

REAL SPACE AND CYBERSPACE: A COMPARISON OF MUSEUM MAPS AND ELECTRONIC PUBLICATION MAPS

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ABSTRACT

It is well known that a floor plan helps the visitor explore the museum space and locate particular objects or collections of interest. This paper discusses models for creating maps to guide visitors through museum spaces, both real and electronic. We describe two examples of printed museum floor plans, comparing two- and three-dimensional depiction of architectural space, and illustrating varying approaches to the representation of architectural and collection details. Finding one's way in cyberspace is a more challenging task than moving through a physical structure. The content of electronic publications is typically seen one screen at a time and the overall scope remains invisible to the user. We illustrate how interactive timelines, tables of contents, virtual room plans as well as printed maps are used to guide users through CD ROM and Web site collections.

KEYWORDS

CD ROM, Web site design, maps, navigation systems, floor plans, museums, visual language, interaction models

INTRODUCTION

The gallery or museum map is an essential orientation tool for any visitor. The visual language of this diagram serves two purposes: location and orientation. The map helps to guide patrons through real space, matching the patron's conceptual needs (where is the doll collection?) with a physical location (third floor, room 36). The map also helps the patron locate himself in real space, matching his current physical location to a position on the map.

This paper seeks to compare the methods used for locating and orienting patrons in a museum building (real space) to the methods currently being used for locating and orienting users of CD ROMs and Web sites (cyberspace) containing museum collections. We have selected examples in these domains in order to compare their strategies of representation and abstraction. The relative strengths and weaknesses of the mediums will be examined. Though they are both examples of cyberspace, we address the CD ROM and Web site examples separately. At the present time the interaction models for these two mediums are dissimilar enough to warrant separate treatment.

I. MUSEUM FLOOR PLANS

There are two principal models of using a museum plan. A visitor may use the guide to explore and learn about the scope of the museum's collections. The other purpose of the map is to help the visitor find a

particular object of interest: an object he knows from reproductions or has already seen in the museum and would like to examine it again.

Whatever the purpose, the visitor will use the map in an interactive way, constantly relating the simplified plan to his location in the real space. The use of the map is a process, not a one-time act. The initial glance at the plan provides the visitor with an overall understanding of the museum's structure and spatial organization, and allows him to choose a destination. As he follows the selected path, he compares the map route to the real space. At the outset of the visit, he learns how to use the two-dimensional language of the map in relation to the physical layout of the galleries, hallways, and stairs. Once he comprehends the language of the map, he will understand what has been included, simplified or omitted.

The museum map is a simplified diagram typically limited to a flat floor plan only. Sometimes, axonometric views are used to indicate a contour of the walls. However, even these more complex diagrams do not reflect the three-dimensional volume of the space and omit any reference to the details of the interior such as the color of the walls, lighting, or type of floor covering. The multi-level and/or multi-building structure of a museum is particularly difficult to represent in a simple language. Yet it is precisely the layout of staircases, hallways, and con-

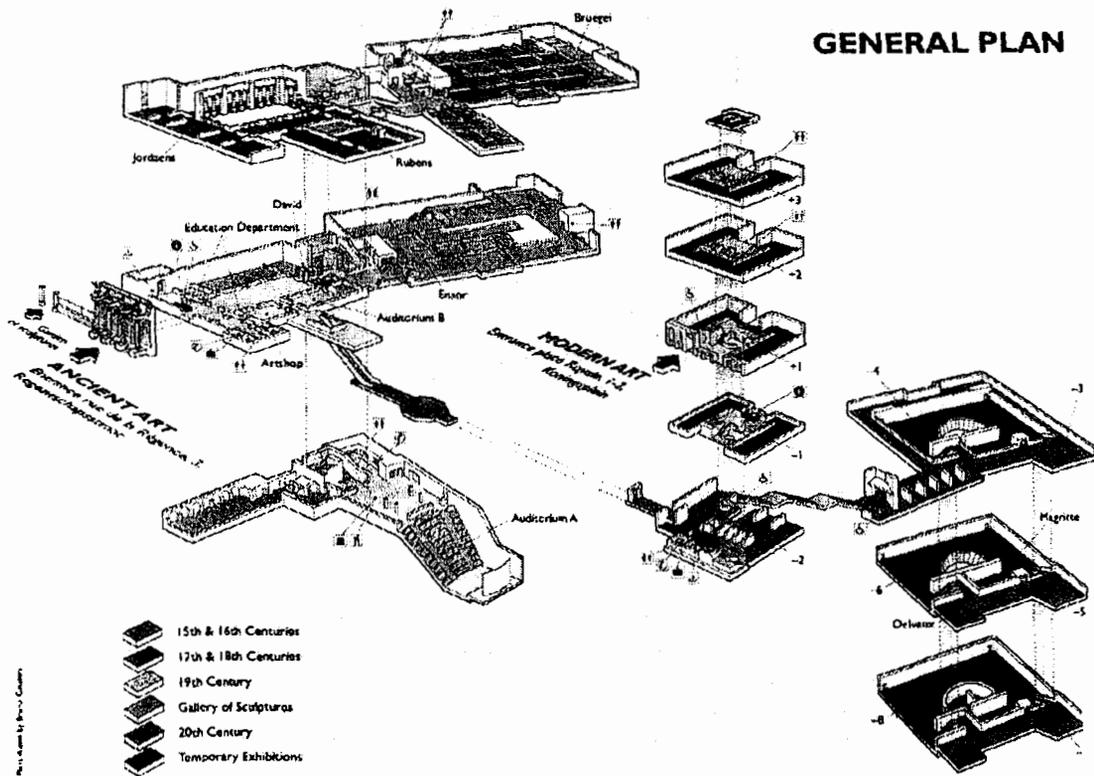


Figure 1: General Plan, the *Musées royaux des Beaux-Arts de Belgique / Koninklijke Musea voor Schone Kunsten van België*

nections between the different parts of a museum that the visitor needs to understand during a visit.

The museum floor plan or gallery map has developed several general characteristics in order to address the needs of the visitor. It is a small printed document designed to be carried during the visit. Its purpose is to create a direct correlation between the physical space of the museum and the collection available for viewing. This is done by highlighting relationships between architectural divisions (floors and rooms) and intellectual divisions (time periods, movements, artists, works). Typically, the maps also include information on the location of non-collection items of interest to the visitor (stairs, elevators, gift shop, wc, coat room). The examples given below illustrate how both two-dimensional and three-dimensional representations of architectural space serve this purpose.

