# Visualising and inferring LMS discussions

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This paper gives an example of how a visualising application applied to the database of a campus LMS could provide a quick and accurate reading on the success of discussions within a given class. The prototype presented has been applied to multiple streams of discussions within a large class to determine if collaboration and cooperation were in evidence. As institutions and academics become more accountable for educational outcomes, we need simple, effective ways to determine if best pedagogical practice in instructional design is in fact getting the desired results.

Keywords: visualisation, LMS, logs, monitoring, analytics

## Expanding the role of the LMS

The learning management system at The University of Auckland, known as Cecil[1], began life as a project within a database course offered by the Management Science and Information Systems Department of The University of Auckland Business School. The first prototypes were running in 1995.[2]

Since 1995 there have been more than one hundred of LMS-like products created (Ruttenbur et al, 2000) (Urdan and Weggen, 2000) with the market share going to Blackboard and WebCT, products that were subsequently merged. Cecil is "home grown" with the university continuing to support and develop more sophisticated and flexible features. Of course all institutions are examining their situation in the light of an open source option (Sakai), increasing license fees for commercial products and a perception that more flexibility is required to address: the demands of academic research into online pedagogy on the one hand; an articulate, consumer-centric student body; and an administrative focus on quality and cost containment. This latter point being the focus of Massy's recent book. (Massy, 2005) Strategically, Team Cecil now supports a portfolio of learning technologies with the hub remaining Cecil. A very recent article in the *Educause Review* makes the strong case for 'business analytics" being applied to the academy with the expectation that we will become "more accountable" for learning outcomes and student success (Campbell et al, 2007). Enterprise wide systems such as an LMS may become the focus of data mining upon which to make evidence based decision, in the hands of an administrative staff who apply a range of flexible technologies to collect, mine and analyse data. Researchers are already exploring LMS databases to determine from activity logs and audit trails what students are 'really doing' within their systems. (Lam et al, 2006)

Cecil is a system that enables learning by providing collaborative space (chat, discussion, e-dossiers), assessment (on/off line) and course administration through a single point of authentication. Cecil is networked to many different systems, ranging from open source (LMS, CMS, peer review, e-portfolio, etc.) to PeopleSoft Academic and the ID section's database of photographs. http://www.cecil.auckland.ac.nz/ is the busiest educational website in New Zealand an achievement that is sometimes exchanged with the university's main site. The operation is professionally managed by the University's technology support centre.

Cecil was designed to provide an elegant assessment and knowledge management platform which would include a time stamp on every transaction. For example, every "click" a student makes in the LMS space is recorded and in the case of a quiz this includes changing one's mind and browsing an exam before answering a question.

Over the past ten years Cecil has recorded the actions of tens of thousands of students using its features. Given a database of about 400 tables with about 4,000 attributes we have been considering how these data might be used to enhance learning and teaching.

[1] Computer Supported Learning becomes CSL pronounced as Cecil.
[2] It has been argued that it may be the first web-based LMS. (Sheridan, 2002)

## Gauging the effectiveness of online discussions

Among the descriptive statistics, we noted the growth in the use of the online discussions. All things considered growth in the use of this sub-system has been acceptable but not in line with expectations.

> Number of discussion messages posted: 33,061
> Number of discussion contributors: 3,521
> Number of times discussions were read: 1.529M

In the past academic year the number of discussion messages has risen 42%, the number of contributors risen 39% and the number of times discussions have been read increased 77%. We had detected among our academic users a reluctance to use online discussions within high enrolment classes due to the high time commitment required. The many challenges of using online discussions have been noted in the literature. (Hiltz and Goldman, 2005) (Beaudoin, 2003) (Holt, et al, 1998) Of particular interest were the various efforts to develop a taxonomy to classify the nature of the contributions of an instructor (Blignaut and Trollip, 2003) and the students (Pena-Shaff et al, 2004, 2005). Quantitive measures of discussion activities can be made, but there are no useful tools to aid in the classification of on line discussions - pending an effective AI application.

Given a range of possible software development objectives, we asked the question: What high level tools might be helpful in identifying an acceptable level of interaction within a discussion forum? Coincidentially *PieSpy* was discovered.

