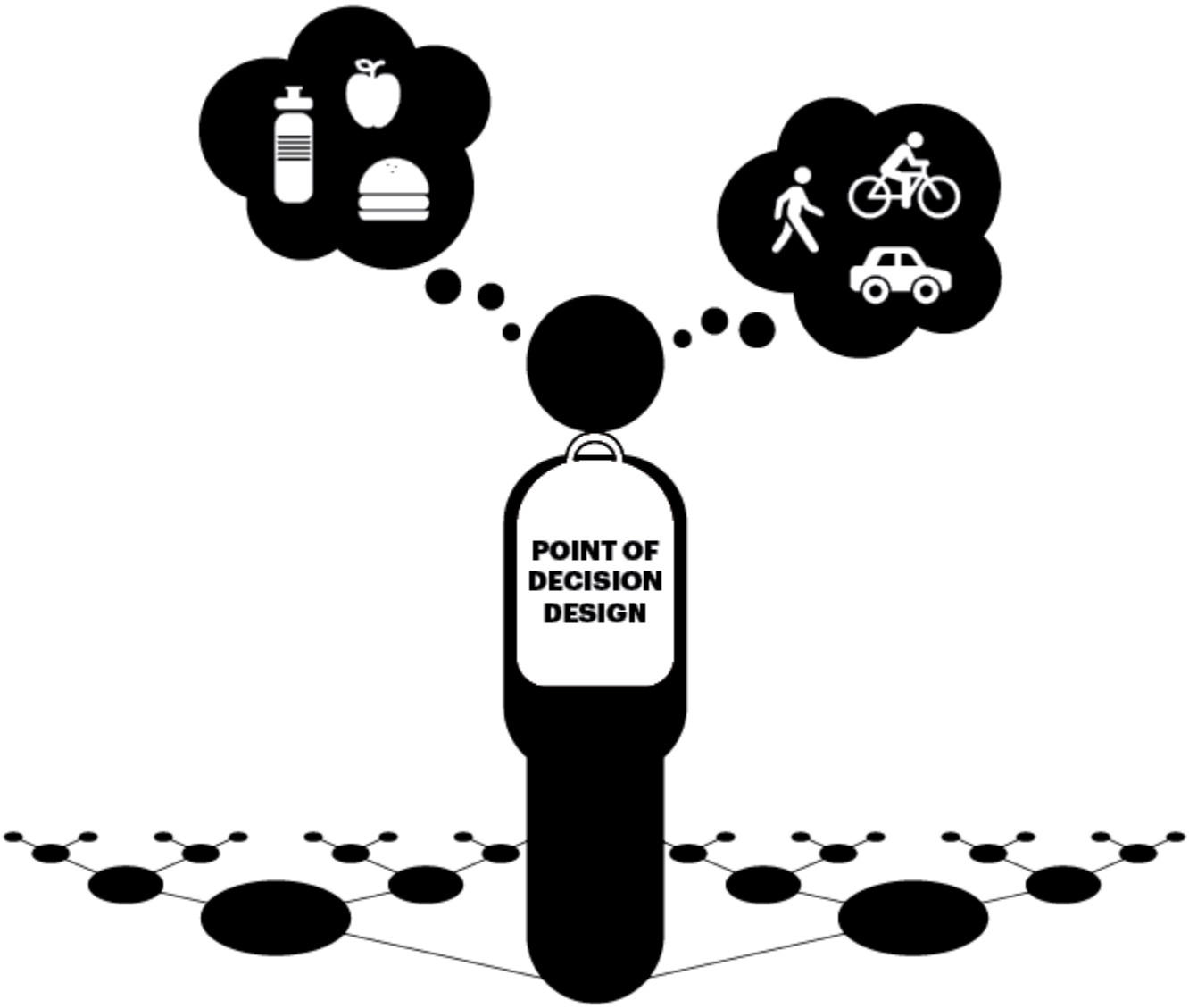

POINT OF
DECISION
DESIGN

RESEARCH TEAM

Upali Nanda, PhD

Michelle Eichinger, MS, MPA

Jessica Hedge

Shelli Dent

Giyoung Park, PhD

Timothy Lalowski, MPH

Sheba Ross, MUD

Ileana Rodriguez, MArch

Erin Peavey, M.Arch

This grant was funded by the AIA Upjohn Grant.
Additional support was provided by Patcraft, DuPont and McCarthy

This work would not have been possible without the generous funding from all our sponsors.


AIA
Upjohn Research Grant 2016
Sponsors
DuPont™
CORIAN®
SOLID SURFACES
patcraft
McCARTHY

EXECUTIVE SUMMARY

Challenge: US college campuses can be considered obesogenic environments given the high levels of obesity prevalent today. This is highly impactful on students' mental health and academic performance. Habits formed in college can define post-college life, establishing a critical window of influence that deserves our attention. A key challenge for students is poor decision making regarding healthy choices on basic issues like physical activity and diet. Can design help in this critical decision making?

Premise: Utilizing a socio-ecological approach that takes advantage of human interactions within our environments, we see opportunities for providing environmental modifications that make healthy living, easy living. Students face many choices every day, including physical activity and diet, which directly impact their health and wellbeing. The premise behind developing our concept, *point-of-decision design (PODD)*, is that healthy decision-making can be "prompted" by our physical environments through the implementation of effective design intervention strategies at critical *points-of-decision* throughout the college campus. In many ways, this study focuses on the "tipping point" defined in the dictionary as "the point at which a series of small changes or incidents becomes significant enough to cause a larger, more important change". So, what is the tipping point for students to make a healthy decision? This is what we are calling the *point-of-decision design.*

Research Question: How can design influence college student health choices by targeting the critical *points-of-decision*?

Project Objectives:

- To understand the chronic problem of obesity on college campuses and the link to diet and activity decisions
- To discern how and "where" college students make decisions about physical activity and nutrition
- To synthesize design strategies implemented at these *points-of-decision* to prompt healthy decisions amongst the myriad choices on typical college campuses
- To generate a design guide for practitioners to aid *point-of-decision design* for college students
- To develop a research concept for future research bringing together the fields of public health and architecture around *point-of-decision design*

Process: A preliminary scan of the literature was conducted to compile and assess previous design strategies utilized in health-promoting college campuses and explore any research linking design to decision making amongst students. Design strategies identified were then summarized. This preliminary review found that *point-of-decision design* has been used by the CDC for tobacco cessation, and later stairwell use, but has not been extensively incorporated by the design community to assess critical points of the most impact. Informed by the literature review, a cross-disciplinary Ideation Session was arranged, inviting 36 participants from all over the US, including: campus facilities planners, architects, designers, public health and student health experts, and undergraduate and graduate students. The basis of the Ideation Session was to discuss critical *points-of-decision* on college campuses and deliberate upon design strategies at these PODs that can promote healthy choices. A follow-up survey was sent to all attendees to clarify themes emergent from the session. Integrating prior research and

the session results, a set of visual design guidelines was generated and included in this report. Additionally, a 2-page Letter of Intent for the Robert Wood Johnson Foundation Investigator-Initiated Research Grant was developed with community partners.

Key Findings:

1. Current literature on designing healthy campuses is more biased towards movement and physical activity than diet. A gap exists that is an opportunity for future design research.
2. Using design for better decision-making is not a very well understood construct. Literature focuses on how a healthy context can be created, but not as much on how design can be a catalyst for healthier decisions.
3. Current thinking on healthy colleges focuses on urban design and campus planning strategies, whereas our findings show that decisions about activity/ diet could be made by students before ever stepping into campus. Leveraging technology/ smartphones as part of the design solution is imperative.
4. *Point-of-decision* is a person-centric– not a place-centric, construct across settings. Understanding diverse user personas and mapping their journeys can aid in determining points of decision. Key points of decision emergent from this literature review include: the smartphone, path, home, dining facility, courtyard, bed, car, corridor, recreation center, classroom, parking location, public space, workstation and online.
5. Behavioral decisions students make are often influenced by a range of factors; such factors can be sorted into 4 key constructs: Availability, Access, Affordability, and Appeal.
6. Design strategies to address a person-centered framework that can respond to a myriad of dynamic influences must be considered along a design continuum ranging from information and product design to interior, architecture and urban design. Some strategies emergent from the lit review and ideation include: farmers' markets, communal kitchens, healthy food offerings and placement, hydration stations, recharge zones, open flex spaces, mixed use buildings, lighting strategies, street trees, bike parking systems, and street furnishings.

Deliverables: 1) A visual design guide for point of decision design [Appendix 1], and 2) A proposal for future research [Appendix 2]

Limitations and Next Steps: This research project had a relatively small scope, limited by an insufficient library of literature and a one-time ideation session funded by a seed grant. Although the Ideation Session was more cross-disciplinary than many others, a few disciplines such as product design and behavioral economics can be included for more comprehensive future sessions. Additionally, more empirical research on student decision making, the role of the environment in these decisions, and robust case studies are needed at a much larger scale if we are to change our thinking about design as not only a latent context, but an active trigger, in changing health across our college communities.

CONTENTS

REPORT

Background

Obesogenic Environments

More than one-third of American adults are now obese, which has nearly doubled since the 1960's, and another third are overweight (National Center for Health Statistics, 2016, p. 200). Obesity is a condition in which the body mass index (BMI)—that is weight divided by squared height (kg/m^2)—is 30 or greater whereas normal weight BMI is 18.5-24.9. Overweight is a BMI of 25-29.9. Obesity is related to several leading causes of death including heart disease, diabetes, stroke, and some cancers (National Center for Health Statistics, 2016). Heart disease, the leading cause of death in the United States, primarily results from poor diet and physical inactivity (National Center for Health Statistics, 2015). Furthermore, a recent review study found bidirectional associations between depression and obesity—depressed and obese people are far more likely become obese or depressed, respectively, over time (Luppino et al., 2010). Therefore, obesity is not merely a physical health concern but also one related to mental wellbeing.

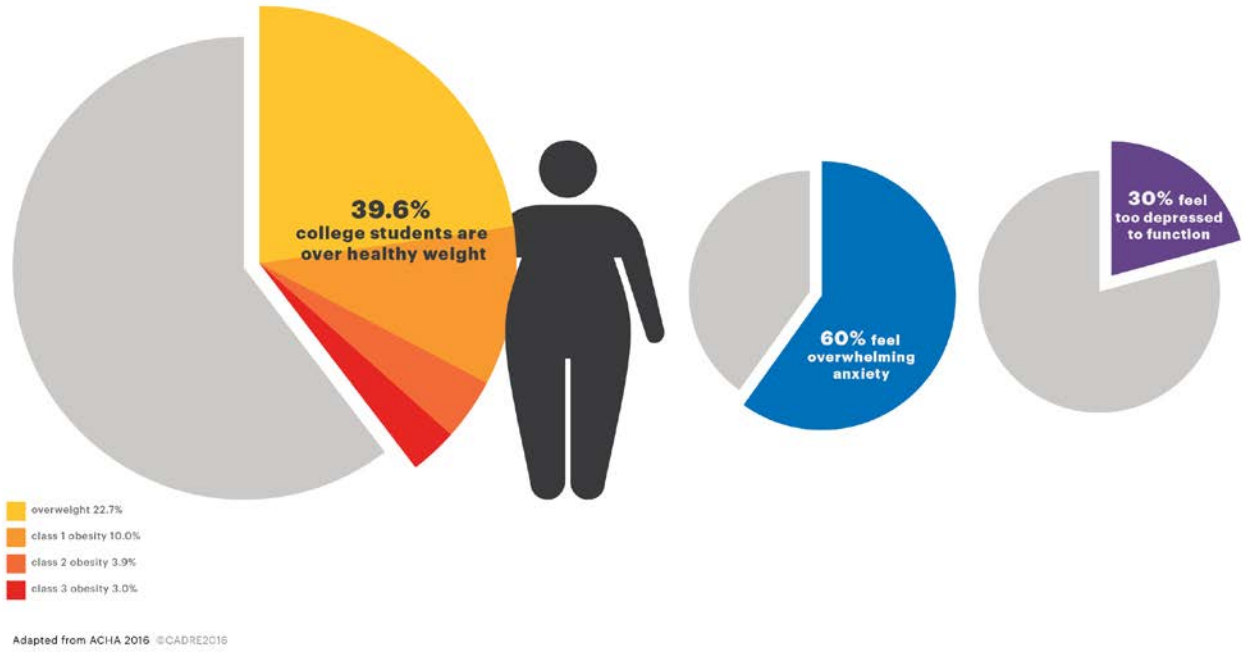


Figure 1. Overweight and obese rate and self-reported psychological distress symptoms among college students (Source: ACHA, 2016)

Collegiate young adults experience transition from adolescence to adulthood, including making personal lifestyle choices on their own (Sparling 2007). However, the greatest increases in obesity across the lifetime occur between the ages of 18 to 29 years (Mokdad, Marks, Stroup, & Gerberding, 2004).

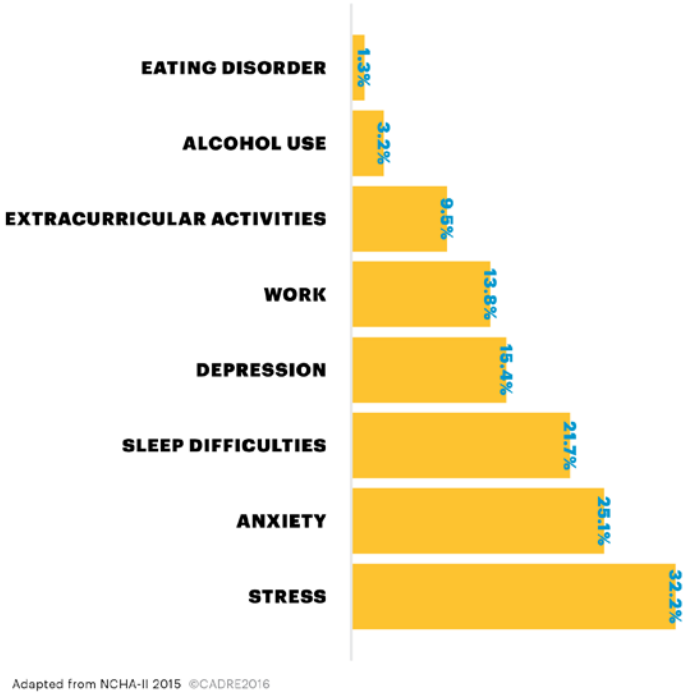


Figure 2. Factors interfering college students' academic performance (source: ACHA, 2016)

Many in this age group do not meet current physical activity recommendations (Adams & Rini, 2007; Nelson, Kocos, Lytle, & Perry, 2009; Racette, Deusinger, Strube, Highstein, & Deusinger, 2005). A recent nation-wide survey revealed 23.6% of students had not performed 30-minutes of moderate-intensity cardio/aerobic exercise within the past seven days, and 43.6% had not performed at least 20-minutes of vigorous-intensity cardio/aerobic exercise (ACHA 2016). In the same study, 23% of respondents reported being overweight and 17 percent being obese (BMI 35 – 39.9) (Figure 1). Furthermore, adjustments on college campus can increase stress and sleep disturbance, which can result in physical inactivity, poor dietary choices, increased caloric intake and elevated alcohol consumption, given the greater autonomy in lifestyle choices (Macht et al. 2005; Serlachius et al. 2007; Patel & Hu 2008; Plotnikoff et al, 2015). Heavy academic workload and being away from home, for example, can threaten college students' mental wellbeing. Nearly 60% of students reported feeling overwhelming anxiety within the last twelve months and about one-third students had felt so depressed that it was difficult to function (ACHA 2016) [Figure 1]. College students indicated anxiety (25.1%), depression (15.4%), sleep difficulties (21.7%), and stress (32.2%) among major factors interrupting their academic performance [Figure 2]. College campuses are where students live, work, play and learn. The greater duration and frequency of time spent on the campus results in greater impacts on students' wellbeing and academic performance (Park & Evans, 2016).

Design for Health

The choice conundrum

College life is about a myriad of choices. From coursework to who to sit with at lunch, college students are introduced to a new context full of independent choices, and this transition has a substantial impact on the decisions college students make. Their new-found independence, with a new social and physical environment, conjointly shapes those decisions, which often differ from previous house-law. When it comes to decisions about activity and diet, most college students have recently gained an immense level of freedom, and as seen in Ansari et al. (2012), this freedom from the household setting changes their decision-making patterns. A critical component of college life is the autonomy in making independent decisions— for many students for the very first time in their lives. In the newly acquired stress of college, life choices about diet and exercise tend to surrender to other

motivators. Diet and exercise decisions among college students has been associated with type of residency (on campus/ off campus) and students' classification/year (freshmen, sophomore, junior, senior, graduate/professional school) with food and vegetable intake, and type of diet on college campuses (Reed & Philips, 2005). This demonstrates the impact of their new found independence.

With increased autonomy, college students' behavioral decisions become more independent compared to K-12 students whose behavior more likely results from family and school systems. *Theory of reasoned action* (TRA) asserts that the most important determinant of behavior is intention, whereas direct determinants of an individual's decisions are their attitudes towards the behavior and subjective norms associated with the behavior (Fishbein & Ajzen, 1975). Additionally, in their *Theory of Planned Behavior* (TPB), the notion of perceived control is supplemented to account for deprived voluntary control over a behavior (Ajzen, 1985). TRA and TPB both were assessed on predictive validity for college nutritional and exercise decisions, indicating a good model of fit (Bruijn, 2010; Deshpande et al., 2009; Hagger et al., 2002), however, TPB accounted for more variations in decisions (Hagger et al., 2002). Figure 3 illustrates how multiple factors lead to behavioral outcomes. Background factors including individual, social, and environmental information mediate three different contributing behavioral, normative, and control beliefs to intention. The three beliefs are further discussed below.

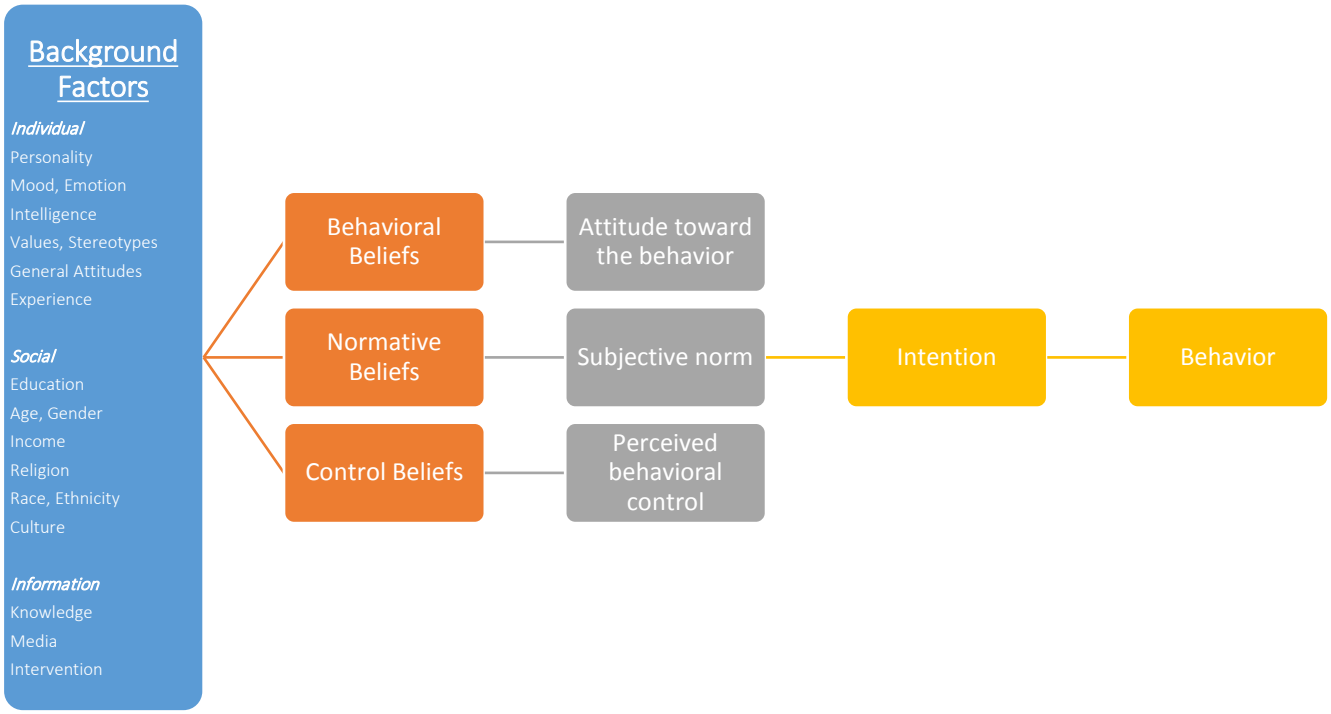


Figure 3. Theory of Planned Behavior (Ajzen & Fishbein, 2005)

Behavioral Beliefs

Behavioral beliefs formulate an individual's attitude towards the behavior based on one's evaluation of the risks and benefits associated with the outcome such as the health impact of diet and exercise. Behavioral Beliefs encompass two perceptions: benefits and risk, and it is the evaluation of

these two components against each other which determine the overall attitude towards a health decision. Several studies have examined the relationship between behavioral beliefs and decision outcome, however almost dominantly within nutrition. For example, weight concerns were the most prevalent modifier in dietary decisions (Mooney & Walbourn, 2001). In order to study the effect of behavioral beliefs on decision outcomes, two interventions have been explored: nutritional information at *point-of-purchase* (Conklin et al., 2005; Freedman & Connors, 2011; Gerend, 2009; Kolodinsky, 2010) and nutrition courses (Ferrara, 2009; Ha & Caine-Bish, 2009; Kahn et al., 2002; Lin et al., 2013). Kolodinsky et al. (2007) also examined the initial nutritional knowledge against diet decisions, finding that individuals with greater nutritional guideline knowledge made healthier diet decisions. Ultimately, the consensus states that merely having greater nutritional benefits and risks knowledge contributes to healthier decisions (Freedman and Connors, 2011; Kolodinksy, 2007; Ha and Caine-Bish, 2009; Hsieh, 2004).

Normative Beliefs

Normative beliefs are perceived normative behavior in a given social environment, which motivates individual's compliance to the norm—in college settings, peers' behavior primarily creates norms. The dominant drivers of college student diet and exercise decisions are most certainly the stark differences between genders. Males are typically more motivated towards physical activity while females are typically more motivated towards healthy eating habits (Buckworth, 2004; Gerand, 2009; LaCaille et al., 2011; Leslie, 1999; Levi, 2010). Furthermore, initiatives geared towards exercise typically have higher success rates in men (Buckworth, 2004; Leslie, 1999), whereas initiatives geared towards diet have higher success rates in women (Gerand, 2009; Levi). Gender has even been associated with vegetable intake and type of diet on college campuses (Reed and Philips, 2005). Majority of these differences have been attributed to perceived social norms which dictate the expected behaviors of young men and women, vying for acceptance among their peers (Levi, 2009).

