Research Report

Raison d'Etre: Embodying Design History and Rational in Hypermedia Folklore

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Abstract We are developing a hypermedia design history and rationale application, Raison d'Etre. One view of this project is that of an empirical study of the design process, compiled and presented in random access video, text, and graphics. A second view is that of a prototype system for presenting history and rationale for a variety of purposes within and beyond the design process. This paper summarizes the motivation, basic vision, current state of progress, and broader possibilities of our project. (This paper was updated for project status as of August 4, 1992).

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Keywords: documentation, history, collaboration

1. Introduction

We are studying the capture, crafting, and use of various kinds of information that is, or can be, produced through the course of the design process. We want to understand what information is used in the design process, and how the availability and use of information could be better supported.

While some design tasks may be carried out by individuals, most commercial system development involves the coordinated activity of groups of people. Even those design breakthroughs created by individuals are explained and worked out

in groups. We have observed (see Section 2 below) that members of design projects sometimes preserve and exchange informal history and rationale: they "make" a history and rationale for their project by telling stories among themselves. This material may play a variety of roles in the design team's problem-solving and group dynamics. One way to study this is to collect testimony from design team members. This provides a view of what information was available and how it was used. These reports need not be restricted to the technical aspects of the system being designed, but can encompass the entire design context including organizational and interpersonal issues as well. Testimony collected from different persons or from the same person at different times can be compared and contrasted to study patterns of consensus, diversity and change.

Such information could help us to better support the design process as well as to better understand it. A collection of the original designers' renderings of the history and rationale of their project at various points in the design evolution might be a useful resource for further design work (even by that same team), for developing documentation, for maintenance and redesign, and for education about the design process (as a case study). To facilitate exploration of these possibilities, we have built and are developing a hypermedia design history and rationale application, Raison d'Etre (see Section 3 below). We are collecting videotaped testimony from members of a design team as their project goes forward from initial conception to deployment in the field.

The Raison d'Etre project can be seen as having two identities. On the one hand, we are conducting a study of system design with the intention of presenting a report of the study through interactive hypermedia. Our main data are videotaped testimonies gathered from the design team members; we are shaping (interpreting) that data into a rich multi-faceted characterization of the design project. Prima facie, such a report is unusually rich: The attitudes of speakers toward what they say is demonstrated, not just inferable or attested from the li-

teral content. Viewers routinely experience empathy with speakers and thus do not merely understand what is said, but to some extent feel it. We believe that this is important in capturing and relating the social context of the design situation. It has been argued that understanding this broader social context is an important element supporting design (Karat & Bennett, 1990). This use of videotaped reports contrasts with many other studies in which design team protocols are rendered principally as textual transcripts (Carroll, Thomas & Malhotra, 1979; Curtis, Krasner & Iscoe, 1988; Karat & Bennett, 1991; Rosson, Maass & Kellogg, 1988).

On the other hand, we are using these rich data to build a prototype of a design rationale application to support reflection and understanding about design activities. Users will be able to explore this particular design project to pursue a number of general questions about design — human relations issues for design teams, how technical issues are discovered, framed, investigated and resolved, what it is that the design team was "really" after, and how the concerns of the design project evolved through time (that is, to see design as an historical phenomenon). While some work does attempt to support design by supporting exploration (e.g., Bodker, Knudsen, Kyng, Ehn & Madsen, 1988; Muller, 1991), we feel that exploring the stories behind a design will provide rich additional insights. This contrasts with many other tools for codifying design history and rationale which attempt to reify chiefly the logic and reasoning behind a design via tables or graphs of textual entries (e.g., Carroll & Rosson, 1991; Conklin & Begeman, 1988; Conklin & Burgess Yakemovic, 1991; Fischer, Lemke, McCall & Morch, 1991; MacLean, Young, Bellotti & Moran, 1991).

2. Making history by telling stories

One inspiration for our work was an informal interview study of the history of two design projects (Note 1; see also Carroll, 1991). Both projects had been running for more than ten years, and hence had a significant history to query; one involved a media workbench and the other a user interface architecture. In these interviews with the design team principals, project history was conveyed largely through stories that reified significant issues, attitudes and events.

