

THE PRES/URRECTION OF DEENA LARSEN'S "MARBLE SPRINGS, SECOND
EDITION"

BY

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THESIS

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Abstract

The following is a report on one effort to preserve Deena Larsen's hypertextual poetic work *Marble Springs, Second Edition* (MS2). As MS2 is based on Apple's HyperCard, a software program that is no longer updated or supported, MS2, and other works created in the same environment, face extinction unless action is taken. The experiment below details a basic documentary approach, recording functions and taking screen shots of state changes. The need to preserve significant properties is discussed, as are the costs associated with this preservation approach.

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Chapter 1: Introduction

Hypertext fiction and poetry, or electronic literature that is written using links to allow the reader/player to follow the narrative into any number of non-linear paths designed by the author(s), has a rich history predating the development of HTML and the creation of the World Wide Web. The concept of print hypertext dates from Jorge Luis Borges' short story "The Garden of Forking Paths" (Borges, 1941), according Wardrip-Fruin and Montfort (2003, 29), although Borges and his contemporaries did not refer to the non-linear novel described in the short story as "hypertext." Vannevar Bush brought the idea of associative links to the electronic realm with his 1945 article "As We May Think" (Bush, 1945). The first working hypertext computer program came in 1967, with the "Hypertext Editing System," developed at Brown University (Wikipedia, 2011). The idea of using links to create connections between information continued to develop in 1970s and 1980s as computers moved from the mainframe room to the desktop and to the home, and hyperlinks began to appear in some retail computer programs.

A number of e-lit authors, including Deena Larsen, experimented with early commercial software programs, manipulating their functionalities to create hypertext fiction and poetry, including Apple Computer Inc.'s HyperCard. HyperCard was intended as a software development package, database application, and/or electronic Rolodex, using hypertext to link virtual "index cards," allowing Apple Computer/Mac users to create "stacks" of cards that would complete computing tasks. Game programmers also saw how to make use of HyperCard, including the makers of the popular game "Myst" (Wikipedia, 2012). And, as noted above, HyperCard became a platform for hypertext authors. A stack of cards could be authored with cards containing links to other cards, allowing for non-linear narrative creation. Deena Larsen used HyperCard to author *Marble Springs*, released by Eastgate in 1993, and *Marble Springs*,

Second Edition, an updated and more complex version of the tale, in 1997, which was never released.

Marble Springs, Second Edition (MS2) and HyperCard illustrate the preservation challenge of software obsolescence: Apple stopped updating HyperCard in the late 1990s; Apple stopped selling HyperCard in 2004; HyperCard runs natively on Mac OS 9 or in “Classic” mode or with an emulator on more recent machines (Wikipedia, 2012); there is no guarantee that Mac will continue to create operating systems that support “Classic” mode; computers that ran HyperCard in its native environment are getting older and may not work much longer; and, the MS2 HyperCard stack cannot be read unless you have a working version of the HyperCard software. This means that, for the general public, *Marble Springs, Second Edition* is extremely rare, existing in a few copies traded hand-to-hand. MS2 is in danger of becoming lost literature.

How lost? Larsen has several old computers running some version of *Marble Springs* (including the corrected archival version), the most recent a 2004 Mac laptop, running OS 9. I gave a copy of the corrected and archival version of MS2 to the *Deena Larsen Collection* at the Maryland Institute for Technology in the Humanities. I have three copies of MS2 backed up and one running on a 1999 grape iMac. There are several authors Larsen shared MS2 with, but whether they have working files or running computers is unknown.

To prevent this loss, there are several ways to approach the preservation of these old HyperCard stacks. The first is to simply take a disk image of the computer that *Marble Springs, Second Edition* is housed on, preserving the environment against storage bit-rot, and hoping that some day in the future we can create a method to read it again. We can perhaps think of this as the cryogenic, or cold storage, approach. Secondly, a documentary walkthrough of the programmed card stack can be created, noting links and important functions on each card, their

relationship to other cards, and keeping pictures of each screen and screen-state, for visual documentation. A third option includes migrating *Marble Springs, Second Edition* into modern software that emulates the original HyperCard environment, allowing the stack to be read or played. A fourth alternative is to remediate MS2 on existing software platforms, such as a wiki, which MS2, with its invitation for users to edit, resembles. This however raises the questions of whether we are preserving a work, or creating a new one. This paper will focus on the second, the documentary approach, while mentioning the others as appropriate.

In this paper I explore and report on the respective merits of this approach in terms of

- 1) maintaining significant properties of the original work (visual appearance, behaviors);
and,
- 2) affordability, or the explosion of costs, including temporal, financial, and physical,
that can occur with even a simple preservation approach.

Methodological Approach and Outputs

As Montfort and Wardrip-Fruin (2005) recommend in “Acid Free Bits,” it is important that e-literature authors “Document Early, Document Often.”

Documentation of a system can consist simply of a few screenshots that sketch out the experience — although hardly a good indication of how a complex system functioned, this documentation is better than nothing. It's far easier to take such screenshots while the work still runs, and it's easiest to take them just after the work has been completed.... Similarly, extracting the texts embedded within the system and preserving them as plain text, at the end of the revision process, is usually relatively simple and can be invaluable later. More extensive documentation — for example, of the processes of interaction and the possibilities

for content generation — may not be as simple to assemble. However, such documentation is highly recommended when creating work using systems that present preservation challenges (e.g., closed, proprietary systems; systems that depend on specific network resources or special hardware). As with much interactive and performance art, documentation may be all that remains of an innovative work of electronic literature.

Given the state of *Marble Springs, Second Edition* at the time this project was started, the efforts described here and documented in Appendix WWWWWWW represent that complex documentation described above, which was not undertaken by Deena Larsen at the time she completed MS2. This lack of documentation put MS2 at long-term risk through obsolescence. Appendix WWWWWWW can be seen as filling that gap. Taking advantage of still working machines and copies of software, I decided to do a close documentation of MS2, mapping each link with .txt documents and screen shot .tiffs and .jpgs to create a “flip book” or a model of the HyperCard stack that would allow scholars and players to at least get a sense of how MS2 would have operated. Further, in recent years, software developers have created a number of programs that purport to migrate HyperCard stacks into new formats, allowing them to run on modern operating systems.

This paper reports on the outcomes or progress made in the following experiments:

- 1) Performing a complete walkthrough of *Marble Springs, Second Edition*, documenting each card and its links with .txt files, and .tif and .jpg screen shots. This step is key preparation for the migration step to follow; and,
- 2) Migrating “Marble Springs 2” using one modern software program—SuperCard.

To preface what is to come, Experiment 1, the walkthrough of MS2, makes up the bulk of this report, and the entirety of Appendix A through Appendix WWWWWWW, which run into the thousands of pages. As well as the details of these experiments, the following pages will include a brief narrative on the history of *Marble Springs, Second Edition*, and this project, and a discussion of the preservation of significant properties of digital objects and how that concern is reflected in my approach.

Chapter 2: Preserving Significant Properties

When preserving digital works we are often confronted with decisions about which functions, or significant properties, of the work are vital to save, and which are not. The JISC (Joint Information Systems Committee) describes significant properties (JISC, 2010) this way:

Significant properties, also referred to as “significant characteristics” or “essence”, are essential attributes of a digital object which affect its appearance, behaviour, quality and usability. They can be grouped into categories such as content, context (metadata), appearance (e.g. layout, colour), behaviour (e.g. interaction, functionality) and structure (e.g. pagination, sections). Significant properties must be preserved over time for the digital object to remain accessible and meaningful.

The JISC goes on to point out that in the preservation process, some properties may be more significant than others. For example, the intellectual content of a text is generally considered more significant and worthy of preservation than the pagination of the text. However, poetry, pagination and page layout may be considered just as important as the words themselves, as they may cue pauses and change meanings.

The first decision that had to be made about preserving *Marble Springs, Second Edition*, then, was what are the significant properties of the work? Then, which of those can be saved? Studying the various iterations of *Marble Springs* we can make some decisions about what properties are most significant.

The History of *Marble Springs*

Marble Springs, as Deena Larsen writes (Larsen, 2012a), has gone through a number of iterations in its history.

- *Marble Springs* 0.0 had text written on index cards, taped to a model train layout, with tangles of colored embroidery thread showing the connections between characters;
- *Marble Springs* 1.0 came to life using HyperCard, as part of Larsen's master's thesis in English at the University of Northern Colorado, and later published by Eastgate Systems. In HyperCard, Larsen could use hyperlinked words and graphic buttons to illustrate and suggest connections between characters, rather than thread. And Larsen invited reader/players of *Marble Springs* to write their own poems and stories about the characters in *Marble Springs*, and send them into Eastgate for inclusion in updates;
- *Marble Springs* 2.0 was the intended update for Eastgate, including new poems written by a dozen contributors, and new characters added by Larsen. This update was never published, but maintained the hyperlinks, and the desire for more reader contributions;
- *Marble Springs* 3.0 is the latest iteration, based on the link maps and images I created while preserving and correcting MS2 and shared with Larsen, now on a wiki < <http://marblesprings.wikidot.com/start> >, and is closer to how she imagined *Marble Springs* from its inception. Words and images still function as links, and readers are still encouraged to contribute.

The Significant Properties of *Marble Springs*

While *Marble Springs* 3.0 had not existed until I had finished mapping all the links in MS2, I had met with Larsen a number of times at a conference and at her home and discussed her intentions with *Marble Springs*. Further, after receiving several computers from Larsen, I read/played MS2, and got a feel for the hypertext. Based on the work's history, those discussions, and my user experience, we can list eleven significant properties for MS2. These eleven will fall into the categories suggested by the JISC above: content; context; appearance; behavior; and structure. Some will fall into two or more categories:

1. Intellectual content (content): The poems, institution descriptions, character biographies, instructions, pop-ups, references, and other text elements that help to make up the history of Marble Springs and its denizens are the core that all other functions and features work with;
2. Textual hyperlinks (content/behavior): Hyperlinked words, denoted by underlining, in the poetic text or in the prose biographies, instructions, descriptions, and pop-up windows connected characters and institutions to one another, in obvious or subtle ways;
3. Graphical hyperlinks (content/appearance/behavior): Most graphic elements served as buttons, functioning either at the meta-level, enabling help or navigation functions, or at the content level, suggesting connections between characters or opening pop-up fields with more information;
4. Primitive graphics (content/appearance/behavior): As Larsen (2011a) writes, "The graphics in Marble Springs 1.0 were designed to provide a dissonance between computer reader expectations and the time. Even by 1993 standards, the graphics

in *Marble Springs* are primitive.” The primitive graphics help to connect modern reader/players to the late 1800s, suggesting age, even while the work is experienced on a computer;

5. Animations (behavior): Larsen made use of HyperCard’s animation functions in some places, mostly in the form of screen transitions. Effects such as fade and checkerboard were employed. The best use of zoom open was to card 015, the Graveyard, which zooms open slowly, helping to underline a feeling of dread.
6. Audio (behavior): Some MS2 cards or events used audio effects. Whenever a reader/player connects to card 028, The White Owl saloon, they are greeted by the sound of five gunshots;
7. Enabling user contributions and editability (content/behavior): MS1 invited users to write, into the copy of *Marble Springs* on their computer, their own poems and biographies of characters; make marginal notes as they discovered connections between characters; create new characters or institutions; in other words to interact with the hypertext, and become co-authors of the work. Reader/players who added content were then invited to send their additions to Eastgate for inclusion in future releases. As MS1 was released before the introduction of the World Wide Web, each reader/player’s version of *Marble Springs* was unique to them, and could not be easily updated with other contributions, except centrally. MS2 incorporated the changes sent in, but was never released. Larsen, in our conversations, said that she always wanted *Marble Springs* to function more like a wiki, where contributors would work with the content and each other to remake and modify the work;

