Knowledge Modeling by Exchange and Comparison of Construct Systems through the World Wide Web

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Abstract

Widespread access to the World Wide Web offers new opportunities for gathering data from geographically separated individuals with common interests in similar domains. WebGrid is a tool that was made available on the web in 1994 to make repertory grid elicitation and analysis freely available to users world wide. WebGrid-II overcomes the problems of supporting an anonymous community of users world wide in grid techniques that require storage of grid data at the server. It makes it possible for large scale experiments on the elicitation and comparison of construct systems to be carried out by anyone with access to the web.

1 Introduction

One area of application of personal construct psychology that has proved useful in many disciplines and professions is the modeling of social knowledge processes through comparing the constructs and terminology of different individuals in the same domain.The comparative analysis of repertory grids to make such similarities and differences apparent was one of the earliest applications of computers to repertory grid analysis (Shaw, 1979, 1980), and the techniques involved have developed over the years to provide powerful tools that have been widely applied (Shaw and Gaines, 1991a, 1991b, 1993).

Widespread access to the World Wide Web offers new opportunities for gathering data from geographically separated individuals with common interests in similar domains, and it has become interesting and useful to port repertory grid elicitation and analysis tools to the web. However, supporting a world wide research community with diverse backgrounds and interests is in itself a major task. What one would like to achieve is universal access to personal construct psychology theory, methods and tools with the minimum requirements for individual support—an anonymous but well-supported user community.

This article describes the features incorporated in WebGrid-II to provide distributed repertory grid elicitation and analysis capabilities to a world wide community of anonymous experimenters and clients in such a way that the experimenter is in full control but needs no special privileges at the server. For single grid elicitation and analysis this is not a major problem and WebGrid-I was made available in 1994 and has been very widely used.

However, comparison between multiple grids requires management of storage at the server in a way that is reliable, easily managed by the experimenter, and requires no knowledge or control by the server operators. WebGrid-II implements such a system which is described in this article.

2 Background

The theoretical foundations for the application of personal construct psychology and repertory grid elicitation and analysis to modeling social knowledge processes have been described elsewhere (Shaw, 1985). Figure 1 shows the type of situation to be modeled.

Anne, John, Mark and Sue are individuals who play a number of different roles in a number of social situations. Anne is shown as having three roles, wife, mathematician and technical vice president. John is also shown as having three roles, husband, golfer and sales vice president. The wife role in Anne together with the husband role in John are involved in the social processes of *anuclear family.* Similarly, the technical VP role in Anne, the sales VP role in John, the finance VP role in Mark and the production VP role in Sue involved in the social processes of a *product executive.* The center part of Figure 1 shows the construct systems supporting the interactions between the roles within people constituting the product executive, and applied by them in in the lower part of Figure 1 to construe a domain of products.

When those in the product executive are interacting they expect to have some common constructs reflecting their joint corporate culture and to have some understanding of one another's constructs reflecting their capabilities to engage in discourse. However, a major problem in sharing knowledge in such social organizations is the use of the same terminology for different constructs and the use of the different terminology for the same constructs. Figure 2 shows the possibilities that arise.

