White Paper Report

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Final Performance Report:
The eCommentary Machine Project

White Paper to the NEH Office of Digital Humanities
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ABSTRACT

The eComma "electronic commentary machine" project is a web application built to assist teachers and scholars working with texts and commentaries on those texts. The eComma application enables groups of students, scholars, or general readers to build collaborative commentaries on a text and to search, display, and share those commentaries online in a more pliable form than has previously been available. This white paper describes our results and findings in the second stage in the development of this application.

1. INTRODUCTION

The eComma "electronic commentary machine" project is a web application built to assist teachers and scholars working with texts and commentaries on those texts. The eComma application enables groups of students, scholars, or general readers to build collaborative commentaries on a text and to search, display, and share those commentaries online in a more pliable form than has previously been available. Whereas most humanities texts online make no provision for user-added comments, tags, and other metadata, eComma can be used not only to assemble total collations of texts but also to allow teams of students or researchers to analyze texts in a transparently collaborative and exploratory manner. In so doing, eComma draws on state-of-the-art textual editing theory and database design protocols to provide unprecedented access to texts and moreover to user-generated commentaries on those texts.

We are grateful to the NEH for supporting the development of eComma. This year has been a successful one for the project. We have taken the application from an prototype to the verge of a 1.0 code release, while testing it extensively in classrooms at the University of Texas and using it to present the Collaborative *Rubáiyát*, which complemented and formed part of the exhibition "The Persian Sensation: The *Rubáiyát of Omar Khayyám* in the West" at the Harry Ransom Center (HRC) at the University of Texas, Austin (UT). At the same time, we have faced challenges that have led us to refine our goals and adjust our expectations for future possibilities. The eComma web application has now been enthusiastically adopted by UT's Liberal Arts Instructional Technologies Services (LAITS), which will oversee its provision as a tool to instructors at UT's College of Liberal Arts (COLA), elsewhere at UT, and at other universities. Meanwhile, eComma's central database technology is expected to be of interest to programmers with diverse projects in the Digital Humanities and beyond.

2. PARTICIPATING INDIVIDUALS AND INSTITUTIONS

The eComma Project Director, Samuel Baker, is an Associate Professor in the English Department at the University of Texas at Austin (UT); the eComma project has been housed in the English Department, which has provided it with its most immediate administrative support. Local support supplementing the NEH Digital Humanities Start-Up grant was provided by Liberal Arts Instructional Technologies Services (LAITS), by UT's Division of Instructional Innovation and Assessment (DIIA), and by the Computer Writing and Research Lab (CWRL) in UT's Department of Writing and Rhetoric. UT's Office of Sponsored Projects oversaw the disbursal of NEH funds.

The mainstays of the eComma Project staff included Assistant Director and Chief Programmer Travis Brown, Assis-

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tant Director Katharine Beutner, and Project Manager for Testing Laura Smith. Graduate students Matthew Reilly and Hala Herbly assisted with testing, and three members of the English Department faculty[1] allowed us to invite their students to participate in testing sessions.

In the course of the grant year, we found important collaborative partners at UT's Harry Ransom Center (HRC) and at its School of Information. At the Ransom Center, we worked with Curator Molly Schwartzburg to make an eComma installation an integral part of a show in the library's exhibition space. At the same time, the classroom version of our software was benefiting from a usability study conducted by Jeff Crow in the School of Information, under the supervision of Professor Randolph Bias.

3. GOALS, STATED AND ADJUSTED

At the time of our application for an NEH Digital Humanities Start-Up Grant, our stated goal was to focus development on the eComma pedagogy software, testing it in E 309 and E 316 classrooms and rolling out a 1.0 version of the software in the course of the year. We did make substantial progress developing the pedagogy version of the eComma web application, as will be detailed below; we decided however also to take the opportunity of working with the HRC on the Collaborative *Rubáiyát* installation, a dedicated version of the eComma application which proved a perfect test case for the "start up" moment of our initiative. We documented our progress on the Collaborative *Rubáiyát* and on the pedagogy software on a project blog, housed by the CWRL at `http://ecomma.cwrl.utexas.edu/blog/`.

