

**Kinetics: Designing the Built
Environment to Combat Obesity**

An Honors Thesis (HONRS 499)

by

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A handwritten signature in black ink that reads "Gary Pavlechko". The signature is written in a cursive style with a large initial 'G' and 'P'.

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Abstract

Obesity, including its consequences and its costs, is the single greatest public health crisis in modern America. It has been directly linked to cardiovascular disease, diabetes, asthma, injury, depression, violence, and social inequity. These medical problems, and others, contribute to skyrocketing healthcare costs related to obesity and inactivity. Worse yet, the percentages of overweight and obese Americans continue to grow, and efforts to encourage healthy decisions have to this point seemed moot. Hope, however, may be on the horizon. Design professionals, such as engineers, architects, and planners, could be the next generation of healthcare professionals thanks to a blossoming initiative called *active design*. Active design is the practice of structuring the built environment in such a way that it encourages and helps people to make healthier lifestyle decisions. The analysis of active design, both in theory and in practice, may provide aspiring designers with the necessary insight and inspiration to transform the sedentary, overweight American culture of today into the active, healthy American culture of tomorrow. As an aspiring designer, I examine and analyze active design and its role in public health, and provide examples of how it can be applied to the built environment.

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Special thanks also to my closest friends and family for everything. Words cannot express my gratitude for all they have done for me.

Kinetics

Merriam Webster defines *kinetics* as the “branch of science that deals with the effects of forces upon the motions of material bodies (Merriam-Webster, 2013).” Although this science has traditionally been classified as a sub-branch of physics, its principles are certainly applicable to larger, more diverse scales. In the United States the rise of obesity has led to a multitude of professions, including culinary, psychological, government, and medical, turning to the study of kinetics as a means to combat the ever-increasing girth of the American population. Restaurants offer healthier food options, gyms are open for longer hours, and fad diet-workout plans permeate television commercials. Yet the numbers continue to rise. In 2012 the American Heart Association reported that 149.3 million Americans age 20 and older were overweight or obese, and of the youth population aged 2-19, 1 in 3 were overweight or obese (Roger, et al., 2012). The same report stated that “overweight adolescents have a 70% chance of becoming overweight adults,” and an 80% chance if at least one parent is overweight or obese (Roger, et al., 2012). To make matters worse, the problem of heaviness is getting heavier, along with its costs. In fact, “if current trends in the growth or obesity continue, total healthcare costs attributable to obesity could reach \$861 to \$957 billion by 2030, which would account for 16% to 18% of US health expenditures (Roger, et al., 2012).” The strategy for combating the obesity crisis has shifted several times in the past few years alone, but the latest approach may at last begin to reverse the trends of American bodyweight.



24 Hour Fitness, San Diego, CA

The entrance to this gym epitomizes the types of design practices which promote sedentary lifestyles. Patrons use the escalator rather than the stairs because it is easier and more convenient to do so. Photograph: Dave T. (Yelp, 2013)

Active design, the practice of structuring the built environment in order to encourage healthier lifestyle decisions, is a blossoming design practice which has the potential to contribute to the American obesity epidemic, and to the science of kinetics. Undeniably the built environment does have an effect on the motion of material bodies, including humans. Until recently, however, the connection between structure and health has either been unseen or ignored. In the September 2003 issue of the *American Journal of Public Health*, Dr. Richard Jackson wrote:

One challenge is to better understand the broad impact of our built environment on health and then to build future communities that promote physical and mental

KINETICS

health. Public health has traditionally addressed the built environment to tackle specific health issues such as sanitation, lead paint, workplace safety, fire codes and access for persons with disabilities. We now realize that how we design the built environment may hold tremendous potential for addressing many of the nation's greatest current public health concerns, including obesity, cardiovascular disease, diabetes, asthma, injury, depression, violence and social inequities (Wignall, 2011).

