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Citation for published version (APA):

Michaelides, M., Buckingham, S. S., Juby, B., Mancini, C., Slack, R., Bachler, M., Procter, R., Daw, M., Rowley, A., Chown, T., & De, R. D. (2006). Memetic: From Meeting Memory to Virtual Ethnography & Distributed Video Analysis. In *2nd International Conference on e-Social Science*

Published in:

2nd International Conference on e-Social Science

Citing this paper

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Memetic: From Meeting Memory to Virtual Ethnography & Distributed Video Analysis

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Abstract: The JISC-funded *Memetic*² project was designed as knowledge management and project memory support for teams meeting via the Access Grid environment (Buckingham Shum *et al*, 2006). This paper describes how these capabilities also enable it to serve as a novel distributed video analysis tool to support interaction analysis. Memetic technologies can be used to record, annotate and discuss sessions recorded within a flexible, visual hypermedia environment called Compendium. We propose that beyond the use originally conceived, the Memetic toolset could find wide ranging applications within social science for virtual ethnography and data analysis.

The Memetic toolset

Memetic integrates a set of tools to support the capture, annotation and replay of an Access Grid session (originally conceived as “meetings”, but as we explain, this is too restrictive).

- *Access Grid (AG)* provides a group with its own virtual venue for remote collaboration over the internet, plus shared documents, data, and applications (perhaps to aid access to a physical resource such as a radio telescope or electron microscope). AG supports the recording of meetings that can be played and stopped as digital media streams. AG can be attended in a purpose-built room (an ‘AG Node’ - Figure 1) or via a desktop interface



Figure 1: View of an AG Node, a designed room intended for end-users to ‘walk in and meet over videoconference’. Three projectors are aligned to show large format video, remote controlled cameras provide participant closeup and whole scene images, and full-duplex microphones are arranged on the tables.

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² Memetic Project: www.memetic-vre.net

- *Arena* provides recording and playback of selected Access Gid audio/video streams (Figure 2)



Figure 2: Arena AG video replay tool

- *ScreenStreamer* provides participants in an AG venue with the option to share their screens.
- *Compendium* (illustrated later) is a software tool which provides a visual interface for mapping ideas and documents iconically, stored in a relational database which also provides an API for other tools to read and write data directly. While it can be treated simply as a text editor, *Compendium* is designed to exploit the power of recording different ideas in different 'nodes' (icons on the screen) which may then be tagged with keywords, and linked graphically into hypertext networks. *Compendium* supports user-defined icon palettes, but comes with a default set of icons which support the recording of meetings in terms of key Issues, Ideas, Arguments and Decisions. The critical functionality is that when a node is created or even just highlighted during an AG session being recorded using *Memetic*, it becomes an index into the video replay, thus opening up possibilities for annotating meetings as data.
- *Meeting Replay* integrates all of the above into a meeting browser (Figure 3). The key addition to *Arena*'s video replay function that *Meeting Replay* adds are interactive event timelines, which provide a visual index to provide an overview of the record, and enable its navigation by clicking on an event. Meetings can be navigated non-linearly either by clicking on the interactive event timelines, or from the *Compendium* client by clicking on the iconic nodes to view the meeting (for example in order to see where a decision was made).

