



ELSEVIER

Available online at www.sciencedirect.com

SCIENCE @ DIRECT®

Int. J. Human-Computer Studies 59 (2003) 403–430

International Journal of
Human-Computer
Studies

www.elsevier.com/locate/ijhcs

The evolution of US state government home pages from 1997 to 2002

Terry Ryan^{a,*}, Richard H.G. Field^b, Lorne Olfman^a

^a*School of Information Science, Claremont Graduate University, 130 E. Ninth St, Claremont, CA 91711, USA*

^b*School of Business, University of Alberta, Edmonton, Alberta, T6G 2R6, Canada*

Received 15 November 2002; received in revised form 24 February 2003; accepted 31 March 2003

Abstract

We examined the home pages of the 50 US states over the years 1997–2002 to discover the dimensions underlying people's perceptions of state government home pages, to observe how those dimensions have changed over the years, to identify different types of state home pages, and to see how these types have changed. We found that three primary dimensions explain the variation in perceptions of home pages. These are the layout of the page, its navigation support, and its information density. Over the years, variation in navigation support declined and variation in information density increased. We discovered that four types of state government home page have existed continuously from 1997 to 2001. These are the 'Long List of Text Links', the 'Simple Rectangle', the 'Short L', and the 'High Density/Long L'. To this taxonomy, two other page types can be added: the 'Portal' page and the 'Boxes' page. The taxonomy we have identified allows for a better understanding of the design of US state home pages, and may generalize to other categories of home pages.

© 2003 Elsevier Ltd. All rights reserved.

Keywords: Home page; Perceived types; Dimensionality; Web Archive; MDS; State government

1. Introduction

The design of Web home pages is a shared concern for HCI and MIS researchers. HCI researchers are interested in how people react to Web pages, including how they understand pages, how they navigate among them, and how they experience various

*Corresponding author. Tel.: +1-909-607-9591; fax: +1-909-621-8562.

E-mail address: terry.ryan@cgu.edu (T. Ryan).

page attributes. MIS researchers are interested in how organizations create Web pages to communicate and interact with people, including customers and employees.

Web designers and the organizations that employ them need to be concerned with Web page designs, and the designs of home pages in particular. The home page provides the first impression of a Web site. It can set a user's opinions of the site along many lines: Is the site useful? Is it easy to use? Is it the product of a professional effort?

Unfortunately, to date there exist few research based guidelines for home pages. This study investigates the history of home page designs in one organizational domain—state government. The historical analysis we present in this paper was motivated by the fact that an archive of Web pages, described in detail below, became available in late October 2001. We saw the availability of the archive as a means to trace the changing patterns of home pages and to see if there were lessons in those patterns. Intuitively, from our experiences with our own institutions, we knew that home pages have changed since the inception of the Web in the early 1990s. However, we wondered how those changes were manifested and whether changes might provide information about processes of Web development. To answer our questions, we selected as our focal point the home pages for the 50 US states. The advantages of this sample are that it is stable, not too large, and comparable in terms of purpose.

The study addresses several general questions.

- What types of home pages have designers employed?
- How have these types evolved?
- What user perceptual dimensions explain the existence of different home page types?
- How has the importance of these dimensions changed over time?

Answering these questions will provide value to both Web designers and organizations wanting to understand what types of pages have been used and how the types have changed.

The road map of this paper is as follows: First, it describes specific research questions (based on the general questions noted above) and briefly outlines the methods used to answer the questions. Then, these methods, which included a data collection phase and two analytic phases, are presented, including results of the analyses. The paper concludes with a summary of findings and suggestions for future research.

If we can understand the evolution of home pages, it will help us to clarify what has happened already and why what has happened might be important. Creators of home pages who have a better understanding of this history might use such understanding to improve communication with visitors to their sites.

2. Literature review

2.1. *The home page*

A number of authors validate the importance of the home page in Web site design. [Andres \(1999\)](#) argues, reasonably, that a Web site cannot be judged by its home page

alone. On the other hand, as he points out, the home page is the site's entry point. Visitors to a home page experience its image and its promise of additional information (and services) as its basic elements. According to Nielsen and Tahir (2002), the home page is the most important page in any site, getting the most visits of any page. It is the primary interface between organizations and people on the Web. They claim that a home page has the purpose of communicating, "what the company is, the value the site offers, ... and the products and services offered" (p. 2).

Van Duyne et al. (2003) state, "a homepage must satisfy the needs of all potential and current customers by establishing the company's identity, while providing multiple ways to navigate" (p. 228). According to them, the home page is "seen 10 to 1000+ times more than any other page" (p. 229). They state that the goals of the home page include creating the right look and feel, building site brand and identity, providing valuable content, making navigation easy to use, establishing a cohesive and logical page layout, and delivering high performance. With respect to creating the right look and feel, they observe "visitors can be turned off by style alone, or by a homepage look and feel that says 'This site is not for me'" (p. 229).

Nielsen and Tahir (2002) argue that users experience home pages in metaphorical terms. They note that not all metaphors are appropriate and some can be misleading. The metaphors they note as most common include the following

- Magazine cover—defining the content, style, and so forth inside.
- Your face to the world—making a first impression.
- Artwork—catching attention and inviting further analysis.
- Building lobby—entrance point from which user can find areas of interest.
- Company receptionist/concierge—helpful, welcoming aid to visitors.
- Book table of contents—hierarchical overview of what information is available.
- Newspaper front page—prioritized summary of content.
- Brochure—enticement to visitors to make further contact.

2.2. *Design guidelines*

Available guidelines for Web design typically do not address the design of home pages specifically, but rather are concerned with the design of Web sites or with Web pages in general. Few design guidelines are derived from research; most are based on the practical experiences of the authors. The following brief review outlines some useful guidelines and styles, but as discussed below ('Research Questions'), there was no clear set of recommendations that we could use as a baseline to compare home pages.

Nielsen and Tahir (2002) provide 113 guidelines for designing usable home pages. As one example, they maintain that home page length should not exceed three full screens, with the most important information coming on the first of these. They provide 40 specific design recommendations. Twelve of these are 'essential' (to be used in all projects), 21 are 'strong' (for most projects), and seven are 'default' (safe to follow). One essential recommendation is to place the organizational logo in the upper left of the home page. A strong recommendation is to use white as the background color. A default recommendation is to employ sans-serif typeface.

According to Lynch and Horton (2001), effective Web page design satisfies an interest in clarity, order, and trustworthiness, balancing visual sensation and graphic information. Readers see masses of shape and color first when they look at a Web page, then graphics, and finally text. They maintain that while designing Web pages, designers should attend to this visual hierarchy, as well as consistency across pages, appropriate page dimensions, useful page length, and the use of grids for ordering information, among other matters. For example, keeping page length short is appropriate for home pages, while long pages are better in terms of ease of downloading (Lynch and Horton, 2001).

Cloninger (2002) defines 10 Web styles that he describes as “fresh” and “underground.” Cloninger takes exception to directives on Web design by people whom he describes as “usability legalists,” including Nielsen (2000, 2003). While Nielsen and others have argued that Web sites with poor usability are destined to fail, Cloninger counters, “If a site is perfectly usable but it lacks an elegant and appropriate design style, it will fail” (p. 4). The design styles Cloninger presents—labeled with descriptions such as LoFi Grunge, Pixilated Punk Rock, and 1950s Hello Kitty—emphasize the creative (and artistic) use of the capabilities of the Web.

2.3. *Home page changes*

Some research has been done that attempts to understand the dynamic nature of the Web. These studies typically have been focused on entire sites. Additionally, prior research in this vein has not taken advantage of any comprehensive source of historical data about Web pages or sites.