8. Non-linear reading experience (structure): *Marble Springs* is designed to be experienced in a non-linear way. When we pick up a book, especially of fiction, we tend to read from title page to end. And most stories are written to read in this manner. Hypertextual fiction and poetry foil this practice by design. From the cover, or card 001, of *Marble Springs* it is impossible by using the mouse, except by accidentally clicking the small randomizer button hidden along the left edge in the white space, to get to the next card in the stack, card 002, Journeys, which gives rudimentary help in navigation. (You can get there using the stack navigation controls in the “Go” menu of course.) *Mable Springs* encourages non-linear reading by presenting reader/players with links and graphics to click, which disrupt the flow of the narrative by taking the reader/player to a new character or location. The experience is more web-like and associative than linear;
9. Electronic instantiation (context/behavior): *Marble Springs* 1.0, 2.0, and 3.0 make use of computer technology to give reader/players the non-linear reading experience. Larsen moved away from paper and string on a train layout because of the obvious limitations this format presented. The main problem is the lack of subtlety: many of the connections between characters in the town and environs of Marble Springs are hinted at in the work, because real people keep secrets, and Larsen wanted to give the reader/player the chance to make these inferences and discoveries on their own. Further, the electronic instantiation allowed for randomizing navigation events in a way that is difficult to duplicate on printed paper;

10. HyperCard environment (context/behavior): HyperCard is the native and only environment for MS2. MS2 is a work that relies on the HyperCard software program to run. In fact, you can have a stack of HyperCards on your desktop, but they cannot run without starting HyperCard. MS2 out of HyperCard is a fish out of water;
11. Physical presentation (context/appearance): In an effort to emphasize the strangeness of reading poems about a town 100 years in the past on a computer and to maintain a touch of antiquity, Larsen sat the computer running *Marble Springs* on a wooden writing desk, placed a rug under the chair, and surrounded the computer with a “cozy,” hiding the hard beige plastic behind green and brown yarn (see below).



Figure 1: “*Marble Springs* in Use,” unknown user experiencing *Marble Springs* in Larsen’s chosen physical display, including wooden desk and Mac Cozy. (Photo from *The Deena Larsen Collection*)

Properties saved and lost in preservation

The archival conceit represented in the preservation effort carried out here is protecting the intellectual content of *Marble Springs* from complete, catastrophic loss due to hardware and software obsolescence. In other words, let's pretend we have the last working copy of MS2, and the last computer running OS 9, and we want to save all of the text, and model or list the most basic functions of how the text operated in the electronic environment. Further, we assume that we do not have the programming expertise or money to pay a programmer to write an emulator that would recreate the OS 9 environment that HyperCard operates in. (This is a fact, rather than an assumption, at this time.) Finally, we want to create a record of MS2 that can be experienced independently from a computer at all, just in case we lose electricity or our preservation file formats all become obsolete. This means creating a paper record.

What does creating a paper preservation record of *Marble Springs* mean for significant properties? Which can we save and what do we lose?

The Saved

Intellectual content: The poems and text are of main concern, and must be saved. Copying and pasting all of the text content into a text document can accomplish this. The more time consuming aspect of this step is completely recording the context of the text, especially things like the pop-up fields that reveal small bits of information. Nonetheless, this step is relatively simple. This step can also be accomplished by taking a screen shot of all of the text. If text disappears below a text boundary, we can scroll down and take another screen shot. This is simple, and preserves the context of the text as well.

Textual hyperlinks: These are the differentiating feature of hypertext over printed works. By clicking on hyperlinks, the reader/player leaves linear reading and navigates the text in a

seemingly limitless way. The text links also suggest links between characters, as in HyperCard; once a word is used as a link, it cannot be linked to another card (although it does not have to operate as a link). Using link words with different characters can show secret connections to the reader/player. A list of linking words and the name of the destination is readily available on card 204, “Skeletal Connections,” though the list is incomplete. The words that link directly to pop-up fields are not listed, leaving out valuable behavioral information. For example, the ordered pair “baby,Graveyard” means that wherever the word “baby” is activated as a link in the MS2 text, clicking on it will take the reader/player to the “Graveyard” (card 015). However, there is no corresponding pair for “crib,crib.” The hyperlink “crib” in card 089, “Counting,” opens a pop-up field that tells us that a crib is also “An eight-by-ten cabin / where prostitutes lived / and entertained / customers.” Since this information is missing from “Skeletal Connections,” it means that each hypertext link on each card has to be clicked and its destination noted or function recorded, either by delving in to the “Field Info” or by clicking each link manually or by noting the observed function. This is not trivial time spent, as there is no obvious function in HyperCard to extract this information for the pop-up hyperlinks.

Graphical hyperlinks: Graphics function as buttons, allowing the reader/player to navigate to other cards. Further, the graphics serve to link characters together in non-obvious ways. For instance, the poem and biographical information about one character may make no mention of a second character. But the graphic element may link to the second character, indicating a secret or hidden connection, possibly a love affair or deep-seated enmity. The graphics in MS2 can have one assigned destination or pop-up field assigned, or different areas of the button can be designated to different cards or pop-ups. (This design prefigured image mapping used in some web sites today.) Further, specific graphics are relevant to the stories of

characters, and may in and of themselves contain information, not just lead to other characters. Therefore, graphics should be preserved if possible. The various buttons and their functions or destinations can be recorded in much the same way as the text links. The advantage to recording the button functions is that in HyperCard button view, under the “Tools” menu, a button can be selected, and its “Button Info” (under the “Objects” menu) can be revealed. This Button Info includes the HyperTalk script that the buttons follow to function, including the name of the destination card or pop-up field. Further, since HyperCard allows the building of “Backgrounds” or templates of often-repeated elements on specific card types, for instance standard buttons on poem cards, there are eighteen or nineteen functions per card that only need to be recorded once, saving a great deal of time. The preservation of graphical functions can be recorded with a combination of screenshots and text documents.

Primitive graphics: The primitive look of the graphics is a function of the original design, and not something that should be changed in preservation. Screen shots of each card will preserve the graphics as they are. Further degradation in image quality might result if the screen shots are converted to .jpg format, but can be avoided using .tif.

User contributions: This property straddles both the saved and lost categories. Obviously the new poems added to MS1 that were prepared for MS2 can be saved using the copy and paste or screen shot method. Does a paper version of MS2 allow users to contribute new content? Yes they can, by writing in the white spaces of the printed pages. But does the paper format encourage reader/players to add content? Some readers have an aversion to writing marginal notes in books, and may not be comfortable marking up the paper preservation copy of MS2. Each time a player links to a blank character card for the first time in MS2 in HyperCard, however, the program asks them to choose whether or not to add text. That is a function that we

can nearly replicate in print, by including a line of text inviting them to write. The difference is in MS2 they must chose before they can move on through the hypertext, and that is a function we cannot replicate on paper unless we have someone there handing out sections of the printed text.

Non-linear reading experience: Hypertexts are “ergodic” as Espen Aarseth says; a reader/player must work and make choices to follow/create a path through the text (Morris, 2006, p. 16), thereby experiencing one narrative among the many possible. In order to preserve that property for MS2 we can map each link and make the link maps prominent, to encourage the user to follow a link. We can also choose to print and bind each card’s images and link maps separately, to aid non-linear exploration. (The 204 Appendices, A through VVVVVVVV, found in the supplemental thesis material, are intended and designed to be bound separately, mimicking the 204 cards of the HyperCard stack in physical form.)

Of the eleven significant properties of *Marble Springs, Second Edition* listed above, we can preserve, on paper, in full or in part, six: the intellectual content; the textual hyperlinks; the graphical hyperlinks; the primitive graphics; the user contributions; and, the non-linear reading experience. Yet some significant properties are lost.

The Lost

Animations: The visualizations of transition effects are lost. They are coded in the script of each card, if we chose to preserve the transition effect information. However, it is hard to envision a checkerboard transition if you don’t know what a checkerboard looks like, and haven’t seen this kind of wipe in action. However, as MS2 does not rely on these transitions and does not contain any time-based media (video, etc.), this property can be let go without too much concern. This is not true of all HyperCard-based hypertexts however, and can represent a great loss for other works. Options for preventing total loss might include filming the functions of the

animations, greater description, screen shot captures of stages of animation to create a “flip book” record, etc.

Audio: For the most part, the audio effects in MS2 are trivial. However, it would have seemed unusual not to use audio and visual effects in 1993, as these effects were just coming into desktop programs and I remember being among the many who were excited by their addition, primitive as these effects were. But they do not, in MS2, convey a great deal of information. Again, as with the animations, the audio is scripted in HyperTalk, and can be noted for posterity and later iterations. Other works may make more use of audio, requiring recording, description, or transcription.

Editability and user contributions: As discussed above, the ability of reader/players to edit or add content can be saved or at least encouraged, but may not be as natural on paper as in the electronic realm. So some aspects of this important property are lost in paper. [MS3 (Larsen 2012b), instantiated on the wiki, preserves this.]

Electronic instantiation: In a paper-printed version, this aspect is totally lost. We are in fact giving up hope of preserving the work in its natural environment, and creating a more static instantiation in the hopes of avoiding complete information loss. It’s a bit like stuffing and mounting the last dodo until we can use cloning to bring the species back. (Unlike the dodo, *Marble Springs* has actually been brought back in MS3, in part through this effort, but in a new instantiation. MS3 has given up on reviving the HyperCard environment so that the intellectual content and the hypertextual functions could live on.) Other efforts and resources must be brought to bear to avoid this sort of loss for other works.

HyperCard environment: Again, we are admitting defeat by going to paper and a wiki format. As stated above, MS2 is dependent on HyperCard as its natural operating environment. If

we are going to truly save MS2 in its original electronic environment, we must first save HyperCard, either by reprogramming or emulating. (Both are beyond the scope of this work and expensive undertakings in their own right, although there are benefits as well.) Remediating MS2 into any other environment is in effect creating a new instantiation, as no new version will work quite the same as MS2 did in its native environment. While the HyperCard environment is a significant property of MS2 as it was originally published, HyperCard is facing extinction. HyperCard was key to making MS2 run in its native environment, but it is not vital to the intellectual content. We can indeed create a new instantiation of MS2, in wiki or HTML for example, that functions in a similar way. However, we will have thrown aside the HyperTalk coding, and created a different expression of the work. We may simply have to let that property go, and accept that the MS2 we are preserving is less than and/or different from the original.

Physical display: This was only a significant property for those experiencing *Marble Springs* at a conference or workshop where Larsen was able to set up the desk, rug, and cozy, as they are one-of-a-kind items and not provided with the purchase of *Marble Springs* 1.0 from Eastgate Systems (which is still available as of this writing). Home users did not get the chance to see Marble Springs in its native display, and never knew what they were missing. However, if a museum or collection were going to recreate the experience as completely as possible, they might display a restored MS on a monitor surrounded by a custom-made cozy.

By saving MS2 to paper, we lose, completely or partially, six of the work's major significant properties: animations, audio effects, user contributions, electronic instantiation, the HyperCard environment, and the physical display. Some of these losses are not trivial. Clearly, the preserved work will not be the same as the original. However, if we are to prioritize and save

the core intellectual content and the basic function of the hypertext onto a paper format, we are going to face some losses.