Three themes were salient. First, what is often called the project "vision" appeared to be codified in stories about the work. Stories more than ten years old about how the project principals met and formed a bond directed at a key technical challenge were told vividly and spiritedly, like they had happened last week. Stories about how project members had pulled together into a team and faced severe constraints were told with ardent pride.

Second, there was generous allowance for individual viewpoints and personal meanings in the stories. Because of the medium, oral histories are personal: the storyteller adds the telling. This is a wonderful property for managing inevitable disputes: the different perspectives belong ipso facto to the different tellers and can co-exist in a way that two design specification documents perhaps could not. In our study it turned out that storytelling was even a basis for ad hoc role-differentiation: some team members were credited with being best at telling a given story.

Finally, there was evidence of historical reconstruction in the designers' stories. History, of course, is not just a litany of facts, it is a living relationship in which people try to understand the past, given the present. The designers were making sense of myriad complex particulars in the present; they sometimes reworked the past to simplify or contribute structure to this task.

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These patterns may seem a bit mundane: how could it be otherwise? But the designers seemed to enjoy these retrospective interviews, all were clearly engaged by the task. Their oral histories were also engaging to listen to, and often rich in arcane technical details (cf. Orr, 1986). The present work continues to develop understanding of the role that informal information like stories can play in the design process. But it also allows us to explore the consequences of better supporting the development and management of this sort of design information.

3. Hypermedia folklore

We envisioned collecting videotaped interviews with designers, along with other materials, to build a hypermedia application similar to that described by our colleagues Frishberg, Laff, Desrosiers, Koons and Kelley (1991). Their application, "John Cocke: A retrospective by friends," consists of a database of stories about John Cocke told by his friends in video clips. The stories are indexed in various ways to support specific navigation and query (e.g., the development of the RISC architecture), but users can also just browse and let a picture of John Cocke, the man, emerge from the various views.

Such applications create a kind of hypermedia folklore. Instead of directly hearing anecdotes about John Cocke (that is, being physically present to hear the story-teller, which only very few people can do in any case), or perhaps reading anecdotes about John Cocke in a biography, one watches and listens as the people who shared those experiences with John Cocke recount the stories. Analogously, instead of reading the history and rationale of a design project, one could see and listen to the people who did the work sharing the insights and experiences they had at particular points in time, see how the project was embodied at various points, gain insight into the chart-bullets that were used to describe it at that time, etc.

As shown in Figure 1, the primary view of the Raison d'Etre database is extremely simple: across the top of the screen are images of the design team members. Across the bottom is a color-spectrum time-line: red (to the left) is the inception of the project, violet (to the right) is its end. In the middle of the screen are five icons depicting five categories used to organize the hypermedia database at its highest level. Clockwise from the leftmost arrow these are "looking backward," "project visions," "looking forward," "human issues," and "technical issues."

"Looking backward" provides access to data objects bearing on project accomplishments and the reflections of team members on previous points in the design process. "Project visions" accesses specific technical views of the project (e.g., its potential impact on its users) as well as high-level views of the project's potential impact on groups of people or on society. "Looking forward" includes anticipated problems, changes, and outcomes. "Human issues" refers to data bearing on group dynamics, personal relationships, communication, and collaboration. "Technical issues" consists of design history and rationale in the more conventional sense, that is relating to specific design characteristics and concerns. We have classified our data into these categories under the assumption that we would develop subcategories within them as appropriate. To date we have developed subcategories for technical issues and human issues, but have not subdivided the other three categories.

All of the graphics on the screen (the team members, the time-line and the category icons) can be used to make selections from the database in two ways. A user can double-click on one of them to receive an explanatory overview specific to that graphical representation. For the member pictures, the user would hear a spoken self-introduction (e.g., "I'm Mike Witt; I studied software engi-

shape?" Technical issues and collaboration/cooperation issues interact of course: "How did Mike and Donna resolve their contrasting views about the role of natural language?" or, "How did the dinner party help coalesce the consensus vision?"