Unmentioned but implied in Dr. Jackson's words was the connection among all the cited public health concerns. Following obesity, each consecutively listed condition or concern can be either directly or indirectly related to high body mass. In other words, a reduction in the obesity rate will consequently also reduce the rates of cardiovascular disease, diabetes, and many other medical issues. Active design, therefore, possesses the immense potential to literally transform the American image. The various aspects of active design are not steadfast rules, but rather guidelines which, when followed, give engineers, architects, and planners the possibility to become the public health professionals of the future.

Proximity

A 2002 article from the American Journal of Preventative Medicine defines density, in terms of the built environment, as the "measure of the amount of activity found in an area (Handy, Boarnet, Ewing, & Killingsworth, 2002, p. 66)." In other words, density refers to the concentration of amenities and attractions within a given area. This can be an extraordinarily useful measurement in determining the capability of a built

KINETICS

environment to support and encourage human activity. Studies have shown that residential neighborhoods, places of work, and areas of commerce which are connected and close to other such locations strongly encourage and support moderate exercises such as walking and cycling. Mixed land use is one of the best practices for active design because it minimizes vehicle necessity and maximizes pedestrian capability.



The Village, Muncie, IN

A social attraction for Ball State University students, the Village features restaurants, bars, and other businesses which are within walking distance of campus, residence halls, and some local apartments. Photograph: Cameron M. Spencer, 2013

Density and mixed land use are most often associated with urban environments, which is why these settings are ideal for the study of such characteristics as they relate to health and fitness. According to a 2004 study in Atlanta, men who lived in “more

KINETICS

suburban, purely residential neighborhoods were on average 10 pounds heavier than the same demographic who lived in more urban, mixed-use areas (Kuang, 2011).” In New York City, one of the most densely populated cities in the United States, the life expectancy is about one and a half years longer than in the rest of the country. Such a slight difference may seem minute and purely coincidental, but it is at least partially attributable to “New Yorkers walking more...because their environment is designed to encourage them to (Kuang, 2011).”

However, urban settings are not the preference of many Americans. Residents of suburban and rural areas often loathe the thought of congested streets and skyscrapers, opting instead for open space and peaceful quiet. Such locations do not dictate population density as a prerequisite, but rather warrant strategic placement of amenities and attractions. For designers, the key is to create a situation which invokes the “eco-slob” effect, in which “the healthy, environmentally friendly option is also the path of least resistance (Arendt, 2007).” Today’s built environments are structured around streets, and therefore rely upon vehicles as the most convenient means of transportation. If instead, however, the built environment were structured in order to make walking and/or cycling the most convenient methods of movement, then the obesity epidemic would begin to decline.

The benefits of increased mixed land use may also stretch beyond mere physical fitness. A widespread reduction in the use of motor vehicles would not only diminish the demand for oil, but also decrease car emissions of greenhouse gases. Furthermore, close proximity of residential properties to amenities such as schools, parks, and stores could amount to higher property values. A study conducted by Joseph Cortright

KINETICS

“analyzed data from 94,000 real estate transactions in 15 major markets provided by ZipRealty and found that in 13 of the 15 markets, higher levels of walkability, as measured by Walk Score, were directly linked to higher home value (Designing Healthy Communities, 2012).” Walk Score measures the number of attractions and consumer destinations within walking distance of a residence in order to generate a score “ranging from 0 (car dependent) to 100 (most walkable) (Designing Healthy Communities, 2012).” According to Cortright:

Even in a turbulent economy, we know that walkability adds value to residential property just as additional square footage, bedrooms, bathrooms, and other amenities do. It's clear that consumers assign a tangible value to the convenience factor of living in more walkable places with access to a variety of destinations (Designing Healthy Communities, 2012).