Chapter 3: Preserving What We Can of *Marble Springs, Second Edition*

Based on my analysis of significant properties, discussions with Deena Larsen, and my technological skills in summer 2010 (following my first discussions with Deena and my decision to pursue this thesis project), I made the decision to preserve to paper *Marble Springs, Second Edition*. Of the eleven properties discussed above, I decided the focus would be on preserving or documenting the intellectual content; the textual hyperlinks; the graphical hyperlinks; the primitive graphics; the non-linear reading experience; and to a lesser extent, the user contributions. I further decided that I wanted to save this information into the most easily preserved, and stable, or archive-friendly, file formats possible.

One caveat must be made here: this was not a purely archival process; this was also a repair process. I had noticed that MS2 contained a number of typographical errors and bad links. In my discussions with Larsen, she asked me if I would be willing to correct the errors as I went along, as she did not want typos saved for posterity. I agreed to fix errors, and in constant consultation with Larsen, fix broken links. I did document each intervention and repair made, both with screen images that showed the before and after, and also with textual descriptions of changes made on each card. Some might argue that my intervention violated purely archival practice. However, as I had access to Larsen, Larsen approved each decision, and I recorded each action, I feel that changes were made in keeping with the true intent of the intellectual content of the work and brought MS2 in line with that original intent. So in this respect I acted as an editor, making corrections to the work. However, since each change was recorded in the card documentation (see Appendix WWWWWWW), and state changes to the HyperCards were captured with screen shots, my actions can still be seen as preservative. Admittedly the lines may blur a bit.

The strategy I developed for completing a documentary preservation of MS2 was thus: Since MS2 was built in HyperCard, and HyperCard works with “stacks” of cards, each card could be seen as a distinct part in the greater whole of MS2. Therefore the entire text and every function of each button of each card were recorded in a plain text document (.txt file). Additionally, screen shots were taken of each entire card, every state change in the visual presentation of each card, and of each specific button on a card. The screen shots were first captured in the Mac OS 9 native SimpleText Picture (or .pict) format, and then converted to Tagged Image File Format (or .tif/.tiff). The .txt format was chosen for text as it is non-proprietary, ubiquitous, and can be read on nearly any computer. The .tif format was chosen for the images as .tif retains the most image information, is uncompressed, and is a preferred format by the Library of Congress for still image preservation (Arms et al., 2011). The .tif images were also converted to .jpg format for web serving, as .jpgs are compressed and have a much smaller file size than .tif. (Based on things I learned after I had nearly completed the documentary phase of the project, I should have used .png instead of .jpg, as .png is lossless and holds more metadata than .jpg.) As noted, the various types of cards shared one of eight card backgrounds, which served as templates for repeated buttons and functions. Each background was recorded and images were taken of the various buttons. In the card documentation the backgrounds are referenced by number without repeating the captured information.

Documenting Text and Functions in MS2

The table below is the captured information from a representative card, in the template I developed after I documented a few cards.

Table 1: Card 042 (Night Winds) documentary walkthrough

MS2_042_walkthrough.txt

Leighton Christiansen

02/17/2011

[1240] - [1306] .5

Error fix:

[Note: Beginning on 05/23/2011, working with Deena Larsen at MITH, I corrected the errors in MS2 to create a clean version of MS2.01. We did this for posterity and to make the migration less problematic.]

05/24/2011

[1100]-[1106]

Text file formatting notes

[Note: the words bracketed by underscores indicate which words are underlined in Marble Springs.

Further note: that some of words recorded below seem to have odd underlining, such as towns. In the original version of MS2 these words, while links, are not underlined under each character. This was important in the creation of Marble Springs, Deena Larsen explained to me on 01/15/2011 in Denver, in HyperCard, because HC required each link word to be unique, as all link words belonged to the same Group.]

[Note: words bracketed with asterisks ***word*** are in bold in MS2.]

[Note: words bracketed by tildes *~word~* are in italic in MS2.]

[Note: the text of cards, and pop-ups will be reproduced below with the line breaks that appear in MS2.]

Card Information

[MS2_042_01_text.jpg]

MS2 Card 042

Card Name: Night Winds

Card Number: 42 out of 204

Card ID: 20127

Contains 2 card field

Contains 1 card button

Can't delete card: checked

Script:

[none]

Card Background Name: Poems bkgnd

Background ID: 2815

[Note: for information on the functions and buttons common to cards sharing the Poem bkgnd 2815, see

[MS2_poembkgnd_walkthrough.txt]]

Table 1 (cont.)

```
-----
Text Tab
-----
[MS2_042_01_text.jpg]
Text:
"
It was always the wind
driving the snow that became
another cloak around her.

There had been no wind
when she had climbed beside _Kurt_
behind eight yoke of good oxen,
the wagon tongue obscuring
the last view of her tired mother
leaning against her Ohio picket fence.

Now the wind froze her tears,
drove the snow into fog
that covered the mountains
outside the quilt-covered door.

Now the wind would bore
holes into the mud-stuffed logs,
forever playing with the _lamp wicks_. ◇
"
    Text links:
        _Kurt_ : card 123 "Kurt Croft"
[MS2_123_01_text.jpg]
        _lamp wicks_ : card pop-up field "Lamp Wicks"
[MS2_042_01_fieldLamp.jpg]
    Field text:
        "
        Lamp Wicks [set in Black Chancery 10 Bold]
        Soaking lamps in vinegar
        twenty four hours before
        placing in the lamp assures a
        clear _flame_.

        ~Everyday Cook Book~
        "
[Note: "Soaking lamps" should read "Soaking wicks" or "Soaking
lamp wicks", shouldn't it?]
[FIXED 05/24/2011, word change]
Now:
        _lamp wicks_ : card pop-up field "Lamp Wicks"
[MS201_042_01_fieldLampFIX.jpg]
    Field text:
        "
        Lamp Wicks [set in Black Chancery 10 Bold]
        Soaking wicks in vinegar
        twenty four hours before
        placing in the lamp assures a
        clear _flame_.
```

Table 1 (cont.)

~Everyday Cook Book~
"
Field links:
flame : card 066 "Firelight"
[MS2_066_01_text.jpg]

Title Tab

[MS2_042_02_title.jpg]
Title text:
"
Caroline Croft
1875-1949

Married _Kurt Croft_ at eighteen. After leaving their families'
farms in Ohio, they
moved to Indian Territory. Thwarted by the _locusts_ and winter
blizzards, they
abandoned their homestead and moved to Marble Springs where Kurt
found work

as a carpenter. Three children;
two others stillborn.
"
[Note: text overruns the graphic a bit and there is an extra
blank line.]

[FIXED 05/24/2011, moved picture and removed extra line]
Now:
[MS201_042_02_titleFIX.jpg]
Title text:
"
Caroline Croft
1875-1949

Married _Kurt Croft_ at eighteen. After leaving their families'
farms in Ohio, they
moved to Indian Territory. Thwarted by the _locusts_ and winter
blizzards, they
abandoned their homestead and moved to Marble Springs where Kurt
found work
as a carpenter. Three children;
two others stillborn.
"
Title links:
Kurt Croft : card 123 "Kurt Croft"
[MS2_123_01_text.jpg]
locusts : card pop-up field "locusts"
[MS2_042_02_fieldLocusts.jpg]
Field text:
"
Blizzards of locusts swept over the

Table 1 (cont.)

land, blackening the sky. Their
whirring sounded as though the wind
had finally cracked and was now
insane.

"

Field links:
[none]

----- Margins Tab

[MS2_042_03_margins.jpg]
[Blank]

----- Bibliography Tab

[MS2_042_04_biblio.jpg]
[Blank]

----- Graphic Element

[MS2_042_05_graphic.jpg]
Image of oil burning lamp.

Clicking on lamp goes to: card 045 "Peggy's Diary"
[MS2_045_01_text.jpg]

but01:

[MS2_042_05_graphic.jpg]
Button name: Graphic Connection
Card button number: 1
Card part number: 2
Card button ID: 7
Icon ID: [transparent box laid over oil lamp graphic]
Script:
 on mouseUp
 visual effect checkerboard slow
 go to card "Peggy's Diary"
 end mouseUp
Links to: card 045 "Peggy's Diary" [MS2_045_01_text.jpg]

The information captured above may or may not make sense without a bit of explanation.

Each file starts with its own coded file name that acts as a unique identifier connecting the file to

the card it records: MS2 is *Marble Springs, Second Edition*; 042 references card 42 in the MS2 stack (the card number is stable, as long as the order of the cards is not changed, while the text name of the card can change without disturbing the order, so the number is the preferred identifier), and “walkthrough” distinguishes this file as the complete documentation of the card, rather than other notes that may need to be made about a card. Further, the date and time that the card was recorded are noted, as well as the date and time of any error corrections, as this card required. There is an explanation of punctuation use, links, and line breaks in each file.

The “Card Information” block copies the information that HyperCard records for each card, found in the “Objects” menu >> “Card Info...” sub-menu. Notice that in this sub-menu each card has a third identifier, the “Card ID.” This is unique to each card and does not change even if the order or text name change. While this should be used as the file identifier as it is most stable, it has no mnemonic meaning, and is less human-readable, so I chose to go with the card order number as that was not going to change in this documentary process. The “Card Background Name” is found the using the “Objects” menu >> “Bkgnd Info...” sub-menu. This number allows the preservationist to find an explanation of the background functions by looking in the file MS2_poembkgnd_walkthrough.txt I created to explain the background functions.

For cards containing poems and histories about characters, four tabs must be recorded: Text (containing the poem, if one is written), Title (containing biographical info about the character, whether or not a poem has been written for them), Margins (where reader/players can record their own information), and Bibliography (where Larsen included sources when appropriate). Content from these tabs are captured in a block in the text file, with line breaks preserved from the original, since this is poetry. Each text block is copied precisely from the card tab. When typographical errors and layout anomalies occurred, these were reported to Larsen,

and a fix was agreed on, and the fix implemented. The changes and repaired information are recorded as seen in the Text and Title blocks of card 042 above.

In addition to the textual content, many cards also have a Graphic element. For each image, the Graphic Element block in the card documentation file gives the file name of the screen shot, a description of the graphic, the destination a click on the graphic takes the reader/player to, and the button information and script recorded by HyperCard. Some images have more than one button overlaid on them; in these cases, each is recorded.

All text in the card description documents surrounded by square brackets ([]) are metanotes recorded in preservation to denote functions (or lack thereof), destinations, and errors. If a Margins or Bibliography tab are blank, as is nearly always the case with Margins, and often with Bibliography, that is noted by the [Blank] note. This also helps the preservationist track what has been looked at and what hasn't.

(The complete catalog of card documentation text files can be found in Appendix WWWWWW.)

You will notice that all of the images referred to in Table 1 above are the .jpg files. This is to protect the master .tif files from accidental damage or loss. Lets look at the images for the card recorded in Table 1, card 042, "Night Winds," next.