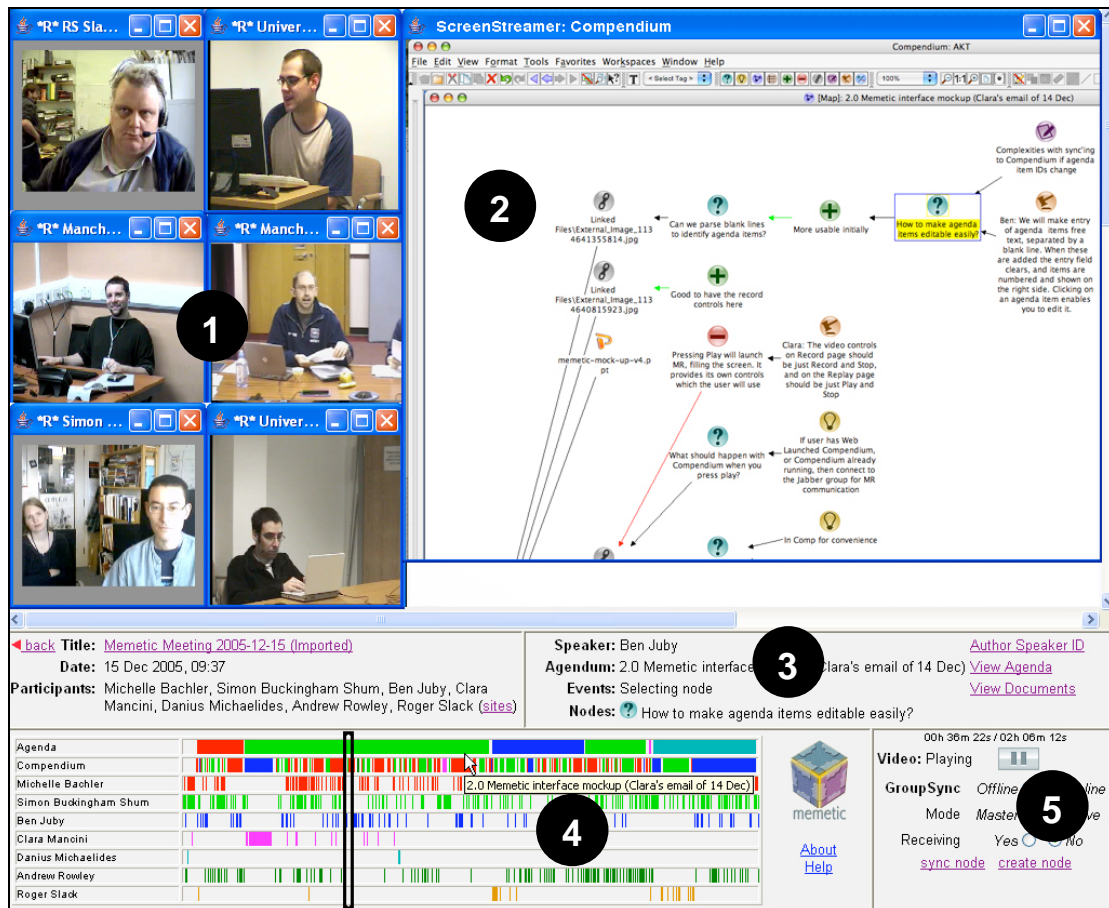


Figure 3: The Meeting Replay web interface in one possible layout. All windows are resizable, repositionable and hideable. (1) participant video windows; (2) shared screen from a participant (there may be >1); (3) status display showing current, Agenda Item, Compendium event (eg. *selecting node*) and the type/name of the last selected node (eg. *How to make agenda items editable easily?*); (4) interactive event timelines for Agenda Items, Compendium nodes, and Current Speaker. Clicking on a coloured bar jumps the video replay to the corresponding point in the meeting. In the initial software release, the Agenda Items and Compendium event lines are automatically generated, but Current Speaker must be manually annotated, if wished, from a radio-button interface. The final release will automatically generate event lines to show the active AG site based on the server traffic; (5) controls to *Play/Pause*, *quit Meeting Replay*, *synchronise the view in the Compendium client* to the map currently open in the meeting, *create a new node* in Compendium with a timestamp matching the current point in the replay, and *couple or decouple the replay* so that everyone viewing it sees the same thing (not active in the initial release).

- Finally, *Meeting Manager* is a forms-based Web user interface for booking, recording and replaying AG meetings (Figure 4). It provides controls to launch Compendium, ScreenStreamer and Meeting Replay to record/replay a given session. A meeting replay can be sent to an AG room (for a group to collectively view), or to a single user's personal computer for solo viewing.