Our adjusted goals, then, have been to make the Collaborative *Rubáiyát* a successful part of the HRC exhibition and a demonstration of the ability of eComma to bring together new publics for the Digital Humanities, while further testing and refining the version of the eComma application designed to produce such publics in university courses. To the latter end, we successfully ran a large scale set of tests in E 316, the English Department's main service course, an introduction to literature required of all UT undergraduates. Results and remarks on this testing are detailed in "outcomes" below.

We will be releasing version 1.0 of eComma under the Affero General Public License in September 2009, and have been funded by LAITS to roll out a document version control repository that would allow eComma administrators at UT or other institutions to store and share texts and bodies of annotation, as part of a general mandate from LAITS to provide access to the eComma application to the faculty at large. These proximate goals for the pedagogical application, together with further aims for research-oriented development of the eComma software, are further described, respectively, in the "Next Steps" and "Future Plans" sections later in this document. Readers of this white paper who are interested in following these developments should keep an eye on the project blog linked above.

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[1]George Christian, Gretchen Murphy, and Wayne Rebhorn.

Finally, taking a step back, it is worth noting that in developing this tool to enable groups to build collaborative commentaries on texts, we have taken on the difficult task of building a text management system from scratch. This was because our review of similar applications, both academic and commercial, found limitations built into them that brought into focus the need for an application built around a range-based model of texts, a data model that can hold textual data outside of any predetermined hierarchical structure and thus make it possible to take give equal status to the intersecting hierarchies that make texts rich (as when, to give a basic example, a sentence runs across poetic lines in an instance of enjambment). In the next section, on "Implementation," we explain in detail the programming challenges entailed by this data model, and how they have influenced the various iterations of the eComma application. The subsequent section on "Lessons learned" then highlights some of the practical, administrative issues we encountered in seeking to carry out our programming project.

4. IMPLEMENTATION

By the spring of 2008 we had developed an initial prototype version of eComma using PHP with the Smarty templating system and the MySQL database. We selected PHP in part because it was the primary language used by projects in UT's Liberal Arts Instructional Technology Services, who provided our initial funding in 2008. PHP hosting is also widely available from inexpensive (or free) hosting providers, which was important given our vision of eComma as an open source application that could be installed by educators or reading group administrators without a large investment in hosting or system administration expertise.

4.1 Platform

In our development of this early version, we chose to impose several platform requirements beyond the basic AMP (Apache, MySQL, and PHP) stack, in the interest of ease of development and support of best practices. While the current version of the application represents an almost complete rewrite of the 2007-2008 version, the platform requirements have remained the same.

- **PHP 5** is required. This allows us to use a more modular, object-oriented coding style, and to expect extensions such as php-json (for parsing and writing JavaScript Object Notation) to be available and enabled by default.

- **MySQL 5.0** or later is required. All of the database access in the application is performed through stored procedures and stored functions, which were not supported in earlier versions of MySQL. Using stored procedures again allows a cleaner separation of concerns in development, as well as providing better performance for many operations than loading data into PHP and manipulating it there. Using stored procedures and functions does limit the database portability of the

application, since stored procedure languages are not standardized and stored procedures are generally not well supported by database abstraction libraries such as PDO (PHP Data Objects). Given the popularity and ease of MySQL, however, we decided that the advantages of using stored procedures outweighed this loss of portability.

- **mod_rewrite**, an Apache module for manipulating URLs, is required. In many open source content management systems, the use of "clean" (semantically significant and implementation independent) URLs through mod_rewrite is possible, but is not enabled by default, despite the fact that mod_rewrite is very widely available. We believe that URL design is an important part of web development,[2] and accordingly made clean URLs the default for eComma. It would be possible to adapt the current version of the eComma application to work without mod_rewrite, but this is not a development priority for us.

Our development servers and the server for the Collaborative *Rubáiyát* run the Linux operating system, and the server that we use for classroom testing runs FreeBSD. We have not tested eComma on Windows servers, but it should work without modification if the necessary versions of Apache, MySQL, and PHP are installed.