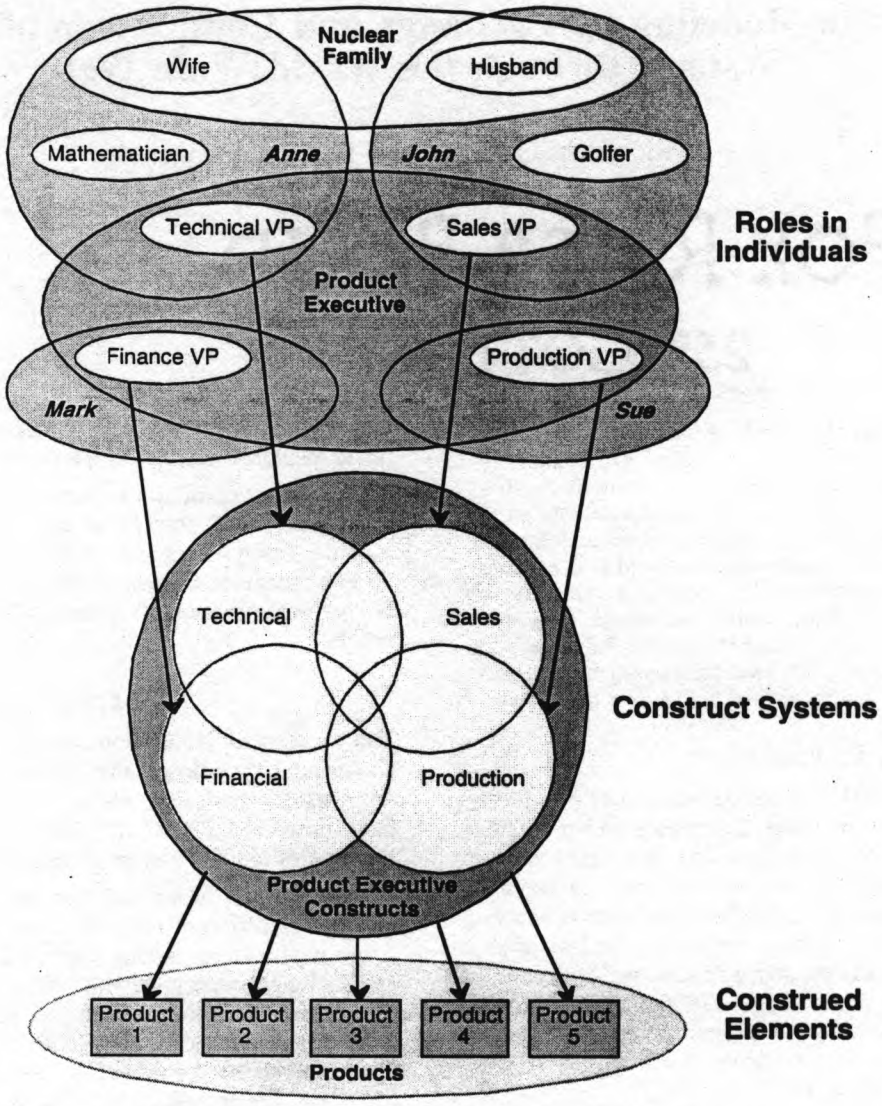

Figure 1 Construct system supporting social processes

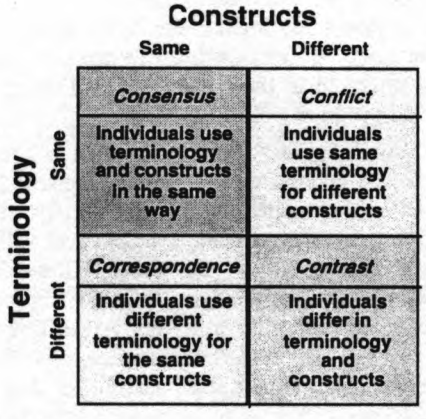

Figure 2 Consensus, correspondence, conflict and contrast in construct systems

The recognition of *consensual* constructs is important because it establishes a basis for communication using shared constructs and terminologies. The recognition of *conflicting* constructs establishes a basis for avoiding confusion over the labeling of differing constructs with the same terms. The recognition of*corresponding* concepts establishes a basis for mutual understanding of differing terms through the availability of common constructs. The recognition of *contrasting* constructs establishes that there are aspects of the differing knowledge about which communication and understanding may be very difficult, even though this should not lead to confusion.

Analysis of repertory grids provides a basis for recognizing consensus, correspondence, conflict and contrast in construct systems. If an individual in one role attempts to fill in a grid from another individual in another role then

matches between constructs indicate consensus and major mis-matches indicate conflict. If an individual in one role attempts to construe elements in a grid from another individual in another role then a match between a construct in one grid and that with different pole names in the other indicates correspondence, while lack of such a match indicates contrast.

3 Setting up Distributed Elicitation in WebGrid-II

To set up a distributed elicitation experiment in WebGrid-II, the experimenter first elicits a grid in the normal way resulting in a screen such as that shown in Figure 3. The grid shown was developed to enable students in a class on advanced information system to compare their construct systems with that of their instructor.

To make the grid available to the class the instructor clicks on the "Save/Exchange" button at the bottom of the screen which leads to the screen shown in Figure 4. Clicking on the "Cache" button will cache the grid on the server to make it available to others. If the experimenter also wants to collect the exchange grids then clicking on the check box below will store the grid in a new directory and automatically store any grids derived from it in the same directory.