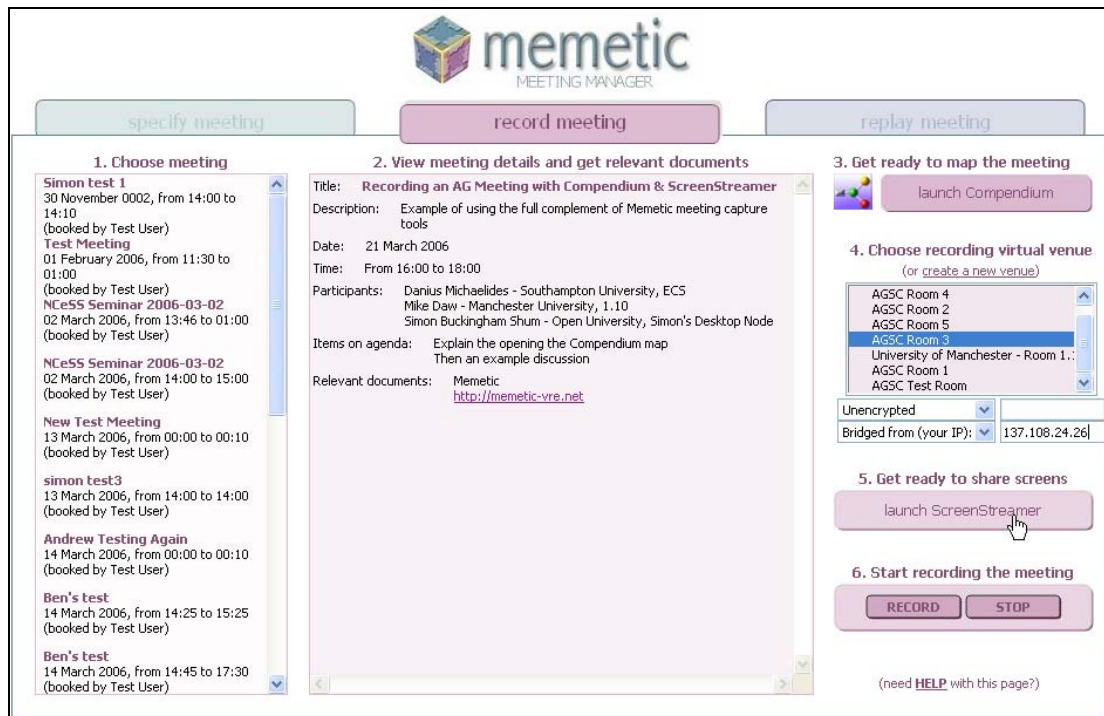


Figure 4: The Meeting Manager website for booking, recording and replaying meetings.

Distributed video recording/replay and analysis

The Memetic toolkit allows the recording of naturally occurring (or indeed artificial) interactions, and their subsequent navigation, annotation and analysis. The Access Grid environment allows a number of viewpoints, all of which can be recorded using the Memetic toolkit. We describe below firstly, how Memetic helps to address the challenge of distributed video capture and replay. We then describe how Compendium adds another dimension to support *distributed coding, indexing, and interpretation* of video.

Memetic is not a dedicated interaction analysis environment, but it does allow users to create dialogue maps and to use automatically generated video replay. In contrast to other environments such as VidGrid (Fraser *et al*, 2005) Memetic does not allow freehand annotations, and we certainly do not propose that Memetic replicates the full power of qualitative data analysis software products. However, we propose that the affordances presented below offer analysts a usable, and in some respects more expressive representational medium, than current products. In particular, for e-scientists distributed geographically and possibly conducting analyses across timezones, the Memetic toolkit exploits the video infrastructure of the Access Grid that is now widely available (and supported) in the research community, which is a factor not well addressed by current products.

Distributed video recording/replay

Memetic allows an analyst to gather and replay multiple, synchronised streams of audio/video data from AG sessions. If working in a distributed team, the replays can be accessed and navigated in tightly or loosely coupled modes, depending on whether everyone wishes to see the same thing at once. Data may of course be recorded from a single venue in order to exploit the Memetic tools, if cross-site activity is not the focus. Such a tool for 'virtual ethnography' (Hine, 2000) opens up possibilities for understanding how systems are used in

settings the investigator may not be able to access readily, and assists in conducting collaborative analysis between remote partners. The camera-rich environment of the AG allows recordings to be made that focus on both verbal and non-verbal components of interaction. Interactions taking place within this AG environment can be analysed from a number of viewpoints and with regard to a particular phenomenon. For example, if one is interested in the ways that persons use gestures such as pointing (Goodwin, 2003) in interaction, it is possible to focus on the particular gesture (and to annotate records where this phenomenon occurs, as described in the next section).

