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Recognizing Campus Landscapes as Learning Spaces

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Introduction

American higher education institutions face unique twenty-first century changes and challenges in providing good, holistic learning spaces for the diverse and evolving needs of today's college student. Continued enrollment growth, societal and technological changes, financial challenges, and a need for increased universal and open access create ever more diverse, changing and complex US university systems. In 2009, 20.4 million students were enrolled in 2- or 4-year colleges and universities. By 2019, enrollments are expected to rise 9% for students under age 25, and rise 23% for students over the age of 25 (Snyder & Dillow, 2011). Questions of where, when, how, and with whom today's college students learn, confront the traditional notions of how university spaces are designed and used for effectiveness (Hashimshony & Haina, 2006). Therefore, we propose that the natural landscape of a university campus is an attentional learning resource for its students.

Americans expect a university campus to look different than other places (Gumprecht, 2007) and that the campus "expresses something about the quality of academic life, as well as its role as a citizen of the community in which it is located" (Dober, 1996, p.47). Today's university must be resilient spaces in which the learning environment encompasses more than technology upgrades, classroom additions, and its academic buildings – in fact, the entire campus, including its open spaces, must be perceived as a holistic learning space that provides a holistic learning experience (Gumprecht, 2003; Gutierrez, 2013; Kenny, Dumont, & Kenny, 2005). Learning is a lifelong and year-round pursuit, which takes place throughout the campus, not just fragmented indoors in designated instructional spaces (Bender & Parman, 2005; Kenney et al., 2005; Strange & Banning, 2001). This is reinforced by Radloff who notes that only "one fifth of a student's time is spent in the classroom, contributing about one quarter of the total learning variance (Radloff, 1998, p. 1). Well-designed and connected networks of indoor and open spaces on campuses can be key, yet typically overlooked catalysts, in student learning and a strong influence on students' initial and longstanding experiences that promote a sense of belonging to the learning community (Boyer, 1987; Greene, 2013).

The college experience is a stimulating and demanding time in a student's life where a multitude of curricular and extra-curricular situations require frequent and heavy use of direct, focused attention and concentration (Wentworth & Middleton, 2014). Thus, university students as a group are at a higher risk of attentional fatigue. Furthermore, increased technology use within today's multitasking society is likely to hijack a student's attentional resource placing her/him at risk of underachieving academic learning goals and undermining success at a university (Fried, 2008; Tennessen, & Cimprich, 1995; Wentworth & Middleton, 2014). Although university culture places demands on students' cognitive abilities, campus natural open spaces have not been systematically examined for their potential in replenishing cognitive functioning for attentional fatigued students. One way to examine this potential is to consider the entire campus with its buildings, roads and natural open spaces as a well-networked landscape system that supports student learning experiences. In doing so, we highlight two concepts that have been addressed in two different domains, bringing them together to help conceptualize future campus planning in relation to student learning. The concepts are – 1) direct and indirect attention and restoration, and 2) a holistic landscape. Before we outline each concept and propose their integration in this paper, we go back in time for a historical perspective of the evolution of campus open space.

Historical Context of the American College Campus

The word *campus*, (derived from a Latin word for "field" – "an expanse surrounded…by woods, higher ground, etc., Harper, n.d.) was first associated with college grounds to describe Princeton University in the 1770's (Eckert, 2012; Turner, 1984) and now refers to the overall physical quality of higher education institutions (Bowman, 2011). Early

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American colleges and universities were self-sufficient and often built in rural locations with dormitories, dining halls and recreation facilities (Bowman, 2011; Eckert, 2012). Many university founders desired to create an ideal community that was a place apart, secluded from city distraction but still open to the larger community, enabling their students and faculty to devote unlimited time and attention for classical or divinity learning, personal growth, and free intellectual inquiry (Eckert, 2012; Gumprecht, 2007; Turner, 1984).