Control Belief

Control beliefs formulate their perception of individual control over the behavior, pertaining to access and choice. However, these are always then mitigated by the reality of the individual's actual control, or their skill, ability, knowledge, and environment (Ajzen, 1985). Access and availability typically commandeer the control belief sector of health behavior intention. Albeit actual access or just perceptions, this has been cited as the largest barrier to diet and exercise decisions for college students (Deliens et al., 2014; Greaney et al., 2009; Hsieh, 2004). Access to large portions, multiple helpings, and meal plans with all-you-can-eat style dining environments all create a context which promotes over-indulgence of unhealthy foods (Greaney et al., 2009). In Bruijn (2010), beliefs about the controllability of fruit consumption were the most consistent discriminating beliefs, and Deliens et al. (2014) showed that availability and accessibility, both physically and financially were the most impactful modifiers of nutritional decisions among college students. When it comes to physical activity, three factors reign supreme: safety, access, and self-efficacy. The perception of safety on bike paths and walking trails is

associated with their use (Ferrara, 2009), the proximity of physical activity centers is associated with levels of physical activity across the board (Reed & Phillips, 2005), and an individual's perception of physical success mediates their motivation to participate (Boyle et al., 2009).

Environment as a Contextual Modifier

A study identified 200 daily decisions people overlook regarding food alone and noted these are only a small subset of the food decisions we make, furthermore, the influence of the environment on such decisions is largely unknown (Wansink & Sobal, 2007). Because choices are so important, a significant amount of research has looked at *point-of-purchase* interventions. The *point-of-purchase* scheme is traditionally employed in marketing as a means to push last minute impulse purchases before checkout. However, public health officials have recently begun utilizing this method in or to motivate positive health choices, placing informational placard or signs in their place (Chandon et al., 2009). This concept has been studied extensively and successfully relating to dietary information placement in college cafeterias (Conklin et al., 2005; Freedman and Connors, 2011; Graham, 2012; Kolodinsky, 2010) and in exercise related to stairwell usage (Ferrara, 2009; Kahn et al., 2002; Soler et al., 2010). Furthering this concept to involve both diet and exercise in the holistic college setting, provides *point-of-decision design (PODD)*, which postulates that healthy decision-making can be "prompted" by our physical environments through implementing effective design intervention strategies at critical *point-of-decision* throughout the college campus.

Factors influencing choice

A robust body of public health literature suggests that disease prevention and public health promotions are more effective when approached with an ecological perspective as its key strength lies in factoring multiple levels of environments in behavioral and health outcomes (Koplan, Liverman, & Kraak, 2005). The ecological model considers various environments around a target behavior encompassing individual and interlinked micro-level physical environments, larger environments nesting such micro-environments (e.g. neighborhood nesting individual dwellings), infrastructure and resources, and social norms and societal values in addition to predisposing factors (e.g. biological factors and individual background). Behavioral and health outcomes are partially from predisposing factors and partially from environmental factors—in other words, nature and nurture. It is critical for researchers to analyze how healthy choices are made during college, because of the potential for behaviors to continue into post-college and adulthood (Arnett, 2001). In 2011, 29.9% of college students were found to be overweight or obese (Meckel et al., 2011), which has been attributed to a drastic decline in physical activity and poor nutritional diet in comparison to high school (Meckel et al., 2011; Strong et al., 2008). Furthermore, longitudinal studies highlight how overweight youth have an increased likelihood of being overweight adults and potentially developing chronic diseases later (Arnett, 2001; Guo et al., 2002).

Public health promotions focus on the nurture aspect of life, as the nature is often impossible to change. This model can be adapted to the college context using the following key constructs: active

living and healthy eating behaviors aimed at obesity prevention. Two of the layers in Figure 4, *campus settings* (micro settings such as a gym and a cafeteria) and *land use/campus planning* (e.g. campus master plan) are physical environments. On the other hand, *advocacy and social norms* can be institutional-level norms and advocacy—for instance, policies that provide opportunities for healthy eating and prioritize campus walkability in facilities planning. Therefore, the advocacy and norms are not separated from the physical environment but can support building healthy campus environments. The built environment of various scales—encompassing product and interior design, architecture, and urban design and planning—contribute to shaping environmental context and influence many decisions around physical activity and food intake.

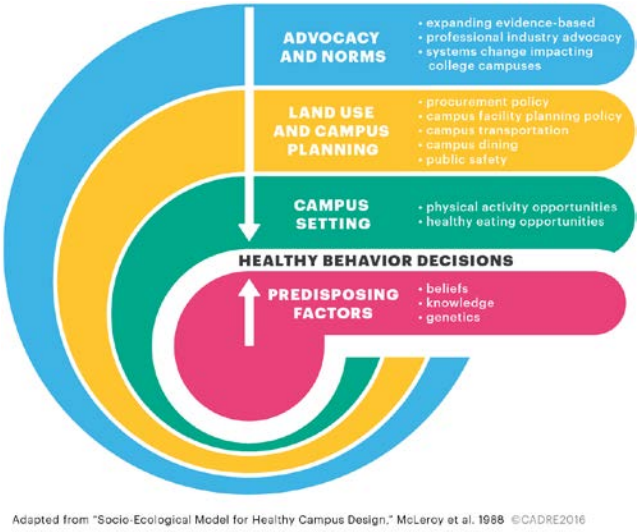


Figure 4. Ecological model for healthy campus design (Adapted from Koplan et al. 2005)

Current thinking on influential factors on behaviors (and choices) can be captured in a simple framework:

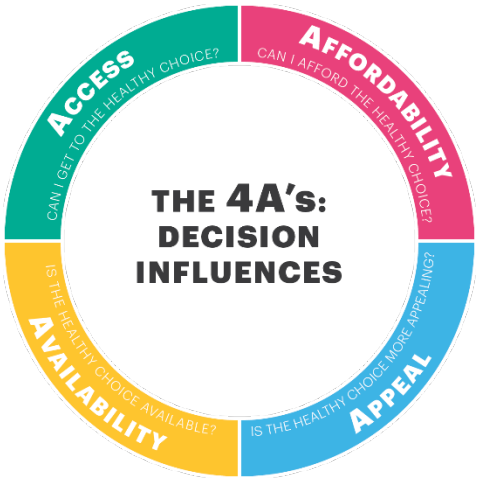


Figure 5. Four categories of influential factors on behavioral choices

This project features four key constructs around physical activity and diet decision making: availability, affordability, accessibility, and appeal—the 4A's. Often diet and activity behavior seem to be associated with cost and convenience, but looking at this more closely, these A's allow us to explain behavior influences, especially as it relates to identifying equitable approaches. These influencing characteristics need to be considered in the context in which the desirable behavior is taking place—at home in their community, at school or learning environment, at the workplace and in its community, and at places of play, leisure and recreation and their environments.

Availability

Opportunities to engage in healthy in behaviors, such as healthy eating and active living need to be available in the context in which behaviors take place. Sometimes these amenities, such as healthy food options or infrastructure to support physical activity, are not always available. For example, vending machines provide quick, convenient snacks, which often are unhealthy, in the work place and schools. Healthy vending offerings give people choice to have a healthy alternative (Keener, D, Goodman, K, Lowry, A, Zaro, S, & Kettel Khan, L, 2009). In communities, recreation facilities and parks provide an opportunity for physical activity, but when not available, limit opportunities to engage an active lifestyle.

Affordability

Cost has been a prohibitive factor in healthy living, especially as it relates to diet choices and physical activity, increasing health inequality. In terms of diet, there is a cost disparity between nutrient-rich foods and less healthy food options (Monsivais, P, McLain, J, & Drewnoski, A, 2010). Grains, added sugars, and added fats are inexpensive, good-tasting, and convenient. Their consumption has been linked to lower quality diets and lower diet costs. Physical activity opportunities may also come with a

cost which can present a barrier toward the active living lifestyle. Fitness center memberships and recreation fees can be prohibitive to participation.

Accessibility

While a healthy choice may be available, is it accessible to everyone? The term "accessible" is broad, but in this document the term will focus on the ability to get to destinations via transportation. Community design and the built environment can foster walkable and bikable destinations. This not only allows for transportation alternatives but the ability to walk and bike to places provide an opportunity itself for physical activity. Distance to playgrounds and parks has been associated with their use.

Mixed-used community design that combines residential, commercial and institutional uses has been recommended to increase opportunities for physical activity (Keener, D, et al, 2009). This allows for walkability and use of transit. Regular transit use is associated with higher physical activity (Saelens, B, Vernez Moudon, A, Kang, B, Hurvitz, P, & Zhou, C, 2014). Public transit provides accessibility opportunities especially for the elderly, low-income and those with disabilities. As it relates to healthy eating and physical activity, public transit that connects residential to grocery and farmers' markets increases access to healthy food. In rural areas, often public transit is limited, but there is a desire for improved transportation systems to recreation places (Moore, J, Jilcourt, S, Shores, K, Evenson, K, Brownson, R & Novick, L, 2010).

Appealing

Appealing in this context is an umbrella term that identifies other factors which contribute to engaging in healthy behaviors. There are many factors that contribute to appeal including safety, addressing stigma and cultural-sensitivity. Community safety, whether perceived or real, has been associated to impact physical activity. While we want to promote more green space, parks and playgrounds, it is important to identify safe, convenient and comfortable strategies in the context of neighborhoods and communities (Bennett, G, McNeill, L, Wolin, K, Duncan, D, Puleo, E, & Emmons, K, 2007).

Stigma presents a barrier for eligible individuals to participating in the USDA's Supplemental Nutrition Assistance Program (SNAP). For example, students understand that participation is income based and that low-income and poverty are associated with feelings of shame and embarrassment (Stein, K, 2008). These feelings may prevent students from participating since peers recognize a social order and hiding their status is preferred. There are several strategies to reduce stigma or eliminate identification in participating in these programs, including avoiding separate lines between competitive foods and food programs and implementing a cashless system for all students (Centers for Disease Control and Prevention, 2013). For adults, a cashless *point-of-sale* system at farmer's markets accepting SNAP, such as the use of tokens for all purchases for everyone, reduces identification of those participating in SNAP.

Whether it is age, race, ethnicity, or disability, factoring cultural sensitivity can facilitate healthy behaviors. For example, social networks of common demographics, especially among minority populations are known enablers to physical activity (Eyler, A, Baker, E, Cromer, L, King, A, Brownson, R, & Donatelle, R, 1998). There are no uniform criteria for culturally-appropriate interventions to support healthy behaviors (Kreuter, M, Lukwago, S, Bucholtz, D, Clark, E, & Sanders-Thompson, V, 2002). Instead, it is important to explore and understand culturally-appropriate characteristics in the context of behavior in a community that will be appealing to population groups.

Campus Settings

Many American campuses and surrounding communities are live-work-play environments where students spend a significant portion of daily life. The socio-ecological model clearly outlines the potential role of the campus settings in influencing healthy behaviors. Research suggests that various environmental attributes on campus can increase physical activity. With respect to physical activity, a majority of the literature is focused on urban dwellers in developed societies, where people spend 90% of their time indoors including time in transportation (US EPA, 1989; European Union, 2003).

Active transport options—for example, walk, bike, public transportation vs. driving—are particularly beneficial to cardiovascular health among other health outcomes; yet, urban planning and community design have been favoring automobile traffic over walking or biking (Wilkinson, Eddy, MacFadden, & Burgess, 2002). A sample of thirteen American university campuses indicated bike rack availability is below 20% (Horacek et al., 2014). Adequate sidewalk and crosswalks, bike lanes, lighting, traffic signals, and signage (Arnold, 1993; Rodriguez et al., 2004; Fraser & Lock, 2011; Pikora et al. 2003; Pucher, Dill, & Handy, 2010; Lockett, Willis, & Edwards, 2005; Painter, 1996; Project for Public Spaces, 2000) can contribute to the degree of perceived safety that can influence transport modal selection, especially among women (Reed & Ainsworth, 2007). Denser street structures and mixed-use development are among salient contributors in non-motorized transport selection, and the presence of bike lanes are particularly important for those who consider bike-commuting (Heinen, van Wee, & Maat, 2010). In addition to transport, accessibility and quality of recreational facilities and services/programs on campus are important aspects to consider when designing with the intention of increasing active living among college students (Reed and Phillips, 2005). Significant percentages of college students, particularly among freshman, were not aware of campus recreation facilities in their university (Reed, 2007). In addition to availability, better access to such recreational facilities from home is linked to reduced obesity and overweight (Sallis et al., 2012). Lastly, features contributing to appeal include parks and greenery, natural light, limited pollution, street maintenance, and a diversity of well-designed architecture and landscaping elements (Pikora, Giles-Corti, Bull, Jamrozik, & Donovan, 2003). Contact with nature has proven beneficial to physical, mental and social well-being (Hartig, Mitchell, Vries, & Frumkin, 2014).

While a majority of the discussion has been around physical activity linked to obesity, there is also some narrative around diet and nutrition that bears mention. For example, the presence of a

grocery store near residence has been associated with lower neighborhood obesity rates (Morland, Diez Roux, & Wing, 2006). People living in communities with greater availability of fresh food likely have healthier diet (Sallis & Glanz, 2009). Eating behaviors are vital to student health due to strong associations between diet and weight gain (CDC, 2016). For students, "on the go," food choice is likely selected based on cost and convenience, with cost being second only to taste (Glanz et al., 1998).

In fact, types of residency for students have notable implications for student health behaviors and outcomes. Students' classification/year (freshmen, sophomore, junior, senior, graduate/professional school) and proximity to health resources have also been associated with health decision outcomes (Reed and Phillips 2005). Housing may also be a contributing factor to weight gain because students residing on campus have been proven to gain more weight than those off-campus studies show that living in residence halls with on-site dining halls improved males' dietary quality, but stimulated weight gain for females (Brunt and Rhree 2008; Pliner and Saunders 2008; Nelson and Story 2009); this gender difference is potentially due to the social norms driving health decisions discussed previously.

There are many factors with weight gain among college students. These include changes in eating patterns, such as emotional eating and increased consumption of low nutrient value foods and alcohol. In addition, there is increased sedentary behavior and less occupational, recreation, and leisure physical activity. (Crombie, A, Ilich, J., Dutton, G., Panton, L., & Abood, D, 2009). Students starting college must adapt to their new environment. These adaptations may influence change in eating habits. For example, those living on campus are more likely to eat in the dining halls where the buffet style dining increases the likelihood of increased calorie consumption. In addition, the stress and change in social support contribute to behaviors that may not be as healthy, such as increased alcohol consumption or emotional eating. These eating patterns tend to increase caloric intake, thus increase in weight gain. Similarly, adapting to living in a college environment influences change in physical activity patterns. In the transition to adulthood, there is a decrease in physical activity and increase in inactivity, or sedentary behavior, such as computer use. However, the level of physical activity change has not been associated with weight gain, but rather the increase in caloric input. At a more micro scale, research suggests that large portions and multiple helpings are common barriers to weight control for students (Greaney, Less et al. 2009). The implications for the common buffet-style dining on portion control are significant. Some schools mandate on-campus residents to purchase meal plans, which may consist of unhealthy options such as "all-you-can-eat" style dining environments.

At a very simple level the design of college settings can be categorized into an open space network, transportation, departmental planning and facilities master plan [Figure 6].

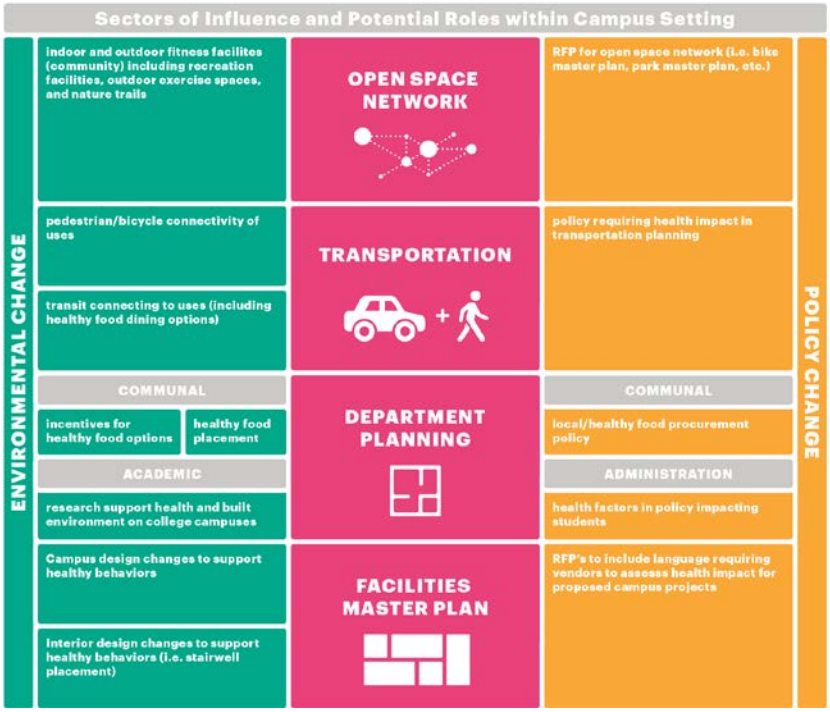


Figure 6. Sectors of influence and potential roles within campus setting

Within this broad categorization, the research has been primarily at two ends of the spectrum—at the macro policy and urban planning scale, and at the micro (information design and product scale). There is, in fact, very little on interior design and architecture related to issues of healthy eating and physical activity. A gap remains—in terms of 1) the order of magnitude where systemic solutions are not proposed across a design continuum (from information and product design- all the way to the urban design and planning of the campus and neighborhoods), and 2) in the overlap of physical environment and human experience in decision making. In many ways, this study focuses on the "tipping point" defined in the dictionary as "the point at which a series of small changes or incidents becomes significant enough to cause a larger, more important change". So, what is the tipping point for students to make a healthy decision? This is what we are calling the *point-of-decision design,* and we address this *point-of-decision* as a systemic environmental design challenge along a design continuum ranging from information, product, interior design, architecture, to urban realm.

Research Question

How can design influence college student health choices by targeting the critical *points-of-decision*?

Project Objectives

- To understand the chronic problem of obesity on college campuses and the link to diet and activity decisions
- To discern how and "where" college students make decisions about physical activity and nutrition
- To synthesize design strategies implemented at these *points-of-decision* to prompt healthy decisions amongst the myriad choices on typical college campuses
- To generate a design guide for practitioners to aid *point-of-decision design* for college students
- To develop a research concept for future research bringing together the fields of public health and architecture around *point-of-decision design*

Methods

A preliminary scan of the literature was conducted to compile and assess previous design strategies utilized in health-targeting college campuses and explore any research linking design to decision making amongst students. Following an extensive review of the literature, including industry and peer-reviewed academic publications, prevalent design strategies were summarized and synthesized into the Ecological Model [Figures 4, 5, & 6]. A design continuum was developed to capture research supported strategies along different scales of design. Based on insights from the literature review, it was determined that there is insufficient knowledge on *point-of-decision design* on college campuses, accordingly, a cross-disciplinary Ideation Session was arranged, inviting 36 participants from all over the US, including: campus facilities planners, architects, designers, public health and student health experts, and undergraduate and graduate students. The basis of the Ideation Session was to discuss critical *points-of-decision* on college campuses and deliberate upon design strategies at these PODs that can promote healthy choices. The full-day charrette formatted session included discussion, a persona exercise, and a campus planning exercise. A follow-up survey was sent to all attendees to clarify themes emergent from the session.

Ideation Session

Attendees

Thirty-six participants joined the session, including seven campus facilities planners/architects in US higher education institutions, eleven architects and designers, five design researchers, three in public health or university health services, two from industry sponsors, and six undergraduate or graduate students. Four from the organizers volunteered to be moderators aiding activities while participating in the session. [See Appendix 1 for list of attendees.]

Agenda

The Ideation Session was planned as a full day charrette from 11 AM to 4:00 PM. Two groups were created: "Move by Design" and "Diet by Design", with 8-12 attendees in each group. Two tables

were created for each group with one facilitator. Two hands-on activities were included: 1) a persona exercise and 2) a campus planning activity. The agenda was as follows:

- Welcome and introduction of session organizers (15min)
- Introduction of the session and context (1hr 45min)
- A summary of literature review during lunch (30min)
- Assign groups to “Diet by design” or “Move by design” (10min)
- Persona exercise (pairs) throughout a day identifying where decisions and actions of diet or movement occur; Translate the results to design strategies (1hr 45 min)
- Office tour and coffee break (20min)
- Campus planning exercise promoting healthy diet or move choices (1hr 45min)
- Open discussion + Voting (1hr)
- Closing Notes

Persona Exercise

The participants paired and selected a persona among 25 provided by the session facilitators, or were allowed to create their own [Table 1]. Each persona was defined with a short description of individual characteristics . Participants were asked to work in pairs to simulate their persona’s daily journey and mark when and where decisions of movement and diet were made, likewise, where actions occurred throughout the day [Figure 7]. Based on the persona exercise, the participants identified *points-of-decision* and design strategies supporting healthy choices. Using sticky notes, the strategies were categorized into five scales: product design, interior design, architecture, urban design, and urban planning [Figure 8]. Finally, the participants voted on the ideas by using dots to determine the “Top 10 *points-of-decision*”.

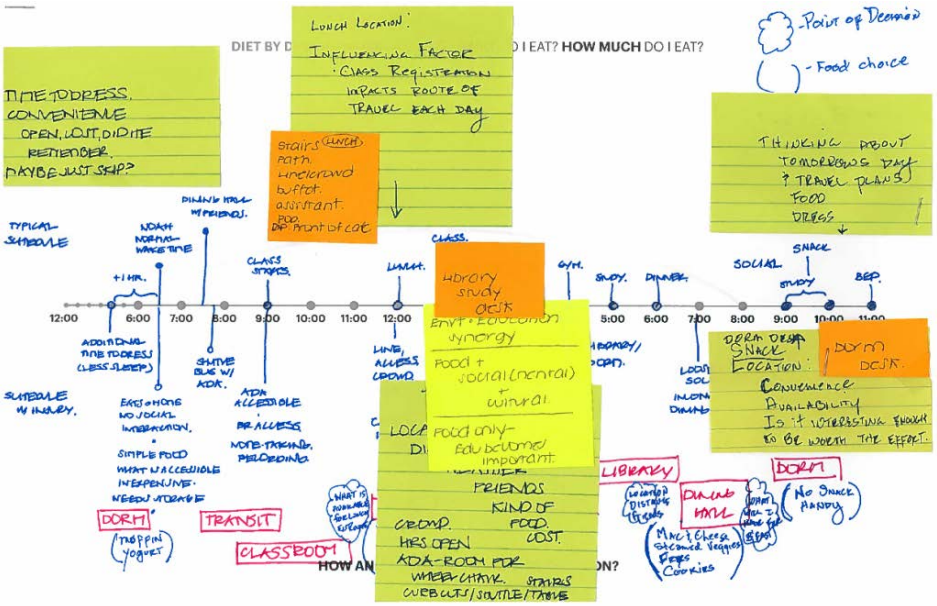


Figure 7. Persona activity example simulating a typical weekday of a student who is physically impaired focusing on Diet

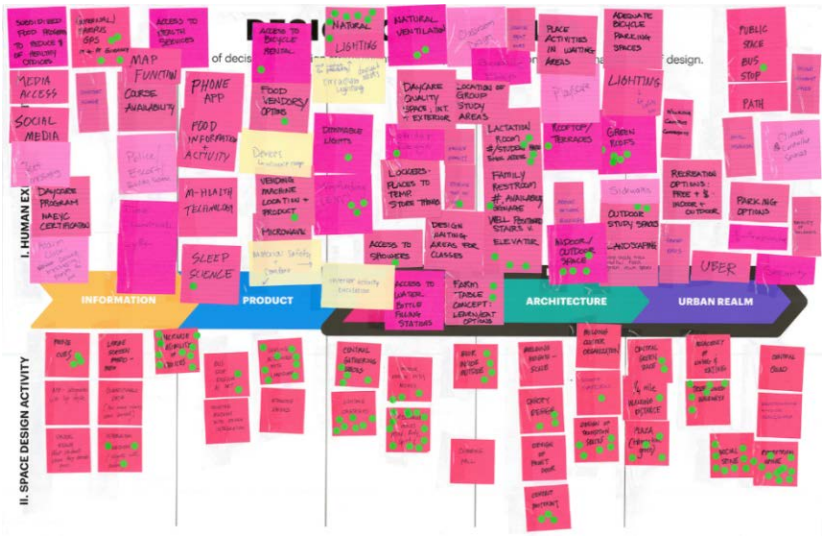


Figure 8. Design strategies for "Move", generated based on persona exercise and participants' votes (green dots)

Campus Planning Exercise

Each group of participants received a 30" x 40" board for a hands-on campus planning activity in which the participants could apply their insights and knowledge gained during the ideation session. The four groups generated campus master plans and attached notes regarding their thinking processes on the boards [Figure 9]. The planning criteria and results were shared with the entire session at the end of the activity.