Example: one of our recordings of collaboration between centres in the UK and North America showed how software is used in both contexts and how each site makes sense of it in collaboration with the other: sharing of screens and navigation between screens is one example – two centres sharing screens may have the issue of navigating between particular parts of a presentation. This issue and the attendant repair mechanisms (both interactional and technical) are only apparent when the centres share the screens *in vivo*. Through the provision of such rich records of system use, analysts can attend to the mundane work of making collaborative systems work in practice, and devise solutions to emergent problems (Suchman and Trigg, 1991).

Interaction analysis in Meeting Replay

Taking first the Meeting Replay tool interface, Figure 5 shows an enlarged view of the event timelines.

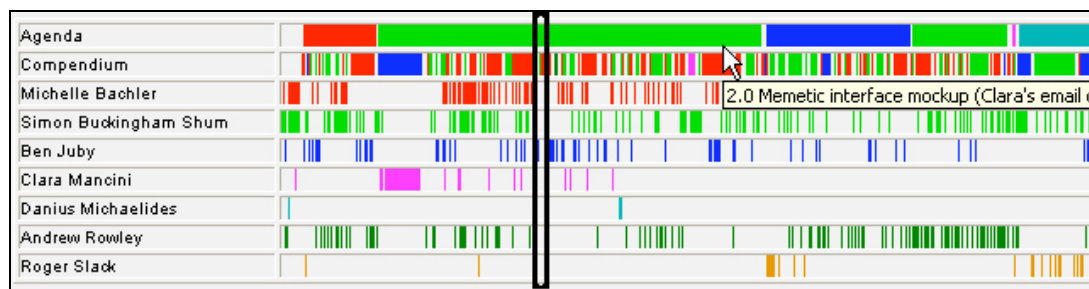


Figure 5: Meeting Replay's interactive event timelines.

The following information, not normally accessible from a video, can be read from the event timeline display:

- When an agenda item was discussed (e.g. the top line of Figure 5 shows that the second item, in green, was returned to after item 3). Details for a given event are displayed on a mouse rollover, as shown.
- Who spoke when, and about which agenda items
- Who spoke a little or a lot.
- Who was speaking when a given Compendium node was created, highlighted, tagged, or a hyperlink followed to an external application or website; this node might be an Issue, Idea or Argument, or a Reference node to an external document such as a spreadsheet, website, photo or slide.
- What the distribution of Compendium node types is (again, they are color coded by type).
- Combining the above, for instance, one can see at a glance which agenda items or Compendium nodes provoked a lot of discussion, amongst whom, and with an approximate indication of whether there was much argumentation (presence or Pro, Con and Argument nodes)

Interaction analysis in Compendium

When Compendium is in *record* mode every new node created is automatically indexed to that point in the video of the AG session. This *Media Index* timestamp can then be edited, or assigned to another node if required. This provides a very simple way for an analyst to index a meeting with a set of iconic markers in a Compendium map, and furthermore, code those indices using whatever coding scheme is being evolved by assigning *Tags* to nodes. If the coding scheme is defined in advance and displayed as a set of icons, the analyst can simply click on the corresponding node to highlight it, which is logged in the Compendium event stream that is uploaded to the Memetic server. These events then appear as clickable coloured bars in the Compendium event timeline in Meeting Replay.

When Compendium is set to *Replay* mode, the maps of icons can be further annotated (e.g. from a different perspective, or simply to provide missing information), and re-uploaded. The Meeting Replay tool can also control the Compendium display to highlight the most current node for the current video timestamp.

Finally, Compendium can be used as a tool to assist analysts as they discuss the different interpretations of the video data. There may be competing analyses, and implications for hypotheses, theory, etc. and it is here that Dialogue Mapping the key Issues, Ideas and Arguments can support e-science (as shown in Clancey, *et al*, 2005).

We now present a walkthrough with commentary to illustrate the expressive possibilities offered by Compendium for to support the tasks of qualitative data analysis. With its unconstrained canvas, Compendium can support whatever spatial layouts are to the analyst's taste. If an explicit linear or tree structure is created by linking nodes, there are layout algorithms to clean up the display either top-down, or left-to-right.

