Move Detroit: An Active Class Space Intervention

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According to the National Center for Environmental Health the built environment directly influences a person's level of physical activity. [1] The Center attributes the absence of particular elements that support the presence of bicycling, walking, and other leisurely physical activities as contributing to sedentary habits, habits that the Division of Emergency and Environmental Health Services relates to a range of diseases and aliments including obesity and diabetes. [2] Our collaboration is a direct engagement of this understanding and positions professors in architecture and kinesiology with educators and wellness specialist in determining new trajectories in creating physical challenge through architecture. Our partnership situates an understanding of these findings into domestic and institutional settings, and discusses everything from the furnishings of a single classroom to the civic infrastructure connecting home and school. The primary result of which is an "Active Class Space" that studies educational conditions germane to the greater Detroit Metro.

A CONVERSATION IN REVIEW

Conversations can be complex. In particular, research conversations that examine the varied states of healthy as physical or mental activity of the human body can be overtly complex. The comprehension of ideas across disciplinary vocabularies can be easily lost as it is with most concepts framing the objectivity of architecture. Although the interactions of the human body with surfaces are defined, the increments and variation that define a range of health metrics from varying disciplines can be so convoluted, as they seemingly rewrite the definition of architecture's capabilities in many regards. This is due in part to the contrast in fields such as Public Health, Education, and Architecture wherein the differences between Health and Healthy can be addressed in very distinct and peculiar ways.

In reviewing the various policies and methods for implementing a standard for physical exertion as an example, the disciplinary differences are dependant on perceptions of nurturance versus neglect, and pose unique quandaries for what each participant perceives as their respective ability to sustain or deter one or the other. It is also between these various capacities of absence or attention that this body of work in Architecture begins to bridge its applicability with the interest of the participating disciplines, interest that are primarily physical but also have the capacity to address medical, emotional, and educational problems as well.

In assessing the conversations we have had thus far, the first assumptions did not always situate Architectural Design in a catalytic role. Sometimes architecture is supporting the processes and relationships that constitute learning environments - as most public schools adhere to guidelines beyond those attributable to building codes and regulations. The totality of this work therefore is the catalytic bridge that integrates the disciplinary agency of architectural form with public health, science, and elementary education curriculum research towards proactive thinking about how child activities in educational institutions addresses issues of obesity as a form of environmental neglect. By establishing parallels across disciplines this research investigates how kinesthetic research into increment and intensity of physical activities evaluates a body of architectural work, directly informed by the collaborative discourse and serves as an evaluation of prototype designs for educational environments.

SUSTAINED EXERTION

Within the last century the role of the architect and definition of architecture have evolved in how they relate to the welfare of individuals in the built environment. The incorporation of health and its corresponding formal definitions, in particular healthy living within civic and the institutional infrastructures, introduces multiple specialties that require extensive disciplinary support. More challenging is when these structures meet contemporary obstacles not previously considered along their traditional boundaries. The feasibility of physical activity as a sustainable building component is one such challenge, wherein the criteria for spatially attributing the aspects of physical activities to a building directly influences the coordination and planning of activities and the materiality of surfaces surrounding them. The plausibility of