His report found that homes with above-average Walk Scores “command a premium of about \$4,000 to \$34,000” over homes with average scores. Thus by the standards of modern economics, the market dictates that mixed land use be a factor in the design of the built environment, in settings ranging from highly urban to starkly rural, moving forward. Said Carol Coletta, President and CEO of CEOs for Cities, which commissioned Cortright's research:

These findings are significant for policy makers. They tell us that if urban leaders are intentional about developing and redeveloping their cities to make them more walkable, it will not only enhance the local tax base but will also contribute to

KINETICS

individual wealth by increasing the value of what is, for most, people, their biggest asset (Designing Healthy Communities, 2012).

Connectivity

Although Walk Score is useful in showcasing distance and proximity as primary factors which affect human activity, it does not encompass the full scope of walkability. Cortright's report makes the same mistake, using the term *walkability* in reference to the distance from "point A" to "point B." Walkability in its most complete definition, accounts equally for both proximity and connectivity.

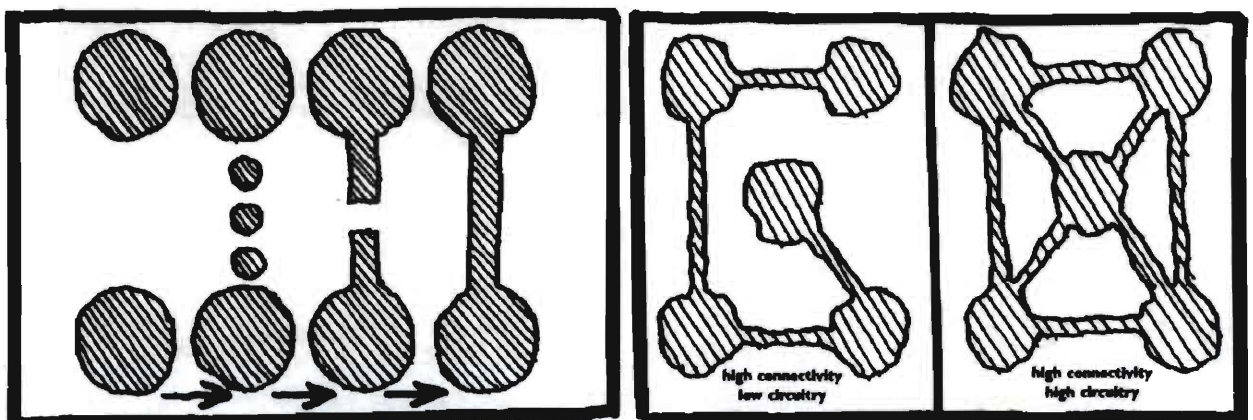
For example, just for fun I typed my current address into WalkScore.com in order to see the score for my location. The site generated a score of 60 (somewhat walkable), stating that "some amenities are within walking distance (Walk Score, 2013)." Yet I never walk to any of the listed amenities because my building is not well-connected to any destinations. In fact in order for me to walk to many of these locations, I would have to cross a consistently busy three-way road. Average traffic concentration on any given day would make it incredibly inconvenient to cross. Additionally, those amenities which are located on the same side of the street as my residence are equally inaccessible due to the lack of sidewalks. Thus although Walk Score can be a helpful tool, it does not serve as the best indicator of true walkability.

Nevertheless complete walkability, which includes the crucial aspect of connectivity, is an essential component of active design. Connectivity is defined as "the directness and availability of alternative routes from one point to another within a street network (Handy, Boarnet, Ewing, & Killingsworth, 2002, p. 66)." In this case the term

KINETICS

street indicates any pathway utilized by bicycles and/or pedestrians, rather than just vehicles. In order to better understand pedestrian connectivity, the study of animal movement is quite beneficial, since most animals cannot afford to be as sedentary as many humans are.

