Spectrum Matrix:

Landscape Design and Landscape Experience

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ABSTRACT Landscape architects are challenged to create places that promote human interaction, involvement, and experience. While there is a growing body of literature providing performance-driven design guidelines, there is a dearth of direction for those wanting to design landscapes for more engaging landscape experiences. This paper addresses this gap by posing a theoretical relationship between an individual's perception and cognition, and the use of landscape elements and their qualities in site design. The paper posits that Csikszentmihalyi's flow theory and Gardner's theory of multiple intelligences relate levels of challenge, intelligence traits, and capacities to an individual's landscape experience. The article presents a matrix of possible experiences, the *Spectrum Matrix* derived from Csikszentmihalyi and Gardner, as a generative design tool for use at various points during the design process to enhance a site design's development to provide more opportunities for engaging landscape experiences. Case study descriptions of built sites demonstrate possible landscape elements, qualities and challenges related to the different ways individual users perceive and interact with and in landscapes.

KEYWORDS Design process, flow theory, multiple intelligences, landscape experience

INTRODUCTION

Landscape architects have a responsibility to manage, plan, and design places that promote human interaction and involvement, enrich human experience, maximize quality of life, and promote ecological, physiological, and psychological health (Simonds 1961; Laurie 1975; Fleming, Honour, and Pevsner 1999; Motloch 2000; Kvashny 2001; Vroom 2006). We expect designed places to engage their users. John O. Simonds went so far as to state: "what must count then is not primarily the designed shape, spaces, and forms [of all great planning and design]. What counts is the experience" (Simonds 1961, 365). Simon Swaffield states, "the fundamental role of landscape architecture is to distill what it is to be human and to seek a greater sense of belonging in the world" (2002, 75). Rachel Kaplan, Stephen Kaplan, and Robert Ryan argue that as we design places for people, we must provide opportunities for people to have meaningful participation (1998, 163). Paul Groth described a multi-sensory hypothesis for vigorous landscapes (1992), making a connection between sensory body experiences, the mind, and the landscape—the individual's experience of place—in place making. Others, such as Randolph Hester's work on sacred structures (1993), and Clare Cooper Marcus' work on commitment to place (1993), call for incorporating individual connections to existing and new spaces as necessary to creating places. How does one design for "the experience" when individuals perceive and engage the same places differently?

Traditional design methods used by landscape architects include site inventory and analysis, site and project programming, conceptual design, design development, and project implementation. Most descriptions of this process present a clear, rational, scientific methodology; the simplest models have a linear procedure, while complex models include non-linear or cyclical procedures with feedback loops. During the design process, designers are encouraged to study the site's environmental opportunities and constraints related directly to the project's functional aspects and programming concerns, geo-political issues governing site development, as well as relevant social and cultural values (Laurie 1975; Motloch 2000; Rutledge 1971; Schon 1985; Steiner 2000; Vroom 2006). But these methods do not question how or why people actually engage with the landscape.

Marcus and Carolyn Francis' *People Places* (1990) represents a growing set of performance-driven design guidelines and evaluation tools developed from post-occupancy evaluation of observed behaviors in specific landscapes. These are intended to help designers use appropriate "people-based" research to develop and/or evaluate the success of landscape designs (Coates 1974; Eriksen 1985; Francis 2003; Marcus and Barnes 1995, 1999; Moore 1993; Moore, Goltsman, and Iacofano 1992; Moore and Wong 1997; Tai et al. 2006). Marcus and Marni Barnes's evaluation criteria focus on the links between design, location, and use in facilitating desirable behaviors (1995, 5). Donald Norman's four criteria include: function, understanding, usability, and physical feel (2002, 69). Meto Vroom includes order, functionality, aesthetics, and reference, where reference connects form and meaning (2006, 94). However, these design

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or evaluation tools are limited because they generalize user activities and design success to observable behaviors and characteristics. These tools are not informed by research incorporating individual motivations for landscape use or the quality of the individual's experiences. There is little to assist designers in addressing the diverse ways that people experience and engage in the world based upon individual perceptual and cognitive capacities. In the absence of such tools, this paper presents a matrix of design considerations relating an individual's perceptual and cognitive capacities to the design and programming of landscapes.

Building upon an earlier work by Sarah Dorminey (2003), this paper brings together two cognition theories to propose a Spectrum Matrix to prompt designers during the site design process to develop landscape settings with more meaningful user experiences.

Mihaly Csikszentmihalyi, Distinguished Professor of Psychology at Claremont Graduate University, is a leading researcher in positive psychology, which studies positive traits such as optimism, creativity, intrinsic motivation, and responsibility (Claremont Graduate University 2011). His theory of flow (1990) provides a foundation for understanding the achievement of meaningful experiences. Flow theory relates an individual's skill level or capacity to the level of challenge posed to that individual when engaged in an intrinsically motivated activity (1990, 1996, 1997).

Howard Gardner, Hobbs Professor of Cognition and Education at Harvard Graduate School of Education and Senior Director of Project Zero, is well known in education circles for his theory of multiple intelligences (Harvard University 2011). The theory of multiple intelligences (Gardner 1983) provides a framework relating an individual's capabilities to eight intelligence domains and their related traits (1983, 1993, 1999). His work in Project Zero involves the design of performance-based assessments of cognitive development and use of the theory of multiple intelligences to achieve more personalized curriculum, instruction, and pedagogy in children's learning environments (Claremont Graduate University 2011; Gardner 2000).

Gardner's work with Csikszentmihalyi focused on the relationship between children's learning environments and flow, and resulted in the development of the Spectrum Classroom (Gardner 2000). The Spectrum Classroom is designed to stimulate various intelligences and enhance an engaged experience (n.a. 2009; Gardner 1993; Project Zero Institute 2000) that when successful results in a state of flow. The relationship between flow theory and the theory of multiple intelligences can be used by designers and programmers to develop sites that more fully engage people and provide opportunity for more meaningful landscape-based experiences. Landscapes that include site elements that support a range of activities at a variety of levels of challenge are more likely to appeal to a wider population of users and provide more opportunities for meaningful experiences.

