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HICKORY DICKORY DOCK: THE CLOCK STRIKES ONE IN HYPERSPACE!

Summary

Hickory Dickory Dock is an art installation that critiques the aesthetics of space and time in interactive computer programs. In particular, the artwork highlights the conceptual and aesthetic limitations of language and symbols in human-computer interaction. The artwork also comments on many of the myths and illusions surrounding interactive computing. Keywords: hypermedia, human-computer interaction, temporal perception.

The Perception of Time

Time is of your own making; its clock ticks in your head.
Angelius Silesius

Most interface designs in interactive programs emphasize the use of spatial references for navigation and orientation. There has been very little focus on the temporal dynamics of the medium and how the perception of time impacts the process of human-computer interaction. Since our perception of time is primarily based on our knowledge and interpretation of actions in three-dimensional (3-D) environments, we tend to rely on the use of 3-D spatiotemporal references in the design and interpretation of audiovisual information for the two-dimensional (2-D) computer screen. Moreover, these interfaces contain words and symbols that represent a Western perspective of time which is not always appropriate for the non-narrative structure of interactive programs.

Temporal orientation is based on spatial representation. In aboriginal cultures the spatial representation of time is derived from events that occur in physical space. A good example is the Australian Aboriginal culture. In this culture there is no concept of time as we know it in the West. The Aboriginal Dreamtime is not a linear perception of time but a spatiotemporal perspective that integrates the past and present, the visible and the invisible, the actual and the potential (1) Space and time are directly linked to events. Simultaneity is emphasized rather than sequence.

The artwork of the Australian Aborigines illustrates these principles of space-time. Their paintings are meant to be read as a simultaneous whole, not sequentially. The Western figure-ground relationship that assigns hierarchies to visual information does not exist in their work. Their artwork is also void of linear perspective which assigns order and direction to the work and distances viewers from the action conveyed in the paintings. In his book Voices of the First Day, Robert Lawlor points out that Western cultures focus on "fixed and isolated quantitative aggregates that exist as if distinct from any previous condition, as well as from any ongoing transformative process" while the Australian Aborigines perceive objects as an integral part of the transformative process (2). The Aboriginal Dreamtime integrates the "actual" and the "potential" into a metaphysical continuum in which time and space are inseparable.

In Western civilizations the perception of time eventually shifted away from the use of space to define temporal events to the use of numerical measurements that defined time as a quantification of space. Precision methods of telling time were originally developed for navigation at sea in the eighteenth century. Clocks, calendars, and numerical methods of representing time became the norm. This abstract representation of time replaced temporal orientation that was based on concrete events in space. The recollection of events was relegated to the temporal hierarchy in which those events took place. As Marshall McLuhan points out, human memory is "set down through fixed chronology. We remember events by memorizing dates" (3). Events that happen at regular times are temporal markers that are equated with numerical representations of time.

The Western perception of time is derived from a linear perspective of time that can be traced to the development of one-dimensional planes in Euclidean geometry Orientation is based on forward and backward directions along an arrow of time. Psychologists have shown that time is measured linearly by distance and location based on a) where we are and where we are going and b) the amount of progress toward a goal (4, 5). This linear representation of time which supports sequential activities may not be appropriate for interactive programs that emphasize alternative temporal perspectives such as simultaneity, associative links to information, and non-narrative communication structures.

Research has shown that temporal orientation is also linked to differentiated patterns of activity that are usually defined in relation to landmarks on the calendar (6). Our routines on Monday through Friday, for example, may differ from our activities on the weekend. We use these different schedules to determine our temporal orientation in the week. In fact, research has shown that three particular days–Wednesday, Saturday, and Sunday–are the principal temporal markers that help us determine our temporal orientation in the week (7).

But how does this type of orientation work in a computer program where similar actions produce dynamically different screens of information that continually reveal new visual structures and spatial relationships? Since the temporal dimension of interactive computing plays a key role in the differentiation of actions, perhaps time can no longer be treated as an abstraction that is separate from events and actions in space.

It is worthwhile to take a look at the temporal perspective of Eastern cultures where time is defined in terms of actual events and potential events. In his book About Time: *Einstein's Unfinished Revolution*, Paul Davies cites the Tibetan monk Lama Govinda who describes the nonlinear space-time continuum as follows:

> The temporal sequence is converted into a simultaneous co-existence, the side-by-side existence of things into a state of mutual interpenetration . . . a living continuum in which time and space are integrated (8).

