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Multidimensional space

Environmental poetics

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Abstract. *To address the relatively impoverished sensory environments generated by modern architectural/urban design practice, this paper proposes a new design framework of individually shaped sensory spaces. These experiential spaces include light, color, temperature, smell, sound, touch and the personal and communal spaces brought to life through habitual use patterns. Each of these independent dimensions has identifiable characteristics of location, shape, boundary, intensity, duration, etc. which may coincide with or only partially overlap the architectural geometric space of walls and voids. This multidimensional framework explores how these sensory spaces may be either congruent, reinforcing each other for an intense nodal experience, or dissonant, diverging to create an illusion (or just bad design).*

Keywords: *architecture, phenomenology, urban design, sensory space*

Multidimensional space

Attenuation of the sensory landscape

The buildings & urban neighborhoods we traverse in our modern world, once lushly varied sensory environments, have paled to a relatively bland homogeneous palette. In the service of concepts like universality and flexibility, the environments we design and build are focused on narrowly acceptable ranges of temperature, light, smell, sound and color. This attenuation of our sensory landscape is a legacy of the modern movement which leveraged the new technologies and cheap energy of the mid 1900's to standardize our sensory experience. Experiments were conducted to understand comfort level preferences for the 80% peak of the population bell curve. Comfort charts were drawn; light levels were targeted; and elaborate electrical/mechanical systems were engineered to maintain these "comfort conditions" over every square foot of building space through every hour of the day, every day of the year.

This homogeneity of experience was generated from an egalitarian desire to provide a base level of comfort for all. As designers of the physical realm, architects were empowered to do this in the mid-twentieth century by the engineering accomplishments that gave them precise control over a building's temperature, light and ventilation and by what appeared to be unlimited energy resources available to maintain the resulting narrow band of conditions. (Banham, 1969) Historically we have benefitted greatly from the minimum standards these systems guaranteed. The advent of these environmental controls saved workers from the suffocating and dim interior spaces of earlier times. But the rigid replication of this approach has resulted in spaces that are everywhere the same and nowhere special – environments that are acceptable but not inspiring, comfortable but not comforting; predictable but not memorable. The systems to maintain this consistency overdraw the earth's resources, returning in exchange environments with no sense of space, time or spirit.

A Multidimensional approach

Modern architecture has so accepted this dictate of homogeneous sensory design that most designers today no longer even consider the potential modulation of sensory experiences within our buildings and neighborhoods. However, numerous voices throughout recent decades have provided wake-up calls to remind us of the rich sensory landscape that is our heritage. Christian Norberg-Schulz, for example, reminds us that in Prague, “The illumination is not continuous and even; strongly lit and dark zones alternate, and make us remember the times when a street lamp created a place.” (Norberg-Schulz, 1980). Lisa Heschong’s *Thermal Delight in Architecture* recalls the vitality of varied temperatures that drew people to cozy fireplaces in winter, cool courtyards in summer – spaces that invoked memories and a sense of place (Heschong, 1982). And Juhani Pallasmaa admires the capacity of the human ear to carve a volume into the void of darkness, (Pallasmaa, 2005). Building on these perceptive voices, this paper reconnects designers with the rich depth of these sensory experiences, develops a language and design framework to conceptualize them, and suggests changes to education curricula to ensure that future generations of designers are equipped to design within the multiple dimensions of sensory experience. Multidimensional space is the term this paper uses to describe this framework of overlapping sensory spaces.

The multidimensional approach involves understanding the sensory spaces as volumetric shaped spaces that we can inhabit – spaces of warmth, color, light, sound, smell, texture, etc., that exist independent of the geometric space of walls and openings. Although rarely designed intentionally, each of these spatial dimensions exists and has identifiable characteristics of location, shape, boundaries (rigid or porous), intensity, duration, etc., that can be designed and perceived just as we design the geometric space. The multidimensional framework lets us comprehend the experience of entering and leaving these sensory spaces. It lets us examine whether they are congruent with each other or dissonant, whether they build to intensify a cohesive experience or diverge to create an illusion (or just a bad design).

