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Hacking the Voice of the Shuttle: The Growth and Death of a Boundary Object

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This is the tale of two hacks. The first was building my *Voice of the Shuttle (VoS)* starting in 1994--a "Web page for humanities research" (as I subtitled it) that collected online resources in the humanities alongside selected scientific, social-science, and other resources. Each item was glossed with a brief description; and the whole was organized in a classificatory framework both faithful to academic categories (field, period, authors, etc.) and blurring them into new configurations (e.g., on my pages for "Cyberculture" and "Technology of Writing," de facto placeholders for the yet to emerge "new media studies" and "digital humanities" fields).¹ One of the earliest attempts to create a portal of Internet resources for the academic humanities, VoS in its prime in the 1990s and 2000s had mirrors in Italy, Japan, and the United Kingdom and was widely used among not only scholars but a wider public. Among its other awards, it was named to Forbes Magazine's "Best of the Web Directory" in 2002 as a "premier online destination for the humanities and social sciences, for casual surfers and die-hard researchers alike" because of its "deep research links" and balanced attention to "classics" and "contemporary topics like Cyberculture, Technology of Writing or Postindustrial Business Theory."²

The second was the malicious hack (actually a series of hacks) a decade later that destroyed--or, put another way, clarified--my dream of what VoS could and could not be. VoS, I now understand, was a transitional version of what Susan Leigh Star and her colleagues theorized as a "boundary object."³ It was a sunrise, and sunset, boundary object spanning disciplinary and geographical scholarly communities in hopes of creating a global collaborative in which humanists (and the public) could freely take and add knowledge across their divisions.

As defined in Star's groundbreaking article of 1989, "The Structure of Ill-Structured Solutions: Boundary Objects and Heterogeneous Distributed Problem Solving,"

"Boundary objects are objects that are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use." (46)

That is, boundary objects are artifacts invested with concepts and practices that facilitate epistemological transaction between communities (e.g., research biologists and amateur naturalists) because, like mental magnets, they have the property of being able to attract local interpretive paradigms from different knowledge enclaves and stick them together with just enough, if partial or "ill-structured," overlap to allow everyone to "cooperate without having good models of each other's work" (46). Specifically, VoS fit the bill of two kinds of boundary objects identified by Star: "repositories" and "forms and labels" (48, 50).

In general, Star observes, boundary objects are key to "open systems" in which "different locales have different knowledge sources, viewpoints, and means of accomplishing tasks based on local contingencies and constraints" (45) and where there is thus "no global temporal or spatial closure" or "central authority" (40). Translated in terms of the metaphor of the "Web" (which I spun out in the title of my site by alluding to Aristotle's, and later Geoffrey Hartman's, mention of Sophocles' lost play about Philomela's "voice of the shuttle"), boundary objects like VoS are creatures of an open rather than Arachnean weave.⁴

Over the last twenty years, VoS lived, and died, this dream of a boundary-spanning open system. Today, it survives as an eroded monument to an early Internet era that dreamed of free, "ill-structured" systems but was "so rudely forc'd"--as T. S. Eliot's *The Waste Land* describes

Philomela's violation--to wake to something else.⁵ The following are the two hacks of VoS that taught me this lesson.

Hacking VoS, 1994

I hacked VoS into existence in late 1994--where "hack" in this context has the *maker* and *bricoleur* senses idiomatic among early computer academics and hobbyists (and more recently among the digital-humanities community in such expressions as "more hack, less yack").⁶ The site began as a local resource at the University of California, Santa Barbara (UCSB), where I had been studying the Internet while working on what became my *Laws of Cool* book. This research spilled over into creating courses that included the Internet as a topic, starting a Web-authoring hobbyist group called the Many Wolves, and selling in the campus bookstore my lengthy, self-published *Ultrabasic Guide to the Internet for Humanities Users at UCSB*.⁷

All this spillover activity was inspired by the fact that, like the self-aware and newly unfettered artificial intelligence at the end of William Gibson's *Neuromancer*, I felt rather lonely online.⁸ There was a big, new wired universe out there, but my local humanities community at UCSB (like most such communities at the time) had barely discovered e-mail. To seduce my community onto the Internet, therefore, I hawked my *Guide*, sent out proselytizing emails disguised as how-to tips, and otherwise tried to pull back the veil of technical arcana that then obscured the Internet. I typically began with housekeeping skills (Unix commands, downloading and uploading, etc.) and then proceeded through various facets of the Internet from FTP and telnet through Gopher and the Web.

