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| Zeitschrift: | Studies in Communication Sciences : journal of the Swiss Association of Communication and Media Research |
| Herausgeber: | Swiss Association of Communication and Media Research; Università della Svizzera italiana, Faculty of Communication Sciences |
| Band: | 5 (2005) |
| Heft: | 1 |
| Artikel: | Just add elephants : breeding and browsing rich media educational resources at the San Francisco Museum of modern art |
| Autor: | Samis, Peter |
| DOI: | https://doi.org/10.5169/seals-790911 |

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PETER SAMIS*

JUST ADD ELEPHANTS: BREEDING AND BROWSING RICH MEDIA EDUCATIONAL RESOURCES AT THE SAN FRANCISCO MUSEUM OF MODERN ART

Three major challenges facing informal learning today are: 1) presenting content in a compelling, media-rich way; 2) making that content granular enough to facilitate rapid access by targeted users to the experiences of greatest interest to them; and 3) designing and building a new generation of sensory-rich, aesthetically satisfying search and discovery aids that can cope with legacy output created in a variety of software platforms and form factors. These challenges are addressed by two e-learning initiatives that have grown out of the San Francisco Museum of Modern Art's Interactive Educational Technologies program, and more specifically its flagship multimedia program, *Making Sense of Modern Art*TM. The first, *Pachyderm 2.0*TM, is a new open source authoring tool that uses a browser-based interface to populate pedagogically conceived Flash templates with rich media content. The second, the *Making Sense of Modern Art Discovery Interface*, unites thirteen previous multimedia features under a single umbrella, affording rapid access to content across legacy programs, and providing a sensory-rich exploration framework for SFMOMA visitors. Each project is introduced, including its origins, educational design considerations, project partners, and implications for the future.

Keywords: Pachyderm 2.0, web application design, multimedia resource discovery, user interface design, open-source, template-based authoring tool.

* Associate Curator of Education and Program Manager for Interactive Educational Technologies, San Francisco Museum of Modern Art; Adjunct Professor, TEC-CH Program, University of Lugano; psamis@sfmoma.org

Introduction

Three major challenges facing the informal learning field are:

1. presenting educational content in a compelling, media-rich way
2. making that content granular enough to facilitate rapid access to the experiences of greatest interest to users
3. designing and building a new generation of sensory-rich, aesthetically satisfying search and discovery aids that can cope with legacy output created in a variety of software platforms and form factors.

These challenges are addressed by two e-learning initiatives that have grown out of the San Francisco Museum of Modern Art (SFMOMA)'s Interactive Educational Technologies program, and more specifically its flagship multimedia program, *Making Sense of Modern Art*™ (accessible online at www.sfmoma.org/msoma).

The first initiative is *Pachyderm 2.0*, the new version of an authoring tool that was first developed by SFMOMA in collaboration with the San Francisco-based company Idea Integration in 1999–2000. Pachyderm allows content experts with little background in technology to use Web forms to generate interactive Flash presentations for kiosks, fixed discs, or the Web. Thanks to a partnership with the New Media Consortium (NMC), the original, proprietary version of Pachyderm is now the subject of an extensive upgrade and overhaul underwritten by the US government's Institute for Museum and Library Services (IMLS). The project brings software development teams and digital library experts from six NMC universities together with counterparts from five major museums to transform proprietary software that was locally useful but arguably limited in lifespan into an open source, platform-independent tool that will soon be available for adoption royalty-free by the e-learning community.

Challenges 2 and 3 are addressed by the second project, the *Making Sense of Modern Art Discovery Interface*. This new visitor interface, developed in collaboration with Method, Inc., consolidates thirteen previous multimedia features, many of them originally published with Pachyderm 1.0. Source programs have been atomized, and their content aggregated under a single umbrella. The new interface affords rapid access to interpretive materials, and provides a framework for the continued expansion of educational resources at the Museum. The goal is to enable visitors who have just come from the galleries to access the rich media content of

greatest interest to them within three clicks, even if they don't know the name of an artist or the title of an artwork.

So this paper treats both Form and Content. On the form side, the Museum is working collaboratively to develop and disseminate *Pachyderm* 2.0, a potent multimedia publishing tool for the field. On the content side, it is aggregating a baker's dozen of interactive educational features developed over the past ten years, including five years using *Pachyderm* 1.0, and augmenting those features with a sophisticated discovery interface layer—itself a new form. In this manner, legacy content is reaching new audiences just in time to change their experience and understanding of modern and contemporary art.¹

1. Breeding: *Pachyderm* 2.0

Developed by SFMOMA to make the publication of modular and updateable rich media an easy task, for the past five years the original *Pachyderm* has allowed non-programmers to create a variety of engaging resources that draw from, and build on, the Museum's collections. The result has been in-depth Flash-based interactive learning programs such as *Making Sense of Modern Art* (www.sfmoma.org/msoma), *Ansel Adams at 100* (www.sfmoma.org/adams) and *Eva Hesse* (www.sfmoma.org/hesse), among many others.²

The first *Pachyderm* (even before it received its elephantine name) was born in 1999–2000 from the San Francisco Museum of Modern Art's need to provide a new, Web-based publishing solution for its multimedia educational program *Making Sense of Modern Art (MSoMA)*. At the time, the Museum's Interactive Educational Technologies (IET) team had already established a track record developing rich media educational programs for kiosk and CD-ROM.³ The first years of the World Wide Web presented the opportunity to dramatically extend our reach, but at the price of drastically curtailed bandwidth. The Museum team had experience with, and a pedagogical preference for, presenting high resolution

¹ Portions of this paper were presented in slightly different form at Museums and the Web 2005 in Vancouver, Canada. See Samis and Johnson (2005) and Mitroff, Samis, and Johnson (2005). My thanks to my co-authors and Archives & Museum Informatics for permission to include these materials.

² An assortment of *Pachyderm* presentations is available at www.sfmoma.org/education/edu_online.html.

³ An award-winning CD-ROM, *Voices & Images of California Art*, was published in two editions in 1997 and 1998.

images of artworks and videos of the artists themselves whenever possible; however, it took a few years before the Web infrastructure could support the data rates necessary to convey such rich media educational experiences. By 1999 that infrastructure had begun to emerge, and the IET team set about expanding its focus to include a Web-based audience.

The Museum chose Macromedia Flash™ because at the time it was the only way to ensure the design integrity we had come to expect from early CD-ROMs while publishing in a Web-compatible format. Flash offered elegance of font and page display, and multimedia integration across the bewildering variety of browsers and platforms then in use (although at the time its relations with Apple's QuickTime™ video standard were far from a match made in heaven). Furthermore, it provided a one-stop solution for publishing to the Web, fixed disc, or a kiosk.

That said, the team was comprised of multimedia educators, not expert Flash programmers. Working with two San Francisco-based firms, Perimetre-Flux Design and Idea Integration, we proceeded simultaneously on four fronts:

1. Developing art historical content and approaches for the first chapters of the *Making Sense* program itself, featuring rich media explorations of works by Robert Rauschenberg, Sol LeWitt, and many other artists of the latter half of the twentieth century
2. Developing interactive templates representing the approaches we felt were best suited to fostering an understanding and appreciation of modern and contemporary art
3. Working with our outside partners to produce the Flash programming for those templates
4. Finally, once again with our outside partners, developing the content management and authoring tool to port our Filemaker data into an SQL database, paired with a Web-based authoring interface. This tool, built to populate the templates we had designed, would enable us to add future chapters to the *MSoMA* program without hiring programmers to do it for us.⁴

Pachyderm 1.0 was the outcome of Deliverables 2, 3, and 4: the templates, the Flash, the browser-based authoring interface, and the under-the-hood logic

⁴ Visual Basic, VBScript and ASP connected the Web interface to the database and the data to the Flash. Flash Generator was used to wed object metadata to artwork images, resulting in .swf files that carried their label and copyright information with them wherever they appeared in the program.

that enables users to populate the templates with media and text, and publish to various platforms on demand. The original version was programmed to be compatible with the Museum's Microsoft IIS server environment.