Figure 9. A campus plan generated by one of the 'Diet by design' groups.

Survey

An online survey link was issued for feedback regarding the Ideation Session. Most items in the survey were a five-point Likert scale with a few open-end questions such as key takeaways. Results of the survey were analyzed using descriptive statistics embedded in the survey platform, Question Pro.

Visual Design Guide

Insights from the ideation session were analyzed using qualitative and quantitative methods. Information from the sessions were transferred to an excel spreadsheets, coded, and analyzed for key themes. These insights were then translated to 1) process insights on how designers can plan for *points-of-decision,* and 2) knowledge insights- an illustration of how *point-of-decision design* can be used today. These insights were translated into a visual design guide [Appendix 2] which is the key deliverable of this study.

Results

Persona Exercise and Journey Mapping

Seven personas were selected for "Move by design" and eight for "Diet by design". Among them, two personas, Believer and Handicap, were chosen both in "Move by design" and "Diet by design", and one pair created a persona. Table 1 shows the personals selected/ created by the teams. Fifteen scenarios were generated during this exercise.

Insights from journey maps were then translated visually to a "node" graphic annotating key *points-of-decision* and key destinations [Figure 10.1]. Twenty-one *points-of-decision* (POD) were identified for each "Move by design" and "Diet by design". Five of "Move by design" PODs and nine of "Diet by design" PODs did not get any votes. Due to the open-end nature of this exercise, several PODs were the same or similar. If the words were the same or equivalent—such as home and house—they were combined. However, if they could be interpreted in different ways—for example, [on the] bus and [at the] bus stop—they were counted separately. Smartphone/ phone-social-media was ranked as the top POD for both "Move by design" and "Diet by design" [Table 2]. Several other PODs—home, dorm room, bed/dorm bed, car, dining hall, and classroom—were ranked both in "Move by design" and "Diet by design". Some PODs are places (e.g. home) while others are transit (car or path). It is not surprising that online resources are influential in daily decision making, especially if the decision makers are millennials. However, in most cases, the participants were not able to connect such online resources (e.g. smartphone or social media) to physical locations where students would look up relevant information. A spreadsheet based analysis was conducted by the research team to identify key *points-of-decision*, and destinations, for the students [Table 2]. This insight was graphically synthesized and translated in figure 10.

Figure 10. Persona analysis sketches using destination nodes

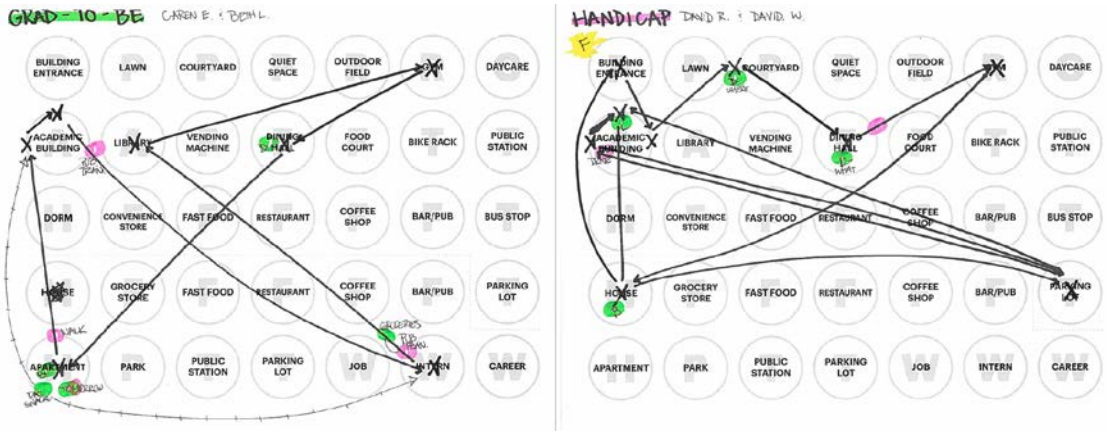


Table 1. Personas used for the journey maps

Persona	Description	Move	Diet
Mommy	A full-time student and single mom with a toddler Time strain because of the baby; only go to campus when I have class	X	
Workaholic	Full-time day-time job; classes at night 5 hours of sleep on a good night	X	
Creative*	Prefer space I can roam and flexibility in social interaction Instant decision making, rather than pre-planned	X	
Athlete	On a strict training schedule for being in the school soccer team Eat a lot after games but normally healthy meals to stay in shape	X	
Sleepyhead	Daily video games and movie watching Keep some food from the campus convenience store in my room	X	
Handicap	A wheelchair user Some of the food locations on campus get too crowded Like to go to the dining halls best with my friends because there is a variety of food and tables	X	X
Believer	Try to avoid the corners and locations where people yell out political propaganda to avoid criticism Eat most of my meals at the dining hall for its large variety of foods to choose for vegetarians	X	X
New kid	Freshman Dorm & a meal plan, no car Gym a few times a week + ride my bike everywhere		X
Consumer	College junior, gained 60 lbs. in college Never learned how to cook and there's no kitchen in my dorm Always resort to the fast food on campus. I don't really like to exercise because people judge me		X
Generation X	Working professional, back to school to finish a college degree Half my classes on campus and half online I cook, eat and sleep all at home with my family, and I exercise every afternoon at the local YMCA		X
All-nighter	Procrastinator → sleepless nights toward the end of the semester During end of semester, fast food and a lot of coffee to stay awake		X
International	Second year in the American university experiencing language and cultural barriers Many Korean restaurants and people around campus No car		X
Grad-to-be	A senior working part-time internship due to less course load Internship 20 minutes away from class Live in a nearby apartment with two roommates Try to pack my food for the day in the morning		X

** Persona created by participants*

Table 2. Information from both groups was synthesized to identify key points-of-decisions

Move	Votes	Diet	Votes
Smartphone	9	Phone-social media	9
Path	8	Dorm room	7
Home	6	Stairs	6
Dining/ Dining hall	5	Dining hall	4
Courtyard	4	Buffet line. Food station	3
Corridor	3	Vending machine	3
Rec. center	3	Home/car	2
Bed	3	Bike rack (outside gym)	1
Car	3	Classroom	1
Classroom	2	Dorm bed	1
Parking	2	Library	1
Public space	2	Vending machine (near classroom)	1
At night at my work, workstation with my computer	1		
Online	1		
Fast food restaurant	1		

Design Strategies

Following the persona exercise, the groups were asked to consider design strategies that could be effective in prompting healthier choices at ***points-of-decision*** and all participants voted on these. The data from these votes, written on sticky-notes, was also analyzed and transferred to a spreadsheet. The session generated 103 strategies for "Move by design" and 83 for "Diet by design"; and the strategies received 53 and 39 votes, respectively. Among the strategies, top 20 were included in Table 3. Unlike PODs, none of the top strategies were suggested for both "Move by design" and "Diet by design". Some of the strategies were not specific enough. For example, 'wayfinding,' which got three votes, is very general—but was a recurring theme. Most strategies are consistent with previous studies; and there are a few new items that no related studies have been identified. For example, communal kitchen has been examined in mainly co-housing contexts but not in college settings. The idea of a "learning kitchen"-

where students can not only cook, but learn to cook, was a creative idea that received a lot of votes. Table 3 summarizes the top 20 design strategies that emerged from the two groups.

Table 3. Key strategies for Move and Diet based on the Ideation Session

Item	Strategies	Move	Diet
1	Communal kitchen		18
2	Food choices-easy and culture related		14
3	Recharge zones, mind, body, spirit!	12	
4	Hydration station (2)		11
5	Bike parking		10
6	Flex space for farmers' market/ food vendors		10
7	Pedestrian spine	10	
8	Central green space to serve as a farmer's market		9
9	Increase visibility of choices	9	
10	Mixed use building		8
11	Seating integrated with landscape	8	
12	Social spine	8	
13	Lighting strategies	7	
14	Natural lighting	7	
15	Kitchen is a training? Part of the curriculum		6
16	Learning kitchen		6
17	Tree-lined walkways	6	
18	Design of transition spaces	5	
19	Green roofs	5	
20	Make it "cool"		5

In the campus planning exercise, teams had an opportunity to apply these design strategies to key *points-of-decision*. Because this exercise was a "tabula rasa" or blank slate exercise- there were no constraints of space and scale. The solutions that emerged were interestingly convergent in some core concepts with some new ideas that emerged are summarized below.

Table 4. Qualitative analysis results from the hands-on, campus planning activity

Feedback to Ideation Session

A survey was sent to Ideation Session attendees after the event. Forty-four percent of the participants (16 out of 36) completed the survey. The participants indicated they understood the objective of the ideation session (73.33% agree or strongly agree); the impact of built environment on obesity (93.33% agree or strongly agree); and the impact on student health and academic performance (80% agree or strongly agree). All of the respondents agreed or strongly agreed with the relevance of the *points-of-decision* to campus design. Eighty percent of them reported they felt they had contributed to the persona and journey map exercise, and the equivalent responses for the campus master plan activity. When asked about their most satisfying aspect of the session, the top answer was the cross-disciplinary nature, followed by hands-on activities such as the persona exercise or campus planning activity. Conversely, the divergent backgrounds may slow progress from an interdisciplinary team, as several pointed out limited time. While one survey participant responded, “Fun to start with a blank state,” another suggested emailing out some materials in advance.

Respondents were asked to share three key takeaways from the session. Forty-seven items were generated, and they were mostly positive. Many selected the importance of environmental design around students’ health. Some suggested the importance of walkability and natural elements on campus while others indicated the needs for greater availability and affordability of healthy diet choices.

Some key quotes about the Ideation Session are shared below:

"Not a 'one shoe fits all' - complex process to get to an optimal state considering many 'personalities' - there is unlikely to be a single perfect design solution. … Getting inside the head(s) of campus users is critical to create the most valued environment."

"Win-win solutions such as offering cooking classes for students where they prepare their own meals are severely lacking on campuses. Such programs can educate students on healthy eating habits and saving money while feeding them."

"Students could definitely make better diet choices if there were healthier options at reasonable prices. The majority of students eat what is cheap and fast so this has to be a top priority in diet."

"The challenge is with assumed standards or best practices that get rolled out cookie cutter style to projects as 'solutions' without considering the larger context of the user population and the environment of the site."

"GPS/location and information-based technology solutions are woefully underutilized as a means of facilitating solutions. Since most students live and die by their smartphone being in their presence, why not leverage that more? We're missing major opportunities here."

Responses mentioned a paradigm shift in education institutes including the criteria of selecting food suppliers on campus. There were suggestions regarding mobile technologies and virtual environments in research and planning. Lastly, the participants indicated they would appreciate the design guidelines and the literature review as deliverables of the session. A set of visual design guidelines was provided in this report [Appendix 2].

In analyzing the feedback of the participants, we see the 4 A's theme consistently emerge, validating the influence of availability, affordability, accessibility and appeal on health decisions.

Visual Design Guide Generation

Insights from the literature review and ideation session deliverables were analyzed and synthesized into a summary "visual design guide" document to serve as a "how to" for *point-of-decision design*. The Guide [Appendix 2] has three parts. Part 1 makes the case for *point-of-decision design* by analyzing the choice conundrum that students must navigate in their daily lives. Part 2 dictates a 4-step process for planners and policy makers to implement design strategies at *points-of-decision*. Part 3 illustrates *point-of-decision design* based on insights from the Ideation Session and Literature Review.

Summary Findings

1. Current literature on designing healthy campuses is more biased towards movement and physical activity, than diet. A gap exists that is an opportunity for future design research.
2. Using design for better decision-making is not a very well understood construct. Literature focuses on how a healthy context can be created, but not as much on how design can be a catalyst for a healthier decision.
3. Current thinking on healthy colleges focuses on urban design and campus planning strategies, whereas our findings show that decisions about activity/ diet could be made by students before

ever stepping into campus. Leveraging technology/ smartphones as part of the design solution is imperative.

4. *Point-of-decision* is a person-centric– not a place-centric, construct across settings. Understanding diverse user personas and mapping their journeys can aid in determining points of decision. Key points of decision emergent from this literature review include: the smartphone, path, home, dining facility, courtyard, bed, car, corridor, recreation center, classroom, parking location, public space, workstation and online.
5. Behavioral decisions students make are often influenced by a range of factors; such factors can be sorted into 4 key constructs: Availability, Access, Affordability, and Appeal.
6. Design strategies to address a person-centered framework that can respond to a myriad of dynamic influences must be considered along a design continuum ranging from information and product design to interior, architecture and urban design. Some strategies emergent from the lit review and ideation include: farmers' markets, communal kitchens, healthy food offerings and placement, hydration stations, recharge zones, open flex spaces, mixed use buildings, lighting strategies, street trees, bike parking systems, and street furnishings.

Deliverables: 1) Final Report 2) Visual Design Guide

Limitations and Next Steps: This research project had a relatively small scope, limited by an insufficient library of literature and a one-time ideation session funded by a seed grant. Although the Ideation Session was more cross-disciplinary than many others, a few disciplines such as product design and behavioral economics can be included for more comprehensive future sessions. Additionally, more empirical research on student decision making, the role of the environment in these decisions, and robust case studies are needed at a much larger scale if we are to change our thinking about design as not only a latent context, but an active trigger, in changing health across our college communities.

Bibliography

Adams, T., & Rini, A. (2007). Predicting 1-year change in body mass index among college students. *Journal of American College Health,* 55(6), 361-366. doi:10.3200/JACH.55.6.361-366

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), Action-control: From cognition to behavior. (11-39). New York: Springer.

Ansari, W.E., Stock, C., & Mikolajczyk, R.T. (2012). Relationships between food consumption and living arrangements among university students in four European countries - A cross-sectional study. *Nutrition Journal*, 11(28). doi: 10.1186/1475-2891-11-28

Arnett, J.J. (2001). Conceptions of the transition t adulthood: perspectives from adolescence through midlife. *Journal of Adult Development*, 8(2), 133-143. doi: 10.1023/A:1026450103225

Arnold, H. (1993). Trees in Urban Design. New York: Van Nostrand Reinhold

Bennett, G., McNeill, L., Wolin, K., Duncan, D., Puleo, E., & Emmons, K. (2007). Safe to walk? Neighborhood safety and physical activity among public housing residents. PLos Med, 4(10), 1599-1607.

Boyle, J.R. and LaRose, N.R. (2009). Personal beliefs, the environment and college students' exercise and eating behaviors. *American Journal of Health Studies*, 23(4), 195-200. Retrieved from http://digitalcommons.brockport.edu/hls_facpub/2

Bruijn, G. (2010). Understanding college students' fruit consumption. Integrating habit strength in the theory of planned behaviour. *Appetite*, 54(1), 16-22. doi: 10.1016/j.appet.2009.08.007

Brunt, A. and Rhee, Y.S. (2008). Obesity and lifestyle in U.S. college students related to living arrangemeents. *Appetite*, 51(3), 615-621. doi: 10.1016/j.appet.2008.04.019

Buckworth, J. and Nigg, C. (2004). Physical activity, exercise, and sedentary behavior in college students. *Journal of American College Health*, 53(1). doi: 10.3200/JACH.53.1.28-34

CDC. (2016). Adult Obesity Facts. *The Center for Disease Control and Prevention.* Retrieved from https://www.cdc.gov/obesity/data/adult.html

Centers for Disease Control and Prevention – Division of Community Health. A Practitioner's Guide for Advancing Health Equity: Community Strategies for Preventing Chronic Disease. Atlanta, GA: US Department of Health and Human Services; 2013.

Chandon, P., Hutchinson, J.W., Bradlow, E.T. , & Young, S.H. (2009). Does in-store marketing work? Effects of the number and position of shelf facings on brand attention and evaluation at the point of purchase. *Journal of Marketing*, 3(6). 1-17. doi: 10.1509/jmkg.73.6.1

Conklin, M.T., Lambert, C.U., & Cranage, D.A. (2005). Nutrition information at point of selection could benefit college students. *Topic in Clinical Nutrition*, 20(2), 90-96. Retrieved from http://journals.lww.com/topicsinclinicalnutrition/Abstract/2005/04000/Nutrition_Information_at_Point_of_Selection_Could.2.aspx

Crombie, A, Ilich, J., Dutton, G., Panton, L., & Abood, D., (2009). The freshmen weight gain phenomenon revisited. *Nutrient Reviews*, 67(2), 83-94.

Deliens, T., Clarys, P., De Bourdeaudhuij, I., & Deforche, B. (2014). Determinants of eating behaviour in university students: a qualitative study using focus group discussions. *BMC Public Health*, 14(53). doi: 10.1186/1471-2458-14-53

Deshpande, S., Basil, M.D., & Basil, D.Z. (2009). Factors influencing healthy eating habits amoung college students: An application of the health belief model. *Health Marketing Quarterly*, 26(2). doi: 10.1080/07359680802619834

European Union. (2003). Indoor air pollution: new EU research reveals higher risks than previously thought. Retrieved from Brussels: http://europa.eu/rapid/press-release_IP-03-1278_en.htm

Eyler, A., Baker, E., Cromer, L., King, A., Brownson, R.,& Donatelle, R. (1998). Physical activity and minority women: a qualitative study. *Health Education and Behavior,* 25(5), 640-52.

Ferrara, C.M. (2009). The college experience: Physical activity, nutrition, and implications for intervention and future research. *Journal of Exercise Physicology Online*, 12(1). Retrieved from https://www.asep.org/asep/asep/Ferrara12_1_23-35.pdf

Fraser, S.D.S. & Lock, K. (2010). Cycling for transport and public health: a systematic review of the effect of the environment on cycling. *The European Journal of Public Health*, 21 (6), 738-743. doi: 10.1093/eurpub/ckq145

Freedman, M.R. and Connors, R. (2011). Point-of-purchase nutrition information influences food-purchasing behaviors of college students: A pilot study. *Journal of the American Dietetic Association*, 111(5), S42-S46. doi: 10.1016/j.jada.2011.03.008

Gerend, M.A. (2009). Does calorie information promote lower calorie fast food choices among college students*? Journal of Adolescent Health* ,44(1), 84-86. doi: 10.1016/j.jadohealth.2008.06.014

Glanz, K., Basil, M., Maibach, E., Goldberg, J., & Snyder, D. (1998). Why americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association*, 98 (10), 1118-1126. doi: 10.1016/S0002-8223(98)00260-0

Graham, D.J. and Laska, M.N. (2012). Nutrition label use partially mediates the relationship between attitude toward healthy eating and overall dietary quality among college students. *Journal of the Academy of Nutrition and Dietetics*, 112(3), 414-418. doi: 10.1016/j.jada.2011.08.047

Greaney, M.L., Less, F.D., White, A.A., Dayton, S.F., …& Green, G.W. (2009). College students' barriers and enablers for healthful weight management: a qualitative study. *J Nutr Educ Behav*, 41(4). 281-286. doi: 10.1016/j.jneb.2008.04.354

Guo, S.S., Wu, W., Chumlea, W.C., & Roche, A.F. (2002). Predicting overweight and obesity in adulthood from body mass index values in childhood and adolescence. *Am J Clin Nutr*, 76(3), 653-658. Retrieved from: http://ajcn.nutrition.org/content/76/3/653.short

Ha, E. and Caine-Bish, N. (2009). Effect of nutrition intervention using a general nutrition course for promoting fruit and vegetable consumption among college students*. Journal of Nutrition Education and Behavior*, 41(2), 103-109. doi: 10.1006/appe.2000.0384

Hagger, M.S., Chatzisarantis, N.L.D., & Biddle, S.J.H. (2002). A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and the contribution of additional variables. *Journal of Sport & Exercise Psychology*, 24(1), 3-32. Retrieved from http://www.humankinetics.com/acucustom/sitename/Documents/DocumentItem/1090.pdf

Hartig, T., Mitchell, R., Vries, S. d., & Frumkin, H. (2014). Nature and Health. *Annual Review of Public Health*, 35(1), 207-228. doi:doi:10.1146/annurev-publhealth-032013-182443

Heinen, E., van Wee, B., & Maat, K. (2010). Commuting by Bicycle: An Overview of the Literature. *Transport Reviews*, 30(1), 59-96. doi:10.1080/01441640903187001

Horacek, T. M., White, A. A., Byrd-Bredbenner, C., Reznar, M. M., Olfert, M. D., Morrell, J. S., . . . Thompson-Snyder, C. A. (2014). PACES: A Physical Activity Campus Environmental Supports Audit on University Campuses. *American Journal of Health Promotion*, 28(4), e104-e117. doi:10.4278/ajhp.121212-QUAN-604

Hsieh, P. (2004). Factors influencing students' decisions to choose healthy or unhealthy snacks at the university of Newcastle, Australia. *Journal of Nursing Research*, 12(2). Doi: 10.1097/01.JNR.0000387492.16804.a3

Kahn, E.B., Ramsey, L.T., Brownson, R.C., …& Corso, P. (2002). The effectiveness of interventions to increase physical activity: A systematic review. *American Journal of Preventive Medicine*, 22(4). 73-107. doi: 10.1016/S0749-3797(02)00434-8

Keener, D., Goodman, K., Lowry, A., Zaro, S., & Kettel Khan, L. (2009). Recommended community strategies and measurements to prevent obesity in the United States: Implementation and measurement guide. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention.

Kolodinsky, J., Green, J., Michaehelles, M., & Harvey-Berino, J.R. (2010). The use of nutritional labels by college students in a food-court setting. *Journal of American College Health*, 57(3). doi: 10.3200/JACH.57.3.297-302

Kolodinsky, J., Harvey-Berino, J.R., Berlin, L., … & Reynolds, T.W. (2007). Knowledge of current dietary guidelines and food choice by college students: Better eaters have higher knowledge of dietary guidance. *Journal of the American Dietetic Association*, 107(8), 1409-1413. doi: 10.1016/j.jada.2007.05.016

Koplan, J. P., Liverman, C. T., & Kraak, V. A. (2005). Developing an action plan. In Committee on Prevention of Obesity in Children and Youth (Ed.), Preventing childhood obesity: health in the balance (pp. 79-124): National Academies Press.

Kreuter, M., Lukwago, S, Bucholtz, D., Clark, E., & Sanders-Thompson, V. (2002). Achieving cultural appropriateness in health promotion programs: targeted and tailored approaches. *Health Education & Behavior*, 30(2), 133-46.