Koehler (1999, 2002) studied changes in Web pages to understand the extent to which pages and their content are stable, and whether different types of pages have different characteristics in terms of content and stability. His 1999 article looked at a sample covering 53 weeks, while the 2002 article extended the study to include 214 weeks (from December 1996 to February 2001). Koehler used a random sample of 361 sites as of December 1996 (it dwindled to 124 by February 2001), which he terms as representative of the Web in 1996, but not in 2001. His study shows that there is still much work to do in finding a meaningful way of classifying Web sites. However, it does not provide a good indication of what kinds of changes take place in sites over time.

Vaughn (2001) traced the changes of one specific Web site, the academic library site for the University of Nevada, Las Vegas, over a 4-year period. He describes the motivation for site changes, the designs that were developed, how the designs were evaluated, and goals for future designs. Vaughn’s case study shows that design decisions are based on a variety of motivations, and in this instance, design decisions are also based on goals for the site, as well as assessment of existing sites and published guidelines. Vaughn’s description is not a comparative study across a set of similar Web sites.

2.4. *Research Questions*

We initiated this study out of interest in the types of home pages that have been created by Web designers and organizations over the years. One way of addressing

this general concern would have been to adopt one of the existing (non-empirically based) typologies discussed above (e.g. Nielsen and Tahir, 2002). The existing home page typologies, however appealing, stem from metaphors (and other notions of usage) that may seem correct to the experts who developed them, but may have little to do with how people see Web pages.

Instead of asking research questions based on existing home page typologies, we decided to investigate what design types people actually identify in real home pages. Such an approach has the virtue of not imposing artificial conceptual frameworks on the research topic. We decided it would be more interesting to understand the types of home pages people perceive, based on whatever criteria they employ. This line of thinking led to two specific research questions on which this study is based.

1. What are the perceptual dimensions that people employ in differentiating home pages?
2. What types of home pages have emerged from the early days of the Web to the recent?

The first of these questions is important in understanding what aspects of home pages are responsible for the groupings of home pages that people perceive. Unlike the existing typologies of home pages, the groupings of home pages that people perceive could be determined by any number of factors. We had no wish to impose our a priori criteria, but rather wished to identify which factors matter to home page visitors in forming their impressions. An answer to this question should have value for designers of home pages for state governments and other organizations—they need to be aware of what aspects of their design will stand out to their audiences.

The second of these questions matters in helping to inform consideration of possible home page designs by organizations and the designers they employ. Knowing what types of home pages have been created is important to Web designers—they want to be aware of what types have been tried, successfully or not, and what types may be novel. If some types have come and gone, while others have come and stayed, knowing this may help designers to make choices about the type of page they might wish to present. Knowing what new types are emerging can be of value, too. In all, being aware of the evolution of home pages, in terms of the types that have appeared, disappeared, and emerged will be a valuable addition to what is known about home page design.

3. Research method

3.1. Web archive

The study of home pages is difficult due to the ephemeral nature of the pages on the Web. Pages change on an unpredictable basis. A resource that has recently become available that can help to overcome some of the problems in studying Web pages is the Web Archive. Found at <http://www.archive.org>, it is a digital library

that has been collecting snapshots of the entire Web since 1996 (Boyle, 1997). It is now possible to access the Web Archive's servers through their Web tool, called the Wayback Machine, and retrieve pages, including home pages, from 1996 to the present.

3.2. *Population of web sites*

Given the massive size of the Web, it was necessary to choose a population to study. We decided to use US state home pages. These pages have URLs of the structure 'www.state.xx.us' where 'xx' is the official two-character state code (e.g., AL=Alabama). One reason for choosing this group of home pages was that it consists of at most 50 instances at any time. This provides enough potential variation to find home page changes over time and yet not so many members of the population that sampling is required. Another reason for the choice of US state home pages was that the sites themselves are unlikely to disappear. This allows the study of the population over time without changes in membership. In addition, given the uniform structure of state URLs, the researcher can be certain of accessing the official home page of the state. Further, the population of US state home pages is interesting because of its importance to users. There is a population of over 250 million people who are communicative targets of these state home pages. Further, every nation has levels of government that are now creating or maintaining Web sites. As e-government becomes a more important method for governments to interact with citizens, the choice of the best or most effective type home pages could be important.

3.3. *Capturing home page images*

We initially explored the possibility of capturing the HTML files of state home pages from the Web Archive. When loaded on our research computers, these files would have allowed us to study the fully functioning graphics and menus of the home pages. Such capture and use proved too difficult for several reasons. The Web Archive in November of 2001 was uneven in its performance. Many home pages would not fully load. Further, we found that comparing a given year of state home pages on a standard office desktop computer was very difficult. It took too long to compare electronic versions of the state home pages. We therefore decided to build a collection of static images of state home pages captured from a browser. The advantage of this approach is that it was something that we could accomplish in a reasonable amount of time. The disadvantage is the loss of interactive elements of the pages. Pictures that are supposed to swap in and out do not, scroll over pop-up menus do not function, and animated graphics do not move.

In November of 2001, we gathered state home page images from the Web Archive site for the years 1996–2000. Entering a state address in the 'Wayback Machine' produces a listing of all pages gathered for that site by year. Our initial plan was to collect the last listing for each state for each year from 1996 to 2000. This would have given us state home pages from late in every year and therefore we would have approximately a 1-year interval between each collected state home page. In practice,

this proved not to be possible. Sometimes, a home page listed by the Archive was not available. Other times, a page might only partially load from the Archive. Our goal in gathering home pages became to obtain a full representation of the home page as close in time as possible to the last home page listed in the Archive for that state for that year. For example, the actual home pages gathered for Alaska were 23 December 1996; 11 December 1997; 10 June 1998; 27 April 1999; and 17 September 2000. The time intervals between captured home pages for a given state are therefore not exactly one year, although they were as close to the target as we could achieve.

For the year 1996, we could capture only 27 state home pages. It is likely that the Web was so new at this point that many states had yet to create an official Web site or were not using the standard URL for their home page. We decided not to use 1996 home page data in this study. While we made every attempt to gather a complete dataset for every year studied from 1997 onward, some data are missing. The home pages for California, Maryland, Michigan, and Montana in 1997 were not available. The state of Washington's pages are missing for 1999 and 2000, as only a text representation of their graphical page was available. In 1998, the Web Archive did not have a loadable page for Idaho. State home page images for the year 2001 were screen captured from the live Web sites for each state during 13 and 14 November. Images for 2002 were screen captured on 14 November of that year. There was no missing data for 2001 and 2002.

For each state, we created an image of the home page for each year by performing a screen capture of the page as displayed on a Web browser and then pasting the captured screen image into Microsoft Photo Editor using a True Color 300 dpi setting. When the state home page did not fit into one browser window, we used the software to assemble multiple screen images into a full-length image. We saved the state home page images as .jpg files, printed these in color on sheets of paper, and then laminated the printed images in order to protect them from handling damage. We found it necessary to split very long home page images onto two printed sheets. These we placed back-to-back before lamination, so that each state home page corresponded to one laminated page.

3.4. Method for comparing pages

After having collected static images of state home pages for the years 1997–2002, we were ready to study how those pages had changed over time. While, it might be possible to visually inspect a small set of images to determine trends, the fact that there were 293 images in the database made direct visual inspection impracticable. We found it to be overwhelming to try to find patterns among the 46–50 images of state home pages for a given year. To lay out 50 state home page images, as printed, requires an area somewhat larger than 3 m × 1 m, which makes examination of the pages cumbersome. We needed an easier method of data analysis.

The solution we settled on was to have people sort images of state home pages into groupings, based on how similar the pages seemed to each other, rather than examine all images at once. Each person sorted one year's worth of images. Across a number of participants, for a given year, these groupings could then be examined.

While any one participant's state groupings are made on individualistic criteria, the aggregation of the data across multiple participants allows underlying similarities in grouping logic to be uncovered. Aggregation of data across participants also facilitates the comparison of groupings from year to year.

3.5. Participants

There were 180 participants in the experiment, 30 for each year of the data. Almost all participants were undergraduate students (the others were MBA students) at a large public university in Western Canada. We recruited experiment participants by poster, email, and word-of-mouth and paid \$10 CDN for their participation. The second author collected all of the data.