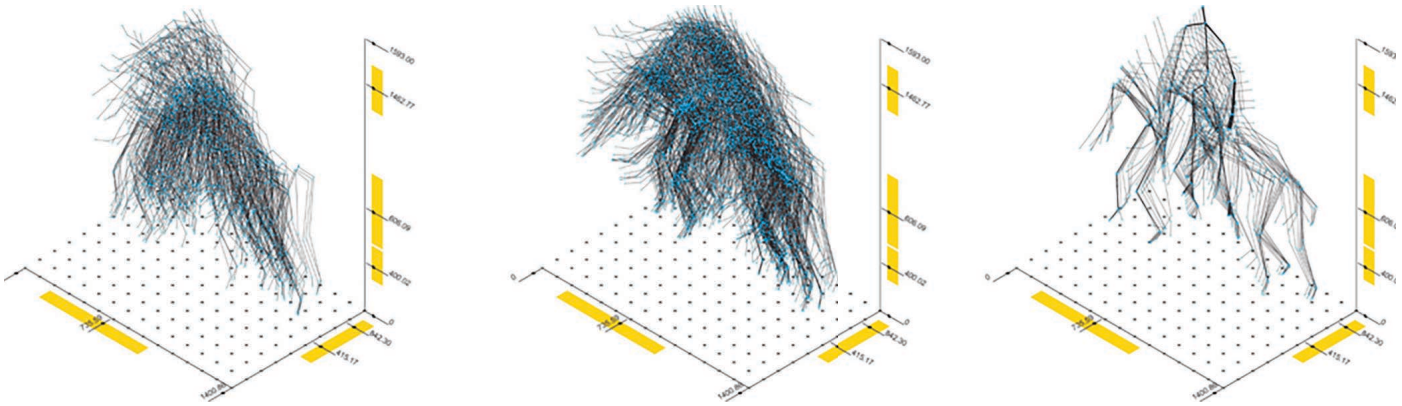


Figure 1: Mappings of vertical and horizontal displacements using motion capture to articulate movements from the compendium of physical activity.

such a notion establishes a basis for this discussion, a discussion that an architect is inadequately presupposed to handle alone.

By definition physical health frames a variety of wellness related issues, including those that are either behavioral or environmental, encompassing the frequently used term "healthy." This research includes components of the term "healthy" that are more commonly associated with leisurely physical activities referencing spatial studies of endurance, agility, and directional displacement. By focusing on the spatial optimization these three components, endurance, agility, and directional displacement, the interpretive studies include a formal stratification of key factors, such as flexibility in the direction of achievement, variety of utility, and incremental physical challenge. Expanding the understanding of built elements as apparatus' for exercise and recovery when assessing physical systems of wellness in architecture.

Preliminary studies of the human body in motion yielded a means for chronicling spatial displacements based on varied levels of exertion [Fig. 1].[3] These diagrams contributed to the analysis of parts of elements categorized by how they encouraged physical displacement or interacted with the displacement, as a direct line of travel or fixed engagement, and when set at differing heights and angles [Fig. 3]. The physical aspects of this research used a compendium of categorized physical activities in understanding the relatedness between the human body and its variability in movement based on the shape, size, and location of interactive elements. It was through the development of spatial requirements for these activities that many of the nuances of the proposed devices and elements formed based on their ability to afford seamless transitions between sedentary body positions and physical activity breaks with minimal change to the educational settings. It was through these intentions for the early prototypes that our team began to question whether architecture, as a comprehensive interior and exterior condition, could directly aid in the prevention of obesity.

TABLE 1 [Fig. 3 and Fig. 4]: Compendium of Physical Activity [4]

02101 2.5 mild stretching
03015 6.5 dancing, aerobic general
07075 1.0 inactivity light meditating
09055 1.5 sitting and talking

12010 6.0 jog/walk combination
12020 7.0 jogging
12040 9.0 running 5.2 mph

15535 11.0 rock climbing, ascending rock
15552 8.0 rope jumping slow
15610 7.0 soccer, casual,, general
15711 8.0 volleyball, competitive in gym
15050 6.0 basketball, nongame, general
15040 8.0 basketball, game
17152 2.5 walking 2mph slow pace firm surface
17180 2.8 walking down hill
17160 3.5 walking for pleasure
17200 3.8 walking 3.5mph, walking for exercise
17210 6.0 walking 3.5 uphill
17110 6.5 race walking
17231 8.0 walking 5.0 mph

INDUCED ACTIVITY

Exercise and play during recess or gym class are the resolute mediums for physical activity in early adolescent education. While these mediums are particularly useful in the maturation of their behavioral skills, they are often limited in providing cognitive skill sets, which remain isolated to classroom activities. The institutional and disciplinary practice of separating activities often facilitates reductions in the number of minutes per day that children engage in recess or gymnasium activities when performance criteria are not met. It is these reductions in the time allotted to being physically active that the White House interprets as directly related to increased obesity rates in pre-adolescents over the last decade. [5]

The project thesis surmises that existing space in schools is under utilized in providing adequate physical activity at an increment equivalent to sedentary activities, and that by incrementally offering conditions for learning and physical activity to simultaneously function, we can decrease the obesity rates of pre-adolescent children. We began by assessing the prevalence of sedentary learning conditions within the classroom, hallway, and auxiliary spaces of participating schools through the physical planning of activity breaks, both in and between classes.