The interactive templates have been the authoring tool's defining feature. Both *MSoMA* and its authoring tool were conceived to facilitate multiple approaches and modes of interpretation, to foster an open-ended, discovery-based understanding of the subjects they treat.⁵ Interactive multimedia allows us to present a variety of provocative voices and historical information, rather than a single, static, art historical storyline; more specifically, in the case of an art museum, it fosters an understanding of the multiple contexts in which an artwork gains its meanings. Each of the templates models a methodology used by art historians and curators in building their understanding of an artwork. Each presents a distinct approach to examining, contextualizing, and understanding objects and images.

For example, the *Formal Analysis* screen allows close-up examination of salient hot spots in a graphic file and refreshes the text as you roll over each one; it can also be used for iconographic analysis. The *Slider Gallery* enables a diachronic reading of a set of images, or the establishment of variations within a typology, without having to move from screen to screen. The *Zoom Screen* allows for extreme close-ups and pans of graphic files accompanied by audio commentaries. The *Onion Skin* presents multiple interpretations, or levels of approach, to a single work, movement, or idea. (See Appendix A for an illustrated discussion of the Pachyderm templates.)

All of the screen templates are designed to create mini-lessons that balance text and image. They dose the text in small, "just-in-time" increments to assure user engagement. For example, the complete text-based content of an "onion skin" screen such as "What was the Bauhaus?" would fill many pages and could easily prove intimidating to casual browsers and students. But the Web visitor arriving at the screen at first sees only a fraction of the text it holds (Figs. 1-2). The template begins with an introductory overview of the topic, accompanied by a video and illustrations. The remaining content is progressively revealed in four sub-themes, all accessible without leaving the screen. Clicking on each sub-theme reveals its own short text intro and accompanying image or media files with their commentaries. Through a succession of self-contained, self-guided, cascading disclosures, multiple dimensions of the topic are revealed without ever leaving the "What was the Bauhaus?" screen.

⁵ See Samis and Wise (2000).



Fig. 1: Example of the Pachyderm Onion Skin template – Introductory state with video playing. (SFMOMA's *Making Sense of Modern Art*)



Fig. 2: Example of the Pachyderm Onion Skin template – Second layer of five revealed.

In fact, almost all the templates have this in common: they serve as *uni-fiers and multipliers of content*. While the whole screen is conceived as the articulation of a single idea, what the viewer sees on first arriving is the first step of the idea's unfolding. Further screen states, reflecting facets of the topic at hand, reveal themselves as a result of the viewer's engagement. Furthermore, brief musical sounds accompany the user's journey through the program, and animated transitions from screen to screen add to the impression of a seamless exploratory experience.

In a recent study, Saint-Martin (2005) compared the interactivity built into the Pachyderm templates as exemplified in *MSoMA* with the more static pages typical of many museum documentation sites:

Les textes qui accompagnent les illustrations ne sont jamais disposés de la même façon d'une page à l'autre... *Making Sense of Modern Art* a mis au point un procédé astucieux pour favoriser la lecture des textes dans leur intégralité.... Il transforme le visiteur et l'oeuvre en interlocuteurs... L'interactivité donne vie à l'oeuvre, elle la propulse dans notre espace, notre univers dynamique, vivant. L'oeuvre prend son sens en touchant nos sens.

Another of *Pachyderm*'s strengths has been that it has allowed us to publish a large pool of stand-alone content screens, each embodying a concept or ped-

agogical point that could then be used and re-used for various purposes in different presentations: a primitive form of a shared content repository. The flexibility of publishing to Web, kiosk, or CD-ROM has been yet another definite plus. But most important of all was that once the initial investment in building the tool was made, it became possible to use these templates to publish new interactive features for the price of the rights licenses and whatever new video production we hoped to add. The cost of programming was reduced to nil; the price to produce quality multimedia dropped accordingly.

Not surprisingly, many museums have asked over the years if they could license *Pachyderm* 1.0 to publish their own educational kiosks or Web sites. Much as we liked the idea, SFMOMA was hardly in a position to provide training, technical support, or software upgrades to a far-flung user community. But the New Media Consortium, an international association of 200 colleges, universities, museums, and other learning-focused organizations, had the means to build on SFMOMA's work. Working together, we could effectively deal with the obstacles that had seemed insurmountable or prohibitively expensive to SFMOMA acting alone. The idea of creating a version of *Pachyderm* that could publish content modules for the emerging e-learning economy took shape in remarkably short order, and several key partners were identified (see table).

Table 1: *Pachyderm 2.0 Project* Partners

| Project Leads ⁶ | |
|---|--|
| NMC: The New Media Consortium | |
| College & University Partners | Museum Partners ⁷ |
| California State University's Center for Distributed Learning | Berkeley Art Museum/Pacific Film Archive |
| Case Western Reserve University | Cleveland Museum of Art |
| Northwestern University | Fine Arts Museums of San Francisco |
| University of Arizona | Metropolitan Museum of Art |
| University of British Columbia | San Francisco Museum of Modern Art |
| University of Calgary | Tang Teaching Museum of Art |

⁶ Dr. Laurence Johnson, CEO of the NMC, and the author serve as co-principal investigators for the project and provide overall leadership to the effort. The NMC *Pachyderm* project site is www.nmc.org/pachyderm.

⁷ The Canadian Heritage Information Network (CHIN) has been participating in project activities as an observer since the fall of 2003.

From the earliest conversations, two goals were formulated related to the development of the *Pachyderm 2.0* authoring environment. The first was to make the software open source and platform-independent, so the tool could be installed on any server, with Linux, Windows, and Mac servers to be tested. The second was to redesign the authoring interface's look and feel, developing a standard set of step-by-step Web forms with the potential for foreign language localizations. Finally, the original coding, which had been idiosyncratic to each template, was to be standardized into a component-based software architecture to facilitate extensibility and the addition of future templates.⁸

This move from an individual institution's proprietary solution to a consortially developed open source tool that can be offered to institutions of all sizes and levels of technological sophistication reflects a set of concerns that has also been identified in Europe (Dédale 2005):

Les institutions culturelles traditionnelles n'ont pas l'habitude de travailler en réseau, elles n'en mesurent pas l'intérêt alors que de tels réseaux constituent une véritable clé à l'intégration des TIC (Technologies de l'information et de la communication) dans le secteur culturel, en particulier pour les petites et moyennes structures....

Les réseaux ou comités d'intérêts doivent non seulement permettre de confronter les pratiques de chacun mais aussi et surtout d'établir des outils concrets d'aide à la conception de projets multimédias. Il s'agit avant tout de mutualiser des moyens et d'offrir aux institutions culturelles des informations, des méthodologies, voire même des technologies qu'elles ne peuvent assumer elles-mêmes, soit par manque de moyens financiers soit par manque de temps ou de compétences en interne.