Figure 1: Spring 2008 version

4.2   Prototype

The early version of the application provided basic phrase-level annotation functionality and had been used in several courses, but had a number of limitations. The design of the interface was very simple (see Fig. 1), and our student users were requesting many features that we had not implemented. For example, it was not possible to view the density of specific tags, or of only tags or only comments, in the heatmap view (Fig. 2). Users could not edit their comments, and

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[2]See, for example Tim Berners-Lee's classic essay "Cool URIs don't change" [1].

were frequently confused by the similarities between the tag and comment entry forms. The implementation was also inefficient in many ways (such as failing to take advantage of Smarty's caching capabilities), and the view component was not easily extensible to new kinds of text presentation. In addition the client-side scripting for the application was not compatible across browsers: while texts could be read in all of the major browsers, the application required Mozilla Firefox for annotation.
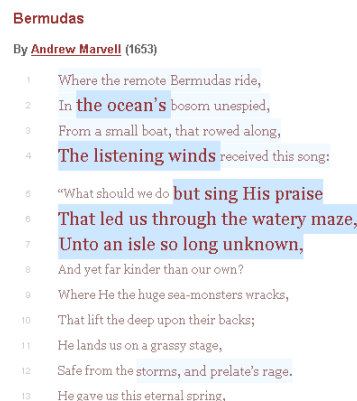

Figure 2: Annotation heatmap (early version)

The performance issues and lack of cross-browser compatibility did not interfere with our immediate goals for the application in the 2007-2008 academic year: we were using it for small groups of students (20-25) who were working primarily from networked classrooms with Firefox installed on all computers. Our tests had demonstrated that eComma could facilitate group reading in valuable ways, however, and we wanted to be able to use it on a larger scale and outside of the campus classroom.

4.3   Development goals

Our development goals for the 2008-2009 year were focused on making it possible to present eComma to larger groups of users in a wider range of situations:

- More flexible annotation and display engine.
- More efficient implementation through smarter caching.
- More appealing user interface.
- Cross-browser compatibility.
- More complete documentation for an open source release.

While we still have an extensive list of features that we intend to implement in the future, we have effectively completed the first four of these goals, as demonstrated by the success of the Collaborative *Rubáiyát* and our series of classroom tests involving hundreds of students in the Spring of 2009. We are nearing completion of the open source release, and are planning to make a 1.0 version available in September 2009.

Our success in building a more computationally efficient engine was dramatically tested at the launch of the Collaborative *Rubáiyát* in February. The application is hosted on a shared single-core Pentium® 4 workstation running a desktop version of Ubuntu Linux, and even with this relatively underpowered configuration we experienced no downtime in the weeks after the launch.

We did encounter some server performance issues during our first E 316 user testing sessions. Our installations for these sessions were hosted on a single FreeBSD virtual server, and when 25-40 students tried to register for accounts almost simultaneously, some of their requests would time out. We resolved this issue by asking the students to register as they arrived, resulting in a more dispersed load on the server. We have since made further improvements to these operations.

We also performed extensive tests of the application's cross-browser compatibility in Microsoft Internet Explorer versions 6 and 7, Opera 9, Safari 3 and 4, and Firefox 2 and 3. In addition to these tests, we asked some students to use browsers other than Firefox during our E 316 user testing, and received only a few reports of browser-specific bugs, all of which we have been able to resolve.

Perhaps more importantly, the Collaborative *Rubáiyát* application has run on the HRC's server continuously with no maintenance[3] for the six months since the launch. This suggests that our goal of promoting deployments of our more mature 1.0 version in situations not under the control or maintenance of the eComma Project will be feasible.

5. OUTCOMES

5.1 The Collaborative Rubáiyát

In June 2008 we began having conversations with Molly Schwartzburg, a curator at the Harry Ransom Center, about using an eComma installation in an upcoming exhibition at the center. In November we received approval to put together a variorum edition of the five editions of Edward FitzGerald's translation of the *Rubáiyát of Omar Khayyám* for the center's exhibition "The Persian Sensation: The *Rubáiyát of Omar Khayyám* in the West," opening in early February 2009.