Users might also be interested in exploring the history and rationale of this project as a *case study* of the design process. They could study the relationship between project vision and implementation: "How did the vision as of October 1991 get implemented in the prototype of June 1992; what changed and why?" or, "How did the vision itself change during 1992?" They could study the organization of the process: "When did the designers have a final understanding of the project requirements?" They could study personnel issues: "How did the leadership roles evolve and differentiate in the project?"

This is a diverse set, but these are only the "browsing" scenarios. We expected that some users might want to build their own analyses of design, perhaps marking some of the hypermedia objects they had viewed, building them into novel sequences and storing them for later use. Indeed, some users might want to alter the rationale application itself, perhaps reorganizing substantial portions of the database and revising the user interface to make use of the new organization.

This rich and open-ended scenario analysis pointed to the need for a simple and flexible organizing rubric for the rationale database. Many of our users, we presumed, might have a rather casual interest in the history and rationale database, and would be pursuing fairly general questions about design and the group design process. Those with a more serious interest might well be interested in only certain aspects of the database; for example, someone might have an interest in human relations issues in the design process but not in the technical issues of the particular design process we studied.

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the menu. For example, selecting "technical issues" would display a menu which included "lexical network," "high speed network," "course content," and other topics subdividing the "technical issues" category.

Selecting a topic gives the user the option of viewing an exposition on the topic (assembled from video clips and other media) or searching through an index of all entries which relate to the topic. For example, if a user were interested in tracking the rationale for changes in the design of the "lexical network" from project inception through prototype through final product, he or she would select all periods in the time line as well as "lexical network" from the "technical issues" menu. The system would then offer the option of viewing a prefabricated sequence of hypermedia data items related to the query (by selection of "Preview" from the display) or of examining individual target items related to the query (by selection of "Find Clips" and then of specific clips returned). Figure 2 presents a screen from the Raison d'Etre prototype showing the listing of clips returned for a Find Clips request specifying a designer (Sanjaya) and a category (looking forward). (In the final system, returned items will be displayed iconically). From this listing, specific clips can be selected and viewed (via the View button).

Figure 2

The links among the clips in the hypermedia database are implicit in the categories assigned to each clip. Users can select lists of clips by selecting categories, and can then browse through them as they wish. Although we are designing an initial category structure for the clips in the database, the system also allows users to create new categories and thus design their own organization of the data.

The current prototype is the initial design we developed; we expect it to evolve and change, perhaps radically, as we get concrete experience with the system. We have attempted to utilize a totally iconic interface for data retrieval. We feel that this has worked fairly well thus far. One can form fairly complex queries without resorting to text entry, and we feel that this will hold for the great majority of the queries users are likely to make of the system. Recall that the user makes selections from the initial screen (Figure 1). These are interpreted in a reasonable way to form a query. That is, if the user selects two or more team members, we assume that he or she is looking for clips from any of the selected individuals, but if two or more topics are selected we assume that the user is looking for clips relevant to all selected categories. This provides a simple query interface at the cost of excluding more complex queries requiring explicit specification of logical operators.

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4. Priceless moments

To date, we have constructed interview questionnaires and conducted two rounds of interviewing. From these interviews, and from our scenario analysis of the application summarized in the preceding section, we have evolved our initial set of conceptual categories for the Raison d'Etre database. In the first round we interviewed the 10 key design team members and collected 11 hours of raw video. These interviews were conducted about three months into the project; a significant amount of upstream planning had occurred, but little design or prototyping work. From this first round, we arrived at our first approximation of the database categories. Developing this preliminary analysis of the video data included "collecting" related clips, that is, assembling raw video clips onto a set of 11 collection tapes, each representing a conceptual category (Van Deusen & Frishberg, 1990).