3.6. Procedures

The experimenter told participants that the research concerned the design of home pages and how home pages may change over time. He then gave each participant a randomly ordered set of the laminated printed images of state home pages for a particular year. The experimenter asked each participant to create groupings of home page images, where each grouping has home pages that are similar to each other, but different from pages in other groups. Participants could use any grouping criteria that made sense to them and could create as few or as many groupings of pages as they wished.¹

Upon completion of the task, each participant returned the sorted set of home page images to the researcher, who asked the participant to explain the rationale for each grouping he or she had created. The experimenter noted any reasons given for groupings. The experimenter recorded the membership of each group of states before randomizing the printed images in preparation for the next participant. No participants reported any difficulty in sorting the home pages into groups; most completed the task within one-half hour.

3.7. Data preparation

We created dissimilarity matrixes for each year to express the perceived distances among state home pages, as suggested by Hair et al. (1998). Estimating perceived distances among home pages is a necessary step for dimensional and clustering analyses.

As a first step in creating a dissimilarity matrix for home pages for a year, we created individual agreement matrixes for each participant for that year. Each agreement matrix contained a row and a column for every state. Each off-diagonal cell of the matrix served as the intersection of the column for one state with the row for another; for diagonal cells, the state was the same for the row and the column. The entries in any cell could either be '1' (if the participant had grouped the column

¹The benefit of this approach is that important grouping criteria are likely to emerge across the set of 30 participants in a given year. If we had given our participants the criteria to use for grouping, then these would be the criteria we would find in the data.

	AK	AL	AR	AZ	CA	CO	CT	DE	FL	...
AK	1	1	0	0	0	0	0	0	0	
AL	1	1	0	0	0	0	0	0	0	
AR	0	0	1	1	1	0	1	1	0	
AZ	0	0	1	1	1	0	1	1	0	
CA	0	0	1	1	1	0	1	1	0	
CO	0	0	0	0	0	1	0	0	0	
CT	0	0	1	1	1	0	1	1	0	
DE	0	0	1	1	1	0	1	1	0	
FL	1	0	0	0	0	0	0	0	1	
⋮										

Fig. 1. Partial similarities matrix for an individual experiment participant.

state and the row state together) or '0'. For example, if a participant grouped Alaska (AK) with Florida (FL), then that participant's agreement matrix contained a value of 1 in the cell at the intersection of the column for Alaska and the row for Florida (see Fig. 1).² If the participant did not group Connecticut (CT) and Alabama (AL) together, the cell at the intersection of the column for Connecticut and the row for Alabama would contain a value of 0. Note in Fig. 1 that the diagonal cells all contain values of one, since all state home pages are by definition grouped with themselves.

As a second step, we constructed a matrix having one row and one column for each state, in which every cell initially received a value of 30, equal to the number of participants in the experiment for that year. We then subtracted each participant's agreement matrix from this initial matrix, resulting in a dissimilarity matrix containing cell values ranging from zero to the number of participants. The cell values in the dissimilarity matrix can be thought of as perceptual distances between states in the multidimensional space defined by participants' judgments of home page similarities. Note that the diagonal cells all contain values of zero, since all state home pages are at a distance of zero from themselves. In the example shown in Fig. 2, one can see that California (CA) and Florida are at a distance of 14 from each other (i.e. 16 of 30 participants had them grouped together), while Delaware (DE) and Florida are at a distance of 29 from each other (i.e. only one participant grouped them together). Therefore, the home pages for California and Florida are perceived by participants to be closer together than are the home pages for Delaware and Florida.

3.8. Analysis of research question 1

The first question we sought to answer concerned the perceptual dimensions underlying the groupings made by our experimental participants. We used multi-dimensional scaling (MDS) to determine the dimensions present in the grouping data.³ We chose to consider a minimum of two and a maximum of six dimensions

²Obviously, the cells below the diagonal would contain the same values as corresponding cells above the diagonal of the matrix.

³The SPSS multi-dimensional scaling procedure was used, creating Euclidian distances from the data using counts and ordinal measurement.

	AK	AL	AR	AZ	CA	CO	CT	DE	FL	...
AK	0	17	22	20	24	24	22	25	23	
AL	17	0	24	25	24	25	23	26	26	
AR	22	24	0	23	22	15	21	23	23	
AZ	20	25	23	0	23	24	26	29	20	
CA	24	24	22	23	0	25	27	25	14	
CO	24	25	15	24	25	0	20	23	25	
CT	22	23	21	26	27	20	0	15	26	
DE	25	26	23	29	25	23	15	0	29	
FL	23	26	23	20	14	25	26	29	0	
⋮										

Fig. 2. Partial aggregate distance matrix.

during the analysis.⁴ The data we used to analyse the first research question covered the years 1997 to 2001.⁵

Davison (1983) provides guidelines for deciding on appropriate dimensionality in MDS solutions. These guidelines state that analysts should obtain several solutions in different dimensionalities and then choose between them based on three criteria: interpretability, fit to the data, and reproducibility. This last criterion can be used when there are two or more sub-samples that come from the same population, the idea being to select the number of dimensions that emerge consistently in the separate sub-samples. Interpretability of dimensions, to be analysed in detail below, concerns the correspondence between empirically derived dimensions and theoretically understandable dimensions. Assessment of an MDS solution in this sense is a question of judgment, rather than correspondence to a particular metric or rule-of-thumb. Goodness of fit to the data is assessed in statistical terms. In MDS analyses, fit is often expressed with a metric known as ‘stress’. Johnson and Wichern (1992) provide a fit guideline that when stress is 0.20, goodness of fit is poor; at 0.10, fit is fair; at 0.05, fit is good; and at 0.025, fit is excellent. An additional guideline for deciding the best dimensionality in the results is that analysts should look for the smallest number of dimensions for a given level of fit (Hair et al., 1998).

3.9. Analysis of research question 2

We used hierarchical clustering analysis to analyse dissimilarity matrixes and determine what types of home pages participants perceived.⁶ A hierarchical clustering analysis is appropriate whenever one wishes to understand how items group together and there exists no pre-established number of groups (Johnson and

⁴While it was possible that there might be only one interpretable dimension, we expected that this result was unlikely. In addition, while it also was possible that there would be more than six dimensions, we felt that a solution with so many dimensions would not be parsimonious and would be difficult to explain.

⁵We gathered year 2002 data after the first analysis was complete (Ryan et al., 2002) and used them in our analysis of research question 2.

⁶The SPSS hierarchical clustering procedure was used, treating the data as squared Euclidean distance measures and using a between-groups linkage strategy.

Wichern, 1992). Since a different sample of participants had grouped each year, we obtained a distinct clustering solution for each year.

Hierarchical clustering produces a solution by combining cases (in this instance, state home pages). Initially, for any given year in this study, there are as many clusters as there are state home pages. As a first move, the clustering procedure combines the two objects (state home pages) that are closest in the multidimensional space determined by the values in the dissimilarity matrix (distances among state home pages), resulting in a number of clusters that is one less than the original number of clusters. After this first move, the objects available for further clustering consist of a two-item cluster (i.e. the two pages that were combined in the first move), plus all the other pages as one-item clusters. In each successive move, the procedure combines the nearest two objects, whether they are one-item clusters or multi-item clusters, stopping when there is only one object left, a cluster that contains all the original pages. When there are 50 pages, it is possible, although unlikely, that the best solution would be one in which there are 49 clusters—the result that one would get after just the first move. It is also possible that the best solution would be one in which there is only one cluster. For most purposes, some number of clusters in between these extremes is best.

One must make a judgment about when the best solution has been achieved. This judgment can be based on a variety of factors, including some statistical metrics, but the solution ultimately must make sense in terms of interpretability of clusters. According to Hair et al. (1998, pp. 442–443):

A major issue with all clustering techniques is how to select the number of clusters Unfortunately, no standard, objective selection procedure exists In the final analysis, however, it is probably best to compute a number of different cluster solutions ... then decide among the alternative solutions by using a priori criteria, practical judgment, common sense, or theoretical foundations.