In the book *Landscape Ecology Principles in Landscape Architecture and Land-Use Planning*, ecological fragmentation is discussed according to species movement through four main aspects of habitat: patches (areas of similar habitat), edges (barriers or boundaries), corridors (connections between patches), and mosaics (networks of habitats). Each aspect is analyzed according to its effect on biodiversity. The general theme is that, when any one or more of these aspects is significantly reduced, local extinction rates increase and local biodiversity decreases due to limitation of movement (Dramstad, Olson, & Forman, 1996). Although humans are certainly not at risk of becoming locally extinct, the negativity of movement restriction cannot be ignored.



Corridors (left) and Mosaics (right)

Connectivity through corridors and mosaics is vital for the movements of both animals and humans. Images: (Dramstad, Olson, & Forman, 1996)

The aspects of habitat can be easily translated to the built environment in relation to walkability. Patches, areas designated specifically for pedestrian use, are essential

KINETICS

to active design because they provide the means necessary to travel by foot. These patches should have defined edges, such as tree line or shrubbery buffers, to safely separate pedestrians from vehicular traffic, but should not be so restrictive that they discourage activity. Corridors, however, are the driving forces of connectivity, and are the pathways through which movements are orchestrated. Effective sidewalks fall into this category. Practically speaking, the best corridors are cohesive, substantially wide, and directly connected to significant destinations (Dramstad, Olson, & Forman, 1996). For example, many American parks contain walking paths attached in a continuous loop contained within the park itself. Conversely, very few parks or walking paths are directly tied to amenities such as schools or stores. Again regarding practicality, corridors cannot always be designed as to directly link patches for use by walkers or cyclists. In such cases, corridors as “stepping stones (Dramstad, Olson, & Forman, 1996)” can act as perfectly acceptable substitutions. Pedestrian crosswalks fit into this type of corridor. As long as the distance between stepping stones is adequately small, foot transit will not be deterred. *Landscape Ecology Principles* does lament, however, that the loss of just one corridor or stepping stone can significantly reduce, and even completely prevent movement (Dramstad, Olson, & Forman, 1996). Thus mosaics, networks of walkable pathways, should be the ultimate goal of designers hoping to fight obesity. Continuity and connectivity are paramount in the success of mosaic creation, and are therefore key elements in active design.



David Letterman Communication and Media Building, Ball State University, Muncie, IN

The Letterman Building serves as a node for pedestrian traffic because it connects directly to both the Art and Journalism Building and the Robert Bell Building.

Photograph: Cameron M. Spencer, 2013

Stairs

To this point the discussion of active design has dealt mostly with outdoor environments, but if fitness is the design goal, then physical activity cannot stop at the door. Active designs throughout building interiors are crucial to creating successful atmospheres which encourage and support activity. The principles of walkability are just as applicable inside buildings as they are outside. However one of the distinguishing primary aspects of building kinetic interiors is the use of stairs. Indeed as with walkability, stairs exhibit the dual capability to be used both interiorly and exteriorly,

KINETICS

but interior stairs are of particular importance due to the prevalence of escalators and elevators. Invented and implemented with ease and convenience in mind, escalators and elevators more commonly replace usefulness with laziness. British architect Will Alsop quips a simple, albeit hyperbolic solution: “If you really wanted to do something about it, you could take all the elevators out of all the buildings in London. Then people would be fit (Arendt, 2007).” Obviously the elimination of all elevators would not be practical, especially for a multi-story building like a skyscraper or for an individual confined to a wheelchair, but Alsop’s point is well received. People must begin to choose stairs over escalators and elevators if the obesity rate is to be reduced.

Stairs are so vital to everyday exercise that a joint effort among New York City’s Departments of Design and Construction, Health and Mental Hygiene, Transportation, and City Planning has listed “conveniently located stairs” as a “key measure” for promoting daily health (Vinnitskaya, 2012). In fact, a 1997 study found that “men who climb 20-34 flights of stairs per week have a 20% lower risk of stroke or death from other cardiovascular diseases (Kuang, 2011).” Furthermore, Dr. Karen Lee of New York City’s health department states, “Studies show that if the average American adult climbed stairs for just two minutes a day (six to eight flights), enough calories would be burned to prevent average annual weight gain (El Nasser, 2012).”