Very soon, however, it became clear that I would do best to concentrate on just one facet of the net. That was the Web, of course, which had begun to prove its general appeal and was

quickly subsuming other facets. My agenda thus simplified: I standardized on recommending the Web as the path to follow beyond e-mail, and I tried to make visible enough compelling academic Web content to entice my community to take the bait.

It was to surface this content that I started VoS in December 1994 as a simple file of HTML links circulated locally on campus--a restriction necessitated by the fact that my university's humanities server computer at the time (humanitas.ucsb.edu) was not yet a Web server. My links file became an accretion disk growing ever larger and more densely organized as I continued collecting (using mainly the Lynx text-only browser for sheer speed in the days of dial-up modems). I also solicited and HTML'd the writings of UCSB people for a "Featured Works" section, rotating among academic departments so that I could lure fresh newcomers onto the Web to read the work of colleagues or mentors.

When on March 21, 1995, the campus Humanitas machine became a web server, VoS made its global debut as its home page. It remained there until July 22, 1999, when it migrated to its present campus top-level domain (vos.ucsb.edu). As VoS went global, I adjusted my descriptions of pages, categories, topics, etc. on the site to make it more useful for a larger audience--i.e., to make it a better boundary object.⁹ VoS now addressed the UCSB humanities community *plus* a widening archipelago of other user communities, each discrete in disciplinary field or geographical location yet all cross-linked through my evolving ontology of categories and levels. Due to my background in literary studies, the disciplinary communities that gathered around my literature pages (sending me correspondence, making suggestions, etc.) were fullest and deepest. But my Art and Art History, Religious Studies, and several other pages also early on acquired robust, discrete user communities. A similar archipelago pattern emerged geographically. Most repeat visitors in the early years hailed from the U. S., Canada, and the U.

K., but increasingly I saw in my log files sizable user communities from Italy, Australia, New Zealand, Japan, Mexico, and several other countries (plus a constant stream of first-time visitors from all over).¹⁰ The fact that such globalism was a matter of boundary spanning rather than homogenization was suggested by events after a VoS mirror site went up in Italy in 1998 (one of several mirrors around the world).¹¹ Suddenly I began receiving email from Italian users accompanied by suggestions for resources authored in Italy. It was clear that a discrete community had been added to my user base. And in terms of sector- and age-groups, too, communities were boundary-spanning in the sense of being at once differential and intersecting. As might be expected, most visitors and contributors came from higher-education institutions. But many also came from the elementary and high school educational communities, adding a distinct flavor of their own. Even the surprisingly large number of general public users (from the .com, .gov, .org, and .mil domains as well as America Online, Prodigy, Compuserve, Netcom, etc.) asserted a discrete personality while also reaching hands across the aisle to academe. I often received feedback from such users in a persona self-conscious about its niche outside higher education but determined to bridge the boundary--e.g, the user fooled by the "shuttle" in my site title who wrote to say that "as a working engineer I wouldn't normally have stumbled onto your site, but I just had to see what NASA had to say about the humanities" or, again, the correspondent who began a letter, "I'm just an AOL'er, but I have a literature site that may interest your readers."

Only occasionally did usage spikes sparked by the mention of VoS in a mass-circulation newspaper, magazine, or website (as occurred at various times when *CNN.com*, *Forbes.com*, *Los Angeles Times*, *New York Times*, or *USA Today* cited the page) create an apparently undifferentiated global response. For instance, when the CNN website in 1996 linked to an essay

I had posted on VoS the previous year ("Should We Link to the Unabomber? An Essay on Practical Web Ethics") over 3,000 visitors stopped by each day, which at the time was a large number for an individual academic site.¹²