LaCaille, L.J., Dauner, K.N., Krambeer, R.J., & Pedersen, J. (2011). Psychosicial and environmental determinants of eating behaviors, physical activity, and weight change among college students: A qualitative analysis. *Journal of American College Health*, 59(6). Retrieved from http://www.tandfonline.com/doi/citedby/10.1080/07448481.2010.523855?scroll=top&needAccess=true

Leslie, E., Owen, N., Salmon, J., …& Lo, S.K. (1999). Insufficiently active australian college students: Perceived personal, social, and environmental influences. *Preventive Medicine*, 28(1), 20-27. doi: 10.1006/pmed.1998.0375

Levi, A., Chan, K.K., & Pence, D. (2010). Real men do not read labels: The effects of masculinity and involvement on college students' food decisions. *Journal of American College Health*, 55. doi: 10.3200/JACH.55.2.91-98

Lin, L.P. and Wan Dali, W.P.E. (2013). The impact of nutrition education interventions on the dietary habits of college students in developed nations: a brief review. *School of Medical Sciences, Universiti Sains Malaysia*. Retrieved from https://tspace.library.utoronto.ca/handle/1807/54713

Lockett, D., Willis, A., & Edwards, N. (2005). Through seniors' eyes: An exploratory qualitative study to identify environmental barriers to and facilitators of walking. *CJNR*, 37(3), 48-65. Retrieved from http://www.ingentaconnect.com/content/mcgill/cjnr/2005/00000037/00000003/art00004

Luppino, F. S., de Wit, L. M., Bouvy, P. F., Stijnen, T., Cuijpers, P., Penninx, B. W., & Zitman, F. G. (2010). Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Archives of general psychiatry*, 67(3), 220-229.

Meckel, Y., Galily, Y., Nemet, D., & Eliakim, A. (2011). Changes in weight indexes and aerobic fitness of physical education students over three years of college. *Journal of Human Sport and Exercise*, 6 (1). Doi: 10.4100/jhse.2011.61.13

Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *Journal of the American Medicine Association*, 291(10), 1238-1245.

Monsivais, P., McLain, J., & Drewnoski, A. (2010). The rising disparity in the price of healthful foods: 2004 2008. *Food Policy*, 35(6), 514-20.

Mooney, K.M. and Walbourn, L. (2001). When college students reject food: not just a matter of taste. *Appetite*, 36(1). doi: 10.1006/appe.2000.0384

Moore, J., Jilcourt, S., Shores, K., Evenson, K., Brownson, R. & Novick, L. (2010). A qualitative examination of perceived barriers and facilitators of physical activity for urban and rural youth. *Health Education Research*, 25(2), 355-67.

Morland, K., Roux, A. V. D., & Wing, S. (2006). Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. *American journal of preventive medicine*, 30(4), 333-339.

National Center for Health Statistics. (2015). Health, United States, 2014: with special feature on adults aged 55-64. Retrieved from Hyattsville, MD: https://www.ncbi.nlm.nih.gov/books/NBK299348/pdf/Bookshelf_NBK299348.pdf

National Center for Health Statistics. (2016). Health, United States, 2015: with special feature on racial and ethinic health disparaties. Retrieved from Hyattsville, MD: http://www.cdc.gov/nchs/data/hus/hus15.pdf#053

Nelson, M. C., Kocos, R., Lytle, L. A., & Perry, C. L. (2009). Understanding the perceived determinants of weight-related behaviors in late adolescence: a qualitative analysis among college youth. *Journal of nutrition education and behavior*, 41(4), 287-292.

Nelson, M.C. and Story, M. (2009). Food environments in university dorms: 20,000 calories per dorm room and counting. *American Journal of Preventive Medicine*, 36(6), 523-526. doi: 10.1016/j.amepre.2009.01.030

Painter, K. (1996). The influence of street lighting improvements on crime, fear, and pedestrian street use, after dark. *Landscape and Urban Planning*, 35, 193-201.

Park, G., & Evans, G. W. (2016). Environmental stressors, urban design and planning: implications for human behaviour and health. *Journal of Urban Design*, 21(4), 453-470. doi:10.1080/13574809.2016.1194189

Pikora, T., Giles-Corti, B., Bull, F., Jamrozik, K., & Donovan, R. (2003). Developing a framework for assessment of the environmental determinants of walking and cycling. *Social science & Medicine*, 56(8), 1693-1703. doi:http://dx.doi.org/10.1016/S0277-9536(02)00163-6

Pliner, P. and Saunders, T. (2008). Vulnerability to freshman weight gain as a function of dietary restraint and residence. *Physiology & Behavior*, 93(1), 76-82. doi: 10.1016/j.physbeh.2007.07.017

Plotnikof, R.C., Costigan, S.A., Williams, R.L., …& Germov, J. (2015). Effectiveness of interventions targeting physical activity, nutrition and healthy weight for university and college students: a systematic review and meta-analysis. *Int J Behav Nutr Phys Act*, 12(45). doi: 10.1186/s12966-015-0203-7

Project For Public Spaces. (2009). Measuring the impact of public markets and farmers markets on local economies. Retrieved from http:// www.pps.org/articles/measuring-the-impact-of-publicmarkets-and-farmers-markets-on-local-economies/.

Pucher, J., Dill, J., & Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: An international review. *Preventive Medicine*, 50(S). S106-S125. doi: 10.1016/j.ypmed.2009.07.028

Racette, S. B., Deusinger, S. S., Strube, M. J., Highstein, G. R., & Deusinger, R. H. (2005). Weight changes, exercise, and dietary patterns during freshman and sophomore years of college. *Journal of American College Health*, 53(6), 245-251.

Reed , J.A. and Phillips, D.A. (2005). Relationships between physical activity and the proximity of exercise facilities and home exercise equipment used by undergraduate university students. *Journal of American College Health*, 53(6). doi: 10.3200/JACH.53.6.285-290

Reed, J. (2007). Perceptions of the availability of recreational physical activity facilities on a university campus. *Journal of American College Health*, 55(4), 189-194.

Reed, J., & Ainsworth, B. (2007). Perceptions of environmental supports on the physical activity behaviors of university men and women: a preliminary investigation. *Journal of American College Health*, 56(2), 199-204.

Rodriguez, D.A. and Joo, J. (2004). The relationship between non-motorized mode choice and the local physical environment. *Transportation Research: Part D*, 9(2), 151-173. doi: 10.1016/j.trd.2003.11.001

Saelens, B., Vernez Moudon, A., Kang, B., Hurvitz, P., & Zhou, C. (2014). Relation between higher physical activity and public transit use. *American Journal of Public Health*, 104(5), 854-9.

Sallis, J. F., & Glanz, K. (2009). Physical Activity and Food Environments: Solutions to the Obesity Epidemic. *Milbank Quarterly*, 87(1), 123-154. doi:10.1111/j.1468-0009.2009.00550.x

Sallis, J.F., Floyed, M.F., Rodriguez, D.A., & Saelens, B.E. (2012). The role of built environments in physical activity, obesity, and CVD. *Circulation*, 125(5), 729-727. doi: 10.1161/CIRCULATIONAHA.110.969022

Soler, R. E., K. D. Leeks, L. R. Buchanan, R. C. Brownson, G.W. Heath, D. H. Hopkins, and Services Task Force on Community Preventive Services. (2010). Point-of-Decision prompts to increase stair use. A systematic review update. *American Journal of Preventive Medicine,* 38 (2 Suppl.), S292–300. doi: 10.1016/j.amepre.2009.10.028.

Stein, K. (2008). Erasing the stigma of subsidized school meals. *Journal of the American Dietetic Association*, 108(12),1980-3.

Strong, K.A., Parks, S.L., Anderson, E., Winett, R. & Davy, B.M. (2008) Weight gain prevention: Identifying theory-based targets for health behavior change in young adults. *Journal of American Dietetic Association*, 108 (10) 1708-1715. doi: 10.1016/j.jada.2008.07.007

US EPA. (1989). Report to congress on indoor air quality: Volume II - Assessment and control of indoor air pollution, Washington, DC. Retrieved from: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiIntHA3b3QAhXnylQKHdaQA64QFggdMAA&url=http%3A%2F%2Fnepis.epa.gov%2FExe%2FZyPURL.cgi%3FDockey%3D9100LMBU.TXT&usg=AFQjCNEBxGkYcvtpZBpNeUvmXh3fLhVmgw&sig2=sdH5BjInAMG8PdzfATUpsg

Wansink, B. and Sobal, J. (2007). Mindless eating: The 200 daily food decisions we overlook. *Environment and Behavior*, 39(1). doi: 10.1177/0013916506295573

Wilkinson, W. C., Eddy, N., MacFadden, G., & Burgess, B. (2002). Increasing physical activity through community design: A guide for public health practitioners. Retrieved from http://www.bikewalk.org/pdfs/2010/IPA_full.pdf

APPENDIX 1. IDEATION SESSION ATTENDEES

Campus Facilities
Kate Pepin University of Michigan, Dearborn + SCUP
Caren Easterling H-E-B
Ann Wozniak Boise State University
Chris Wright Boise State University
Thomas Lund University of Texas, Dallas
Richard Dempsey University of Texas, Dallas
Beth Lewis Texas Women's University
Abby Roberson Texas Medical Center

Design
Bill Bruce CRJA-IBI
Chuck McDaniel ASLA
Doug Childers HKS, Houston
Ileana Rodriguez HKS, Houston
David Harper HKS, Miami
Sheba Ross HKS, Atlanta
Mark Vander Voort HKS, Dallas
Dan Arrowood HKS, Dallas
Leonardo Gonzalez HKS, Dallas
Craig Kolstad HKS, Dallas
David Williamson HKS, Dallas

Design Research
Shahin Vassigh Florida International University
Whitney Gray Delos
Vienna McCleod International WELL Building Institute
Upali Nanda HKS, Houston
Angela Ramer HKS, Dallas
Giyoung Park HKS, Dallas

Public Health
Juliet Rogers University of Michigan
Michelle Eichinger Designing4Health

Student Health
Jeremy Beer H-E-B
Susan Hochman University of Texas, Austin + ACHA

Student
Arsalan Gharaveis Texas A&M University
Ohbet Chen Texas A&M University

David Rader University of Texas, Arlington
Shelli Dent Georgia State University
Jessica Hedge University of Houston
Heather Roth University of North Texas

Sponsor
Susan Homan Dupont Corian
Jen Kin Patcraft

Communications
Mary Seale HKS, Dallas

APPENDIX 2. VISUAL DESIGN GUIDE

VISUAL DESIGN GUIDE

Point of Decision Design
for College Campuses

HKS CADRE | Center for Advanced Design Research and Evaluation
Planning4Health Solutions

ACKOWLEDGEMENTS

AIA

Upjohn Research Grant 2016

Sponsors

DuPont™ CORIAN® SOLID SURFACES

patcraft®

McCARTHY

CORE TEAM
Upali Nanda; Michelle Eichinger; Jessica Hedge; Shelli Dent; Giyoung Park

RESEARCH SUPPORT Timothy Lalowski; Erin Peavey; Mary Seale; Ileana Rodriguez, Sheba Ross

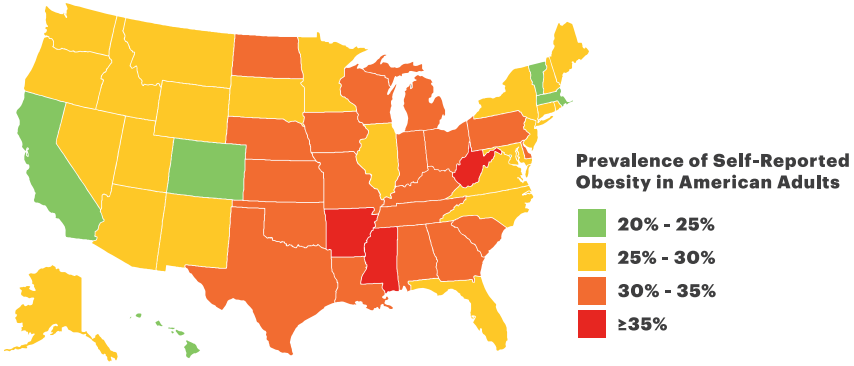
IDEATION SESSION ATTENDEES. JULY 2016.

Campus Facilities	Design	Design Research	Public Health	Student Representation
Kate Pepin University of Michigan, Dearborn + SCUP	**Bill Bruce** CRJA-IBI	**Shahin Vassigh** Florida International University	**Juliet Rogers** University of Michigan	**Jeremy Beer** H-E-B
Caren Easterling H-E-B	**Chuck McDaniel** ASLA	**Whitney Gray** Delos	**Michelle Eichinger** Designing4Health	**Susan Hochman** University of Texas, Austin + ACHA
Ann Wozniak Boise State University	**Doug Childers** HKS, Houston	**Vienna McCleod** International WELL Building Institute		**Students**
Chris Wright Boise State University	**Ileana Rodriguez** HKS, Houston	**Upali Nanda** HKS, Houston		**Arsalan Gharaveis** Texas A&M University
Thomas Lund University of Texas, Dallas	**David Harper** HKS, Miami	**Angela Ramer** HKS, Dallas		**Ohbet Chen** Texas A&M University
Richard Dempsey University of Texas, Dallas	**Sheba Ross** HKS, Atlanta	**Giyoung Park** HKS, Dallas		**David Rader** University of Texas, Arlington
Beth Lewis Texas Women's University	**Mark Vander Voort** HKS, Dallas			**Shelli Dent** Georgia State University
Abby Roberson Texas Medical Center	**Dan Arrowood** HKS, Dallas			**Jessica Hedge** University of Houston
Sponsors	**Leonardo Gonzalez** HKS, Dallas			**Heather Roth** University of North Texas
Susan Homan Dupont Corian	**Craig Kolstad** HKS, Dallas			
Jen Kin Patcraft	**David Williamson** HKS, Dallas			

PART I WHY IT MATTERS

OBESITY IN COLLEGE
OPPORTUNITY: DESIGNING A HEALTHY CONTEXT
EXISTING DESIGN STRATEGIES
CHOICE CONUNDRUM
STUDENT PERSONAS
DECISIONS ON CAMPUS
INTRODUCING POINT OF DECISION DESIGN
INTRODUCING THE DESIGN CONTINUUM

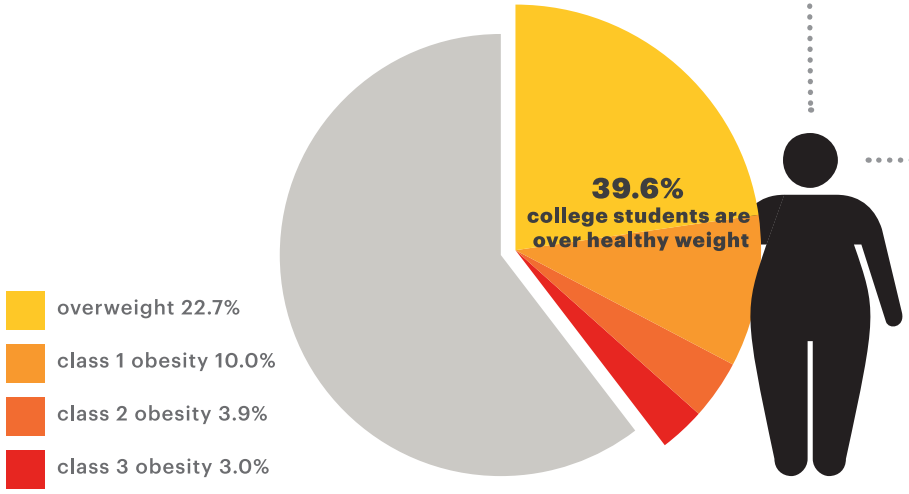
CHALLENGE OBESITY IN COLLEGE



Adapted from CDC "Obesity prevalence Map," 2014 ©CADRE2016

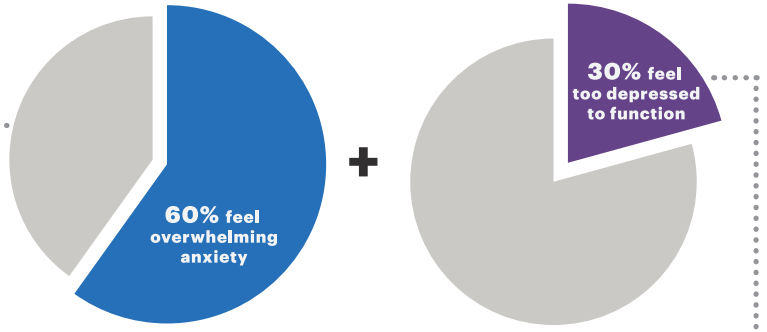
OBESITY IN **AMERICA**

OBESITY IN **COLLEGE**



Adapted from ACHA 2016 ©CADRE2016

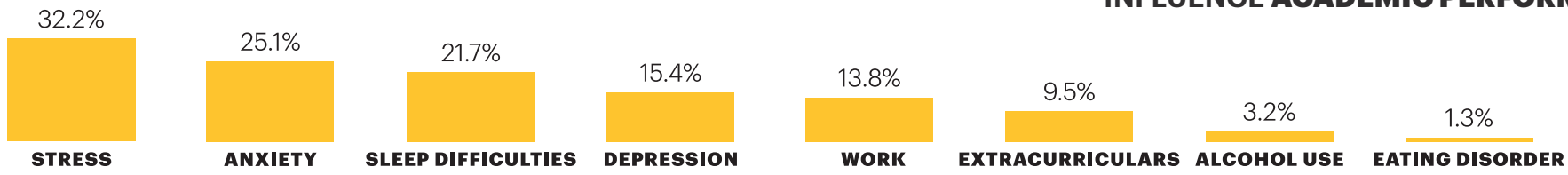
HOW DOES OBESITY IMPACT THE **MENTAL HEALTH** OF COLLEGE STUDENTS?



Adapted from ACHA 2016 ©CADRE2016

Adapted from Luppino et. al 2010 ©CADRE2016

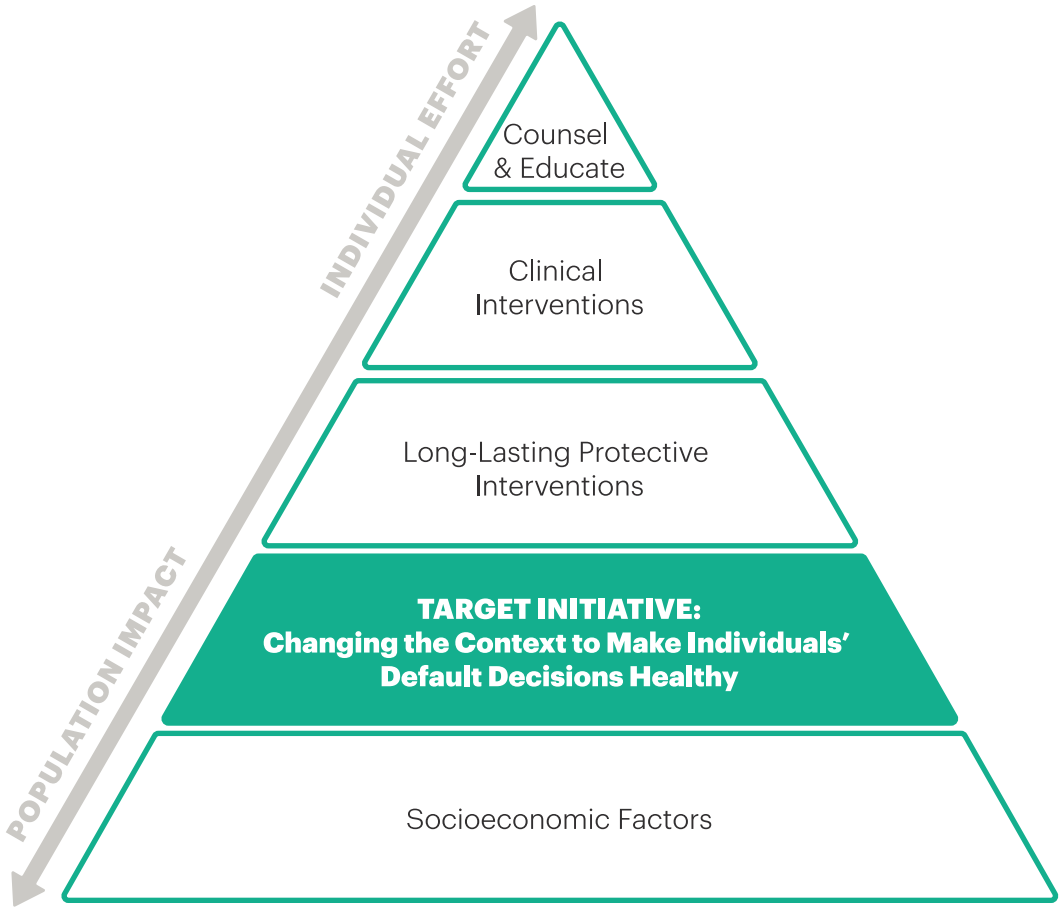
HOW MUCH DO MENTAL HEALTH FACTORS INFLUENCE **ACADEMIC PERFORMANCE?**



Adapted from NCHA-II 2015 ©CADRE2016

OPPORTUNITY DESIGNING A HEALTHY CONTEXT

The Health Impact Pyramid shows there are five ways to impact health on an indirectly related scale of individual effort and population impact. We target the fourth tier, "Changing the Context to Make Individuals' Default Decisions Healthy," by changing the context with design.



Adapted from "Health Impact Pyramid," Frieden 2010 ©CADRE2016

CHANGING THE CONTEXT THROUGH DESIGN

TRANSPORTATION INFRASTRUCTURE

Adequate Sidewalk Width

- Adequate width allows for pairs to walk side-by-side, including wheelchairs
- Walking and biking are the most common forms of physical activity

Cervero, R, Kockelman, K (2004). The relationship between non-motorized mode choice and the local physical environment. Transportation Research: Part D, 9, 151-173.

Bike lanes, Bike Share/Parking Facilities

- Walking and biking are the most common forms of physical activity

Fraser, S & Lock, K. (2011). Cycling for transport and public health: a systematic review of the effect of the environment for cycling. European Journal of Public Health, 21, 738-43.
Pucher, J, Dill, J, & Handy, S. (2010). Infrastructure, programs, and policies to increase bicycling: an international review. Preventive Medicine, 50, S106-S125.

Transit Stops/Shelters

- People who take transit regularly get the recommended amount of physical activity through walking
- Associated with impacting obesity, supporting wellbeing and medical costs.

Edwards, R (2008). Public transit, obesity, and medical costs: assessing the magnitudes. Preventive Medicine, 46, 14-21.

Predictable Paths of Travel

- Well-connected streets determine how people move; connectivity is predictor of walking as a mode of transportation

Sun, G, Oreskovic, N & Lin, H (2014). How do changes to the built environment influence walking behaviors? A longitudinal study within a university campus in Hong Kong. International Journal of Health Geographics, 13, 28

HEALTHY FOOD AVAILABILITY

Attractive and Visible Stair Placement

- More physical activity is associated with increased stair use instead of elevator use
- 25 feet of an entrance and before any elevators
- Artwork, music and color more aesthetically attractive

Nicoll, G (2007). Spatial measures associated with stair sue. Science of Health Promotion, 21, 345-52.
Kerr, N, Yore, M, Ham, S, & Dietz, W (2004). Increasing stair use in a worksite through environmental changes. American Journal of Health Promotion, 18, 312-15.
Boutelle, K, Jeffrey, R, Murrary, D & Schmitz, M (2001). Using signs, artwork, and music to promote stair use in a public building. American Journal of Public Health, 91, 2004-6.