RELATIONSHIP OF LANDSCAPE EXPERIENCE TO FLOW AND MULTIPLE INTELLIGENCES

Meaningful Landscape Experiences

"Meaningful" is an adjective signifying that an object has meaning, function, or purpose (American Heritage 1993). The attachment of meaning to objects or events is an inherent part of human perception (Geertz 1973). "An experience has pattern and structure, because it is not just doing and undoing in alternation, but consists of them in relationship . . . The action and its consequence must be joined in perception. This relationship is what gives meaning; to grasp it is the objective of all intelligence" (Dewey 1934, 44). Edward Relph adds that meaning accrues as individuals develop a field of relationships between themselves, place, and activities (1993). These relationships are constructed and determined, in part, by an individual's range of perceptual and cognitive abilities and their ordering of information. In perceiving the environment, people always look for an answer to questions such as "what is that?" or "what does it mean to me?" (Vroom 2006, 289).

For a landscape experience to be meaningful to a user, the landscape must include qualities and elements within an individual's range of perception and cognition. Those landscape elements that are perceived and understood are then evaluated for their purpose or function. If an individual does not understand or recognize an aspect of the landscape, the experience of that element is difficult to place in some mental order thereby making it challenging to remember or engage in meaningful participation (Kaplan, Kaplan, and Ryan 1998). If someone does not perceive an aspect of the landscape, it does not have relevance for her or him. For example, if someone does not perceive a planted area to be wildlife habit, in his or her eyes that habitat is not present. For those that do perceive the planted area as something more than a green area, there is more to see and explore.

Csikszentmihalyi also notes that meaningful landscape experiences bring order to the contents of the human mind by integrating one's actions into a unified flow experience (Csikszentmihalyi 1990). Attaining flow becomes the ultimate measure of a meaningful or fully engaged experience (ibid).

Flow

People use the term flow to describe their state of mind when their consciousness is harmoniously ordered. In this state of mind, they pursue whatever they are doing for its own sake (Csikszentmihalyi 1990). Csikszentmihalyi's theory of flow relates an individual's skill levels to the levels of challenge embodied in a particular activity. Flow, or the psychology of optimal experience, is a state of intrinsic motivation, of total mental and physical involvement described by many as being "in the zone" (Csikszentmihalyi 1990; Norman 2004). The best moments of flow usually occur when a person is engaged in an activity where the body and mind are stretched to their limits in a voluntary effort to accomplish something difficult and worthwhile (Csikszentmihalyi 1990). Flow theory relates challenges (both physical and mental) to bodily senses. These senses relate to different ways of perceiving, comprehending, and/or knowing. The state of flow is intrinsically motivated and results in an enjoyable experience.

Csikszentmihalyi makes a distinction between pleasure and enjoyment. Pleasure is a feeling of contentment when expectations determined by biological programs or social conditioning are met, such as receiving a massage or taking a hot bath. Pleasure lacks a sense of achievement or a necessary contribution to the result. Enjoyment occurs when a person has met some prior expectation or satisfied a need or desire, and gone beyond to achieve something unexpected. Enjoyment requires forward movement and achievement. Attaining this sense of enjoyment, or flow, entails:

1. Confrontation with tasks we have a chance to complete
2. The ability and opportunity to concentrate on what we are doing
3. The ability to concentrate because we have clear goals
4. Tasks that have immediate feedback
5. Deep but effortless involvement away from awareness of everyday life
6. A sense of control over one's actions (whether possible or actual)
7. Disappearance of concern for self, although this is stronger after the flow experience is over
8. An altered sense of time duration (Csikszentmihalyi 1990, 49–50)

Flow is the symbiotic relationship of engagement between personal skills and life challenges. Flow experiences are challenging and not always pleasant, though almost any activity can be playful and facilitate flow.

Challenging activities require skills; a person without the right skills for an activity cannot be in flow. If a person undertakes an activity that has a high degree of challenge and lacks the skills to match it, anxiety occurs. Conversely, when a person's skill level is too advanced for the challenges encountered, boredom results. Successfully meeting the challenge creates the enjoyment (Csikszentmihalyi 1990). Csikszentmihalyi notes that all challenges, "whether they involved competition, chance, or any other dimension of experience," had in common a "sense of discovery and a creative feeling of transporting the person into a new reality" (1990, 74).

Multiple Intelligences

Gardner's theory of multiple intelligences builds upon educators' awareness that people perceive and interact with their worlds in different ways. The theory posits a range of traits and capabilities distributed across eight intelligence domains relating to the bodily senses and traditional intelligence measures, such as mathematics and language. The theory of multiple intelligences states that individuals have varying abilities in each of these domains (Gardner 1983, 1999). This distribution composes an individual's perceptual and cognitive capacities into a unique intelligence profile that describes traits of how they interact with their environment. Gardner frames intelligence as "(a.) the domains of knowledge necessary for survival of the culture, (b.) the values embedded in the culture, and (c.) the educational system that instructs and nurtures individuals various competencies" (1993, 231). While individual cultural and social groups may privilege particular intelligence competencies, all of the intelligence domains exist across cultural groups. Gardner's work expands upon Piaget's definition of intelligence, which deals with how human knowledge is acquired, constructed, and used (Gardner 1993, 18). Gardner's theory incorporates two assumptions:

1. Not all people have the same interests and abilities, and not all learn in the same way, and
2. Nowadays, no one can learn everything there is to learn.

Gardner defines intelligence as "the ability to solve problems, or create products, that are valued within one or more cultural settings" (1983, x). Intelligence provides the opportunity for recognizing and solving problems that require attainment of new knowledge. Gardner's view of intelligence covers a broad range of cognitive abilities by incorporating systems of symbols, different values of many cultures, and an acknowledgement of the variety of intellectual accomplishments (Haggerty 1995). While there is some overlap, each intelligence domain embodies a particular set of characteristics and traits. The eight domains include:

- logical-mathematical
- musical-rhythmic
- bodily-kinesthetic
- verbal-linguistic
- visual-spatial
- naturalistic
- intrapersonal
- interpersonal

Logical-mathematical intelligence is the ability to recognize abstract patterns, perform inductive and deductive reasoning, execute complex calculations, and think scientifically about investigation. This is a numerically-based intelligence. People strongly inclined toward this intelligence can think in numbers and understand the patterned relationship of objects, their order, and quantity. Development of this intelligence progresses from an understanding of "objects to statements, from actions to the relations among actions, from the realm of the sensorimotor to the realm of pure abstraction and ultimately, to the height of logic and science" (Gardner 1983, 129).