A. *MUSÉES ROYAUX DES BEAUX-ARTS DE BELGIQUE / KONINKLIJKE MUSEA VOOR SCHONE KUNSTEN VAN BELGIË, BRUSSELS¹*

The map for this large museum includes two presentations — a General Plan [Figure 1] and Plans of the Rooms — printed on the two sides of a three-panel brochure.

The General Plan is an excellent example of a three-dimensional projection abstracted into an effective information graphic. This exploded diagram of the two buildings that house the public collection makes direct reference to the architectural detail of the space. The exterior details of the two main entrances are reproduced, as are major architectural details of the interior. The rest of the interior and exterior walls are removed to provide a simplified overview of the space and a clear view of the relationships of the several floors.

ground floor

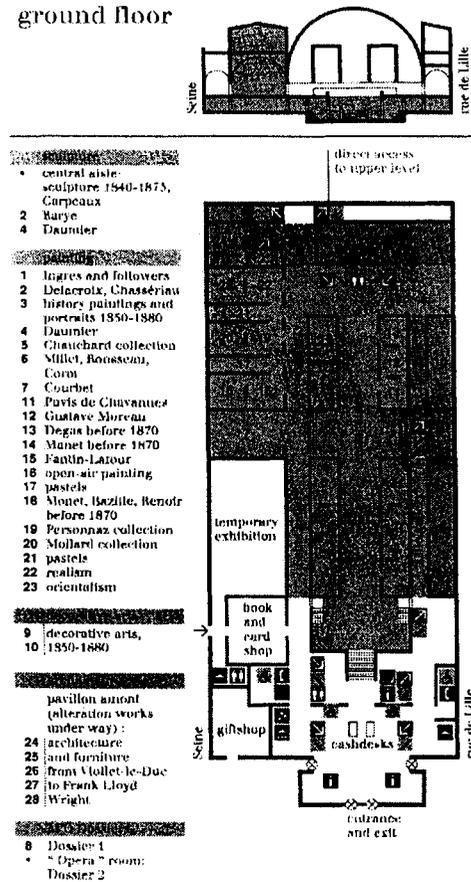


Figure 2: Ground Floor from the Musée d'Orsay Map

Color is applied to the floors to separate the parts of the collections grouped by time period and media. This use of color makes it easy for the visitor to see at a glance where each collection is located. It is also easy to judge quantity in terms of floor space. Major painters (Bruegel, Rubens) are located by gallery in the General Plan, but otherwise the details of what is contained in each room are delegated to the Plans of the Rooms on the opposite side of the map.

B. MUSÉE D'ORSAY, PARIS²

One side of the Musée D'Orsay map shows the building with portions of the exterior wall and roof removed. This representation is a colorful and realistic picture of the building, but is a poor information graphic. The location information is limited to non-collection items such as the restaurant, gift shop, etc. The bulk of the location information is found on the opposite side of the map, in the form of three

discrete floor plans [Figure 2]. The portions of the collection on each floor are separated by color, and each room is numbered. These numbers are then correlated with the movements, artists, and media in the collection. At the top of each two-dimensional floor plan is a two-dimensional elevation showing the location of the floor in the building.

A striking addition to this map is the bright arrows that mark the directions of the stairways and escalators. The up and down staircases are an important feature of the visitor's experience of Musée D'Orsay, which explains and justifies their prominence in the map.

II. CD ROM OVERVIEWS

The structure of electronic publications is for the most part invisible. When entering a museum, the patron has some idea of the size and shape of the building. When presented with the catalog of an

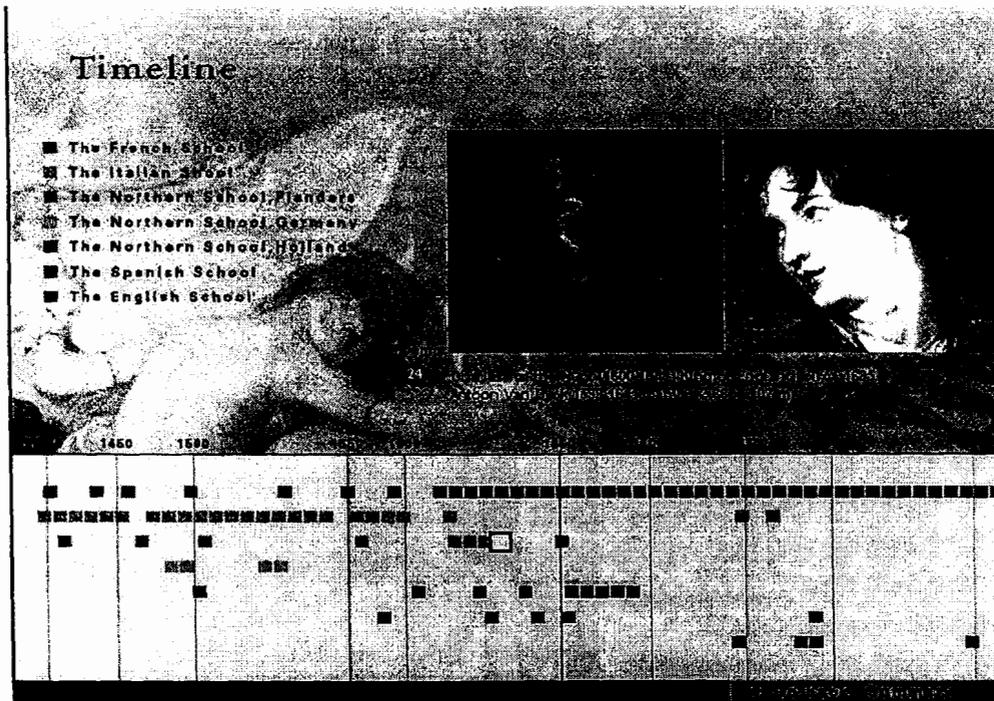


Figure 3: Timeline Screen, *Le Louvre, The Palace & Its Paintings*

exhibition, the reader immediately sees the extent of the publication (all pages contained between two covers), and can quickly get a visual sense of the quantity of material it contains. When presented with a CD ROM, the viewer can only see one screen at a time. This may be one of ten or one of ten thousand screens of information. The invisible content of the CD ROM is hidden from view in the electronic memory of the computer.

The map of an electronic publication must do more than the map of a museum or gallery. It must do more than the table of contents of a book publication. It must show what the electronic publication contains and where to find it. The electronic publication is a book without a cover and binding, a building without walls or roof. The map of the electronic publication must compensate for this lack of physical context and provide a visualization of the nature and scope of the entire collection.