In Japan the term *MA* is used to describe the integration of space and time. For the Japanese, the existence of space is defined by the temporal flow of movements or events (9) Even the interval between events is important because this space symbolizes the potential for all possible actions. The term *MA* refers to an empty space "where various phenomena appear, pass by, and disappear . . . and signs exist in an infinite variety of freely ordered arrangements" (10) . The Oriental antipathy to sequence, abstraction, and precision is summed up in this statement by Harold Innis:

> The world does not fix a notion with a definite degree of abstraction or generality but evokes an indefinite complex or particular image. It is completely unsuited to formal precision Neither time nor space is abstractly conceived: time proceeds by cycles and is round . . . (11)

The Eastern philosophy of time is very similar to the temporal dynamics of hypermedia programs. In these programs, spatial relationships are defined over time, and time must be viewed as an integral part of actions and events. Unfortunately, Western language and symbols establish labels and categories that limit our perception of space and time. In order to fully explore the potential of interactive computing, we need to reevaluate these perspectives.

The Spatiotemporal Structure of Hypermedia Programs

Visual space structure is an artifact of Western civilization created by Greek phonetic literacy

- Marshall McLuhan

With the development of language in the West came linguistic categories, deductive reasoning, and diachronic logic, all of which defined sequential hierarchies in space and time. The spatial structure of hypermedia programs is built on these cognitive hierarchies. We interpret our position in space using an egocentric, horizontal-vertical coordinate axis. Terms like up/down, left/right, center, and in front of/in back of describe our position in space.

This same coordinate system is used to define the hierarchical structure of objects in the computer interface design. This hierarchical spatial order in turn defines a sequential temporal structure in the interface design that emphasizes causality. Language and symbols in the computer interface reflect this decidedly Western perspective of time. Words like "forward" and "back" and arrows that point to the left and right underscore the linear, narrative interpretation of time and space that limits the perspective of time to specific directions and discrete numerical values.

These perspectives are often at odds with the spatial and temporal experiences in an interactive multimedia environment where simultaneity, random access, and non-narrative communication are emphasized. Moreover, in interactive programs, cycles of action and time defined by the interactive process establish a spatiotemporal dichotomy between the possible and the actual, a tension that is not accurately represented by the language and structure of interactive interface designs

Hickory Dickory Dock

Time is the mediator between the possible and the actual.
- G. J. Whitrow

The artwork Hickory Dickory Dock explores the issues of space and time in the interface design of interactive computer programs. Hickory Dickory Dock is an installation comprised of the storyboard for an interactive computer artwork. In this installation, twenty-four screen designs are framed and displayed back-to-back to create twelve stations that are arranged in a formation resembling the mathematical symbol for infinity The documentation that accompanies the installation consists of twenty-four notecards mounted on a ring. The cards contain the author's programming instructions for the storyboard. The installation demonstrates how computer interfaces use Western labels and categories to limit spatial and temporal orientation to specific cultural perspectives.

Computer interfaces should clearly define different levels of human-computer interaction and provide orientation cues for navigation. In two of the screens in Hickory Dickory Dock, the statements "You are here." and "Where are you?" remind the viewer that temporal orientation is dependent on a sense of spatial location, i.e., where you have been and where you are going

However, since temporal orientation is based on our perception and knowledge of 3-D space, it is difficult to develop temporal cues for a 2-D environment like the computer interface. The "arrow" is a commonly used interface symbol that exemplifies these perceptual problems. Arrows that point to the right, left, top, or bottom of the screen can be confusing because there are no spatial cues to tell the user where the arrows actually lead to. The arrows point to a space that is hidden from the viewer. The 2-D computer interface lacks the visible, physical transition from one space to another that defines spatiotemporal orientation in a 3-D environment.