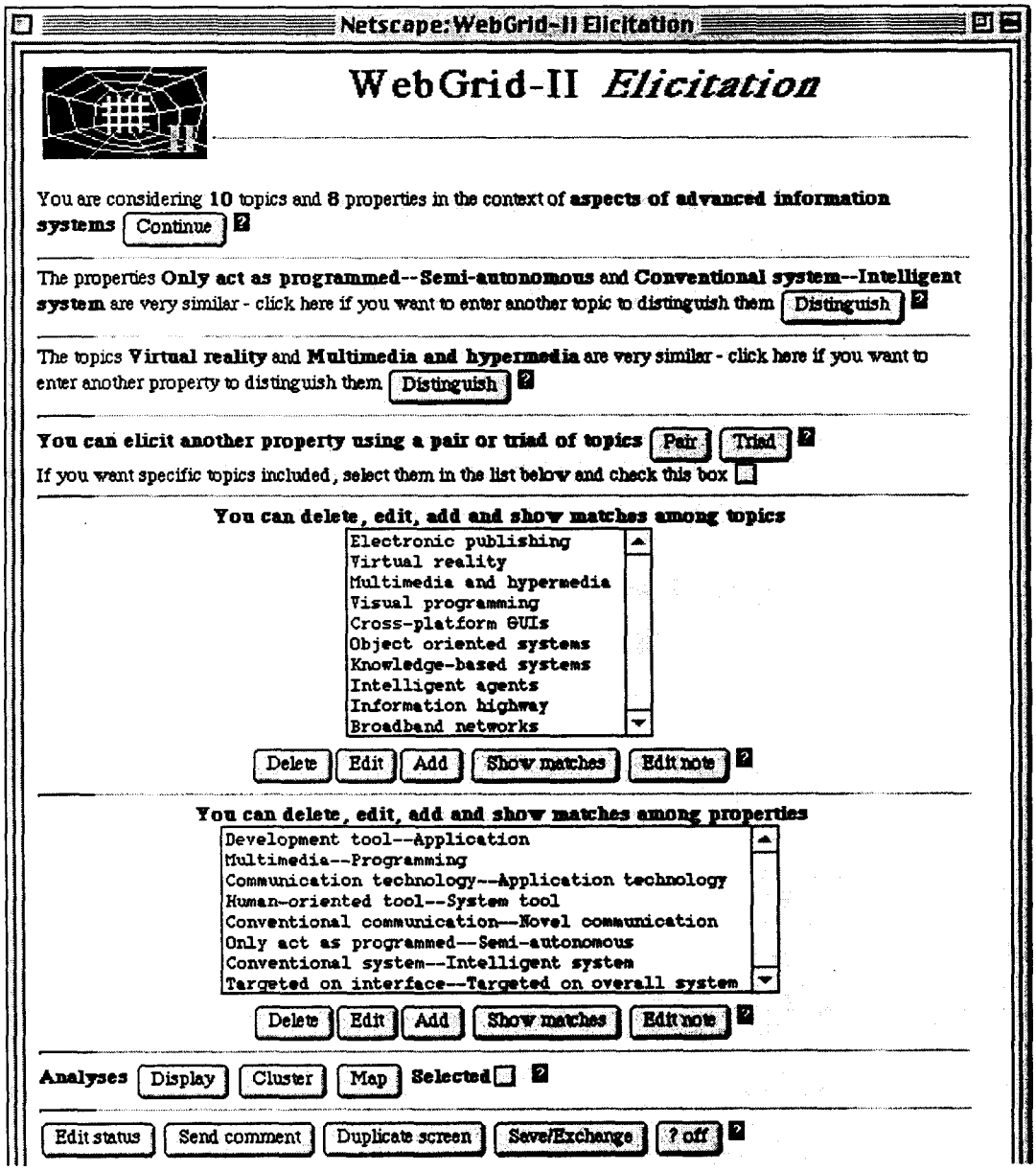

Figure 3 Initial grid elicited using WebGrid-II

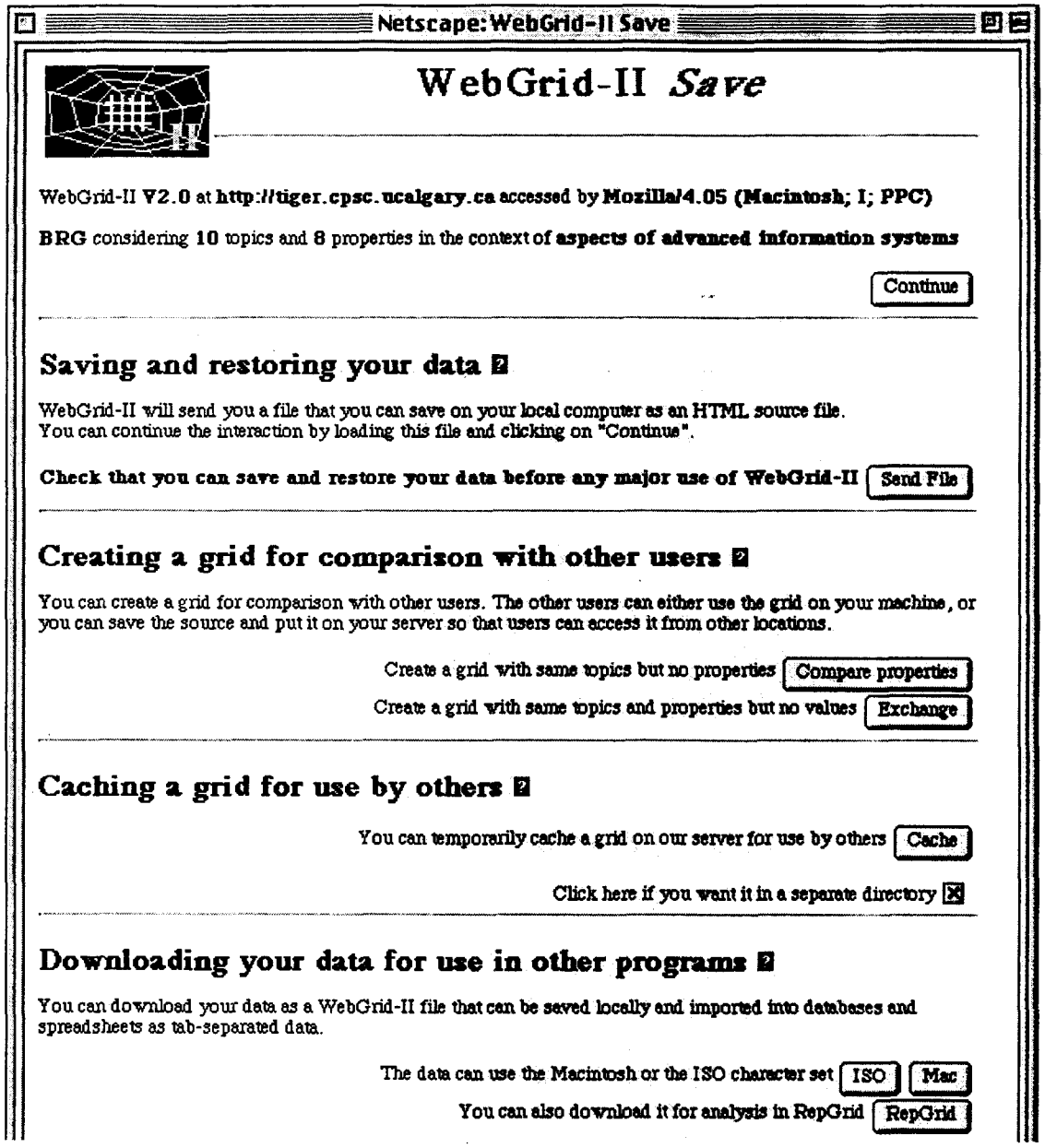

Figure 4 Caching the initial grid for access by others

Figure 5 shows the screen returned when the "Cache" button is clicked in Figure 4. The experimenter is provided with 4 URL's, uniform resource locators that give access to material on the World Wide Web. The first gives access to the original grid, the second to a grid with only the elements and the third to a grid with the elements and constructs but no values. The fourth URL is only provided when the "separate directory" option is selected in Figure 4 and it gives the experimenter access to the set of grids collected.

In this example, the experimenter asked a colleague who was co-instructor for the course to use the URL http://tiger.cpsc.ucalgary.ca/WGExchange/2981895558:0+.k to develop an exchange grid to see how similar the two instructors were in their use of the constructs in it. The students on the course were given the URL http://tiger.cpsc.ucalgary.ca/WGElements/2981895558:0+.k and asked to develop their own constructs and compare them with those of the instructor.