Figure 6 shows how one could use Compendium's default icon set as a user-defined 'coding toolbar'. Clicking to highlight a node either during the live meeting, or while replaying it, indexes the video for that span of time, which on replay will show up as a Compendium node on the event timeline.



Figure 6: Using Compendium's default icon set as a user-defined 'coding toolbar'.

Figure 7 shows how the codes defined in Figure 6 could in addition be sequenced if desired, to construct a timeline which shows event transitions in a video. An arbitrary number of views onto the video can be created.

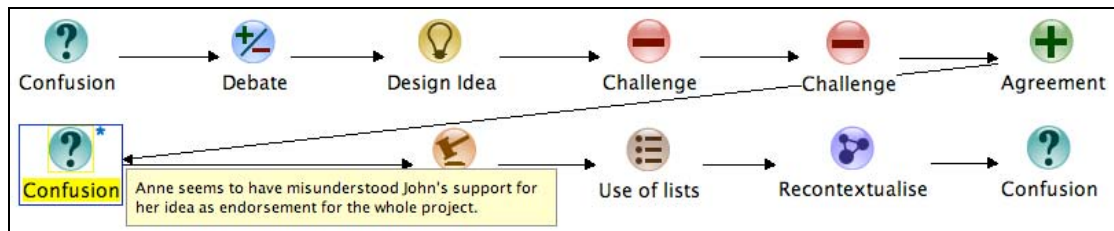


Figure 7: The codes defined in Figure 6 could be sequenced into a timeline.

Figure 8 presents a fictional example to show the use of Compendium to annotate interpretations of data with respect to the literature (as shown, images can be added to the *Reference* nodes to add expressive richness). A small Dialogue Map has started at the bottom, to show how project activity could be coordinated and captured.

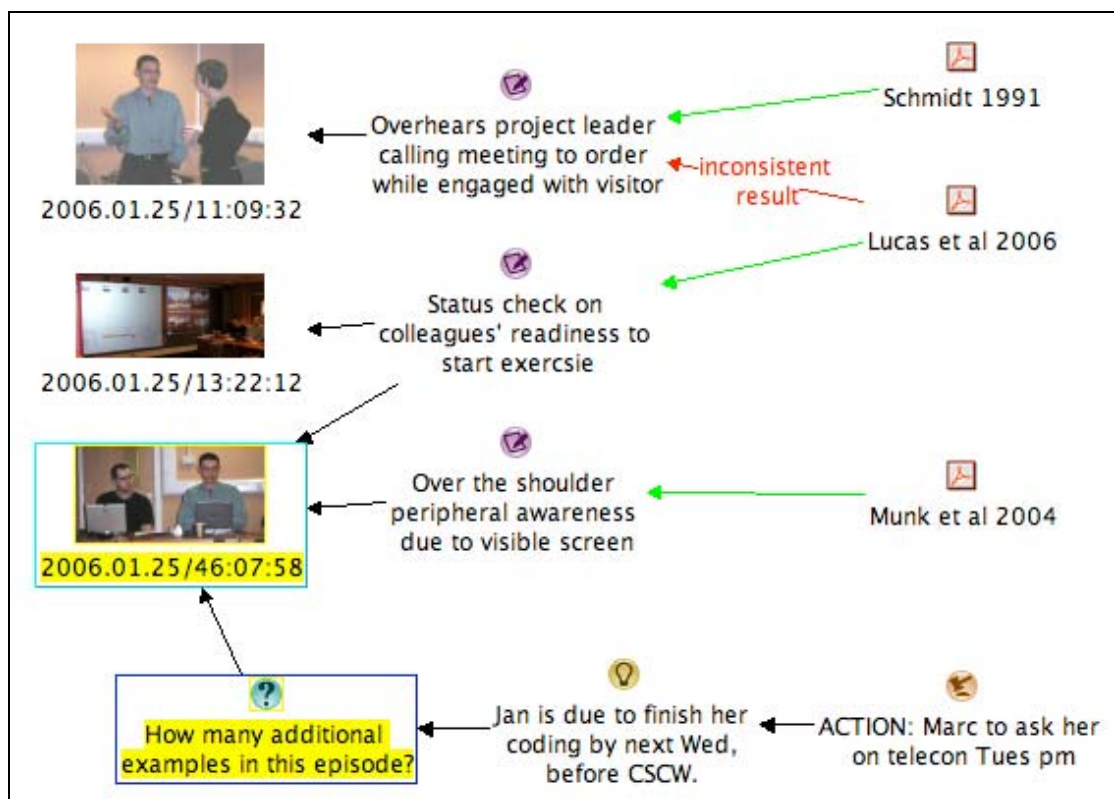


Figure 8: Using Compendium to annotate interpretations of data with respect to the literature.

