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Architectonics of Multimedia

ABSTRACT
Multimedia has emerged in recent years as a viable component in shaping built environments, where media, such as audio, visual and interactive content take on spatial significance. This has spurred multidisciplinary ventures exploring potential applications of multiple media in habitable spaces. Particularly relevant are the progressive insights emerging from works of multimedia installation art and interactive spaces. From a case study analysis of twenty-five such works, eleven were selected for discussion in this paper, which aims to discern the key mechanisms that enable media content formats to take on spatial significance and address their relevance to architectural practice. Key mechanisms identified took the form of transformative, interactive and temporal influences exerted by multimedia in the space of analysed works. Furthermore, from an understanding of the effect of transformative, interactive and temporal influences on the tectonics, topos and typos that define any built work, a theoretical basis was established to discern the architectonic significance of multimedia that could inform future practical applications in architecture.

Introduction

The use of media in architecture has taken on many forms throughout history. From governmental offices to religious institutions or theaters, media has been used to influence the experiential quality of a space. Media, in this context, should not be confused with its alternative meaning of mass communications. While many are familiar with multimedia applications for computers, telecommunications, information devices and gaming systems, its application in physical environments is less understood. Theoretical ideation on multimedia’s spatial potential has been in dialogue since the 1960s, however, it was not until the 1990s that it became economically and technologically feasible to implement such ideas in practical application. Recent efforts in art, interactive design, informatics and computer science to integrate multimedia with the physical aspects of a space have introduced new modes of contemplating spatial function and structure. Many such efforts have expanded from how people experience and interact with a space to include how a space can sense and interact with people.¹ In contrast, few built examples from architectural practice have yet to progress beyond multimedia as a form of novel decoration. This is perhaps indicative of a need to provide architects with a deeper understanding of multimedia that draws upon the knowledge base of disciplines actively engaged in multimedia development.

Relevance of Multimedia Installation Art and Interactive Spaces

Some of the most progressive examples of multimedia used in spatial applications can be found in multimedia installation artworks and interactive spaces. Installation art describes a genre of artwork that involves an enterable space that typically intends to function as an immersive environment that influences a person’s perception of the

¹ Bullivant, 2006, pp. 6–17.
Interactive spaces are physical spaces with interactive systems embedded that can accommodate interactions via tangible devices or sensors. Since these works are not necessarily subject to the pragmatic requirements of an architectural project, they are free to explore ideas that might be too costly or unconventional for architects to experiment with. Aspects of multimedia, interactive design and information technology are often integrated with architecture in the creation of these installation works. While architecture typically involves static physical elements that compose a constructed form and define a resultant space, multimedia installations and interactive spaces can involve dynamic elements that respond to and interact with people, the surrounding environment and data inputs to define a resultant space. In addition, the site-specific nature of the works and emphasis on the human experience of a space make multimedia installation art and interactive spaces particularly relevant to architectural design.

**Area of Research**

This body of research is situated within an integrated area of study that covers art, multimedia technology, interaction design and architecture. Focus is placed on the integration of multimedia with physical built spaces, rather than virtual reality environments. The aim of this paper is to determine the manner in which multimedia influences an architectural context and the resultant effects of these influences in order to discern the structural logics that enable media content formats to take on architectonic significance in real environments. To work towards this aim, a case study analysis of works of multimedia installation art and interactive spaces was conducted. Works to be analysed were limited to those that use multimedia as a primary component of an architectural context — where multimedia takes on an architectonic function in the space. Focus was placed on contemporary works that exhibit innovative use of multimedia in augmenting a space.

**Method:**

**Analysis of Component Elements**

Due to the complexity of multimedia installation art and interactive spaces, it is helpful to consider each work as a system consisting of the multimedia implemented, the correlating installation space and the people that experience and interact with the space.

![Fig.1. A typical multimedia installation system diagram](image)

Within this system, the multimedia component functions as a sub-system. The multimedia sub-system is composed of an input that is processed through computation and a corresponding output that is usually in a content form intended for human sensory perception.

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Providing an Architectural Context

To discern the influence of multimedia and its effect on a correlating architectural space, this paper references an architectural theory by Kenneth Frampton that proposes ‘the built invariably comes into existence out of the constantly evolving interplay of three converging vectors, the topos, the typos and the tectonic.’ Topos comes from the Greek word for place. It refers to the site, environment or context in which a building is situated and inherently responds to. Typos means type. It refers to the function or purpose of the space that a built work defines. Tectonics refers to the physical construction of an architectural work or the built components that define a space. While Frampton probably did not have multimedia in mind when he developed this theory, it is evident that he understood architectural space and one’s experience of it as inextricably linked to the diverse elements that influence and inform it.