4. Results and discussion

4.1. Research question 1

Table 1 shows the stress levels of the MDS for two to six dimensions across years. Recall that the first question to be answered in analysing an MDS result is how many dimensions indicate a parsimonious solution. A two-dimensional solution does not provide a good fit to the data. Stress is between fair and poor for the years 1999, 2000 and 2001, and fair for 1998. For three dimensions, fit improves to fair (stress is less than 0.10) for all four years. For three dimensions, stress is fair; for four dimensions, stress is almost good; and for five dimensions, it is good. The six-dimensional solution can be ruled out, as the simpler five-dimensional solution provides a good fit (Hair et al., 1998).

Results of gains in stress scores are shown in Table 2. The gain (lowering) in stress values when moving from three to four dimensions is meaningful, averaging 0.025.

Table 1
MDS dimension results by year

Year	Measure	Number of dimensions				
		6	5	4	3	2
2001	S-Stress	0.03039	0.03791	0.04647	0.05847	0.07804
	Stress	0.03546	0.04756	0.06084	0.08173	0.11618
	RSQ	0.99278	0.98817	0.98276	0.97308	0.95656
2000	S-Stress	0.03494	0.04105	0.04738	0.08061	0.09824
	Stress	0.03592	0.04422	0.05372	0.08656	0.11088
	RSQ	0.99079	0.98715	0.98284	0.96434	0.95224
1999	S-Stress	0.03083	0.03890	0.04797	0.05777	0.06450
	Stress	0.03607	0.04830	0.06734	0.09147	0.11185
	RSQ	0.99285	0.98855	0.98140	0.97176	0.96471
1998	S-Stress	0.02734	0.03158	0.03974	0.05238	0.06300
	Stress	0.03385	0.04113	0.05524	0.07741	0.09419
	RSQ	0.99337	0.99101	0.98567	0.97568	0.96970
1997	S-Stress	0.02701	0.03294	0.03913	0.05117	0.10074
	Stress	0.02896	0.03607	0.04331	0.06117	0.11831
	RSQ	0.99413	0.99156	0.98886	0.98081	0.94708

When moving from four to five dimensions the gain drops to 59% of that found in the earlier move from three to four dimensions. This indicates that adding a fourth dimension is helpful in explaining the participants' groupings, but that a fifth dimension is not so helpful. Based on this reasoning, a four-dimensional solution was accepted.

The analysis proceeded at this point by taking the four-dimensional solution for each year of the data and preparing sheets of pictures of the home pages falling at either end of each of the dimensions.⁷ Within each year, interpretability of the results involves being able to describe what the nature of each dimension is. Across the years, reproducibility of the results involves being able to describe how the identified dimensions carry over year by year. A solution is less reproducible if there are no consistencies in dimensions from one year to the next.

We examined end-point exemplars of the four dimensions across the five years of data beginning with 1998, chosen randomly. For each dimension, we attempted to identify what was similar about exemplar pages at one end, but different from the exemplars at the opposite end. In any MDS analysis, the first dimension is the one that accounts for the most variance. Each subsequent dimension accounts for most of the variance that remains. Results of the dimensions we found for each year of the data are shown in Table 3.

The first dimension we called 'navigation support' because home pages in this grouping were focused on how the user could navigate to linked pages. In 1998, the

⁷We identified pages as being at either end of a dimension by examining the magnitude of their scores on the dimension, as determined in the MDS analysis. Pages with the largest positive scores were at one end of the dimension; those with the largest negative scores were at the other.

Table 2
Stress gain results by year

Year	Stress gain in moving from n to $n+1$ dimensions		
	3 → 4 dim. gain	4 → 5 dim. gain	4 → 5 to 3 → 4
2001	0.02089	0.01328	64%
2000	0.03284	0.00950	29%
1999	0.02413	0.01904	79%
1998	0.02217	0.01411	64%
1997	0.01786	0.00724	41%
Mean	0.02501	0.01398	59%

Table 3
Dimensions by year

Year	Dimension			
	1	2	3	4
2001	Info Density	Layout	Navigation	Focus
2000	Info Density	Layout	Navigation	Color
1999	Layout	Info Density	Navigation	Color
1998	Navigation	Layout	Info Density	Color
1997	Navigation	Info Density	Layout	Focus

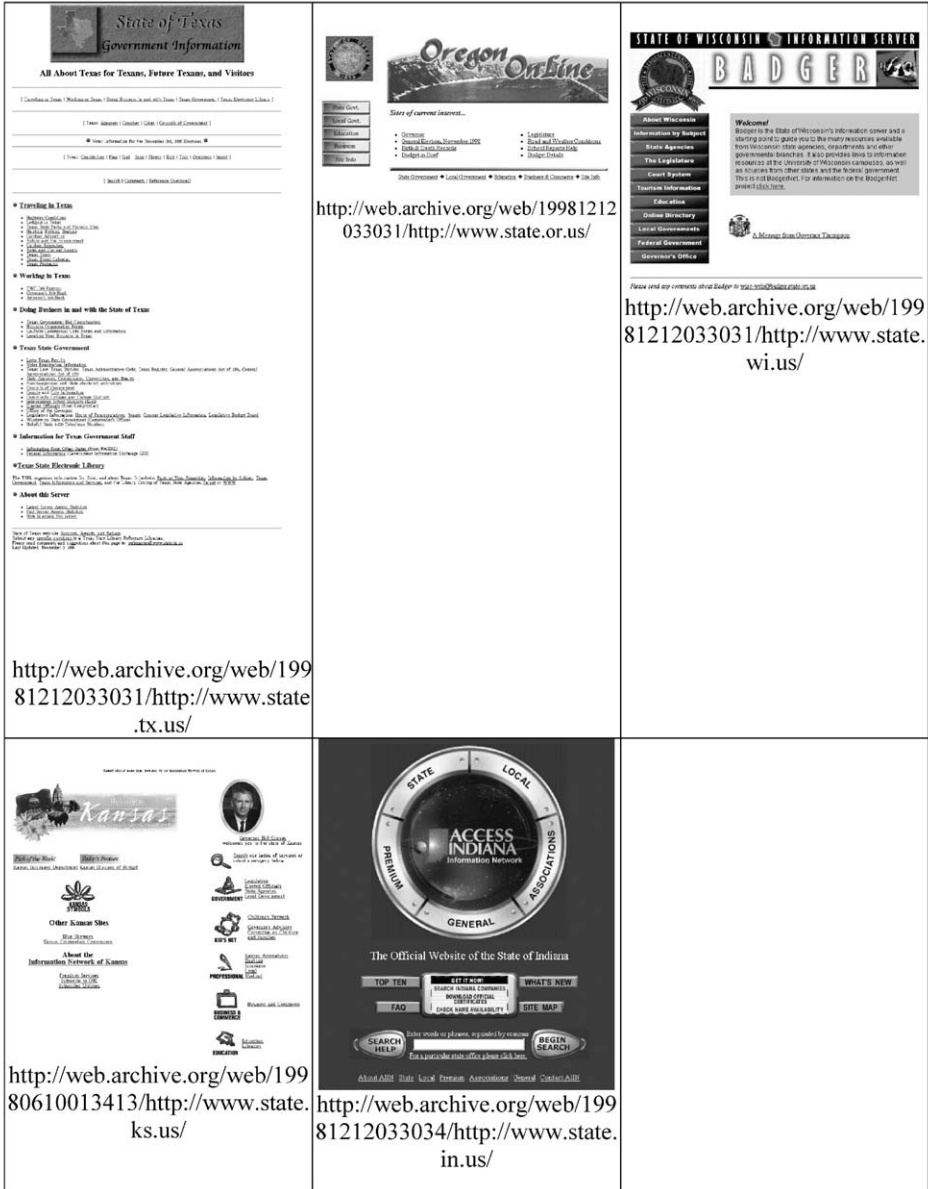
user interface of the states at the high end of this dimension allowed navigation by categorical buttons (see Oregon [OR] in Fig. 3) as opposed to the long list of text links used by the states at the low end of the dimension (see Texas [TX] in Fig. 3).