Figure 9 shows a fictional analysis of two transcript fragments to demonstrate additional expressive affordances to support qualitative data analysis. (1) The transcript was converted automatically into nodes (one paragraph per node) by pasting it inside a node and using the *Convert detail to nodes* button; (2) nodes in the two fragments were linked and arranged into two columns; (3) utterances were tagged according to a coding scheme, shown as the "T" on the highlighted node (e.g. the *SHO: diagnosis* tag is shown); (4) connections between utterances in the two fragments have been highlighted using colour coded links (horizontal arrows); (5) an issue has been raised about one of the nodes (*Question mark* node linked to the highlighted node); (6) photo/video data has been linked to other utterances (right margin).

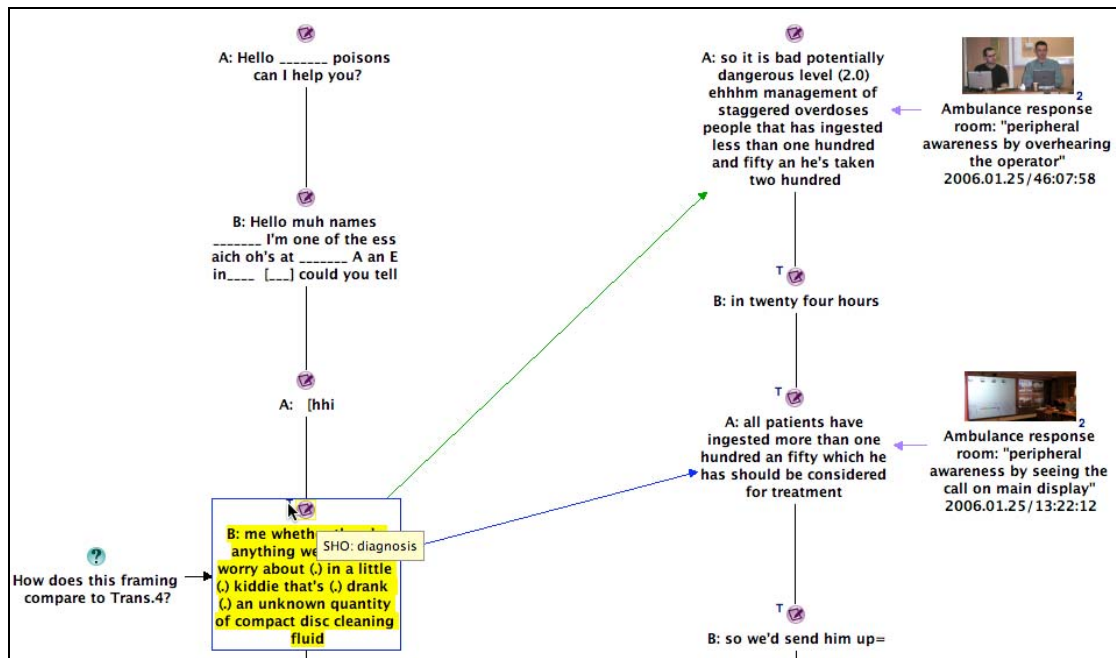


Figure 9: A fictional analysis of two transcript fragments to demonstrate additional expressive affordances to support qualitative data analysis.

Compendium supports hypertext linking through “transclusion”, whereby the same node coexists, and can be edited/tagged directly, in many views. Figure 10 shows that an utterance from Figure 9’s transcript (top left window) is in two other *Maps* and one *List* (the total of four views is signalled by the “4” annotated on the icon). As shown, rolling the mouse over the digit pops up a navigation menu with links to all the containing views, thus informing the analyst in what contexts a node is playing a role of some sort. Following a link opens the target Map/List, and scrolls the display to highlight the target node. Nodes can be transcluded by manually copying+pasting them from one view to another, by inserting the results of a search into a new view, or by typing the label of a new node, and selecting an existing node with a matching label from a menu popped-up by the auto-completion mechanism.