Musical-rhythmic intelligence is an ability to appreciate the rhythm and structure of music, and to create and reproduce sound, rhythm, music, tone, and vibration. It also involves a heightened sensitivity to sounds and vibration patterns. While most components of music are dependent on auditory ability, rhythmic organization exists in people lacking the ability to hear. Music is understood through the horizontal and vertical relationships of the pitches and tones through time and can be demonstrated through a "series of colored forms" (Gardner 1983, 105).

Bodily-kinesthetic intelligence involves the ability to control voluntary body and mimetic movements, and to gain understanding through awareness of the body. People skilled in this intelligence possess strong gross and fine motor skills and a good sense of timing. Our levels of motor skills influence our perception of the world. The "position and status of the body itself regulates the way in which subsequent perception of the world takes place" (Gardner 1983, 211).

Verbal-linguistic intelligence involves verbal memory and recall, and it produces a flair for words, the ability to teach or explain verbally, and linguistic based humor. Individuals with a high level of this intelligence understand both the meaning of words as well as subtle differences between synonyms. They comprehend and follow grammar at the appropriate times, but can also bend it for artistic elegance. In addition, the ability to use language to evoke an array of emotions demonstrates an understanding of the different functions of language. When a person possesses high linguistic ability, he or she often excels at rhetorical persuasion and clear explanation, uses mnemonic tools for memorization, and can artistically compose written works that express and reveal memories of experience. Linguistic intelligence is not limited to oral or auditory ability; deaf individuals demonstrate verbal-linguistic intelligence through gesture or rhythm such as sign language or music (Gardner 1983).

Visual-spatial intelligence is associated with an ability to form mental images, understand relationships between people and an occupied space, and perform mental manipulations of visual perceptions. People skilled in this intelligence use visual memory, have an active imagination, and are able to view the "visual world accurately, to perform transformations and modifications upon one's initial perceptions, and to be able to re-create aspects of one's visual experience, even in the absence of relevant physical stimuli" (Gardner 1983, 173). Spatial intelligence is not limited to the visual realm. Without the ability to see, blind individuals must visualize space in their mind in order to move through it. These transformation or modification tasks can be challenging due to the number of mental calculations that may be required. Gardner cites psychometrician, L. L. Thurstone's theory that spatial intelligence is divided into three branches: "the ability to recognize the identity of an object when it is seen from different angles; the ability to imagine movement or internal displacement among the parts of a configuration; and the ability to think about those spatial relations in which the body orientation of the observer is an essential part of the problem" (1983, 175). These abilities help people recognize both familiar and altered surroundings, to use maps and other abstract depictions of space, and to understand the form and tension created by lines in a space.

Naturalistic intelligence is associated with classification and recognition. It encompasses an ability to grow things, sensitivity to flora and fauna, understanding people's impact on nature and nature's impact on people, and an ability to classify natural species and artificial items. Artificial items such as artistic styles, shoes, and cars are classified with the same skills used to classify flower species. Associated with the naturalistic intelligence are both a desire and the enjoyment of interacting with nature. Naturalistic intelligence is a multi-sensory intelligence informed by sight, touch, smell, sound, taste, and time. Gardner also theorizes that the basic perceptual skills of artists, poets, and scientists aid in recognizing patterns within nature and society (1999).

Closely linked and intertwined, the personal intelligences, *intrapersonal* and *interpersonal*, function in a circular relationship. Interpersonal interaction with others informs *intrapersonal* knowledge, which then influences interpersonal interactions and so on. An understanding of internal feelings and emotions, and use of this understanding to guide personal behavior characterize the intrapersonal intelligence. Intrapersonal intelligence allows people to understand and label the difference between opposing emotions, feelings, and sensory stimuli. More advanced intrapersonal intelligence levels include the ability to "detect and symbolize complex and highly differentiated sets of feelings" (Gardner 1983, 239).

Outward relationships and the understanding of other's moods or motivations define *interpersonal intelligence*. The fundamental aspect of this intelligence is the ability to distinguish among different people and their temperaments. A more advanced aspect of this intelligence is the ability to understand and interpret other's feelings or intentions, even when hidden (Gardner 1983). The interpersonal knowledge gained from observations of the consequences and reactions of other's behavior helps influence intrapersonal understanding of internal decisions and choices, which in turn, dictates one's relationships with others. All intra- and inter-personal understandings contain systems of cultural symbols and meanings that aid in the interpretation of experience. Gardner defines cultural symbols as "rituals, religious codes, and mythic systems" (1983, 242). According to Gardner, the overall combination and interaction of the personal intelligences helps form a sense of oneself, resulting in a person's ability to experience and interact with his or her environment (1983, 242).

MULTIPLE INTELLIGENCES, FLOW AND LANDSCAPE DESIGN

Site programmers and designers routinely create places using elements that can provide individuals with diverse and varying levels of challenge. Aside from children's playgrounds, there is little guidance for designers wanting to provide users a range of challenges related to their cognitive and perceptual abilities (Coates 1974; Eriksen 1985; Moore, Goltsman, and Iacofano 1992; Tai et al. 2006). While the urban open space design guidelines developed by Marcus and Francis (1990) and Francis (2003) provide suggestions for spatial arrangements and landscape functions specific to different types of developed sites, these guidelines address user satisfaction based on the observation of place specific behavior. These guidelines do not consider the influence of perceptual and cognitive capacities upon a user's understanding and experience of a landscape or place, their motivation to engage with or within the landscape, or the quality of their experience. Kaplan, Kaplan, and Ryan's (1998) "Matrix of Patterns and Themes," based upon their research in human perception and preference, presents a framework developed to assist in the design and management of landscapes that include the well-being of people. The themes—understanding one's environment, opportunities for exploration, restful and enjoyable place experiences, and meaningful participation—share some qualities with Csikszentmihalyi's conditions for achievement of flow. While Kaplan, Kaplan, and Ryan recognize that people are different in many important respects, their matrix is based upon peoples' shared needs (Kaplan, Kaplan and Ryan 1998, 5). It stops short of addressing individual motivations and levels of engagement. Understanding user motivation and measuring the quality of one's experience in the landscape is a laudable research area and one that needs attention. In the interim, lessons learned from Gardner and Csikszentmihalyi's work with the Spectrum Classroom offer directions to address people's perceptual and cognitive capacities and to engage them in the achievement of flow during their landscape experiences.