The second dimension we labeled ‘layout’, which we defined as the structure of the elements of the page. For example, in 1998, state home pages that are at the high end of the layout dimension all have a header bar and a left menu bar—also known as a navigation rail (see Wisconsin [WI] in Fig. 3), whereas those at the low end have a scattering of links and categories without any apparent structure (see Kansas [KS] in Fig. 3).

We interpreted the third dimension as ‘information density’, which is determined by the amount of information presented on the state home page. This dimension’s endpoints had high (see Colorado [CO] in Fig. 3) versus low information density (see Minnesota [MN] in Fig. 3).

These three dimensions of navigation support, layout, and information density were found as the first three dimensions in the MDS analysis for each of the years 1997–2001. The fourth dimension found for each of those years varied from year to year. In 1997 and 2001, it was ‘focus’, which we defined as the target of the message of the page. State home pages reflect the choices their designers have made about their audiences and messages. At one end of this dimension are the states that choose their current citizens as their audience and ‘e-government’ as their message

(see North Carolina [NC] in Fig. 3). States at the other end of this dimension, especially those focused on tourism, take a more outward-looking focus (see Montana [MT] in Fig. 3). The citizen/e-government focus is exemplified by



(a)

Fig. 3. (a) Top left to bottom right—TX(1998); OR(1998); WI(1998); KS(1998); IN(1998). (b) Top left to bottom right—CO(1998); OH(1998); AZ(1998); MT(2001); NC(2001).

color backgrounds (see Arizona [AZ] in Fig. 3), while at the other end were pages having white backgrounds (see Ohio [OH] in Fig. 3).

Note from Table 3 that as home pages evolved over the years of 1997–2001, our participants found the most variation in navigation support (in 1997 and 1998), then in layout (in 1999), and finally in information density (in 2000 and 2001). From the third-most important dimension in 1998, information density became the second-most important in 1999 and the most important in 2000 and 2001. It suggests that, in terms of state government home pages, the Web is polarizing into high information density ‘portal’ pages and low information density ‘entry’ pages.⁸

In the early years of the Web and our data (in 1997 and 1998), the dimension of navigation support showed the most variation. Some state home pages had a long list of links that users would have to scroll through in order to make navigational choices. Other state home pages provided categories in the form of buttons to allow users to make guided choices about which links to follow. Our data show that as time passed there was still variation in navigation support—it was still the third dimension found in the years 1999–2001—but the amount of variation was less than that of information density and layout for those years. The extremely long list of links that some states used in 1997 and 1998 gave way to use of low and moderate numbers of links. Home pages that differed dramatically in 1998 on navigation support have become more similar over time.

Differences in layout seem to fall into a middle range. Only in 1999 was layout the dimension on which state home pages varied the most. In that year, there was a great deal of variation in the look and feel of the state home pages. Some were using the layout of a header bar and left menu bar, others had a header bar only, and still others had little layout at all.

The fourth dimension of a full-color background emerged in 1998 and essentially disappeared by 2001. An inspection of the 2001 state home pages showed that color is now prominent in many home pages, but full-color backgrounds had been replaced for the most part by white ones. Given the low variation in colored backgrounds in the 2001 data, the color dimension disappears from the MDS analysis.

After these dimensional analyses were complete, we analysed experiment participant debriefing comments by having a research assistant code each comment as primarily dealing with layout, navigation support, information density, focus or color. Results shown in Table 4 are that home page information density, layout, and navigation support, in that order, were the dominant reasons for the state groupings created.

With regard to the first research question, we wished to discover the underlying dimensions of the state home pages and how those dimensions have changed over the years studied. We found three primary dimensions explain the variation of state home pages. These were the layout of the page, its navigation support, and its

⁸ It is worth noting that none of the pages examined in this research were ‘splash’ screens (Nielsen and Tahir, 2002; Van Duyne et al., 2003), which are opening pages shown before home pages; all offered at least minimal navigation to content.

Table 4
Percentages of debriefing comment categories by year

Year	Layout	Navigation	Info Density	Focus	Color	Other
2001	39.9%	14.5%	21.0%	5.1%	3.6%	15.9%
2000	19.0%	14.9%	39.7%	9.9%	4.1%	12.4%
1999	23.2%	14.9%	37.5%	3.0%	10.1%	11.3%
1998	35.9%	11.8%	32.0%	6.5%	7.2%	6.5%
1997	18.6%	27.8%	35.1%	2.1%	2.1%	14.4%
Overall	27.3%	16.8%	33.1%	5.3%	5.4%	12.1%

information density. A fourth dimension was found in each year. It varied between the background color of the home page and the focus of the page. Over the years 1997 to 2001, variation in navigation support declined and variation in information density between pages increased. Variation in layout was moderate over the years.

4.2. Research question 2

Next, we wished to analyse different types of state home pages and how they may have changed over the years. After examining a number of cluster solutions across years, we decided that a 15-cluster solution was the best one for all years considered together (see Table 5). This provided a consistent number of clusters and limited variation in the results that might have occurred had we chosen different numbers of clusters in the solutions for each year, however some of these clusters contained only one or two states. To simplify our task, we decided to restrict our examination to clusters of at most three members, leaving six to nine clusters depending on the year.

A first finding of interest is that the number of clusters per year having three or more members has been in steady decline, from nine members in 1997 to eight in 1998 and 1999, then seven in 2000 and 2001, and six in 2002 (see Table 5 for cluster sizes by year). The evolutionary theory of change (Van de Ven and Poole, 1995) proposes that change occurs as a result of fit between the organization and its environment. The early years of the Web can be thought of as a new environment, which could be populated by a wide variety of home page types. There was a bloom of new varieties; similar to a bloom of new species that occurs when a new physical environment becomes available. Competition then weeded out less successful types and reduced the total variety of types in the population. The theory of Institutional Change can also be applied (Gooderham et al., 1999). The organization, here the US state, sees itself as being part of an ‘organization field,’ as a member of a loose set of organizations that are similar to each other. These other organizations are the focal organization’s reference group. When enough of the reference group changes in a given direction, or even one key referent changes, then the focal organization changes in the same way to maintain a match with the other. The organization changes to keep its membership in the group, so that others can see it as falling in the same group of organizations. Home page type may therefore have fewer varieties over time as states seek to match the dominant types of the time.

Table 5
Cluster solutions for years 1997–2002

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2002	RI	AL	AR	IA	CT	CO	CA	FL	AZ	ID	KS	MD	ND	NM	AK
	VT	DE HI IN NE NY OH	MT	PA SD	KY NH		IL MN MO NJ SC WV	MI MS OK TX WA WI WY	GA MA ME TN UT VA	LA	NV			OR	NC
2001	MA	DE	AR	IA	AZ	CT	CA	AL	KY	AK	MD	NJ	NM	OR	VA
	VT WV	GA HI IN MS NE NH NY OH	CO LA ME	IL RI SD	ID KS MT ND PA WY	UT	FL MI MN WA WI	TX	MO OK TN	NC		SC	NV		
2000	MI	NC	AR	DE	CT	AZ	FL	KS	AL	PA	KY	AK	TX	OR	WY
	NH OK MA VT	ME UT HI MS	CO LA ID CA	IA IL SD NM NV	TN		VA	ND MN GA		WI IN NY		OH RI MO	MT MD		
Missing: WA	WV	NE NJ SC													
1999	MO CA	LA TN	KS ND	SD FL	AK IA	AR ID	AZ IN	CT IL	MN KY	OH AL	NM ME	NC MT	OK	PA	RI

4.3. Types of home pages discovered

We discovered a number of types in the data. They are: the Long List of Text Links; the Simple Rectangle; the Short 'L'; the High-density/Long 'L'; the Portal; and Boxes. There were also experimental types that appeared and then vanished.