By June 1996, VoS had grown to some 70 Web pages covering 23-30 disciplines (depending on how one counts disciplines); and the time I spent working on the site averaged two hours each day. The total bulk of VoS at that time was about 3 Mb of links plus another 1 Mb of images and other matter. But it was the range of VoS's user and contributor communities--widening and intersecting, enacting the "world wide web" as an open weave suited to the "interdisciplinary" enthusiasm of the time--that most excited me. I remember in those early days, when I still had shell access to the server (something unthinkable today), that I watched my log files in real time to see the hits coming in from user communities around the world. People also sent me scores, then hundreds, and ultimately thousands of emails each year to contribute links, request subject coverage, make corrections, etc.--to the point that suggestions I once fielded by email had to be redirected through a Web form to an automatically aggregated "New Links Suggested By Users" page from which I harvested material.¹³ I felt that I had hacked the humanities for the better; and that VoS could become the crossroads site for all like-minded, if distinct, communities interested in the humanities.

On October 16, 2001--with the programming assistance of Robert Adlington and Jeremy Douglass (at the time graduate students in my department)--VoS took the fateful step of migrating its static HTML pages to a dynamic database-to-HTML platform (built on a Microsoft SQL Server backend with a custom-programmed content management system created by Adlington and Douglass). The goal was not just efficiency (allowing me to edit via Web forms to propagate changes) or more customizable searches and views for users. It was also to broaden

and deepen community. The plan--still stated on the VoS home page as a relic--was to let users sign up for accounts that would permit them to submit links for specific locations on the site and then, once these had been edited and approved, maintain links and even in future create custom versions of VoS for local purposes. I quote from the full plan that appeared in December 2003 when one pressed the "Helping Edit VoS" link on the VoS front page:

"Contributing to VoS: Once users sign up for a free account on VoS, they will be able to use Web forms to suggest links for particular areas of the site. . . . Suggested links appear right away on VoS under Unvetted Submissions. They later [appear] on the regular pages after being reviewed by VoS editors. . . ."

"Editing VoS (for those with accounts): In a later implementation phase of the new VoS, users who have signed up for accounts will have additional editorial privileges allowing them to maintain/revise links that they have contributed. There will also be group accounts that enable classes, organizations, conferences, etc. to build subsets of VoS resources that will appear both on the regular VoS pages and on a special page set aside for the group. . . . VoS will thus be an open platform serving the needs of both general and specific communities of users. . . ."

(Internet Archive copy of "VoS Help Page," December 20, 2003)

Hacking VoS, 2004-5 ("Bad Hack")

That was the open dream. But the dream died--or as I put it, clarified--when the dark side of the force of "hacking" emerged in two hacks by outsiders in 2004-5. On January 31, 2004, I woke to find all content and the category structure of VoS erased, leaving a single category populated by the stark phrase, "Bad Hack." It was a SQL injection attack--a mode of exploiting

online SQL databases that came into fashion beginning circa 1998.¹⁴ We restored VoS from tape backup, then put in place a number of protective measures. However, on December 11, 2005, a further attack resulted in another catastrophic hack, deleting all content and retitling the top category in the VoS hierarchy, tauntingly, "Site Hacked." After detailed forensics by Jeremy Douglass (working with our longtime department sysadmin, Brian Reynolds), we traced the attack's pathology and probable origin. In all likelihood, it was initiated from a part of the world well-known to target Western and other Web sites. The modus operandi was to inject bad SQL statements via http requests to learn about table properties from the database's error reports--a dark-arts forensics that ultimately gleaned enough about the database to change admin permissions, at which point anything was possible, including bursts of "script-kiddie" rote manipulations of the database.¹⁵ Over several months (even as further SQL injection attacks were attempted), Douglass worked to harden the VoS site--one of the most flagrant diversions of intellectual talent for purely non-productive, reactive goals I have ever witnessed (though the chapter on "The Aesthetics of Error: IF Expectation and Frustration" in Douglass's dissertation on interactive fiction owes its inspiration to his forensics on the VoS error-report exploit).¹⁶

The result of these "bad hacks" was a fatal hardening of the arteries of VoS. We hardened the site in innumerable ways by revising table relationships, constraining permissions, turning off error reporting, and restricting access routes for editors, with the overall result that both the quantity of editor-users and the quality of their editing experience were severely curtailed. This stopped the hacks, but it also killed plans for a relatively open system. Of course, if VoS had been a .dot com firm with vast engineering staffs, it could have created a secure custom platform. Or if its homemade content management system had not preceded later ones supported by open-source communities (WordPress, Drupal, etc.), it could have outsourced its security concerns.

