspects of construction. For example, peeling away layers may not always be possible when old elements are permanently affixed to one another. Scarpa’s cladding method can be a useful technique in this case. In their renovation of a Milwaukee office building into a Montessori school, Studio Works clad certain parts of the hallways to signify special spatial elements
Actual construction may not always reflect old drawings, if the renovation designer is even lucky enough to have them. An attitude toward unknown factors, therefore, becomes a necessity. For example, Anne Lacaton and Jean-Phillippe Vassal chose to expose the hidden cable structure above the existing dome in the renovated Palais de Tokyo (fig. 29). This rough structure and the old peeling plaster contrasts with the new, creamy plaster on the underside of the dome.

Additionally, changes in structural elements, such as from bearing wall to frame, must take into account the deconstruction process. In this case, the frame structure would be offset from the previous wall structure, in order for it to take up load during removal.

Reflection

Designers must give careful consideration to the relationship of
mass and frame, as well as between cladding and structure and systems and structure. These points of joining and juxtaposition can be didactic elements in understanding the means of construction, as well as the designers’ attitudes about the work. When interacting with an existing building, new architectural elements necessarily enter into a dialogue, through contrast or analogy.

Montessori manipulatives frequently emphasize two important relationships: part-to-whole, where elements are understood as part of a system, and comparative, where elements vary and can be analyzed relative to each other. Manipulatives focusing on comparative relationships often single out a particular concept and vary that in order to attach meaning and language to it, for example big, bigger, biggest or blue, bluer, bluest. The cylinder blocks are a perfect example of this (fig. 31). Each block of cylinders tackles a different combination of height and diameter.

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46 Montessori, *From Childhood to Adolescence*, 14
An architect who is aiming to produce architecture that acts as a manipulative should devise a system with a set of components that differ in reaction to circumstance. For example, if a beam is supported on one end by tension cables, the number of cables or thickness of the cable might increase for a longer beam. This would provide an opportunity to learn about moment. Similarly, a brace supporting a cantilevered walkway might increase in depth when the width of the walkway increases, also indicating a larger moment.

Scarpa has elements in his designs which almost act like Montessori manipulatives. For example, on the Fondazione Querini Stampalia Bridge, Scarpa doubled the handrail in order to resist deflection at the longer span (fig. 32). The handrail would be more instructive, however, if it only doubled at the long span. Observers, noting the difference between short and long spans, could draw conclusions about stiffness, moment and the structural limitations of material.

The technology of architectural structure makes sense as a topic for the Third Plane of development, for which Montessori specified the exploration of real world applications and skills, as well as understanding of machines and technology used by society.
PROGRAM: MONTESSORI EDUCATION

Since the needs of the Montessori program will determine the architectural interventions in this project, it is necessary to understand this pedagogy and what architectural elements would facilitate it. For Christopher Day, an ideal learning environment “...both nourishes and inspires—in proportions according to age. Children need architecture not to shape, but to serve them.”47

Maria Montessori and Her Method

Maria Montessori (fig. 33) was born in Italy in 1870, and was trained both as a medical doctor and as an anthropologist. While working at the State Orthophrenic School in Rome, Montessori was placed in charge of children considered uneducatable. With her medical and anthropological background, Montessori was interested in their development as humans. By furthering the work of Jean Itard and Edouard Seguin,48 two French physicians who worked with disabled children, Montessori was able to apply interactive methods to stimulate development, enabling them to test on par with average children.

Towards the end of her life, Montessori reflected on her work and noted three main themes.49 First, human development from 0-24 years is not a continuous linear process, but rather a series of cyclical planes of absorption, internalization and application, as reflected in the Planes of Development diagram, developed by Montessori. Second, the successful development of humans occurs as a result of universal tendencies in relation to their surroundings. The Prepared Environment, discussed in greater detail later, is specially designed to provide a rich and stimulating environment, appropriate to the interests of the students’ developmental plane. Finally, this interaction with the environment is most developmentally productive when investigations are self-chosen and based on interest.

47 Day, Environment and Children: Passive Lessons from the Everyday Environment, 8
48 Lillard, Montessori Today, 8
49 Ibid., 4
Planes of Development

Children’s and young adult’s developmental stages cause them to encounter and interpret their experiences in a special way. Montessori identified four Planes of Development, or developmental phases, for children and young adults, aged 0-24 years. These planes share specific characteristics that provide humans with a developmental framework, allowing us to readily adapt to a specific time, place, and culture. Each plane has a specific developmental goal and the direction towards that goal is readily identifiable. Specific sensitivities optimize the attainment of the goal for that plane. This is why, for example, young children learn languages much more readily than adults.

Montessori uses the Italian word “tendere” to refer to the arrow-like focus (tendency) towards the young individual’s goals of both developing the
brain and body through the interaction with the environment and adapting to their group.\textsuperscript{51} It is this drive toward the goal-driven interaction with the environment that this project seeks to employ. Each successive plane builds on the skills developed in the previous plane. Rein Forrest, a teacher of nine-to twelve-year-olds at North Avondale Montessori in Cincinnati, states, “Montessori uses a spiraling curriculum, which instills a deep understanding that continues building from year to year. The public system, however, tests on a wide sweep of unrelated concepts.”\textsuperscript{52} The triangular shape of Montessori’s Planes diagram (fig. 34) indicates that the first three years of a phase act as an absorption period, while the last three years operate as a honing period. For this reason, Montessori specified multi-aged classrooms in three year age ranges. Students in that age group who are more advanced can help younger students, while reinforcing their own understanding.

\textsuperscript{51} Lillard, \textit{Montessori Today}, 13
\textsuperscript{52} See Rein Forrest’s comments in Appendix I
Though the first plane of development, ages birth to six, is the phase most commonly associated with the Montessori Method, Montessori developed her pedagogy up through age twelve and outlined her program for the third plane, ages twelve to eighteen, and fourth plane, ages eighteen to twenty-four.

In the first phase, children investigate their world through direct experience—through their senses—and primarily with their hands, which Montessori refers to as the “instrument of the intelligence.” Montessori’s manipulatives are a direct manifestation of this need (fig. 35). Children are introduced to concepts through concrete objects that they can move and touch. For example, Heidy Davenport, who teaches three- to six-year-olds at North Avondale, places a heavy pumpkin in the classroom to emphasize the mass of tangible objects, prompt problem-solving, indicate the season,

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53 Lillard, Montessori Today, 27
and potentially motivate social interaction, when children ask for help.\textsuperscript{54} The Montessori Golden Beads imbed a correlation between increasing units and numerical value, as well as lay groundwork for more advanced concepts, such as volume and exponents. “[When working with the math materials], they understand the thousands are really heavy and they have to be careful with the units\textsuperscript{55} because they’re so tiny and they can get lost.”\textsuperscript{56}

Fine and gross motor control is another key goal for young children. According to Nico Dimarco, a teacher of six- to nine-year-olds at North Avondale, “the work rug delineates space and gives them a sense of order on the floor (fig. 36). Being able to move about each other gives them a sense of movement and body control. When they are working, the whole floor is filled with rugs, so they have to be careful and concentrate on their movement.”\textsuperscript{57}

\textsuperscript{54} See Heidy Davenport’s comments in Appendix I
\textsuperscript{55} Single beads
\textsuperscript{56} See Heidy Davenport’s comments in Appendix I
\textsuperscript{57} See Nico Dimarco’s comments in Appendix I
This control, in turn, allows for later skills, such as writing, drawing, dancing, and generally moving through space. In other words, this refinement serves the children—it doesn’t just shape them.