The Spectrum Matrix (Table 1) can prompt designers to use a wider range of landscape elements in creating activity opportunities that engage a user's perceptual and cognitive capacities across a range of intelligences. Csikszentmihalyi's theory of flow states that experiential quality is related to the range of challenges individuals encounter and to people's ability to engage in desired activities that present an appropriate level of challenge. Gardner's theory of multiple intelligences suggests the use of elements and related activities that appeal to the traits and characteristics of multiple intelligence domains as a means of enhancing opportunities for individual users to achieve flow through their activities. These two theories suggest that designers can incorporate a range of landscape elements and activity opportunities in their site designs to engage the users' range of intelligence traits and differing ability levels.

Three assumptions guided development of the Spectrum Matrix:

Table 1. Spectrum Matrix

Engaging the Logical / Mathematical Intelligence

Refers to: quantity–classification and acts on the object; logical or mathematically defined patterns; and logical or mathematical internal or external relationships between objects. This is a confrontation with the world of objects

Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Abstract pattern recognition	Elements convey or compare distances	
Inductive reasoning	Logical sequences of elements or events	
Deductive reasoning	Creation of line or other geometric forms	
Discerning relationships and connections	Patterns use mathematical concepts	
Performing complex calculations	Elements involve proportion	
Scientific thinking and investigation	Elements involve scale	

Engaging the Musical / Rhythmic Intelligence

Refers to: melodies—pitch; rhythms—groups according to prescribed system; harmonies; and timbre—qualities of tone. Doing, not thinking. Not related to words, rather closer to mathematics.

Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Appreciation of structure and rhythm	Music, sound, vibration, tone	
Schemas or frames for hearing music	Creation	
Sensitivity to sounds and vibration patterns	Mimicry/reproduction	
Appreciation of sound qualities	Sounds of nature or human emphasized	
Recognition, creation and reproduction of sound, rhythm, music, tones and vibration		

Engaging the Bodily / Kinesthetic Intelligence

Refers to: ability to use one's body in highly differentiated and skilled ways for expressive and goal-directed purposes; abilities to handle one's body; and abilities to handle objects. There is a sense that this develops through imitation for both learning and teaching.

Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Pre-programmed body movements	Challenge various levels of physical abilities	
Expanding awareness through body	Understanding of personal limits	
Mind-body connection	Fine/gross motor skill challenges	
Mimetic abilities	Movement, balance, stillness, agility challenges	
Improves body functions	Relationship between body and mind	
	Movement effects movement of other elements	

Engaging the Verbal / Linguistic Intelligence

Refers to: rhetoric—persuasion; mnemonic—memory help; explanation—instruction adages; use of language to explain language—"do you mean x or y;" use of oral and written expression; and communicative and expressive abilities. Oral abilities are still very important in many pre-literate groups.

Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Facility with words	Literary references	
Explaining, teaching and learning abilities	Riddles, rhymes, puns	
Convincing others of a course of action	Areas for communication	
Linguistically-based humor	Narrative	
Verbal memory and recall		
Meta-linguistic analysis (language investigating itself)		

Engaging the Visual / Spatial Intelligence

Refers to: manipulation of color and color interactions; manipulation of form, singularly and in relationship to others; spatial manipulations; geometric play and manipulations; recognition and knowing of places in space; relationships between places, spaces and things; and knowing of spatial properties.

Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Active imagination	Patterned or geometric divisions	
Finding your way in space	Visual stories	
Forming mental images	Distortion of space, size, shapes, colors	
Mental manipulations of objects	Creation/manipulation of space, size, view, color	
Accurate perception from different angles	Mental manipulation challenges (such as M. C. Escher-like drawings)	
Visual memory		
Graphic representation (2 or 3 dimensional)		

(continued)

Table 1. (*continued*)

Traits (Gardner 1983; 1993; 1999)	Related Characteristics	Challenge
Engaging the Naturalistic Intelligence **Refers to:** distinguishing among members of a species; recognizing the existence of other, neighboring species; charting out the relations, formally or informally, among several species; and abilities in making and justifying distinctions between elements or things (may be through touch, sight, touch, taste or sound). This is a valued capacity where survival of an organism depends upon its ability to discriminate between different species.		
Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Communion with nature	Revelation of natural process(es)	
Sensitivity to nature's flora	Planting areas for creation, reproduction	
Growing things	Varying plant choices and uses	
Recognizing and classifying species	Interaction with surroundings	
Appreciating impact of nature on self and self on nature	Use of different plants that relate to each other in subtle (and not so subtle) ways	
Caring for, taming, interacting with living creatures		
Engaging the Intrapersonal Intelligence **Refers to:** ability to notice and make distinctions among other individuals, including moods, temperament, intentions, and motivations.		
Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Effective verbal/non-verbal communication	Sport areas	
Sensitivity to others	Group interactive elements	
Empathy	Group interactive areas	
Working cooperatively in a group	Outdoor classrooms	
Creating and maintaining 'synergy' with others		
Deep listening and understanding perspective of another		
Engaging the Interpersonal Intelligence **Refers to:** development and access to one's own feeling life.		
Traits (Gardner 1983; 1993; 1999)	**Related Characteristics**	**Challenge**
Concentration of the mind	Quiet areas	
Mindfulness (stop and smell the roses)	Memorial areas	
Meta-cognition (thinking about thinking)	Areas with large expansive views	
Transpersonal sense of self	Labyrinths	
Awareness of personal goals and motivations	Areas for individual creation or manipulation of space and surroundings	
Awareness and discrimination of one's emotional range		

1. Landscapes that offer choices and a diversity of challenge levels relative to multiple intelligences provide greater opportunities to engage a user.
2. Flow is a desirable goal of landscape experience and achieving flow is a meaningful experience. Providing a variety of challenges relating to multiple intelligences facilitates the creation of flow.
3. On-site critique of built landscapes can result in a broader understanding of the potential range of experiential qualities afforded by a landscape and its elements when this critique is informed by an integrated understanding of the cognitive psychology theories of flow and multiple intelligences.
4. Direct observation of the landscape does not provide a complete assessment as it does not address user motivation or the actual quality of user experience.