Documenting Images in MS2

When a reader/player is first directed to a poem card via a link in MS2, they are sent to the Text tab, to see the poem first, as seen in below:

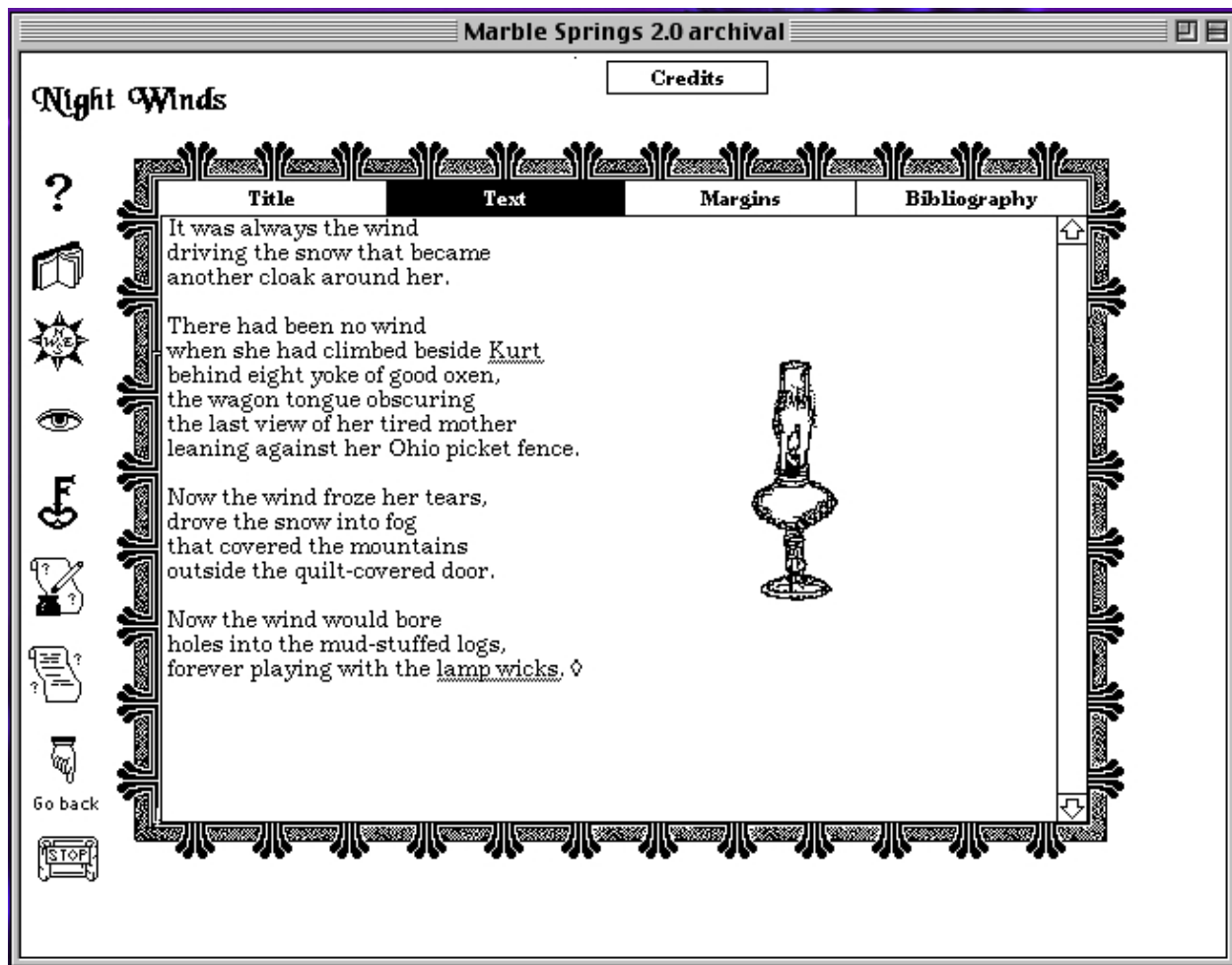


Figure 2: Card 042, "Night Winds," Text tab

The reader/player can read through this poem, and notice two underlined words or phrases: "Kurt" and "lamp wicks." The reader/player can read all the way through the poem, or click on a linked word when they see it. "Kurt" redirects to card 123 "Kurt Croft," and "lamp wicks" opens card pop-up field "Lamp Wicks" as seen below.

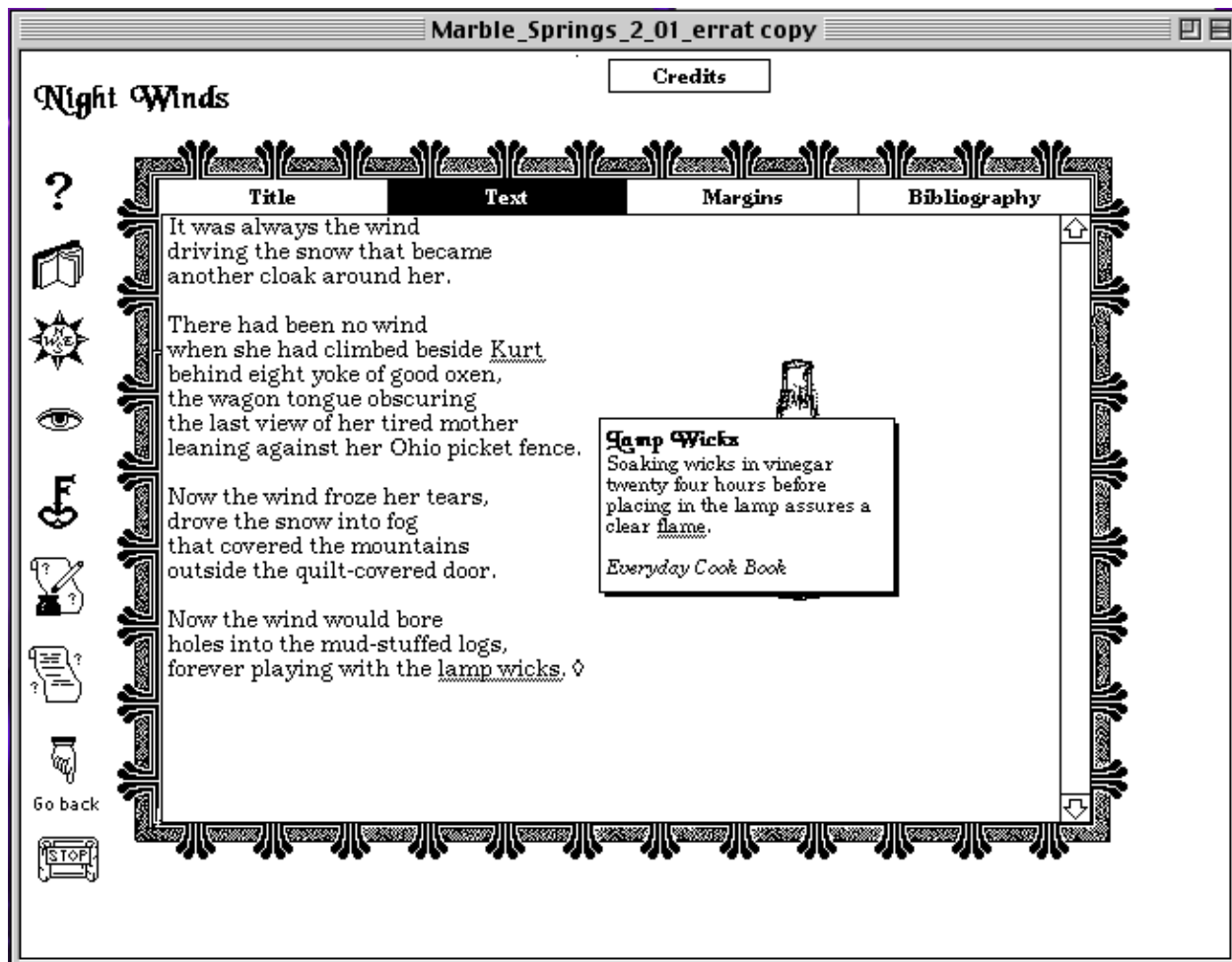


Figure 3: Card 042, "Night Winds," pop-up "Lamp Wicks"

Pop-up fields may also contain working hyperlinks. The information about a field can be found by entering the "Field View" under the "Tools" menu and then selecting "Objects" menu >> "Field Info..." which is now enabled. Clicking on the "Title" tab or on the poem's title in the upper left corner takes the reader/player to the "Title" tab, and the biographical information about the character as seen in Figure 4.

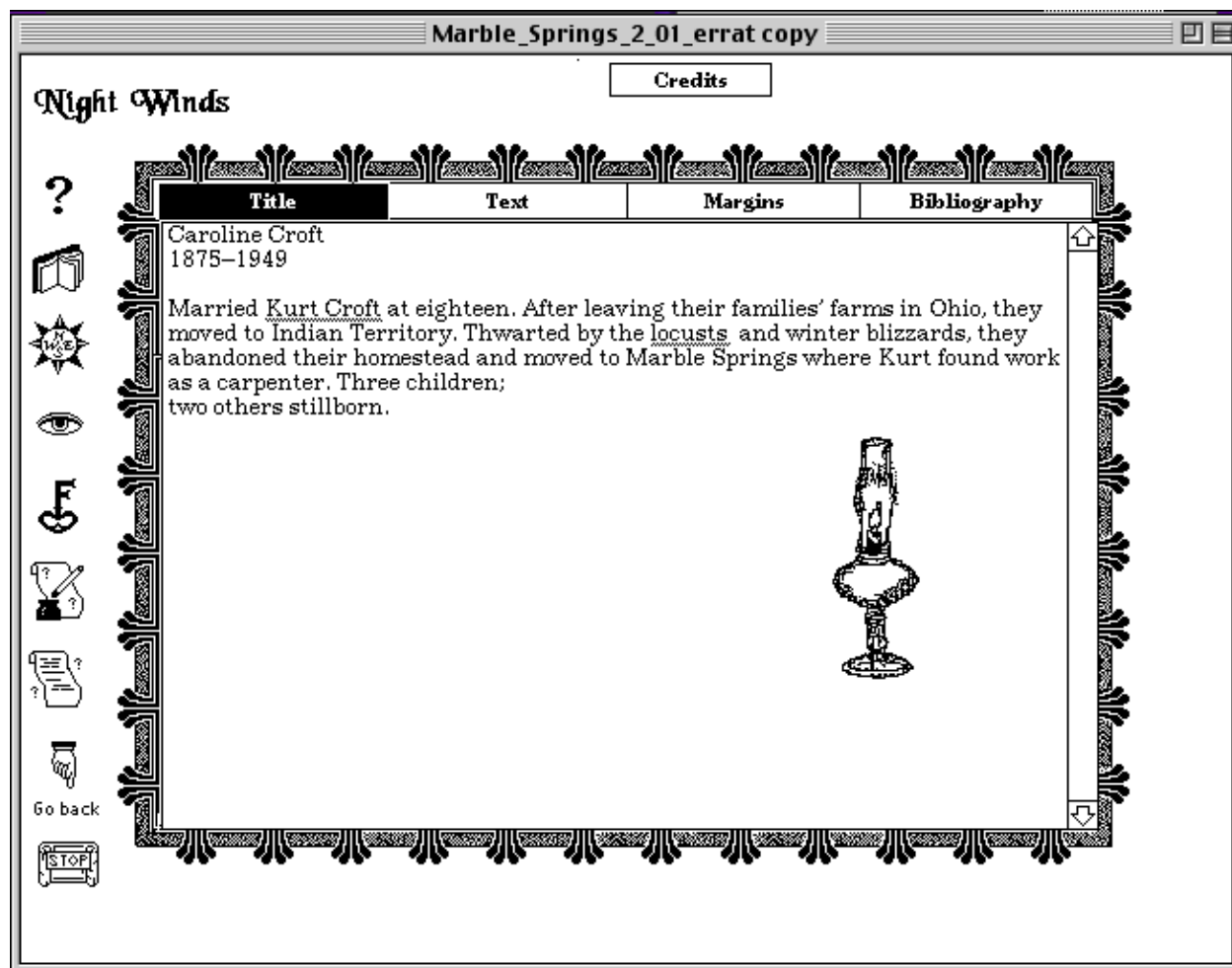


Figure 4: Card 042, "Night Winds," Title tab

Here the reader/player can read about Caroline Croft, and link out to Kurt Croft or open the "Locusts" pop-up field. As noted before, corrections were made to this card. There was a minor layout problem as seen in Figure 5:

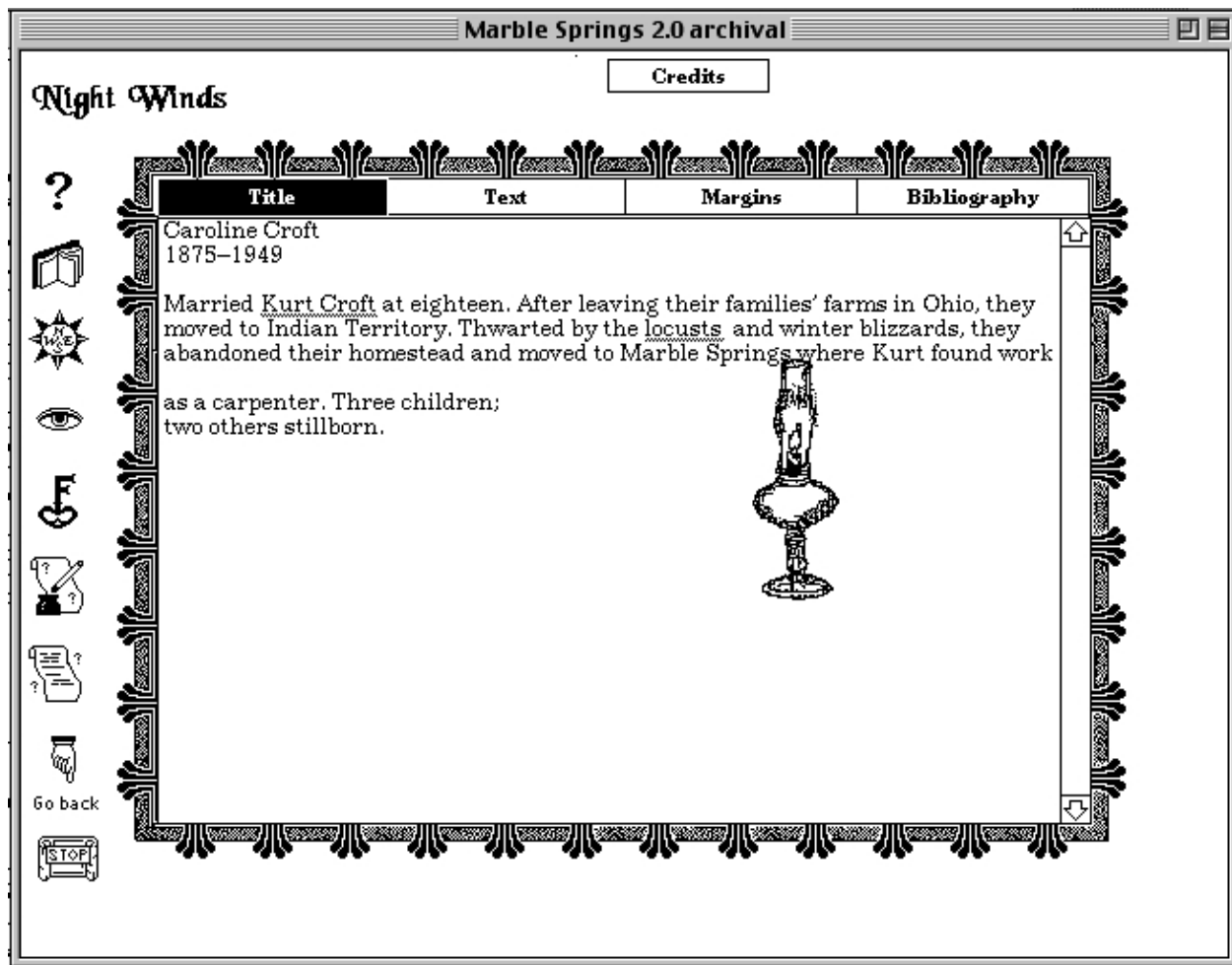


Figure 5: Card 042, "Night Winds," Title tab, with errors

The text and the image obscure each other a bit and there is an extra blank line in the text.

The Margin and Bibliography tabs are blank, but images are captured for each to record that they are indeed blank rather than forgotten.

Additional card functions include clicking on the oil lamp image which redirects the reader/player to card 045 "Peggy's Diary," suggesting a connection between Caroline Croft and Peggy Dagmar without making that connection explicit.

Finally, there are the background buttons. Each icon in the card background redirects reader/players to other parts of the HyperCard stack or performs other functions, such as quitting the program. There are also hidden buttons that randomly redirect players around the text. The

layout of the buttons for card 042 and the other cards that share this background can be seen in the following image and table:

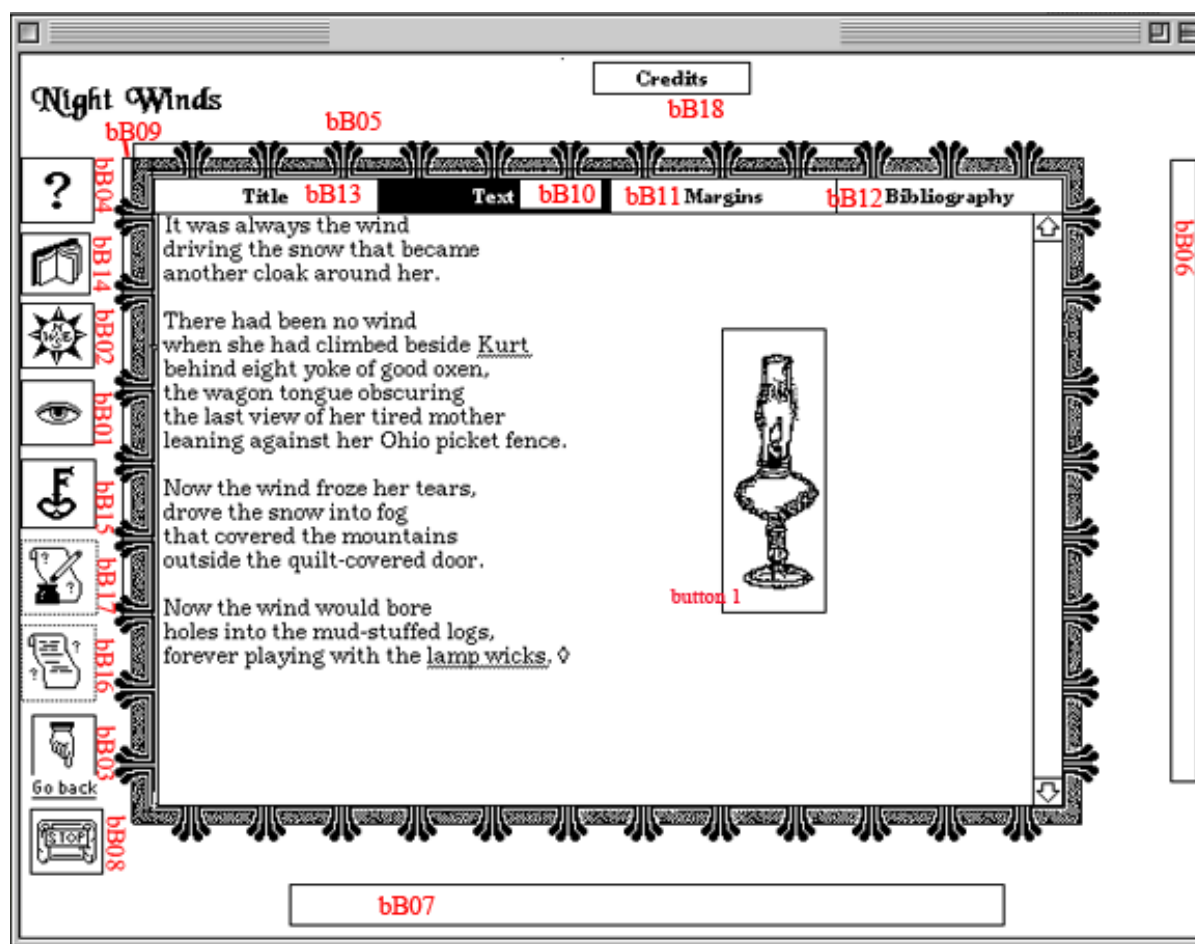


Figure 6: Card 042, “Night Winds,” button view

In the figure above, the 18 background buttons and one graphic element button are labeled in reference to the table below. In HyperCard, buttons are not labeled in the button view. Rather the preservationist must open the “Button info...” sub-menu and record the information found there, as described before. The background buttons are denoted by the prefix “bB” and are numbered according to their HyperCard designations. The HyperCard designations usually match their chronological placement on the card, although my experience and Deena Larsen’s anecdotal evidence suggest that buttons sometimes change numbering unexpectedly.

Table 2: Button and Link guide for card 042, “Night Winds” Text tab

Button or link word	Destination card or field	Background button	Destination card or Action
Button 1	card 045 "Peggy's Diary"	bB 01: Eye	card 031 Directory
Kurt	card 123 "Kurt Croft"	bB 02: Map	card 013 Main Map
lamp wicks	opens card pop-up field "Lamp Wicks" see following page	bB 03: Go Back	Goes back 1 card
		bB 04: Help	card 005 Help
		bB 05: Random (top)	Randomizer
		bB 06 Random (right)	Randomizer
		bB 07: Random (bottom)	Randomizer
		bB 08: Get Out	Gives reader Quit option
		bB 09: Random (left)	Randomizer
		bB 10: Text	Reveal “Text” tab
		bB 11: Margins	Reveal “Margins” tab
		bB 12: Bibliography	Reveal “Bibliogrpahy” tab
		bB 13: Title	Reveal “Title” tab
		bB 14: Open Book	card 117 Mentioned Characters
		bB 15: Key	card 013 Main Map
		bB 16: Parchment & ?s	card 007 How to Read
		bB 17: Pen & Parchment	card 011 How to Write
		bB 18: Credits	card 186 New Authors

The table above records, on the left, the foreground buttons and textual links for state of the screen as represented in Figure 5 above. The right columns record the background buttons and actions. A table for each screen state of each card has been recorded; these tables, with corresponding screen captures, are included in Appendices A through VVVVVVVV.

To completely record each screen state change for card 042, “Night Winds,” required eight screen shots, plus two correction screen shots, and a composite image with the buttons

numbered, as seen in Figure 5 above. Altogether, 11 images were needed to completely record one poem card. Some cards required fewer screen shots, many cards required more, some many more. When paired with the preservation text documentation that ran three to four pages, as in Table 1 above (page 21 to 24) we can see that the preservation data can be voluminous.

Chapter 4: Things Blow Up: Documentation Data Exceeds the Preservation Object

No matter which method we choose to preserve a born-digital hypertext, there are certain costs that we encounter. The costs include covering temporal, financial, and physical resources. The temporal costs are measured in the time it takes a human to complete the preservation act, and in the amount of time we want to support the infrastructure to store our preservation objects. Financial costs include paying a preservationist and/or programmer, buying storage media or servers, and maintaining the storage environment. Physical resources can include the space required to save old computers and files, and the disk space needed to save our preservation outputs. (See for example Xue, et al., 2011.)

In the case of documenting *Marble Springs, Second Edition*, the increase in preservation data file size as compared to the original file size was tremendous. The final corrected version of MS2 weighs in at a meager 1.1 MB. The HyperCard 2.2 application needed to run the MS2 stack is 964 KB. And the custom-built Marble Springs font suitcase is 136 KB. Altogether, provided you have the proper operating environment, it takes 2.1 MB of disk space to store and run the 204 cards of poetry and prose, images and sounds, of MS2.