Farmer's Markets

- Provides direct access to healthy foods/fruits and vegetables where demand and access for healthy foods are not met.
- Offers social connectivity and sense of community

Project For Public Spaces. Measuring the impact of public markets and farmers markets on local economies. 2009; http:// www.pps.org/articles/measuring-the-impact-of-public-markets-and-farmers-markets-on-local-economies/.

Community Gardens

- Provides access to fresh produce where other healthy food outlets are not as accessible
- Provides sense of community

Twiss, J, Dickinson, J, Duma, S, Kleinman, T, Paulsen, H, & Rilveria, L (2003). Community gardens: lessons learned from California healthy cities and communities. American Journal of Public Health, 93, 1435-8.

Grocery Stores

- Lower obesity rates in neighborhoods having a supermarket/grocery store

Morland, K., Roux, A. V. D., & Wing, S. (2006). Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. American journal of preventive medicine, 30(4), 333-339.

CHANGING THE CONTEXT THROUGH DESIGN

ACCESS TO GOODS AND SERVICES

Mixed Density (residential), Mixed Land Uses and Infill

- Having a greater mix of land uses are attributed to lower obesity
- Residents are more likely to walk with multiple and useful destinations in the area.

Distance to Parks, Healthcare Facilities, Community Services, Multi-use Courts

- Distance around ¼ or ½ mile makes walking and cycling viable
- Courts (i.e. basketball) are opportunities for active recreation
- Increase Social Cohesion

McCormack, G, Giles-Corti, B, Bulsara, M (2008). The relationship between destination proximity, destination mix and physical activity behaviors. Preventive Medicine, 46, 33-40.
Kaczynski, A, Potwarka, L, & Saalens, B. (2008). Association of park size, distance, and features with physical activity in neighborhood parks. American Journal of Public Health, 98, 1451-1456.

PRODUCT PLACEMENT

Healthy Food Offerings and Placement

- Healthy food offerings at dining locations increase the consumption of healthy foods
- Healthy "grab 'n go", vending machines and cafeteria layout
- Make healthy food offerings more visible and accessible increases healthy eating habits

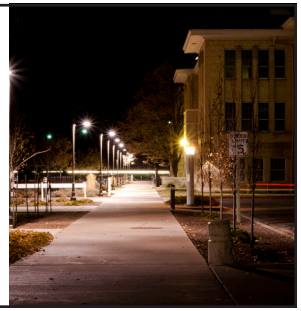
Levy, D, Riis, J, Sonnenberg, L, Barraclough, S & Thorndike, A (2012). American Journal of Preventive Medicine, 43, 240-8.

SAFETY

Crime Prevention through Environmental Design (CPTED) Techniques

- Perceived or real safety provides level of comfort for outdoor activity

Crowe TD. Crime prevention through environmental design: applications of architectural design and space management concepts. Boston: Butterworth-Heinemann; 2000

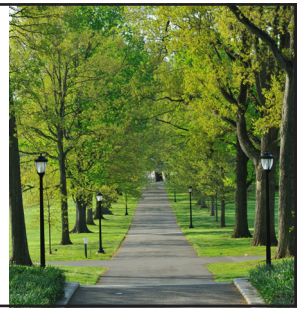


STREETSCAPE DESIGN AND OPEN SPACE

Street Trees (between road and sidewalk)

- Trees provide shade and safety and protect from sunlight and heat

Arnold, H. (1993). Trees in Urban Design. New York: Van Nostrand Reinhold.



Pedestrian Scale Lighting

- Lighting provides safety at night

Painter, K. (1996). The influence of street lighting improvements on crime, fear, and pedestrian street use, after dark. Landscape and Urban Planning, 35, 193-201.

Street Furnishings

- Benches provide rest during activity
- Signage provides direction

Lockett, D, Willis, A, Edwards, N (2005). Through seniors' eyes: an exploratory qualitative study to identify environmental barriers to facilitators of walking. Canadian of Journal of Nursing Research, 37, 48-65.
Project for Public Spaces: How to Turn a Place Around. New York: Project for Public Spaces, Inc. 2000

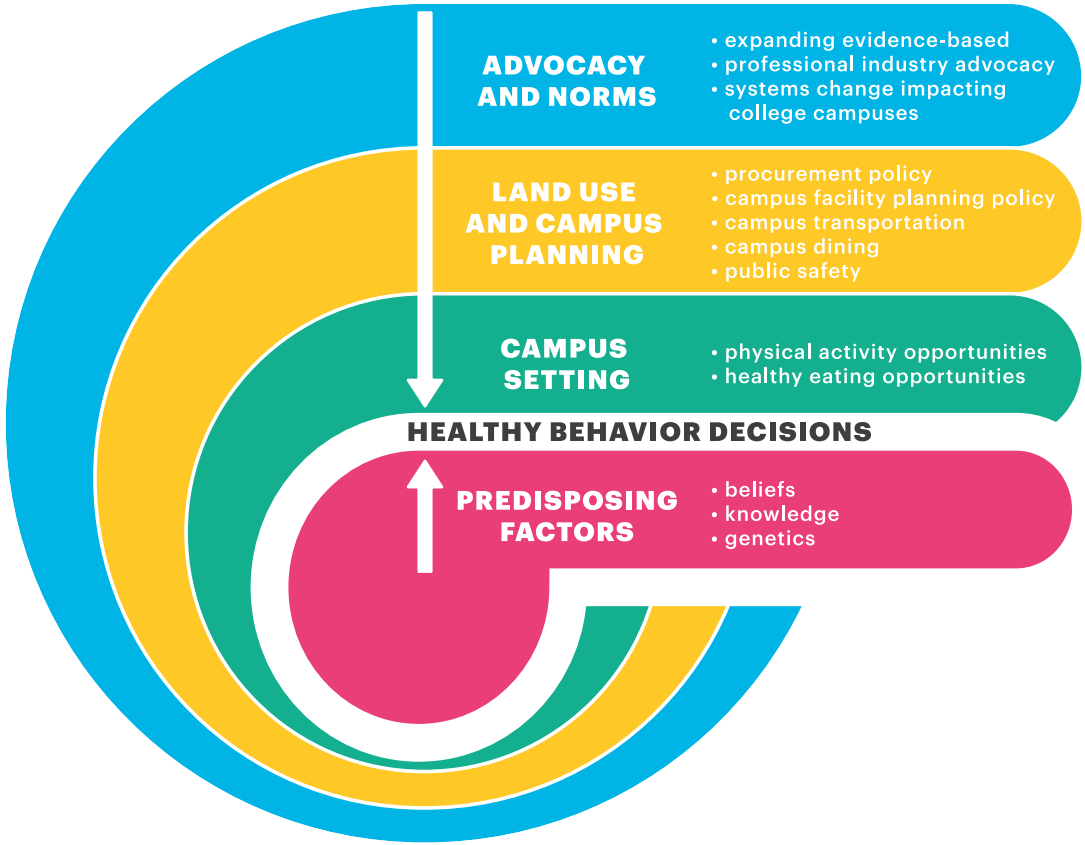
Green Infrastructure, Gardens, Multi-use Fields, Shelters (grills, picnic area), Public Plazas

- Multi-use fields allow for unstructured physical activity
- Nature contact is a predictor of physical activity
- Increase social cohesion
- Plazas provide area to promote walking and social interactions

Caloguiri, G & Chroni, S (2014). The impact of the natural environment on the promotion of active living: an integrative systematic review. BMC Public Health, 14, 873
New York City Department of Transportation. NYC Plaza Program. http://www.nyc.gov/html/dot/html/sidewalks/Publicplaza.shtml.

THE CHOICE CONUNDRUM

While it is possible to create a healthier context through design, the challenge college students face is there are too many choices for them to choose from.- and healthy decision making becomes a challenge. The adapted Socio-Ecological Model for Healthy Campus Design below shows where the design opportunity for healthy behavior decisions is located among various campus influences. How can design alter the campus setting to positively affect healthy decisions?



Adapted from "Socio-Ecological Model for Healthy Campus Design," McLeroy et al. 1988 ©CADRE2016

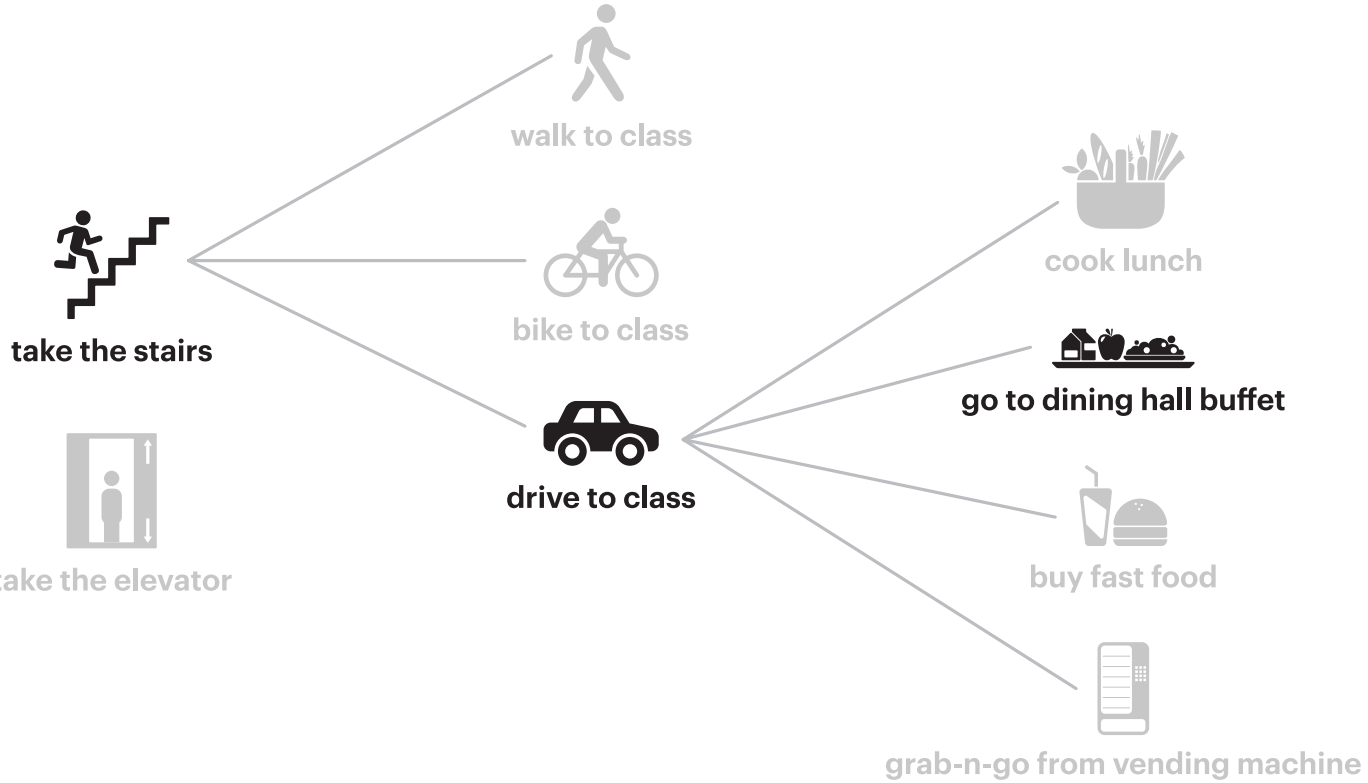
WHERE AND HOW DO WE MAKE DECISIONS?

There are too many choices to accurately make the healthy decision every time. Design solutions focused at critical points of decision can sway student behaviors towards healthy decisions in order to make the healthy choice the easy choice.

DECISIONS ON CAMPUS

HOW AND WHERE DO STUDENTS MAKE DECISIONS?

Students are faced with healthy and unhealthy decisions everyday. What are the driving influences at locations where students make decisions? How can we design these drivers to make the healthy choice the easy choice?



STUDENT PERSONAS

WHO MAKES DECISIONS?

Individuals on a campus bring different personalities, emotions, schedules, majors and more to the campus culture. How can we create a universal design for multiple personas in one campus community?

INTRODUCING POINT OF DECISION DESIGN

Point-of-Decision Design relates to the use of design features that support and promote a change in behavior, towards making healthy choices, at the point of decision.

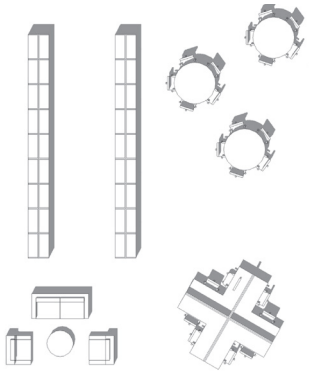
THE DESIGN CONTINUUM

Design can influence behaviors across multiple scales: information, product, interior, architecture and urban realm. Click on each sector below to see a map of design elements on specific scales.

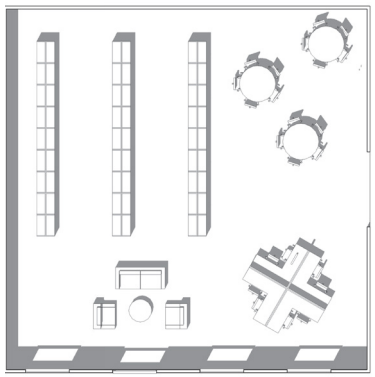
INFORMATION | PRODUCT | INTERIOR | ARCHITECTURE | URBAN REALM

PLACE

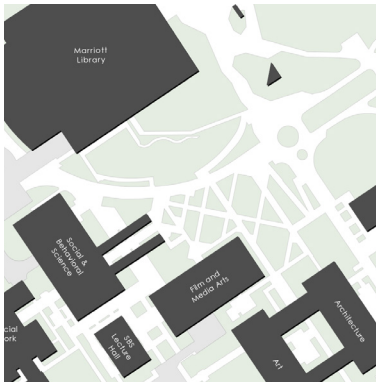
internet, device apps, signage, flyers



furniture, lighting fixtures, wearables



lighting ambience, airflow, color scheme



spatial relationship, constructed features

pathways, building organization, density

PART II WHAT WE CAN DO

4 STEPS TO POINT OF DECISION DESIGN

#1 KNOW YOUR STUDENTS

#2 LOCATE STUDENT POINTS OF DECISION

#3 IDENTIFY INFLUENTIAL FACTORS

#4 DEFINE YOUR DESIGN STRATEGIES

WHAT TO DO FOR YOUR CAMPUS

4 STEPS TO POINT OF DECISION DESIGN ON COLLEGE CAMPUSES

POINT OF DECISION DESIGN

#1 KNOW YOUR STUDENTS

Who is making decisions? Identify user personas and key destination points through campus-wide surveys, interviews and first-hand observations to understand personalities and cultures.

#2 LOCATE STUDENT POINTS OF DECISION

Where are students making decisions? Use your students personas to create journey maps and mark out the most popular and most influential points of decision.

#3 IDENTIFY INFLUENTIAL FACTORS

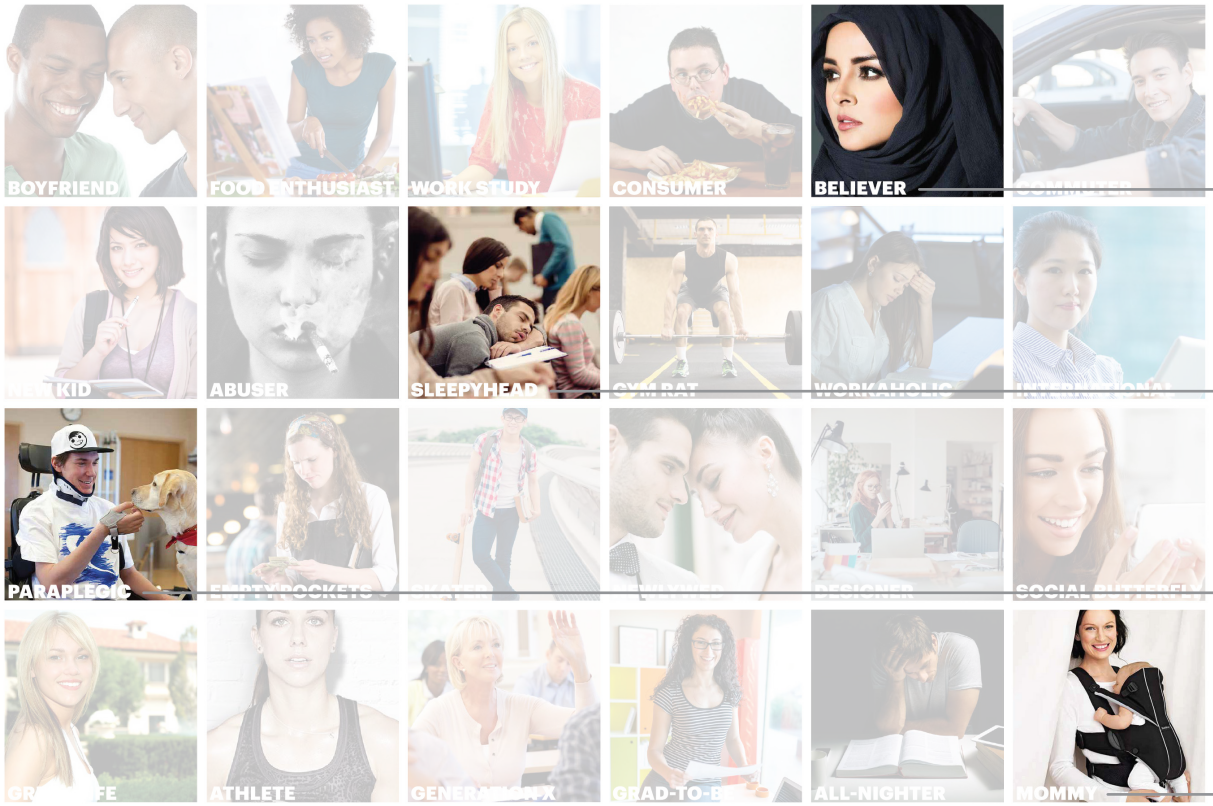
Which factors can influence their decisions? Identify influential factors at each point of decision based on student feedback, and identify which factors fall under campus setting (design) or predisposing factors (control).

#4 DEFINE YOUR DESIGN STRATEGIES

How can we design across scales to prompt a healthy decision? Use the visual design guide and other resources (critical links document) to apply design strategies to campus setting factors at each point of decision.

#1 KNOW YOUR STUDENTS

Understand the various student personliaties and cultures living on your campus. Group similar student personas in order to analyze your student body with just a few personas such as those below.



Sometimes I feel people judge the way I dress for my **religion**, so I take quiet paths, and hang out with my friends in the **courtyards**. I'm a **vegetarian**, so I usually eat at the **dining hall** since there are many good options."

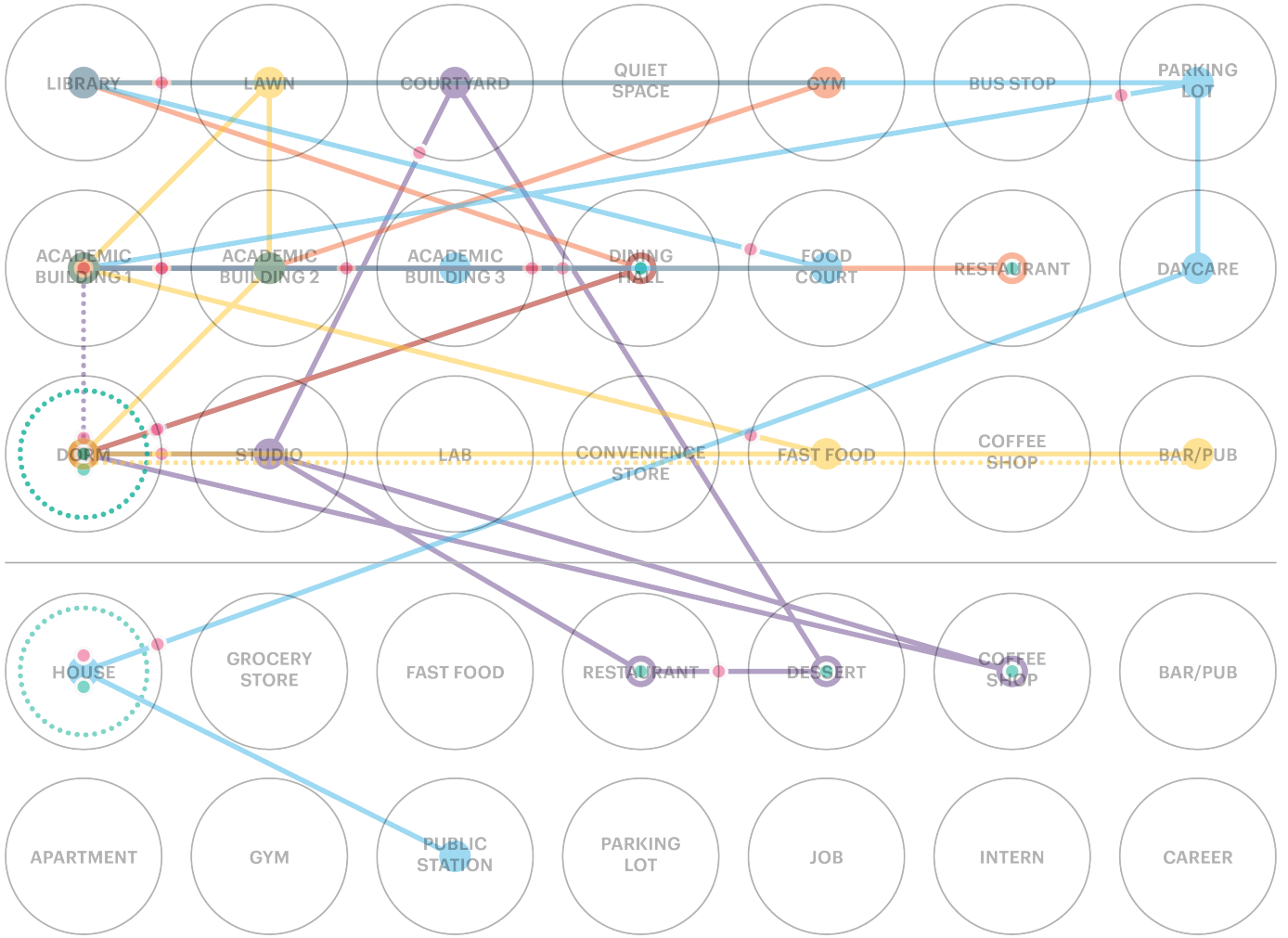
"Most nights I stay up **playing video games**. Sometimes I skip class and stay home since my friends and I take turns and share notes. I keep **food from the campus convenience store in my room** for grab-and-go food."

I take different routes than most of the people who walk because **my chair takes minimal terrain**. I avoid the food locations that get too crowded. I like to go to the **dining halls** best because there is a variety of food and tables."

Jack makes hours at home a priority, so I **exercise at home with online videos** and I learned to **cook**. With him around, I **only go to campus when I have class** because I don't like to leave him in the **campus day care** too long."