Other important developmental goals for this age group include: care and maintenance of the self and the environment, referred to as “practical life skills;” sensorial exploration, which teaches the qualities and facts of the world; manners and social behavior; and math and language skills.58

While children in the first plane learn from their immediate environment, children in the second plane, ages six through twelve, gain increasing abilities of abstraction and want to understand “the world, the universe, the whole of humanity, and all of culture.”59 Teachers use a series of interdisciplinary Great Lessons and Key Lessons in order to provide an overarching framework for increasing detail. Dimarco states, “Montessori philosophy uses

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58 Lillard, Montessori Today, 35
59 Grazzini, The Four Planes of Development, 35
Cosmic Education to guide this group. Cosmic education emphasizes how we’re all connected. The fundamental ideas of cosmic education are the underlying current for six- to nine-year-olds. It...fosters community in the class.”

The third plane of adolescence, the age range for which this project is intended, is a time of great vulnerability and sensitivity, according to Montessori.⁶⁰ These “humanistic explorers”⁶¹ are interested in social interaction, morality, community and independence. The primary interest is in reality, both the natural world and society.⁶² The manipulatives for this age group primarily consist of students’ practical investigations that facilitate these interests. The important transition of this plane, coupled with its vulnerability, led Montessori to propose the Erdkinder program, in which students connect with the natural world through productive work, leading towards financial independence (fig. 37).⁶³

The adolescent pedagogical program, as outlined by Montessori, indicates a mixture of practical skills and intellectual growth, all towards becoming a fully capable individual in society⁶⁴—one who is hopefully able to improve it.⁶⁵

- Social space and independent space
- Local community interaction
- Academics including liberal arts, sciences and independent reflection
- Farming and gardening
- Business in practice
- A museum of machines and repair shop, for understanding the tools of society
- Home care
- Other vocational studies

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⁶⁰ Montessori, From Childhood to Adolescence, 98
⁶¹ Lillard, Montessori Today, 154
⁶² Ibid., 156
⁶³ Grazzini, The Four Planes of Development, 37
⁶⁴ Lillard, Montessori Today, 152-163
⁶⁵ Montessori, From Childhood to Adolescence, 98
According to Forrest, “middle and high school [Montessori] programs should emphasize business, self-sufficiency and farming.”66 Dean Blase, who teaches English at Clark Montessori High School, echoes Forrest’s comment, but emphasizes the benefits of an urban setting and a connection to a community. “You can’t leave kids in nature all of the time. Montessori started off teaching street urchins [who had little access to the countryside]. It is important to get out to nature and then return to society, so you don’t become a hermit. Nature is instructional, but it’s not the end goal.”67

Students in this age range need to belong to a community.68 This thesis design will focus specifically on increasing connectivity within the existing building and, therefore, stimulation within the school community. Simultaneously, the design will include a number of socially connected independent and small group study nooks. This will address the third plane need for social and independent space.

Montessori wrote the least about the fourth plane, ages eighteen to twenty-four, which corresponds to university life. Though the individual is “fully formed,” this is the time to develop a personal mission and life direction.69 Montessori though it was extremely important for individuals to gain financial independence at this time.70

**The Prepared Environment**

The Montessori prepared environment provides an atmosphere where young people are allowed to explore and learn in a hands-on, concrete way. It is marked by beauty, order, reality, simplicity and accessibility.71 A trained teacher introduces students to materials in the prepared environment and then the students work with them at their own pace.72 This well structured

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66 See Rein Forrest’s comments in Appendix I
67 See Dean Blase’s comments in Appendix I
68 Ludick, *Pedagogy of Place*, 152
69 Grazzini, *The Four Planes of Development*, 37
70 Her extreme emphasis on this matter may be a result of her father’s disapproval of her own professional pursuits in medicine. Montessori felt that independence allowed a person to make their own decisions. Montessori, *From Childhood to Adolescence*, 134
71 Montessori Association Internationale, *The Prepared Environment*
72 Ibid.
environment is a place where students can trust their own powers and face the unknown. Manipulative materials are introduced in an order which facilitates understanding of cause and effect. Materials and lessons build on each other.

In order to understand the Montessori prepared environment, one must define, refine and expand it. Montessori specified that the school and classroom environment should prepare students for life. Since a child learns by engaging with his or her environment, Montessori believed that the classroom should be optimally arranged in order to attract and enrich the child. Human beings respond and adapt to their environment, therefore an educational environment should cause children to adapt in the most optimal way. Lillard states that, “adults work to change the environment; children use the environment to change themselves.”

According to The American Montessori Society’s (AMS) accreditation standards, the ideal physical environment for a Montessori school should, among other things, be clean, orderly, and neat, aesthetically pleasing, and have plenty of storage. The AMS also emphasizes the importance of spaces facilitating a variety of activities, such as individual/group, floor/table, noisy/quiet. The AMS requirements are a good starting point, but they tend to fall between nebulous or prescriptive. Major themes, however, include: storage and organization, variety of space size and activity, facilitation of practical life skills, and aesthetics.

Based on interviews with teachers and analysis of architectural projects designed for Montessori, the most salient architectural strategies facilitating Montessori include: access to outside and nature; rooms within rooms—allowing for group to individual study and team teaching; and central spontaneous social space. Essentially, these distill to a strong attitude about connectivity with the students’ surroundings, the internal community, as well as the community at large.

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73 Lillard, Montessori Today, 16
74 Ibid., 15
75 Montessori, From Childhood to Adolescence, 11
76 Lillard, Montessori Today, 42
77 American Montessori Society, School Accreditation Standards and Criteria, 3.7.2
Outdoor Education

When explaining the Erdkinder program for adolescents, Montessori states “work on the land is an introduction both to nature and to civilization and gives a limitless field for scientific and historic studies...We have called these children the ‘Erdkinder’ because they are learning about civilization through its origin in agriculture.”

In reference to outdoor education, Dimarco states, “at [the old] Clinton Springs School there’s a wooded area with places to sit outside and teach and a hiking trail. Clinton Springs Gardens are nearby. The trails come up into a field. All of this is still on school property. Outdoor education is a wonderful addition and almost a luxury.” Davenport agrees with the importance of

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78 Montessori, From Childhood to Adolescence, 107
79 See Nico Dimarco’s comments in Appendix I
students to access the outdoors, “care for self and care for the environment is important in Montessori. It would be great to have doors to the outside to garden, to plant and water things, to study the roots of a tree—something like a room outside of the room. It could have a door from the classroom, so that it would be just an extension of the classroom.”

The design of outdoor classroom areas frequently incorporates both water and vegetative material. Ben Franklin Elementary School, designed by Mahlum Architects, has two outdoor classrooms (fig. 39) within the open courtyards of the school’s E-shaped configuration (fig. 38). An intermittent stream running through one of the courtyards is supplied by rainwater runoff from the school’s butterfly roof. Similarly, Mark Horton Architecture designed the roof of Montessori Children’s Center to slant toward a cistern, which collects rainwater for the school’s garden. Herman Hertzberger’s design for the Montessori School at Delft includes an extensive outdoor discovery area.

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80 See Heidy Davenport’s comments in Appendix I
made from concrete masonry units (fig. 40). The blocks enclose a sand pit and garden plots, and are divided by an open gutter, which children access to water plants or make sand castles.