The Spectrum Matrix can also serve as an tool for evaluating whether and how a site, design program and/or concept or built work offers a range of experiences for a diversely intelligent population by matching landscape experience opportunities to an individual user's abilities and proclivities. The site inventory and analysis process can be expanded to include existing and potential opportunities to engage characteristic traits of Gardner's eight intelligence domains. Site programming can be expanded to identify intelligence traits to which the design should respond, to describe activities related to intelligence traits, and to include a range of potential challenge levels for invoking multiple intelligences in site design. Proposed design solutions can be critiqued during conceptual design and design development phases to assess the range of intelligences and traits addressed and the range of challenge levels present.

This tool does have limitations. The multiple intelligence profile of tool users can limit their ability to recognize landscape characteristics and/or opportunities that are outside of their individual perceptual and cognitive capacities. Additionally the tool is not appropriate for assessing the success of built landscape projects. Post-occupancy observation methods would need to be supplemented with research of user motivation and quality of landscape experience to learn how and if a landscape design was successful. This research has not yet been done.

The Spectrum Matrix includes three columns. The first contains Gardner's list of traits in each of the intelligence domains. The second column lists related landscape elements and characteristics that may engage some of Gardener's traits. For example, the logical-mathematical intelligence traits include abstract pattern recognition as well as tendencies to discern relationships and connections among features in the landscape. The design of landscape elements might incorporate geometric forms or other mathematic patterns placed in logical sequences of elements or events. This listing is not exclusive and invites users to add from their own experiences. The third column is left blank for users to articulate how specific elements and landscape qualities are to be incorporated into the site's design to engage multiple intelligences of users at a variety of challenge levels. For example, a low level of challenge within the logical-mathematical domain may include simple geometric shapes and their placement on the site. A higher level of challenge might include incorporation of geometric shapes in a single element and/or at the site scale, with parts of the pattern missing, allowing users to cognitively fill in the missing pattern pieces. An even higher level of challenge might include elements based upon the same geometric theme, but with different outcomes, such as seen in Max Bill's "Fifteen Variations on a Single Theme" (Bill et al. 1974) or Walter Hood's *Blues and Jazz* (Hood and Watts 1993).

CASE STUDY DEMONSTRATION

Three case studies of public garden parks demonstrate the engagement of multiple intelligence traits by manipulating landscape elements and their characteristics. Each park also demonstrates a range of challenge levels among the intelligence domains. While these parks were not designed with consideration of multiple intelligence or flow theory, they were selected because they were designed to engage users' bodily senses and to evoke a sense of region or culture (Childress Klein Properties 2003; Cole, Jenest, and Stone 2007; Maldonado 2000; Messervy 2009). The Case Study Synopsis of Three Built Garden Parks (Table 2) synthesizes across the parks the use of landscape elements to engage traits within the intelligence domains. The following site descriptions illustrate how these places engage particular traits of multiple intelligences as well as how places address various challenge levels.

Jardin Atlantique (François Brun, Michel Péna and Christine Schnitzler. Paris, France. 1994)

Built above the Gare Montparnasse, the major railway terminus connecting Paris to western France, this 8.65-acre neighborhood park/roof garden contains a central lawn, fitness area and tennis courts, a set of garden rooms with pavilions, and elevated walkways (Figure 1). The project program required active recreation for office workers and passive recreation areas for residents of this densely populated residential and commercial neighborhood. An Atlantic maritime theme emphasizing sky, sea, and movement connects the park to an idea of the Atlantic Ocean's expansive natural coastal landscape. The designers used classical and scientific associations as well as the senses to appeal to the intellect (Firth 1997; Hucliez and Monet 2000, 123–127; Maldonado 2000; Miller 2009; Paris Convention and Visitors Bureau n.d.). Using a wide variety of plants, paving surfaces, walls and fences, and spatial configurations, the designers created a nostalgic recollection of a 19th century Parisian garden that offers multiple challenges across the intelligence spectrum.

Table 2. Case Study Synopsis of Three Built Garden Parks.
Some examples of landscape elements and characteristics relating to the intelligence domains.

Jardin Atlantique	Toronto Music Garden	The Green
Logical/Mathematical Domain		
Spaces ordered in nested rectangular pattern Pavilions designed as deconstruction of geometric forms Elements spaced in various 2- and 3-dimensional, mathematically defined forms.	Relates the mathematics of musical rhythms to spatial sequencing and direction of movement	Chess and checkerboards offer programmed challenges Mosaic and geometric surface patterns are used throughout the site
Musical / Rhythmic		
Use of surface materials to emphasize tonal qualities, Focused attention on presence and absence of ambient sounds Use of water to create focused sound—sometimes hidden from view	Musical patterns are expressed in the path direction and width, as well as in the plant locations and juxtapositions Grasses and other plants bring sounds created by the wind Tonal vibrations vary with different path surfaces Audio guides are available on-loan.	Various tonal qualities provided by use of different surface materials Nature sounds are mimicked in motion-activated recordings Water noises vary with orchestrated flows at the Fish Fountain.
Bodily / Kinesthetic		
Range of sports and play areas for various age groups and group sizes Play equipment and areas linked to multiple ages and abilities Walking, climbing and play opportunities for different physical movements	Paths, plantings and topography direct pedestrian circulation and influence the type of movement in relationship to dance steps, some long and flowing, others shorter and jumpier Boulders and stepping stones invite more challenging movement Grasses and other plants close to the paths move with you in some seasons	Walls and sculptures provide opportunities to climb and balance. Lower walls for lesser risk, and higher surfaces for riskier play Large, open lawn panels used for unstructured play Water play at and in the fountain
Verbal / Linguistic		
Text and symbol signs provide directions and use information Place names used throughout park refer to area's French war history Group areas and wide primary paths provide opportunities for communicating	Interpretive signs relate dance and music to each part of the garden	The mosaic patterns are embedded with cultural symbols Poems, riddles, word associations, and literary references are used throughout the park

Shapes and lines expressed in planting and paved areas follow mathematical patterns. The regular spacing of plants and poles presents a rather simple logical/mathematical challenge, while the oscillating paving bands, rolling sundeck, and elevated walkways offer more complexity (Figures 2 to 5). These same features engage: the bodily/kinesthetic intelligence through suggested or actual horizontal and vertical movements; the visual/spatial intelligence through demarcation of spaces and sub-spaces at the park and garden room scales; and the naturalistic intelligence through incorporation of different plant species and stones in varied relationships to one another. The centrally-located weather station and water park, called the Isles of Hesperides, may titillate the logical/mathematical, verbal/linguistic, and musical/rhythmic intelligences through the collection of scientific data, association with another place, and the timed undulation of water jets.

