

Screen Space: Navigation And Interactivity

*Georgios Papaconstantinou
Dept. of Architecture, University of Thessaly*

This paper considers the introduction of both human-computer interface and interactive multimedia design in the architectural education and practice. The development of information and communication technologies offers to architects new tools of design as well as new areas of architectural practice. What is more decisive is the change of mentality in the way of conceiving space and of the design procedure itself. The question posed is if drawing conventions are changing and in what way. The paper attempts to establish analogies between the recent introduction into architectural thought of notions such as the human body movement, events and scenarios with the development of navigation and interaction principles and conventions in the computer world. The study of human-computer interface contributes in the understanding of the major role of the computer screen as a point of convergence of different representational forms and the emergence of new ones proper to the digital culture.

Keywords: *Multimedia; interface design; interactivity; navigation*

Introduction

In the last few decades the development of digital media offers to architects not only new tools of design but as well new areas of architectural practice. This paper considers the introduction of both the human-computer interface (HCI) design and the interactive multimedia design in the architectural education and practice. We believe that the design of multimedia products, either off-line (CD-ROM, DVD-ROM) or on-line (websites) holds potential for a privileged domain of architectural practice. On the other hand, the introduction to architectural education of the study and analysis of human-computer interface design offers a better understanding of the major shifts in the conception and design of space due to communication and information technologies.

Our approach to these new challenges in archi-

tectural education is focused on the following thematic axes:

- the study of the different levels of organisation of the screen space as an environment of communication and representation
- the use of the notion of "program" to analyse both the spatial organisation principles and the data organisation
- the development of a new codification of communication based on the modalities of interaction (gesture, index, metaphors)
- the comparison between the 3Dimensional organisation of virtual space and the multi-layer space of multimedia data organisation.
- The analysis of the human-computer interface as a point of convergence of existing cultural forms and the emergence of new ones, proper to computer world.

The paper attempts to establish analogies between the recent introduction into architectural thought of notions such as the human body movement, events and scenarios with the development of navigation and interaction principles and conventions in the computer world. Bernard Tschumi emphasizes the role of the movement of the human body in generating spaces produced by and through its movement. He considers that human movement constitutes the intrusion of events into architectural spaces. "At the limit, these events become scenarios or programs, void of moral or functional implications, independent but inseparable from spaces that enclose them" (Tschumi, 1996, p.111). On the other hand Antoine Picon considers a growing preeminence of events and scenarios over static entities in contemporary architectural design (Picon, 2003). Under the influence of computer and communication technologies architectural form becomes similar to a cross-section in a continuous flow, similar to an event.

We will attempt to establish analogies or divergences of the above mentioned development in architectural thought with contemporary approaches of navigation and interaction principles in the computer world. We believe that the movement of the user in the digital space is a basic characteristic of the computer culture and that digital space is always a navigational space. There are two different ways of moving in digital space

- Simulating movement in 3D virtual space, manipulating space data via a screen interface or embedding devices.
- Moving through the multiple layers of data and different media on the screen of a multimedia environment

The study of human-computer interface contributes in the understanding of the major role of the computer screen as a point of convergence of different representational forms and the emergence of new ones proper to the digital culture. As distribution of all forms of knowledge and culture becomes computer-based, we are no longer interfacing to

a tool but to a culture encoded in digital form and computer screen emerges as a cultural interface (Manovich, 2001).

Human-computer interface and multimedia

Multimedia and hypermedia

Multimedia and hypermedia are two terms sometimes confused and used indifferently to describe the same thing. Actually the term multimedia refers to the use of multiple representational media (text, photographs, drawings, moving image, sound and so on). On the other hand the term hypermedia refers to the non-linear linking to the content, following intuitive thinking. A rather broad definition of digital multimedia is "any combination of two or more media, represented in a digital form, sufficiently well integrated via a single interface, or manipulated by a single computer program" (Chapman and Chapman, 2004).

Compared with established media forms such as fine arts, photography, cinema, etc. multimedia is still in its early days. The CD-ROM specification was published in 1985 with drives appearing on personal computers from about 1989. The World Wide Web became publicly available at the start of 1992. The concept of hypermedia is generally traced to an article written by Vannevar Bush in 1945, in which he described the *Memex*: a machine for browsing and annotating a large collection of different documents. It included a mechanism for creating links between documents, allowing documents related to one currently being read to be retrieved. Bush's innovative concept was that association of ideas was fundamental to the way people think and that document storage systems should be organised in a way that reflects these associations.