Fuji Montessori, designed by Tezuka Architects, is a single story ring-shaped structure which surrounds a central courtyard. Walls along the courtyard open completely, blurring the boundary between inside and outside. Students are encouraged to play in the mud, with a series of water taps located along the periphery. During the construction of the school, existing trees were captured inside of small courtyards, which are accessible from inside. Students may climb the trees from the inhabitable roof.

Relating to adolescents’ connection with the community, David Kahn states, “the Erdkinder definition of place refers to the larger economic, geological, social, political, and spiritual possibilities of the immediate surroundings.” This comment suggests that an ideal Montessori high school building might open onto the surrounding community, as well as provide access to the landscape and agricultural opportunities. The fact that Montessori called this group ‘Erdkinder’ emphasizes this as a core part of the pedagogy for adolescents. LeCuyer expresses a complementary view toward works by contemporary architects, such as Enric Miralles and Patkau, “in lieu of being idealized objects superimposed on the land, these building grow out of the land, being shaped by and amplifying the topography of their sites.”

**Rooms Within Rooms**

The independent study and group work that is a fundamental aspect of Montessori education demands a variety of spaces and zones within a room and educational facility. When talking about a particular location in her classroom, Davenport comments, “I put a low table by the coats [in a corner] because I couldn’t find space for it, but the kids really like it because it’s a nook and quiet.” Observations at Clark Montessori indicate similar configurations. In Blase’s room, students sit on a mat in the corner, while

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81 Ludick, *Pedagogy of Place*, 152
82 LeCuyer, *Radical Tectonics*, 17
83 See Heidy Davenport’s comments in Appendix I
reading independently (fig. 41). She plans to acquire a screen to make the zone even more distinct. Delano Steinart arranged a couch and chairs in one corner of her classroom in order to encourage small group discussion. When asked what kind of architectural elements would facilitate Montessori Delano Steinart states, “There could be little solo spaces with built in chairs for meditation and independent study.”

Understanding that sitting on the floor and spreading out materials is an integral part of students’ work mode, Studio Works installed a series of platforms (fig. 42) in a renovation of a Milwaukee office building into a Montessori school. Essentially, these platforms extend the floor upward, creating a more rich spatial experience.

Lewis.Tsurumaki.Lewis’s (LTL) design of Bornhuetter Hall incorporates small room-sized window boxes that extend from a larger room over a public entry courtyard (fig. 43). These nooks are private zones that are still visually and

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84 See Anne Delano Steinart’s comments in Appendix I
socially connected to more public areas. “Overlooking the interior courtyard, the study nooks are sized for individual or small-group study. In this way, the coming together of two or three students is also the moment of contact within the larger community,” states LTL. Residents can feel independent, but within a larger group. LTL continues, “The study nooks’ proximity to hall traffic and lounge activity means that students can both withdraw and engage in the community at the same time.”

Frampton describes Hertzberger’s work as having an “emphasis on mictrotectonic elements such as terraces, benches, sills, balustrades and thresholds.” For the design of Montessori College Oost (MCO), Hertzberger included small desk spaces into the corridor balustrade (fig. 45), yet he is critical of this solution. “In the MCO, we attempted to create additional workplaces in the areas next to the balustrades of the internal balconies, but
one might have found a better solution,” comments Hertzberger.\(^8\(^\)\(^7\) This design is similar to extended learning areas (fig. 44) found in newer Cincinnati public schools, such as Pleasant Ridge Montessori. In a more recent Hertzberger design, classrooms share an anteroom that can be divided off by folding doors. In these configurations, classrooms share a central flexible space that can be used for teaching, group or independent study.

**Central Social Space**

According to the North American Montessori Teacher’s Association, “adolescent programs characteristically have discrete spaces for specialized activities: photo lab, science lab, stage, art room, and lesson rooms all adjacent

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\(^8\(^\)\(^7\) Bergers, Montessori College Oost in Amsterdam. Detail Magazine, 231
to open space that unifies the side rooms.”88 Day confirms the importance of these unifying spaces for adolescents, “teenagers need ‘social rooms’... whereas teenagehood is often a period of alienation from the rest of society, such an approach develops social responsibilities ...and inclusive cohesion.”89 David Kahn similarly emphasizes the importance for adolescents to belong and contribute to their surroundings.90 In *School Design*, Henry Sanoff underscores adolescents’ need for gathering spaces “to engage in stimulating activities, conversation, and exploration of ideas.”91

In Hertzberger’s Apollo Schools, two school wings are joined by a central meeting space defined by large steps that act as an auditorium (fig. 46). For Montessori College Oost, Hertzberger pushed this idea further by linking floors across a central atrium through a series of catwalks and large stairs,

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88 North American Montessori Teacher’s Association website
89 Day, *Environment and Children*, 62
90 Ludick, *Pedagogy of Place*, 152
91 Sanoff, *School Design*, 48
which can be used for meeting spaces (fig. 47). Since these enlarged zones occur in a circulation space, spontaneous social interaction occurs frequently.

**Reflections**

The Montessori environment is not created by simply fulfilling a list of requirements. It is the combination of factors, the totality of the prepared environment, which fosters exploration and stimulation of children. This includes the other children, the teacher, the Montessori materials, and the careful arrangement of the classroom. It must include architecture of delight that sometimes recedes, to allow the materials to foreground, and other times advances, to enrich the environment or, itself, become a learning material. The major strategies that motivate the alteration of the building are increasing

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47. Central circulation, Montessori College Oost. Herman Hertzberger

92 Lillard, *Montessori Today*, 22
connectivity within the school community; with the exterior urban context and community; and with the landscape. The design for this thesis will focus on the first of these three strategies. These points of alteration will provide joints of inquiry for the development of a didactic architecture.
TECTONIC INTERVENTIONS
PROJECT

Urban Context

Downtown Cincinnati lacks a public Montessori high school. This would serve both new and established families in Over-the-Rhine, the West Side, and the Business District. Montessori developed her method in an urban context, working initially with disadvantaged children. This school, therefore, will fit the needs of the diverse students of Downtown Cincinnati well. Dean Blase, a teacher of Montessori high school students prefers working in an urban context because students are better able to connect with society. David Kahn’s writing in Pedagogy of Place indicates that an urban environment can be a rich location for Montessori adolescents, so long as a connection is established. The teenager must live and work in a “context to which the [student] feels he or she belongs and contributes.”93

Site Context

Located in downtown Cincinnati at the between Thirteenth and Fourteenth Streets and Sycamore and Broadway Streets, the property of the School for Creative and Performing Arts, formerly Woodward High School, was donated to Cincinnati in 1831 by William Woodward.94 Incidentally, Twelfth and Thirteenth Streets used to be named Abigail Street and Woodward Street, after Woodward and his wife, who are actually buried on the site. The property to the south of SCPA is under the control of the Woodward Trust, which leases it to third parties.95 This property is primarily used for parking lots and small mixed use buildings.

The northern half of the school’s city block is dedicated to a large elevated play field. Paved parking lots meet the building on the east and west sides, while a narrow strip of paving provides loading and maintenance access on the south side. Surrounding buildings to the east and north are primarily dedicated to residential use, while mixed use program is mainly to the west and south, increasing in density toward East Central Parkway (fig. 48).