In the second round (collected four months later), we interviewed the, now 9, key team members, collecting 12 hours of raw video — including a demonstration of the current prototype. Our collection categories were refined in view of the initial design of their application revealed by this second set of interviews. At this time, we are organizing the data via the five database categories described above; our earlier eleven categories have been subsumed under one of the five current categories. We have also redesigned our interview questionnaire so as to evoke material in our five organizing categories, while at the same time leaving room for further evolution of the database categories. We expect to conduct at least three and perhaps as many as five additional rounds of interviews, but we have implemented a limited version of Raison d'Etre now based on the first two rounds in order to get early feedback on our design.

We have been extremely impressed with the good will and interest the designers have shown towards our work. At the outset, we committed ourselves to

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staying out of the way when time was short or tensions were high. This compromises our effort to an extent: if we collect information in a staggered manner only in the pauses between more frenzied periods of activity in the project, we deprive ourselves of some of the most dramatic material. The positive side of this tradeoff, however, is that we better preserve the team members' dignity, privacy, and good will towards us and our own project (this is a bit like the contrast between a roving minicam interview and a press conference; we've opted for the latter). The current state of affairs is that team members seem interested in when the next round of interviews will be and eager to participate again.

At least to this point, we have eschewed open sharing of our materials with the team members. Immediately after a round of interviews, we invite them to view their own clips. We do not invite viewing of other team members' interviews or of one's own interviews more than a few weeks after the videotaping. We have several motives for this. First, although we believe that constructing informal history and rationale databases could be the basis of useful tools for designers, we do not yet feel confident enough that we know how to do this and do not want to use the design team we are documenting as an experimental test case. Second (and this is a specialization of the first point), we worried, and worry still, that the contrasting technical views might be exacerbated as personal contentions by having them reified and publicized. It is inevitable that team members will disagree at times; we want to explore this phenomenon and we believe that it can in principle be useful to contrast individual positions. But we surely do not want to do this in so artless a manner as to force the team members to resolve conflicts in point of view that are better tolerated, or to relive conflicts that have been resolved or obviated by the passage of time. We're being conservative.

A third reason for not being more open with the database as it develops is also related to the first point above. We wish not to interfere with the very process we are documenting. For example, we need to be careful not to create

normative behavior and attitudes. Interviewing the designers at all can only make them more self-aware, and hence perhaps unnaturally consistent and less spontaneous. But having them view and review our materials could create significant normative pressures that might, in the end, *produce* more than *capture* design history and rationale. Such issues cannot be evaded in "open system" research (Bhaskar, 1979), that is, in studying systems that are not under the investigator's control, but we want to acknowledge and bound these issues as best we can. Part of this hinges on the difference between the design process as it now exists and the design process we would like to create, but which we can create only by working actively within current practice (we return to this topic in the final section).

The exercise of including time as a central dimension in Raison d'Etre has many consequences. Complex processes, like the work of a design team, consist of many priceless moments, each unique in many ways. For example, simply identifying who the key team members are is bound to where you are in time. People often become key team members while an issue for which they are relevant and involved experts is still open. In our case, two team members were central while the issue of defining an approach to multimedia data architecture and authoring support was being defined and resolved. Once this issue had been provisionally settled, a third person took responsibility for developing the agreed-upon approach in collaboration with one of the original two. In consequence, for one round of interviews, we focused closely on the first two people, but we shifted focus to the third for the next round.

The set of key issues also changes through time. In part, we were led to the five database categories because finer-grained taxonomies of our materials seemed ephemeral. For example, in the first round of interviews the chief technical issue discussed by the team was the nature of the initial proof-of-concept prototype. However, "Prototype" does not seem to be a lasting category: subse-

quently the team has articulated the more detailed and lower-level technical concerns that came up in the course of developing the prototype. In our first round of interviews, we collected a lot of information on how the group had become a social structure and how various members saw the work as oriented towards science and technology development. As the project has become more concrete and focussed, these topics have receded somewhat into the background; they are now interesting only insofar as something might have changed.

Finally, the stories and comments that the team members recounted were in some cases strongly tied to the time of the interview. For example, in the first round of interviews we collected several accounts of how the team had selected a sample content domain for their proof-of-concept prototype. These accounts were very interesting to us, both because we know that the sample domain can often exert a large influence on the system itself and because the rationales we collected were personalized in interesting ways: from a team member more identified with project vision and management, we got a rationale in terms of social and pedagogical values; from a team member more identified with implementation, we got a rationale in terms of availability of multimedia data and amenability of available data to the mechanisms of the prototype.