The presentation of art museum collections has been one of the most common uses of CD ROM. A pioneering and very successful example is the Microsoft Art Gallery³. This publication consists of a version

of the MicroGallery originally created by Cognitive Applications Ltd. for the National Gallery of London. The organization of this collection has been studied and analyzed by Garzotto et al⁴.

Dozens of CD ROM publication have appeared in recent years, following common art, history and science book formats: catalogs, monographs of artists, periods, movements, and important paintings. We have selected five examples which illustrate a range of formats and variety of approaches to the task of mapping the content of the electronic publication.

A. LE LOUVRE, THE PALACE AND ITS PAINTINGS⁵

As the title suggests, the subject of *Le Louvre* is both the building and a selection of paintings in the collection. The authors of this CD ROM expect the viewer to be as interested in a painting's room location as in art history.

TIMELINE

The overview of the painting collection is found in the Timeline display [Figure 3]. This diagram repre-

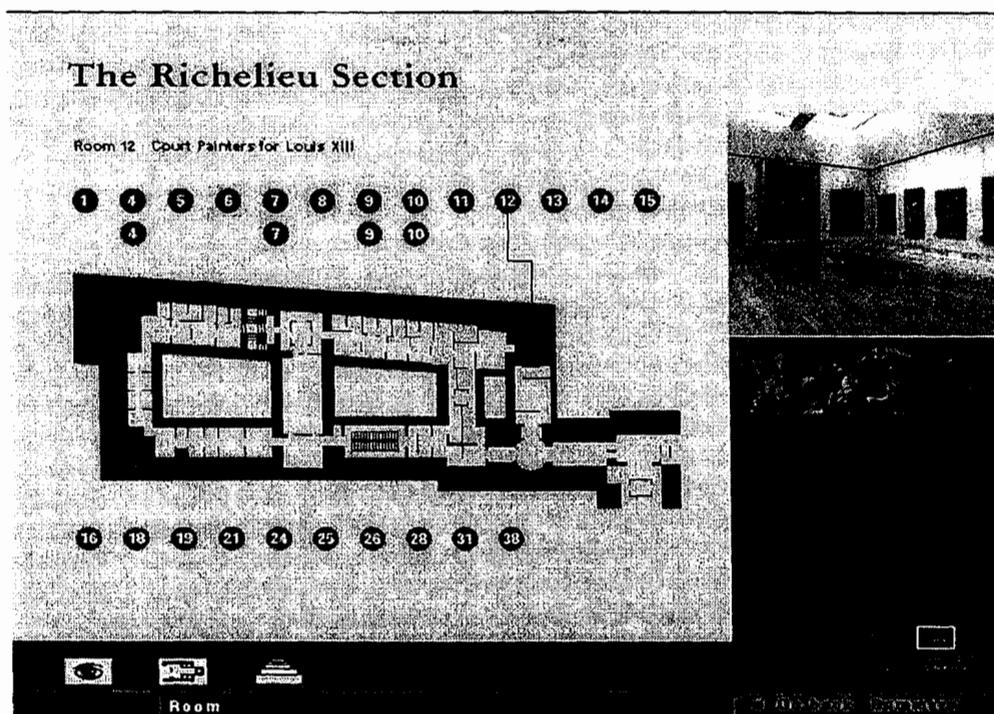


Figure 4: Room Plan Screen, Le Louvre, The Palace & Its Paintings

sents the scope of the painting collection along two dimensions: by school and by time. Color is assigned to each of the seven regional or national schools, and a square of this color is placed on the grid to represent a painting in the collection from this school. The position of the square roughly corresponds to the chronological position of the painting. In this way, a viewer gets a quick sense of the number of paintings from each school on the CD ROM, as well as the chronological distribution of the works.

Information about the paintings is presented one painting at a time and displayed when the viewer clicks on a corresponding square. The selected painting is represented in the timeline as a white flashing square. The image of the painting and the painter (where available) is labeled along with a link to the room in which the painting hangs.

We will see this relationship between a large grid containing an abstract representation of the complete set of information and the detail on a single element in the collection, in visual and/or textual form in many examples. Unlike the printed map,

where all information must be presented simultaneously, the electronic map can reveal additional details through interaction.

ROOM PLAN

Selecting a room number or icon leads the viewer to the Room Plan display [Figure 4]. This diagram locates each room within a floor plan of its wing in the palace. A small floor plan of the entire palace shows the location of the wing. A photograph of the room and thumbnails of the paintings on the CD ROM are also displayed. Using this display the viewer can move from room to room and preview the paintings available.

It is not clear why the CD ROM publication should be used to orient the viewer for locating paintings in the museum. In a kiosk situation this may be a very useful function, allowing the viewer to find a painting by type, school, or artist, and then to locate it in the museum. In a publication situation, with the viewer neither in the museum itself, nor likely to use the location knowledge gained from the CD ROM during a later visit, this function seems misplaced.