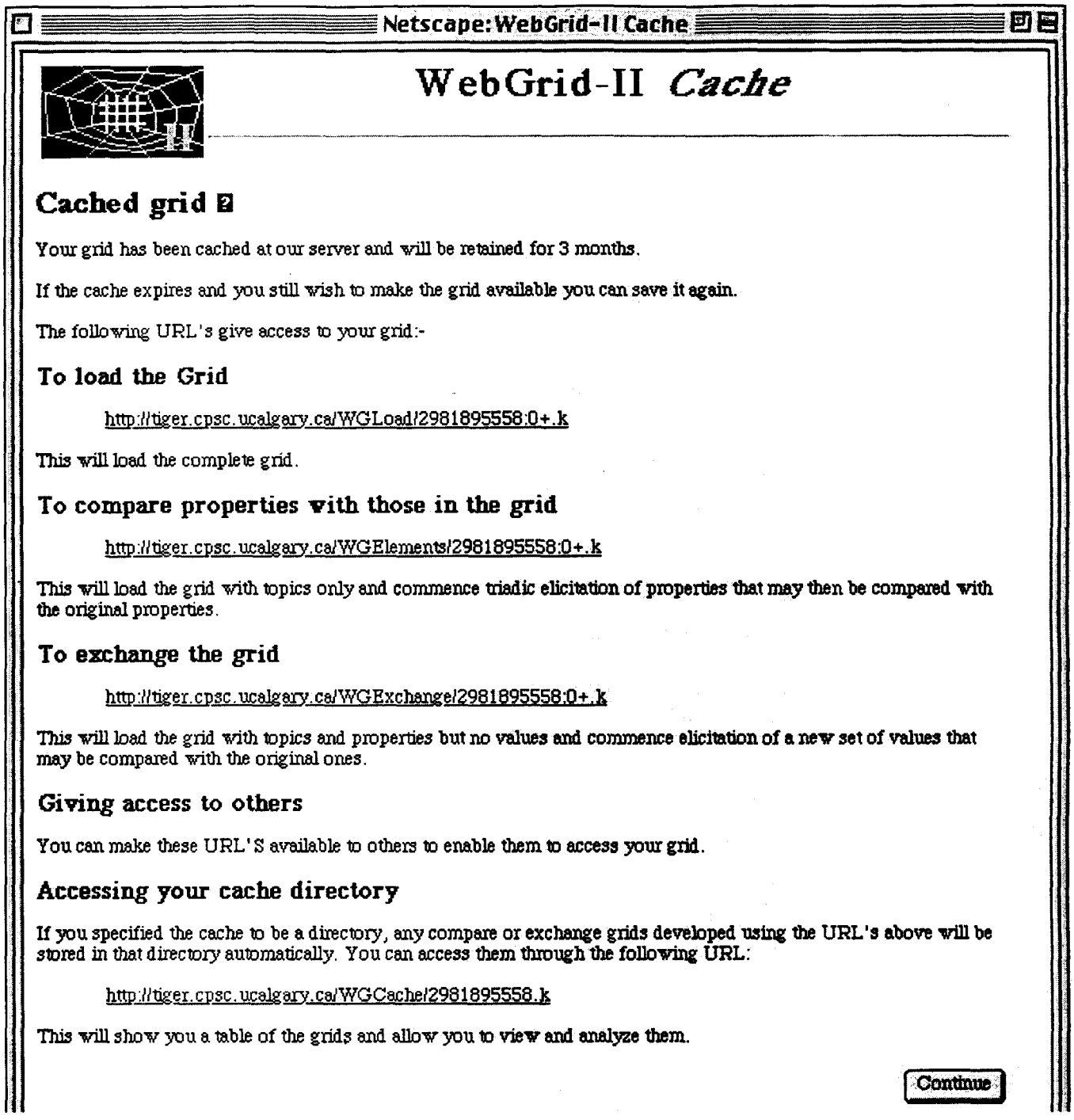

Figure 5 Caching the initial grid for access by others

The normal way of issuing such URL's is to post them to a web page embedded in a link together with accompanying explanatory test, for example through the HTML:

When you have experimented with WebGrid in your chosen example then use it to compare your model of advanced information systems with mine through
this link.

4 Comparison Tools in WebGrid-II

When the co-instructor accessed the URL for exchanging grids shown at the end of the previous sectionWebGrid-II loaded the original grid with elements and constructs but no ratings and took the co-instructor through a series of screens for rating the elements on the constructs. When this was complete it generated a screen similar to that of Figure 3 but with a "Compare" button in the analysis row after the "Map" button. Clicking on this returns the difference grid shown in Figure 6. It can be seen that the instructors have a clear consensus on 6 out of the 8 constructs and a potential conflict in the use of the other two, mainly arising from the way they construe four of the elements.

When a student accessed the URL for developing constructs with the given elements shown at the end of the previous section WebGrid-II loaded the original grid with the elements only and took the student through a series of construct elicitation processes. When this was complete it generated a screen similar to that of Figure 3 but again with a "Compare" button in the analysis row after the "Map" button. Clicking on this returns a comparison grid, an example of which is shown in Figure 7.