In Hickory Dickory Dock the 3-D layout of the storyboard helps the viewer understand the spatial and temporal restrictions of Western language and symbols in the 2-D computer interface. The installation forces the viewer to abandon the interactive technologies (mouse, keyboard, touch screens) and metaphors that have become an accepted part of human-computer interaction. The viewer must translate the commands and symbols in the interface design into movements and actions in the 3-D environment. In so doing, the viewer must make the conceptual leap from abstract temporal references to concrete logic. In this process, the viewer experiences the problems inherent in trying to use visual and linguistic abstractions to define physical actions that are based on the perception of 3-D space. For example, the viewer must compare the meaning of arrows that point to the left and right of the computer screen to corresponding movements in the 3-D environment. It quickly becomes clear that the spatiotemporal meaning of the 2-D interface symbols does not map directly to the actions in 3-D space.

The twenty-four individually framed screen designs symbolize the measured control of the Western temporal order. They represent abstract units of space and time that are detached from the events and actions in the physical world. Temporal and spatial continuity are reduced to static, isolated symbols of time that echo the discrete, mathematical units of the Western clock. The measured space of time represented by the screens underscores the patterned logic of temporal orientation.

In the installation there are cognitive links between the paired screens that are displayed back-to-back. Although the viewer senses the temporal interconnections between these screens, the relationships remain elusive because only one screen is visible at a time. Continuity between the screens becomes a cognitive function based on memory. Once again we are reminded of the lack of correlation between abstract temporal references in the screen designs and events in the real world. The screen designs are mounted between oversized pieces of Plexiglas, creating transparent borders that visually link the storyboard with the external environment and remind us of the need to bridge the gap between abstraction and reality.

Throughout the storyboard a frame in the center of the screen design is a recurring visual element that acts as a window on time. This window defines a passive role for the observer and reinforces the concept of temporal determinism. The frame also symbolizes the elements in computer interfaces (such as computer windows) that create perceptual boundaries and limit our interpretation of space and time. These perceptual limitations are further emphasized by two screen designs in which the frame is combined with navigational arrows placed at the top, bottom, and sides of the screen. The viewer can use the arrows to reveal or isolate parts of the underlying information in the frame. The viewer can never access all of the information at once.

Although the frame highlights the perceptual limitations of the computer interface, the frame also suggests the prospect of new directions in spatial and temporal perception. The frame allows the viewer to group information in different ways and experiment with different spatial and temporal perspectives, including microcosmic and macrocosmic levels of orientation. These screens suggest that if we can alter our perception of space and time, we may be able to devise new temporal cues for orientation.

The frame in the screen designs is centered on a solid black background. This background eliminates spatial and temporal landmarks and creates a sharp contrast with the ordered, temporal structure of the frame, the navigational grid, and the language in the interface. This contrast is further emphasized in the screens that include 3-D graphics. The graphics are free-form images composed of layers of transparent, colored light. The images create different levels of space and time that defy the constructs of Euclidean space In these images, time becomes multidimensional and nonlinear. The limitations of language and symbols in the interface give way to an open pictorial space that is subject to diverse interpretations. The arrow of time is bent.

In one sequence of screens, however, the frame is completely eliminated, and the viewer is presented with a new set of navigational ambiguities and restrictions. In this sequence each screen contains a single word, NOW, EARLIER, or LATER, in the center of the screen and arrows for navigation near the right and left edges of the screen. Once again, this sequence demonstrates the spatiotemporal ambiguity that exists when 3-D navigational cues are used in a 2-D interactive environment. The arrows always point to an invisible screen, making each screen an isolated, fixed moment in time. As previously discussed, the interface lacks the spatiotemporal continuity that exists in a contiguous 3-D environment. The screen designs in the artwork emphasize this spatial and temporal segregation by using large areas of blank space to separate the arrows near the edges of the screens from the words in the center.

Language and Design

Time came not from heaven but from the mouth of man.
- John Wheeler

The opening statement in the installation "Ready, Set, Go" challenges the viewer to a race against time. However, the initial feelings of empowerment that are aroused by this challenge quickly subside when the viewer realizes that he or she doesn't know the rules of the game. The viewer must surrender to the power and control of the clock that keeps ticking away.

As the viewer progresses through the installation, there is a continual emphasis on the role that language plays in the perception of time. The installation begins with written instructions derived from telephone answering machines. "At the tone, please leave your name, the date, time, and a brief message." Written responses appear in various screens beginning with "This is John. It's 7:30 am on Monday. Call me before noon."