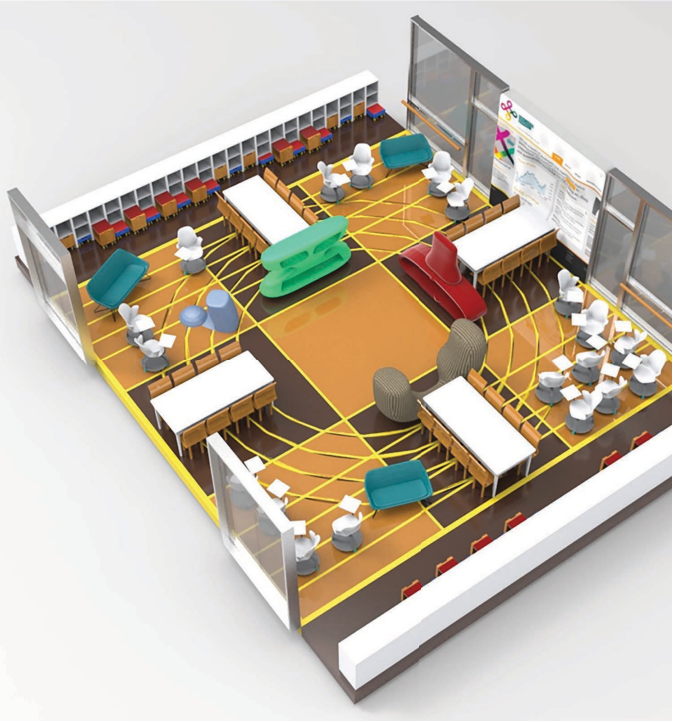


Figure 2: Proposition for Active Class Room modifications to furnishings and walls in existing classroom space.

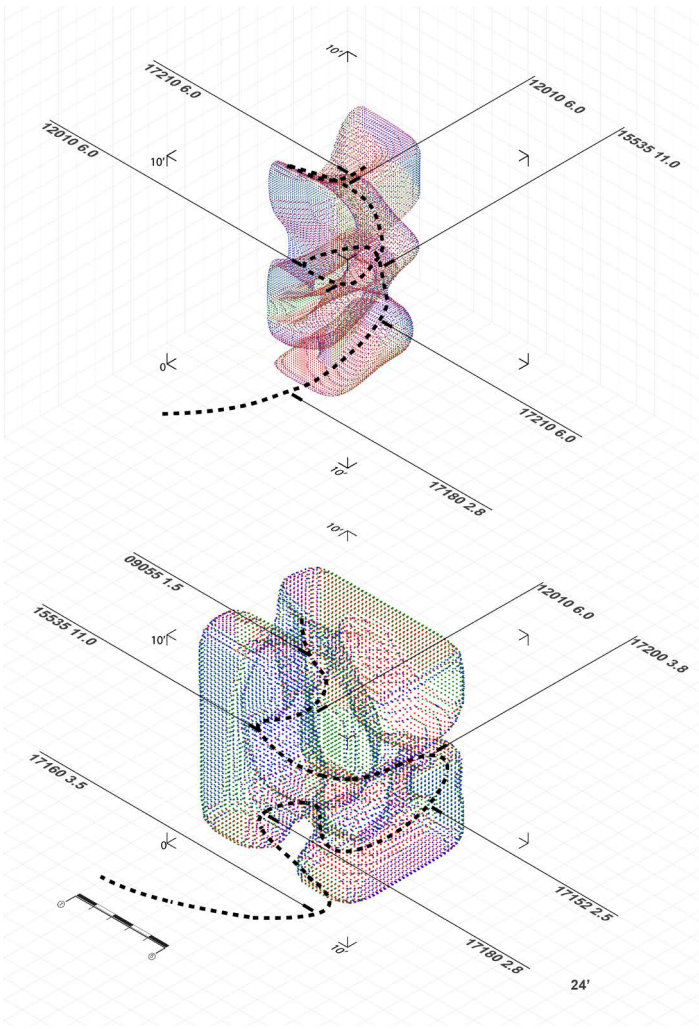
The Kinesiology team developed an iterative approach to achieving the suggested allocation of 30 minutes of physical activity for our adolescent cohort through a series of 3 minute breaks scheduled throughout the day, which served as the generative means for developing architectural ideas initiated from our conversations on the spatial affordance of physical activity in the classroom. Simultaneously, the projects conceptual ideation advanced through three phases. The first two phases queried the capacities of modifying the existing conditions through existing and new furnishing layouts, and the last sought to investigate how previous findings influenced the development of a new building proposition.