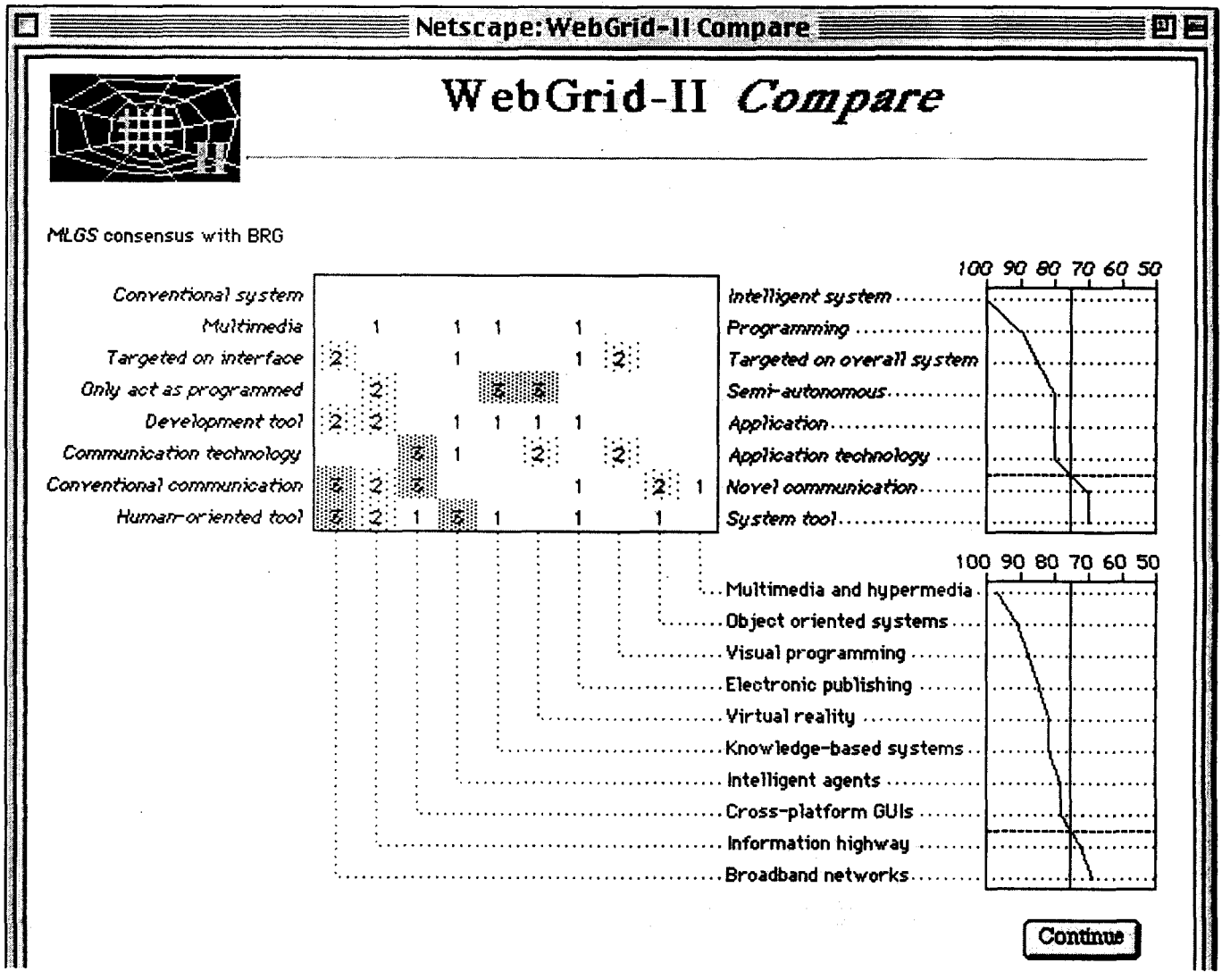

Figure 6 Difference grid comparing the two instructors

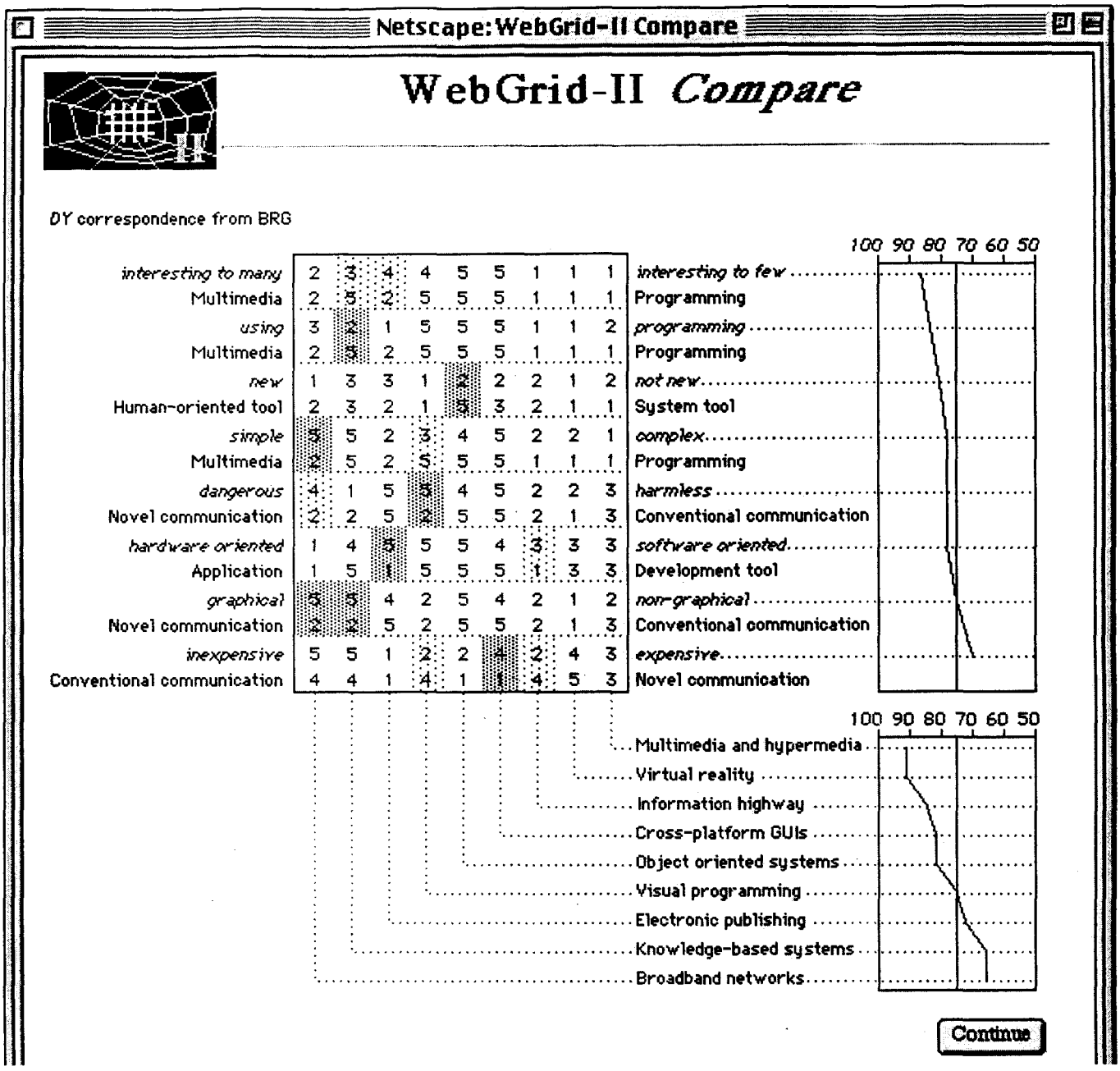

Figure 7 Comparison grid comparing student and instructor constructs

From Figure 7 it can be seen that the student's construct "interesting to many—interesting to few" matches with the instructor's construct "Multimedia—Programming", an example of correspondence.From the element matches at the bottom right it can be seen that the instructor and student may have difficulties in discussing "Broadband networks" since they have few corresponding constructs making similar distinctions for these elements.

5 Experimenter Access to Data Collected by WebGrid-II

The examples of the previous section show howWebGrid-II provides the clients with comparative analyses. It also provides the experimenter with full access to all the grids collected through the final URL at the bottom of Figure 5. This generates the screen shown in Figure 8 listing the original grid and all those generated from it.