Formative Analysis

Revisiting *Pachyderm* in a consortial, team-based way five years after its initial development presented an interesting opportunity/conundrum. On the one hand we already had a fully developed mission and target spec: "Create an Open Source State-of-2005 software tool that does everything *Pachyderm 1.0* did in 2001." The team did not have to imagine a software that had never been made.

On the other hand, we knew that there were a host of improvements possible. With that in mind, under the leadership of Rachel Smith, inter-

⁸ Activities related to the first goal primarily involved rewriting the original *Pachyderm* code to incorporate open-source components such as MySQL rather than the original FileMaker Pro and Microsoft SQL databases, and rewriting scripts and other components originally in Visual Basic in the more open PHP and XML.

face and usability expert at California State University's Center for Distributed Learning, the partners undertook an extensive formative evaluation and requirements gathering process (Smith 2005):

1. Development of over fifty personae (museum curators, educators, and a variety of visitors of different ages, educational levels, and degrees of familiarity/ease with technology; university faculty, librarians, and students in different subject areas) and as many user scenarios, following Carroll's methods (2002).
2. User observations at Sonoma State University, Case-Western Reserve University and The Metropolitan Museum of Art.⁹
3. Deriving and posting of requirements using the Center for Distributed Learning's Requirements Tracker,¹⁰ culminating in the drafting of the full Pachyderm 2.0 specification.¹¹

Once the requirements had been established and prioritized, further rounds of heuristic evaluation on paper prototypes and the beta version were conducted by the Center for Usability and Assessment (CUDA) at CalState – Long Beach.¹² Finally, observation of the Pachyderm 2.0 authoring process has been conducted at the Rochester Institute of Technology's Usability Lab.

Architecture and Authoring

The Pachyderm 2.0 programming architecture consists of an extensible library of templates, each with its particular interactive design concept and functionality. Different templates have different functions: some are menus and provide navigation among the content streams; others are content explorations; finally, the Comparison Timeline allows the relational juxtaposition of different artworks (or objects) to reveal hidden affinities and differences.

Content is atomized and can be re-assembled in a variety of presentation formats. Media files are accessed through a simple content management system with Dublin Core-compliant fields. When authoring, the user first selects the template that corresponds to his/her pedagogical strategy and the media assets he/she desires to showcase. Then, from

⁹ See Smith and Willbanks (2004) and Stepanek (2004), respectively. The Pachyderm Document Archive houses these and other germane and instructive documents generated during the development process. It is available at the url: <http://www.nmc.org/pachyderm/docarchive.shtml>

¹⁰ <http://www.cdl.edu/resources/requirementsTracker/newreq.php>

¹¹ Available at <http://www.nmc.org/pachyderm/docarchive.shtml>

¹² <http://www.csulb.edu/centers/cuda/> For a community-based heuristic evaluation tool also developed by CalState University but available to all, see ideaonline. Url: <http://idea.csusm.edu>

within the authoring interface, the user simply clicks on the various spaces in the Web form that correspond to the slots in the template, alternately cutting and pasting text into the text fields and identifying images, videos, or animations for the media slots. The presentation may be saved at any stage along the way; when it is complete, it is published as a Web site, a kiosk, or a CD-ROM/standalone set of files, and can be viewed instantly in its full Flash form (Figs. 3-4).



Fig. 3: Authoring a series of screens (Pachyderm 2.0 beta)

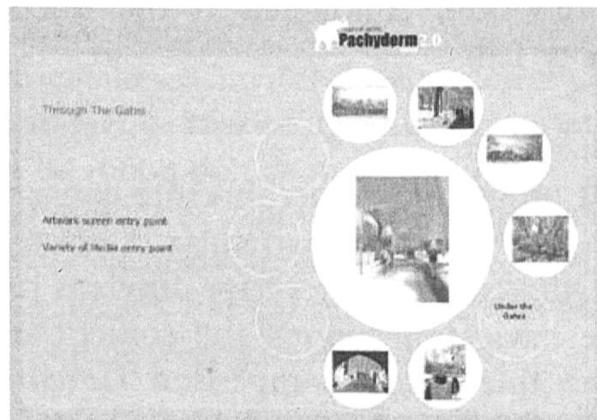


Fig. 4: Published Pachyderm 2.0 beta "Phone Dial" menu template

The Pachyderm 2.0 templates are built from a component database of screens and the widgets that make up those screens. XML defines the components both for the author-facing Web forms and the end user-facing Flash presentations.¹³ On publishing, the selected templates merge with the selected media files and texts to produce the final Flash presentation.

¹³ Apollo, an open source learning object-centric project developed at the University of Calgary, acts as the foundation for Pachyderm, running on top of Web Objects and drawing data from a MySQL database. Apollo handles user accounts, resource management, and adds services for building the application interface itself. The use of WebObjects is a slight compromise given our complete openware goal, but it has saved us countless programmer hours in achieving the desired set of features.

Delivery and Dissemination

Thanks to the IMLS and the dedicated efforts of project participants (whose efforts have far exceeded the dollars accorded to the project), present schedules call for *Pachyderm 2.0* to be offered royalty-free for educational use effective Fall 2005. (The software is in beta testing as of this writing.) Moreover, *Pachyderm 2.0* will publish learning objects that are reusable, optimized for Web delivery, and conformant with key search, archival, and cataloging standards such as Dublin Core, SCORM, and IEEE LOM.

The *Pachyderm 2.0* Project is not just about rewriting the software, however. Central to the project is the development of at least 20 richly interactive learning experiences by the project's museum and university partners using the new environment. The development of these materials will constitute a comprehensive test of the software in at least 10 different settings, and prove its worth as an authoring environment — as well as provide exemplars for the range of ways in which the tool might be used.¹⁴

2. Browsing: The *Making Sense of Modern Art* Discovery Interface

In the coming years as professors, students, museum curators and educators all begin to develop rich media content—whether using *Pachyderm 2.0* or other means—discovery tools will play an increasingly vital role in the digital knowledge continuum. Google™ is already the home page of choice for millions, but the list-based presentation of returns, while precise, is lacking in savor and imagination. As Tudhope and Binding (2004) write: “service protocols... need to be able to support the development of innovative and responsive Web interfaces that encourage different types of users to take full advantage of the resources offered for searching... digital heritage collections.”

There are multiple aspects to this challenge. Some are of the taxonomic and metadata variety, i.e., wrangling diverse databases to communicate and federate their resources in meaningful ways for both specialists and non-specialists in a given field. Equally important, however, are the user interface challenges: how do we create a pleasurable exploration environment in which the underlying Knowledge Organisation Systems give way to an intuitive “discovery framework” that facilitates not just searching but browsing as well, and what Tudhope calls “serendipitous discovery.” The

¹⁴ For more information about *Pachyderm 2.0* and to monitor project progress and product availability, see the *Pachyderm* project Web site at www.nmc.org/pachyderm.

goal is to create a trusted zone of pleasurable inquiry in which knowledge seekers can follow the meanders of hyperlinked learning resources confident that each new presentation proposed will be sufficiently relevant, and of high enough production value, to be of interest to them. Such discovery zones will have the potential not only to draw on information federated from multiple sources, but will themselves add sufficient context so each element feels part of a continuously unfolding narrative. This kind of informal learning environment is the digital equivalent of a vanishing experience: a long sit-down immersion in the library stacks, browsing titles familiar and un-, in a subject area of your choice.