Human-computer interface

When the concept of interface first began to emerge, it was commonly understood as the hardware and the software through which a human and a computer could communicate. As it has evolved, the

concept has come to include the cognitive and emotional aspects of the user's experience as well. Today, the implication of the term human-computer interface (HCI) includes:

- physical input and output devices
- use of metaphors to conceptualize the organization of digital data
- ways of manipulating data, that is a grammar of meaningful actions that user can perform on it
- the cognitive and emotional aspects of the user's experience

The notion of program: form and event

Through the generalization of notions such as information, code and program, information and communication technologies have affected the way designers perceive and interpret environment and therefore the way they construct the environment. Many theorists and historians assume that evolution in social context preceded the invention of the computer (Picon 2003). The origins of computer based reality can be traced back to the end of World War II and the development of Cold War. A new conception of space was emerging, a space of phenomena that could be visualised only through the use of screens, maps and diagrams. Phenomena such as military attacks, the stage of supplies and economic trends were simulated using new concepts as *events* and *scenarios*. We must not forget that in the same post World War II context Ivan Sutherland created in 1962 the Sketchpad, a drawing program that is the first example of interactive computing, using visual human-computer input/output devices such as the vector-graphics screen and the Lightpen.

The virtual environment of computer's digital space retains the above preeminence of events and scenarios over static entities. Antoine Picon analyses the consequences of this preeminence in the domain of architectural design and describes a phenomenon of what he calls as destabilisation of form. "A destabilization all the more paradoxical since it is the designer and the calculation of the computer

that simultaneously and rigorously define form. Architectural form becomes similar to a cross-section in a continuous geometrical flow, similar to an event. As a result, design procedure becomes more and more comparable to writing a scenario". (Picon 2003, p.303). Until a few decades ago architectural design was synonymous with the quest for the ideal or functional form. The similarity between form and event is probably one of the most important effects computers have had on architectural thought and practice.

As we have already mentioned, Bernard Tschumi emphasizes the role of human body movement as a generator of space. He goes even further on proposing the replacement of the old Vitruvian trilogy of architectural design (*venustas, firmitas, utilitas* – attractive appearance, structural stability, appropriate spatial accommodation) by a new one: language, matter and body (Tschumi, 1996). Nevertheless how schematic these distinctions can be, the convergence of events, drawings and texts in digital technology has expanded the boundaries of architectural design. Tschumi also proposes the re-introduction of the notion of program in the field of architectural design. He defines an architectural program as "a list of required utilities that indicates their relations, but suggests neither their combination nor their proportion" (Tschumi, 1996, p.113).

We can put forward the question of an analogy of the notion of "program" in architecture and the multimedia paradigm. In digital design the screen functions as a communication space of events and scenarios. The displacement in the virtual space of a multimedia application is based on:

- the space relations organised by an architectural program. Complex compositions can be constructed if the work is thought of as a number of elements and events.
- the abstract formulation of a series of decisions, expressed in symbolic and mathematical form, organised by the program-software. Timeline-based programs are used for non-linear composition and editing of multimedia environments.

Vision and gesture

The fluid and dynamic character of the digital space gives birth to a new mental experience, the one of interactive navigation. This experience is an association of glance and gesture which is operated by the program in the data space. The virtual displacement in the multimedia environment is based on the organisation of different possible paths and the codification of this displacement. This codification uses metaphors of space organisation and has developed a new digital ergonomics and identification. Designing interaction is diagramming the potential flows of possible events.

Interactive design is programming even when the details of the actual mechanism are hidden. Computer devices like mouse, electronic stylus, etc have re-inserted the analog gesture of the human hand. But at the same time this gesture works on the data level affecting the organisation of the information. Thus between the glance and the movement of the hand is positioned the language, the symbolic organisation of information. The french anthropologist André Leroi-Gourhan (1993) argues that a technique is at the same time tool and gesture. Tool and language are two poles of the same mechanism since we construct a tool that we already have mentally conceived.

Interactivity and navigation

The 1978 Aspen Movie Map designed at the MIT Architecture Machine Group, headed by Nicolas Negroponte is acknowledged as the first interactive multimedia navigable space. Still images (16mm film frames) were taken towards the four cardinal directions at equal intervals along the main streets of the city. The program used the metaphor of driving and allowed the user

- to “drive” through the city of Aspen, Colorado in two distinct environmental conditions (summer, winter)
- to obtain information about specific buildings and monuments that he crossed in his way.

The Aspen Movie Map as well as the 1990s Apple QuickTime VR technology was based on the idea of constructing a large scale virtual space from still images or video of a physical space. We can consider this approach as a sampling of the continuous urban or architectural space. This attempt opens up unique aesthetic possibilities not available with 3D computer graphics. Multimedia exemplifies a different type of cultural economy and aesthetic forms.