The advent of land-grant institutions through the Morrill Act of 1862 required new buildings to be built with laboratories and observatory space for agricultural, technical education, and scientific research (Eckert, 2012; Turner, 1984). Unlike the classic designs of America's first institutions, the physical campus of the land grant university was designed to significantly contribute to student learning through its working farms, forests, arboretums, greenhouses, gardens (Griffith 1994; Painter, et al., 2013). Open space and "zones" for disciplines became far more common than closely clustered buildings previously designed to protect students from the lures of the outside world (Painter, et. al, 2013).

Campus construction was sparse during the Depression and World War II of the 1930s and 1940s. A dramatic post-war increase in student enrollment - 2.5 million to 7 million from 1955 to 1970 (Bowman, 2011) - and new federal grant-supported scientific research programs created a frenzied need to invest in new facilities. College presidents approved filling existing campus open space with large, stand-alone structures that typically did not cohere or unify with the existing campus style (Turner, 1984). The inclusion of the automobile on campus resulted in parking lots claiming large areas of natural open space within a "ring road" type of plan, in which vehicles were mostly kept outside the pedestrian oriented campus core (Bowman, 2011, p. 27).

Today the campus open space still remains a significant center for teaching and learning for students in natural resources management, sustainability/ecology, agriculture, forestry, etc. and more recently, a focus on environmental education and sustainable practices (Painter, et. al., 2013). Student grass-root efforts of the 1970s and the college campus sustainability movement that began with the first Earth Day, increased public awareness that environmental protection is a critical issue. Now as climate change is a major scientific and political issue, a renewed commitment to sustainability is evident in campus planning efforts to integrate built and open spaces within "green infrastructure" (Way, Matthews, Rottle & Toland, 2012).

As an integral part of the image, mission and goals of the university, Griffith (1994) reminds higher education communities "that open space must be treated as a scarce resource" (p.29) and as a functional and unifying element that is on par with the campus buildings, utilities, vehicular traffic, parking facilities, and pedestrian circulation campus planning components. By preserving and suitably integrating open spaces into the green infrastructure, universities can add value and quality to the campus environment by: forging a campus identity, creating a sense of community, curbing escalating campus density, serving social and recreational needs, providing environmental benefits, and facilitating fundraising and recruitment of both faculty and students (Griffith, 1994). In fact, Grummon (2009) found that 13.5% of incoming students surveyed selected a university based on sustainability concerns. A historic perspective shows that campuses are evolving in response to the prevailing philosophy of education – older campus plans emphasized disciplinary boundaries and newer campus designs are more amorphous and integrative.

Concepts of Attention and its Impact on Student Learning

As an influential landscape designer of early campuses, Fredrick Law Olmstead worked with the philosophy that the physical landscape features had a direct impact on shaping human behavior, and offer students an active, experiential education versus passive or theoretical learning. Thus, a well-designed campus was an integral part of the educational experience of students, one equal in importance to the students' academic subjects and connected to higher education's mission (Schuyler, 1996-1997). Olmstead stated that "natural scenery employs the mind without fatigue and yet exercises it; tranquilizes it and yet enlivens it; and thus through the influence of the mind over the body, gives the effect of refreshing rest and reinvigorating to the whole system (Bratman, Hamilton, & Daily, 2012, p. 124). This observation of campus design features that can help mentally fatigued individuals has been empirically demonstrated in a body of research that uses the *Attention Restoration Theory* (Kaplan & Kaplan, 1989) to understand and describe the many benefits of human-nature interactions (Atchley, R.A., Staryer, D.L., & Atchley, P., 2012; Berman, Jonides, & Kaplan, 2008; Bratman, Hamilton, & Daily, 2012; Hartig, Mitchell, de Vries, & Frumkin, 2014; Keniger, Gaston, Irvine, & Fuller, 2013; Taylor, Kuo, & Sullivan, 2002; Tennessen, & Cimprich, 1995). Attention Restoration Theory (ART) centers on the internal and external influences affecting one's cognitive ability and suggests that exposure to and interaction with nature has specific recovery effects on the human attentional system.