4.3.1. Long list of text links type

For each year of the data from 1997 to 2001, we found a cluster where each state home page has a long list of text links (see TX in Fig. 3). The size of the cluster was seven members in 1997, increasing to 11 members in 1998 and 1999, and then decreasing in 2000 to six members and three in 2001. In the early years of the Web, states selected this common type for communicating with the Web-browsing public. The cases of Hawaii and Mississippi are instructive in that their home pages grew from 1997 to 1999 by adding links. Their pages got longer and required users to scroll down through an ever increasing list of categories and links. The number of links for Hawaii grew from 106 in 1997, to 130 in 1998 and 132 in 1999. For Mississippi, link growth was more dramatic, from 152 in 1997, to 190 in 1998, to 228 in 1999. Both states changed their home pages in the year 2000 to a simple entry page with very few links.

The Long List of Text Links type existed for five years, but has now all but disappeared. State government Webmasters have presumably discovered that pages of links that require the user to scroll over many screens of information are not an effective means of communicating with state citizens, potential tourists to the state, and those who may wish to conduct business in the state. The last state to use this type was Vermont, which has now moved to a more popular and expected type.

4.3.2. Simple rectangle type

The second major type of State home pages found was the Simple Rectangle. In the years 2000 and 2001, this type of cluster had the most members (see Table 5). A rectangular shape designed to fit within a browser window (as displayed at standard monitor resolution, viz. 800 × 600 pixels), one or more graphics, and categorical links exemplifies the type. The OH home page from 2001 reproduced in Fig. 4 is an exemplar of this type, which has remained relatively consistent over the years. In 2002, there were seven members of this type.

4.3.3. Short 'L' type

A well-defined cluster in 2001 is the Short 'L' type. It has a rectangular shape like that of the Simple Rectangle, but can be somewhat larger and has a clearly defined header bar and left menu bar that are all one piece (see Maine [ME] in Fig. 4). In the early years of this type, the 'L' shape is harder to discern. New Jersey in 1997 had a left menu bar and a header, but they were not joined. By 1998, there was a greater proximity of the header and the left menu bar and the colors acted visually to join the two pieces. Arkansas had a slight disconnect between two pieces that was resolved in 2001. In the 2002 data, we did not find a cluster of three members or more for the Short 'L' type. While the type can still be seen for individual states such as

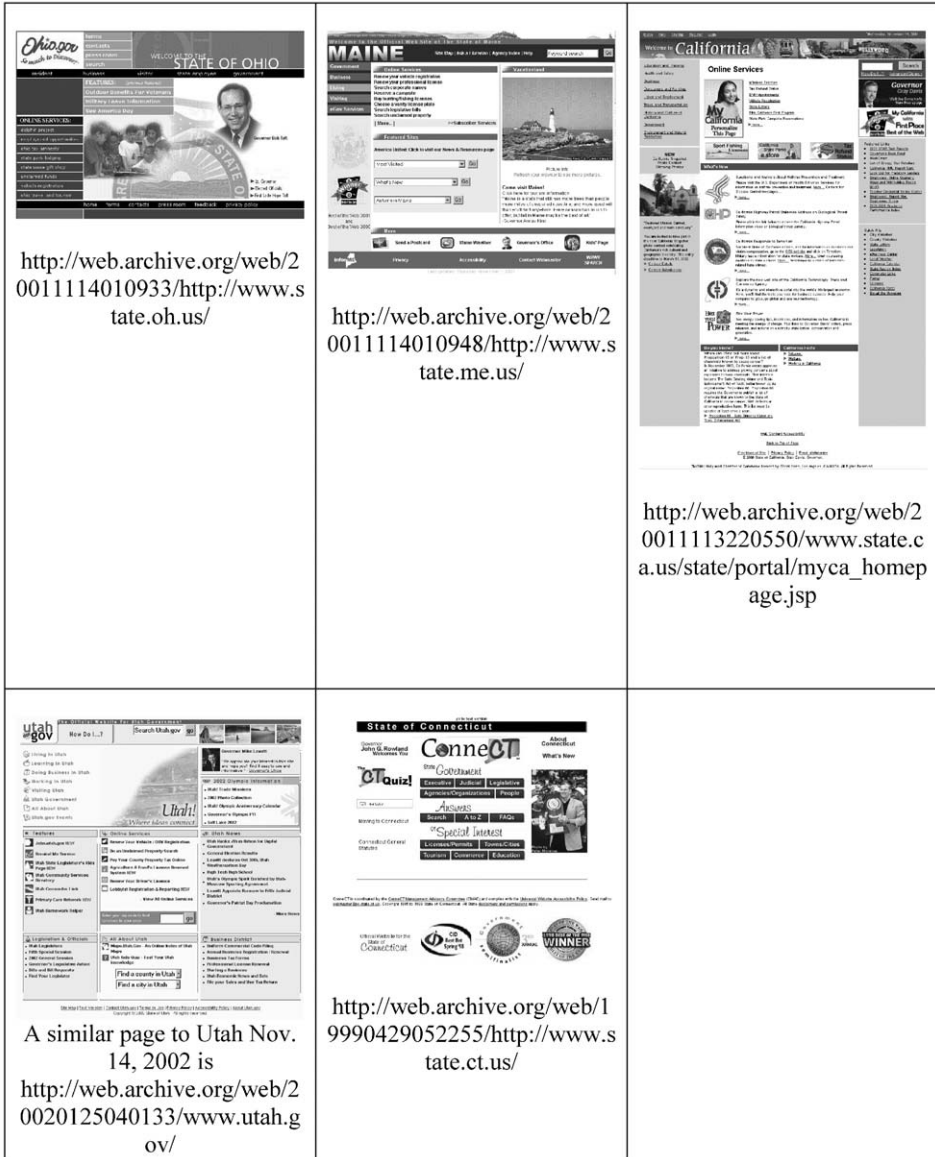


Fig. 4. Top left to bottom right—OH(2001); ME(2001); CA(2001); UT(2002); CT(1999).

Louisiana and New Hampshire, it has lost its cohesiveness. Some state home pages have added more links and therefore are moving toward the High-density/Long 'L' type (see below), others are adding a third column on the right side of the page and becoming more like the Portal Page type (see below).

4.3.4. *High-density/LONG 'L' type*

The next type found in the data is the high-density page. It is longer than a Simple Rectangle, has the beginnings of the top header bar and left menu bar type of the Short 'L', and has a high density of images, links, and sometimes information density, but the home pages of this type do not consist mainly of long lists of links. This type of home page has existed since 1997. Note in Fig. 3 how the 1998 state home page of CO looks quite modern to the eye and would not seem out of place on the Web of today. The type has evolved over the years to become longer; to be denser by having more links, more images, and more information density on the page; and to have a more clearly defined 'L' type of header and left menu bar. The density has become very high. For example, the state of Iowa's home page has followed the High-density/Long 'L' type since 1999 and has grown more complex each year. This complexity increase is reminiscent of the link growth experienced by Mississippi and Hawaii from 1997 to 1999. It is likely that the High-density/Long 'L' type will disappear the same way the Long List of Text Links type disappeared.

4.3.5. *Portal type*

In 2001, a new cluster type emerged from the state home pages. We give it the name Portal because these pages have the look and feel of a Yahoo™-style portal page. These pages have the Long 'L' header bar and left menu bar, but to this has been added a right hand menu bar or set of links (see California [CA] in Fig. 4). The resulting type has the appearance of a horseshoe or inverted 'U' shape. A further differentiation of the Portal Page from the High-density/Long 'L' type is the page can be somewhat shorter than the Long 'L'.