93 Ludick, Pedagogy of Place, 152
94 Cincinnati Public Schools website
95 The Woodward Trust website
The former Woodward High School, designed by Gustave Drach, was built in the Italianate style in 1907 (fig. 50-51). This is actually the second Woodward School on the site. William Howard Taft, who attended the first school, laid the cornerstone for the existing building. It is constructed of brick bearing walls, supporting reinforced concrete floor plates with cast beams, approximately nine feet on center.

The exterior of the building has a banded rusticated base of light stone with arched windows. Above this, vertical bands of brick surround three floors of windows, separated by terra cotta spandrels, resembling green slate. The glazing elements vary between green and clear glass. The second and third stories have rectangular windows, while the fourth story has arched windows. A large green-grey terra cotta cornice with dentils rests on corbels above the fourth floor. Vertical bands of brick continue above the cornice, surrounding the rectangular windows of the fifth floor, and ending in the slate-colored
49. Collages. Possibility of using light wells for a greenhouse or conservatory, in reflection of the Montessori farming program for the third plane.
50. Typical building areas, clockwise from right: building exterior; hallway; classroom; light well; stairwell.
51. Special building areas, clockwise from left: auditorium; cafeteria; gymnasium; plunge pool; entry stair.
52. Connection to the social network. Existing (above) and proposed.
53. Connection to the landscape. Existing (above) and proposed.
54. Connection to the community. Existing (above) and proposed.
thick fascia at the top of the building. The fascia features a less pronounced cornice with dentils.

The narrow east and west ends of the building measure approximately 166 feet and are articulated into three vertical sections. The two side articulations have two window bays, while the middle recessed section has three and an entrance. The long north and south elevations of the building measure approximately 297 feet and have five articulations. Similar to the shorter elevations, the four side sections have two window bays, while the middle section contains three and an entrance. The end and middle sections project beyond the other two sections.

Internally, the building’s most striking formal feature are the central light wells, which bracket the school’s auditorium. These light wells, which are clad in light reflecting beige brick, are generally inaccessible. Verdigris copper flashing finishes the parapet of the light well. Corridors, which ring around the light wells and auditorium, form the main circulation pattern of the building. Classrooms are accessed from the corridors and are on the exterior.
56. Existing wall section between corridors and the auditorium. Notice pilasters and arches are only decorative, not structural.
of the building. The corridors and classrooms are divided by a three foot thick wall. Half of this wall, facing the classrooms, is a masonry bearing wall, while the other half of the wall, facing the corridors, is a shaft for sporadically placed ventilation ductwork. Heating is provided by radiators. Internally, all brick walls are finished with plaster and drop ceilings conceal the concrete floors plates.

The material palette of the interior includes mosaic tile, Rookwood and Wheatley tile fountains, marble, and wood flooring. The main entrance is on the west side, and has a grand stair, marble columns and a stained glass window from the original school. The fifth floor, which is about a story and a half, contains a gymnasium to the east and a cafeteria to the west. Classrooms and abandoned plunge pools are on the north and south sides. The roof holds twenty skylights, but these have been sealed and blacked-out. Though some wear exists, the school is generally in good condition.

57. Fake beam and pilaster in Woodward High School corridor. The real one-way concrete structure lies above the drop ceiling.

58. Decorative arches and pilasters in the auditorium. Ceiling molding does correspond to a waffle slab, above.
59. Group study zones, opening onto the corridor (above) Study zones connect through the central auditorium/civic space.
The natural materials\textsuperscript{96} and sense of place and history\textsuperscript{97} make the school, in some ways, appropriate for Montessori. However, the concentric configuration of the classrooms around a single loaded corridor results in a dearth of communal space. The primary communal spaces are the lunch room and the auditorium, which are intended for organized assemblies. Montessori’s self-directed focus and interest in communal engagement would indicate a more flexible configuration with a variety for independent study or small and large groups, similar to the extended learning environments at schools such as Pleasant Ridge Montessori. The five-story façade on all four sides, though beautifully ornamented, acts like a fortress against the community. The symmetrical configuration of the building also does not acknowledge sun paths (fig. 52-54). The lack of community spaces and engagement with the landscape offer design opportunities for the project. While addressing these issues, interventions will architecturally reveal the tectonics of the old and new elements of the school.

\textbf{Design Implications}

Careful consideration must be given to the relationship between architectural characteristics, such as mass/frame, cladding/structure, and contemporary/historic. When interacting with an existing building, new and old elements form a discourse through contrast or analogy. The design seeks to facilitate Montessori ideals, such as increasing connectivity within this delineated building, and emphasizing technology underneath obscuring ornament. Montessori’s background in anthropology and sensitivity to local context would not support a tabula rasa approach to the site. Yet, since the attitudes of connectivity and technology diverge from the design of Woodward High School, it follows that the interventions should contrast with it.

Though the former Woodward High School building conceals and obscures how tectonic systems work (fig. 56-58), it does reveal historic attitudes about ornament that place the school within the Italianate context of Cincinnati’s Over-the-Rhine district. The tension between the tectonic interventions, connecting with exposed structural layers, and preserved historic cladding weaves a dialogue spanning architectural disciplines. For example, cuts intentionally interrupt fake pilasters and arches. Where openings penetrate brick bearing walls and old brick must be removed, a smooth edge of new brick highlights the alteration. Removal of cladding reveals structural interaction between new steel columns and existing one-way concrete slabs. Exposure of, and perforations through, the auditorium roof waffle slab allows light into this dark space.

\textsuperscript{96} See Sudie Doughton Mason’s comments in Appendix I
\textsuperscript{97} Ludick, \textit{The Pedagogy of Place}, 159
The design proposes to utilize selected classrooms as group study zones. The classrooms open into the corridor through the replacement of bearing walls with steel columns. Opening the wall would expose hidden ventilation shafts. Group study areas, on various levels, connect through the central auditorium, which becomes a circulation and civic space for the school (fig. 59).

The design utilizes a system with a set of four primary components that differ in reaction to circumstance and act as architectural manipulatives. Cables support a stair on one end and the number of cables or thickness of the cable increase when the stair length increases. This would provide an opportunity to learn about moment. Similarly, a brace supporting a cantilevered walkway increases in depth when the width of the walkway increases. In another element, the handrail doubles up to combat deflection where it has to span a longer distance. Finally, stair-beams deepen where their length increases. Instructed observers, noting the difference between double and single handrails, deep and shallow stairs, or single and multiple cables would understand structural principles of stiffness, moment and the limitations of material.

As previously stated, technology of architectural structure is particularly appropriate for this program. Montessori’s life work underscores the greater comprehension students achieve by interacting with their physical surroundings. Adolescents, on the cusp of entering society, must grasp real world applications and the technology used by their culture. In so doing, young adults have the opportunity to realize their potential and make a valuable contribution.

The tectonic interventions of this design act as one element in the Montessori system of a total didactic environment.
60. Draft of presentation boards, showing architectural manipulatives along the top datum and the interaction between old and new elements in the main collages. Supplementary drawings line the bottom of the boards.
ILLUSTRATION CREDITS

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APPENDIX I: INTERVIEW TRANSCRIPTS

Interview Questions A

- Name of school
- Name of teacher
- Number of students
- Age range of students

- How strictly is Montessori Method followed here?
- What sorts of physical needs do children of this age require? In light of Montessori? How is this manifested in this room?
- What elements in the room are movable or adaptable? By the children? What about in the school? How often are they moved? What improvements might be made?
- How is the hallway used as an extension of the classroom? As a zone of negotiation?
- How does Montessori translate into architecture? What sorts of architectural needs does Montessori Method require? What does the Method suggest about the physical environment?
- North Avondale and other schools are building new facilities: How pleased are you with the new Montessori building? How should a Montessori building differ from a traditional school building?
- I am specifically interested in movement of people and of architecture, and also, how users may change and engage their environment to better suit their needs. How do you think this relates to Montessori? Do you have any experiences that suggest that this would be beneficial?