Light space

Take for example the experience of light space, perhaps one of the easiest to understand as, like geometric space, it too is experienced through sight, the predominant human sensory mode. Similar to our modern approach to the solid volumes of architectural space, too often current lighting design falls prey to the seduction of the two dimensional image. It is an axiom of lighting design that we can’t see light unless it is reflected off an object. Although scientifically accurate, this belies our kinetic experience that a volume of light exists between the light source (whether it is the sun or an electric light) and the surfaces it illuminates – a three dimensional volume of light nestled between three dimensional volumes of shadow. David Abram captures this whimsically as he explores the realm of shadow, noting that, “one of the countless signs that our thinking minds have grown estranged from the intelligence of our sensing bodies, is that today a great many people seem to believe that shadows are flat.” (Abram, 2010) To the contrary, on exploring his own shadow, he experiences “a precisely bounded zone of darkness that floats between my opaque flesh and that vaguely humanoid silhouette laid out upon the pavement... The actual shadow does not reside primarily on the ground; it is a voluminous being of thickness and depth, a mostly unseen presence that dwells in the air between my body and that ground.” (Abram, 2010)

This experience of three dimensional volumes of light/shadow presages the rich possibilities of light space. Originating in the theater lighting profession, lighting design has long carried the power to create mini-environments within a larger setting. Just as the theater spotlight defines a small cone of activity within the larger stage, so creative architectural lighting can generate light spaces that feel separated from the space around them. Some light spaces occur naturally, such as the cozy glow of a window seat in direct sunlight or the shady recess beneath an old pine tree. Others are more intentionally designed with carefully crafted

window openings and electric light fixtures. Good lighting designers use these effects to advantage to create volumes of light (or darkness) not confined by physical walls. They create glowing spheres of light around restaurant tables to envelop intimate diners. They entice us with glimpses of bright volumes of light bulging out from behind walls or produce a burst of light to celebrate the intersection of two long hallways. In each of these, the occupant knows when he/she has entered and left the light space, senses how intense it is and how porous or abrupt its boundaries appear.

Light Space

The evening lamp on the family table is also the center of a world. In fact, the lamp-lighted table is a little world in itself, and a dreamer-philosopher may well fear lest our indirect lighting cause us to lose the center of the evening room. (Bachelard, 1969, p. 170)



Figure 1. A volume of light creates a cozy space around the dinner table

Lighting designers may even actively try to camouflage a room's geometric shape by creating an illusion with a contradictory light volume. For example, they may intentionally lower the apparent height of a room by creating a light volume that stops short of the actual ceiling height. This can be done with dropped pendant lights or down light fixtures in an open grid offset from the ceiling.

However in most of our buildings today, especially our work environments, this richness of lighting design is neglected in deference to the goals of flexibility and universality. A standard light fixture template is used to lay out an unchanging grid of light across the dropped ceiling throughout the building. Even in break rooms and lobbies, where the range of activities doesn't require it, the uniformity of light levels persists.

Thermal space

This same uniformity is the default condition for all the sensory modes. Consider the homogeneity of thermal spaces in our modern world. Some environmental designers have even coined the term "thermal beige" to describe the monotonous nature of our contemporary thermal environments. How often any more do we experience moving in and out of warm cozy nodes like the inglenook fireplace set off from the main body of a living room or the warm abode of a window seat in sunshine? In *Thermal Delight in Architecture* Lisa Hescong jogs our collective memories of humankind's long history of seasonal migration to these spaces, the patterns of use marking the hours of the day or seasons of the year. (Hescong, 1982) These thermal nodes can be designed and shaped in our current architectural landscape just as light spaces are designed. They have location, volume, intensity, and boundaries. Who has not experienced the sphere of warmth around a campfire and sensed the edge of this warmth as it dissolves into the surrounding night air?

These benefits are not only aesthetic. Astute designers can also use this approach to conserve energy – using it only where it is needed. They may constrain the thermal comfort volume to the lowest eight feet in a high ceilinged space, basically creating a truncated volume of heat where the occupants reside. They may choose to modulate nodes of warmth or “coolth” where people can gather to be refreshed. The passively designed cool-tower at Zion National Park’s visitor center, for example, creates an “alcove” of cool air at its base for visitors to gather in and refresh themselves.

Thermal Space

Marcel Proust gives a poetic description of such a fireside space, as sensed by the skin: “It is like an immaterial alcove, a warm cave carved into the room itself, a zone of hot weather with floating boundaries.”

(Pallasmaa, 2005)



Figure 2. An inglenook creates a thermal, light, olfactory, auditory, and social node off the main living area. (Photo courtesy Coleen Duffley Photography)

Multi-sensory spaces

Just as we can understand these sensory spaces of light and temperature, so we can call to mind and design inhabitable volumes of smell, sound, texture and touch, color and pattern – each of them independently located in space and time. Current computer simulation programs can even render the shape of these spaces, noting how they overlap or contrast with a building’s geometric space or the landscape of an urban neighborhood. And as these rich sensory nodes take shape, they define sub-spaces that people are drawn to either alone or in a group. While the window seat calls out a private refuge for a solitary afternoon of reading; the inglenook draws a more social gathering.