Music Garden (Julie Messervy and Yo-Yo Ma. Toronto, Canada. 1999)

This three-acre waterfront park's rolling topography and dense planting is a nature interpretation of Johann Sebastian Bach's "First Suite for Unaccompanied Cello" (Figure 7). Each movement of the suite—Prelude, Allemande, Courante, Sarabande, Menuett,

Table 2. (*continued*)

Jardin Atlantique	Toronto Music Garden	The Green
Visual / Spatial		
Distinct variation of color and material choices in each garden room Spatial variations between rooms throughout the park Spatial sequences visually tie surface and elevated paths in place Wave-like features create linked enclosure and sequence variations, both vertically and horizontally.	Variously patterned paths and visual spatial sequences lead into separate garden 'dances', where longer views are manipulated by topography and plantings Path widths and directional changes highlight internal and external spatial foci.	Park alcoves are clustered around the central open panel providing a range of spatial enclosures and a network of paths Spaces are designed to conceal and reveal views and openings Many of the sculptures are oversized, challenging known perceptions of scale.
Naturalistic		
Planting interprets Atlantic coastal landscapes Flowering plants contribute to urban habitat development Seasonal changes emphasized in plant choices and locations Theme garden plants and stone choices incorporate color, texture, and other associations.	Each garden has a distinctive plant palette and use of stone and other landscape elements Programming by the park's friends group includes regular care of the perennial beds Dense tree planting on the street-side of the park focuses visual attention on the lake.	Nature sounds are incorporated into some of the paths Small animal sculptures are hidden throughout the park Various plant species and combinations challenge categorization and habitat knowledge.
Intrapersonal		
Intimate seating/resting areas—some secluded, others to side of more public areas Quieter play and restful areas are separate from active zones.	Individual areas for self-reflection and contemplation Many paths sized for passage of one or two people.	Places provided for self-reflection and other individual activities in secluded alcoves and in areas just off the central lawn terrace.
Interpersonal		
Group gathering areas, including the sundeck, also provide spectator seating and viewing areas Children's play areas have opportunities for group and individual play.	Small and large group gathering areas are placed in the group 'dance' gardens Scheduled and impromptu musical events provide social engagement opportunities.	Designed multi-player games range from chess and checkers to hopscotch Open lawn areas and the fountain offer opportunities for unprogrammed group interactions.

and Gigue—is based on a courtly dance from Bach's time and represented in a mini-garden. Collectively, the mini-gradens comprise the park (Ma et al. 2000). In creating what Yo-Yo Ma called a concert hall without walls in a landscape set to music (Dooley 2000; Ma et al. 2000; Messervy 2009; Rouyer 1999; Thompson 2000) the design of the Music Garden appeals deliberately to visitors' senses of sound, movement, and space. Landscape designer Messervy said, "For me, gardens are—like music—about flow; music flowing through time, and gardens flowing through space" (Messervy 2009, 11). It is not surprising that the garden directly challenges visitor's musical/rhythmic, bodily/kinesthetic, and visual/spatial intelligences. Persons with a strong musical/rhythmic intelligence may easily sense a multitude of relationships between Bach's music and the elements within each of the mini-gardens, as well as their relationship to other intelligence domains. For those desiring to hear Yo-Yo Ma playing the movements of Bach's First Suite as they move through the garden, audio guides are available.

Landscape elements in each garden represent the musical movements as they relate to physical and visual movement through space. Messervy used Labanotation, a system of notating dancers' movements developed by Rudolf Laban, to inform the paths' designs and placements (Messervy 2009, 15). Plants, stones, topography, steps, and other garden structures define the park

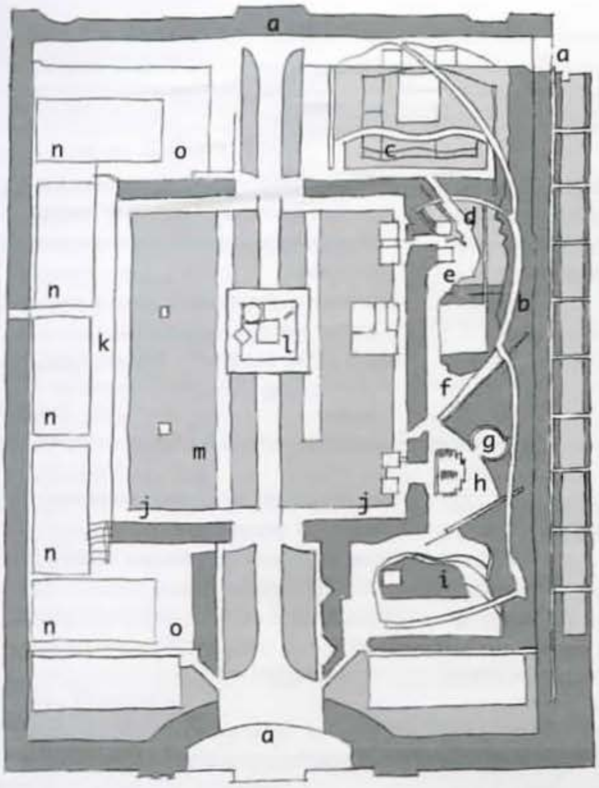

Figure 1. Plan of the Jardin Atlantique. (Adapted from Heery 1997)

Figure 2. A range of tonal qualities, mathematically-inspired patterns, and distinct surface materials on the seating and waving sundecks, walkways, and lawn offer musical/rhythmic, logical/mathematical, and naturalistic challenges. The metal arbor and light poles challenge the logical/mathematic intelligence levels as they measure distances, and create two- and three-dimensional forms and undulating rhythms while also challenging visual/spatial intelligence levels through creation of a variety spatial enclosures. (Photo by author 2006)

spaces (Figures 7 to 9). The paths' spatial arrangements directly engage characteristics of the bodily/kinesthetic and visual/spatial intelligences. For example, visitors familiar with the Bach's Prelude or listening to the audio guide may relate the flowing sound to a flowing river, interpreted by Messervy as a curling streambed of granite punctuated by boulders and junipers. The Menuett path's width and gentle slope encourages a stroll rather than the rush or obvious stepping sequences associated with the Courante or the Allemande (Messervy 2009, 15). Movement of visitors through each of the mini-gardens challenges the bodily/kinesthetic intelligence.