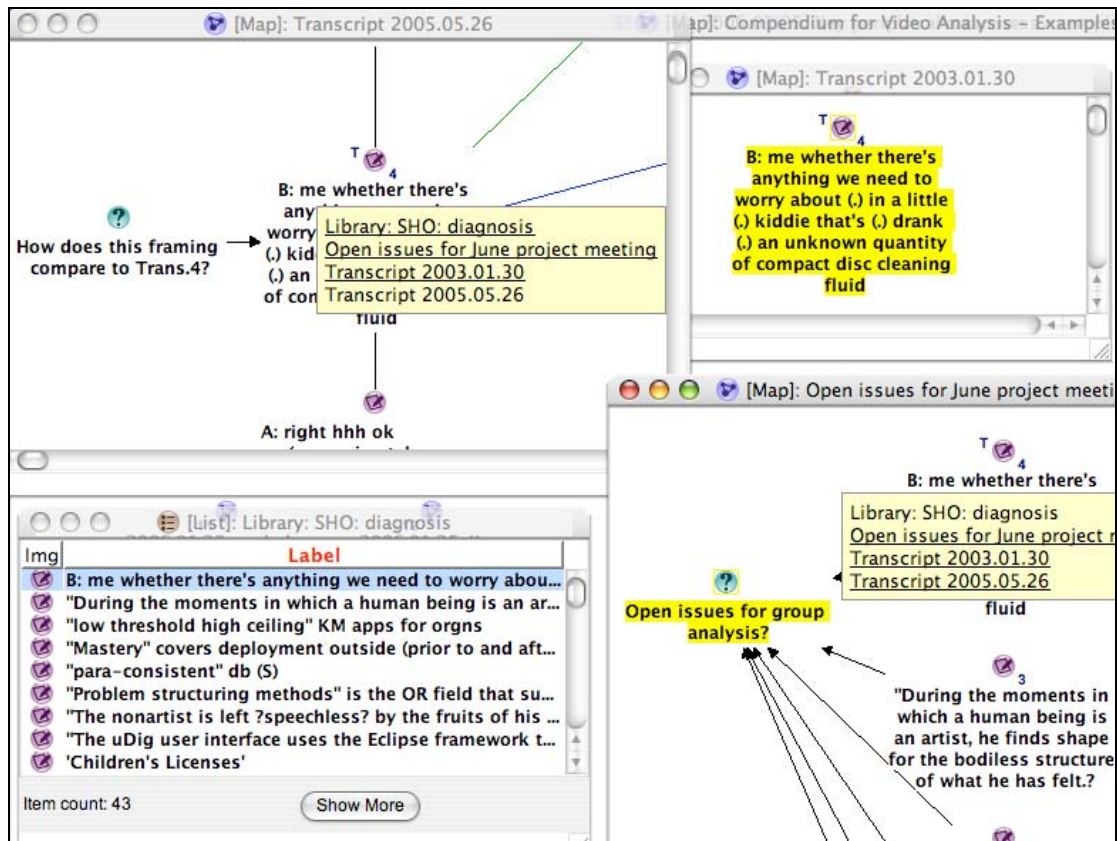


Figure 10: A node transcluded in multiple views.

In addition to searching the relational database by keyword, author and date, the analyst can use node type and tag combinations, to support the collation of nodes from multiple maps into a new Map or List.