## *PieSpy*: A visualisation tool

> *PieSpy* is an IRC bot that monitors a set of IRC channels. It uses a simple set of heuristics to infer relationships between pairs of users. These inferences allow *PieSpy* to build a mathematical model of a social network for any channel. These social networks can be drawn and used to create animations of evolving social networks.
>
> …These visualisations reveal the structure of the social network, highlighting connectivity, clustering and strengths of relationships between users. Animated output allows viewers to see the evolution of the social network over time.
>
> …Visualisation of social networks is important, as it allows the viewer to determine facts about nodes and relationships between nodes more rapidly than examining the raw mathematical model. For example, the prominence of a node in the network can be determined by its centrality, which is easy to see in a visualisation of a social network. (Mutton, 2005)

## Applying a visualisation tool to a discussion forum

As noted earlier, Cecil time stamps every transaction within the system with the result that the database has records of all staff and student contributions to a discussion as well as other attributes such as: a time line of the class (schedule of assessed events), the context of a discussion (thread) and those who are directly responding / contributing. When the 'bot' is used to read a discussion, a movie-like animation plays to depict the interplay of staff and students against a timeline of significant class events. An organic ebb and flow of interactions provides some evidence of:

- How effectively a new thread is 'kicked off' by the instructor because one can observe a series of student interactions with the instructor and subsequently a 'spin-off' of multiple discussions among students. For example in Figure 1 the instructor initiates a discussion about an assignment but the response is low key from only a few of the students. This changes as the due date for the assignment approaches.
- Who the social leaders or class gurus? Over the course of some weeks it becomes clear who the individual reference points are for internal student discussion. In Figure 2 it becomes obvious that there are leaders in the class and these are at least as significant as the instructor when it comes to communication.
- Initially lags in the discussion activity were interpreted as procrastination, because deadlines advanced activity certainly picked up. In Figure 3 as the time line indicates a mid-semester test is looming, the instructor assumes the role of a central information source for both course discussions in general and more activity about an assignment the is imminent.

- Students became more engaging and spontaneous as the course progressed. Space is not sufficient to provide evidence of the growth in discussion intensity as the course progress and students become more familiar with each other.

Apply the interpretation guide (below) to Figures (1-3) to analyse the snapshot of a PieSpy visualisation of an online discussion.

### Interpretation guide

- Blue nodes denote students
- Red nodes denote staff
- Green nodes denote discussion forum (thread)
- Lines between nodes mean that a message has been sent from one person to another (or in the case of the discussion nodes, from one person to the whole discussion group).
- As more replies pass between two people, the "social bond" between them strengthens and they are drawn closer together.
- The strength of the bond is indicated by the weight of the line. Over time, the lines fade away since older communication s not as important as newer.
- The current messages are indicated by an orange line. The half-arrows on the ends of the lines denote the direction of the reply.
- At the top of the screen is a timeline showing when non-assessed activities start (e.g. lectures) or where assessed activities are due. When the activity is within 2 days of "now" it glows orange.

## The future of a visualisation tool to a discussion forum?

While instructors may spend significant amounts of time observing and contributing to asynchronous discussions, a visualisation tool provides a very different, qualitative perspective on the 'life' of the forum – and very quickly too!

Some interesting things to look out for are: people who become the "centre of attention", discussion threads that become the "centre of attention", dramatic changes in the frequency of activity associated with changes in threads, break away groups, and homogeneous clusters of students .

*PieSpy* should be adaptable to most LMS, so there are a number of potential research studies arising from this prototype - given demographic data about the students (age, gender, race, ethnic background, education, enrolment in courses (on/off line)).

Factors affecting student engagement with online discussions:

1. Students who may or may not exercise appropriate online skills given their time online – following the research of Frederico (1999)
2. Student interaction may vary based upon the instructor's decision to be a facilitator or moderator (Vogel & Klassen, 2001) (Feenburg, 1989)
3. Tracking the 'invisible' online student, lurker behaviour (single / multiple classes), gender and other demographic differences, correlations with final grades, etc. Beaudoin (2003), Holt (1998), Gunn (2003)

## Conclusion

Collaborative environments provide excellent opportunities for students to learn and mature. The time instructors spend either monitoring or facilitating these environments can be open-ended. In classes with enrolments exceeding 400 students there may be multiple discussion groups of about 20 students. With this prototype, using an open-source application such as *PieSpy*, the professor has at hand a quick, useful tool for gauging the participation levels and sophistication of activities within a forum. Of course, if certain events look interesting, the professor may follow up by selectively 'drilling down' to investigate specific phenomena. Thus, visualisation of discussions may become but one, simple tool in the armamentarium.