We decided that while this installation would use the same underlying annotation engine that we were developing for our classroom installations, we would also use the exhibition as an opportunity to experiment with a theming system and several other experimental elements.

The installation posed a new kind of design challenge, since we had to retheme the application to match the HRC website's look and feel (see Fig. 3) while still maintaining an eComma identity and the components necessary for annotation. We made many of the design decisions that have been carried into our 1.0 version during this redesign, including

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[3]With the exception of a reinstall from backup after a failure unrelated to the application during a system upgrade.

a much more distinctive color-coding scheme (see Fig. 4) intended to differentiate comments (blue) and tags (red).

Figure 3: The Collaborative *Rubáiyát*

One of the experimental elements that we built for the Collaborative *Rubáiyát* is the collation engine (Fig. 5). In this view the user can select one of the five editions of FitzGerald's translation as a basis of comparison and see all of the differing words highlighted in the other editions. The word-level collation is done automatically using an implementation of the standard `diff` longest common subsequence algorithm adapted to our data model.

After finalizing the design and completing a stable working engine for the Collaborative *Rubáiyát* in the first week of January, programmer Travis Brown worked on adapting the application to the needs of the HRC's staff and visitors with continuous feedback from Molly Schwartzburg, who was using the application to create a collection of several hundred curatorial tags and comments (Fig. 6).

5.2 Classroom Testing

E 316K, "Masterworks of Literature," is the English literature course required of all undergraduates at the University of Texas regardless of their College or major. It thus provided the eComma pedagogy tool with a challenging set of testers: students not necessarily committed to literary study or to literature itself, who might also have a first-hand experience of the technologies being tested that would go beyond the (not insignificant) experience of the social-networking and data-management web applications increasingly central to student life. The sections in which we conducted tests were devoted to British and to American literature, to poetry and to prose; we did keep the focus to short passages
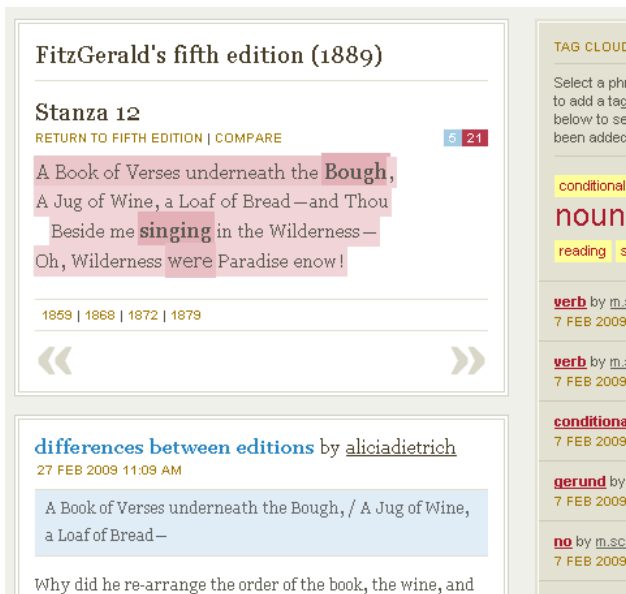
Figure 4: Tag heatmap, tag cloud, and comments

Figure 5: Version collation

of literature, however, and were rewarded with sessions remarkably free of technical difficulties with database functionality.

In general our student testers proved enthusiastic about the eComma application. Many of them found the experience of collating their comments on texts with those of their classmates quite revealing about both the form and intensity of literary structure, some of them comparing it favorably with discussion section. Students spontaneously suggested possible uses for eComma that we had long considered as possibilities ourselves: for comparing Latin translations, for instance, or for analyzing laws. The general enthusiasm of our student testers was particularly remarkable given their willingness to home in on the program's interface limitations. At present, eComma presents its users with long comment threads; many users wanted more options available to display selected comments, perhaps by cross-indexing them for display with tags. They also wanted more control over the interface, whether with regard to searching through comments and tags, with regard to editing annotations they (or others) had previously made, or simply with regard to seeing their own contributions to the overall commentary highlighted by color or otherwise.