According to Frampton’s theory, tectonics, topos and typos can be understood as vectors that always converge to define any built architectural work. These three vectors thus served as effective referential points to derive and understand the architectonic makeup of each case study space. The spatial significance of multimedia influences in each case could then be then assessed by analysing the perceived changes to the tectonics, topos or typos of the space as a result of the multimedia introduced.

Proposed multimedia influence

From the observations and analysis of the case studies, three forms of multimedia influence were discerned based on: their relevancy to an architectural context; the purposeful functionalities they afforded; and the prevalence with which they were observed. The three modes of influence proposed will be referred to as transformation, interaction, and temporality. 1) Transformation refers to the observed ability of multimedia to influence a dramatic change in the perceived form, sense or function of a space. 2) Interaction refers to the observed ability of multimedia to provide responsive mechanisms that influence a physical environment. These responsive mechanisms enable human and environmental inputs to influence a space. Interfaces can range from a point of tangible interaction involving a button or lever, to spatial interactions where movements in a space can function as inputs to a system. 6) 3) Temporality refers to the observed ability of multimedia to afford the sense of nonlinear timelines for a space where one’s sense of time can be altered or juxtaposed to the expected timeline. Time is an influential yet often overlooked factor that influences one’s sense of space. ‘The heart of one’s sense of time is the sense of now’, states Kevin Lynch, who supported the significance of time in influencing one’s sense of space.7 Temporality can influence the perceived duration of time, the speed or flow of time, or the location of a space in time.

Table 1: Matrix of Multimedia Effects

Table 1 presents transformation, interaction and temporality with respect to Frampton’s three vectors (topos, typos and tectonics). The resulting matrix describes the transformative, interactive and temporal influence of multimedia and their resultant effect on the tectonics, topos and typos of an architectural space. The matrix can be used to effectively describe all observed instances of multimedia influence in the case studies.

<table>
<thead>
<tr>
<th>Vectors</th>
<th>1. TRANSFORMATION</th>
<th>2. INTERACTIVITY</th>
<th>3. TEMPORALITY</th>
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</thead>
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<td>Interactive Tectonics: Tectonic elements with the ability to sense, react and interact.</td>
<td>Temporal Tectonics: Modulations in tectonic form and function in the context of time.</td>
</tr>
<tr>
<td>Topos</td>
<td>Transformative Topology: Modulations in topological cues resulting in a changed sense of place.</td>
<td>Interactive Topology: Environments that can sense and react to stimuli.</td>
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Influencing Tectonics:
Transformative Tectonics — Transformative Influence on Tectonics

Transformative Tectonics refers to the ability of multimedia to modulate the form, sense and or function of tectonic elements. The following examples illustrate the transformative influence of multimedia on tectonics as observed in case studies.

The first case study, titled Entramado, exhibits transformative tectonics through the construction of space with visual media. (Fig. 2. a.) This work is situated in an exterior public space with benches and trees interspersed. Projections of animated lines and geometric shapes trace tectonic elements in the space, transforming them into visually dynamic objects. Physical tectonics merge with visual media to generate the visual experience of a digital 3D environment in a physical space. As people move around the space, their shadows mask projections to reveal the actual physical environment. The projections also function as a form of illumination that activates the space for evening use.
The sense of sight and touch are the primary senses that directly influence one’s perception of a space. People can visually grasp the relative size, shape, and position of the concrete benches and ground plane. Previous experience that might presume these elements to be stable and static is contradicted when static physical objects take on a dynamic visual appearance. Grid-lines and shapes projected on the ground plane and benches function as a secondary layer of structure in the design of the space. In this case, visual media influences the perceived extent of the space, correlates with tectonic elements to augment their visual appearance and illuminates the space.

Another aspect of transformative tectonics is evident in a work titled Audio Space, where sounds are used to create spatial structures. (Fig. 2. b.) The installation is set in an interior space. Visitors wear special headsets equipped with stereo earphones, a microphone and location sensors. They are invited to walk around the room and input an audio recording of themselves at any point in the space. Each recording can then be heard again by another person when standing in or near the position it was recorded. The recordings associated with different points in the space function as an audial structure that is perceptible as one moves around. Using stereo sound, the headset gives directional cues to where other recordings are located in relation to the participant.