What is especially interesting about this example is that only a month later the team changed their sample domain due to problems with data availability and worries about social controversy. In the second round of interviews we were able to gather a solid and broad-based rationale for the *new* sample domain — the previously tight rationale for the now-rejected domain is no longer observable with the fidelity observed in the first round. In fact, some designers' stories forget its very existence. That early rationale has become a priceless moment in the history of this design project: It will not come again.

Another example comes in the stories of collaborative work. Early in the project, the team met often in "all-hands" meetings to establish goals and to carry

out high-level design. In our first round of interviews, several team members told the story of a particular group meeting in which major functional objectives were set, and which led to a social outing that accented some of the personal commitments team members had brought to the project. As the project progressed, activities shifted from planning to development of the proof-of-concept prototype, and our second round of interviews evoked little discussion of general group meetings. Instead, team members recounted episodes of intensive technical interaction on particular subproblems in the design.

As we said at the beginning of this paper, we are interested in understanding what information is used in the design process. We believe that the data contained in Raison d'Etre provides a useful picture of this. Our data does not focus on the traditional products of design such as functional specifications and final code, but it does contain the designers' views of what they were doing. Does such a packaging of information used in design offer support to the process? At this point we do not know, but we will explore how designers respond to and might use such a presentation of history and rationale, and how others might use it to better understand a design project.

Figure 5 goes about here

5. Some lessons learned in the development of Raison d'Etre

Developing hypermedia reports from collections of video clips is a difficult and time consuming activity. In deciding what information to include in Raison d'Etre and how access to it should be provided, we are faced with a dual problem: we have a lot of video data (from the first round of interviews alone we collected 300 clips), and video data is not easy to work with. Our initial approach was to roughly categorize the clips, physically copying them onto collection tapes (Van Deusen & Frischberg, 1990), and then in a second pass to more finely analyze and evaluate each clip and its textual transcription, collecting detailed notes on

index cards. In this way, we hoped to validate and/or develop our categorization scheme and through that to begin to detail structures to assist people in browsing the Raison d'Etre database. Proceeding in this manner, we would have edited and re-edited the index cards, collection tapes, and transcripts until we could have specified a final clip selection and ordering for a laser disc (this was the production process for the John Cocke application).

Instead, we elected to build the system described in Figure 1, but to have the transcripts of the video clips "stand in" for the video itself. With approximately one person-month of effort, we were able to develop implementations on both IBM PS/2 and Apple MacIntosh platforms. Working with a hypertext "skeleton" of our target hypermedia system has enabled early experimentation with the user interface, and has greatly improved the efficiency of our analysis tasks. Our current analysis procedure is to view the "raw" video data in a single pass to parse the start and finish times for clips and to assign category terms. An example of the clip descriptions we create is in Figure 3 (this screen depicts the response to a request to view the first clip listed in Figure 2).

```
Raison d'Etre Video Clip Description        ( Next )  ( Return )

Speaker: sanjaya
Time:    time1
Start:   04:06:44:03      Finish: 04:07:43:23

Category: authoring  tools
          looking  forward


Comment: contrasts to bobs account of toolset.  talks about
         backend vs frontend.  good clip.

Text:    Bob Mack and Peter Malkin really have a very very
         tough problem in deciding what the underlying
         substrate for the multimedia authoring system is to
         be. Mark Laff has for a long time been developing a
         very solid, and very rigorous system that's almost
         ready for production use, that he calls IMP.  Now
         Mark's system has a few things, lacks a few things.
```