6. LESSONS LEARNED

While the programming challenges faced by the eComma project have of course resulted in some changes of approach, for instance as outlined above in regard to design and application architecture, the main lines of the original conjecture underlying the project have provided a solid foundation for the application's realization. Likewise, the project has been well served by its administrative structure, which found strong Assistant Directors, Travis Brown and Katharine Beutner, bearing the major responsibility for programming and
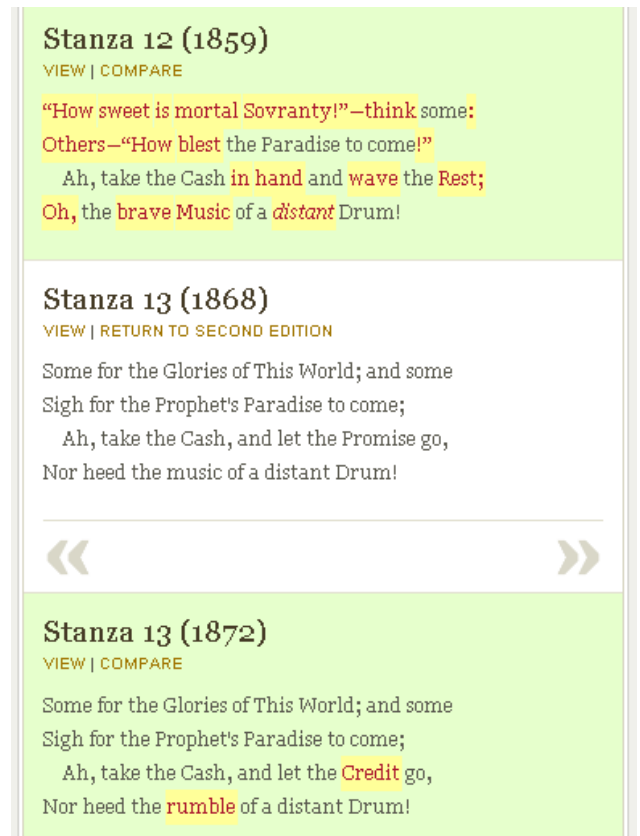
for general development, respectively. The Principal Investigator, Samuel Baker, wishes to state for the record his conviction that the success of the project is mainly Brown and Beutner's accomplishment, and that the example of the eComma project in general and of their work on it in particular should encourage the funding of future projects in the Digital Humanities (and in the humanities generally) driven by graduate student energy.

That said, the main lesson learned by all the major participants in the eComma project, including not only Baker, Brown, and Beutner but also local institutional managers with UT organizations such as LAITS, DIIA, and the CWRL, has been that it is very difficult to recruit programmers equipped to carry out the tasks necessary to realize a custom-built Digital Humanities application. At the time that we applied for NEH funding, we thought that we would be able to find assistant programmers who could reliably build key elements of the application's database and GUI structure, but such programmers proved elusive; we did briefly employ several talented undergraduate programmers, but they were unable to dedicate sufficient amounts of time to the project and were hampered by inexperience with the humanities and by complex and unfamiliar programming architectures. Thus as the project developed, Brown was required to shoulder much more of the programming burden than we had originally anticipated he would need to do.

With these lessons in mind, we at UT hope to institution-

Figure 6: Tag cloud

alize, in the years to come, ground-level exchanges between computer science and the humanities: bridge-building exercises, perhaps including course offerings, that will prepare programmers to participate in humanities projects and humanists to best make use of programmers' skills and preferences. We meanwhile hope to continue to assign major responsibilities for Digital Humanities projects to graduate students in the humanities and in computer science, in no small measure because they are among the best positioned to mediate projects across disciplinary boundaries which they themselves are young enough to see beyond.