Figure 3. The two-dimensional wave pattern of the western path challenges the visual/spatial intelligence as the complex pattern breaks the passage into smaller areas. The path's sequences of lines and solids encourages visitors to engage their bodily/kinesthetic intelligences by walking or hopping through them; some may even recognize their mathematical relationships. (Photo by author 2006)

Figure 4. Different forms of stone in the riverside room create alternative circulation paths and playful opportunities to engage various intelligences. Human engagement with the materiality of the floor plane offers various musical/rhythmic interpretations. The pea stone crunches, while the stepping-stones offer a solid tone or tap depending on how you move from one to another. Challenges to the naturalistic intelligence include categorization of the stones, the types and use of wood in the benches, and the place of each in creating a river theme. (Photo by author 2006)

The comparison of body movements as visitors move through each mini-garden also references bodily/kinesthetic intelligence.

In addition to creating spatial definition and textural interest year-round, plant placements and combinations offer challenges to the naturalistic and logical-mathematical intelligences. Placement of specific plant associations within the gardens, such as expanses of tall grasses that provide habitat and are blown about by the Lake Ontario's on and offshore winds, engage naturalistic intelligence. The Prelude garden's regularly spaced hackberry trees that recall measures of time engage logical/mathematical intelligence. The definition of pathways, resting places, and gathering spaces address personal intelligences. Many of the gardens' narrow paths and small resting points encourage reflection and meditation, while the amphitheater and stages in the Gigue and Menuett gardens encourage groups to gather and share activities, thus engaging intrapersonal challenges. Musical performances and activities such as club and children's gardening days encourage interpersonal engagements across the park. Simple interpretive signs that name each mini-garden and provide a short piece of the movement's musical notation provide minimal references to verbal/linguistic intelligence.

Figure 5. Atlantic maritime plants are positioned geometrically, to be blown in the wind and provide color and textural contrast to the central lawn. The plant choices and locations offer numerous opportunities to engage naturalistic intelligence levels. They represent the coastal landscapes, contribute to urban habitat creation, and make a range of seasonal changes more apparent. (Photo by author 2006)

The Green at Wachovia (Cole, Jenest, and Stone. Charlotte, North Carolina. 2002)

This 1.5-acre urban park stretches between two main streets on the southern end of Charlotte's downtown district. Covering an underground parking garage located between two new multi-story mixed-use buildings, it is located across the street from a conference center. The park consists of a terraced sequence of central lawn spaces lined on two sides by smaller, more intimate alcoves for play or retreat (Figure 10). Local artists designed nine installations for the garden (Childress Klein Properties 2003). Some engage sound rhythms, others create games of movement or literary puzzles, and still others use patterns to reference cultural diversity. The Green offers something for most of the senses and all intelligence domains in a playful manner (Figures 11 to 14). Brightly colored plants, signs, and sculptural elements vie for attention. Smells from outdoor cafes mix with the scents of plants and water within the park (Cole, Jenest, and Stone 2007; Hines n.d.).

This park's extensive use of literary references challenges visitors to make cognitive connections to elements in the park or further afield. The signs, benches, and games provide challenges as utilitarian objects,

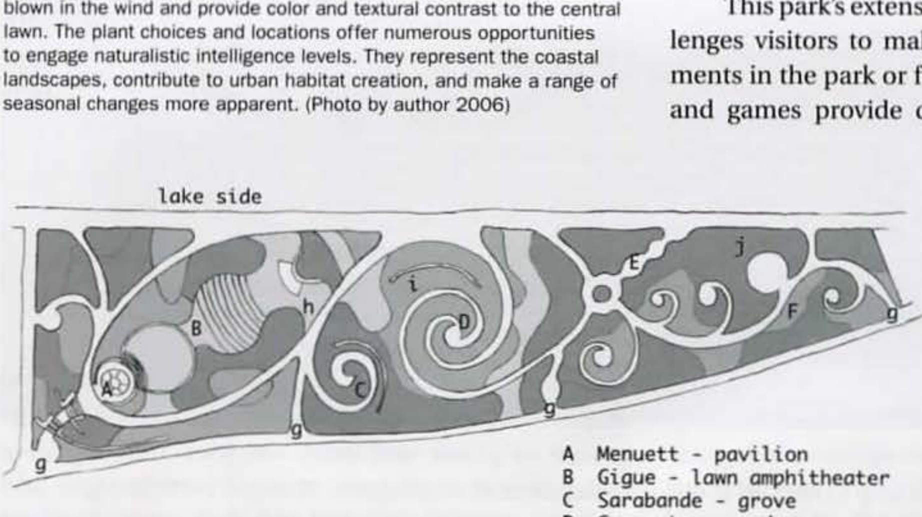

Figure 6. Toronto Music Garden, plan. (Adapted from Messervy 2009)

Figure 7. The Prelude's path is edged by a bubbling stream of rocks and boulders, shrubs and grasses, and a hackberry allée that leads from the sidewalk into the garden. Individual stones offer informal intrapersonal seating opportunities to watch people while visually set apart from the main path. Larger boulder groupings offer interpersonal opportunities to gather. The regular spacing of the allée provides a regular visual and spatial base-note or rhythm to visitors moving up the path. (Photo by author 2000)

Figure 8. The double-spiral of the Courante's path to an apex swirls through a wildflower meadow, engaging both the bodily/kinesthetic and naturalistic intelligences. Those with higher naturalistic intelligence levels may note habitat values, those with lower levels may categorize plant colors and forms. The Gigue's amphitheater steps engage visitors' bodily/kinesthetic intelligences through the riser-tread relationship that creates different bodily movements when going down or up into the Menuett's stage and gazebo. (Photo by author 2000)

and privilege visitors with higher verbal/linguistic intelligence and literary and geographic knowledge. For example, street signs along a main path engage in geographic wordplay, pairing literary luminaries with US towns sharing their names. Other signs puzzle visitors with a combination of symbol and letter riddles to generate phrases as they move through the park. A garden alcove's reference to Lewis Carroll's *Alice in Wonderland* does not use words, but rather features a change in the scale of common elements. Mosaic tile patterns drawn from local cultural groups (Childress Klein Properties 2003) on over-sized chairs and tufted stools—engage the visual/spatial and logical/mathematical intelligences. Set in an elongated alcove, the chairs and stools also offer places to engage the personal intelligences.