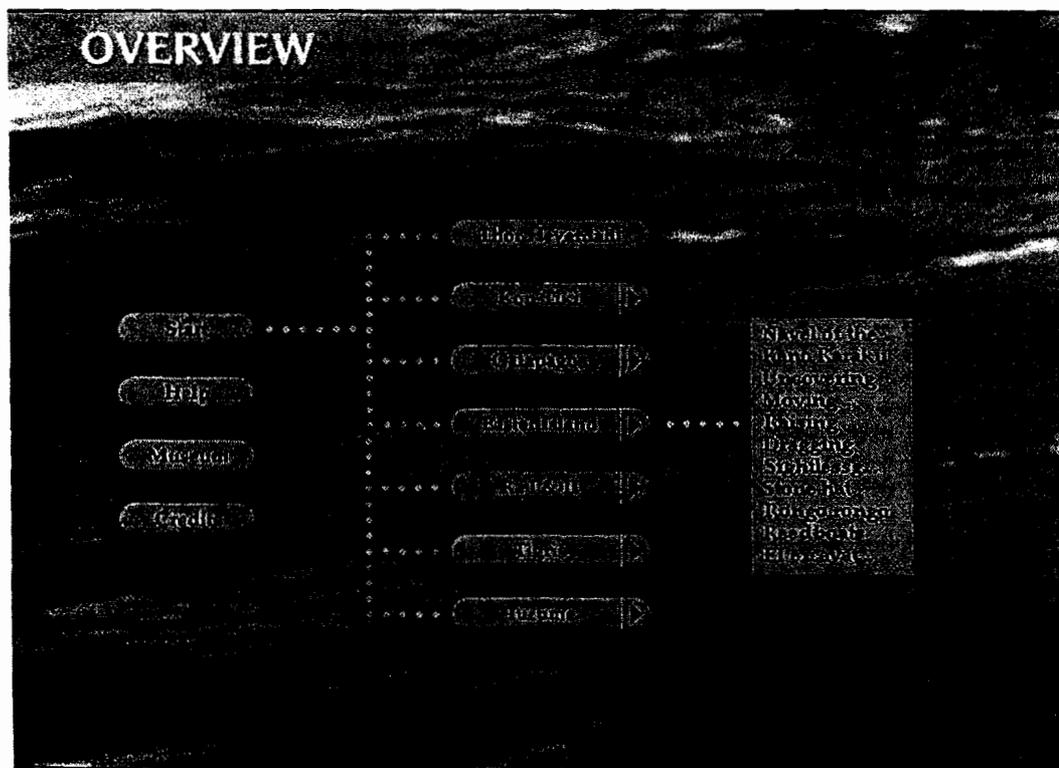


Figure 5: Overview Screen, Kon-Tiki Interactive

B. KON-TIKI INTERACTIVE⁶

Kon-Tiki Interactive is a CD ROM about the museum in Oslo, Norway devoted to the explorations of Thor Heyerdahl. Originally developed in 1993 as a kiosk available within the museum, the publication was made up of selected video clips summarizing Heyerdahl's major expeditions. In developing the material for independent publication as a CD ROM, the authors added more background materials in the form of text and still pictures⁷.

The Start screen presents the viewer with a revolving globe surrounded by seven circular thumbnail micons (animated movie icons) of the expeditions. The movement of the globe dramatically locates each expedition in geographic space. In contrast, the more abstract Overview screen provides a fuller map to the CD ROM contents [Figure 5]. The major expeditions are repeated, shown connected to the Start screen. In addition, the viewer quickly sees the three other unconnected features (Help, Museum, Credits). The arrow on the six expeditions labels leads to a list of the detail screens for that expedition. To conserve space, the subsection lists appear one at a time, only when the viewer selects an expedition

arrow. This gives the viewer a more complete sense of the quantity of information available in each section than the Start screen. Through the names of the subsections the viewer also gets some sense of what lies in store when a link is followed.

C. ITALIAN METAMORPHOSIS, 1943-1968⁸

Italian Metamorphosis was a large special exhibition covering the history and international influence of post-war Italian design, shown at the Guggenheim Museum in New York. The Italian Metamorphosis CD ROM was installed for use by visitors to the exhibition in two locations. The CD ROM was also sold in the book store along with the exhibition catalog. There was no attempt made to locate objects in relation to their position in the museum exhibition on the CD ROM. A separate printed map gave the visitor a sense of how the objects were distributed throughout the galleries.

The Time Chart screen provides the only overview of the CD ROM contents [Figure 6]. This abstract grid shows the nine topic groups used to organize the objects in both the exhibition and the CD ROM. The years from 1943 to 1968 are listed on the left.

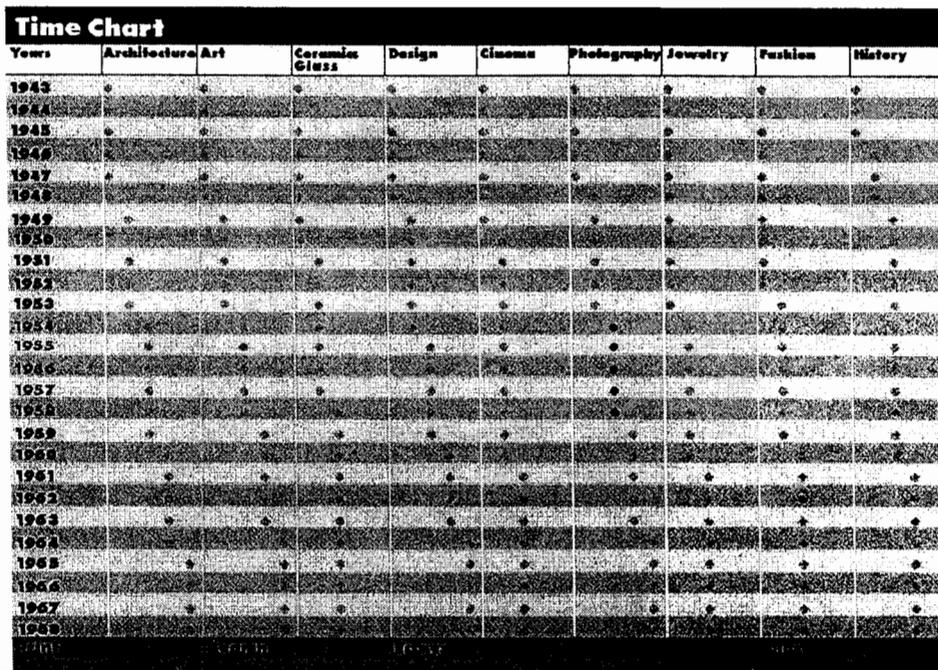


Figure 6: Timeline Screen, Italian Metamorphosis, 1943-1968

The horizontal position of a bullet in the column for each topic shows how the material is grouped. In this example the years 1954-1958 under Photography are highlighted. Clicking anywhere in this column takes the viewer to information about photography during this period. This diagram does not give the viewer any sense of the quantity of information available, only the topic and time span covered by each group.

D. MONGOLIAN FELT TENT

Mongolian Felt Tent was a kiosk developed for Mongolia: The Legacy of Chinggis Khan, a traveling exhibition organized by the Asian Art Museum of San Francisco. This kiosk contained information related to, but not duplicated in the exhibition catalog and the exhibition galleries. Instead the kiosk provided supplementary information about a large object, a full-sized tent set up in a covered courtyard outside the gallery space. For a discussion of an electronic presentation that covered the exhibition itself, see the description of the Mongolian Exhibition Web site below.

A printed map [Figure 7] was developed to represent the contents of the kiosk as part of an external help system. Placed on the kiosk above the touch screen monitor, the map was intended to provide the user with a quick overview of the electronic publication. The diagram uses an isometric projection to organize a set of rectangles representing screens of information, grouped on carpets. The carpets present the four-chapter structure, while the subsections of two of the chapters are represented by parallel groups of rectangles on the same carpet. The rectangle in the front of each group contains a miniature of the corresponding screen, acting as a visual title page for each section or subsection. The rectangles behind this miniature screen indicate the quantity of information in that section. Text balloons highlight the feature of that section (Felt Making Video, The Game Is Here, etc.).