If we think of the bottom edge of the user's screen as the "fold" in a newspaper (Braun, 2002; Nielsen and Tahir, 2002) then the information the user must scroll down to see is "below the fold." In newspaper terms, this information is less likely to be seen and therefore is less important. The design of Portals appears to consider the fold. The Portal shows the user an initial screen of the most important information and links. Further information and links exist below the fold in one or at most two more screens.

The 2001 cluster of the Portal type had six members. In 2002, there were 15 members of the Portal type. This is explosive growth of a new type that is widely and quickly adopted by states. We expect that this type will become more popular over time as states migrate from the Long 'L' type in order to achieve a more compact presentation of information density and navigation links.

4.3.6. *Boxes type*

A new type emerged in 2002 that we call Boxes (see Utah [UT] in Fig. 4) marked by the division of the home page into discrete square or rectangular areas. The organizing logic of the type is to separate information density into areas of the screen for easy visual identification. It is difficult to tell if this is a new type variation that will become popular and adopted by other states or if it will be an experimental type that will be selected against and die out.

4.3.7. *Experimental types*

We have discovered four types of state home page that have existed since 1997 and two types that have recently emerged. Other experimental types have come and gone during that time. One is 'Big Buttons', a 1997 cluster of three states (Kentucky, Rhode Island, and Wyoming) with quite large images or buttons for the page user to click. Other 1997 experimental types were those of a simple welcome page, pages with a simple index, and pages having an index as well as some navigation buttons. In 1998, and for that year only, a 'Frame' cluster emerged (Delaware is one state in this cluster). Frame use was popular in Web design for a short time until users and Web designers found that in practice they had slow loading times (Nielsen, 2000). A 'Scattered Buttons' cluster of five states emerged in 1999 with the type of button links displayed on the page in seemingly random placements (see Connecticut [CT] in Fig. 4). While individual states may have kept this type of home page design (Connecticut still has it in 2002), it has not emerged as a distinct cluster since 1999. In the data for the year 2000, a 'High Color' cluster of four states (New York, Wisconsin, Indiana, Pennsylvania) was found. Each of these states had a full color background with no white space. Indiana's [IN] home page shown in Fig. 3 from 1998 has this full color background.

4.4. *Patterns of home page change*

Individual home pages may also be examined over time. The home page for CT has changed only slightly in 6 years (see Fig. 4). Other examples of this stability are Vermont and Maryland. Vermont has maintained a Long List of Text Links type from 1997 to 2002. Maryland's home page type is not only stable, but also unique, having a large graphic of the Annapolis waterfront superimposed on a picture of the state house, along with a number of categorical links. A search button was implemented on the page in the year 2000. In 2002, a link to the 'Maryland Web Portal' was added that points to a page having the Short 'L' type. A low amount of change in home page type has the advantage of presenting a consistent look to the user. Those who access the state home page frequently will not be surprised by the design of the page and only have to adapt slightly to new link titles or link placement.

Some states, such as Florida and Nevada have made a number of changes to their home page types over the years. States frequently changing their home page designs are likely searching for a home page that can serve to brand their state. Other states have tried to balance continuity with freshness by staying with a design for a long period of time and then opting for a discontinuous change. New Mexico, Minnesota and Oregon all stuck with a consistent design for the four years of 1998 to 2001 and all changed dramatically in 2002. Oregon moved from a Short 'L' to a Long 'L' type. New Mexico and Minnesota both had early versions of the Portal type in 2001. Each had a central graphic and an inverted 'U' shape. Minnesota's home page changed in 2002 into the Portal type, New Mexico's into the Long 'L'.

5. Conclusion

We asked experiment participants to sort state home pages within a given year into groupings and then used that data to examine the dimensions underlying the sorting and to identify empirically clusters of state home pages. This allowed us to find commonalities among the pages and thereby uncover different types of home pages. Without using the grouped data, the examination of 293 home pages would have been too cognitively complex a task, especially given no a priori criteria on which to combine pages.

In addressing our first research question, we found that there were three main dimensions that explained the variation of state home pages. These were the navigation support of the page, its layout, and its information density. While the home pages we studied varied the most on their perceived navigation support in the early years of the Web, variation now is more in terms of the information density of the pages. State Webmasters need to consider the choices that they will make in deciding on how much information to place on the home page, how to order and present links for user navigation, and the layout of page elements to employ.

In considering the second research question, we identified a taxonomy of home page types that have appeared in the population of US states. The taxonomy has at one end of its continuum the Simple Rectangle type. This is the lowest complexity design and the smallest page. The next type is Short 'L', then Boxes and High-density/Long 'L'. At the farthest end of the continuum is the Portal Page. It has high complexity, high information density, and both a left and a right menu bar so the user has many navigation choices. The Portal Page type appeared in 2001 as an outgrowth of the Long 'L' type and became a much more popular type in 2002. Given that the purpose of state home pages is to provide information and a communication medium to site users, a type that is more expectable by users will allow communications to be more effective. Common types may therefore become more popular over time. In 2002, the Long List of Text Links type was no longer found as a cluster of three or more states. Only Vermont maintained this type of home page. Emerging in 2002 was a new home page type—Boxes—with the page separated into square or rectangular elements.

There have been home page types over the years that have not continued. In 1997, clusters of pages existed with a simple welcome message, an index, or an index with some navigation buttons. Other types tried and discarded were those with high background color and frames. We expect that any communication medium will have experiments of new types and usage patterns. Some will fail and some will succeed, to be repeated in the future. The home page is evolving and changing. We saw early experimentation, but now see more agreement on the usage of only a few types. This may change, as some current authors (e.g., Cloninger, 2002) propose that more creativity in page design can lead to increased value. Some state Webmasters have stuck with one type since they or their predecessors first put their state on the Web; others have tried a number of different types, searching for the right one for their state and its citizens. Other Webmasters have changed their state home pages incrementally, keeping an early look and feel for consistency and continuity's sake,

and then making a discontinuous change to a new type. It remains to be seen whether, as time goes on, more states will fit into the taxonomy that we have uncovered or new types of home pages will continue to emerge.

5.1. Limitations

We created our home page taxonomy using the population of United States state home pages. It is important to study the generalizability of this taxonomy by examining other populations of home pages, such as Fortune 500 companies, museums, gaming sites, and advertising agencies. Each of these might have different types of users and therefore different design goals represented in the types of their home pages.

Additionally, we asked participants to sort printed images of home pages, rather than sorting 'live' versions, because the sorting task was impracticable on the technological platform we had available for the research. Also impracticable was a direct identification of clusters from the entire set of home pages. Different findings may have occurred had we found different solutions to these methodological problems. On a similar note, the use of static images of home pages did not allow participants to experience the interactivity of the pages. This had repercussions for participants' appreciation of the content and functionality of the pages they viewed. Use of 'live' pages might increase the influence of these variables, which undoubtedly are important factors in forming an impression of a home page.

A final limitation of this research is the use of student participants only. While students are part of the potential audience for government Web home pages, there may be systematic differences between students and other members of the population of interest. For one thing, students are likely to be more accustomed to Web pages than other members of the target population. On the other hand, the students participating in the research are not known to have any special exposure to state government Web home pages that would clearly bias their perceptions. We felt that pragmatic considerations justified the use of student participants for this exploratory work. Future research should consider the use of participants from other groups.

5.2. Implications for future research

Organizations have had to learn how to use the Web to communicate. Additionally, the technologies of the Web have changed over time. It is likely that home pages have evolved because of organizational learning, technological changes, competitive pressures, fashion, etc.