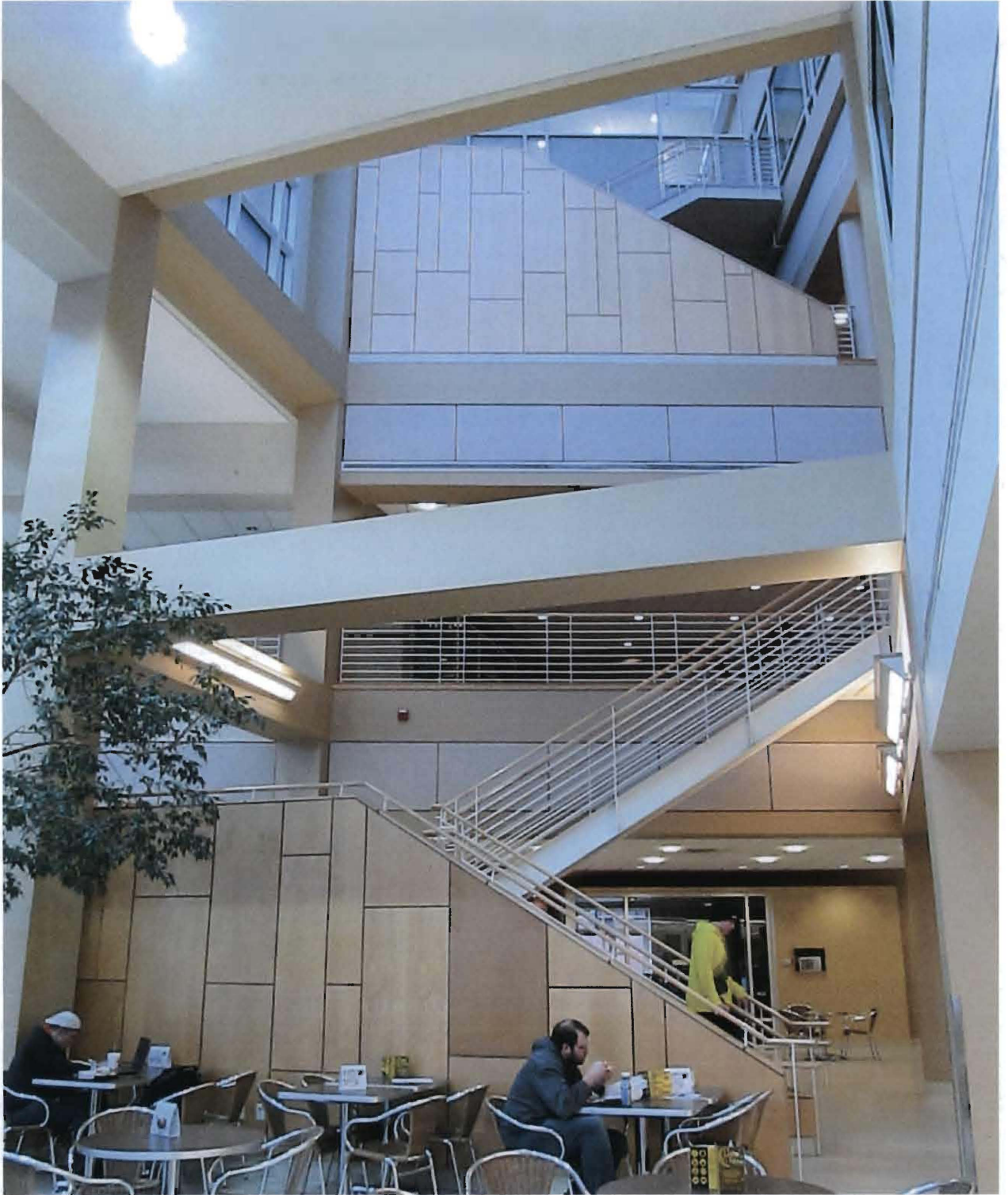
Yet too regularly stairways are “hidden away like dirty secrets (Arendt, 2007),” located in the deepest recesses of buildings as an afterthought. Comments British researcher Amelia Lake:

KINETICS

Using the stairs is not seen as normal. In most new buildings it's very difficult to find the staircase. The focal point when you enter tends to be the lift (elevator). In certain buildings, you'll even find that using the stairs will set off the fire alarm (Arendt, 2007).