Interview Questions B

- Name of school
- Name of teacher
- Number of students
- Age range of students

- How strictly is Montessori Method followed here?
- What sorts of physical needs do children of this age require? In light of Montessori? How is this manifested in this room?
- What is the prepared environment? How can the prepared environment extend to the architecture?
North Avondale Montessori
Rein Forrest, interviewed 10/10/08
28 students in homeroom class
11 fourth graders (9- to 10-year-olds), 9 fifth graders (10- to 11-year-olds),
8 sixth graders (11- to 12-year-olds)
She also teaches an additional 14 sixth graders from other classrooms. They come into her room to clarify assignments, so there are interactions outside of class time.

How strictly is Montessori Method followed here?

I think you have to compare private and public schools. Private Montessori schools tend to be accredited through the Association Montessori Internationale (AMI) or the American Montessori Society (AMS). This accreditation is not followed as much in the public system. We also have meet standards set by No Child Left Behind and the state. We have multiple intelligence assessments. Because we have to meet these benchmarks, the public system sometimes contradicts Montessori. Montessori recognized a synthesis of multiple methods of understanding. In our society, there is only one—a test, but Montessori pedagogy recognizes many ways of assessing understanding—dance, drawing, a report, a presentation.

Montessori uses a spiraling curriculum, which instills a deep understanding that continues building from year to year. The public system tests on a wide sweep of unrelated concepts. The teachers must comply, so there are some things we must do and there are other areas where we can follow the Montessori philosophy and lessons.

Different teachers have different experiences in Montessori. A teacher who has less experience with Montessori and has training primarily in traditional methods will find it easier to compromise with the public requirements. So, within this one school, there are different methods.

What sorts of physical needs do children of this age require? In light of Montessori? How is this manifested in this room?

Montessori emphasizes the prepared environment, so there are considerations that precede the entrance of the kids. I set up furniture and place the materials on the shelves. I consider pathways and how the traffic can flow so that students can get to the shelves without disturbing students working at their desks.

We had to decide between tables and desks with storage for the students. I went with the desks with storage in order to keep the space tidier. There is one table, but I chose very organized students to sit there and they
keep their work in containers under their chairs. I also had to consider the grouping of the desks and the students. The table in the back is available for group work and experiments. Most students work on the floors. Sometimes I work at the table with the kids, so it’s not just a teacher’s table, it’s a teaching and student work table.

The placement of the computers was limited by the location of the plugs. There are a minimum number of outlets in here. There is no a/c, so we had to have fans running during August. The new building will have a/c. We need tall shelves to hold equipment and materials. There’s no television in here now, but I used to have a TV with a VCR and it was also connected to the computers to show things online.

I also need hooks to hold maps and overhead projector screens. We use bulletin boards to display the kids’ work. For example, they did cave drawings while learning about early humans, and we did circle analysis art, in which they divide circles into six equal parts, while studying the Babylonians. If the students write poetry, I will cut the paper to fit the poems and mount it on attractive card stock. The students draw illustrations for them. I present their work in the hallway for people to see.

I have to make sure the students are organized. We were just performing a geometry lesson. The students trace the geometric shapes, but they have to draw the angles with very sharp pencils, so they can measure them with a protractor, later. If this isn’t done precisely, the lengths will be off by millimeters and the angles will be off by degrees. So there is a great degree of physical discipline in order to achieve the learning goals.

**What elements in the room are movable or adaptable? By the children? What about in the school? How often are they moved? What improvements might be made?**

The desks are movable and we do move them back for large group meetings in which we need a large group space. The desks are units, so that makes it easier. We’ll also move the tables back, then. The shelves are on wheels, for example the science and language shelves. We could have sliding shelves. I would like a wipe board that pulls down, or even comes out of the floor. I like wipe boards because they are more visible for the kids, especially when I’m color coding.

**How is the hallway used as an extension of the classroom? As a zone of negotiation?**

The sixth graders were just working in the hallway on an early humans presentation. One group of fifth graders was working on another project, too. They had to move out there and they couldn’t collaborate loudly because
the other students in the classroom had to complete assignments. They were practicing oral presentations with props.

*How does Montessori translate into architecture? What sorts of architectural needs does Montessori Method require? What does the Method suggest about the physical environment?*

There is preparation of the environment and of the instructor. For example, AMS and AMI have guidelines about certain amounts of tiled floor for working with water, and carpeted floor for sitting on the floor. There are also guidelines about square feet per child. There is a lot of color coding in Montessori. This helps with the organization of work, but also many children are visual learners. We color code the folders, for example math folders are red, language is blue, social's yellow, and history's black or yellow. The containers are also color coded: green for botany, red for zoology, blue for geometry, and rattan or white for language. The math manipulatives are also color coded. The units [ones] are green, tens are blue, hundreds are red. These associations of green, blue and red are carried through as the kids progress in math. We also color code with grammar symbols. Many older kids still think of verbs as big red balls. The children are constantly asked to look for patterns in their work.

*North Avondale and other schools are building new facilities: How pleased are you with the new Montessori building? How should a Montessori building differ from a traditional school building?*

A traditional school doesn’t have as much furniture in the space. I even pay for a storage unit because I don’t have enough room to store all of the Montessori materials I’ve collected. I rotate materials out to introduce new items. Montessori teachers have a portfolio of materials that are their own. I have some lamps in the unit and I would like some soft lamp light at times. Right now, we only have fluorescent lighting in here. Sometimes I use music as signals for change of activity. We also use music for creative writing. Montessori teachers, here, also buy the rugs and pillows for sitting on the floor and they clean them themselves. One of the teachers has a low, Japanese-style wooden table for kids to use while working on the floor. That seems like a good idea.

A single workspace for kids with ADHD helps, since they get distracted. I also have other students with sensory integration issues and they work with an occupational therapist. Another student has dyspraxia, which makes handwriting difficult. For longer writing or tests, they will speak into a recorder and dictate to a scribe, an intervention specialist.

I also need containers to put things in. I usually end up buying many
items, myself. We could use flat, horizontal storage for charts and large posters. The decimal checkerboards need vertical storage. Peg boards could also be used for storage. We need places to keep supplies. We have learning materials that come from the district. Montessori requires a lot of storage for the materials. We need mailboxes for the children in the classroom. We have paper and colored pencil supplies, measuring equipment, and presentation materials. Storage could be in one place for all of the teachers, or in the individual classrooms.

We also keep cleaning materials like a broom and dust pan. We’re also required to have hand sanitizer to reduce the spread of germs. We even have to store respirators and masks. We have a new committee that’s organizing materials in case there is a pandemic. In Montessori, the children take care of the environment as much as the teachers. There are routines and rituals that are important. For example, when it rains outside, the students know to leave their muddy shoes in the hall underneath their coat hooks.