Or, yet again, if VoS had been a Wikipedia that simultaneously expanded its contributor base and an increasingly elaborate, bureaucratic system of governance (policies, criteria, talk pages, administrative and enforcement roles, arbitration processes, sanctions, protections, and bots to assist with the above), then things could also have been fine. But VoS was just an academic site I had personally started and maintained with graduate students and a departmental sysadmin. We couldn't be the secure open system we wanted to be at the time. Today, the cost in work hours that would be needed to reimplement VoS on a new platform designed for better compromise between openness and security is simply too great to justify when the site's original function (helping humanists discover links) has in great part been superseded by algorithmically-driven search engines (though, of course, these sacrifice the edited organization and context provided by VoS). Plus, of course, the Web has just gotten too big, making my original vision of "editing" it naive. When VoS started, there was Yahoo with its (at the time) hierarchically collected and arranged resources. I thought I could not only match Yahoo but outdo it in providing an organizational framework better suited to scholarship. Now there is Google, Bing, etc., and I have neither the ability nor ambition to impersonate them, which is also to say that as a scholar I actually do not wish to be a corporation. For corporations today, after all, the great boundary object is the stock market and, more basically, capital.

VoS was a scholar's dream of the Internet born in an era when no one imagined how big the Web would become or how divergent, hostile, or capitalized some of its digital population could be. Boundary crossing, after all, also invites invasion. In Star's terms, VoS was an "ill-structured" open system that woke to the reality that such systems must eventually be guarded, thus revealing themselves to be what they perhaps always were: temporary displacements of modernity's closed organizations of knowledge for which, today, the dream is again to find

boundary objects able to nudge "closed" toward "open."

In a section of her later "This is Not a Boundary Object: Reflections on the Origin of a Concept" (2010), Star reflects on "the growth and death of boundary objects"--"their origin, development, and, sometimes, death and failure" (613).¹⁷ She hypothesizes a cycle:

Over time, people (often administrators or regulatory agencies) try to control . . . and especially, to standardize and make equivalent the ill-structured and well-structured aspects of the particular boundary object. . . . [But] Over time, all standardized systems throw off or generate residual categories. These are categories that include "not elsewhere categorized," "none of the above," or "not otherwise specified." As these categories become inhabited by outsiders or others, those within may begin to start other boundary objects . . . and a cycle is born [last ellipsis in original]. (613-14)

Or, as Star also says: "We live in a world where the battles and dramas between the formal and informal, the ill structured and the well structured, the standardized and the wild, are being continuously fought" (614).

VoS was *wild*, and now it is tamed. A larger thesis that could be started at this point (something I am working on in a book on digital humanities and cultural criticism) is that in modernity new media are experienced as "new" precisely when they serve as transitional boundary objects initiating such a cycle. Today, for example, open-system new media attract professional communities of "knowledge workers" (or students training to be such workers) laboring in standardized organizational institutions where earlier conventions of professional autonomy are increasingly subjected to "managerialism." The boundary-object new-media spaces such professionals develop on the side (their blogs, their open-source projects, etc.)

compensate for eroded autonomy by regenerating residual professional patterns of cross-organizational association, collegiality, shared governance, etc. (and related modes of intellectual, artistic, and--more basically--social association). But fast forward the time line, and such boundary objects evolve their own standardized protocols and governance structures uncannily mimetic of managerialism ("templates" for blogs, for example). Then the cycle starts over as "not otherwise specified" exceptions incubate fresh boundary objects (e.g., today's social media) tantalizing institutionalized knowledge workers with visions of refuge from modernity's standardizations and, more uncanny, contemporary postindustrialism's *distributed* standardizations (e.g., password control points, template forms, and surveillance propagated at all levels of distributed systems).