A scientific approach dominates the design of human-computer interactivity today. Such disciplines as cognitive psychology, ergonomics and optics have been drawn in to support computer scientists in the task of designing interfaces. More recently artistic disciplines such as industrial, graphic and sound design have been introduced into the interdisciplinary design procedure. In the reigning view an application and an interface are conceptually distinct and most of the time the interface is designed after the application. Brenda Laurel investigates the interdisciplinary nature of design by incorporating techniques from artistic disciplines such as drama and theater and analysing the poetics of human-computer activity (Laurel, 1993).

Most of the architectural experimentation with new technologies is oriented towards interactive 3D environments, whether they simulate physical space or virtual space based on biological or mathematical models. Designers are familiarized today with the usual hard edged, polygonal look of 3D computer graphics with a softer, more atmospheric environment made of translucent textures and floating particles.

Interactivity and operation

In a multimedia environment the user moves through the multimedia space each step at a time, trying to explore each element, enjoy its media sources (text, video, animation, sound) and then move to the next one. He establishes an itinerary, thinks in terms of performing actions such as indexing, selecting out of menus, pointing at objects and so on. Exploring a multimedia space allows the user at the same time

to unfold the logic organization of the content.

Design for interactive multimedia includes two main procedures. On one hand we have the spatial composition of the surface of each screen and the time-based composition of audiovisual events. Parallel to that, we have the composition of the structure of the interactive navigation. Interaction design is part of user interface design. The spatial composition of each screen is deconstructed in terms of the hyperlinks and the space of the entire multimedia project is a complex one of different types of media, of location and of travel. Moving from one element or event into another establishes a third dimension in the mind of the viewer, that of the interactive narrative. Navigable space has become a new tool of labor and a common way to visualize and work with any data, since it can be used to represent both physical spaces and abstract information spaces. Lev Manovich poses the question if this evolution leads to assume the emergence of a new paradigm in human-computer interface (Manovich 2001).

Hyperlinking and space

The new logic of computer screen makes space as important as time. The possibility of embedding hyperlinks adds other spatial and temporal dimensions. The typical use of a hyperlinking is to establish a relation of an element inside the space of the screen surface with information displayed outside it. This information can either fit in the screen or be presented in a different window entity. The new spatial dimensions can be defined as follows:

- spatial order of layers in a composite 2D/3D space
- virtual space constructed through compositing three dimensional space
- 2D movement of layers in relation to screen frame
- relationship between screen information and linked information in the adjacent windows (2D space)

Hyperlinking separates data from its structure. The same data can be endlessly assembled in new

structures. Parts of a single document can exist in physically distinct locations, ie a document has a distributed representation. The design of space functions is characterized by interactivity, non-hierarchical organization and modularity.

During human-computer communication in a multimedia environment we are forced to oscillate between the roles of a viewer and a user, shifting between perceiving and acting, making choices. This oscillation constitutes the cyclical organization of the digital space user's experience. At the same time the screen alternates between representation and control, between an illusionary universe and a set of controllable elements.

Screen space: information takes control

The space of the screen has a double status: visual as well as symbolic. It can be considered as the visual reflection of the information structure in the computer memory. It is an electronic collage, organised with multiple levels of space and information:

- architectural composition of the screen space with the integration of different data types (text, static graphics, animated graphics, sound, video) in multiple layers and electronic windows.
- The combination of the above media is a consciously constructed aspect of the aesthetic of the work.
- introduction of the language, i.e. the codification and modification of digital image in the level of memory programming
- Organisation of the active areas or spots of the screen space that enable interactive communication and navigation

The screen as a cultural interface

As distribution of all forms of knowledge and culture becomes computer-based, we are no longer interfacing to a tool but to a culture encoded in digital form. Lev Manovich employs the term cultural interface to describe the ways in which computers present and allow us to interact with cultural data

such as Web site interfaces, CD-ROM/DVD-ROM titles, multimedia encyclopedias, on-line museums and other new media objects (Manovich, 2001). The language of cultural interfaces is largely made up of elements of already familiar cultural forms. We can distinguish three main forms: cinematic tradition of moving image, text/typography and painterly tradition that bring to the digital space their own set of conventions:

- painting brings the linear perspective organization, the juxtaposition of forms and materials and the opening to an homogenous, concrete, physical space.
- moving image tradition brings the mobile camera representation of space, editing techniques, narrative conventions and spectator activity.
- text/typography brings the rectangular page organization with columns of text, images framed by text, ordered sequence of pages, table of contents and indexing

A fourth tradition, a recent one, has developed inside the computer world and concerns the conventions and principles of the human-computer relation itself as it evolved from the early 1950s to 1980s and the final appearance of Xerox Star (1981), Apple Lisa (1982) and most importantly the Macintosh (1984). It is the modern HCI as we know it today with principles such as direct manipulation of objects on the screen, overlapping windows, iconic representation and dynamic menus. These interface operation conventions are today broadly accepted and they constitute a cultural language of their own. Each of the three above media forms, two old ones and one recently developed, contribute with their proper way of information organization, correlating space and time and structuring human experience into the emergence of the modern HCI. Each has its own grammar, its own metaphors and offers a particular physical interface.