The new building will have wipe-off boards and not chalkboards. There will also be tall shelves for storage. It will fit some of our needs pretty well. We’ll have some outdoor space for botany. It would be great to have a garden space with raised beds so we could grow our own food. Montessori thought older kids should be encouraged to have businesses and farms. There is a school in upstate Ohio or Pennsylvania called the Farm School that does this. There’s also another one in Maine. Middle and high school programs should emphasize business, self-sufficiency and farming. Clark Montessori had beehives on their roof, but they’re in a swing space since they’re moving to a new building. Clark also used to have a bike shop. They’d get old bicycles and renovate them and then the school would reward younger students with a bike, for perfect attendance, for example.

I am specifically interested in movement of people and of architecture, and also, how users may change and engage their environment to better suit their needs. How do you think this relates to Montessori? Do you have any experiences that suggest that this would be beneficial?

There is some strain on the teacher’s body from sitting on the floor for long periods of time. I do yoga to stay limber, but other teachers use chairs for their knees. So the teacher’s body is a something to consider.

In the new building, we’ll have a science room, but there were funding issues. It’s a shared space and the stations are shared by all of the classes. Each station has storage space for teachers to keep materials there, but we have six stations and eight classes. I’d like to have my materials where I teach. So, the new building already doesn’t work for us and the environment won’t coordinate as we grow and change. It would be nice to have flexible space, like learning centers that aren’t designated classrooms, but can be shared by a
pod of multiple classrooms. This way we don't have to use hallways. Pleasant Ridge is already using their learning centers as classrooms because they're too overcrowded.
North Avondale Montessori  
Nico Dimarco, interviewed 10/14/08  
25 students in homeroom class  
7 first graders (6- to 7-year-olds), 8 second graders (7- to 8-year-olds), 10 third graders (8- to 9-year-olds)

How strictly is Montessori Method followed here?

It varies from teacher to teacher. Montessori philosophy uses cosmic education to guide this group. Cosmic education emphasizes how we’re all connected. The fundamental ideas of cosmic education are the underlying current for six- to nine-year-olds. It teaches how we’re all connected and fosters community in the class. We also teach in small groups.

I have the least amount of furniture of the nine teachers for this age group. The district said we had to have 25 students to have an assistant. We also increased the number of students per class because one of the teachers was moved to the new Pleasant Ridge School. We lost students to Pleasant Ridge, so they’re pretty crowded now. The fact that we were moving to a swing space while our new school is built turned some parents off.

What sorts of physical needs do children of this age require? In light of Montessori? How is this manifested in this room?

They need space to lay out work rugs. This space is bigger than what we had before. Those rooms were square and smaller. We need a sink for science and art and this area has to be tiled. We need carpet for being on the floor. Storage is important. The aim is to prepare the environment because you don’t want materials piled up and disorganized. At the Xavier Montessori lab, they have a little area for students to store their work. It’s not visible to the classroom, so it’s okay if it gets a little messy.

I would like to have animals and living things, like fish, in here. We’re a little cramped in here because there’s too much traffic in the halls to have coat hooks in the hall. The coats take up space in the room.

Low bulletin boards are useful so students can see assignments and I can post a work plan for them. The students have different assignments at different times and they work through them.

It’s important for students to work on the floor because the materials are often too large for a desktop. The materials can take up a lot of space, for example the geometric objects are unwieldy. The work rug delineates space and gives them a sense of order on the floor. Being able to move about each other gives them a sense of movement and body control. When they are working the whole floor is filled with rugs, so they have to be careful and concentrate on their movement. Sometimes the students sit at the curved table, but being
on the floor allows for more than five students to work together, which is
typical. For example, we were doing a demonstration for eleven third graders
on timelines, before.

Some kids want to have a seat because they equate it to being big kids.
Sometimes kids fall asleep on the floor and some kids can’t sit a certain way
for too long. They’re allowed to have their shoes off as long as they are doing
their work.

Changing a student’s behavior depends on the student. Sometimes it’s
enough to just look at them or say their name. Sometimes I model appropriate
behavior or work with the student or talk to the student or even the parent.
Also, having the kids for three years helps the kids and their parents understand
expectations. We will monitor to make sure activities are being done correctly,
and they are sitting and working. Proximity or tapping their notebook can do
it, a subtle gesture. This morning I had three students near me while I was
teaching someone else. It can help them to focus and gain good habits, if they
are just near the teacher.

What elements in the room are movable or adaptable? By the
children? What about in the school? How often are they moved?
What improvements might be made?

We should be able to move the furniture if we need to, for example for
testing. I would like more modular furniture, like the Xavier lab preschool.
They have a routine of moving furniture. I think that’s good for kids to change
their environment. This furniture is too heavy. We do move the rugs.

How is the hallway used as an extension of the classroom? As a
zone of negotiation?

In the old school, we were in the modular buildings and the students
used the end of the hallway to lay out the timeline of life, to practice a play
or skit, or to converse quietly. They only used the end of the hallway because
that was away from the bathrooms. Here, we can’t use the hallway because it’s
so traveled. One teacher has a desk outside her class door and students who
are misbehaving sit there and write a reflection on why they did something
wrong.

How does Montessori translate into architecture? What sorts of
architectural needs does Montessori Method require? What does
the Method suggest about the physical environment?

Students need lots of natural light and windows. There should be
places in the room for storage and a water source, a sink. At Clinton Springs [the old site] there's a wooded area with places to sit outside and teach and a hiking trail. Clinton Springs Gardens are nearby. The trails come up into a field. All of this is still on school property. Outdoor education is a wonderful addition and almost a luxury.

**North Avondale and other schools are building new facilities:** How pleased are you with the new Montessori building? How should a Montessori building differ from a traditional school building?

The new architects had a huge concern about carpeting and allergies, but we need it and we need a water resistant area. We need shelves. The heating source on the new plan was causing a conflict with the shelves, so that was a problem. We need windows to be high enough so shelves don’t block them. We also need an open space. In the modular buildings, there was an extra room that we used as a common area for films and presentations. Sometimes these areas are called learning centers.

**I am specifically interested in movement of people and of architecture, and also, how users may change and engage their environment to better suit their needs. How do you think this relates to Montessori? Do you have any experiences that suggest that this would be beneficial?**

A movable wall system would be great for classrooms that do teaming. The nine- to twelve-year-olds and six- to nine-year-olds do teaming a lot. One section could be open a little to allow movement of students back and forth. We could open it up more to move furniture. They could block some sound from one side to another.

Hand movement helps kids to learn things. It incorporates more senses and the body. It's common especially in math. They use materials over and over; repetition helps them to internalize a concept. This activates different pathways that are connected, rather than looking at paper.
North Avondale Montessori
Heidy Davenport, interviewed 10/14/08
24 students
9 preschoolers (3- to 4-year-olds), 14 kindergarteners (5- to 6-year-olds)

How strictly is Montessori Method followed here?

We follow Montessori quite strictly. Well, as much as we can. It was started 100 years ago. Montessori was advanced; she would’ve changed with the times. So, we have to improvise to fit the times. We have to encourage students to use the red rods and the pink tower. Each block is one trip, so to put it away, that’s 20 trips all together. That’s hard for them because everything’s so fast now. Just look at the Disney channel versus Mr. Rogers. Mr. Rogers was much slower paced. We don’t want them to hate what they’re doing. When they come into this style of learning, they have to slow down and they’re not always ready. We still have to follow the child’s pace; that’s what Montessori did.