To rewrite the myth: VoS had a tale to tell of interdisciplinary freedom. But the bad hacker violated it; cut its tongue out; and shut it up in a guarded place.¹⁸ So VoS remade itself as a hardened site. Arachne took over--a spider at the center of a managed web. Seeking new open spaces, Philomela thought she might next become a "digital humanist," trying out fresh ways of making interdisciplinary boundary objects such as topic modeling, network analysis, mapping, and visualization.

Notes

Parts of my narrative of the early days of VoS in the "Hacking VoS, 1994" section of this chapter are adapted and expanded (with permission of the journal editor) from my article, "Globalizing the Humanities: 'The Voice of the Shuttle: Web Page for Humanities Research,'" *Humanities Collections* 1.1 (1998): 41-56. An open-access version of the earlier article (the submitted manuscript version) is available at <http://liu.english.ucsb.edu/wp-includes/docs/VoSessay.pdf>.

¹ Significant milestones in VoS's development include: *December 1994*: began as local resource at University of California, Santa Barbara (UCSB); *March 21, 1995*: became world-accessible on UCSB's Humanitas server (humanitas.ucsb.edu); *July 22, 1999*: moved to new server and domain name (vos.ucsb.edu); *October 16, 2001*: changed from static HTML pages to database-to-HTML site in custom-made content management system; *January 31, 2004*: "Bad Hack" SQL-injection attack; *December 11, 2005*: "Site Hacked" SQL-injection attack; *2004-5*: hardening and lockdown to restrict editing; *2006 and after*: gradual slowing of active development and maintenance. The earliest archived copy of VoS in the Internet Archive is dated 21 November 1996: web.archive.org/web/19961121003828/http://humanitas.ucsb.edu/. See this copy for the site's early ontology and content, including the mentioned pages on "Cyberculture" and "Technology of Writing."

Over most of its history, VoS was edited and maintained as a solo endeavor by myself, though during 1999 to 2002 I sponsored about 20 graduate students as editorial assistants with the aid of campus funds. (See <http://vos.ucsb.edu/credits.asp> for acknowledgements to these

assistants and others.) While I did the early technical work on the site, later technical work relied on contributions from graduate students in my department working in concert with my department's longtime sysadmin, Brian Reynolds. Carl Stahmer developed such technical resources as a search engine, user suggestion form, and automated link management system to facilitate harvesting from my "New Links Suggested by Users" page. Robert Adlington and Jeremy Douglass performed the programming and database design work that changed VoS into a database-to-HTML dynamic site. Douglass (in league with Reynolds) then again crucially assisted in conducting technical forensics and security upgrades in response to the hacker attacks of 2004-5.

² For an archived copy of the *Forbes Magazine* review of June 2002, see The Internet Archive: <https://web.archive.org/web/20021221085454/http://www.forbes.com/bow/b2c/review.jhtml?id=6392>. Some other awards VoS garnered at the time--when the novelty of the medium and the lack of algorithmic ranking (e.g., Google's PageRank) led to many attempts to sift quality through awards and ratings--may be seen on this archived copy of the VoS awards page from 2001: <https://web.archive.org/web/20010606163655/http://vos.ucsb.edu/shuttle/awards.html>.

³ See Susan Leigh Star, "The Structure of Ill-Structured Solutions: Boundary Objects and Heterogeneous Distributed Problem Solving," in *Distributed Artificial Intelligence*, Vol. 2 Michael N. Huhns and Leslie George Gasser, ed. (Los Altos, CA: Morgan Kaufman, 1989: 37-54); Susan Leigh Star and James R. Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology 1907-39," *Social Studies of Science*, 19.3 (1989): 387-420; Susan Leigh Star and Karen Ruhleder, "Steps Toward an Ecology of Infrastructure: Design and Access For Large

Information Spaces," *Information Systems Research* 7.1 (1996): 111-34; Susan Leigh Star, "This is Not a Boundary Object: Reflections on the Origin of a Concept," *Science, Technology, & Human Values*, 35.5 (2010): 601-617; and chapter 9 in Geoffrey C. Bowker and Susan Leigh Star, *Sorting Things Out: Classification and Its Consequences* (Cambridge, Mass.: MIT Press, 1999).