The Mongolian Felt Tent map was published in *Information Architects*⁹. The design of this map closely resembled the map of the Dynamic Diagrams Web site first presented at American Center for Design

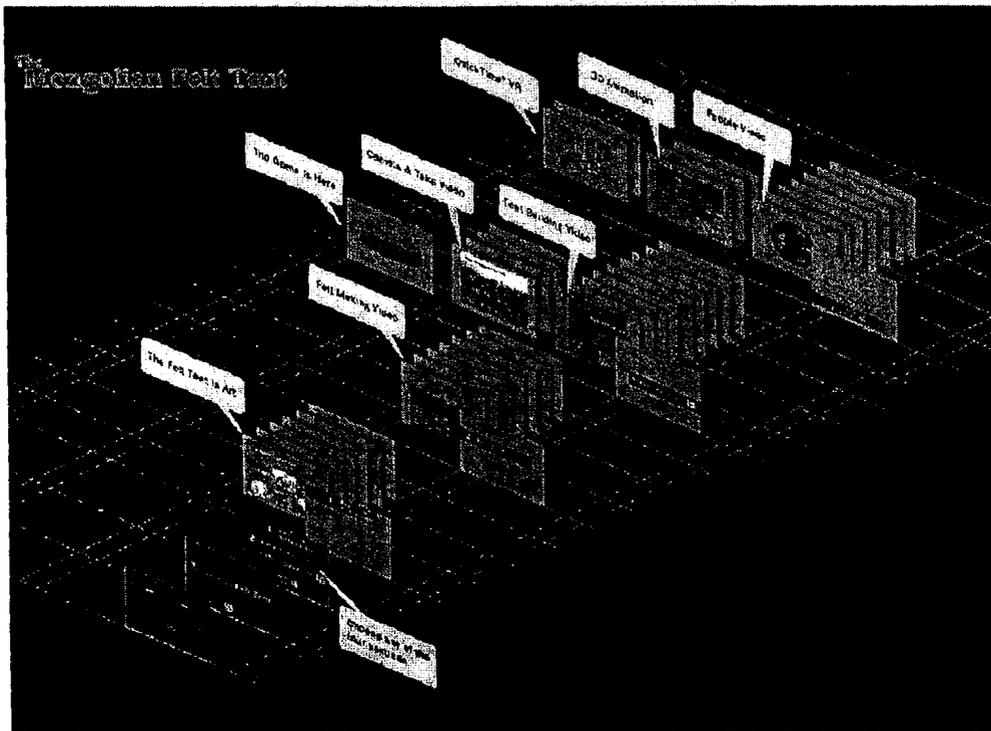


Figure 7: Map of the Mongolian Felt Tent

Living Surfaces conference in October, 1995, later reproduced in two magazine articles¹⁰.

A CD ROM version of *The Mongolian Felt Tent* is in development and will include an interactive version of the map.

E. AU CIRQUE AVEC SEURAT¹¹

Au Cirque avec Seurat, by Frédéric Sorbier with the assistance of Musée D'Orsay, is a CD ROM of a virtual exhibit. As such it has no real gallery space to refer to, beyond an introductory photo montage that leads the viewer into Musée D'Orsay and up to the gallery where the *Cirque* hangs on the wall. Focusing on this major painting, the author creates a tour of the culture and art history of the period, demonstrations and explanations of Seurat's technique, and survey of circus figures in graphic art.

The navigation screen, reached by clicking on the compass icon, presents the contents of the CD ROM in the form of icons and names [Figure 8]. These icons are used extensively throughout the navigation system, appearing without labels in the left

margin as the viewer moves through the publication. The most striking feature of the navigation screen is the stage below the list. When the viewer selects a section, a representation of the screens in that section appears in the stage area. The screen miniatures are arranged in an isometric projection, similar to the one described in the previous example. When there are more screen miniatures in the section than can be presented in the stage area, arrows on the left and right permit the viewer to "scroll" the presentation horizontally.

Each section of *Au Cirque avec Seurat* is organized as a linear sequence. This linear structure is well represented by the series of screens in the diagram, each corresponding to a major position in the sequence. The viewer can navigate to any portion of the sequence by clicking on the corresponding screen miniature. Conversely, when the viewer chooses the navigation screen from anywhere within a sequence, that screen is highlighted in the resulting version of the navigation display. Credit screens, which accompany any reproduction of original artwork, are represented as smaller miniatures off to

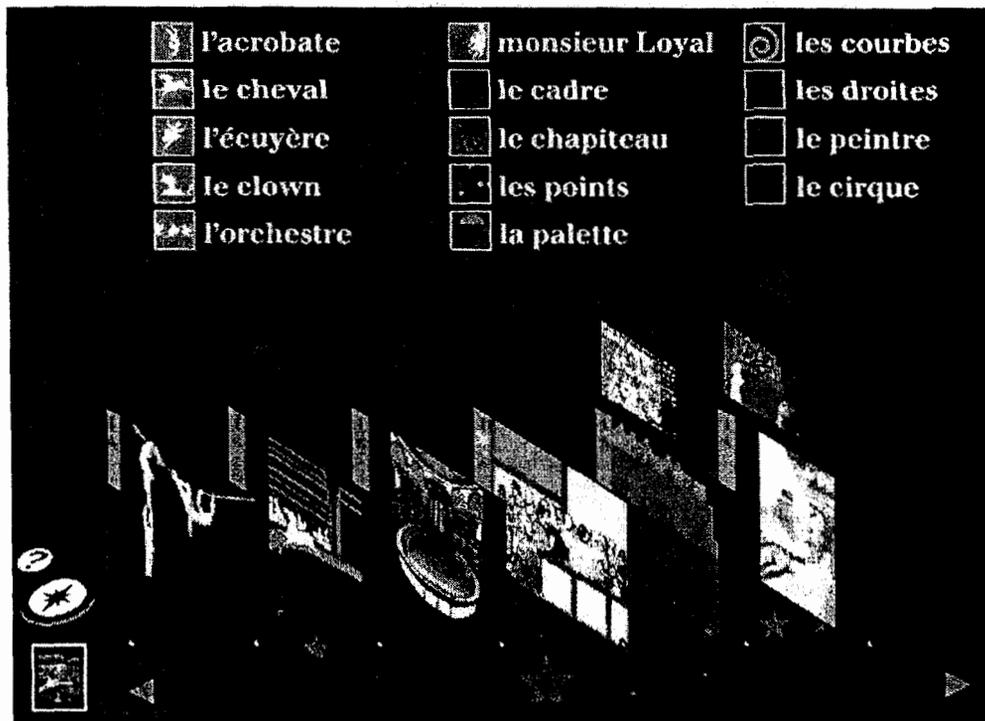


Figure 8: A Navigation Screen, *Au Cirque avec Seurat*

the side of the animation screen. The size is used as it is in many pre-Renaissance paintings, to represent the relative importance of the information in the composition rather than to represent its relation in three-dimensional space.