As mentioned above, the preservation effort detailed here involved making a plain text (.txt) file for each card (204 cards) and each of eight backgrounds. Further there are text documents detailing how the randomizer script works, listing the directory of characters, and an errata list, among a few others. The total comes to 221 text documents at 1.8 MB. In order to include them as Appendix WWWWWWW in this thesis, the plain documents were pasted in Microsoft Word, before being converted to .pdf for thesis deposit. The file's size, because it is mostly unformatted text, is only 1.2 MB. However the page count is 935. The 204 appendices, A through VVVVVVVV, saved as individual files, capture each card and include a cumulative

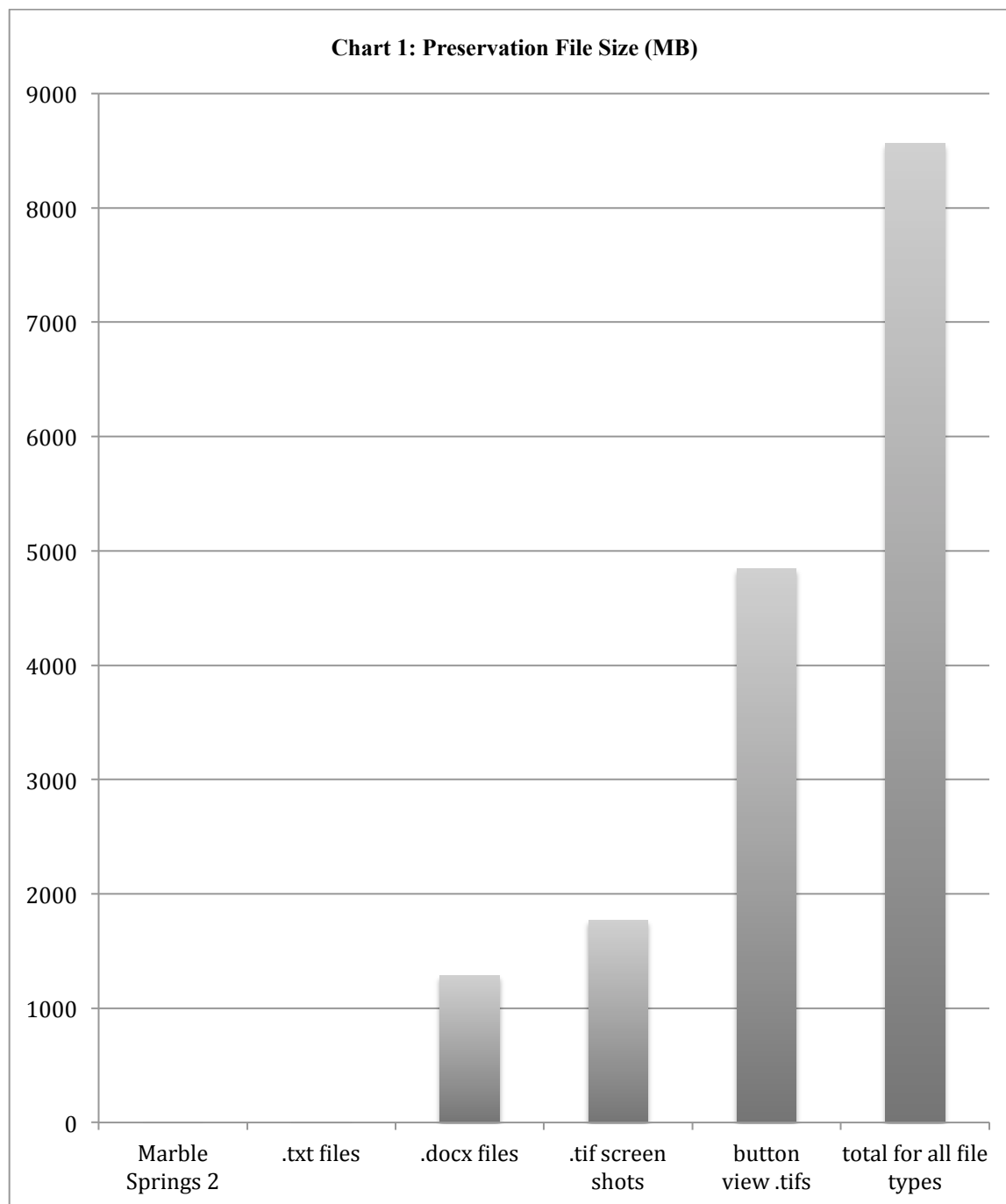
1476 screen images, 867 tables, and 2235 pages. The file size for those 204 Word documents is 1281.1 MB or 1.25 GB.

To completely capture screenshots of every state change of the card, a close up of each button, and the repaired screens after the errata were repaired required 2743 screen shots in .pict, all duplicated as .tif images. The total file size for the .pict images is 278.3 MB, while for the .tif images it is 1.73 GB. The .jpg files made from the .tif images are 386.3 MB. Another 382 images were created in creating the button view images with the buttons labeled with red letters. These files were created in PhotoShop, using layers of text, with the card button view images then slipped into the bottom layer, to take advantage of the background template. This method created large files: 19 of the images, those with the most buttons, came in at 60 to 70 MB each. The file size was reduced for most of these images to 1 to 4 MB by compressing the layers. The total file size for this folder of images is 4.73 GB.

So if we total this up, before converting the Word documents to .pdf for thesis deposit, we have the following data totals in our documentary preservation of *Marble Springs, Second Edition*:

- 426 text documents in .txt. or .docx formats;
- 1284.1 MB, or 1.25 GB of textual data;
- 8611 images in .pict, .tif, and .jpg formats;
- 7279.6 MB or 7.1 GB of image data;
- totaling 8563.7 MB or 8.36 GB

The total amount of disk space devoted to preserving MS2, a 1.1 MB sized file, with 16 locations, 80 poems, 137 characters, on 204 cards, exceeds the original size by 7785 times.



We can add to this the fact the hours devoted to this documentary preservation total more than 300 hours. This should serve as a warning: even the most straightforward and seemingly low-tech preservation approach can have tremendous costs.

Chapter 5: The Resurrection of *Marble Springs, Second Edition*?

We can save basic intellectual content of endangered hypertext and born-digital works, as shown in the appendices that follow, using very basic methods, such as documenting functions and taking screen shots. However, this is rather unsatisfactory in the long run, as too many significant properties are lost. *Marble Springs, Second Edition*, without greater technological intervention, will become, along with other hypertext works created in HyperCard, lost literature. In *Born Again Bits*, Liu, et al. (2005) note that HyperCard works exist by authors “John Cayley, William Dickey, Clark Humphrey, Deena Larsen, John McDaid, Stuart Moulthrop, Michael Murtaugh, David Rokeby, Jim Rosenberg, Matthew W. Schmeer, and Sarah Smith. It seems certain that more than a hundred electronic literature works in HyperCard exist, many by top electronic literature authors.” Liu, and the members of the Electronic Literature Organization, urge the e-lit community to develop emulators, or programs that recreate the original operating environment of works on modern machines. They recommend the development of open source solutions for long-term preservation, as proprietary formats can fall to hostile competitors or business climates.

In “Acid-Free Bits” and in “Born-Again Bits” the ELO sets out an ambitious plan to make the guidelines they suggest easier to follow for hard-coding digital authors. The X-Literature Initiative was to involve the creation of an XML schema that takes into account the special characteristics of digital lit. Further, the ELO planned to create free interpreters, through the Interpreter Initiative, so that older and current works could be updated (“Born-Again”). A key hope of the ELO was to create a HyperCard interpreter for Mac, as the HyperCard system of stacked digital cards was a favorite among early e-lit authors. Their plan was to fund one or two full-time coders to work on and deliver the interpreter by 2006 or 2007. Sadly, there is no

evidence of this interpreter as of early 2012. Neither have the X-Lit Reader Tool, the X-Lit Migrator tool, nor the X-Lit Muse authoring tool, discussed in “Born-Again” been brought to fruition. However, the plans they outlined were ambitious, and perhaps beyond their immediate reach. Creating a genre-wide open-source standard will not be easy.

I conducted experiments with a number of emulators that claimed to recreate the entire Mac OS 9 environment in addition to HyperCard. I started by doing a Google search for “mac OS 10.6 classic mode” I read through the results and picked out a couple of promising links. For instance, from MacInTouch Special Reports, Compatibility section (<http://www.macintouch.com/specialreports/snowleopard/slfaq.html#comp>) a note read: “Can I still run SheepShaver or something that lets my classic Mac OS apps work?” The response was “We've had several readers report that SheepShaver 2.3 does work in Snow Leopard. We haven't heard anything, official or otherwise, about Mini vMac, Basilisk II, and other PowerPC or 68K emulators.”

I saw various references to SheepShaver and Basilisk 2. I also found a reference to the site E-Maculation, a community site dedicated to running emulators on Mac (<http://www.emaculation.com/doku.php>) At E-Maculation I read through the pages for the emulators SheepShaver, Basilisk II, Mini vMac, PearPC, and SoftMac. Below I report on this research.

SheepShaver

- http://www.emaculation.com/doku.php/sheepshaver_mac_os_x_setup
- Reading through the pages I discovered: “You will need a compatible Mac OS install CD to be able to install a Mac OS in the SheepShaver emulated machine.

Depending on the used ROM file, SheepShaver can run System 7.5.3 through Mac OS 9.0.4. SheepShaver cannot run 9.1 or later.”

- The laptop I have on loan from Deena Larsen is running Mac OS 9.2.2, but as we could not find the OS install disk for Larsen’s laptop, or obtain one, I was unable to determine whether or not I could use SheepShaver.

Basilisk II

- http://www.emaculation.com/doku.php/basiliskii_osx_setup
- “Basilisk II emulates up to a 68040 Macintosh, which can run Mac OS 7.x through 8.1.”
- My machine runs OS 9, so Basilisk II will not work.

Mini vMac

- http://www.emaculation.com/doku.php/mini_vmac
- <http://minivmac.sourceforge.net/doc/about.html>
- “The Mini vMac emulator collection allows modern computers to run software made for early Macintosh computers, the computers that Apple sold from 1984 to 1996 based upon Motorola's 680x0 microprocessors. The first member of this collection emulates the Macintosh Plus.”
- This emulator was for earlier machines than I was working from, and wouldn't be any help.

PearPC

- <http://www.emaculation.com/doku.php/pearpc>
- “PearPC emulates a PPC Macintosh inside of Windows and Linux. It emulates a machine capable of running OS X versions up to 10.4 (Tiger). PearPC does not

emulate a Machine capable of running OS X 10.5 (Leopard) or greater. The emulated machine can also run Darwin and Linux.”

- PearPC does not seem to be a solution for me at the present time, as I do not have a Windows or a Linux machine to try it out on. This may be something for future study.

SoftMac

- <http://www.emaculation.com/doku.php/softmac>
- “Developed by Emulators, Inc., SoftMac is a closed-source emulator of 68xxx based Macintosh computers. It runs in Windows only. The current version of SoftMac is 8.2 (released in 2002), available as a free download. SoftMac can run OS 7.0.1 to 8.1 within its emulated Macintosh.”
- SoftMac is propriety software. As discussed by Liu, et al, (2005), the “ELO proposes the development of open source interpreters to ‘run’ important or populous categories of e-lit—for example, HyperCard—so as speedily to restore large numbers of older works to readable status.” Open source solutions are more desirable for preservation than proprietary software because the code is available to the community of users for improvement and modification, as well as avoiding the possible obsolescence of proprietary emulation software if the company that holds the copyright should go out of business or stop supporting the software.