The European Community's Sixth DigiCULT Forum addressed issues of this kind in Rome in 2004, where experts imagined:

...a system that, as Traugott Koch described, "invites you to start at some point in a hierarchy, trickling down, exploring up and down and wandering through the hierarchies or networks.¹⁵

At the same time the Rome conference was occurring, the SFMOMA team was developing screen designs and taxonomies for a new microscopic "federated repository" of ten years of interactive educational technology programs at SFMOMA, the Discovery Interface for our new Koret Visitor Education Center.¹⁶

The original *Making Sense of Modern Art* program was published as an interactive kiosk for the inauguration of SFMOMA's new building in January 1995. It was authored in Macromedia Director; the World Wide Web as we know it had just been born. The program was predicated on the premise that the Museum galleries are a wonderful place to have an "unmediated" encounter with a work of art if you come equipped with a receptive attitude and art historical knowledge, but they fail miserably to provide appropriate contextual cues to those without prior training in the field.¹⁷ Multimedia was seen as a way to restore the context the galleries stripped away.

In the following years, prototypes of more sophisticated, object-oriented interfaces that could deliver the program's expanded pedagogical logic

¹⁵ Steemson (2004).

¹⁶ For more on the concepts informing the Koret Visitor Education Center, see Samis (2003).

¹⁷ Among other things, museum galleries strip away: the process of an artwork's making; the artwork's relationships to its maker, to works that came before or after, to its time; germane drawings and related documents; any media that may have been produced about the artist or work; and, all too often, a suggestion of the plethora of methods of approach and understanding that might be applied to the work. What is left is, of course, the artworks' physical presence, usually impeccably lit (if it's not a work on paper, that is!).

were developed in mTropolis (still only disc-based) and Flash, which finally ensured Web compatibility. The Flash version of *Making Sense of Modern Art* as it is available today in SFMOMA's educational spaces and on the Web is the result of a five-year campaign of content development and production. It provides rich, multi-leveled explorations of key artworks from SFMOMA's collection, all published using Pachyderm 1.0. Its question-based, artwork-specific approach honors visitor inquiry, setting discovery-based learning at the heart of its pedagogical method. But as rich content has been added—including no less than one hundred video clips of artists, curators, and art historians specially produced for the program—the program's multi-level architecture has become a barrier to uncovering the very resources we have worked so hard to provide.

As a case example: assuming a visitor knew enough to even look for the classic video of artist Robert Rauschenberg telling the story of his *Erased de Kooning Drawing*, he or she would have to navigate successfully through as many as five levels (Fig. 5a-d on the following page).

As part of a National Leadership Grant from the IMLS, the SFMOMA IET team began to break the “black box” of MSOMA's Flash programming on the Web in 2002 by adding html “side doors” that led directly to all of the artworks featured in the program. These “threshold pages” served a dual purpose. On the one hand, they provided the metadata needed for Google and other search engines (including the site-wide search function on www.sfmoma.org) to find and link into the Flash program. On the other hand, they served as a mediator between *Making Sense*'s identity/look-and-feel and the Web world beyond, announcing the Web surfer's arrival at a new space and kind of program, and the plug-ins required for proceeding further (Fig. 6 on page 23).¹⁸

¹⁸ Steemson (2004) quotes Traugott Koch: “Only 20 per cent of users come through the Website front doors. The other 80 per cent jumps from somewhere into the middle of the service via search engines.’ It was, he said, a reality no-one had designed for and gave a poor result to users. ‘They end up on such a page and it is totally out of context. They do not know what to do, they do not know what it means, and they do not know where it comes from or what is the logical feature before or afterwards.’ If the heritage sector was to build on being discovered this way, using Google or other big search engines, it needed to redesign most of its Web pages so that each carried its own context and help information.” This was precisely the logic behind SFMOMA's development of the threshold pages. Recent findings confirm that we indeed receive far more Web traffic, including Google referrals, through these threshold pages than through the program's front door. Such html pages have also been made for all of the other Flash exhibition features developed using Pachyderm: *Art as Experiment*; *Art as Experience*; *Ansel Adams at 100*; *Eva Hesse*; *Gerhard Richter*; *Roy: Design Series 1*; *Philip Guston*; *Romare Bearden*; *Frank Stella*; *Voices & Images of California Art: Robert Bechtle*; and *Richard Tuttle: The Presence of Simple Things*. Since most of these programs focused on one artist and only a small number of artworks, they did not suffer from the problem of buried content hierarchies that plagued a survey program like *Making Sense*.

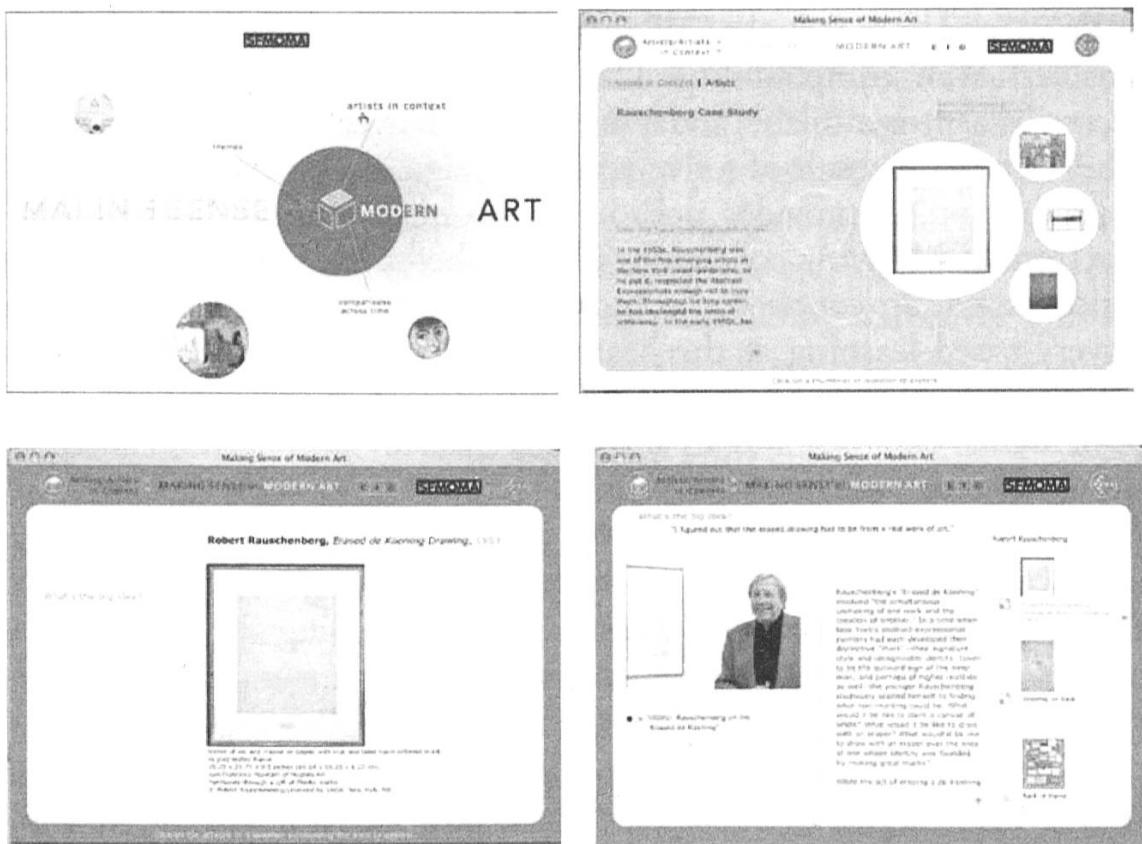


Fig. 5a-d: Navigating to a specific rich media resource in the previous version of Making Sense of Modern Art (four levels out of five)

- Title animation and Entry screen present 3 portals to content: Artists in Context, Themes, Comparisons Across Time. Choose *Artists in Context*. Within Artists in Context table of contents (not shown), which previews groupings across the 20th century, choose *Rauschenberg Case Study* table of contents.
- Rauschenberg Case Study* shows four Rauschenberg works treated in depth in the program. Choose *Erased de Kooning Drawing*.
- Erased de Kooning Drawing* Artwork Screen offers zoom of work itself and/or question(s) surrounding the work. Choose the question *What's the Big Idea?*
- What's the Big Idea?* Variety of Media screen offers video, scrolling text commentary, and enlargeable thumbnails. Choose VIDEO: Robert Rauschenberg on the *Erased de Kooning*.