If architects and designers hope to enhance stair use, then the paradigm needs to shift from concealing stairs and promoting elevators to the exact opposite. In order to do so, several strategies have been suggested and implemented.

First, stair exposure is imperative. According to architect Joan Blumenfield, “Exposed staircases that connect to different parts of a building encourage people to use them (El Nasser, 2012).” To even the novice designer this should make perfect sense. After all, the logical implication in the cliché phrase “out of sight, out of mind” is that the opposite “within sight, within mind” is equally viable. Additionally, mere stair exposure can be vastly improved when upgraded to stair prominence. In other words, stairs should be not simply uncovered, but also emphasized and even celebrated. Designing stairs to be successfully appealing can be achieved through a multitude of creative techniques which utilize characteristics such as shape (elegant curves or sharp edges), color (bright hues or contrasts), and material (glass or wood) in order to attract attention and boost appeal.



Art and Journalism Building, Ball State University, Muncie, IN

The exposed staircase in the Atrium Food Court of the Art and Journalism Building promotes utilization because it is the focal point of the space.

Photograph: Cameron M. Spencer, 2013

KINETICS

Another useful tactic which can promote stair use is the application of signage. Images, diagrams, and messages posted throughout a building can be utilized to direct inhabitants toward the stairs. Directory signs toward escalators and elevators may also be posted, but the use of hierarchy could easily place stairs as the higher priority. Sign layouts which are effectively hierarchal may even subconsciously convey to the viewer a message which praises or demands stair use while simultaneously condemning elevator use. Other arrangements might be less subtle. For example, in buildings throughout New York City, “brightly colored signs showing a figure climbing stairs have gone up near elevators” with the message: “Burn Calories, Not Electricity (El Nasser, 2012).” Regardless of the methods which are employed, active designers must promote stair use as the primary means of floor-to-floor movement.

Stimulation

Perhaps the single greatest, and most important challenge posed to active designers is the creation of environments which are as interesting as they are practical. In all tracks of design, this is the pinnacle achievement to which all architects, engineers, and planners aspire. The distinctive issue faced by active designers, however, is to develop surroundings which invigorate the users, inspiring them to move without becoming a distraction. Interesting, fun spaces are the most effective media in which human movements, activities, and exercises are performed. A 1998 Cornell University report published in the *Journal of Environmental Psychology* comments on environmental stimulation:

KINETICS

Stimulation describes the amount of information in a setting or object that impinges upon the human user. Intensity, variety, complexity, mystery, and novelty are specific design qualities pertinent to stimulation. Human beings function optimally with moderate levels of stimulation. Lack of stimulation leads to boredom or, if extreme, sensory deprivation... Too much stimulation causes distraction and overload which interfere with cognitive processes that demand effort or concentration (Evans & McCoy, 1998, pp. 85-86).

As is often the case, sensory balance is ideal. Yet for the younger generations especially, erring on the blander side of caution may not always be the best option.