#2 LOCATE STUDENT POINTS OF DECISION

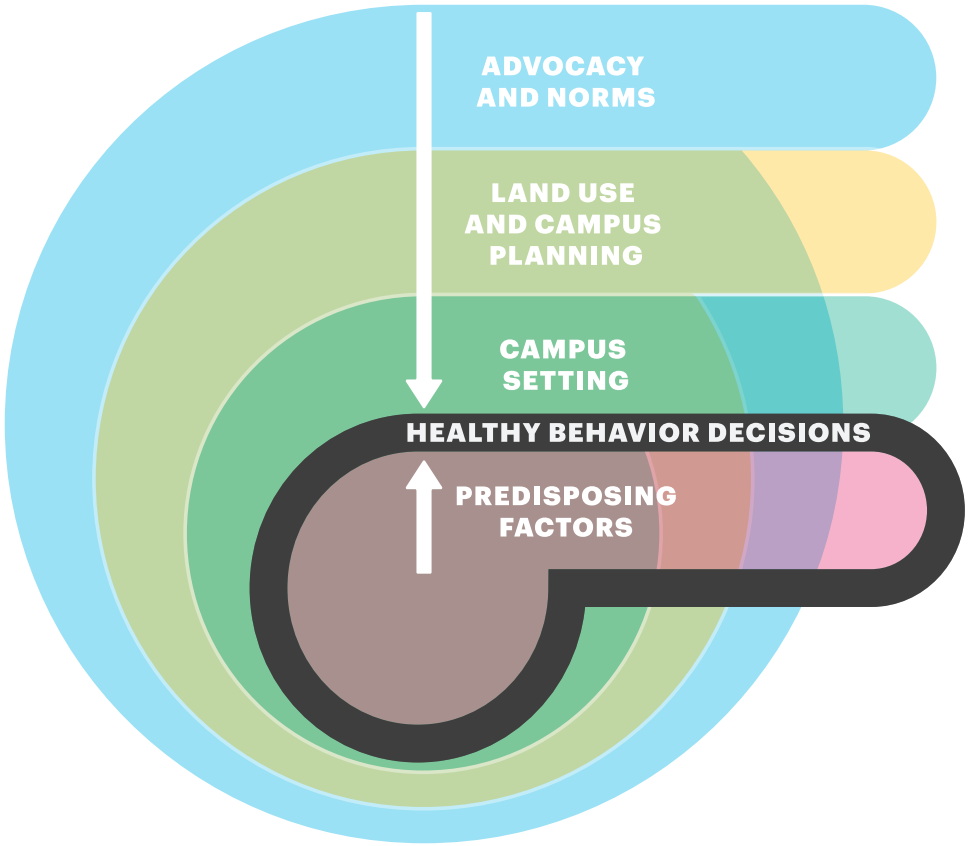
Diverse students face healthy and unhealthy choices everyday. See the below exmples of “day in the life” journeys to identify the most common points of decision on campus.



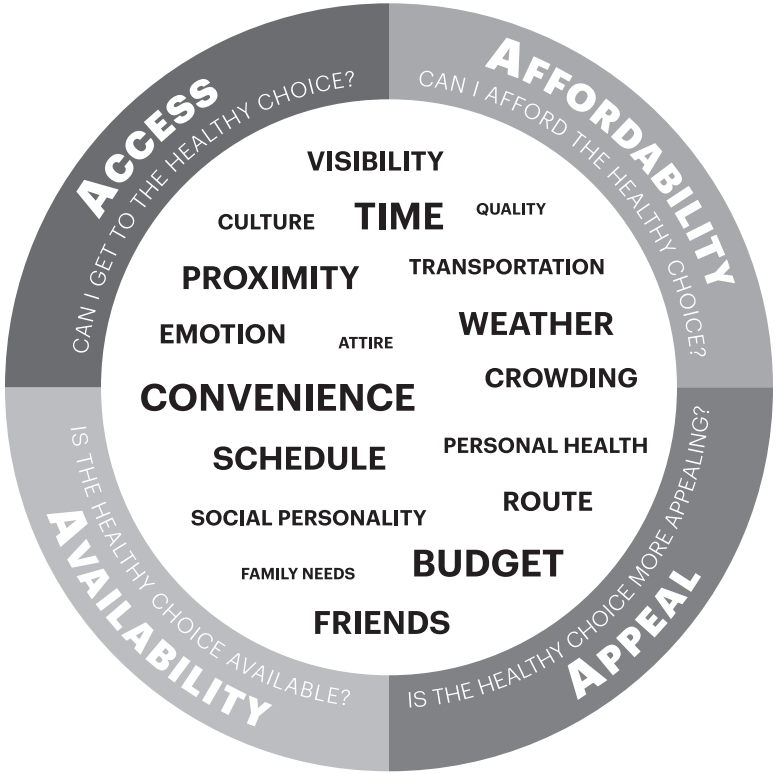
Meal Planning Decisions on Move Decisions on Diet

#3 IDENTIFY INFLUENTIAL FACTORS

The socio-ecological model tells us there are multiple influential factors that impact behavior. The predisposing factors of the socio-ecological model cannot be controlled by design. However there are influential factors which can change day to day based on the 4 As: access, affordability, availability and appeal. For this reason, it is important to engage students and see which factors at points of decision can be influenced by design.



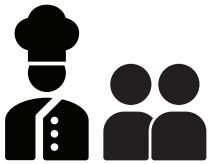
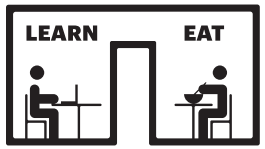
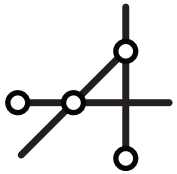
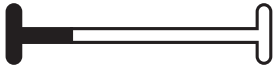
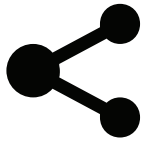
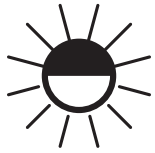
INFLUENTIAL FACTORS



Adapted from "Socio-Ecological Model for Healthy Campus Design," McLeroy et al. 1988 ©CADRE2016

#4 DEFINE YOUR DESIGN STRATEGIES

The design strategies listed below offer ways to create a healthy campus across all scales of design. See green boxes for Diet by Design, pink boxes for Move by Design and gray boxes for strategies in both diet and physical activity.

FARMERS MARKETS 	COMMMUNAL KITCHEN 	CULTURAL FOOD CHOICES 	HYDRATION STATIONS 	FLEX SPACE FOR FOOD VENDORS 
COOKING CLASSES 	PORTION CONTROL 	RECHARGE ZONES 	MIXED USE 	HEALTHY CHOICE MAPS 
CROSSROAD PROMPTS 	1/4 MILE ACCESS TO HEALTHY GOODS 	SOCIAL GATEHERING SPACES 	PEDESTRIAN/SOCIAL SPINE 	BIKE PARKING 
SEATING INTEGRATED WITH LANDSCAPE 	RELAXATION SPACES 	STRATEGIES WITH NATURAL LIGHT 	TREE-LINED WALKWAYS 	GREEN ROOFS 

DIET BY DESIGN | MOVE BY DESIGN | NEUTRAL STRATEGY

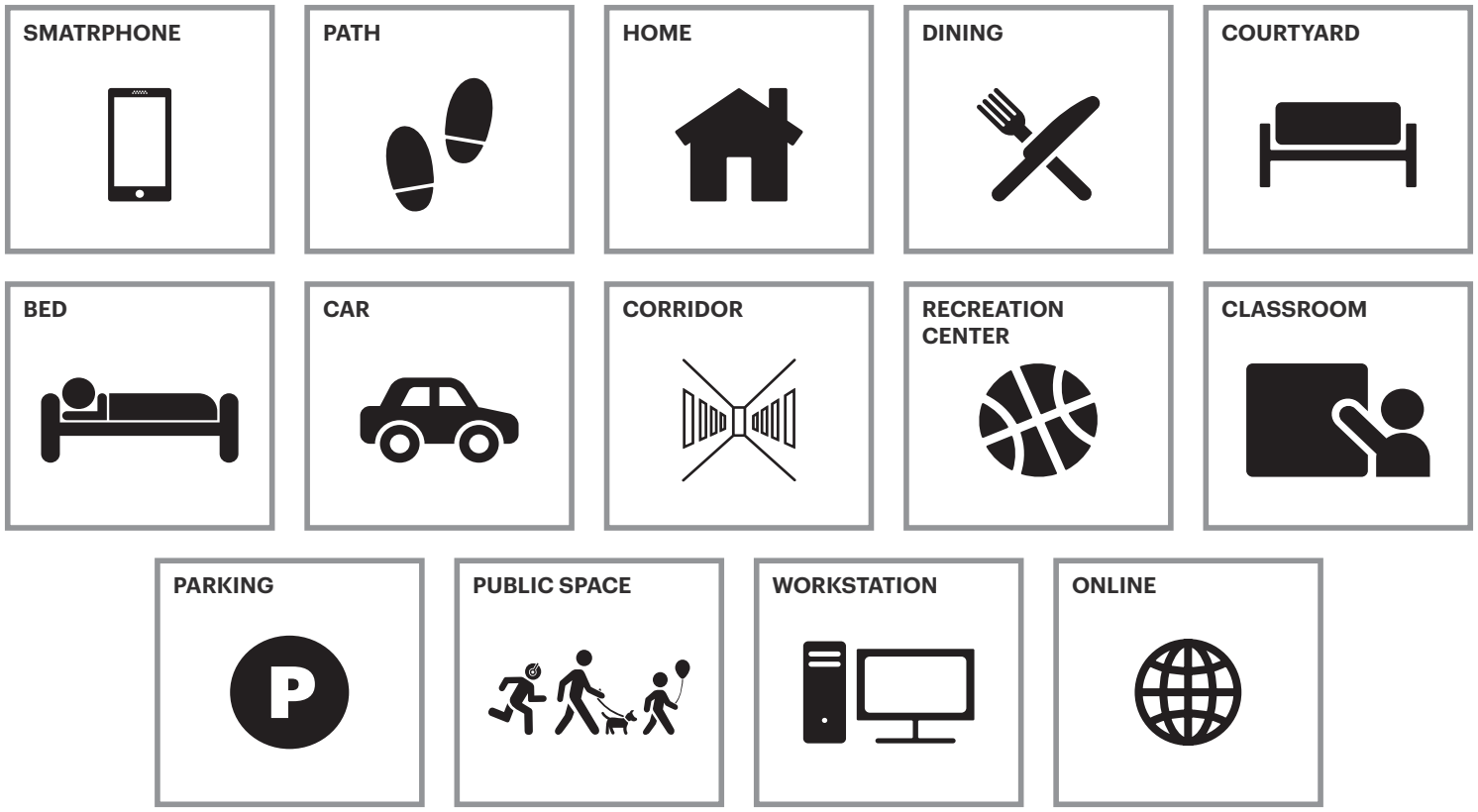
PART III SUMMARY

i14 POINTS OF DECISION ON A COLLEGE
CAMPUS 24 DESIGN STRATEGIES
POINT OF DECISION DESIGN [PODD]

PODD EQUATION

POINTS OF DECISION

Based on an Ideation Session with 40 cross disciplinary participants 14 key points of decision on a college campuses were identified (See detailed report for ideation session process).



DESIGN STRATEGIES ALONG THE CONTINUUM

INFORMATION | PRODUCT | INTERIOR | ARCHITECTURE | URBAN REALM

PLACE

HEALTHY CHOICE MAPS WITH GEOTAGS INTERACTIVE APP

HYDRATION STATIONS ACCESS TO FILTERED WATER

NATURAL LIGHT DAYLIGHT WITH INDOOR/OUTDOOR SCHEMES

TRANSIT STOPS AND SHELTERS

CENTRAL GREEN SPACE AS FLEX SPACE FOR FARMERS MARKETS + FOOD VENDORS

CROSSROAD PROMPTS

CULTURAL SENSITIVITY HEALTHY GROCERY + FOOD OPTIONS

LEARNING KITCHEN SHARED KITCHENS IN HOUSING, COOKING CLASSES

RECHARGE ZONES MIND, BODY, SPIRIT, TECHNOLOGY

BIKE TRANSIT PARKING, LANES + PATHS, RENTAL

TREE-LINED WALKWAYS STREET TREES

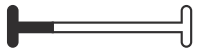
MAKE IT COOL HEALTHY CHOICES AS THE A TREND

PORTION CONTROL PRODUCTS DINNERWARE + NUTRITIONAL INFORMATION

GREEN ROOFS GARDENS AND TERRACES

COMMUNITY GARDENS

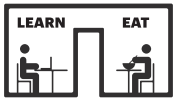
1/4 MILE ACCESS TO HEALTHY GOODS WALKABLE DISTANCE



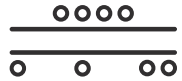
HEALTHY FOOD OFFERINGS & PLACEMENT

ATTRACTIVE AND VISIBLE STAIR PLACEMENT

MIXED USE ACADEMIC, RETAIL, FOOD, HOUSING



SOCIAL SPINE VISIBLE GATHERING NICHES NEAR HEALTHY FOOD/ACTIVITY



INCREASED VISIBILITY OF CHOICES

LIGHTING SAFETY STRATEGIES CRIME PREVENTION AT NIGHT

PEDESTRIAN PATHWAYS INTEGRATED RUNNING LOOP/TRAILS

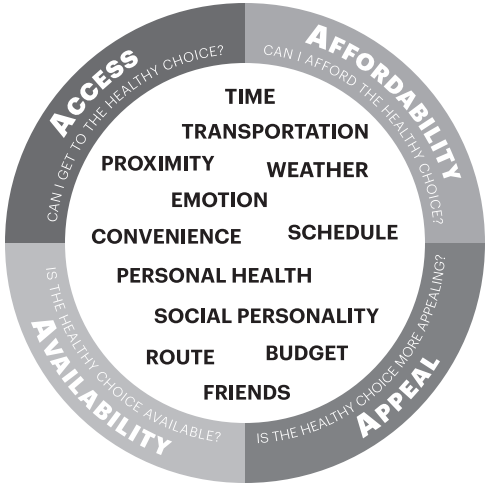
STREET FURNISHINGS SEATING INTEGRATED WITH LANDSCAPE

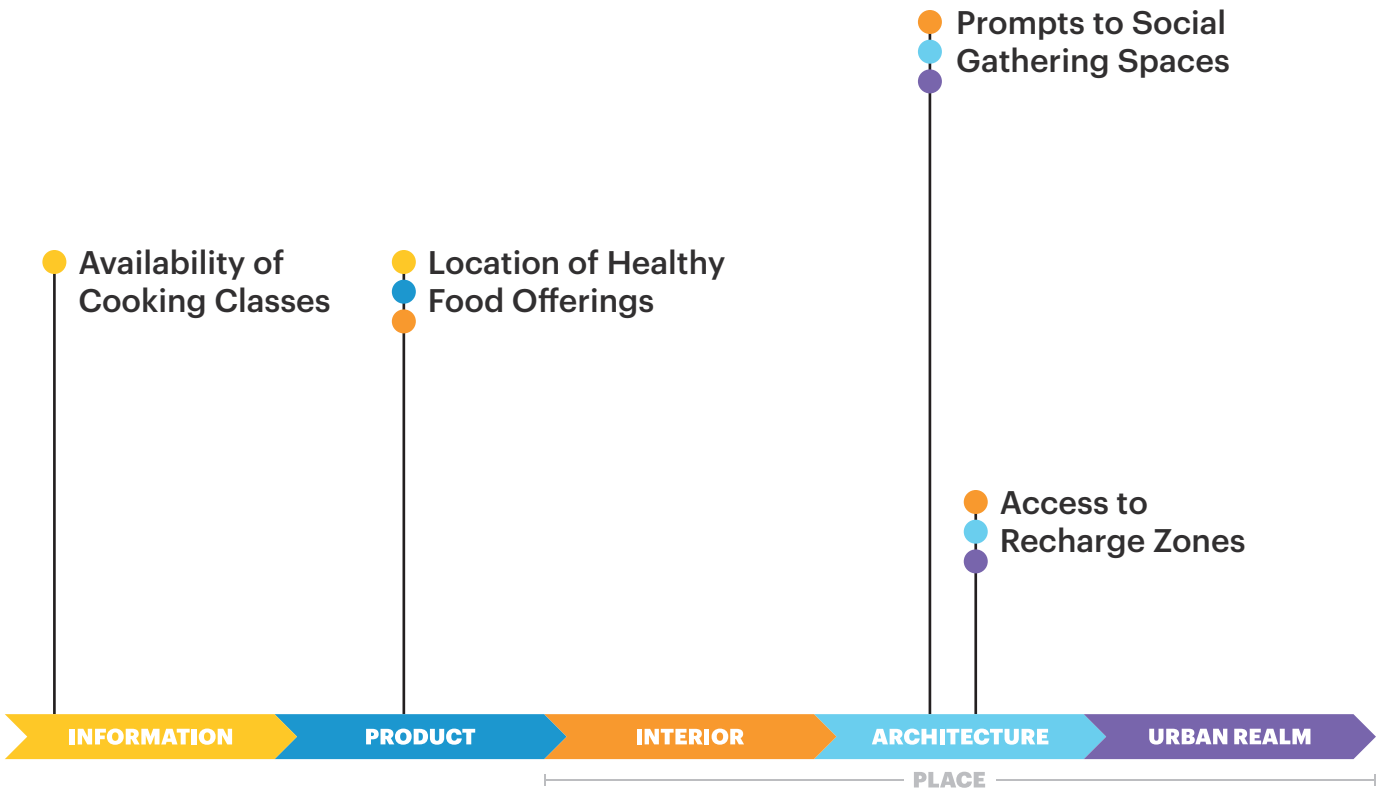
Ideation Session

Literature

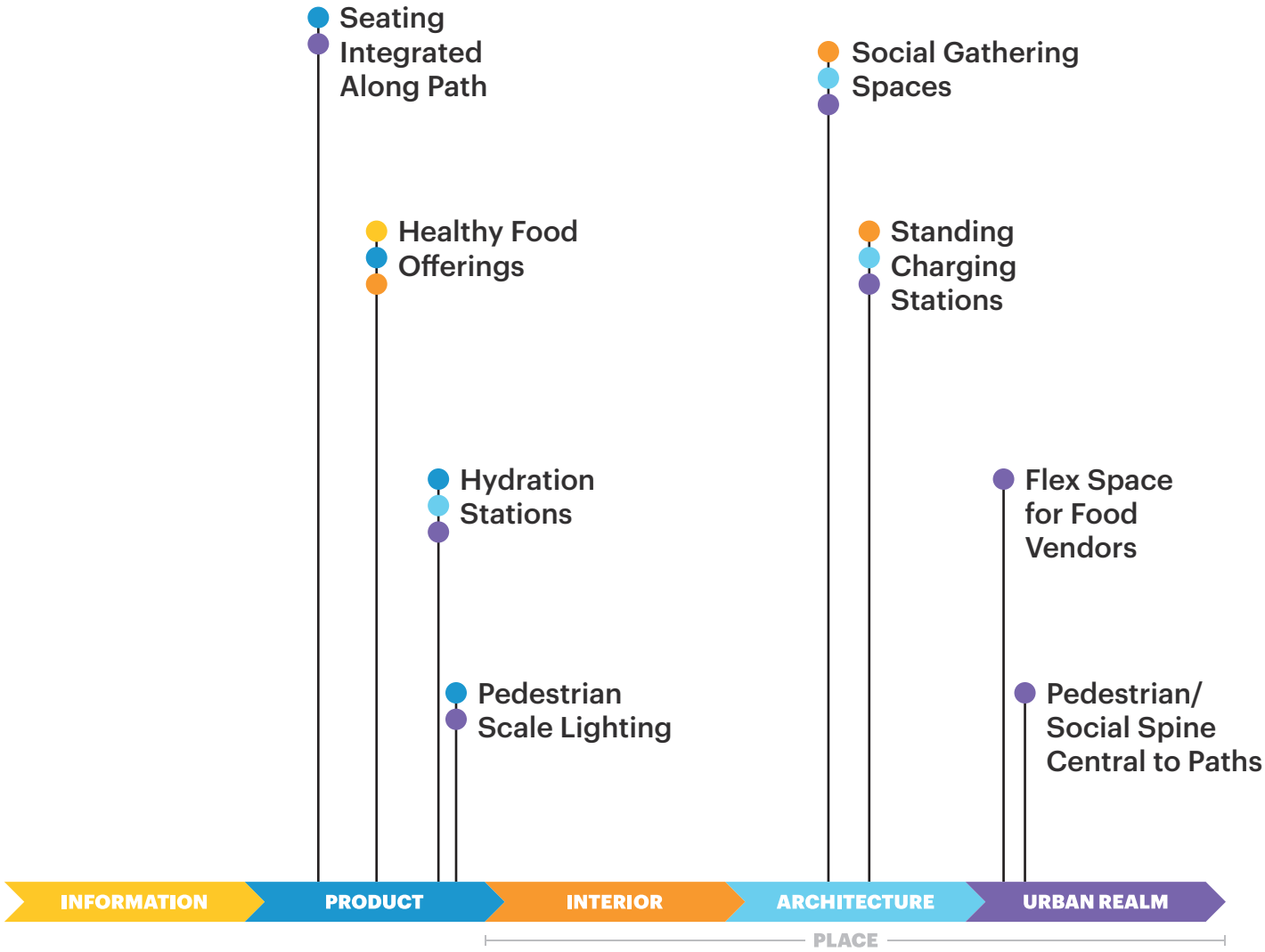
24 design strategies were summarized based on an analysis of the literature and ideation session findings. Most new ideas appeared on the left side of the continuum (information and product design). Also more diet-based strategies came from the Ideation Session whereas most move-based strategies were from preexisting literature.