III. WEB SITES

The CD ROM has gained acceptance in the museum community as a new media for publishing large collections of multimedia information. The Web has also found a place in the public communication program of many museums. The inexpensive and flexible nature of the Web has spawned many museum Web sites. Once the museum community overcame its fear of losing control of digital images, the wealth of visual materials on the Web has grown tremendously.

The technology behind Web sites is changing rapidly, so it is difficult to make generalizations that will last more than a few months. However, the current Web technology (circa mid-1997) allows for an interaction model that is much more limited than for CD ROM publication.

The general notion of what a Web site is and what it contains is also poorly defined. As we have noted above, an electronic publication is invisible. But the invisible content of a CD ROM is at least finite, contained within the boundaries of a plastic disc or set of discs. The contents of a Web site are invisible to both the viewer and in many cases to the administrator of the Web site as well. The contents of a Web site are simply all documents that can be reached by following links from or doing some form of database transaction. There is currently no standard way to define a Web site's content or boundaries.

We have selected four examples from museum Web sites that illustrate the current state of maps on the Web.

A. ASIAN ART MUSEUM OF SAN FRANCISCO, MONGOLIA EXHIBITION¹²

One use for a museum Web site is to create a "virtual" visit or tour of the museum for visitors who are geographically remote from the publishing institution. An elaborate example of this application

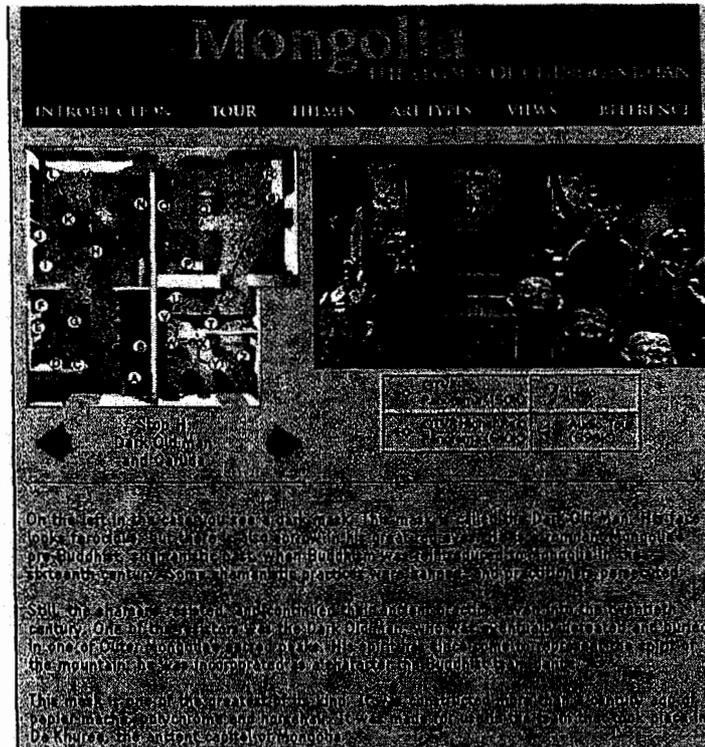


Figure 9: A Tour Screen from the Mongolian Exhibition
<http://sfasian.apple.com/Mongolia/Home.htm> (consulted 15 May 1997)

is the gallery tour of Mongolia: The Legacy of Chinggis Khan developed by the Asian Art Museum of San Francisco and the QuickTime™ VR team at Apple Computer in the summer of 1995.

The Web site provides a showcase for Apple's QuickTime™ VR, a technology that creates interactive panoramas from a series of carefully positioned still photographs. The viewer can move around the exhibition by clicking on positions marked on a floor plan [Figure 9]. Each position corresponds to a still photograph of the objects in this portion of the gallery, individual photographs of each object, and a panorama of the featured object as installed. By interacting with the different views, the Web site user may get a sense of how the original exhibition appeared to a museum visitor.

This effort to create a "virtual gallery" experience is much more integral to the presentation of the works of art than the location of paintings in specific rooms in Le Louvre. In the Mongolia Exhibition, the authors are specifically trying to recreate the experience of walking through a particular show, presenting each object in its case or in the arrange-

ment on the wall, as viewed from specific positions in the gallery. On the Louvre CD ROM, we are offered a view of the paintings in the gallery, but this view is presented for reference, presumably to guide the user during a future visit to the permanent collection.

However, the relationship between the floor plan and the panoramas in the Mongolia Exhibition is not well expressed by the Web site technology (circa 1995). The floor plan itself provides a representation of the "stops" on the tour. Selecting a "stop" on the map brings the user to a picture, text label, and links to pages containing both a low-resolution (about 150K) and high-resolution (about 500K) QuickTime™ VR panorama, and an audio narration. At the time this was designed, QuickTime™ and QuickTime™ VR were not integrated into the Web browser and required separate applications to play back on the user's screen. Today, with the QuickTime™ plug-in integrated into popular Web browsers, each of these links leads to a separate page. This fragmented visual experience undermines any sense of moving around in "virtual" space. The six

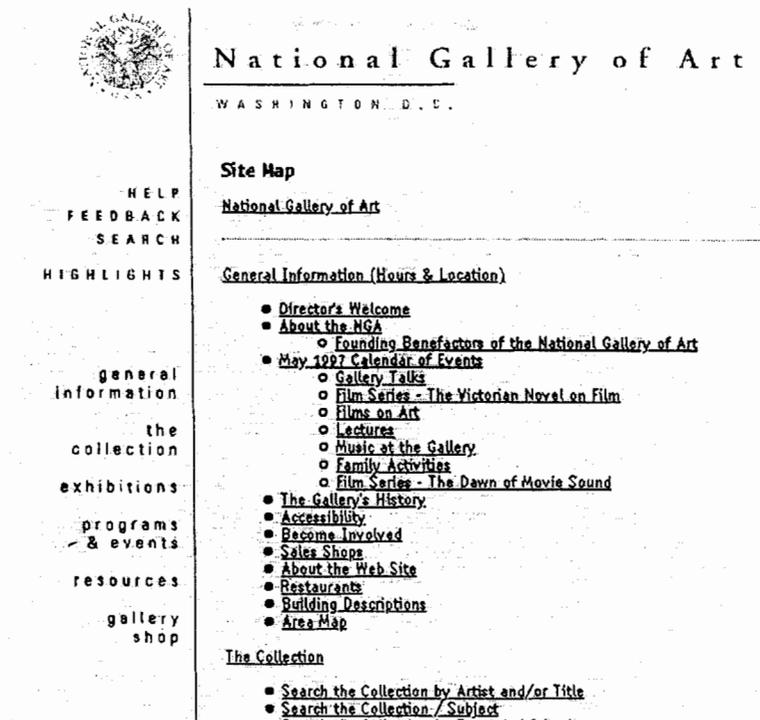


Figure 10: Site Map, the National Gallery of Art (Washington) web site
<http://www.nga.gov/copyright/toc.htm> (consulted 15 May 1997)

topic links in the page header provide a better overview of what the Web site actually contains.