There are also the Ohio standards and we have to teach those through the Montessori materials we have, or make up materials, for example clocks or banking materials. Montessori didn’t have many language materials, for this age group, besides the movable alphabet and sandpaper letters. Those work well because three year olds are really into tactile things.

What sorts of physical needs do children of this age require? In light of Montessori? How is this manifested in this room?

We just received a girl from a Catholic school that had to sit at a desk all day. Kids this age need to move—within guidelines. She looks happier, now. Their fine motor skills are developed through the practical life materials. Everything goes from left to right to get them ready for reading. The materials prepare the fine motor skills for writing. The pink tower has to be moved to use it, so that allows for movement. It is also strategically placed in a tight spot where it might topple, so the children have to be careful walking by it. It takes body control to walk around other children’s mats. They have to be careful and respectful around other children’s work.

They’re allowed to work at tables or the floor or a lapboard. I put a low table by the coats because I couldn’t find space for it, but the kids really like it because it’s a nook and quiet. The coats seem to absorb some noise. I considered putting the coats in the hall because I don’t like the clutter or extra stimulation, but it works so far.
What elements in the room are movable or adaptable? By the children? What about in the school? How often are they moved? What improvements might be made?

The children can move certain chairs, but not a work table chair. They can’t just take a chair from any table. They’re allowed to move small tables. They don’t really do it, though. I change classroom materials every month for practical life, science, geography, painting and the water area. I put out new media.

How does Montessori translate into architecture? What sorts of architectural needs does Montessori Method require? What does the Method suggest about the physical environment?

For the children, they’re allowed to build with blocks. They can use the red rods and make a maze from them. In the artwork, they can use popsicles and cardboard to build. They have freedom to do projects; we don’t tell them what to make. I put out play-dough first and then clay later. The clay takes more effort because it dries out.

I would like a space that’s for the teacher, only. In the Montessori classroom, the children weren’t supposed to see adult stuff. Right now, my desk is right out there. I want my own space that’s in the room, but separate. Low windows would be nice, so the children can see out and clean. [Nearby, a child had been cleaning some of the low windows in the hallway. Davenport points this out.] Do you notice that she doesn’t clean the ones that are already clean? Care for self and care for the environment are important in Montessori. It would be great to have doors to the outside to garden, to plant and water things, to study the roots of a tree—something like a room outside of the room. It could have a door from the classroom, so that it would be just an extension of the classroom. We would know there were three kids out there watering flowers, but they would be safe. I know this is hard in a city, though. The new building will have a green roof, but I don’t know if it’s occupiable.

It would be great to have a yoga room and movement room. They do need to move. We do yoga and they really like it because they can still talk. It would be great to have a bathroom close by. If one of them has an accident, we can be there faster. Two sinks would be ideal. When fifteen or twenty children have to wash their hands before lunch, it’s hard for them to wait. It’s a good lesson for them to wait, but it’s a long task. If the bathroom was nearby, it could have a pedal sink so many kids could gather around it.

North Avondale and other schools are building new facilities: How pleased are you with the new Montessori building? How should a Montessori building differ from a traditional school building?
We dreamt for a year out loud and built models. It seems that all along, the architects already had a set plan, though. So, it’s hard for me to say that I’m happy with it or not.

Montessori rooms ideally would have green space nearby. There should be more mobility room and more shelving because we’re constantly making materials. I keep some of mine in the basement and every month change out three bins of materials. Things are supposed to be beautiful for the children to attract them to it.

Some schools have lines to follow in the hallway, like the line in the classroom. The hallway walls were purple and green before we moved in. The teachers weren’t looking forward to coming [to the Burton School swing space] because the halls were so dark, like a cave. Employees from GE painted the walls off-white to brighten the hall. This calms the kids and brings attention to the Montessori materials and their work. We want to wow them and keep their attention, which is kind of hard now. I can’t imagine working in a traditional kindergarten and teaching them with a book. It is easier to keep their attention with physical materials.

I am specifically interested in movement of people and of architecture, and also, how users may change and engage their environment to better suit their needs. How do you think this relates to Montessori? Do you have any experiences that suggest that this would be beneficial?

I don’t like movable walls for this age group. Kids really need consistency. They don’t need a wall to move for them. They knew it was there, before. If we don’t do group time, for example, they wonder what happened to it. It throws them off and affects their behavior. It might depend on the clientele, but some of these kids have a lot changing in their lives.

It would be nice if we could work near the six- to nine-year-olds. For example, if a child is really advanced they could just walk over. It would be more of a community relationship.

That’s all we do in here is learn with our hands—to develop minds and hands for writing and reading. My kids worked with the math materials, when they were younger, and now they understand multiplying in the thousands. They understand the thousands are really heavy and they have to be careful with the units because they’re so tiny and they can get lost.

I put a heavy pumpkin in the washing area so the children would need to use their hands or ask their friends for help using their communication skills. It teaches them success and failure and coming up with a solution. I try to have them help each other instead of asking an adult. They learn it’s okay if they can’t do it because we’re all friends.

[While we’re talking a helicopter flies overhead searching for a kid who wandered outside.]
Security for kids who might get outside and lost is important. If children have too much space, it might feel like a gym. We want a bigger space, but not too much, so they don’t feel like they have free reign.
Clark Montessori High School
Dean Blase, interviewed 11/21/08
Classes of 22 students, 80 total
11th and 12th graders (16- to 18-year-olds)

How strictly is Montessori Method followed here?

Maria Montessori never fleshed out ideas for adolescents, but there are core principles that we do follow: respect, community, learning, hard work, and peace. These are based on Montessori’s work.

We made some decisions about the structure of the program. For example, the teachers serve as the guidance counselors and advisors. We also have an annual camping trip in nature, which is especially good for the urban kids. We were hoping for a greenhouse to be integrated, but that didn’t happen.

The classrooms are universally connected to real life experiences. In other words, how is this going to serve the adult? For example, we don’t teach students to write literature analyses so they can do well in college; it’s so they can solve big issues in life and so they can feel comfortable reading as adults.

We are committed to field study. Students go on two week intercessions twice a year and they go study an area of interest in the world. For example, one group of students went on an intercession to New York City and learned about the fashion industry.

Cincinnati has a high school Montessori training program—one of only two in the country. It’s called CMSTEP (Cincinnati Montessori Secondary Teacher Education Program) and they adapt early childhood methods to older students. Teachers have to do this training within three years of teaching at Clark. Teachers come in and share how they’ve adapted methods and then other teachers offer advice and critique.

There’s a Montessori high school outside of Cleveland, called the Hershey Farm School, and it was built specifically to address Erdkinder. One of the Hersheys was sending his child to Montessori day school and decided they wanted to make Erdkinder real.

I get teary eyed thinking of sending my daughter off. I like the urbaness of Clark. You can’t leave kids in nature all of the time. Montessori started off teaching street urchins. It is important to get out to nature and then return to society, so you don’t become a hermit. Nature is instructional, but it’s not the end goal.

What sorts of physical needs do children of this age require? In light of Montessori? How is this manifested in this room?

Some students are not natural readers. They hear talking and get
distracted. It would help if they had a cubby space or something partitioned to help them focus.

We cut a hole in the wall with a masonry saw to connect the adjacent class with their teaching partner class. But there are noise issues, especially when there’s multiple groups—some quiet, some loud. There’s a lot of simultaneous use: lecturing, reading, and building. All three happen at the same time and require different sound levels and types of focus.