POINT OF DECISION DESIGN SMARTPHONE



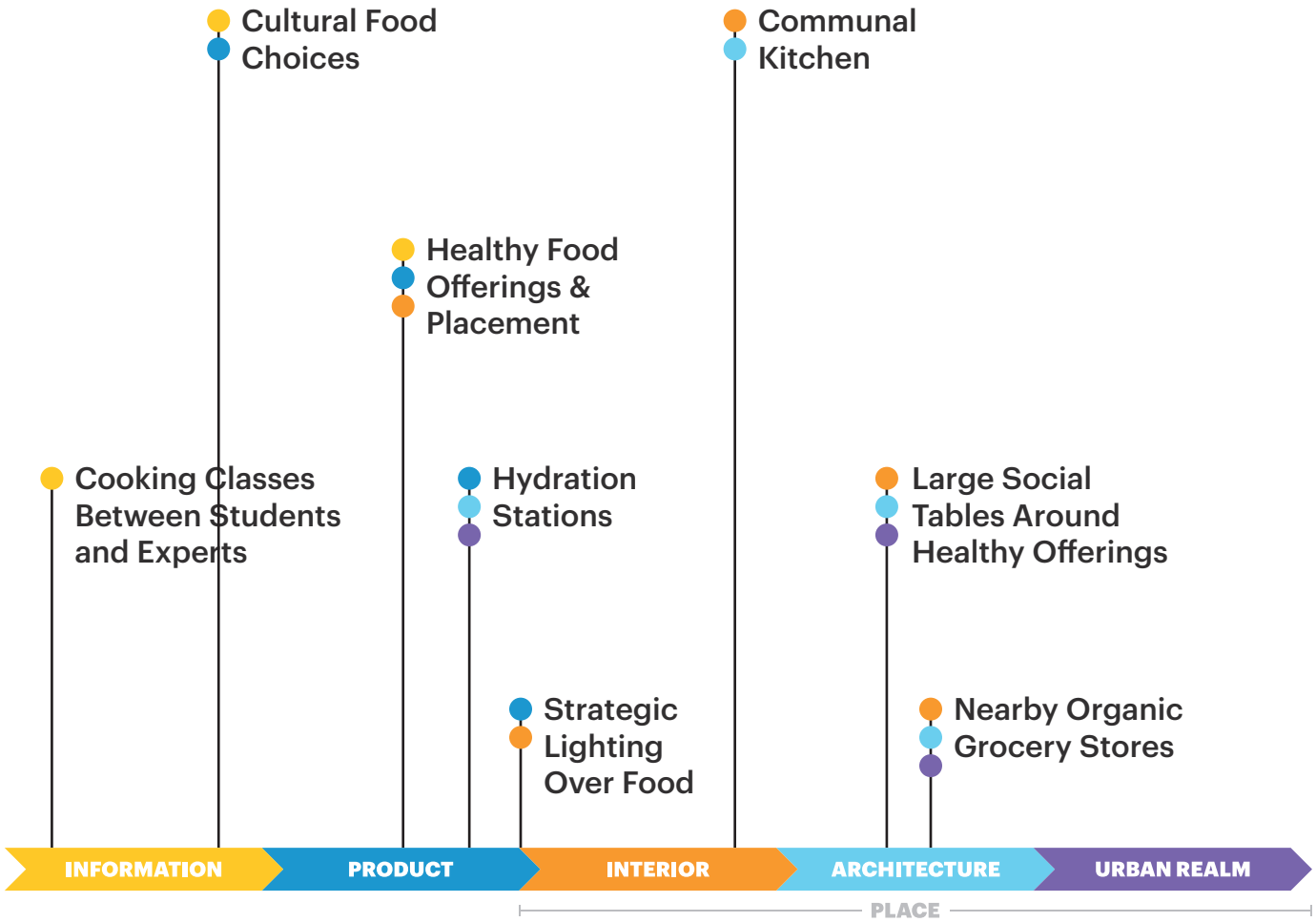


POINT OF DECISION DESIGN PATH

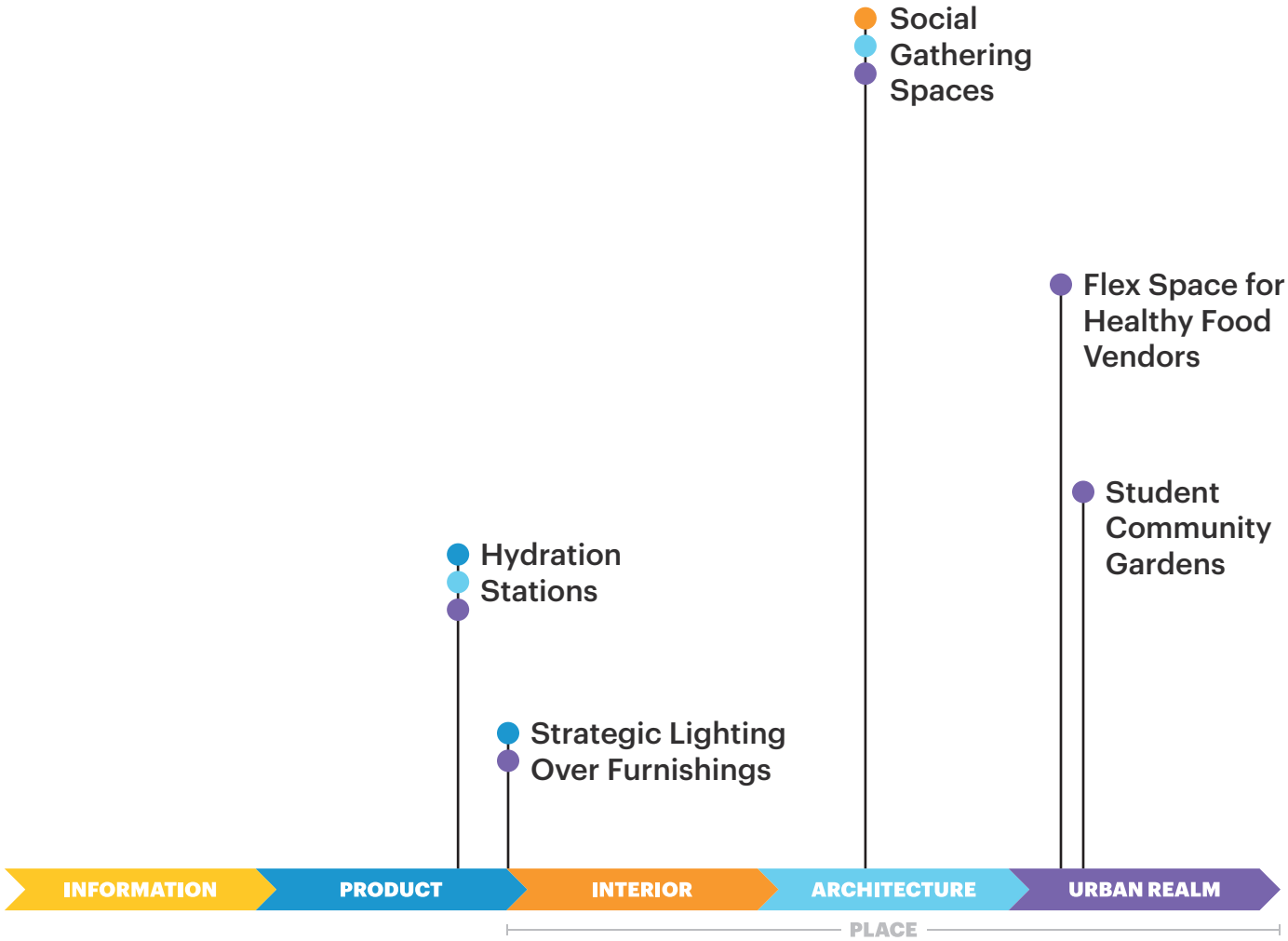


POINT OF DECISION DESIGN HOME

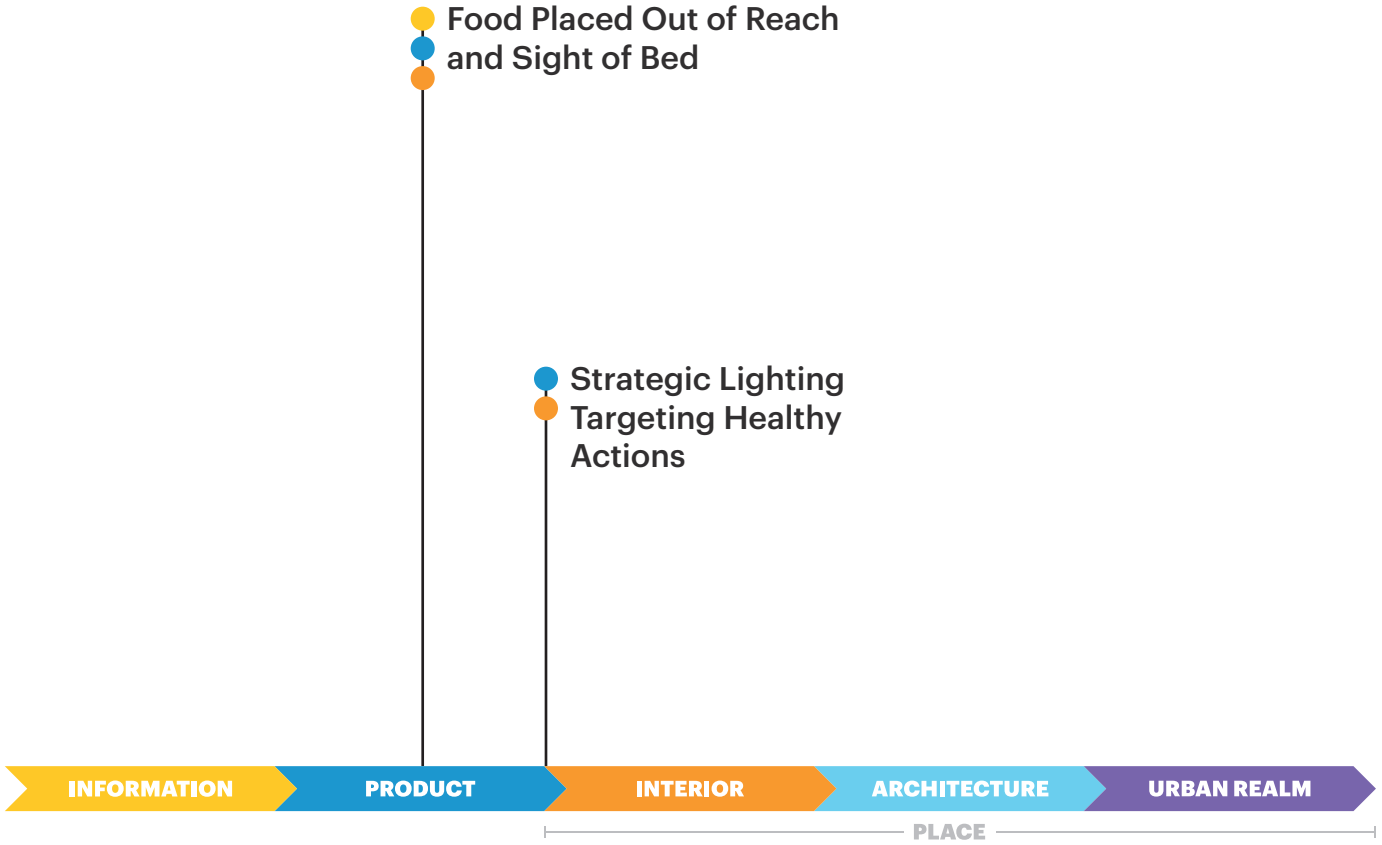
POINT OF DECISION DESIGN DINING



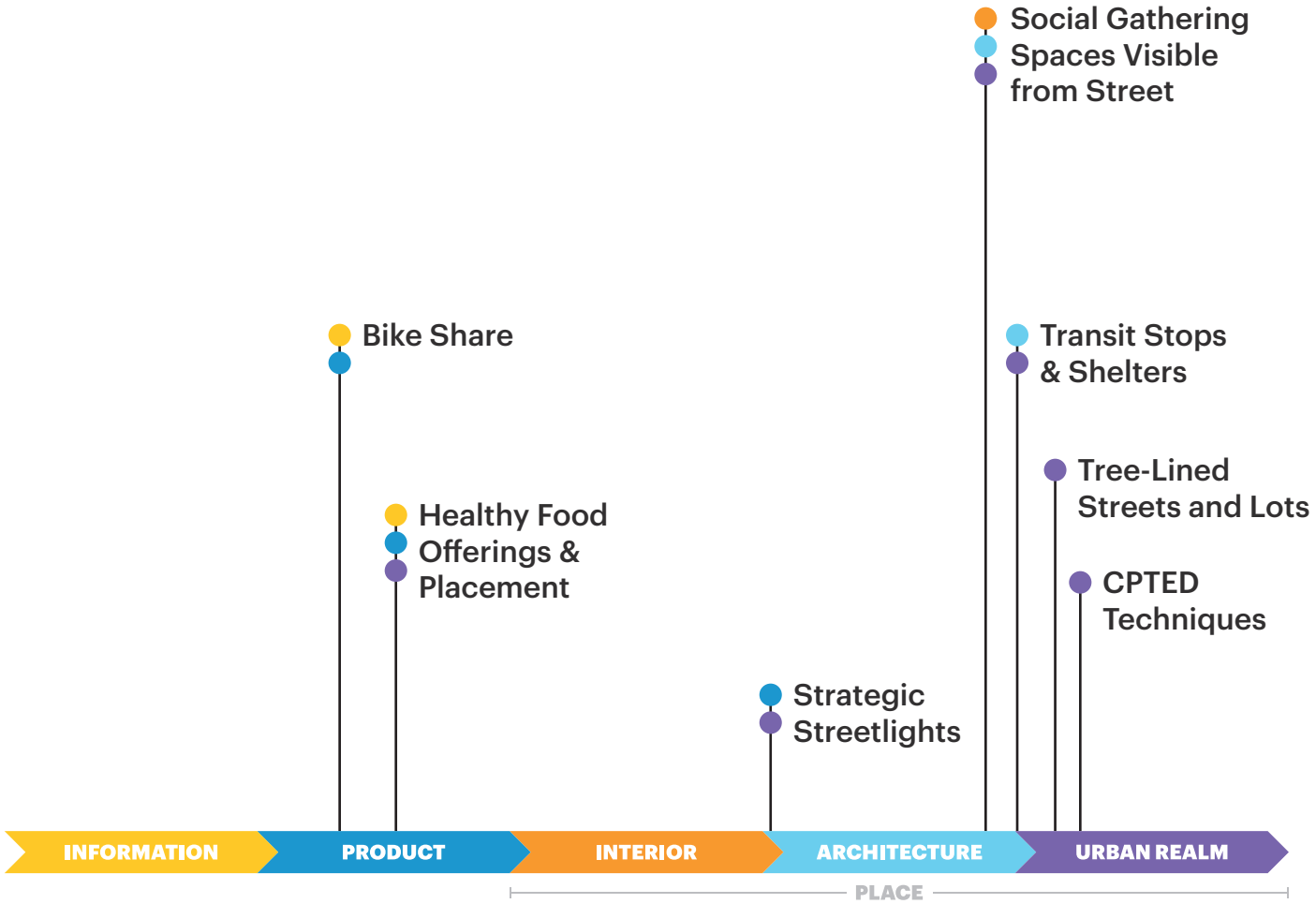
POINT OF DECISION DESIGN COURTYARD



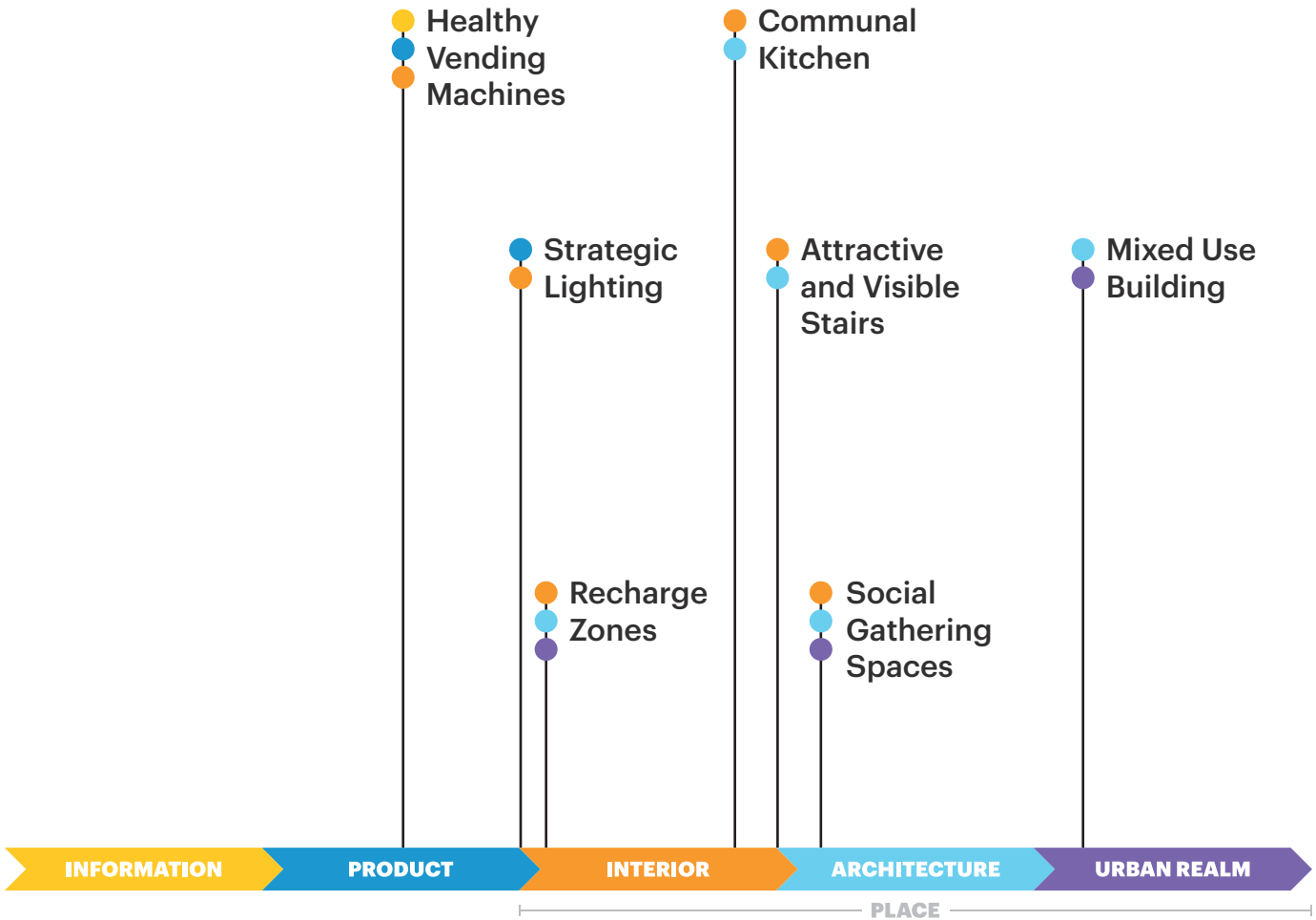
POINT OF DECISION DESIGN BED



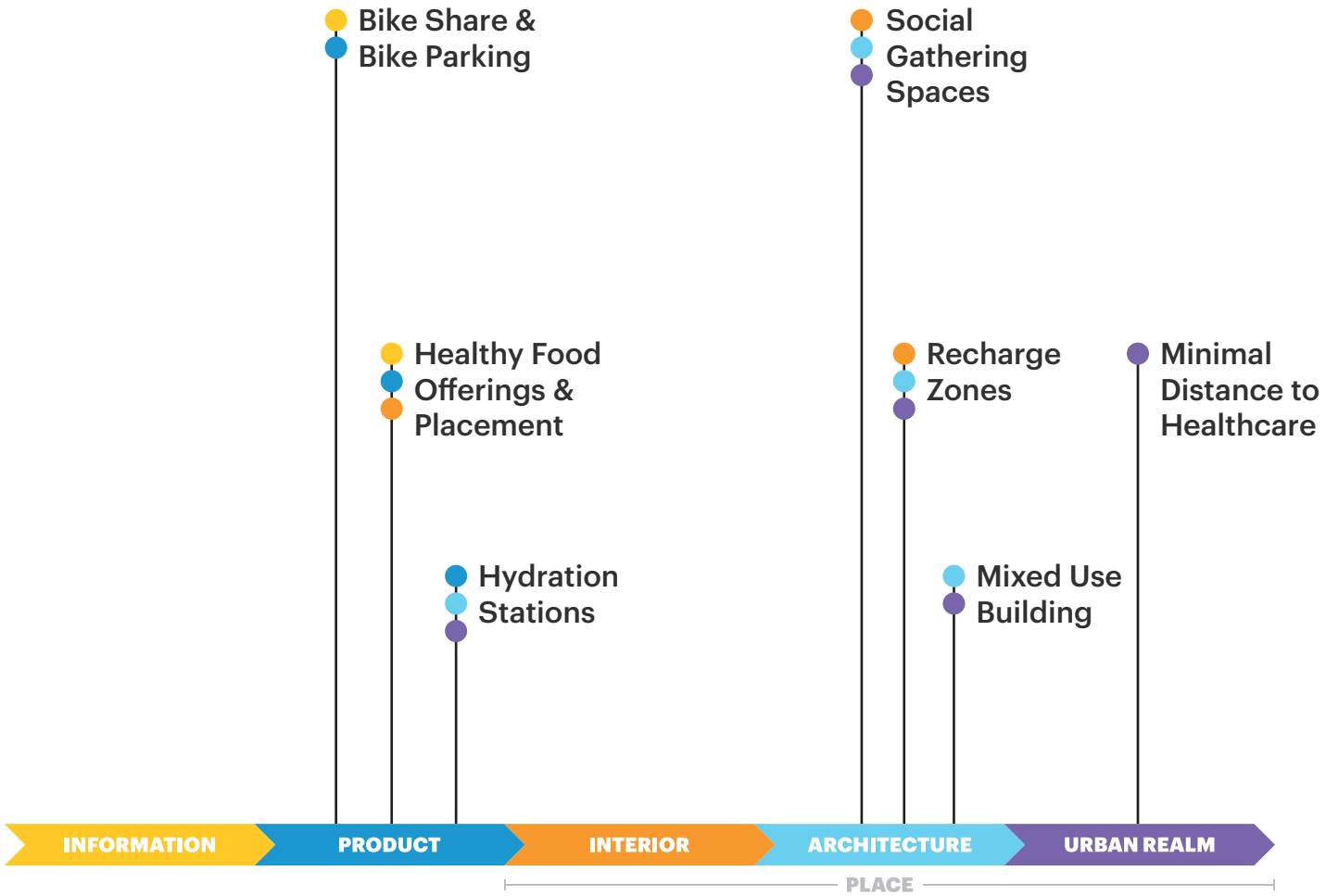
POINT OF DECISION DESIGN CAR

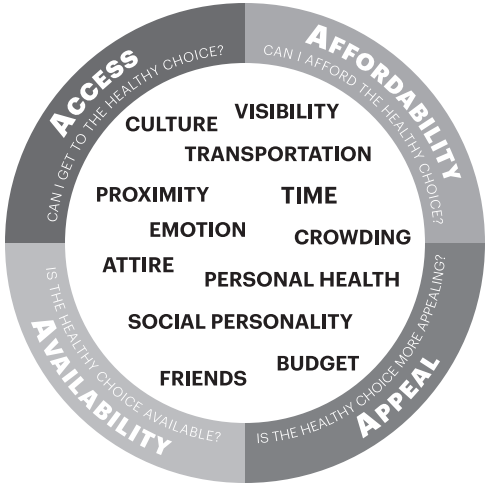


POINT OF DECISION DESIGN CORRIDOR

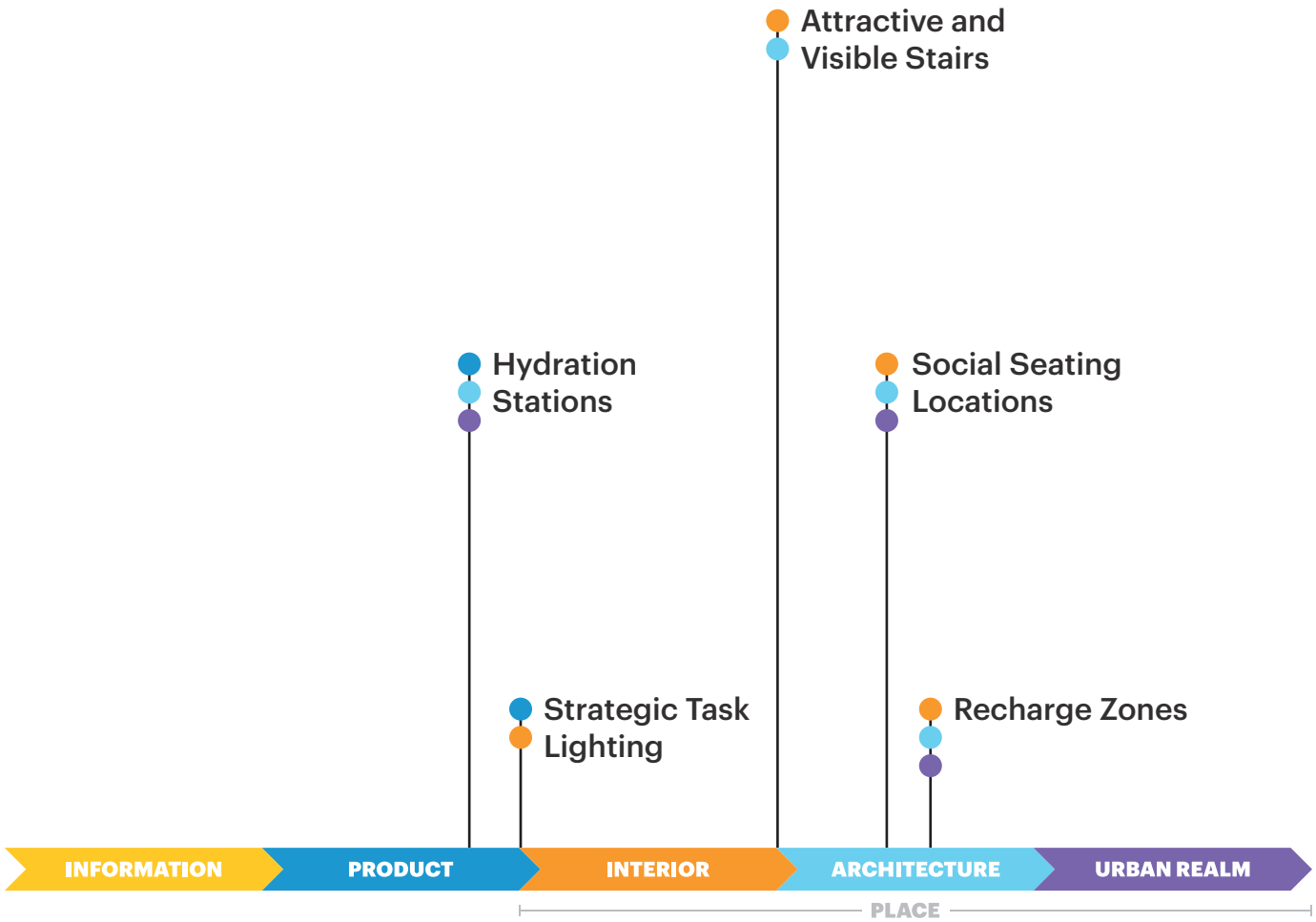


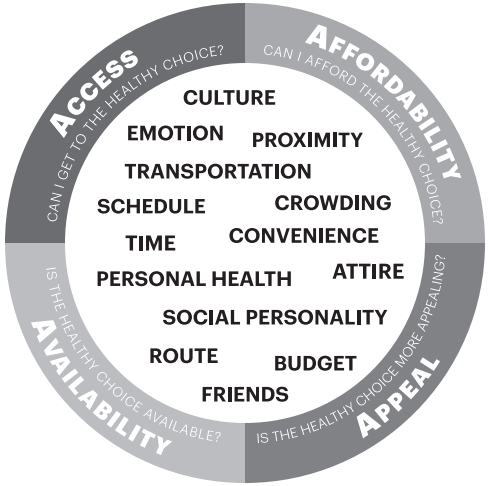
POINT OF DECISION DESIGN REC CENTER



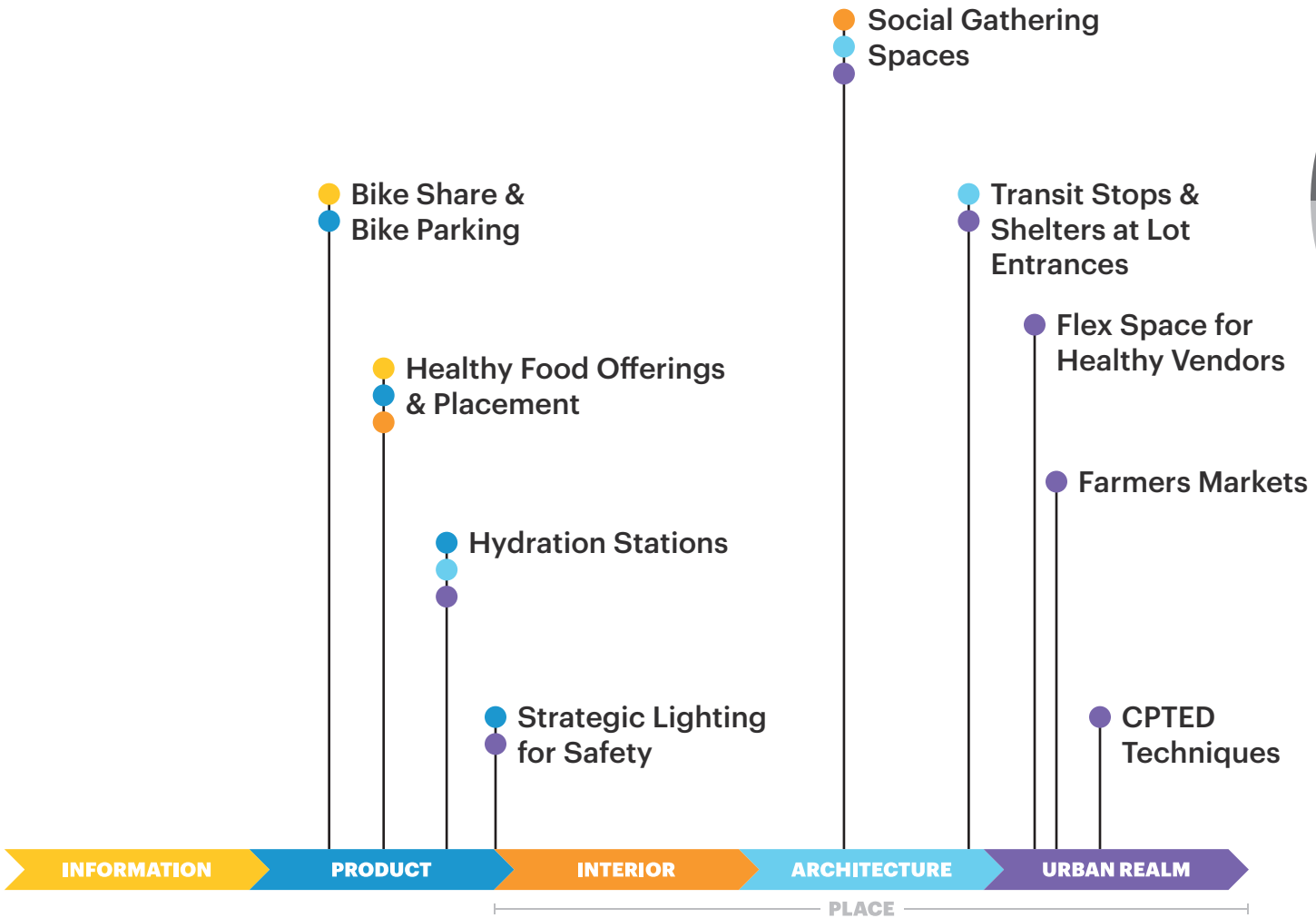


POINT OF DECISION DESIGN CLASSROOM

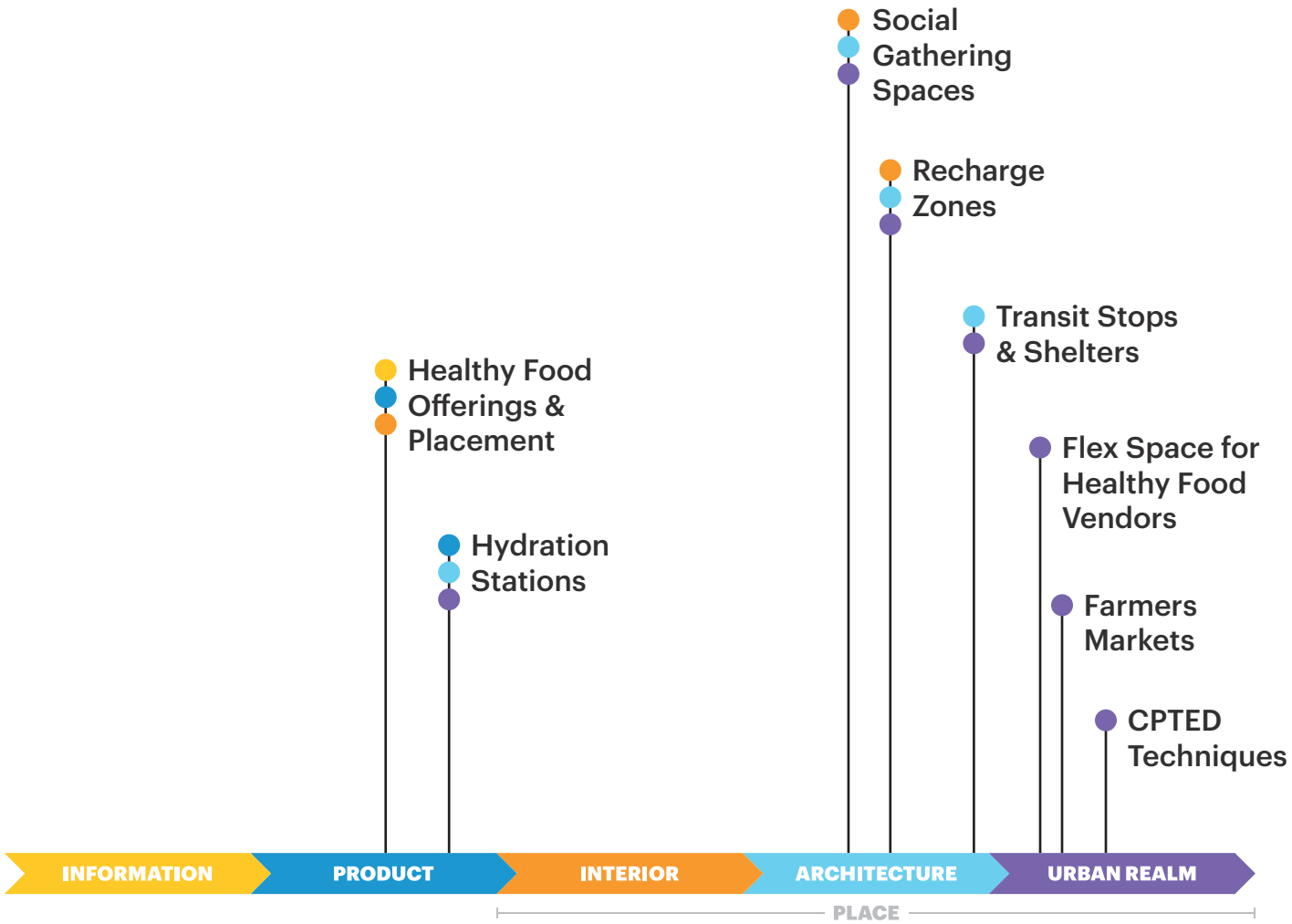




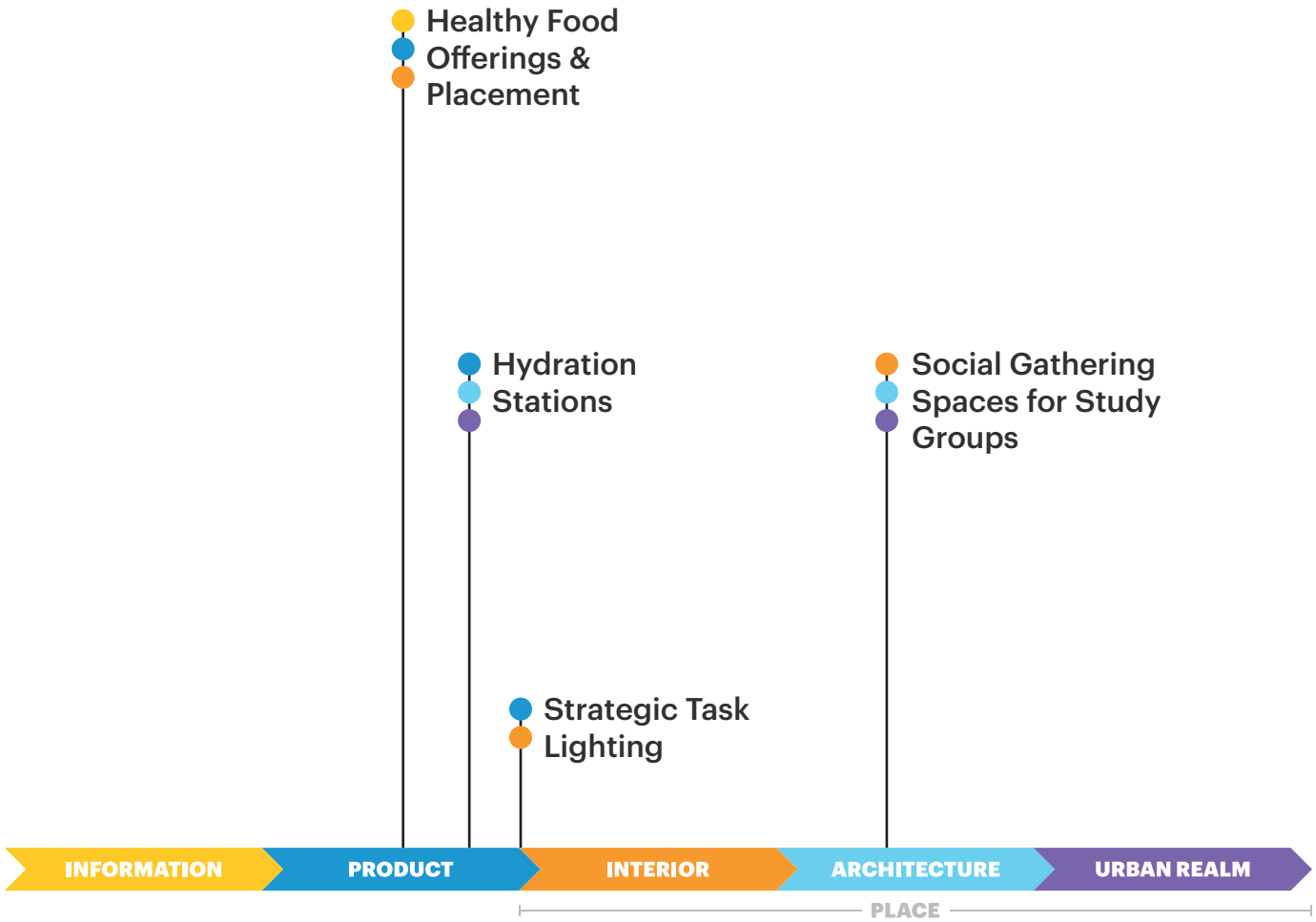
POINT OF DECISION DESIGN PARKING



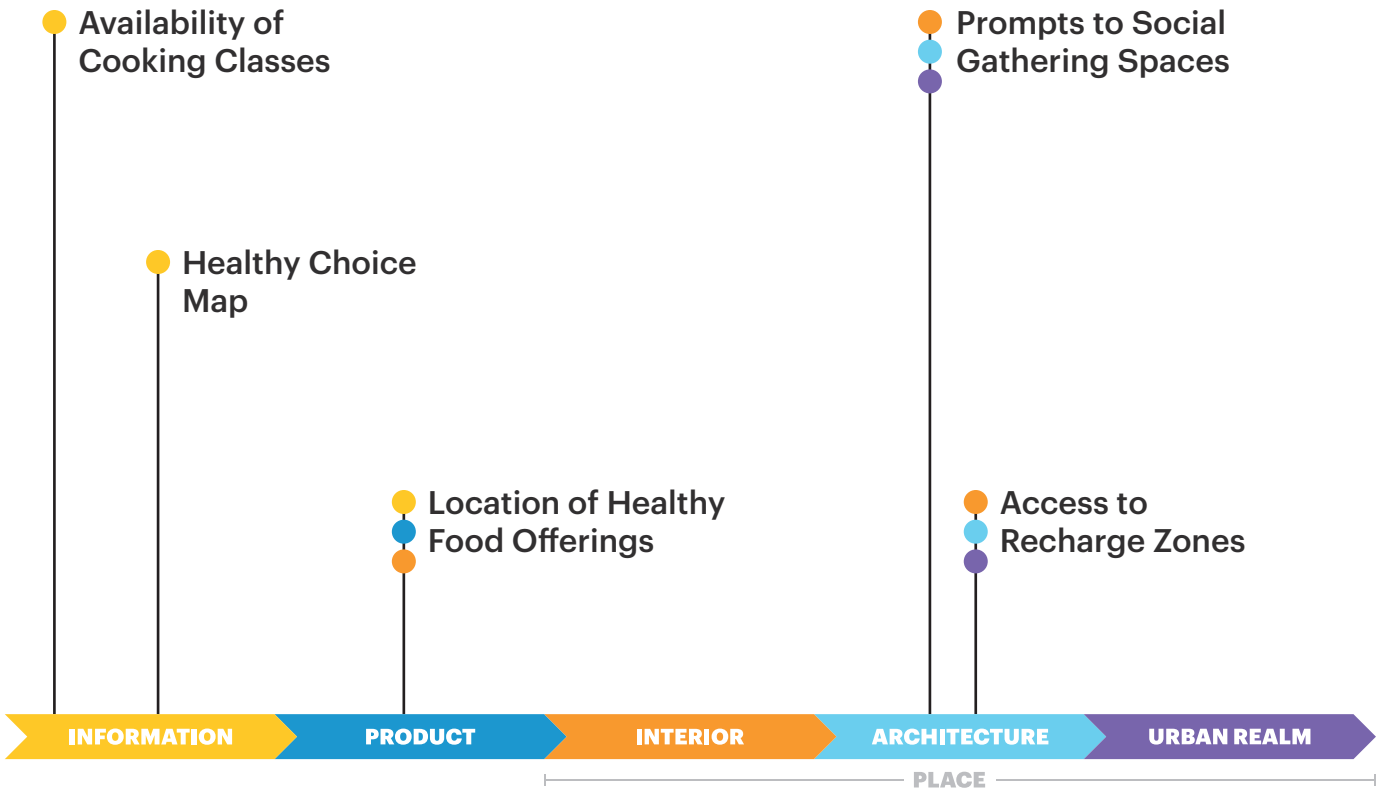
POINT OF DECISION DESIGN PUBLIC SPACE

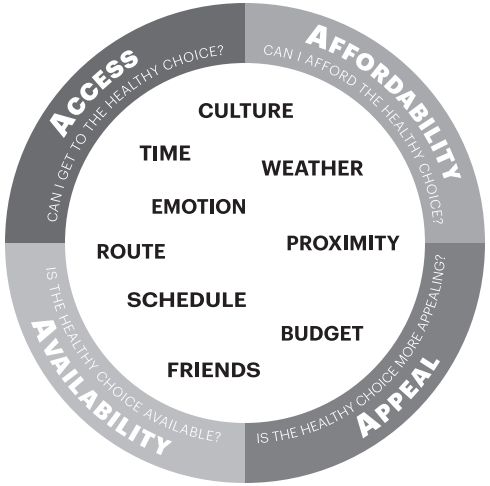


POINT OF DECISION DESIGN WORKSTATION



POINT OF DECISION DESIGN ONLINE





PERSONA + POINTS OF DECISION + DESIGN STRATEGY + INFLUENTIAL FACTORS =

POINTS OF DECISION DESIGN

CRITICAL LINKS

CONTEXT SPECIFIC DESIGN

Cervero, R, Kockelman, K (2004). The relationship between non-motorized mode choice and the local physical environment.

Transportation Research: Part D, 9, 151-173.Fraser, S & Lock, K. (2011). Cycling for Transport and Public Health: a Systematic Review of the Effect of the Environment for Cycling. European Journal of Public Health, 21, 738-43.

Pucher, J, Dill, J, & Handy, S. (2010). Infrastructure, Programs, and Policies to Increase Bicycling: an International Review. Preventive Medicine, 50, S106-S125.

STREETSCAPE DESIGN

Arnold, H. (1993). Trees in Urban Design. New York: Van Nostrand Reinhold.

Painter, K. (1996). The influence of street lighting improvements on crime, fear, and pedestrian street use, after dark. Landscape and Urban Planning, 35, 193-201.

Lockett, D, Willis, A, Edwards, N (2005). Through Seniors' Eyes: an Exploratory Qualitative Study to Identify Environmental Barriers to Facilitators of Walking. Canadian of Journal of Nursing Research, 37, 48-65.

Project for Public Spaces: How to Turn a Place Around. New York: Project for Public Spaces, Inc. 2000.

TRANSIT

Edwards, R (2008). Public Transit, Obesity, and Medical Costs: Assessing the Magnitudes. Preventive Medicine, 46, 14-21.

CONNECTIVITY

Sun, G, Oreskovic, N & Lin, H (2014). How do Changes to the Built Environment Influence Walking Behaviors? A Longitudinal Study within a University Campus in Hong Kong. International Journal of Health Geographics, 13, 28.

TRAILS and OPEN SPACE