Language establishes temporal markers in the storyboard that emphasize the sequential order of time: "*Call me before noon; Call me before your break; Recorded Earlier; LIVE.*" Language also reduces time to categories and generalizations that simplify and exclude information, and limit our perception of reality. This limited perspective is demonstrated by a sequence of screens in which each screen contains only one word, NOW, EARLIER, or LATER, and only one screen, the one with the word NOW, provides an exit from the sequence. If the viewer tries to select EARLIER or LATER to leave the sequence, an "error" message, "You can only select NOW," appears and reminds the viewer of the deterministic order of time.

The voice messages that are written rather than spoken also emphasize this temporal determinism by creating a permanent record and spatial visualization of the passage of time. The written messages, which are less intimate and subjective than audio messages, distance the viewer from the action and emphasize the abstract perspective of language and the Western system of temporal references. The infinite loop of repetitive messages underscores the deterministic nature of this temporal order.

One screen contains the quote "*Oh dear! Oh dear! I shall be too late*" from the White Rabbit in Lewis Carroll's Alice in Wonderland. This quotation and a subsequent modification of the quote from first person to third person, "He's late! He's late! He's going to be late," remind us that everyone, participants and observers, is subject to the deterministic order of time.

Several other screen designs contain references to Mother Goose nursery rhymes. These screens, which include nonsensical references to time and counting from rhymes such as Hickory Dickory Dock and Buckle My Shoe, provide a satirical commentary on our early childhood exposure to the abstract temporal framework of clocks and numbers.

The nursery rhymes also introduce the concept of rhythm and repetition as temporal references. The author's programming instructions in the documentation indicate that the nursery rhymes should be displayed on the screen one word at a time, thus emphasizing the rhythmic structure of the rhymes. Since rhythm is a characteristic of oral communication, the rhyming sequences establish an interplay between the temporal abstraction of numbers and the subjective interpretations of time that are inherent in human recitation.

The Documentation

The scene of action of reality . . is a four-dimensional world in which space and time are linked together indissolubly.
- Hermann Weyl

The documentation that accompanies the storyboard provides an additional commentary on the use of language and symbols to define the deterministic nature of time. The documentation

serves as a gallery handout for the viewer, but it also contains the author's programming instructions for the storyboard. This dual role causes initial confusion for the viewer who is not sure how to use the documentation. If the documentation is a gallery handout, the viewer should take an active role in using the material. However, the documentation contains the author's directions for programming the work so the viewer's role is reduced to that of a passive observer. Other parts of the documentation further emphasize this passive role by underscoring the deterministic nature of time and the interactive process itself. For example, on one of the screens, the words Yesterday, Today, and Tomorrow, appear in a list in the frame in the center of the screen. Yesterday is crossed off the list, and the documentation indicates that the "Viewer must select Today." The documentation also notes that if the viewer selects Tomorrow, the error message "You cannot get to Tomorrow without going through Today" appears on the screen. In other sections of the documentation, the combination of third person and active voice in phrases like "The music stops" and "The music continues" highlights the deterministic nature of the interactive program.

The physical construction of the documentation, twenty-four notecards on a ring, resembles a collection of samples and invites the viewer to find the right card for each screen display. This matching process requires the viewer to make the conceptual leap between the verbal descriptions of the program and the interactive processes the descriptions reference. The result is an ambiguous matching game that reflects the questions and uncertainty that exist in most forms of human-computer interaction.

The notecards with their script-like font and centered lines of text also resemble a group of formal invitations. Many of the instructions are even written as if they were announcements to a performance:

"Yesterday, Today, and Tomorrow"
appearsequentially and simultaneously with "Five, Six . . ."

These announcements remind us that the viewer is really an observer rather than a participant in this interactive experience. The role of the observer is limited to occasional moments of interaction that are carefully marked in the documentation by the instruction "Interaction permitted here."

The documentation is also a commentary on the problems that arise in using language to describe the process of human-computer interaction. These problems stem from the lack of direct correlation between actions in the 2-D computing environment and events in the physical 3-D world. For example, the documentation includes phrases such as "Screen 6 leads to screen 7" in which "leads to" is crossed out and replaced with "links to". Similarly, the command "Select the arrows . . ." goes through several iterative changes including "Click on the arrows . . ." and "Touch the arrows . . ."