Kids also need cubbies for self-guided assignments. They pull out forms with activities and then complete them individually. These cubbies should be attractive. The prepared environment is set up so kids can come in and work independently. We have a box filled with materials relating to a book. These lessons can be transformative, much like the Great Lessons in the Cosmic Education program for the second plane of development [6-to 12-year-olds]. I also have a reference section for learning how to cite things, like the MLA dictionary.

*What is the prepared environment? How can the prepared environment extend to the architecture?*

As a teacher, trying to create the prepared environment allows students to come in and feel like they are doing all the learning. It’s about making the space work for the kids, setting up stations, activities, things, references, objects.

We hope the architect makes it easy for teachers to prepare the environment in as many different ways as possible. For example, the four walls could be cubbies. There could be a knoll space or small focus area. Different seating options would be provided, such as sitting on the floor or outside chairs. There would be sound control and bins everywhere.
Clark Montessori High School
Anne Delano Steinart, interviewed 11/21/08
Classes of 22 students, 94 total
80 homeroom 11th and 12th graders (16- to 18-year-olds)
14 elective 9th to 12th graders (15- to 18-years-olds)

How strictly is Montessori Method followed here?

I was trained as an experimental educator, not as a Montessori teacher. I have an understanding of it, since I went to Montessori up to third grade. I am new to Clark, so I haven’t had time to adapt to Montessori. In Clark, the upper grades are intact, more like a traditional high school. It feels different from the 7th and 8th grade communities. Students feel a sudden shift from multi-aged classrooms. Clark should be a multi-aged classroom school, but it isn’t so much and this probably has something to do with testing. There should still be communities, though.

In high school, it’s more content based, rather than value based, such as learning for learning’s sake. Kids think they’re “going to be graded” or “going to lose points” and that’s terrible from the teacher’s perspective.

What kids need is a real sense of wonder. Find a way to generate wonder and nurture it—that’s what high schoolers need. Maybe they can’t always be running around and investigating, but what if the environment wasn’t always what it seemed and had a sense of discovery?

What sorts of physical needs do children of this age require? In light of Montessori? How is this manifested in this room?

We need to sit in a circle to have seminar discussions and sitting on the floor is important, but we always lose something with different configurations because the rooms are small. It would be great if we could push the table into the floor, but it would have to be an easy transition because the transitions are where instruction falls apart. We’ve moved the tables around. They used to be in small groups, but you can’t move them easily during class, so we don’t move them often. In this room, we have a little space with a couch and chairs to have small group meetings.

Sound is an issue. In a classroom, the person who needs silence sets the tone of research times.

Sensory stimulation is an important part of Montessori. Students here get a lot of cognitive stimulation, but they’re not engaged in tasting, smelling, touching, listening. Explorations get boiled away down to the verbal.

Kids this age like to stretch out a lot, move around and put their feet up. Their bodies are big and they need to stretch. We have a huge problem with kids putting their heads down. Chairs should be comfortable, but help
you stay awake. If kids intrinsically are engaged and felt a sense of wonder, then maybe this wouldn’t be a problem.

**What is the prepared environment? How can the prepared environment extend to the architecture?**

We need lots of storage. Each kid should have their own cubby. We don’t have any place to put lost items. Students need a place to put coats and book bags.

Based on hearsay, it sounds like we don’t have enough multi-purpose space in the new Clark High School building. It’s very tightly programmed and there’s no flexibility.

There should be a blurring of the line between inside and outside, as well as practical experience, for example a pizza oven and farming space.

Of Clark’s five values, peace is the one that kind of gets the shaft. Maybe there’s a way to facilitate both internal peacefulness for one’s self and group conflict resolution. There could be little solo spaces with built in chairs for meditation and independent study and a conference center where students could work conflicts out. If that could be expressed in the architecture, that would be ideal.
What do you think it might mean for the prepared environment to extend to the architecture?

Montessori did speak of direct access to nature or to some sort of garden classroom. It’s important for children to be able to study plants and nature, and also for them to take care of living things. Ideally, all classrooms would have access to an exterior garden. These outside areas could be social, too. Groups could work on projects together. Montessori wrote a book you might want to look at called, *Spontaneous Activity in Education*. The environment should foster that.

There should also be an emphasis on natural materials. Pastels would be preferred over bright colors. There shouldn’t be vibrant colors in a school room because they are distracting, not peaceful. To a certain degree, the room should recede, so students can focus on their activities. This is a countercultural idea for us because most schools and books have bright colors. If you try to buy a toy in this country, for example nesting cups, each one would be a different color. Montessori materials are all one color because Montessori tried to limit differences. In that example, it’s not a color exercise, so the color is distracting from the fact that each cup is a different size.

What sorts of educational materials did you have in your classroom?

Practical life exercises are very important for young children; these exercises teach them how to care for their environment. We had a sweeping exercise and it was limited in the beginning. They started by sweeping into a square on the floor and then later sweeping larger areas.

Again, it’s important to have teaching materials made from natural materials. Reduce the amount of plastic. We liked to have woven baskets for holding material because the students could see variation in the different basket weaves. Children are often limited in their exposure to ceramic and glass, but we would have those materials available. If you use a glass and clean it, you can tell when it’s clean because it sparkles and is pretty. Children also learn to be careful and learn material qualities, like weight, of different materials.

We also had Montessori bells, and these were very special and expensive. They were beautiful and perfectly made. Visually, they all looked the same.
size, but their weight was different and that’s how they had distinct tones.

Later on, I started to bring in local wood as an activity. It was an exercise involving matching samples of local woods, such as cedar, pine, fir. If you were to apply this in the architecture, you could have one kind of wood in one place and another in a different place, so children would be able to understand and eventually match or identify. Of course those woods are specific to Washington state and something different could be used somewhere else. You could use whatever is specific to that place, like tile or stone.

**Why are natural materials important in a Montessori application?**

Natural materials have more soul. A rock is a rock and there’s not going to be another one like it. Each one’s a little different. Handmade baskets have variation, too. The grain of wood color in the floor varies because the planks come from different trees.

It’s important for young children beginning their education to see how people have used thing from nature to help them. Children in cities don’t have experience with these things. They see very few beautiful baskets. They don’t walk on wood floors, they walk on synthetic rugs. Most kids are given plastic to use, but different materials are stimulating. Betty [my co-teacher] had fabric swatches spread out for children to match. There was wool, tweed, felt, velvet. They would match visually and then do it with their eyes shut.

**How do Montessori classrooms use the floor?**

The St. Nicholas school in England, where I was trained, discouraged permanent rugs on the floor, which is interesting because you usually see that in a Montessori classroom. They would have tile or wood on the floor. If students are moving chairs on a rug, or walking on a rug, they may not notice the sound or movement they are making. Kids are more careful when there isn’t a permanent rug down. Students would unroll a mat to work on and also have another mat to sit on. We also had low tables and small benches for them.

**What else does a Montessori classroom need?**

Every room needs storage for all of the materials, both accessible by kids and not. Some things you don’t use all year long.
TECTONIC INTERVENTIONS
APPENDIX II: DRACH'S CONSTRUCTION DOCUMENTS

Original drawings of Woodward High School (SCPA), by Gustave Drach, provided by the Cincinnati Board of Education.
TECTONIC INTERVENTIONS
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