B. NATIONAL GALLERY OF ART, WASHINGTON DC¹³

The Web site for the National Gallery of Art in Washington, DC offers an example of another common strategy, the table of contents as site map. The NGA Web site is divided into six main sections, each represented by a text link in the page margin. The names of these sections do not indicate the quantity of information each contains.

The Site Map page, accessible only from the Search page, provides an outline of the six sections [Figure 10]. This indented list provides both titles and a sense of the hierarchy of information on the site. The viewer can navigate to many pages on the site by following a link from the Site Map.

The items included in the Site Map represent a selection of pages on the Web site rather than a complete overview of the site's contents. Such a selective strategy may be dictated by the cost of manu-

ally maintaining a more complete list, or it may be a limit imposed by the way the information is displayed and stored. The Site Map list shows the collection represented by topics and subtopics (e.g., Decorative Arts/French Renaissance Ceramics), but never goes to the detail of the objects themselves. Such a display would be prohibitively large.

C. MYSTIC SEAPORT MUSEUM, CONNECTICUT¹⁴

The Web site for the Mystic Seaport Museum provides information about all the programs and services offered by this outdoor maritime museum. Like the NGA Web site, Mystic Seaport is divided into major sections, each represented in a link from the page footer. There is also a manually authored outline of the entire Web site, linked to from "Index" and titled "Table of Contents."

In addition to these common features, the Mystic Seaport Web site includes a link to MAPA, a data-driven visualization of the link hierarchy for the entire Web site. MAPA was developed by Dynamic Diagrams in 1996. The MAPA software gathers all the link data from a Web site and then organizes the

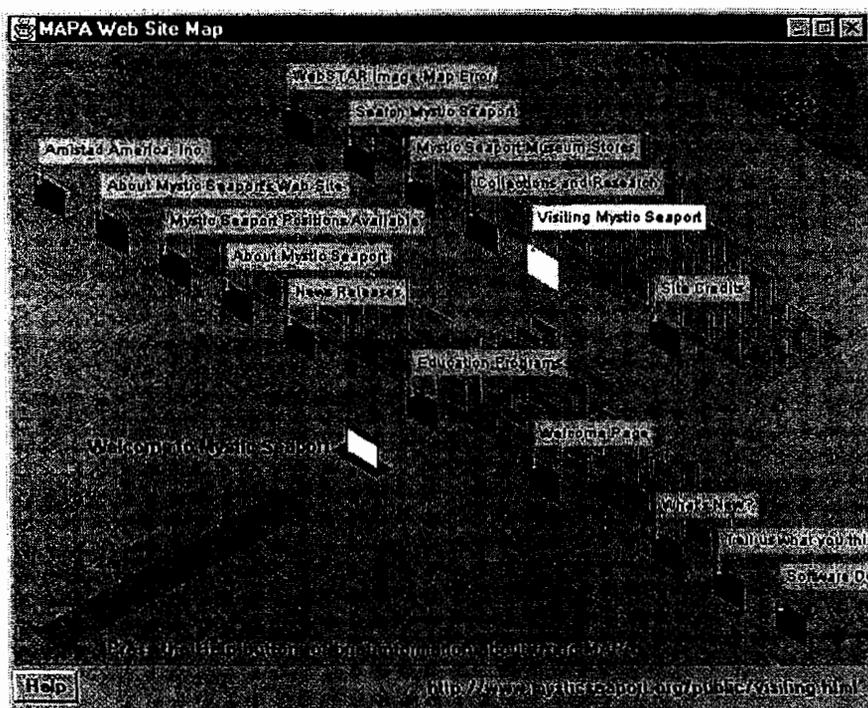


Figure 11: MAPA on the Mystic Seaport Museum Web Site
<http://www.mysticseaport.org/> (consulted 15 May 1997)

pages into a single hierarchy. This hierarchy is then used to create a dynamic map of the Web site, centered on any page. When the viewer launches MAPA from a page on the Web site, a Java applet requests the information to draw a map from the link database [Figure 11]. The resulting map always shows three levels of hierarchy: the page of origin, the "child" pages that are one link away, and the pages that are below this "child" pages. This technique allows the map to display any three levels of detail in a Web site of arbitrary size. The viewer can move up and down through the hierarchy or go to a page in the Web browser by clicking or double-clicking on the page rectangle.

The layout of the rectangles representing each page uses the same isometric projection employed in The Mongolian Felt Tent map and other site maps published by Dynamic Diagrams. This layout technique packs a large amount of structural information into a small amount of screen space. The trade off is a minimum amount of title information displayed. The full title and URL for each page appears as the viewer passes the cursor over the page rectangle.

Only one title is displayed at a time. A new version of the MAPA applet that displays groups of titles is under development [Figure 12]. In this version entire groups of titles are displayed, in exchange for temporarily obscuring groups of pages in the next level of the map. The MAPA display provides navigation, location, and visualization support for the entire Web site.

D. DETROIT INSTITUTE OF ART VISUAL RESOURCES ART IMAGE DATABASE¹⁵

A Web site can act as the interface to a collection of information such as a visual database or collections management system. As such, the presentation of information on a Web page can be computed at the time of presentation, allowing for a broad range of custom views. The Detroit Institute of Art has recently added the Visual Resources Art Image Database to their public Web site. The interface for the presentation of images is a gallery wall, encouraging the user to create his own "virtual" gallery.