The first conversations with teachers actively discussed the position of the children during the activity breaks against their preferences for the classroom's orientation and management of behavioral issues, demonstrating how physical distancing between objects (desks, chairs, storage) and participants during the activity breaks influenced the level of participation, and warranted reconsiderations of the arrangement of furnishing in the classrooms. Quantifying a variety of small and large movements associated with specific physical activities, such as low (stretching to light walking), medium (moderate walking and stationary activities), and high (climbing, jumping, running) in developing arrangements of furnishings that facilitate collective physical movement. The classroom configuration shown in [Fig. 2] demonstrates the consideration of active zones and learning zones as a proposition within the same confines.

The second set of studies worked through adaptations to furnishings and elements of the classroom and hallway. Primarily the research team questioned a variety of components as individual elements: wall, floor, ceiling, storage, desk, and chair, within the zoned activities of classroom environments. The developments included both the making of prototype components for a school that situated physical interface as part of a mechanism for playful learning, and the arrangement new and existing devices as networked instruments that encourage movement. The first part of the second study queried which zoned portions of the classroom were more suitable to physical activity while maintaining the current teaching practices and furniture. The second stage was the manipulation of the components to allow seamless transitions between physical activity and learning conditions in the same space. This strategy recognized efficiencies within existing arrangements while determining how deficiencies in teacher control or student independence during the activities would impact their interaction with components during the activity break. Additionally, the investigation examined the replacement or removal of elements in the creation of alternate conditions with intention of informing how spatial changes to the classroom's definition would alter the activities or curriculum of the classroom. Concurrently, the criteria from classroom observations and interventions were used to propose alternate learning-scapes that situated interactive surfaces onto building elements, positioning education across a civic landscape defined by sheltered conditions, and networked across a continuity of physical movements from home to school and back.

PHYSICAL REASONING

These questions formed from observations of routines in the schools and even informed the location of the first of three prototypes, which was a composite wall system consisting of a storage system, the system's structural wall, and multiple points of interface along a turning wall condition that was intended to allow children an opportunity for play while lined up waiting for the bathroom [Fig. 3]. The selection of the hallway as the primary initial intervention was associated with the differences in down-time associated with children in certain schools waiting for the bathroom and the realization that classroom space would be utilized for scheduled in class activity breaks. The architectural aspects of this proposition posits visual cues against physical reactions to stimulate play simultaneously in both the classroom and the adjacent hallway, while pursuing an aesthetic of physical activity based on variations in height, dexterity, and range of motion. The formal differences in the position of the interface points versus the overall mechanism is defined by the performance of engaging the object's shape, influencing the aggressiveness of the final physical geography, and can be directly related to the physical engagement of the surface. Each element was considered in response to an individual's physical exertion on the corresponding surface, evaluating the formal performance of its shape for flexibility, resilience, strength, and durability in withstanding repetitive activities, and the compressive and tensile displacements of the object when embedding sensor technology in a soft version of the surface. The performance criteria for the embedded sensors included the kinetic resonance within the surface during activation, calibration of the sensors dependent on the thickness of material around their setting, and its flexibility as a composite device related to the isolation of the activities based on simulations conducted evaluating the range of motion