In this case, multimedia transforms a static tectonic structure by augmenting it with a cumulative spatial audio structure that can be navigated by hearing. While human hearing is attuned to the directional and spatial specifics of sounds we hear, it is often thought of as secondary to the visual and haptic senses for navigating and interpreting a space. Here, however, hearing is elevated to the primary mode of understanding a space. Another critical aspect of the audial structure is that people who visit the space create it. The structure responds to the inputs of people and is cumulative, as it tends to become more complex over time. As a result of the ability of sound to ‘dramatise’ spatial experience, people can also contribute to the emotional character of the experienced structure as each person’s recording has the potential to influence the experience of others navigating the space.

Fig. 2. a. Merging of virtual and physical elements with visual media, b. Audial structure created by people augmenting tectonic structure

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Interactive Tectonics — Interactive Influence on Tectonics

*Interactive Tectonics* refers to an observed effect of multimedia to enable tectonics to sense, react and interact with outside influences. The following examples illustrate the interactive influence of multimedia on tectonics as observed in case studies. The case titled *Polygon Playground* exemplifies interactive tectonics wherein tectonic elements function as input devices for an interactive system. (Fig. 3. a.) This work is set in an interior exhibit space. A stepped structure is augmented with projections that trace its physical form, and display dynamic graphic patterns on its surface. People are encouraged to climb on the structure. Their presence triggers changes in the projected visuals that simulate physical deformations in the sculpture in real time response to the position and movements of people on the steps. Here, the static, solid structure appears to become malleable. In this example, interactive projections enable the movements of people to influence the perceived physical and material character of a tectonic structure, although there is no physical change. This is enabled by the dominance of human visual perception. The projections act as a layer of flexible and dynamic texture that closely coordinate with tectonic forms to create the final integrated construct people perceive.

Another example of interactive tectonics is evident in the *Bridge* case study, where people trigger changes in tectonic form and function. (Fig. 3. b.) This work is set in a large interior space filled with a half-metre-deep pool of water. A ramp leads to the pool’s edge where a step is visible just above the water’s surface. When stepped on, the participant’s weight activates a second step to rise out of the water. Moving to the next step triggers another step to rise in front, and the previous step then submerges. Here, tectonic elements sense the presence of people, and activate a secondary structure augmenting the form and function of the primary tectonic structure. Hence, the pathway, or secondary structure, is only triggered to appear when needed.

Temporal Tectonics — Temporal Influence on Tectonics

*Temporal tectonics* refers to the observed effect of multimedia to modulate tectonic form and function in the context of time. The temporal influence of multimedia effects not only the perceived sense of time, but also the duration of a particular function or aspect of a given tectonic element. Referring back to the *Bridge* case, this example also illustrates temporal tectonics with the use of on-demand tectonic elements. The structure of the pathway is only present when needed. If no one is

Fig. 3. a. Tectonics elements function as input devices, b. Temporary shifts in the form and function of tectonic elements
present to activate the pathway, the space returns to its status as a reflecting pool, unable to be occupied. (Fig. 3. b.)

**Influencing Topos:**

**Transformative Topology — Transformative Influence on Topos**

*Transformational Topology* refers to the observed effect that modulates topological cues resulting in a changed sense of place. *The Grand Tour* case uses communication links to structure space and, hence, transform the extent of a topos. (Fig. 4. a.) The installation is set in the exterior street spaces of a dense urban environment. Framed reproductions of painting masterpieces are hung on exterior walls or facades. Accompanying each painting is a panel with a cell phone number people can call to hear an audio description of the work. A web address is also provided for viewing maps with painting locations and audio or text descriptions of each work. People can choose the paintings they are interested in and create their own itinerary through the city to see physical works, or select from themed itineraries. The reproductions paired with audial and visual information accessible by cell phone and internet communication links, compose a multimedia system that provides a flexible means of defining the extent of a topos. Here, multimedia can extend a given topos beyond a singular physical space to encompass a series of distributed spaces linked via communications of their physical locations and the urban passages that interconnect them. People can decide the extent of the topos for themselves based on the paintings they choose to see and the passages taken between them.

Another example of transformative typology involves multiple locations experienced within one physical environment. (Fig. 4. b.) The *Displaced Emperors* case is set in an exterior space adjacent to the facade of a historic building. Projections depicting interior spaces from a building in a remote location are correlated with portions of the exterior facade. People can control which interior spaces are visible by moving a virtual hand over the facade that is, in turn, controlled by the movements of their own hand. Each interior space is projected in tandem with music that correlates to the historical period in which each room was constructed. The projections and audio recordings correlate scenes from a remote location with the immediate installation space allowing people to experience aspects of both locations simultaneously. The perception of the immediate topos is transformed, merging the experience of multiple locations in one physical place. Digital information in the form of video and audio creates a virtual structure that merges visual aspects of one topos into the physical topos of another. Interactive capabilities enable people to choose which part of the environment is visible at any one time.