Defining "nature" can pose a bit of problem however. Nature can be labeled as a non-human physical feature such as an individual plant or butterfly. Nature can also be delineated as a particular place within a spectrum of naturalness from urban park to a pristine wilderness.

Furthermore there is a subjective component to the concept (Nash, 1982: Proctor, 1998) due to the diverse opportunities and means through which one might encounter and experience nature (Hartig, et al., 2014). Therefore, this paper will define *nature* or *natural environment* as the… "physical features and processes of nonhuman origin that people ordinarily can perceive, including the "living nature" of flora and fauna, together with still and running water, qualities of air and weather, and the landscapes that comprise these and show the influences of geological processes" (Hartig, et al., 2014, p. 21.2). Subsequently, we expand the campus 'learning environment' to also include a university's open space, we also include in our definition of nature, the concept of a "landscape." Valles-Planells, Galinan, & Van Eetvelde (2014) define a *landscape* as a "holistic, spatial, and mental dynamic entity, which is the result of people-place interactions" (p. 1). It is this holistic view of a campus' spatial patterning and the student's relationship with the natural and built environment or its landscape that is capable of having an effect on student learning. Interaction with nature, in particular, can help to maintain or restore cognitive function such as direct attention, problem solving, focus and concentration, impulse inhibition, and memory, which can become depleted from fatigue or with overuse (Hartig, et al., 2014; Kaplan & Kaplan, 1989). This executive attentional system encompasses a variety of psychological phenomena and is commonly separated into *direct* or voluntary attention and *indirect* or involuntary attention. We explain those concepts below as they apply to student learning and learning spaces.

Direct attention requires mental effort and cognitive control for an individual to sustain focus and prevent distracting stimuli from interfering with an intended activity (James, 1890; Kaplan & Kaplan, 1982; Posner & Snyder, 1975). Working memory, impulse inhibition, and concentration are required to employ one's directed attention (Bratman, Hamilton, & Daily, 2012). This ability to focus one's attention is essential for effective performance of many of life's necessary and daily activities, such as acquiring and using selected information; making and carrying out plans; and self-regulation of responses and behavior to meet desired goals (Kaplan & Kaplan, 1982). Direct attention is, therefore, an important cognitive skill required on a daily basis for students processing multiple sources of information, and working towards their academic goals at universities. After a period of prolonged cognitive demands and mental saturation, difficulties in concentrating, reduced performance on tasks, higher rates of irritability and tension, and more impulsive and hostile behavior may arise (Kaplan, 1983; Kaplan & Kaplan, 1982; Tennessen & Cimprich, 1995). "Attentive efficiency can be recovered after a period of rest and regeneration, obtained through the activation of involuntary attention" (Barbiero, Berto, Freire, Ferrando, & Camino, 2014, p. 32).

Involuntary attention occurs when individuals are presented with stimuli that are "inherently intriguing" (p.124). Interaction with natural environments (especially green nature) employs faculties of concentration not normally used – involuntary ones – thus allowing the neural mechanisms underlying directed attention a chance to rest and replenish. This in turn can benefit performance on other tasks, delay gratification, and perhaps even regulate levels of depression and stress. Therefore, providing opportunities for interactions that draw upon involuntary attention could be impactful on university campuses for attentional, fatigued students and their learning mechanisms. A wide range of natural settings in and around a college campus can play a role in student learning and engagement. Perceived greenness of different campus spaces can influence students' perceived restorativeness in them. Student perception of the surrounding campus landscape and the opportunities it offers for intentional and unintentional learning or recreational engagement/activity might influence their overall campus experience. Research on student campus experiences related to surrounding nature in campus landscapes is a relatively newer research domain. Future research can test the premise substantiated by past literature that the natural landscape of a college can be an asset by enabling attention-restorative benefits and positively influencing learning and academic performance.