Language in the documentation also reminds the viewer that the computer program itself is controlled by a temporal hierarchy that consists of an event loop defined by causality and predetermined actions. Phrases like "Screen 6 links to screen 7" affirm the deterministic logic of the computer program where the interaction is limited and controlled by the structure of the underlying software.

The documentation is also a commentary on the paradoxes that occur in the perception of events in time. We usually describe events as simultaneous or sequential, but not both. Psychologists have shown that we cannot physically perceive events simultaneously because the brain processes perceptual stimuli sequentially (12). Rudolf Arnheim points out that what we perceive as spatial simultaneity is really experienced as a temporal sequence. For example, the physical layout of a building is experienced in time as you walk through the building (13).

These paradoxes are illustrated in the documentation. One of the screen designs shows the corresponding times for cities in many different time zones. In the documentation for this screen, the author's programming instructions use a circuitous play on words to describe an animated display of information in which the different "simultaneous" times are displayed individually one after another (i.e., sequentially), and then flashed onto the screen as a group:

"Simultaneous Time Zones" appear sequentially.

"Same Time Zones" appear simultaneously.

Music and the Sounds of Time

The notion of time fades gracefully away . .
- Christopher Isham

Anthropologist Claude Lévi-Strauss maintains that "music uses time to obliterate time" (14) Music is ethereal, ephemeral, and it encompasses space. It lacks the fixed, hierarchical structure of the temporal order created by Western language and symbols. The structure is multidimensional and simultaneous, not fragmented. As McLuhan points out, there are no boundaries to sound because we hear it from all directions at once:

> Acoustic space is build on holism, the idea that there is no cardinal center . . . The acoustic mode rejects hierarchy; but, should hierarchy exist, knows intuitively that hierarchy is exceedingly transitory (15).

Some cultures use the holistic qualities of music to create metaphysical interpretations of time that integrate their emotional and psychological perspectives of time with concrete actions. For example, traditional Japanese musical ensembles do not play with a conductor who directs the beat using one absolute temporal reference. Instead the individual players rely on spontaneous interaction with each other to create "subtle, differentiated time-patterns [that] create omnipresent currents of music" (16). The Australian Aborigines use song and dance to integrate the legends of their ancestry with the surrounding physical space. Using music that is devoid of temporal references, they define spatial areas that transcend the limitations of the physical world. Like the Japanese musical ensembles, they do not restrict themselves to a specific temporal rhythm during the performance of their work. They freely add information to their music to create an omniscient experience (17).

In Hickory Dickory Dock an except from Brahms's Waltz in A Flat repeats in the background. The music provides a satirical commentary on our discrete methods of measuring time The simultaneous, all-encompassing nature of music contrasts with the fixed frames and measured layout of the installation. The music bridges the gap between the viewer, the physical environment, and the Cartesian world inside the screen designs.

However, the semantic structure of the classical music also reinforces the semiotic constraints of the language and symbols in the storyboard. The formal structure of the waltz, characterized by measured rhythms and cyclical refrains, is defined in terms of the Western temporal perspective. The holistic qualities of music are constrained by a temporal order that suddenly seems very artificial in a tactile 3-D world. The control that time exerts on our lives and the impact the clock has on the quality of life become more disconcerting, and the confining spatiotemporal structure of the installation suddenly becomes even more intolerable. A Western "dreamtime"

emerges in which time is suspended between abstraction and reality.

Conclusion

The future is contained in the present . . .
- La Place

Hickory Dickory Dock highlights the constraints that Western temporal perspectives place on the design of interactive multimedia computer programs. By exhibiting the screen designs in the storyboard as finished works of art, the installation critiques the temporal constraints of interactive computing by celebrating the principles it appears to reject.

Temporal orientation is based on our perception of distance and differentiated patterns of activity, both of which are measured in terms of abstract, metric landmarks defined by the clock and the calendar. The computer interface in interactive programs represents a different temporal order in which time must be integrated with actions and events. However, this computing environment differs from the 3-D world of tangible objects because in the computer program, conceptual events take place in a metaphysical space.

In interactive multimedia computing, we can no longer rely on linear temporal structures that limit our perspective to sequential hierarchies and causality. Interactive multimedia computing is a medium that requires new temporal perspectives that transcend the perceptual limitations of the Western temporal order.

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