Fig. 6: Threshold page for the same artwork, providing instant access from Google

But in the Museum itself, where *Making Sense* was delivered on standalone kiosks sans keyboards, this search-engine solution for accessing deep content did not apply. Furthermore, the Museum has developed no less than twelve other interactive educational features over the years, many exhibition-specific, some with titles as alluring but ultimately uninformative as *Art as Experiment*, *Art as Experience*. With the opening of the Museum's Koret Visitor Education Center the Fall of 2002, how was a visitor to know where they would find a specific artist or artwork in this welter of educational resources?



Fig. 7: The Learning Lounge in SFMOMA's Koret Visitor Education Center

Thanks to the open plan of the Koret Center's Learning Lounge (Fig. 7), where seven kiosks offering all of our programs are available for drop-in use, SFMOMA staff was able to make extensive observations of visitor behavior. It was further determined through heuristic evaluation that the initial interface housing the programs was visually attractive but difficult to navigate: the content was organized by the legacy principle, accumulating program titles like so many separate volumes on a library shelf. That said, of the array of possibilities offered, two programs proved to be most popular: a simple menu-based video anthology drawn from all of our programs called *Artists Working*, *Artists Talking*; and the pre-Web point-and-click slide show of artworks, artist videos, and documents called *Voices & Images of California Art*.



Fig. 8: Artists Working, Artists Talking: large-screen video plays on left; menu of artist names on right

With *Artists Working, Artists Talking*, choosing an artist name triggered a full-screen, high-quality video: instant gratification. Visitors were then free to click on the next name (Fig. 8). We often observed people going down the column, starting with a familiar artist such as Diego Rivera or Frida Kahlo and then triggering every subsequent video, whether they were familiar with the artist or not. Many seemed interested in a learning experience that required little navigation or reading, was ready at hand and did not require meandering down hierarchical menu trees with little assurance of what lay at the ends of the branches.

Clearly, an overhaul of our hierarchical presentation strategy was in order if we wanted more visitors to access the rich interpretive content hidden deep in the layers of the other programs.

For a number of reasons, we did not feel the mere addition of a search box was a solution. First of all, the Museum's kiosks have no keyboards, both to prevent visitors from accessing the Windows desktop and hacking the system folder, and to avoid the problem of visitors occupying the stations to check their email. But more importantly, only a handful of modern and contemporary artists are really household names. A search box can be a dumbing-down device, depending as it does on active rather than tacit knowledge. Rather than come up with slim returns when people type in standard searches like "Picasso" and "nude"—the Museum's collection is rich in neither of these—we felt it was preferable to present our real program strengths in a positive and inviting way, one that gave museum visitors a chance to use the tacit knowledge they had just gained on their stroll through our galleries.¹⁹

¹⁹ Along these lines, the European DigiCULT Forum panelists describe situations in which "users were often unsure what they wanted, but knew what it was when they saw it." See Steemson (2004).

Over the past year, working closely with San Francisco-based Method, Inc., the Museum has developed a new set of menus and filtering screens designed to surface deep content in a just-in-time manner, without benefit of a keyboard. The interface further proposes a series of cross-linkages within its own lateral knowledge organisation system, encouraging browsing and “serendipitous discovery.” The goal has been to atomize, consolidate, and re-present the museum’s multimedia programs, be they Flash presentations authored in Pachyderm or something older, so that a kiosk user can find rich media resources of interest to them within just three clicks.



Fig. 9: The new Making Sense of Modern Art Discovery Interface home page

Visitors arriving at a kiosk are now presented with a periodically recycling set of thumbnails, short video animations, and interactive feature titles, which appear against a spacious white ground anchored by three colored buttons leading to three browsing interfaces: *Artworks*, *Artists*, and *Interactive Features* (Fig. 9). In our pedagogical thinking, first among equals for visitors just back from the galleries is the *Artworks* portal.



Fig. 10: The Artworks Browsing Menu

By scanning this menu - presented as visual arrays of thumbnails midway between a gallery wall and a slide table (Fig. 10) - visitors can instantly identify works they have just encountered and might be curious about. Rolling over a work activates a tooltip with label information. (This is

not a touchscreen interface.) Clicking takes you to the artwork's screen. At this point, the under-the-hood magic of the technical architecture assembles all of the multimedia content produced to date about that work, whatever its original program source, and proposes it along with a zoom view of the artwork for inspection. Every artwork on this browsing menu has associated multimedia content: the visitor is *guaranteed* a rich media experience, not just a database-format collections catalog entry.²⁰

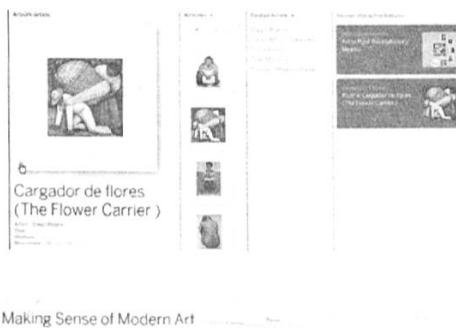


Fig. 11: Artwork screen for Diego Rivera's Flower Carrier. Related interactive features are on the right. The user has also exercised the options to see other artworks by Rivera and a list of related artists.

Further connections - Related Artworks (by the same artist) and Related Artists - arise at this navigational layer of the interface, but they are initially presented as options rather than obligatory distractions. The initial focus is on connecting the artwork directly with its rich media interactive features, which appear in the right hand column by default. The related links columns deploy in the center only when requested (Fig. 11).

Related interactive features are showcased on the right with a tooltip previewing content for one of the programs. In this case, the viewer has not selected additional options to view Artworks by Cunningham or a list of Related Artists, so the central columns have not deployed.

Fig. 12: Artist screen for Imogen Cunningham.

²⁰ Further filters on the browsing menus allow visitors to select artists or artworks by geographic region, time period, medium or movement.

The second portal, the *Artists* menu, initially displays as a list, providing a tooltip preview of each artist's work on rollover. Clicking on an artist's name takes the visitor to an Artist Screen (Fig. 12):

At this point, the first, discovery phase of the visitor experience has successfully concluded. Next is the presentation phase. The interface serves as the stage for and technically supports the needs of all thirteen interactive features, dating from 1997 to the present. Each appears suspended in its footprint (either 640 x 480 or 800 x 600 pixels) against the white background, surrounded by the overarching discovery framework navigation.