## References

Beaudoin, M. F. (2003). Learning or lurking? Tracking the 'Invisible" online student. In: Bernath, U. and Rubin. E. (Eds), *Reflections on Teaching and Learning in an Online Master Program: A Case Study*. Oldenburg: Bibliotheks und Informations System der Universität Oldenburg.

Blignaut, S and Trollip, S.R. (2003). Developing a taxonomy of faculty participation in asynchronous learning environments – an exploratory investigation. *Computers & Education,* 41, 149-172.
Blignaut, S. & Trollip, S. (2003). A taxonomy for faculty participation in asynchronous online discussions. In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2003* (pp. 2043-2050). Chesapeake, VA:
Campbell, J. P. Debois, P.B. & Oblinger, D.G. (2007). Academic Analytics: A new tool for a new era. *Educause Review*, 42(4), 40-57.
Feenberg, A. (1989). The written word: On the theory and practice of computer conferencing. Mason, R. and Kaye, A. (Eds.) *Mindweave: Communication, computers and distance education.* Oxford: Permagon Press.
Frederico, P. (1999). Hypermedia environments and adaptive instruction. *Computers in Human Behaviour,* 15, 653-692. https://doi.org/10.1016/S0747-5632(99)00044-8
Ganapahty, S. Ranganathan, C. & Sankaranarayanan, B. (2004). Visualisation strategies and tools for enhancing customer relationship management. *Communications of the ACM*. 47(11), 93-99.
Gunn, C., McSporran, M., MacLeod, H. & French, S. (2003). Dominant or different? Gender issues in computer supported learning. *Journal of Asynchronous Learning Networks,* 7(1), 14-30.
Hassler, V. (2004). Online collaboration products. *Computer,* 37(1) 106-109
Hiltz, S. R. & Goldman, R. (2005). *Learning together online: Research on asynchronous learning networks.* Mahwah, NJ: Lawrence Earlbaum & Associates.
Holt, M., Kleiber, P., Swenson, J., Rees, E. & Milton, J. (1998). Facilitating group learning on the Internet. B. Cahoon (Ed.) *Adult learning and the internet*.. San Francisco: Jossey-Bass Publishers.
Lam, P., Keing, C., McNaught, C.& Cheng, K. F. (2006). Monitoring eLearning environments through analyzing web logs of institution-wide eLearning platforms. In *Who's Learning? Whose Technology? Proceedings ascilite Sydney 2006* (pp. 429–439). Sydney: Sydney University Press.
Massy, W. F. (2005). *Honoring the trust: Quality and cost containment in higher education*. Edison, NJ: Anker Publishing.
Mutton, P. (2005). *PieSpy* – Inferring and Visualizing Social Network on IRC. http://www.jibble.org/piespy/ [viewed 20 August 2007]
Mutton, P. (2004). Inferring and visualizing social networks on Internet relay chat, *iv*, pp. 35-43, *Eighth International Conference on Information Visualisation,* IV, 2004.
Pena-Shaff, J. Martin, W. & Gay, G. (2001). An epistemological framework for analyzing student interactions in computer-mediated communication environments. *Journal of Interactive Learning Research,* 2(1), 41-68.
Pena-Shaff, J. & Nicholls, C. (2004). Analyzing student interactions and meaning construction in computer bulletin board discussions. *Computers & Education*, 243-265.
Pena-Shaff, J., Altman, W. & Stephenson, H. (2005). Asynchronous online discussions as a tool for learning: Students' attitudes, expectations, and perceptions. *Journal of Interactive Learning Research,* 16(4), 409-430.
Ruttenbur, B. W., Spickler, G. & Lurie, S. (2000). *eLearning: The engine of the knowledge economy.* New York: Morgan Keegan & Co.
Urdan, T. A. & Weggen, C. C. (2000). *Corporate e-learning: Exploring a new frontier*. Berwyn, PA: WR Hambrecht + Co.
Vogel, M. (2000). Implementing a CMC tutor group for an existing distance education course. *Journal of ComputerAssisted Learning,* 163, 178-183. https://doi.org/10.1046/j.1365-2729.2000.00129.x
Zhuge, H. & Shi, X. (2004). Toward the eco-grid: A harmoniously evolved interconnection environment. *Communications of the ACM*, 47(9) 79-83. https://doi.org/10.1145/1015864.1015867