The use of materials that sound differently when walked, run upon, or hit as well as motion-activated speakers that whisper nature-inspired sounds engage musical/rhythmic intelligence capacities in other areas of the park. Tactile patterns and the hopscotch board

Figure 9. Each garden path has a musical score. Plaques near the path entries provide both musical/rhythmic and verbal/linguistic challenges. (Photo by author 2000)

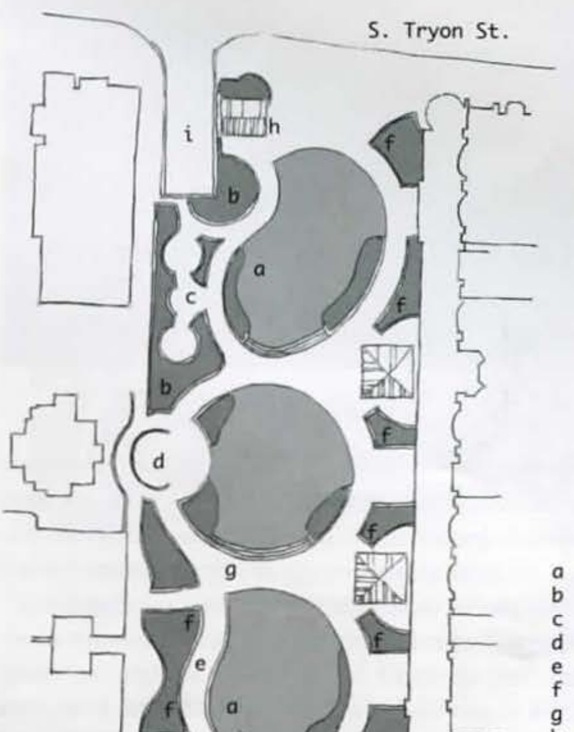

Figure 10. Plan of The Green at Charlotte. (Adapted from Childress Klein Properties 2003)

Figure 11. Author Signposts (2002), designed by Gary Sweeney, highlight the park's literary theme and connect Charlotte to locations around the United States through verbal/linguistic challenges. The geographic references on the signs offer a larger spatial challenge by extending a visitor's sense of place far outside the boundaries of the park. (Photo by author 2006)

Figure 12. Artists Linda Kroff and Aide Saul designed Cultural Arrangements (2002) for three linked secret garden rooms. The tuffets arranged around a tile carpet provide colorful interpersonal seating. Extensive use of different tile and mosaic patterns and variations in their scale and spatial arrangements offer visual/spatial, logical/mathematical, and naturalistic intelligence challenges. (Photo by author 2006)

address the bodily/kinesthetic capacities by engaging fine and gross motor skills. Textured paths and tile patterns invite interpretation through touch and body awareness. The hopscotch board, interactive fountain, tilted lawn spaces, stone walls, and flowing paths encourage running, jumping, and climbing.

SUMMARY

Meaningful landscape experiences are, in part, the result of a successful merging of site challenges and users' capacities across the eight intelligence domains. When site designs and programming provide a range of challenges to engage users' intelligence domains, users have more opportunities to engage in the landscape and achieve flow. Using the Spectrum Matrix as a tool during the design process, designers can evaluate how a range of intelligence traits and challenges associated with landscape elements will engage users in a proposed project. Close critique of the project as it evolves from programming and schematic design through design development, implementation, and use, allows designers to review and refine the use of landscape elements on the site and the levels of challenge they provide for different site users.

The Spectrum Matrix can be used during the site inventory and analysis phase to assist in closely examining the site and assessing its potential to engage multiple intelligences. Such opportunities can then inform development of the project program. Framing the site

Figure 13. Kroff and Saul's over-sized chairs and benches play with visual/spatial capacities and offer places for interpersonal and intrapersonal interaction. The game board provides opportunities for a logical/mathematical challenge. Poems embedded in the chair mosaics offer challenge to visitor verbal/linguistic capacities. (Photo by author 2006)

Figure 14. Carolyn Brooksma's Fish Fountain (2002) includes literal, figurative, and literary references to water, combining logical/mathematical, verbal/linguistic, and naturalistic challenges. Combinations of different stone aggregates add another type of naturalistic challenge, and dancing water sprays allow visitors to engage their bodily/kinesthetic intelligences as they play with and around the water. Anticipation of and interaction with the spray sequences engages visitors' musical/rhythmic intelligence. (Photo by author 2006)

inventory and analysis process in the context of challenging multiple intelligences will help designers recognize opportunities for creating enhanced landscape experiences. Use of the Spectrum Matrix during project programming places more emphasis on users' cognitive and physical skills and abilities, and their potential experiences on the finished site. The Spectrum Matrix is not particularly helpful during the conceptual design phase as it can neither provide nor critique a concept, except when a concept focuses on a particular intelligence domain or a combination of them. However, the Matrix can be a powerful tool for critique during the design development phase as it encourages designers to closely review specific site elements, spatial arrangements, and design details as they relate to a wider range of users' interactions with and within the site. Design proposal reviews can identify the abilities of a particular user group and the extent to which a design challenges the multiple intelligences associated with these abilities.

We are challenged to conceive of and build landscapes that allow users to enjoy our creations as well as to enjoy themselves by engaging in and with the landscape. The Spectrum Matrix is a prompt. First, the Matrix reminds site designers and programmers that people perceive and understand their worlds differently and come with different sets and levels of multiple intelligence skills. Secondly, it reminds us to look closely at our design work for opportunities to diversely challenge user engagement with landscape across multiple intelligences.

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