The screen as a window to extending space

The key feature shared by all modern HCI is the “page” metaphor which has undergone a long process of vir-

tualization. Overlapping windows were first proposed by Alan Kay in 1969. In 1984 Apple introduced an interface of overlapping windows following the stack of papers and book metaphors. Thus the page was extended by scrolling and going back and forth. In 1987 Apple introduced the HyperCard program which extended the page concept in new ways enabling the co-existence of multimedia elements and offering the possibility of establishing links between pages. Hyperlinking became a new way of organizing and accessing media. HTML stretched the concept of page even further creating distributed documents that are the location of the parts of a document in different parts of a computer network. All modern interfaces display information in overlapping and resizable windows. As a result a computer screen can present the user with a practically an unlimited amount of information despite its limited visible surfaces.

Compositing and space density

As a technique of coexistence of different elements or multiple layers, digital compositing has its roots in collage painting, optical printing in cinema and video keying. The crucial step was that digital technologies have enabled is the homogenization of all media into a single computer environment thus creating a digital composite space. Digital compositing allows the control of the transparency of individual layers and the combination of potentially unlimited layers of information. What is most important is that homogenization permits the creation of a new object that can keep its initial modularity. During the production procedure the various elements are adjusted stylistically, spatially and semantically into a whole. The user can move the elements within the program limits.

As a general operation compositing is a counterpart of selection. Since a typical new media object is put together from elements that come from different sources, these elements need to be coordinated and adjusted to fit together. This relationship is more interactive and is made possible due to the modular organization of a new media object.

Creativity and selection

The shift in digital design on the one hand seems to strengthen already existing media forms while on the other hand acts as a catalyst of new forms. Concepts and techniques invented by avant-garde movements of the beginning of the 20th century became embedded in the commands and the interface metaphors of computer environments. As a matter of fact avant-garde strategies of collage, photo-montage, constructivist design, film editing, etc. became materialized in a computer environment. In an analog way the shift from the material object to the variable digital information has been prepared by the electronic technologies during the 20th century (sound synthesizers, video art). Artistic preoccupations of 20th century artists such as the escape from the two dimensional canvas or screen surface and to correlate different media find today a new dimension. Elements of different media are placed next to each other on the screen surface, both in width and depth, in an attempt to establish visual, stylistic, semantic and emotional relations.

Software does not simply adopt avant-garde techniques without changing them. Contemporary artistic experimentations have proved that computer programs can be diverted from their original purposes to be used by designers and artists in quest of a new language. The multimedia artistic and cultural domain is rich in experimentation that can obtain a feed-back to architectural design.

Conclusions

New media spaces are always navigable spaces and they represent a key form of digital design. Information and communication technologies have spatialized all representations and experiences while digital narrative is equated with travelling through information. Navigable space is already an accepted and familiar way of interacting with any kind of data. There are two different prototypes of navigable space. The first one concerns 3D representation of physical, virtual and abstract data cyberspace and is strongly

influenced by the moving image conventions. The second one is that of multimedia exploration and is more influenced by the typography, graphic and painting traditions.

Navigable space in multimedia applications represents a new challenge. Rather than considering only the geometry and logic of static space, we have to take into account the new way in which space functions in computer culture, as a trajectory than an area. Multimedia space is a space of digital composing in which different spaces are combined into a single seamless virtual space.

The human-computer interface imposes its own logic and models human experience and design procedure. A designer has the possibilities of freely mixing different media forms and conventions following organizational strategies available for use in new contexts. A multimedia environment requires us to combine modalities and even to create new ones. The compositional structure of interactive multimedia works is on the one hand a visual, spatial composition and on the other hand narrative and navigational structure.

References

- Chapman, N., Chapman, J.: 2004, *Digital multimedia*, John Wiley & Sons, West Sussex.
- Leroi-Gourhan, A.: 1993, *Gesture and Speech*, MIT Press, Cambridge Mass, french edition: Leroi-Gourhan, A.: 1964, *Le geste et la parole*,
- Laurel, B. (ed): 1990, *The Art of Human-Computer Interface Design*, Addison-Wesley, Boston
- Laurel, B.: 1993, *Computers as Theatre*, Addison-Wesley, Boston
- Manovich, L.: 2001, *The Language of New Media*, MIT Press, Cambridge Mass
- Picon, A.: 2003, *Architecture, science, technology and the virtual realm*, in A. Picon, A. Ponte (eds.), *Architecture and the Sciences Exchanging metaphors*, Princeton Architectural Press, New York, pp. 292-313.
- Tschumi, B.: 1996, *Architecture and Disjunction*, MIT Press, Cambridge Mass