Holistic landscapes for holistic learning

Previously, we extended our definition of nature to include a 'landscape' and outlined how the concept of direct and indirect attention can help explain the cycles of fatigue and restoration among individuals, students in particular. Yet, more work is needed to understand how these attention cycles manifest on campus and through what types of experiences. Keniger et al. (2013) classified settings for human-nature interaction into the following types: *indoor* (plants), *urban* (high human impact), *fringe* (on the outskirts of town or city), *production landscape* (agricultural), *wilderness* (low human impact), and *specific species* (animals, pets). In these settings, human interaction can take place via three modes – *indirect* (experiencing nature passively even though not physically present in it), *incidental* (chance encounters with nature via other activities) and *intentional* (purposeful activity) (see Table 1). Empirical research using the ART framework has examined all modes of human interaction in indoor, urban and wilderness settings and suggests that in the absence of fascinating natural stimuli, humans miss out on the critical type of rest (Keniger, et al., 2013). Urban stimuli typically lack the capacity to restore our direct attentional capacities effectively.

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Table 1: Student-nature interactions in campus landscapes

Nature setting typologies*	**Examples of student-nature interactions**			**Campus nature settings**	**Landscape features**
	Incidental	*Indirect*	*Intentional*		
Indoor (mostly built)	Views to outside areas or wall photos/ murals	Foliage or flowering plants indoors	Greenhouse used for botany classes	• Plants within buildings • Living laboratories • Indoor fountains, aquariums	• Size, shape and location of windows • Density and proximity of buildings • Management of outdoor areas • Quality of indoor and outdoor lighting
Urban (mostly built)	Viewing a roof garden from the windows of a student lounge	Mural of a landscape scene on the wall of a tunnel or walkway	Outdoor plaza used for art classes	• Spaces between campus buildings • Outdoor water features • Green roofs • Rain gardens	• Height of buildings • Complexity and ornamentation of façade • Sense of enclosure (no blocked views)
Fringe(nature dominant)	View of preserve from window	Campus trails leading to a peri-urban reserve	Classes held on the trails	• Prairie or forest preserve • Arboretum • Oceans and lakes	• Convenient and easy visual and physical access to the fringe • Continuity of trail system
Production landscapes (managed for anthropocentric needs & objectives)	Class lectures that includes photos or video on related subject	Encountering a production field enroute	Class exercises related to production landscapes	• A farm	• Visual and physical access to production landscapes
Wilderness (All natural)	Class lectures that includes photos or video on related subject	N/A	Off campus student trip to designated wilderness through classes or campus recreation programs	• State or federal public lands near campus	• Physical access to trails
Specific species	View of wildlife outside classroom window	Encountering wildlife while walking between buildings on campus	Nature study	• Migratory birds or wildlife on or near campus	• Habitat that attracts preferred wildlife

**Based on Keniger, L., Gaston, K., Irvine, K., & Fuller, R., 2013*

Most American universities are situated on large number of acres (up to 28,000 acres) and function like miniature cities in their complexity of urban-natural configurations to provide a dynamic sensory experience. Campus master planning efforts are whole-systems approaches (Koester, Eflin, & Vann, 2006) that preserve open space and integrate sustainable features such as indigenous plants, rain gardens, green roofs, and buildings that function as living laboratories. For example, more than two-thirds of the Cornell University campus is open space; its ecosystem services are visualized along a spectrum of naturalness as greenways, quads and greens, streets and walks, etc. (Cornell University Campus Master Plan, 2014). Such holistic landscapes can impact student learning because they provide multiple everyday opportunities for multi-sensorial, student-nature encounters– an important precursor to activating the attention restoration cycle (Speake, Edmondson, & Nawaz, 2013; Ratcliffe et al. 2013). Everyday campus spaces include other physical design features empirically associated with attention restoration – height of surrounding buildings -the fewer floors the better (Lindal & Hartig, 2013); extent of naturalness of views from windows -more natural the better (Matsuoka, 2010); and proximity-awareness of nearby nature impacts its use and effectiveness (Speake et al. 2013). These features can help enable and enhance a sense of being away and thereby lead to attention restoration. A holistic approach to the built and natural campus spaces and their flexible and permeable boundaries in students' campus experiences begins to acknowledge that student learning is dynamic, in which one's ideas are enriched through structured classroom encounters including serendipitous unstructured non-classroom campus encounters (Hanan, 2013).