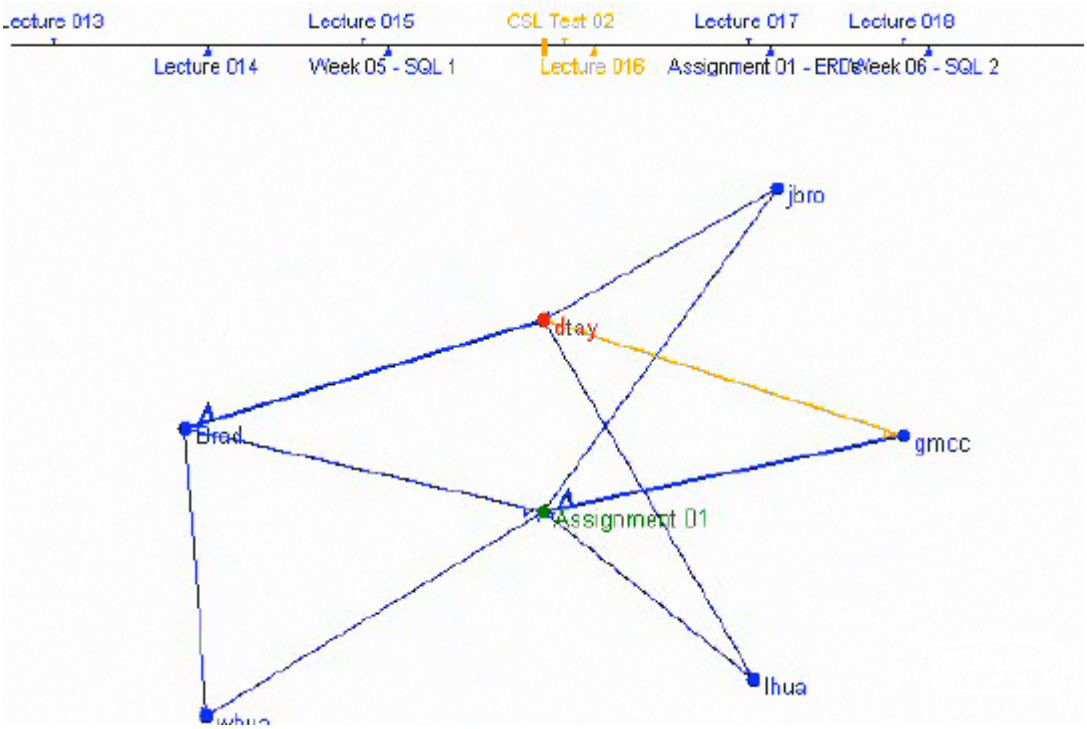


**Figure 1: Central thread is assignment #1 with light student discussion**

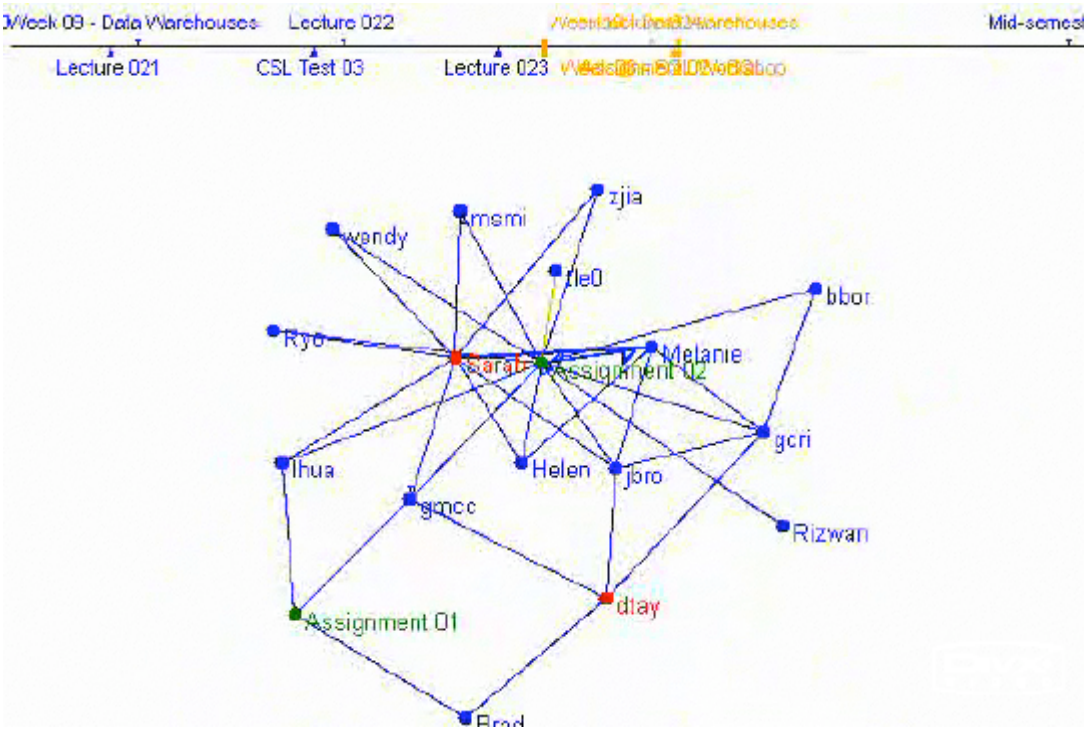


**Figure 2: Diffused discussions, two assignment threads, instructor