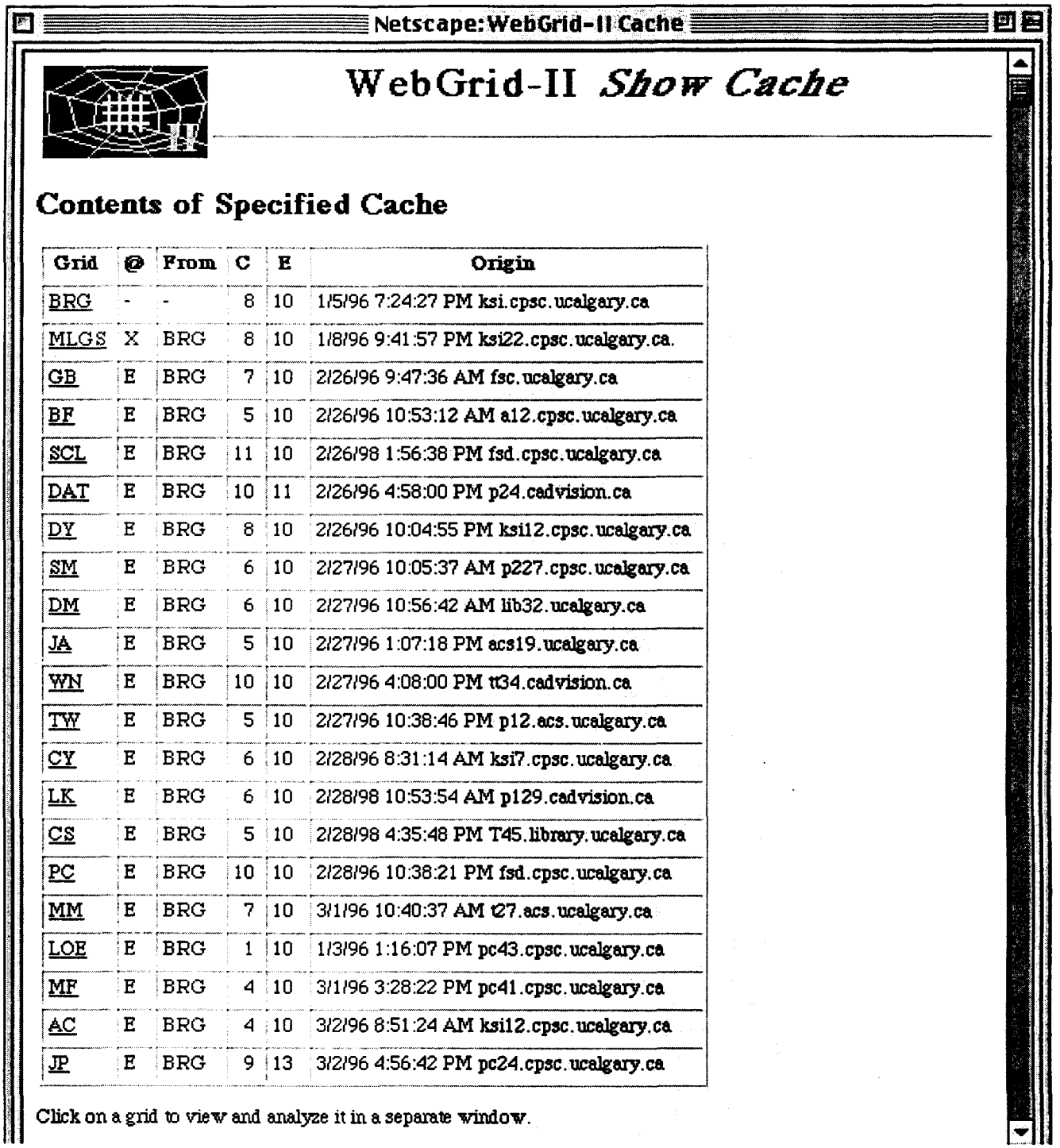

Figure 8 Directory of cached grids for access by experimenter

The listing in Figure 8 shows the identifier entered by the user, "E" for elements only or "X" for exchange, the numbers of constructs and elements, the date and time of storage and the Internet address of the machine used. The experimenter can click on any identifier and view the grid, compare it with the original as shown in the previous section, or otherwise analyze it.

6 Conclusions

This article has focused on the new features of WebGrid-II which enable it to support distributed modeling of social knowledge processes through the World Wide Web using repertory grid elicitation and analysis. WebGrid-II uses an anonymous caching technique to provide this support without requiring the remote users to be known or to have password controlled access to the server. It makes it possible for large scale experiments on the elicitation and comparison of construct systems to be carried out by anyone with access to the web. This presentation is intended as a short tutorial for those interested in using WebGrid-II in this way and will demonstrate how to use the system in practical applications such as organizational modeling, personnel selection and market research.

Acknowledgments

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URLs

WebGrid can be accessed at
http://tiger.cpsc.ucalgary.ca/WebGrid/

Related papers on WebGrid and World Wide Web can be accessed through **http://ksi.cpsc.ucalgary.ca/articles/**

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