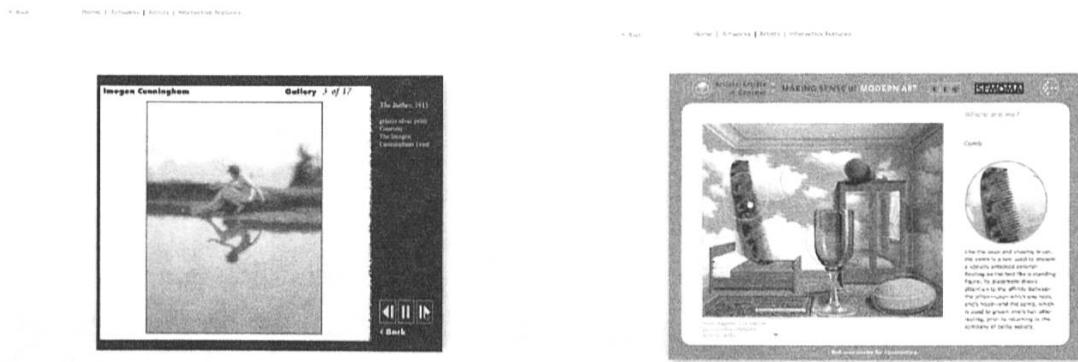


Figure 13a

Figure 13b



Figure 13c

Fig. 13: (a) *Interactive Feature screen for Imogen Cunningham feature drawn from Voices & Images of California Art, originally a CD-ROM.* (b) *Interactive Feature screen for René Magritte feature drawn from Making Sense of Modern Art, a Flash program authored with Pachyderm.* (c) *Interactive Feature screen for The Sleep of Reason feature drawn from Bill Viola, originally an HTML Web site.*

Figures 13a, 13b, 13c illustrate two challenges: finding an overarching design elegant and unobtrusive enough to serve as a unifying backdrop to the various different graphical looks that have characterized our programs over ten years, and creating a sophisticated enough programming infrastructure to accommodate legacy programs written in now-obsolete applications such as Apple Media Tool (1994-98), as well as HTML and Flash, whether they are served remotely or sourced directly from the kiosk's hard drive.

The final entry portal is through the *Interactive Features* browsing menu (Fig. 14). Although visually distinct, this is the nearest equivalent to the organizing principle of the original Koret Interface.



Fig. 14: *Interactive Features* browsing menu with *Artists Working, Artists Talking* tooltip highlit.

In designing the Discovery Interface, we took to heart the lessons learned observing visitors happily clicking their way down the list of our video anthology program, *Artists Working, Artists Talking*. (Those videos, by the way, are prominently featured next to every artist they treat, and the entire growing artist video anthology has a permanent home on the opening screen of the Interactive Features menu.) By developing this set of three point-and-click browsing interfaces, the Museum is surfacing multimedia resources that were previously buried and inaccessible to most casual users.

In our discussion we have focused on the new screens and functions we have developed in the Discovery Interface, but we have left out the enabling of an infinite variety of braided excursions into our programs, which can be dipped into like a pool or explored in depth like an ocean, all from the safe shore of the surrounding navigational controls.

Early in the conceptual development phase, our colleagues at Method proposed that the entire Discovery Interface be retitled “Making Sense of

Modern Art" since, in effect, all of our programs attempted to build context around, and make meaning of, the art in our collection. This rebranding was a crucial step in acknowledging our project's mission: integrating all our prior programs into a seamless whole to give the user more transparent access to learning content, allowing visitors to flow effortlessly from the direct experience of artworks in the gallery to rich media discoveries, and thereby transforming the quality of their museum experience. It is our hope that knowing they have so many high quality, easily accessible resources close at hand will increase our visitors' sense of comfort in the galleries when faced with the often challenging examples of contemporary art.

Conclusion

Just Add Elephants? At heart, this paper addresses dual needs:

- the creation of compelling, rich media content around cultural heritage objects, elaborating a contextual knowledge web and variety of approaches to the objects museums display
- the preservation, parsing and display of an ever-growing library of content so it can be discovered by our visitors, both physical and virtual, in an intuitive and engaging way

Each challenge hides behind it a negative alternative: static, poorly produced content; monolithic, opaque, hierarchical interfaces; fragmentation and loss of content through the inability to carry older efforts forward in a cohesive and fresh way. The failure to pursue these goals would imply missing the opportunity to connect meaningfully with potential learners at their moment of maximum interest and greatest need.

The two initiatives described in this paper, *Pachyderm 2.0* and the *Making Sense of Modern Art Discovery Interface*, stem from our desire to meet those needs. *Pachyderm* was born at SFMOMA, but thanks to our partnership with the NMC will soon find greater applicability in the open source cultural heritage and higher education worlds. As for the Discovery Interface, it is presented here as a contribution to the field of knowledge gathering and e-learning in hopes that its set of visually engaging, context-sensitive menus and filters may contribute to an emerging discussion around representations of knowledge domains. It is our field's mission to keep finding more effective ways to activate the rich

and multi-layered meanings latent in our cultural collections - which differ from museum to museum, visitor to visitor, learner to learner.

The elephant referred to, of course, is Pachyderm. On the one hand, it serves as the content generator for the media-rich experience; on the other, it serves as one potential source among many for the variety of granular presentations/learning objects that discovery interfaces of today - and federated content repositories of tomorrow - will draw upon to meet our visitors halfway as they seek to engage little-known aspects of our cultural heritage, past or present.

Acknowledgments

My thanks go first to the SFMOMA directors who have supported and understood the need for this work over the years: John R. Lane, David A. Ross, and Neal Benezra; next to former SFMOMA Curator of Education John Weber, who co-conceptualized the Interactive Educational Technologies program and was an enthusiastic, exacting, and informed participant; Susie Wise, who spearheaded the push to Pachyderm and *Making Sense of Modern Art*; and fellow team members Tim Svenonius, Tana Johnson, and Stephanie Pau, with whom it is a pleasure to work every day. Additional thanks go to: our consulting partners on the two projects described, Kevin Farnham, et al. of Method, Inc. and the Perimetre-Flux and Idea Integration teams of 1999-2001; to Coe Leta Finke for her insightful reading of an earlier draft of this paper; and to Barbara Rominski, for her discerning help with the final version.

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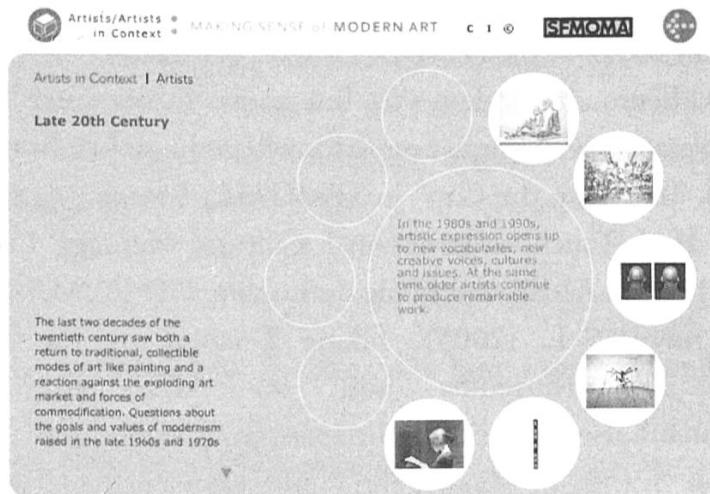
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Voices and Images of California Art (1998). San Francisco Museum of Modern Art: Classroom Curriculum Edition. Book and CD-ROM.