7. NEXT STEPS

Over the next 16 months, with the support of LAITS at UT, we will pivot the project from a development phase to an implementation and publicization phase. Using the application extensively in our own courses, and introducing it to other teachers on campus, we will promote its adoption across disciplines from English to the DRW to other text-intensive areas such as history and government, while developing new proposals for research that uses eComma to store and share insights into textual structure (such research development being itself an important dimension of undergraduate and graduate pedagogy). Finally, we will transition our technology development program from its current reliance on a single programmer to instead share it across a more sustainable programming team. (This will become more feasible as the programming project horizon shifts from the solving of problems unique to eComma toward more familiar web development tasks.)

With a 1.0 version of the eComma software finished, we will be ready, in 2009-2010, to present the tool to a variety of possible on-campus users at the University of Texas.

We will seek local occasions to demonstrate the software across the Departments in the Liberal Arts and beyond, while recruiting more faculty and graduate students to use the application in conjunction with their courses. Baker will be teaching his own section of E 316 for the first time, in which he plans to give eComma a central pedagogical role, and likewise Beutner will use the application extensively in her E 314L Women's Popular Genres course. At the recent CWRL orientation for new graduate student assistant instructors, the CWRL staff presented eComma as an available pedagogical tool, and we have already received inquiries from other graduate students who intend to use it in their classes. Furthermore, the new cohesiveness among English Department faculty and graduate students interested in the Digital Humanities will foster its adoption by teachers beyond those already involved with its testing. Meanwhile, we will seek to further develop our relationship with the DRW and CWRL, the venues whose pedagogical imperatives gave rise to eComma in the first place, while cementing new ties with the Linguistics program, with which Brown is increasingly involved. This new direction for Brown is suggestive of new possibilities for reckoning with eComma's potential as a complement to the Texas German Dialect Project (TGDP) software initiatives and other projects in linguistics.

Finally, teachers and scholars at a variety of other campuses have expressed an interest in the eComma application and in its database model, and LAITS at UT has declared its willingness to facilitate the distribution of the application not only to UT faculty, but to users at other institutions as well as to private individuals wishing to avail themselves of it. Where a larger community of eComma users is concerned, we envision establishing repositories for TEI texts that can be used in eComma installations, and for the bodies of annotation that result from the use of the application. A TEI text repository dedicated to eComma should facilitate the use of the application, but should also make visible what choices users are making about base texts, thereby giving rise to important further discussions. Similarly, the possibility that archived eComma installations might be used as vehicles for insights into the texts or commentary methods they exhibit, either on their own or in comparison with new installations, strikes us as an exciting one for the disciplines where textual commentary is at the heart of the enterprise.

The eComma application will require continual refinement to stay current in the fast-moving environment of Digital Humanities web development. Not only will teachers of English and composition want to tweak it for special purposes, we expect to make its database system and interface innovations available to faculty and students in fields from linguistics to art history, which will require ongoing changes, for instance a revival of the image-tagging code we wrote with DIAA support in 2007. Thus it will be important to address the issues with staffing described in the "Lessons Learned" section in ways that make possible the maintenance and development of the application going forward.

8. FUTURE PLANS

The Texas Institute for Literary and Textual Studies (TI-LTS) year-long symposium on the Digital Humanities slated by the English Department for 2010-2011 will provide a superb platform from which to present eComma to Digital Humanities scholars from around the country. This process of publicizing eComma beyond UT will begin with the dissemination of this NEH white paper overview of the project. Moving forward from this white paper we plan to share our experiences with select national presentations and papers focused on the programming and pedagogical sides of the project. (A recent informal presentation at the University of Nebraska-Lincoln has been a first step in this regard.) We will also seek to assemble teams of scholars who, equipped with the eComma application, can propose to fund its use with further outside awards: for instance, the NEH Preservations and Access Grant and the NEH Scholarly Editions Grant. In order to develop successful applications for these grant opportunities, we will build working groups able to synthesize their scholarly command of particular archives with an affinity for the Digital Humanities and for pedagogical and public outreach. Recruiting graduate students and faculty in the humanities, as well as programmers interested in applying their skills to humanities-centric projects, is thus a next step crucial to these future plans.