At this point, current emulators did not seem to offer a good solution for me. It seems that we still need to work on an open source emulator for HyperCard in modern machines.

There is a proprietary program that claims to migrate HyperCard stacks: Solutions Etcetera’s SuperCard. I tried a number of times on my own to convert the MS2 stack, but kept

getting fatal errors. These errors are likely due to the custom scripting and functions Larsen and her team created when faced with trying to make HyperCard behave in the way they wanted. While Larsen and I were researching and working together at MITH in May 2011, we sent off a copy of MS2 to the support staff at SuperCard to see if they could help us. After several email exchanges we discovered that in order to get SuperCard to convert MS2 we would need to delete, by hand, all 1062 screen transition scripts, eliminate the custom “Parts” menu, and spend \$75.00 per hour (an estimated \$600 total) for Solutions Etcetera techs do the work. We decided to hold off due to the immediate expense. Further, the stack returned would not run like the original MS2, as the transitions would all be missing. There is a chance I may follow up with this option on my own at a future date.

As mentioned above, Larsen has revised *Marble Springs* into *Marble Springs 3.0* using a wiki (Larsen 2012b). However, this is not MS2 in a new environment. In MS3, new characters and poems are introduced, and there are no animations or sounds. Further, there are tag clouds and other textual linking not present in MS2. While MS3 does use screen shots from MS2, the shots are not full function so the icons do not lead to the various help documentation built into MS2.

Marble Springs, Second Edition, may be preserved, but it is far from resurrected.

Chapter 6: *Marble Springs*, Version ???, or, What *Was* the Point?

It is worth asking what was the point of creating gigabytes of data about *Marble Springs*, *Second Edition*? Further, how does this project fit in with the trajectory of MS? As Associate Director of the Maryland Institute for Technology in the Humanities and reader for this project, Matthew Kirschenbaum, remarked, "...the project, as we've discussed, has more than a suggestion of Quixotic whimsy--encouraged, to be sure by D[eeena]L[arsen] and the nature of M[arble]S[prings] itself" (M. Kirschenbaum, personal communication, April 24, 2012). Indeed there was a certain amount of whimsy that helped to get this project started.

Larsen and I met at the Electronic Literature Organization "Archive & Innovate" conference in 2010. I had studied Larsen, as well as many of the other attendees, during my undergraduate work. Based on comments I made about preservation and best practices, we discussed the preservation of *Marble Springs*, which at that time was only known to me in the first version, and only through mentions in literature, not through experience. Larsen invited me to visit her at her Denver home, and told me to be prepared to bring home computers. While in Denver, I was directed into the crawl space under the foundation of Larsen's home to find more than 40 Mac Classics and other beige box models, all wrapped carefully in plastic. I chose four, looking for tags that said "works." With these four, plus two clamshell laptops and an iBook running OS 9, HyperCard 2.2, and *Marble Springs*, *Second Edition*, I was sent home to begin the task of preservation.

I first tried to get emulators to run on my current desktop, as detailed above, but that failed. So I began the documentary approach described. This is where the whimsy ended and the serious documentation began. Early decisions included capturing every script, button, and link. Transition effects and audio effects were also recorded. The careful documentation of every state

change of MS2 puts the efforts I have made squarely in line with recommendations of “Acid-Free Bits” discussed above. Rather than being apart from the evolution of *Marble Springs*, the documentation present in Appendix WWWWWWW represents a crucial step missed in the creative process: complete documentation to hedge against future obsolescence.

To be fair, no (or few, anyway) artists in the midst of the creative process want to be bothered with such precise record keeping. As it happened, that would mean adding hundreds of hours to the creation of the work. As noted in “Acid-Free Bits,” “[u]ltimately, preserving electronic literature will be the work of a system of writers, publishers, electronic literature scholars, librarians, archivists, software developers, and computer scientists,” or a community effort. Preservation can best be achieved, I would argue, by pairing the archivist with the artist as early in the creative process as possible. This could mean real-time or near-real-time creation of documentation and metadata, and perhaps discussions about practices that would ensure greater preservability. It is hoped that the results here can spur the efforts of groups like the ELO to find funding for programmers and archivists to create emulators and/or find/create open-source ways to automate preservation efforts. This was a great deal of time devoted to just one work.

Thirdly, Appendices A through VVVVVVVV represent yet another way to encounter *Marble Springs*. The screen shots and link tables should allow reader/players the opportunity to, albeit poorly, simulate the experience of hypertextual reading, and recall Larsen’s use of string to connect characters. Instructions were written to help reader/players adapt to the wiki form, mirroring Larsen’s own experience with her thesis committee, which had not used links or possibly even a computer mouse before. Further, the use of old technology—paper!—to preserve what became an electronic text fits nicely with Larsen’s Mac Cozy.

Finally, this preservation effort, rather than feebly tilting at technology, spurred innovation. As Larsen notes (About, 2012), MS3, the wiki instantiation of *Marble Springs*, came about because of her access to my “exhaustive lists of links and texts and images.” When I first met Larsen, we both despaired that her chronically poor health meant she would not see the end of my efforts. She in fact has managed to run ahead, and get MS3 up on the wiki, before I could finish writing the report on the preservation efforts. Though Marble Springs, Colorado, is a ghost town, *Marble Springs* the work is no longer lost, and it is nice to know that I had a part in its recovery.

“Marble Springs now rests quietly in the sunlight. Human sounds have long since melted into the old boards, broken from empty winters. Yet hidden in the abandoned dust, the stories still weave their webs.”

-Deena Larsen, “Journeys,” *Marble Springs, Second Edition* [card 002]

Chapter 7: Conclusions

When preserving born-digital hypertexts, we must start by assessing the significant properties of the work, as these can serve as a guide to our preservation strategy. However, given the constant changes in computer software and hardware, it can be difficult, if not impossible, to preserve every significant property of a work. Given the pending obsolescence of the HyperCard software system, the *Marble Springs, Second Edition* HyperCard stack, and the aging iMac on my desk, I chose to save the intellectual content and linking behavior of MS2 using plain text documentation and screen shots. I did this with the understanding that I would lose most of the ergodic characteristics of the work that make hypertext literature interesting to reader/players. Yet even such a seemingly simple preservation approach has many costs, including time and file storage. In the end, I have more than 8 GB of data and files relating to what was originally a 1.1 MB file. Emulation of Mac's OS 9 and of HyperCard would be the better solution, as it would allow us to save scores of HyperCard-based works. However, to date, no proprietary or open-source solution exists, despite the concern expressed in e-lit circles over the last decade. To begin to resurrect MS2 and other works of its type, far greater resources need to be focused on training programmers to write emulators. In the mean time, we have several thousand pages of MS2 to read through and play with if we choose.

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Appendix A: Card 001, “Cover”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_001.pdf

Appendix B: Card 002, “Journeys”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_002.pdf

Appendix C: Card 003, “Notes from somewhere else”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_003.pdf

Appendix D: Card 004, “About the hypertext”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_004.pdf

Appendix E: Card 005, “Help”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_005.pdf

Appendix F: Card 006, “Prologue”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_006.pdf

Appendix G: Card 007, “How to Read”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_007.pdf

Appendix H: Card 008, “History”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_008.pdf

Appendix I: Card 009, “Authors”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_009.pdf

Appendix J: Card 010, “Completeness”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_010.pdf

Appendix K: Card 011, “How to Write”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_011.pdf

Appendix L: Card 012, “Forging New Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_012.pdf

Appendix M: Card 013, “Main Map”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_013.pdf

Appendix N: Card 014, “Town Map”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_014.pdf

Appendix O: Card 015, “Graveyard”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_015.pdf

Appendix P: Card 016, “Black Queen Mine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_016.pdf

Appendix Q: Card 017, “Crow’s Mountain”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_017.pdf

Appendix R: Card 018, “First Congregational Church”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_018.pdf

Appendix S: Card 019, “Cole’s General Mercantile”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_019.pdf

Appendix T: Card 020, “Crystal River Railroad”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_020.pdf

Appendix U: Card 021, “Goliath Manor”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_021.pdf

Appendix V: Card 022, “Marble Springs Jail”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_022.pdf

Appendix W: Card 023, “Ladies Aid Society”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_023.pdf

Appendix X: Card 024, “The Marble Edifice”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_024.pdf

Appendix Y: Card 025, “Quarry”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_025.pdf

Appendix Z: Card 026, “Marble Springs School”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_026.pdf

Appendix AA: Card 027, “Sugar Boy Mine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_027.pdf

Appendix BB: Card 028, “The White Owl”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_028.pdf

Appendix CC: Card 029, “Bates Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_029.pdf

Appendix DD: Card 030, “Searches”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_DD.pdf

Appendix EE: Card 031, “Directory”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_031.pdf

Appendix FF: Card 032, “Settling In”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_032.pdf

Appendix GG: Card 033, “Cattering Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_033.pdf

Appendix HH: Card 034, “Silk Colors”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_034.pdf

Appendix II: Card 035, “Penny and Ida Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_035.pdf

Appendix JJ: Card 036, “Aspen Gold”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_036.pdf

Appendix KK: Card 037, “Rules”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_037.pdf

Appendix LL: Card 038, “Cole Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_038.pdf

Appendix MM: Card 039, “James Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_039.pdf

Appendix NN: Card 040, “Reflections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_040.pdf

Appendix OO: Card 041, “Cooper Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_041.pdf

Appendix PP: Card 042, “Night Winds”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_042.pdf

Appendix QQ: Card 043, “The Seekers”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_043.pdf

Appendix RR: Card 044, “Crow Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_044.pdf

Appendix SS: Card 045, “Peggy’s Diary”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_045.pdf

Appendix TT: Card 046, “Lady Bountiful”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_046.pdf

Appendix UU: Card 047, “Davidson Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_047.pdf

Appendix VV: Card 048, “Doc Nancy”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_048.pdf

Appendix WW: Card 049, “Doc Nancy Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_049.pdf

Appendix XX: Card 050, “Promises”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_.050pdf

Appendix YY: Card 051, “Gaylor Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_051.pdf

Appendix ZZ: Card 052, “Moving On”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_052.pdf

Appendix AAA: Card 053, “In His Name”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_053.pdf

Appendix BBB: Card 054, “Granger Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_054.pdf

Appendix CCC: Card 055, “Seeing the Elephant”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_055.pdf

Appendix DDD: Card 056, “Strength”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_056.pdf

Appendix EEE: Card 057, “Grimes Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_057.pdf

Appendix FFF: Card 058, “Sun’s Gold”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_058.pdf

Appendix GGG: Card 059, “Wildflowers”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_059.pdf

Appendix HHH: Card 060, “Harmon Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_060.pdf

Appendix III: Card 061, “Mountain Sunrise”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_061.pdf

Appendix JJJ: Card 062, “Breaking Points”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_062.pdf

Appendix KKK: Card 063, “Harris Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_063.pdf

Appendix LLL: Card 064, “Eyes”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_064.pdf

Appendix MMM: Card 065, “Heollstar Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_065.pdf

Appendix NNN: Card 066, “Firelight”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_066.pdf

Appendix OOO: Card 067, “Horner Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_067.pdf

Appendix PPP: Card 068, “Respect”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_068.pdf

Appendix QQQ: Card 069, “Red Ribbons”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_069.pdf

Appendix RRR: Card 070, “Sven’s Wife”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_070.pdf

Appendix SSS: Card 071, “Jenson Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_071.pdf

Appendix TTT: Card 072, “Sing Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_072.pdf