Appendix

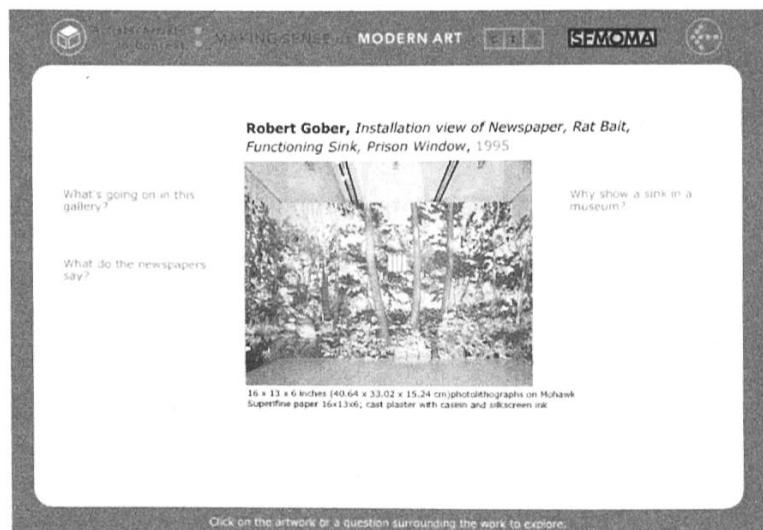
Pachyderm Display Templates

Artists in Context/Phone Dial Screen



This is a visual Table of Contents screen about an idea, a subject area, or even a curriculum. As you mouse over each image on the dial, that image comes up in the center and a text label appears. This serves as a sort of visual table of contents for a set of related objects or artifacts. Clicking on any thumbnail takes you directly to the Artwork Screen. A variety of looks-and-feel are possible for this screen. The Ansel Adams "context" screen is an example (www.sfmoma.org/adams).

Artwork/Exploration Entry Screen



One of our fundamental components—an organizing principle of the program—is the Artwork Screen, with the artwork at its center. You can either click directly on the artwork or object and go into the work to examine it more closely using zoom and pan functionality, or you can select one of the questions that surround the work to explore the context.

¹The second name, when given, is the non-art/generic title accorded by the Pachyderm 2.0 team.

Zoom Screen



This is a pan and zoom close-up of a room-scaled Robert Gober installation. Note that the navigation bar moves to the bottom. We can append up to two audio commentaries, as well as the museum credit line, which always travels with the image.

Variety of Media/Commentary Screen



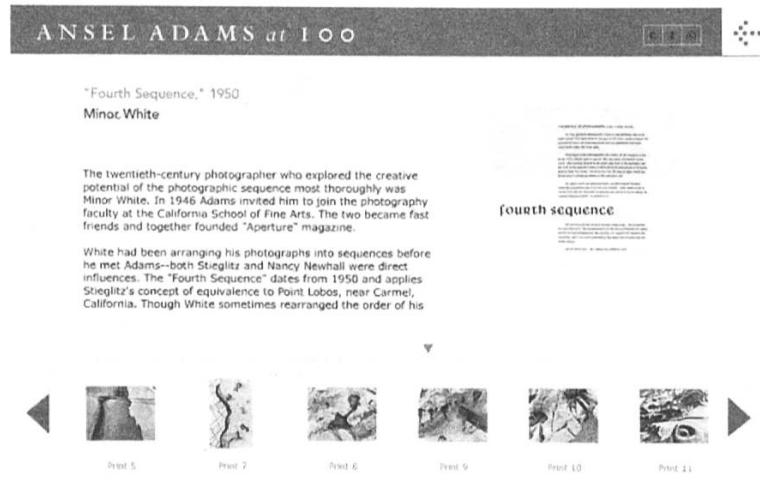
This is the closest thing to a coffee table book online. You can lead off with a video clip in the upper left, as we have here with Jonathan Katz talking about the Gober installation. You can also associate up to three other thumbnails in the right hand slots, each leading to enlargements with additional text, or alternatively to other media files like movies, animations, documents, or URLs. The overview commentary for this screen appears scrolling down the middle.

Onion Skin/Layers Screen



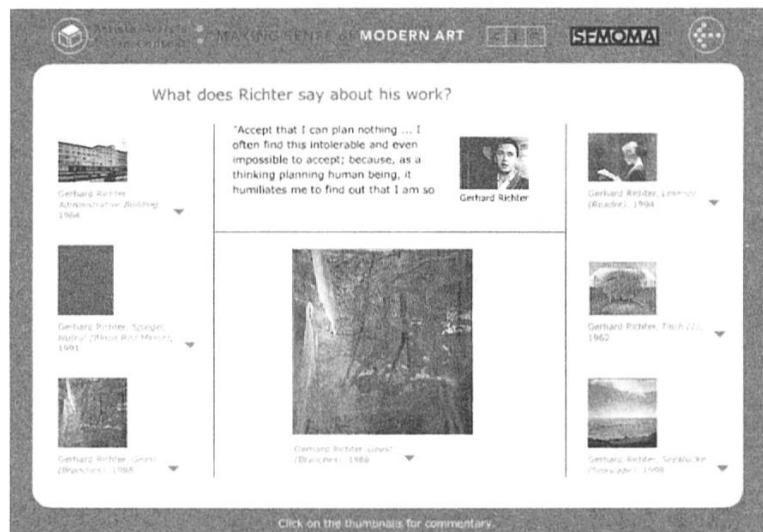
This screen treats multiple "layers" of a single topic. The overview intro is on the upper right. The arrows middle right refer to different dimensions of the topic: clicking on any one of them refreshes the media on the left and the commentary below. You can pack a lot of information into this screen: up to 5 layers comprising 15 images and/or videos, documents, etc., each accompanied by its own specific commentary.

Book Viewer/Series Screen



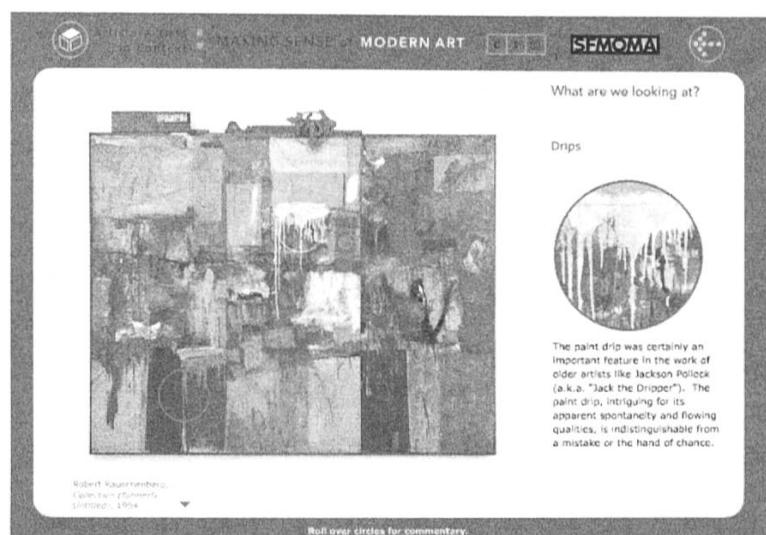
The Book Viewer is our document viewer for paperbased media: books, letters, manuscripts, and other ephemera. The opening screen provides an overview of the book and thumbnails of its pages. Clicking on any thumbnail brings it up in a pan and zoom format permitting easy reading, or allows you to page through them in sequence.