Figure 3

In the process of working with this system, we have discovered some particularly useful aspects of incorporating textual transcripts as an integral part of a system using video data. Of course, it is extremely useful to be able to do string searches, for example, to find the clip in which Bob said "gobbledegook." But one can also search for *all* clips in which a particular phrase occurred, or for all clips with certain category terms. When we view the video, we rate it on a simple three-point scale of "weak," "ok" or "good" (the clip in Figure 3 is rated good); thus, we can search for all clips in which Sanjaya is the speaker, "authoring tools" is a category term, and quality was rated as good. Indeed, using the start and finish times, we can also query the total time of all such clips. This is a tremendous help in planning an application like Raison d'Etre: we can always see exactly what we've got, where we have too much and where too little. Knowing how much "good" information we have on various topics also helps us know where to focus in subsequent interviews. It can help us critique and refine our categories by showing which categories are more discriminatively partitioning the set of clips.

We now view this coupling of the transcript text and video data, and the flexibility it enables for restructuring the hypermedia database, as a key feature of our system — perhaps even an essential feature. The contribution a particular clip makes to our application can only really be assessed in view of the data we collect subsequently and throughout our study, hence we need to be able to continuingly modify our evaluation of given clips and the themes they contribute to. Just as the designers we are studying review and reinterpret their work, so may we and the future users of our system wish to revisit and restructure the categories and groupings of data in Raison d'Etre.

6. The ethos of history and rationale

The ethos of work is to address the task at hand. Design work, like all professional endeavor, can sweep us into a narrow space of local and low-level concerns. To a great extent, it can be no other way: When the task at hand slips out of hand, one's sense of progress and purpose evaporates. When too many considerations or possibilities are allowed to remain active, problem-solving becomes thrashing. Nevertheless, as Donald Schön has stressed in his studies of "reflective" professional practice, obtaining successful solutions to difficult problems frequently requires a coordination of reflection and action, periodically stepping back from, analyzing, and playing with the task at hand, while at the same time performing that task. Schön (1987) sees it as a higher level of skill for a practitioner to be capable and willing to reflect in action.

This simple analysis entrains a dual focus in design rationale studies and tool-building: In the immediate term, reflective practice should be taught and encouraged through tools and representations that minimally interfere with the task at hand. As Fischer et al. (1991) put it, we must strive toward "making argumentation serve design." This can be a pretty severe condition. If we obstruct designers' current practices, we may never get the chance to see whether our understanding and vision of design is useful or not. Our tools and analysis, like so many others before, will be rejected by users who are understandably caught up in the task at hand.

But in the longer term, we cannot afford to always respect this condition. Practices co-evolve with the technologies that support and constrain them; if we are too responsive to current practices and technologies, then we become agents of social and technological inertia. Accordingly, a second focus of work on design rationale needs to take concepts like Schön's reflection-in-action as the vanguard of an emerging supplementary, or perhaps even alternative, ethos of work. To accurately assess the benefits of reflective practice, it may be necessary to first assume that they can exist: to examine the consequences of actively encouraging and facilitating reflective practice over significant spans of time and activity (this is a fundamental paradox in social science research, e.g., Habermas, 1972; Sayer, 1984).

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Our thinking about Raison d'Etre attempts to respect both foci of design rationale studies and tool-building. We anticipate that the immediate contribution of Raison d'Etre will be in education and research, reifying example design processes more vividly than retrospective memoirs and capturing broader rationales for design decisions and outcomes than logic-oriented approaches. Students of design could use our application for case study analysis of, for example, vision-formation, reflection-in-action, technical collaboration, point-of-view, and historical reconstruction. For many such topics, Raison d'Etre would be a salutary information resource.

For the longer-term, our project is committed to the tractability and utility of a new construal of the design process, one which views it not merely as a product-oriented problem-solving process nor as an argumentative discourse (both of which it surely is), but as fundamentally historical and collaborative, as a social process of narrative-building. We are well aware that the multimedia technologies we are working with are fast becoming available and digitally manipulable. When collecting and organizing video narratives is as easy as constructing logical design rationales (i.e., text files), the applications of hypermedia design history and rationale could grow to include synchronous and asynchronous design discussions and note-taking. When these technologies become commonplace and thereby can penetrate the inner loop of the design process, concepts and models for hypermedia design history and rationale should be poised to create the future of design work.

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