not primarily involved**

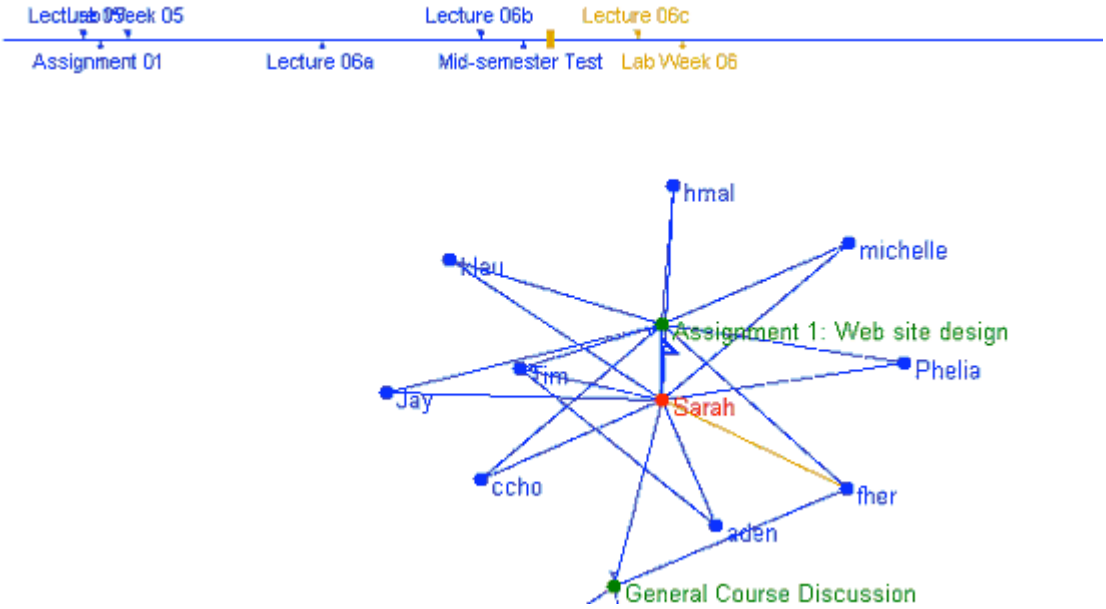


**Figure 3: Instructor central to two threads - assignment #1 and general course discussion**

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