![Fig. 4. a. Extent of a topos expanded with digital information, b. Remote locations experienced in a local place](image-url)
Interactive Topology — Interactive Influence on Topos

*Interactive topology* refers to the observed effect of multimedia to enable an environment to sense and react to stimuli. Possibilities for interaction with media in a spatial context introduce possibilities for human and environmental inputs to influence the nature of the surrounding space and the purposes it can afford. The case titled *Funky Forest* depicts interactive topology through the use of human movement shaping the installation environment. (Fig. 5. a.) Meant for children, it is set in an interior space where projections on the walls depict a fantastical forest scene. Children can use gestures to indicate the desired form of a tree to grow and an animated tree that sprouts in response to the size of their gesture. Each tree activates visuals of birds and insects creating the impression of a living forest ecosystem. Floor projections depict a river landscape where the path of the river’s flow changes in response to children’s movements and gestures. Computer generated sounds complete the playful forest ambience. Here, the projections coordinate with the tectonic structure to create a spatial interface that enables children to activate and influence the nature of the forest environment. In addition, video and audio content influence the perceived physical nature of tectonic elements to appear soft, malleable and dynamic.

The *Homographies* installation exhibits another aspect of interactive typology where interactive elements create a dynamic socialising topos. (Fig. 5. b.) It is set in a large interior space where a grid of fluorescent tube lights equipped with motion sensors is mounted on the ceiling. Each light is capable of rotating independently on a central axis point. Motion sensors detect the position and movement of people. The lights rotate collectively to create lines of light indicating the location of individuals in the space and their position relative to others. The responsiveness of the rotating light tubes gives augmented functionality to the space. Arranged in an array, the light tubes compose an interactive structure that transforms the ceiling into a dynamic, motion-sensing device. In their inactive state, the light tubes align themselves in a conventional manner. When activated by the presence of people, lights tubes reorient themselves to communicate the position of people in the space and suggest possible pathways to connect them. This introduces a social-spatial element encouraging social interactions between people. The augmented function of the ceiling is a peripheral one as people rarely take notice of the space above their horizontal line of sight at first. Peripheral function represents an important aspect of integrating multimedia with architectural design as the media does not have to dominate the experience of a space in order to function effectively. In a peripheral role it can augment an environment without being distractive.  

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Temporal Topology — Temporal Influence on Topos

Temporal topology refers to the observed effect of multimedia to modulate temporal cues that change a space with respect to the context of time. The Meta.L.Hyttan project was used to propose a living history installation in an abandoned blast furnace hall. (Fig. 6. a.) This case conveys temporal topology through the use of temporal influences to construct a sense of ‘now’ for visitors. People navigate the dimly lit hall with a flashlight. Sensors embedded in the space detect this light and trigger a multimedia display. Activated visual, audial and physical media provide temporal cues that simulate the blast furnace hall in its original active state. After a few minutes, the multimedia display dims and the space returns to the present day state. In this case, the temporal influence of multimedia functions to juxtapose the environmental ambience of two time periods in one space. In their activated state, physical elements are transformed with lighting and projections that create temporal cues conveying the pre-existing nature of the space. Other projections give views into the inner workings of mechanical equipment that are otherwise hidden from view. Sounds provide audial cues that contribute to recreating the environmental ambience of another space in time.

Another aspect of temporal topology is shown in the The Weather Project case, where visual media is used to construct a temporal environment. (Fig. 6. b.) The installation is set in a large interior museum space. Monochrome amber colored lights appear like a giant sun at one end of the space. The amber light renders everything monochromatic, similar to the light conditions of a hazy, late afternoon in summer. Artificial smoke and the light reflecting off the ceiling and walls of the space contribute to the hazy impression of the space. Here, visual media alters the light quality of the space. The large scale of the space accommodates the feeling of an exterior environment with the large monochrome light source as its sun. As a result, the interior environment has the feeling of being an exterior one in a constant late afternoon state.
Influencing Typos: Transformational Typology — Transformational Influence on Typos

Transformational typology refers to the observed effect of multimedia that enables modulations in the function of a space to change its purpose. The transformative influence of multimedia on tectonics and topos, often influences the perception of typos. Referring back to The Grand Tour installation, the temporary introduction of the installation’s multimedia system affords the involved spaces alternative purposes. In this example of transformational typology, multiple media functions to transform everyday urban spaces into museum spaces for art and possibly even impromptu gathering places for people viewing and discussing the art. Here, multimedia gives architectural spaces increased flexibility to quickly change typology to serve different needs. (Fig. 7.)