In fact schools have unknowingly contributed to the obesity crisis with bland, non-stimulating environments constructed through careless design practices. Dimly lit gymnasiums better serve for nap-time than play-time, and support a severely limited number of physical activities. Worse yet, crowded cafeterias allow for little movement and interpersonal interaction while low-nutrition, high-energy foods are cheap and easily accessible. To cut off the obesity problem at the source, VMDO Architects have developed a point-based system called *Healthy Eating Design Guidelines for School Architecture*. The system operates from a core of principle guidelines, including:

- *Provide equipment and spaces that facilitate the incorporation of fresh and healthy food choices into the school and its community.*
- *Provide facilities to engage the school community directly in food production and preparation.*

KINETICS

- *Apply evidence- and theory-based behavioral-science principles to nudge the school community toward healthy-eating behaviors and attitudes.*
- *Use building and landscape features to promote awareness of healthy and sustainable food practices.*
- *Conceive and articulate school spaces as community assets to multiply the benefit of school-based healthy food initiatives (Inform Architecture+Design, 2013).*

To address physical fitness, a 2007 report from *Obesity* recommends altering the design of school activity spaces in order to better accommodate multiple functions. The study provides an example of redesigned physical fitness grounds, citing:

The inclusion of facilities that support both competitive/group sports (e.g. gymnasium, courts, and play field) and non-competitive/individual physical activities (e.g. weight room, dance studio, and nature paths) accommodates multiple forms of physical activity. In addition, flexible studio spaces (e.g. yoga and dance) and specialized facilities (e.g. tennis courts) may supplement community resources and foster facility-sharing efforts between schools and their community. Paths that run beyond traditional school grounds also enhance physical activity opportunities and connectivity with the larger community (Gorman, Lackney, Rollings, & Huang, 2007, p. 2524).

KINETICS

**Student Recreation and Wellness Center, Ball State University, Muncie, IN**

Natural light, vivid colors, and open space contribute to a motivational atmosphere within the Student Recreation and Wellness Center which is nearly ideal for physical activity.

Photograph: Cameron M. Spencer, 2013

These new active design initiatives in schools are invaluable to the battle against American obesity, especially for future generations. Yet the school day represents only a portion of the lives of children and teens. To bolster physical activity after school hours, on weekends, and during the summer, other techniques are necessary.

The computer age has undoubtedly contributed to the rise in childhood and adolescent obesity as well. Privileged American youngsters no longer care to experience extracurricular activities because plenty of adventures can be found behind computer and television screens. Additionally, children and teens who awkwardly

KINETICS

attempt to adjust to their growing bodies might choose to partake in sport-themed video games rather than actual sports. As the earliest computer generations have aged into their 20s, their sedentary lifestyles have followed. An article from Fast Company Design notes that “the real world must compete with the digital one in terms of stimulation,” and recommends “dense, multi-use environments with a variety of offerings” which “provide stimulating surroundings that encourage walking and real-life social interaction (Kuang, 2011).” Stimulating surroundings which beckon multiple senses are the most effective in drawing interest, and thereby invoking motion. As long they are not too intense, sensory igniters such as “loud noise, bright light, unusual or strong smells, and bright colors, particularly at the red end of the spectrum, all appear to increase stimulation (Evans & McCoy, 1998, p. 86).” Also mentioned by Fast Co. is the prospect of social interaction, which might be yet another way to stimulate movement for all age groups.

Communal spaces and meeting areas encourage conversation and collaborative thinking, and therefore attract users. Modern coffee shops serve well as these types of spaces, which were commonly termed *parlors* (Merriam-Webster, 2013) in the Middle Ages and during the Renaissance. The potential creative by-products of parlors have led many companies to implement such spaces into their office buildings. The Google offices in Zurich, Switzerland for example, include “one with swings, another with a slide between a floor of workspaces and one with the employee café (Wignall, 2011).” The global headquarters of office furniture company Haworth in Holland, Michigan have undergone a similar facelift. The 300,000-square-foot building features “a three-story atrium, an open stairway and a big public space that is designed like a put or sunken living room,” which features a Starbucks and a “tech bar” to “help workers with their

KINETICS

computer problems (El Nasser, 2012).” Outdoor work areas and access to natural light allow employees to enjoy their work by utilizing mobile technologies, all while bolstering inter-office activity (El Nasser, 2012).