The user interface for the current application is rather awkward. The user can view objects either by cat-

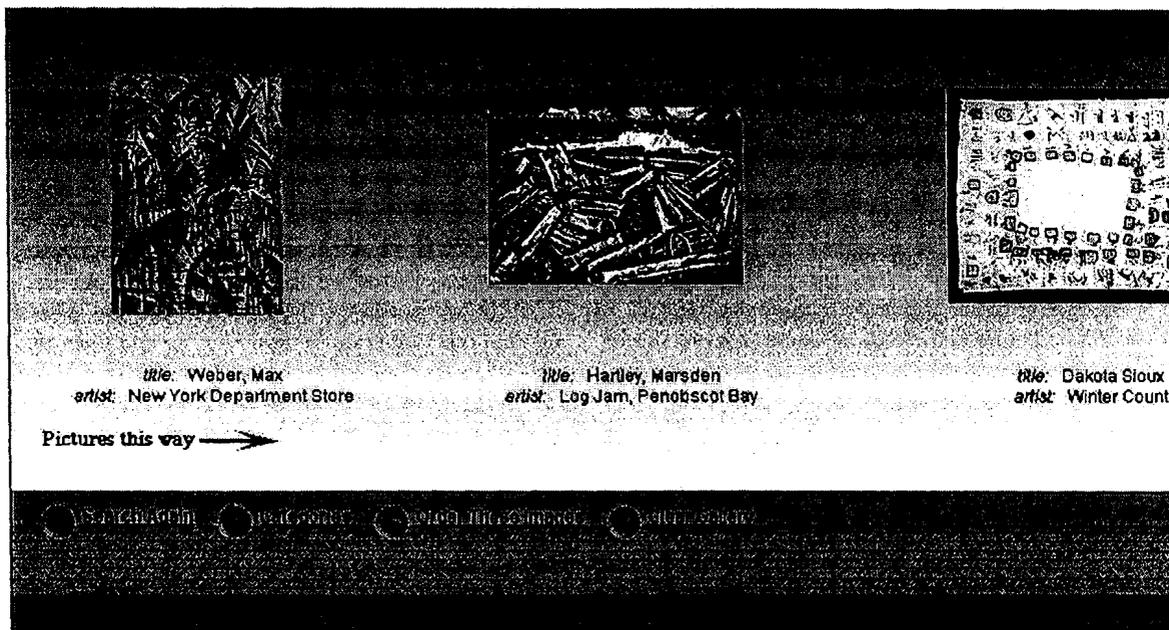


Figure 12: "My Gallery" from Visual Resources Art Image Database, Detroit Institute of Art Web Site <http://www.diamondial.org/home.html> (consulted 15 May 1997)

egory or by searching by artist name or object title. The selection tree used to view paintings by category is two or three screens deep, though the level of detail presented does not seem to require so many screens. There is no indication of quantity in the category tree, even though some categories such as Asian Paintings/Graphics/Other contain a single object, while others such as the American Painting/Graphics/Contemporary contain over ninety objects. The search interface is remarkably unforgiving, returning absolutely nothing for an Artist or Title search unless the user types the exact form used in the catalog (e.g. only "Demuth, Charles" finds any paintings while "Demuth" or "charles demuth" finds nothing). In addition to this simple artist, title or category/subcategory method, we can also imagine many other criteria from which the user could build a list of objects.

Putting these limitations aside, the result is intriguing. The user is presented with a "virtual gallery" display [Figure 12]. The graphic representation of space is rudimentary, consisting of a brown "floor" and a blended white to blue "wall" on which the

image of the object is placed. The user can view these groups of objects, and then select an individual object for a closer look. From this single-object page, he can "add" the object to the "My Gallery" display. The list of objects in "My Gallery" persists across sessions on the Web site through use of a cookie file on the user's computer.

CONCLUSION

Physical media, such as books or gallery spaces, provide a great deal of tangible context entirely lacking in CD ROM and Web sites. But unlike a museum building, a hypertext has no inherent topology. Electronic collections on CD ROM and the Web are hypertexts, that is collections of text and images grouped into units, connected by navigational links. The nature of the units in the two media differ, screens for CD ROM, pages for Web sites. The problem of being "lost in hyperspace" was noted in the early hypertext research, and is a direct result of having no visual point of reference¹⁶. An overview or other representation of these electronic collections is a useful orientation and navigation tool.

Without it, the viewer is at a tremendous disadvantage. The visual representations of a hypertext have been discussed for over a decade but are still a new and challenging area of exploration.

Sophisticated use of printed information graphics, such as the example from the Musées royaux des Beaux-Arts de Belgique cited above, can repeatedly help a visitor track his location in a complex space. The combination of portability and coding that relates items or groups of objects in the collection to the architectural detail of the museum makes the printed museum map an effective and important orientation tool for the visitor.

Our common experience of viewing art objects in the galleries of a museum suggests that the electronic collections of art, such as the CD ROMs discussed above, use an architectural metaphor to locate objects for the viewer. However, the simple one-to-one relationship of objects to actual rooms in a museum, used by *Le Louvre* CD ROM and the Asian Art Museum of San Francisco's Mongolia Exhibition Web site are of a limited use in the new media. One of the great strengths of electronic information is its flexibility of presentation. Any object appears only in a virtual, not a physical, space. Any painting or video can be reached by many paths and appear under several categories.

The electronic overview can provide three functions: defining an overall structure, providing a look-ahead facility, and tracking the viewer's activity. The second and third functions are unique to mapping cyberspace. All three functions are illustrated by some of the electronic examples cited above.

The map should provide the viewer with an overall structure in which to locate any specific screen or page unit. *Le Louvre* presents most of the painting information in terms of chronology and national schools. These two groupings are used consistently and become easy points of reference for location and navigation throughout the CD ROM. *Kon-Tiki Interactive* groups information by expedition, providing a similar grounding.

The map should also provide a look-ahead function, giving the viewer a sense of where he can go. The Overview in *Kon-Tiki Interactive* provides this function for each expedition, displaying the names

of the detail screens linked to each. The MAPA display provides two levels of look-ahead for each page on the Mystic Seaport Web site. This gives the viewer a sense of where he can go and how many further choices will be presented.

Electronic media can be programmed to track a viewer's activities. A printed map cannot automatically tell you where you are or what you already have seen as you move through a museum. An electronic map should be able to provide you with a view of the virtual space that responds to your current "position" as well as your past activity in the electronic collection. Both the *Au Cirque avec Seurat* navigation map and MAPA on Mystic Seaport Museum Web site demonstrate this feature to some degree. In both cases the map presented to the view will vary according to where the viewer is in the collection. In addition, these examples illustrate the most common feature of an electronic map — that it provide not only a view of the objects in a collection but also a mechanism to get to those objects. Representing a user's path or past activity is a function that has been the subject of hypertext research¹⁷. As the viewer moves through the electronic collection, the map could be programmed to mark the path he has already traversed. Such visual feedback would prevent undesired repetitions and provide an indication of what part of the tour has been completed or what part of a collection has already been viewed. While Web browsers currently use color to mark visited and unvisited links, we anticipate more sophisticated visualizations of a user's interaction with a Web site will improve the user's experience of that site.

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