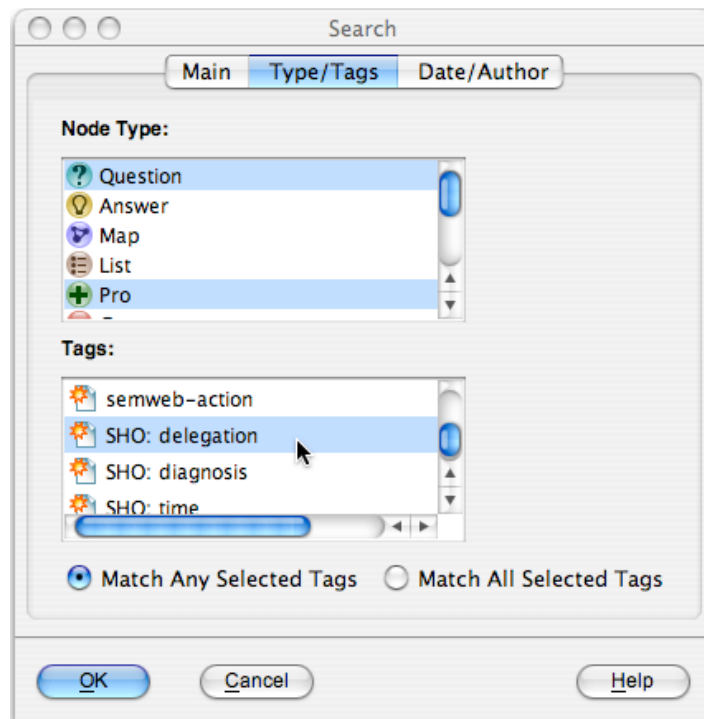


Figure 11: Search interface which allows searching by node type and tag.

The analyst can inspect how heavily tags have been used, analogous to bookmarking websites that show the most frequently used tags in the user community (Figure 12).

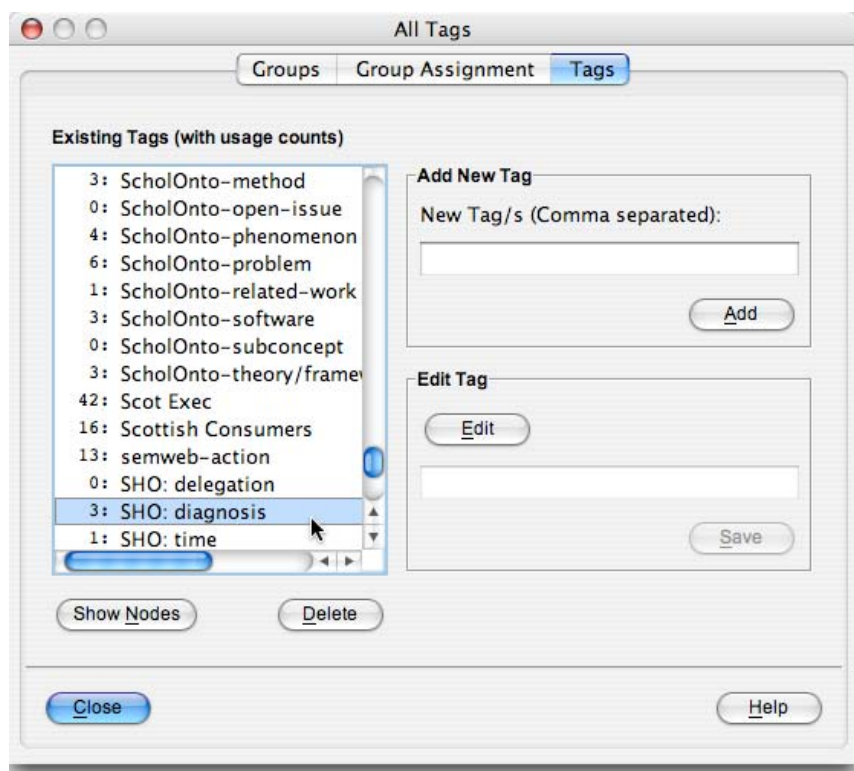


Figure 12: Node Tagging interface to create, group and maintain keyword tags.

Conclusions

In this paper we have described how Memetic uses the camera rich environment of the Access Grid to capture video records of remote interactions, and how the annotation and replay tools enables users to analyse these as data. Our examples to date are illustrative: while Meeting Replay has been used to record a wide diversity of sessions, and some of our end-user partners (evaluating the tools at the time of writing) are expressing interest in its affordances for virtual ethnography and video analysis, the tools have yet to be used in a serious case study. We welcome approaches from the e-social science community who recognise the capabilities described in this paper as tools they would like to test.

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