Interactive Typology — Interactive Influence on Typos

Interactive typology refers to the observed effect of multimedia to enable a space to change purpose in response to stimuli. In this case, the actions and interactions of people in a space can have a strong influence on the perceived typology of a space. The temporary alteration of tectonic function observed in the installation titled Underscan illustrates an example of interactive typology. Situated in an exterior public plaza, bright lights illuminate the space and cast pronounced shadows of people. Motion sensors in turn track the movement and position of people and their cast shadows. A person pausing in the space triggers the projection of pre-recorded
video footage depicting another person in the community, within their cast shadow. When the person walks away, the projection fades. (Fig. 8.)

Fig. 8. Temporary alteration of tectonic function

In this example, the movement patterns of people influence the perceived material quality and function of the ground plane into a personal video space where visitors can encounter another person in the community. As multiple video spaces occur simultaneously, multimedia temporarily affords an alternative typos where potential video encounters can take place.

**Temporal Typology — Temporal Influence on Typos**

Case study observations have indicated that multimedia has the ability to temporarily change the typology of a space to offer an alternative timeline for spatial functions. This will be referred to as ‘temporal typology’. *Free Avone* is an example of temporal typology where the function of a space is modulated in real time response to external stimuli. The installation is situated in a vacant exterior urban space adjacent to a building facade. A person holds a laser pen device and their drawing gestures are enlarged in real time into projections that simulate spray can graffiti on the whole surface of the building facade. (Fig. 9.)

Fig. 9. Modulating function in real time response to stimuli

In this case, the large-scale graffiti projections transform the building facade into a canvas and the adjacent urban space into an interactive space for artistic expression. Similar to the *Grand Tour* installation, the unexpectedness of these media interventions in an everyday urban space, coupled with their ability to temporarily transform an otherwise mundane space, could be a powerful tool in urban regeneration. In the *Meta.L.Hyttan* case introduced earlier, multimedia temporarily transforms the purpose of the space from an abandoned industrial space to a living history museum where people can experience its past state. Here, temporal typology is expressed in the form of a temporal environment triggered by external stimuli. (Fig. 6. a.)

**Conclusion**

This paper sought to understand the manners by which multimedia influences physical architectural spaces, discerning the key mechanisms that enable media content formats to take on architectonic significance. From an investigation and
analysis of twenty-five works of installation art and interactive spaces, the following conclusions were reached.

Referencing Kenneth Frampton’s architectural theory, the influence of any given form of media on an architectural space could be determined by assessing its effect on the tectonics, topos and typos of the correlating architectural space. Findings from case study analyses indicated ‘transformation’, ‘interactivity’ and ‘temporality’ as three key forms of multimedia influence in an architectural context. Categorising the three forms of influence with respect to their effect on Frampton’s three vectors established a matrix of nine multimedia effects: transformative tectonics, transformative topology, transformative typology, interactive tectonics, interactive topology, interactive typology, temporal tectonics, temporal topology and temporal typology. The resulting matrix presents a unified, though multifaceted theoretical model that can be used to identify and describe the architectonic influences of multimedia.

In practice, this model affirms the relevance and spatial significance of multimedia for a real-world architectural context. It also provides a means for practitioners to gain a structured insight into the relationships between media and architecture. The purposeful integration of multimedia as an architectural construct implies an innovative approach to architectural design that could be of equal interest to artists and designers. Findings from this study are intended to contribute to a theoretical framework that supports integrated approaches to architectural design and encourages architectural discourse that draws from a multidisciplinary knowledge base.

Anne James is an architect in Kyoto, Japan. She received her PhD from the Department of Architecture and Design at Kyoto Institute of Technology in Japan, sponsored by a fellowship from the Japanese government. Originally from the United States, she received her undergraduate degree in Art and Design from the California Polytechnic State University in San Luis Obispo, and her graduate degree in Architecture from the University of Virginia. Her architectural experience focused on the potential of architecture as a catalyst for positive change in underserved communities. Her current research investigates the integration of multimedia into architectural design. She hopes to apply this to the development of affordable and accessible hybrid models of public cultural institutions.
Bibliography


Appendix of Referenced Artworks