9. ACKNOWLEDGMENTS

In conclusion, we would like to thank the CWRL for providing us with a server and networked classroom space for user testing, DIIA for initial funding and ongoing personnel support, and LAITS for continuing funding and for expert project management. We would also like to thank the HRC for allowing the eComma Project to be part of "The Persian Sensation: The *Rubáiyát of Omar Khayyám* in the West." It has been fitting that the process of producing a web application devoted to collaborative knowledge production has itself been such a collaborative one; our hope, meanwhile, is that those developing the project in the future enjoy such collaborations as much as we have in these past two years.

APPENDIX

A. DOCUMENTS AND INSTALLATIONS

`http://ecomma.cwrl.utexas.edu/docs/neh-wp.pdf`
This document, available in an electronic version.

`http://ecomma.cwrl.utexas.edu/blog/`
The project blog. We are in the process of moving the blog and all new installations to servers at UT's LAITS, but the new addresses will be noted here. We will also announce the upcoming open source code release here.

`http://ecomma.cwrl.utexas.edu/docs/ecomma-laits.pdf`
A presentation by Katharine Beutner and Travis Brown for the LAITS Third Friday program. The presentation situates eComma in a context of similar annotation applications and

explains aspects of the eComma range-based data model in more detail.

`http://scholar.hrc.utexas.edu/rubaiyat/`
The home of the Collaborative *Rubáiyát* at the HRC.

`http://www.youtube.com/watch?v=DLUK9baCCkk`
A video about the Collaborative *Rubáiyát* produced by Lee Tran, Daniel Zmud, and Katharine Beutner, with the assistance of Molly Schwartzburg and Alicia Dietrich.

B. PUBLIC REVIEWS AND RESPONSES

Prior to the opening of the Collaborative *Rubáiyát*, the eComma Project had received little public attention. Travis Brown had presented a demonstration of a prototype version of the software at THATCamp 2008 at the Center for History and New Media, and we had created a blog to publish news about the project in June 2008, but the Collaborative *Rubáiyát* was the first installation that was open to annotation by the general public.

Carolyn Kellogg reviewed the application for Jacket Copy at the *Los Angeles Times* on April 9, 2009 [4]. The review is generally positive, concluding that eComma offers an "interesting and energizing way to approach a classic work" and that "experiments like this are to be commended," but the reviewer also has reservations, claiming that the application "lacks a certain integration that could lead to drawing connections" and dismissing the tagging functionality as "kind of nifty."

Other responses to the Collaborative *Rubáiyát* include a post by Keene Haywood for the New Media Consortium [2], discussions on Andrew Wessels's blog A Compulsive Reader [5], a citation by Jason B. Jones at Bookslut [3], who refers to the application as "a *very* cool online version of five editions of Edward FitzGerald's version of the poem," and many other posts on various blogs and Twitter.

C. PARTICIPANT BIOGRAPHIES

Samuel Baker is the eComma Project Director. He is an assistant professor in the English Department of the University of Texas at Austin and has recently completed a book about British Romantic writers and the sea, entitled *Written on the Water: British Romanticism and the Maritime Empire of Culture* (forthcoming from the University of Virginia Press in 2009).

Katharine Beutner is Head of Development and also serves as an Assistant Director and grant writer. She is an English doctoral student at the University of Texas at Austin and is writing a dissertation on conflict between literary women in the early eighteenth century. Her first novel, *Alcestis*, will be published by Soho Press in February 2010.

Travis Brown is the Chief Programmer, Designer, System Administrator, and second Assistant Director of the eComma project. He is a doctoral student in the English Department of the University of Texas at Austin, where he

studies British Romantic narrative poetry and verse prosody. He led the UT Linguistics Department's team in the 2009 Conference on Computational Natural Language Learning (CoNLL) Dependency Parsing and Semantic Role Labeling Shared Task, and has been active in the development of the MSTParser data-driven dependency parser and the Shalmaneser semantic role labeling toolkit.

Laura T. Smith manages the testing of eComma. She is an English doctoral student at the University of Texas at Austin, and is concentrating on poetry and poetics.

D. REFERENCES

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