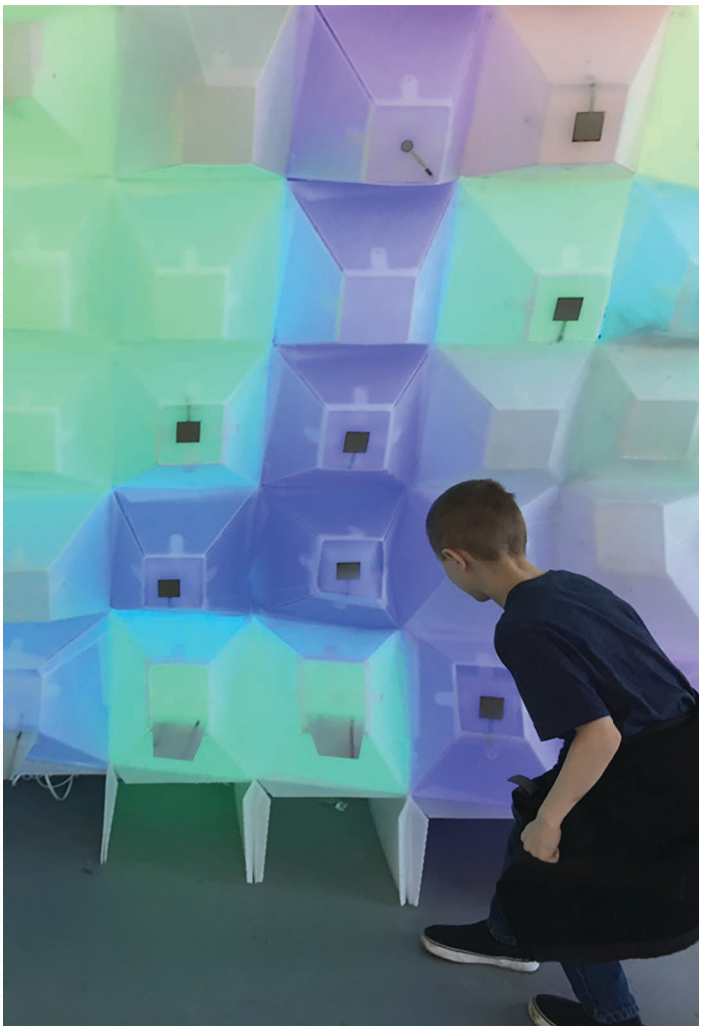


Figure 3: Analysis of Activity Follies and Usability Testing of the first prototype wall condition (Research Through Making, University of Michigan).

for particular exercises from the compendium of physical exertions defined as low, medium, and high.

SITUATED BODIES

The activities of the early analysis provided a consistent module for analysis of physical conflicts during the activities based on the room arrangements, buffer zones, activity zones, and pathways for linear activities adapted to varying levels of exercise and activity in the classrooms. Initially the designed intent was to create a shelving system to charge and display interface devices and controllers for physical activities that are smaller than the final intervention. They were intended as control points for play that could be added to the surfaces of the chair, wall, floor, desk, and ceiling. What was found through introspective inquiry is that the wall's Cartesian grid worked well in establishing a regularized point of interface, allowing the differences between distortions in parallel surfaces to be addressed in the structural frame versus the surface interface controller when turning the geometry of the wall around a corner. The geography of controllers responds to the hand and the notion of a "high five" hand smack, the surface of the knee in a striking motion, and the tip of the foot in pressing a pedal. The geography of the overall wall is based on the interface affordance associated with the range of heights specific to the age demographic, and the previous intentions of interface devices to encourage play would be a collection of single points set in an array. In the first prototype [Fig. 3] higher controllers are all hand slaps, the middle controllers are a combination of hand slaps and knee taps, and the low controllers are foot pedals.

Derived from the observation of twisting and turning associated with in-class physical activity breaks the formal gesture articulates physical avoidance while simultaneously creating continuance in a place of multiple interactions. In the conversations with the research team the importance of continuous movement was often expressed unaware of the contextual or conditional activities. Therefore, it is not a factual pursuit of knowledge defined by external references, but rather a pursuit of techniques in forming new knowledge on movement in architecture, engaging physically the intentions of architecture by physically creating the diagrams of use. The caveat being that the research into physical activity, use, and movement happens through an architectural body that evokes movement instead of a preconceived perception of its visual role.