Caloguiri, G & Chroni, S (2014). The Impact of the Natural Environment on the Promotion of Active Living: an Integrative Systematic Review. BMC Public Health, 14, 873.

New York City Department of Transportation. NYC Plaza Program. http://www.nyc.gov/html/dot/html/pedestrians/publicplaza-sites.shtml.

SAFETY

Crowe, TD. Crime Prevention through Environmental Design: Applications of Architectural Design and Space Management Concepts. Boston: Butterworth-Heinemann; 2000.

Jacobs, J. (1961). The death and life of great American cities. Vintage.; Newman, O. (1972). Defensible space (p. 264). New York: Macmillan.

MIX OF USES, ACCESS TO GOODS AND SERVICES

McCormack, G, Giles-Corti, B, Bulsara, M (2008). The Relationship Between Destination Proximity, Destination Mix and Physical Activity Behaviors. Preventive Medicine, 46, 33-40.

Kaczynski, A, Potwarka, L, & Saalens, B. (2008). Association of Park Size, Distance, and Features with Physical Activity in Neighborhood Parks. American Journal of Public Health, 98, 1451-1456.

STAIRS

Nicoll, G (2007). Spatial Measures Associated with Stair Use. Science of Health Promotion, 21, 345-52.

Kerr, N, Yore, M, Ham, S, & Dietz, W (2004). Increasing stair use in a worksite through environmental changes. American Journal of Health Promotion, 18, 312-15.

Boutelle, K, Jeffery, R, Murray, D & Schmitz, M (2001). Using Signs, Artwork, and Music to Promote Stair Use in a Public Building. American Journal of Public Health, 91, 2004-6.

HEALTHY FOOD AVAILABILITY

Project For Public Spaces. Measuring the Impact of Public Markets and Farmers Markets on Local Economies. 2009; http://www.pps.org/reference/measuring-the-impact-of-public-markets-and-farmers-markets-on-local-economies/.

Twiss, J, Dickinson, J, Duma, S, Kleinman, T, Paulsen, H, & Rilveria, L (2003). Community Gardens: Lessons Learned from California Healthy Cities and Communities. American Journal of Public Health, 93, 1435-8.

Morland, K., Roux, A. V. D., & Wing, S. (2006). Supermarkets, other food stores, and obesity: the atherosclerosis risk in communities study. American journal of preventive medicine, 30(4), 333-339.

PRODUCT PLACEMENT

Levy, D, Riis, J, Sonnenberg, L, Barraclough, S & Thorndike, A (2012). Food Choices of Minority and Low-Income Employees: A Cafeteria Intervention. American Journal of Preventive Medicine, 43, 240-8.

OTHER RESOURCES

Center for Active Design, 2013. Active Design Guidelines. (See Resources: Urban Design Checklist, Building Design Checklist). https://centerforactivedesign.org/guidelines/

Urban Land Intitute. Building Healthy Places Toolkit: Strategies for Enhancing Health in the Built Environment. Washington, DC: Urban Land Institute, 2015. http://uli.org/wp-content/uploads/ULI-Documents/Building-Healthy-Places-Toolkit.pdf