Appendix UUU: Card 073, “Quilts”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_073.pdf

Appendix VVV: Card 074, “Confinement”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_074.pdf

Appendix WWW: Card 075, “Baking”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_075.pdf

Appendix XXX: Card 076, “Lincoln Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_076.pdf

Appendix YYY: Card 077, “How It Is”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_077.pdf

Appendix ZZZ: Card 078, “The Accomplice”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_078.pdf

Appendix AAAA: Card 079, “Rubenstien Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_079.pdf

Appendix BBBB: Card 080, “Whispers in Wine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_080.pdf

Appendix CCCC: Card 081, “Mateson Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_081.pdf

Appendix DDDD: Card 082, “Crumbs”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_082.pdf

Appendix EEEE: Card 083, “French”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_083.pdf

Appendix FFFF: Card 084, “Cover Up”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_084.pdf

Appendix GGGG: Card 085, “Miller Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_085.pdf

Appendix HHHH: Card 086, “Hair”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_086.pdf

Appendix III: Card 087, “School Days”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_087.pdf

Appendix JJJJ: Card 088, “Morrison Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_088.pdf

Appendix KKKK: Card 089, “Counting”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_089.pdf

Appendix LLLL: Card 090, “O’Shanty Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_090.pdf

Appendix MMMM: Card 091, “His Hands”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_091.pdf

Appendix NNNN: Card 092, “Paine Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_092.pdf

Appendix OOOO: Card 093, “Half-breed”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_093.pdf

Appendix PPPP: Card 094, “Pitkin Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_094.pdf

Appendix QQQQ: Card 095, “Ute Crossing”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_095.pdf

Appendix RRRR: Card 096, “Waiting”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_096.pdf

Appendix SSSS: Card 097, “Rainer Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_097.pdf

Appendix TTTT: Card 098, “Conning Through”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_098.pdf

Appendix UUUU: Card 099, “Investments”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_099.pdf

Appendix VVVV: Card 100, “Miss Song”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_100.pdf

Appendix WWW: Card 101, “Literary Society”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_101.pdf

Appendix XXXX: Card 102, “Smith Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_102.pdf

Appendix YYYY: Card 103, “Reassurances”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_103.pdf

Appendix ZZZZ: Card 104, “Stokes Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_104.pdf

Appendix AAAAA: Card 105, “Nowhere”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_105.pdf

Appendix BBBB: Card 106, “Katy’s Creek”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_106.pdf

Appendix CCCCC: Card 107, “Stoner Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_107.pdf

Appendix DDDDD: Card 108, “Scraps”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_108.pdf

Appendix EEEEE: Card 109, “Striking Silver”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_109.pdf

Appendix FFFFF: Card 110, “Out of Egypt”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_110.pdf

Appendix GGGGG: Card 111, “The Washerwoman”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_111.pdf

Appendix HHHHH: Card 112, “Abandoned”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_112.pdf

Appendix IIII: Card 113, “Wringle Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_113.pdf

Appendix JJJJ: Card 114, “Left Behind”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_114.pdf

Appendix KKKKK: Card 115, “Mail Order Bride”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_115.pdf

Appendix LLLLL: Card 116, “Joe Cattering”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_116.pdf

Appendix MMMMM: Card 117, “Denizens of Marble Springs”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_117.pdf

Appendix NNNNN: Card 118, “Jeremiah Cohen”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_118.pdf

Appendix OOOOO: Card 119, “Walter Cole”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_119.pdf

Appendix PFFFF: Card 120, “Wayne Cole”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_120.pdf

Appendix QQQQQ: Card 121, “Matthew Cole”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_121.pdf

Appendix RRRRR: Card 122, “Troy Cooper”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_122.pdf

Appendix SSSSS: Card 123, “Kurt Croft”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_123.pdf

Appendix TTTTT: Card 124, “Martin Crow”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_124.pdf

Appendix UUUUU: Card 125, “Perdy Dagmar”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_125.pdf

Appendix VVVVV: Card 126, “T.M. Davidson”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_126.pdf

Appendix WWWWW: Card 127, “Clancy Gaylor”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_127.pdf

Appendix XXXXX: Card 128, “Charles Gladston”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_128.pdf

Appendix YYYYYY: Card 129, “Paul Granger”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_129.pdf

Appendix ZZZZZ: Card 130, “Hank Green”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_130.pdf

Appendix AAAAAA: Card 131, “Griffith”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_131.pdf

Appendix BBBBBB: Card 132, “Dickon Grimes”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_132.pdf

Appendix CCCCCC: Card 133, “Eric Harmon”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_133.pdf

Appendix DDDDDD: Card 134, “Ernest Harmon”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_134.pdf

Appendix EEEEEEE: Card 135, “Isaac Harmon”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_135.pdf

Appendix FFFFFFF: Card 136, “Jordan Harmon”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_136.pdf

Appendix GGGGGG: Card 137, “Sam Harmon”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_137.pdf

Appendix HHHHHH: Card 138, “Jim Harmon”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_138.pdf

Appendix IIIII: Card 139, “Joel Harris”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_139.pdf

Appendix JJJJJ: Card 140, “Jimmy Heollstar”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_140.pdf

Appendix KKKKKK: Card 141, “Joey Heollstar”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_141.pdf

Appendix LLLLLL: Card 142, “Jud Heollstar”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_142.pdf

Appendix MMMMMM: Card 143, “Timmy Horne”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_143.pdf

Appendix NNNNNN: Card 144, “Pastor Horner”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_144.pdf

Appendix OOOOOO: Card 145, “Doctor Hudson”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_145.pdf

Appendix P P P P P P: Card 146, “Alfred James”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_146.pdf

Appendix QQQQQQ: Card 147, “Sven Jenson”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_147.pdf

Appendix RRRRRR: Card 148, “Ken Jones”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_148.pdf

Appendix SSSSSS: Card 149, “Fred Keeperly”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_149.pdf

Appendix TTTTTT: Card 150, “Randall Klaron”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_150.pdf

Appendix UUUUUU: Card 151, “Jake Mateson”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_151.pdf

Appendix VVVVVV: Card 152, “Sandy McQuigg”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_152.pdf

Appendix WWWWWW: Card 153, “Asa Miller”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_153.pdf

Appendix XXXXXX: Card 154, “Bart Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_154.pdf

Appendix YYYYYY: Card 155, “Ellen Anne Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_155.pdf

Appendix ZZZZZZ: Card 156, “Ella May Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_156.pdf

Appendix AAAAAAA: Card 157, “Bartholomew Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_157.pdf

Appendix BBBBBBB: Card 158, “Scott Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_158.pdf

Appendix CCCCCC: Card 159, “Bonnie Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_159.pdf

Appendix DDDDDDD: Card 160, “Hope Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_160.pdf

Appendix EEEEEEE: Card 161, “Faith Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_161.pdf

Appendix FFFFFFFF: Card 162, “Patience Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_162.pdf

Appendix GGGGGGG: Card 163, “Spent Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_163.pdf

Appendix HHHHHHHH: Card 164, “Trials Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_164.pdf

Appendix IIIIII: Card 165, “Troubles Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_165.pdf

Appendix JJJJJJ: Card 166, “Straw Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_166.pdf

Appendix KKKKKKK: Card 167, “Michael Nolan”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_167.pdf

Appendix LLLLLLL: Card 168, “Kevin Paine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_168.pdf

Appendix MMMMMMMM: Card 169, “Jonah Paine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_169.pdf

Appendix NNNNNNN: Card 170, “Micah Paine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_170.pdf

Appendix OOOOOOO: Card 171, “Ezekial Paine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_171.pdf

Appendix P P P P P P P P: Card 172, “Henry Pitkin”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_172.pdf

Appendix QQQQQQQ: Card 173, “Ben Rainer”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_173.pdf

Appendix RRRRRRR: Card 174, “Jacob Rubenstien”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_174.pdf

Appendix SSSSSSS: Card 175, “Luc San”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_175.pdf

Appendix TTTTTTTT: Card 176, “Herbert Jenkins Smith”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_176.pdf

Appendix UUUUUUU: Card 177, “Richard Stokes”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_177.pdf

Appendix VVVVVVV: Card 178, “Tom Stoner”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_178.pdf

Appendix WWWWWW: Card 179, “Lizzie Morrison”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_179.pdf

Appendix XXXXXXXX: Card 180, “Will Turner”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_180.pdf

Appendix YYYYYYY: Card 181, “Robert Vernon”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_181.pdf

Appendix ZZZZZZZ: Card 182, “Peter Wringle”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_182.pdf

Appendix AAAAAAAAA: Card 183, “Ichiro Yamamoto”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_183.pdf

Appendix BBBBBBBB: Card 184, “Kenji Yamamoto”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_184.pdf

Appendix CCCCCCCC: Card 185, “Maddy Bates”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_185.pdf

Appendix DDDDDDDD: Card 186, “Credits”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_186.pdf

Appendix EEEEEEEE: Card 187, “Ephraim Horner”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_187.pdf

Appendix FFFFFFFF: Card 188, “Josiah Horner”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_188.pdf

Appendix GGGGGGGG: Card 189, “Saul Horner”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_189.pdf

Appendix HHHHHHHH: Card 190, “Mariah Horner”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_190.pdf

Appendix IIIIIII: Card 191, “Douglas Gaylor”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_191.pdf

Appendix JJJJJJJ: Card 192, “Gilbert Gaylor”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_192.pdf

Appendix KKKKKKKK: Card 193, “Andrew Gaylor”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_193.pdf

Appendix LLLLLLLL: Card 194, “Earle Gaylor”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_194.pdf

Appendix MMMMMMMM: Card 195, “Saskatee”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_195.pdf

Appendix NNNNNNNN: Card 196, “Sandor Popovic”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_196.pdf

Appendix OOOOOOOO: Card 197, “Cleo Cat”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_197.pdf

Appendix P: Card 198, “Ruth Cole”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_198.pdf

Appendix QQQQQQQQ: Card 199, “Allison James”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:
MS2_199.pdf

Appendix RRRRRRRR: Card 200, “Naomi Cole”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_200.pdf

Appendix SSSSSSSS: Card 201, “Chokecherry Wine”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_201.pdf

Appendix TTTTTTTT: Card 202, “Trygve Lode”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_202.pdf

Appendix UUUUUUUU: Card 203, “Cover 2”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_203.pdf

Appendix VVVVVVVV: Card 204, “Skeletal Connections”

The full documentation of this *Marble Springs, Second Edition* card, including images of each screen state change and tables of hyperlinks, can be found in the supplemental file named:

MS2_204.pdf

Appendix WWWWWWW: Raw Data

This file concatenates the full textual documentation of each card of *Marble Springs, Second Edition*. These documents capture the card information and scripts that is illustrated in Table 1 beginning on page 21 of the main text. The can be found in the file named:

MS2_Appendix_WWWWWWWW.pdf

Appendix XXXXXXXX: PICT Images

Each original screen shot taken of *Marble Springs, Second Edition* running in its native OS 9 in HyperCard 2.2, as part of the preservation and documentation process, can be found in the supplemental file named: **MS2_PICTs**

Appendix YYYYYYYY: TIFF Images

Each screen shot taken of *Marble Springs, Second Edition* running in its native OS 9 in HyperCard 2.2, as part of the preservation and documentation process, then converted to archival TIFF format, can be found in the supplemental file named: **MS2_TIFFs**

Appendix ZZZZZZZZ: JPG Images

Each screen shot taken of *Marble Springs, Second Edition* running in its native OS 9 in HyperCard 2.2, as part of the preservation and documentation process, then converted to lower quality JPG format, can be found in the supplemental file named: **MS2_JPGs**