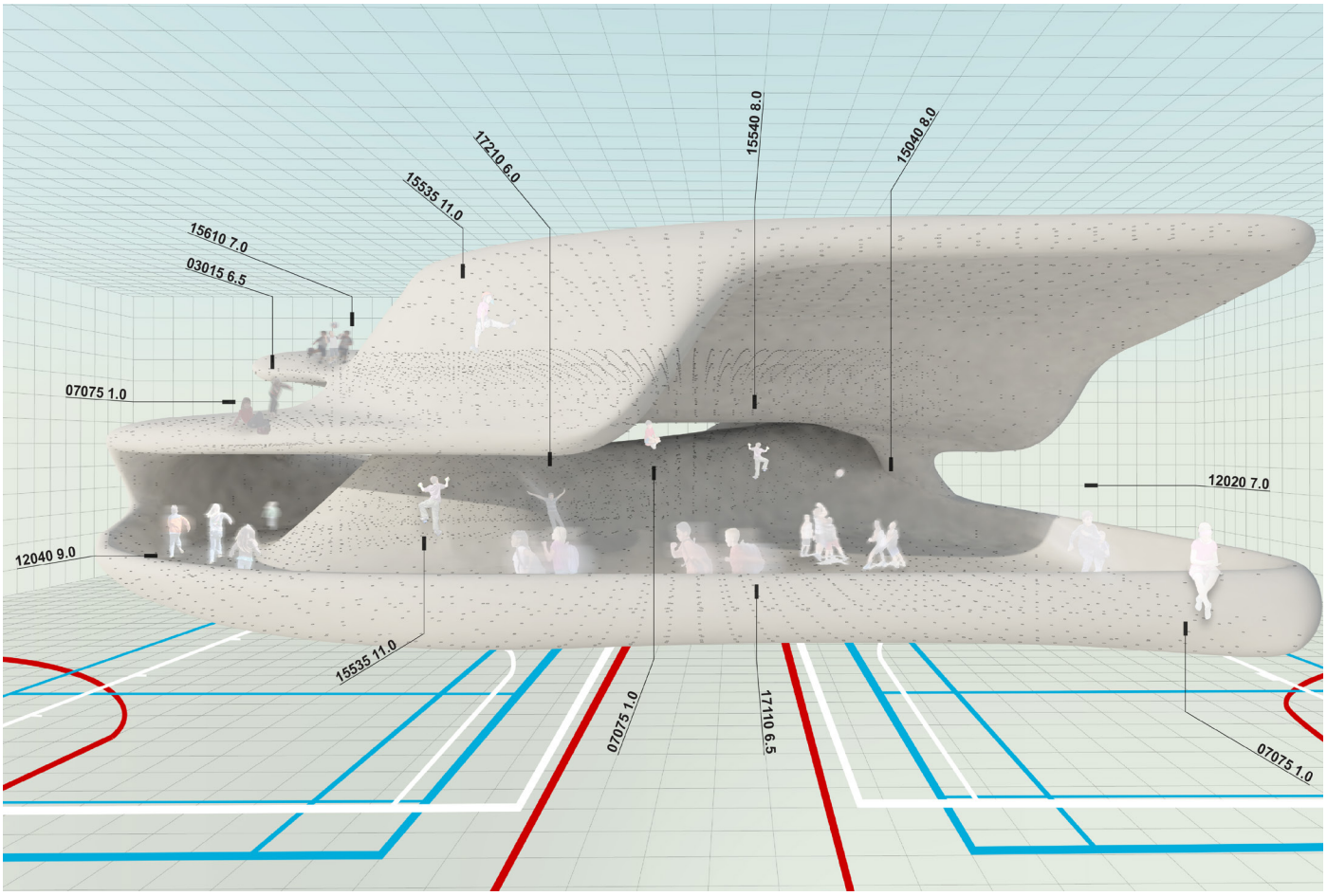


Figure 4: A Proposition of Physical Activity zones as a civic landscape within the confines of a school.

A SHARED COMPENDIUM

In creating these works the investigation of shapes in relation to movement was often a point of discussion, and while we relied heavily on a compendium of activities to frame levels of exertion, the articulation of the codified activities in relation to an object or precedent was a way of finding similar conditions in existing facilities that promoted physical activity intermittently through a building or landscape. The use of precedent analysis later in the project provided an update on ways of discussing the initial compendium of physical activities as actual inhabitations, and equally informed the rationale by which the later proposed devices and elements were evaluated in relation to a larger network. An example of which is the mapping of bicycle paths in and around the Danish Pavilion by Bjarke Ingels Group. The mapping informed us on what mechanisms were important when conveying the vertical and horizontal displacement, the endurance, and the critical places of effort irrespective of the participant's strength, providing a template for critically rationalizing new forms with similar intentions. The ability to utilize these metrics in an algorithmic generative manner is still in forward of our current conclusions, but the ability to critically question the incline of a surface or degree of turning in a walled condition as a means of enticement forecast the feasibility of such an endeavor.

CONCLUSION

Consequently, the research conversations address a cross section of formal and gestural considerations associated with larger movements of the body, and though the intent is not to define a standard or define guidelines for institutional settings, it is understood that the necessity to evaluate the energy expenditure capable of being achieved by modifications to surface conditions does facilitate a more rigorous interpretation of use and usability in architecture. Architecturally, it is the testing of a variety of deformations within specific architectural fragments composed of adjacent and non-adjacent elements, and the applicability of flexibility, resilience, strength, and durability in withstanding repetitive activities related to compressive and tensile displacements. Conversationally, it is a discourse on a range of physical activities that defines the scope in relation to its utilization, and informs multiple disciplines as to the plausibility of physical activities in practice in the classroom, which in turn provides the dynamic for these resources to be in greater service when designing buildings, their context, and their connection to the broadest of healthy networks.

Figure 5: Interface devices and wall detail.

ENDNOTES

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