Collaboration Web/Aspects Screen



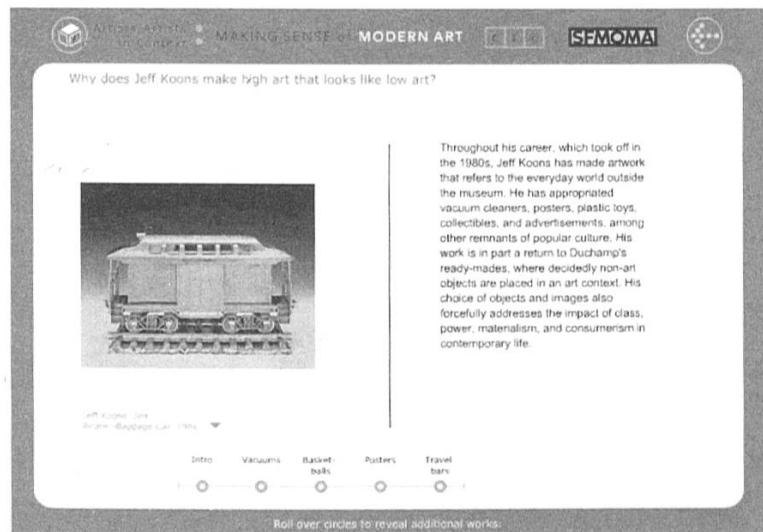
This screen is especially good for showing relations between different artworks or creators. Clicking on any of the side thumbnails refreshes the content at the center of the screen, both top and bottom. In this case, we are hearing painter Gerhard Richter's comments about each of the different styles in which he has worked. Conversely, this can be used as a "Critical Response" screen, in which six different opinions are expressed about a single catalytic object.

Formal Analysis/Detail Viewer



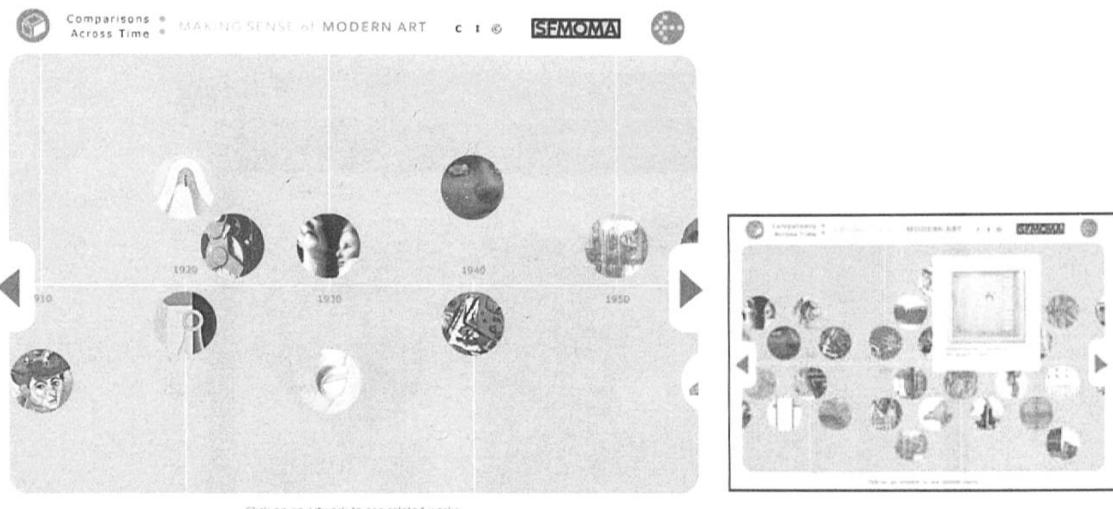
This screen enables the viewer to mouse over red circles on the main image to reveal close-up details along with a commentary on the right. It can also be used for maps or diagrams or biological specimens – any visual document that repays close scrutiny and is full of zoned information.

Slider Screen



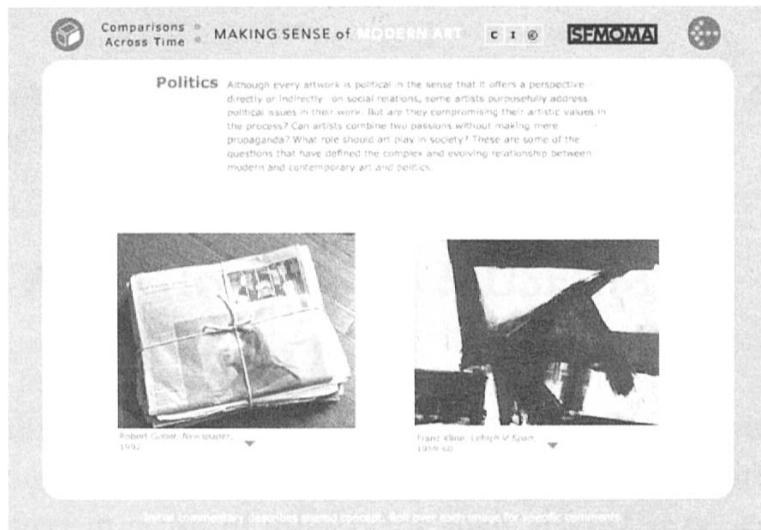
The Slider Screen is used to create either a chronology or a typology. In this case we see a sequence of works by artist Jeff Koons. As you pass your mouse over the circles on the bottom line, the screen above refreshes with new images and texts in sequence. There are five stops on this slider; some presentations use as many as seven.

Timeline



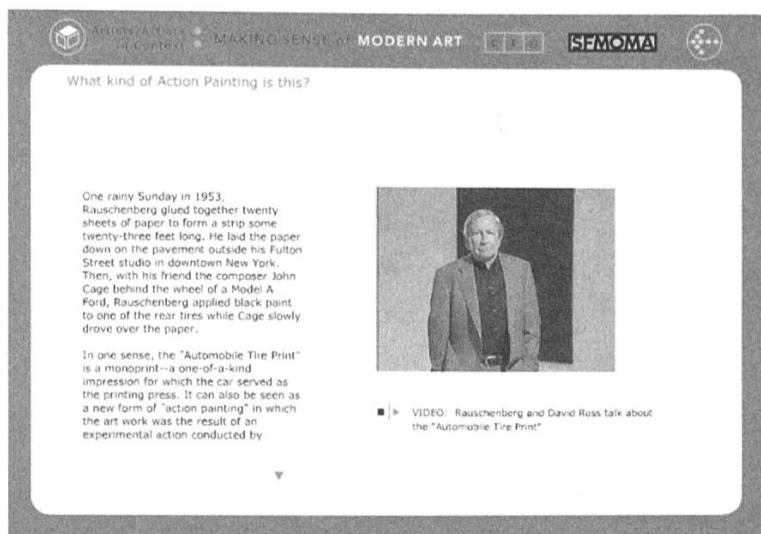
As you mouse over each circle on this timeline, a titled enlargement of the artwork appears (see inset). If you then click on the artwork or the object, other artworks or objects that share a common keyword or concept come near it from across the Timeline. Mousing over each one of these identifies it; if you then drag a comparison work to the central image, you will arrive at a comparison screen.

Comparison Screen



Here you see both objects on equal footing, united by the keyword/concept at the top. The screen's default state is a description of the keyword concept. Mousing over either of the artworks will change the text at the top to reflect how that particular artwork reflects the keyword concept.

Video Focus /Media Focus Screen



This screen is basically the Variety of Media screen without additional links. It displays a single media file and accompanying text.