The inglenook’s strength as a social node is heightened by its intense overlap of multiple sensory zones. This small confined space adjacent to the larger space of the room is reinforced by the warm thermal space of the fire, the flickering orange light space of the flames, the crackling sound space and the smoky charcoal olfactory space. Over time, its habitual use on chilly winter evenings makes it also a cozy communal space filled with stories and laughter. These perceived personal and cultural/spiritual shaped spaces are easily identified by the people who ritually use them, but they may be indiscernible to those who have not shared the experience and may not even recognize the spatial boundaries.

Crafting these multisensory spaces requires a true integrated design approach that can no longer tolerate the handoff of responsibility from the designer, to the engineer, to the occupant, but rather requires all of these parties to sit down together at the design table and speak a shared language. Once architects and designers are trained to envision the shape and attributes of these sensory and cultural spaces, we open up the potential to move beyond the monotony of spaces homogenized by narrow engineering specifications or camouflaged with Muzak, white noise or traffic. Our multisensory designs will consist of intentional nodes of overlap among three or four sensory volumes that intensify the overall experience

and ritualize its use as a cultural space. Or they will contrast individual sensory space experiences to create mystery and illusion. They will provide variety to allow occupants to choose their preference of warmth, light level, sound or quiet. Our designs will make spaces come alive with the rhythms and rituals of sensation and movement, privacy and community. We will create this in our homes, our offices, our public buildings and our urban neighborhoods. Two recent architectural examples illustrate the impact that design like this can have. In the Chapel of St. Ignatius (Seattle), Stephen Holl used the concept of seven bottles of light in a stone box, to generate the form, clearly delineating light spaces separate from their geometric space container. Each of the seven bottles of light is a differently colored volume experienced sequentially in the building. Perhaps the most compelling sensory space in the chapel is the Chapel of the Blessed Sacrament, whose walls are dripped with bee's wax. Stepping into this space, the visitor enters an olfactory volume of sweet smell that also radiates with the warmth of the amber glow from a concealed skylight.

These rich sensory spaces are not reserved solely for spiritual pilgrimage. In his personal residence in Venice, California, artist Doug Aitken experiments with a variety of sensory dimensions to enliven his home. "The goal was to create a warm, organic modernism that's also perceptual and hallucinatory," he said of the design. (Yablonsky, 2012) Aitken both combines sensory spaces to create intense sensory environments and contrasts them to create illusions, expanding the geometric space by dissolving walls with pattern and mirrors. "The ground-floor walls and curtains have been silk-screened to simulate the hedges growing outside the windows, the sky-lighted staircase is lined with angled mirrors that turn the passage into a dazzling kaleidoscope... at certain times of day, the living room windows appear to melt away, dissolving the painted walls into the greenery beyond them." (Yablonsky, 2012) Even the stairwell is an active sound space "played" by the rhythm of footsteps ascending and descending.

Future directions

This paper's articulation of multidimensional sensory space is an initial step toward a fundamental shift in the sensory design of our built environment. Achieving this will involve:

- **Process Change:** The multidimensional sensory approach must bridge the divide separating spatial designers and their building science colleagues. An integrated process involves all team members working to co-design the full environmental experience. Developing a list of buildings/urban precedents will support this by allowing designers to experience the multi-layered sensory impacts first-hand.
- **Educational Change:** Lasting change will require restructuring the studio learning experience to train tomorrow's designers in a multisensory approach that involves cross disciplinary participation of building science team members in the studio.
- **Tool Development:** Although currently available design tools can render individual sensory spaces, no common platform exists in standard design practice to visualize and juxtapose these diverse sensory environments. The expanding body of virtual reality research must be leveraged to provide an accessible tool to simulate all sensory modalities for the design of the built environment.

With these changes, we can make the places we spend time and move through in our daily lives more humane and interesting. These multi-sensory spaces will use the earth's precious resources well to create magical, memorable experiences. No longer shuffling between anonymous universal spaces, we will savor our environments and *dwell* in the true sense of that word – to live or stay as a permanent resident, to linger over. And we'll imbue our man-made realm with the life, variety, and vitality that we are drawn to in the world of nature.

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