MountMitte, Berlin, Germany

This massive playground utopia stimulates and entices even the most sedentary of users to run, jump, and play, all while getting great exercise.

Image: MountMitte (Brownell, 2012)

Outdoor spaces are equally effective in other settings as well. Fort Belvoir Community Hospital in Virginia, for example, features “six different healing gardens” which “entice ambulatory patients to leave their hospital rooms and walk outside, thus connecting them to the valuable healing properties of nature (Wignall, 2011).”

Elsewhere, the popular modern trend of parkour has inspired the construction of some distinctive playgrounds. Parkour, or freestyle, “invites kids and adults to treat the city as a gymnasium (Brownell, 2012),” and is defined by Merriam-Webster as “the sport of

KINETICS

traversing environmental obstacles by running, climbing, or leaping rapidly and efficiently (Merriam-Webster, 2013).” In Berlin, Germany, MountMitte, an “urban playground on steroids,” eliminates inactivity with “zip lines, barrel runs, and suspended cars that climbers can enter high above the ground (Brownell, 2012).” MountMitte speaks to the inner-child in each individual, placing fun as the highest priority. Fun is, in all likelihood, the simplest, cheapest, and most efficient component of active design which can be implemented in all facets of the built environment.

Conclusion

Obesity is the single greatest health crisis in the United States today, and contributes to a plethora of other mental and physical health problems which cost the nation billions of dollars. With the ever-increasing possibility for architects, engineers, and planners to contribute to a resolution, the practice of active design reduces the obesity rate by encouraging people to walk, run, and simply move. Although proximity, connectivity, stairs, and stimulation are the core aspects of active design, many other characteristics and methods exist, and many more have yet to be invented or implemented. However, the underlying theme and the most basic driving force behind active design is convenience. A built environment which allows the path of least resistance to also be the healthiest is what will ultimately lead to fitter, thinner, more physically active population. As stated by urban designer and architect Jack L.

Robbins:

Instead of trying to change individual choices by using a moral appeal about what is good for us (you should walk to work because it is better for you), it's about

KINETICS

changing the environment to reshape available choices (you'll want to walk because it is easier, cheaper, faster or more enjoyable). This strategy recognizes that the public's underlying motivations are not about health but, rather, about what is convenient and enjoyable (Wignall, 2011).

Although these changes cannot occur overnight, active design has the potential to transform the public image, individual self-images, and the perception of Americans throughout the world. If aspiring designers, like me, can even begin to grasp such a profound purpose, then we can contribute immensely to a nation which will grow not in girth but in well-being, through kinetics.

Author's Prologue

Growing up I was consistently exposed to the fields of health and science, especially as they related to athletics. My mother has been a registered nurse for over twenty years, and my grandmother was a registered nurse as well before she retired. Similarly, my grandfather was a health and physical education teacher and a four-time state champion football coach before he retired. I played sports throughout my childhood and all through high school, so physical activity has always been a major part of my life. When I was sixteen I contracted type I diabetes, so health and physical fitness became even greater driving forces in my daily existence. Needless to say, my upbringing and experiences should have probably led to me pursuing a career in medicine, sport science, or something related. Instead I am on my way to pursuing my Master's degree in Architecture.

KINETICS

Yet these influences have always remained. I enjoy running and exercising, and do so every day. I travel by foot whenever possible, and do my best to maintain optimal bodily function. For a period of time I even thought I wanted to major in Physical Therapy, but I eventually returned to my first love of design. This thesis represents not only my passion for design and the built environment, but also my enthusiasm for physical health. I hope the ideas on these pages resonate with fellow designers so that our posterity may enjoy the blessings of a built environment which fosters healthy bodies and invigorated minds. With the right principles and practices, active design and kinetics can help build a society which no longer suffers from the detrimental effects of obesity, but which instead rejuvenates from the benefits of physical fitness.

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