Prior researchers have been concerned with the analysis of the genres of electronic communications (Dillon and Gushrowski, 2000; Yates and Orlikowski, 1992; Orlikowski and Yates, 1994, 1998; Orlikowski et al., 1995; Yates, et al., 1997, 1999; Roberts, 1998; Shepherd and Watters, 1998, 1999; Roussinov et al., 2001; Rehm, 2002). A genre is a pattern of communications (Bazerman, 1988, 1994), which amounts to an expectable form that communications in a given medium might take (Agre, 1998). Readers and writers share genres by producing, reproducing and

changing them in a recursive relationship (Orlikowski et al., 1995). Scholars have disagreed somewhat about the qualities that define electronic communications genres. Yates and Orlikowski (1992) argue that the substance and form of a communication determine its genre. Orlikowski and Yates (1994) restated these two dimensions as socially recognized communicative purpose and common aspects of form. Shepherd and Watters (1998) propose that content, form and functionality characterize genres of electronic communication, which they term 'cybergenres'.

Despite the level of interest in genres found in MIS research, genre theory may not be the most appropriate lens for viewing home page evolution. While some researchers consider the home page to be a genre (e.g. Roberts, 1998), many would not count varieties of home pages as different genres. In this study, we might have assumed that the home page is a distinct genre of electronic communication, but we decided not to pursue an understanding of people's perceptions of home pages in genre terms. Instead, we explored the types of state government home pages that people perceive and attempted to understand the dimensions that underlie these types, as well as how they have changed. In future, researchers may find it valuable to attempt to explicitly consider the common ground between the research approach reported in this paper and traditional genre analysis methods. To do this, it will be necessary to determine to what extent people rely on theoretically accepted genre dimensions in forming their perceptions of home page types. This will require a practical method to be developed to clarify the purposes, content, form and functionality of home pages, as well the connection between home pages and the sites they introduce.

We plan several extensions to the study reported here. We will investigate whether participant ratings of home page appeal and usability are related to the home page types identified here. We will use the taxonomy that we have found to study live home pages of states within each home page type, performing usability tests to see how participants react to the layout of live home pages, how they access the information density on those pages, and how they use the navigation tools built into each home page. We will try to develop measurement scales to capture the three primary dimensions identified in this study, which will allow them to be used as variables in additional research. We will perform additional qualitative analyses of participants' experiences with sorting home pages into groups. Such analyses will provide insights into what dimensions are important in perceptions of home page similarity. Finally, we will conduct a series of replications of this research in different domains, including a variety of educational, governmental, not-for-profit and business organizations. In combination, these projects will help us to refine our understanding of how people perceive home pages and what impact design decisions have on such perceptions.

References

- Agre, P.E., 1998. Designing genres for new media: social, economic, and political contexts. In: Jones, S. (Ed.), *CyberSociety 2.0: Revisiting CMC and Community*. Sage, Thousand Oaks, CA.

- Andres, C., 1999. *Great Web Architecture*. IDG Books Worldwide, Foster City, CA.
- Bazerman, C., 1988. Systems of genres and the enactment of social intentions. In: Freedman, A., Medway, P. (Eds.), *Genre and the New Rhetoric*. Taylor & Francis, London, pp. 79–101.
- Bazerman, C., 1988. *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science*. University of Wisconsin Press, Madison, WI.
- Boyle, A., 1997. Archiving the Internet for posterity, <http://web.archive.org/web/19970810233147/www.msnbc.com/news/60659.asp> (current 21 February 2003).
- Braun, K., 2002. *Usability: The Site Speaks for Itself*. Glasshaus, Birmingham, UK.
- Cloninger, C., 2002. *Fresh Styles for Web Designers: Eye Candy from the Underground*. New Riders, Indianapolis.
- Davison, M.L., 1983. *Multidimensional Scaling*. Wiley, New York.
- Dillon, A., Gushrowski, B., 2000. Genres and the web: is the personal home page the first unique digital genre? *Journal of the American Society for Information Science* 51 (2), 202–205.
- Gooderham, P.N., Nordhaug, O., Ringdal, K., 1999. Institutional and rational determinants of organizational practices: human resource management in European firms. *Administrative Science Quarterly* 44, 507–531.
- Hair Jr., J.F., Anderson, R.E., Tatham, R.L., Black, W.C., 1998. *Multivariate Data Analysis*, 5th Edition. Prentice-Hall, Upper Saddle River, NJ.
- Johnson, R.A., Wichern, D.W., 1992. *Applied Multivariate Statistical Analysis*, 3rd Edition. Prentice-Hall, Upper Saddle River, NJ.
- Koehler, W., 1999. An analysis of web page and web site constancy and permanence. *Journal of the American Society for Information Science and Technology* 50 (2), 162–180.
- Koehler, W., 2002. Web page change and persistence—a four-year longitudinal study. *Journal of the American Society for Information Science and Technology* 53 (2), 162–171.
- Lynch, P.J., Horton, S., 2001. *Web Style Guide*. Yale University Press, New Haven, CT.
- Nielsen, J., 2000. *Designing Web Usability*. New Riders, Indianapolis.
- Nielsen, J., 2003. useit.com: usable information technology, <http://www.useit.com> (current 21 February 2003).
- Nielsen, J., Tahir, M., 2002. *Homepage Usability: 50 Websites Deconstructed*. New Riders, Indianapolis.
- Orlikowski, W., Yates, J., 1994. Genre repertoire: the structuring of communicative practices in organizations. *Administrative Science Quarterly* 39, 542–574.
- Orlikowski, W., Yates, J., 1998. Genre systems: structuring interaction through communicative norms. Center for Coordination Science Working Paper #205, Sloan Working Paper #4030.
- Orlikowski, W., Yates, J., Okamura, K., Fujimoto, M., 1995. Shaping electronic communication: the metastructuring of technology in the context of use. *Organization Science* 6, 423–444.
- Rehm, G., 2002. Towards automatic web genre identification. In: Sprague Jr. R.H. (Ed.), *Proceedings of the 35th Hawaii International Conference on System Sciences*, Kona, HI.
- Roberts, G.F., 1998. The home page as genre: a narrative approach. In: Sprague Jr. R.H. (Ed.), *Proceedings of the 31st Hawaii International Conference on System Sciences*, Kona, HI.
- Roussinov, D., Crowston, K., Nilan, M., Kwasnik, B., Cai, J., Liu, X., 2001. Genre based navigation on the Web. In: Sprague Jr. R.H. (Ed.), *Proceedings of the 34th Hawaii International Conference on System Sciences*, Maui, HI.
- Ryan, T., Field, R.H.G., Olfman, L., 2002. Homepage genre dimensionality. In: Ramsower, R., Windsor, J. (Eds.), *Proceedings of the Eighth Americas Conference on Information Systems*, Dallas, TX.
- Shepherd, M., Watters, C., 1998. The evolution of cybergenres. In: Sprague Jr. R.H. (Ed.), *Proceedings of the 31st Hawaii International Conference on System Sciences*, Kona, HI.
- Shepherd, M., Watters, C., 1999. The functionality attribute of cybergenres. In: Sprague Jr. R.H. (Ed.), *Proceedings of the 32nd Hawaii International Conference on System Sciences*, Maui, HI.
- Van Duyne, D.K., Landay, J.A., Hong, J.I., 2003. *The Design of Sites: Patterns, Principles, and Processes for Crafting a Customer-Centered Web Experience*. Addison-Wesley, Boston.
- Van de Ven, A.H., Poole, M.S., 1995. Explaining development and change in organizations. *Academy of Management Review* 20, 510–540.

- Vaughn, J., 2001. Three iterations of an academic library web site. *Information Technologies and Libraries* 20 (2), 81–92.
- Yates, J., Orlikowski, W.J., 1992. Genres of organizational communication: a structural approach to studying communication and media. *Academy of Management Review* 17, 299–326.
- Yates, J., Orlikowski, W.J., Rennecker, J., 1997. Collaborative genres for collaboration: genre systems in digital media. In: Sprague Jr. R.H. (Ed.), *Proceedings of the 30th Annual Hawaii International Conference on System Sciences*, Maui, HI.
- Yates, J., Orlikowski, W.J., Okamura, K., 1999. Explicit and implicit structuring of genres in electronic communication: reinforcement and change of social interaction. *Organization Science* 10, 83–103.