Students spend most of their tightly structured learning time indoors amidst traditional instructional classrooms (where students' direct attention is most required) that are primarily structured for the visual mode of learning (e.g., whiteboards on designated walls, seating that faces the instructor). Flexibility in seating and spatial configuration can begin to help diffuse this emphasis and begin to accommodate other auditory and kinesthetic learning modalities. We also recognize that outdoor class instruction is not suited or appropriate for all academic domains. Student breaks from directed attention activities are typically taken inside student unions, alcoves and corridors, student lounges, and some outdoor spaces. de Bloom, Kinnunen and Korpela (2014) found that people in corporate settings benefit most from directed attention breaks spent in natural settings. Student-nature interactions during study breaks help restore attention (Felsten, 2009). We do suggest that regular cognitive breaks from direct attention in natural settings can help students regulate, replenish, and strengthen cognitive function and ability to prepare for either the next round of classes or improve the effectiveness and efficiency of an independent study period. When learning is envisioned as holistic and dynamic, all campus spaces, whether indoor or outdoor, instructional or non-instructional, become significant components of a student's everyday experience.

Viewing the campus landscape as a holistic spatial and mental dynamic entity (Valles-Planells, et al., 2014) within the context of the Kaplan framework for attentional restoration, and using and extending the typologies provided by Keniger et al. 2013 provides us a unique opportunity to reconceptualize the campus landscape of the future as an attentional resource. In Table 1, we provide examples of student-nature interactions in specific campus nature settings and landscape features that enable holistic learning experiences.

Conclusion

Traditional campus indoor spaces, by necessity and function, provide ample opportunities for structured learning experiences that draw upon students' direct attention. However, a student's learning experience is not often balanced by unstructured or structured opportunities for drawing forth effortless, indirect attention that occur in human-nature interactions (Valles-Planells, et. al, 2014). Attention to a mix of different learning spaces that combine nature and interesting architecture (Orr, 2004) provide more options for regulating learning and restoration cycles. Public areas and outdoor learning environments, including nature trails and ecological study areas, lend more opportunities for community interaction and social encounters that foster a sense of belonging, whereas quiet areas provide a place for students to refresh themselves, have a temporary escape, or quiet reflection, affording an enriched and enjoyable campus life (Kenney, et al., 2005). Just as Hashimshony & Haina (2006) provide visionary and heuristic scenarios for a university of the future, we need a vision for integrating a systemic view of what these integrated campus nature networks would like in the future. In addition, there is a need to conduct more focused and nuanced research on identifying the human-nature mechanisms that lead to (among others) attentional resource benefits.

In this paper, we focused on the cognitive benefit that a holistically designed campus can provide as a resource for learning, that is, the enhancement of "direct attention." Thereby, we also addressed the importance of providing multi-dimensional access to student-nature campus interactions. We expanded the notion of a university campus to include our conceptualization of a holistic landscape, and expanded the notion of student learning to include our vision of dynamic and holistic learning so that much-needed

breaks/pauses in learning can occur in all kinds of indoor and outdoor enclosures.

The preservation of open space is vital to the maintenance and effective functioning of a quality university learning environment (Radloff, 1998). Recognizing college campus landscapes as vital learning spaces will harness the holistic potential of college campuses as attentional resources. We suggest that successful meshing of the two notions can occur by adopting a whole-systems approach to campus design – one that requires communication and collaboration among academic, administrative and facilities planning stakeholders. Such an approach also goes beyond advertising the *aesthetic value* of the campus open spaces for student recruitment purposes to recognizing the entire campus landscape as a learning space and advertising its *educational value* – that is emphasizes something deeper than what meets the eye.

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