⁴ As Geoffrey H. Hartman wrote in "The Voice of Shuttle: Language From the Point of View of Literature" (in his *Beyond Formalism: Literary Essays, 1958-1970* [Yale University Press, 1970]: 337),

"Aristotle, in the *Poetics* (16.4), records a striking phrase from a play by Sophocles, since lost, on the theme of Tereus and Philomela. As you know, Tereus, having raped Philomela, cut out her tongue to prevent discovery. But she weaves a tell-tale account of her violation into a tapestry (or robe) which Sophocles calls "the voice of the shuttle." If metaphors as well as plots or myths could be archetypal, I would nominate Sophocles' voice of the shuttle for that distinction."

For VoS, I created a hypertext-fiction-like page that explained the myth behind the site's title through a hypertextual interweaving of passages from poets, critics, and theorists all playing on the theme of Philomela (<http://vos.ucsb.edu/myth.asp>). A significant early contribution to VoS was made by Patricia Klindienst when she allowed me to post as a "featured work" her "The Voice of the Shuttle is Ours," first published in *The Stanford Literature Review* 1 (1984): 25-53. The original post that VoS included as a featured work is available at <http://oldsite.english.ucsb.edu/faculty/ayliu/research/klindienst.html>.

⁵ From T. S. Eliot's *The Waste Land* (New York: Horace Liveright, 1922; Bartleby.com, 2011; www.bartleby.com/201/), ll. 203-6:

Twit twit twit

Jug jug jug jug jug jug

So rudely forc'd.

Tereu

⁶ On the early semantics of the word "hack" in computing communities, see the appendix on "'Ethical Hacking' and Art" in my *The Laws of Cool: Knowledge Work and the Culture of Information* (Chicago: University of Chicago Press, 2004). On the "more hack, less yack" expression in the digital humanities, see e.g. Natalia Cecire, "When Digital Humanities Was in Vogue," *Journal of Digital Humanities* 1.1 (2011), Web; and Adeline Koh, "More Hack, Less Yack? Modularity, Theory and Habitus in the Digital Humanities," *Adeline Koh*, 21 May 2012, Web.

⁷ A relic of the UCSB Many Wolves web authoring collective survives in the Internet Archive: <http://web.archive.org/web/19961121021644/http://humanitas.ucsb.edu/projects/pack/webshow.htm>. A PDF of my *Ultrabasic Guide to the Internet for Humanities Users at UCSB*, self-published in hard copy in 1994, is available at <http://liu.english.ucsb.edu/wp-includes/docs/retro/ultrabasic-guide.pdf>.

⁸ I refer to the need of the freed artificial intelligence at the end of Gibson's novel to communicate with other machine intelligences in the galaxy. See William Gibson, *Neuromancer*

(New York: Ace Books, 1984), p. 270.

⁹ An example is the description on the VoS "Science, Technology, & Culture" page, which explained the rationale for including these topics to a larger humanities audience: "This sub-page includes a selection of resources on science, medicine, technology, and cultural-studies/historical approaches to science designed for humanists interested in the relation between sci-tech and society. The emphasis is on materials that reflect upon, historicize, critique, collect, exhibit, or otherwise mediate (and mediatize) sci-tech rather than on scientific research per se."

¹⁰ An example of the international character of site visits can be seen in the "Domain Report" section of the following archived VoS "Visitor Statistics" page of January 10, 2001:

<https://web.archive.org/web/20010110182000/http://vos.ucsb.edu/access.html>

¹¹ The site was kept at http://www.vol.it/mirror/humanitas/humanitas_home.html.

¹² CNN.com included a link to my Unabomber essay (original of 1995 available at <http://oldsite.english.ucsb.edu/faculty/ayliu/research/whyuna.htm>) on April 9, 1996 in its story, "Exhaustive Search of Kaczynski's Cabin Continues" (http://edition.cnn.com/US/9604/09/unabom_pm/).

¹³ For a sense of the robustness and density of user suggestions, see e. g. the archived version of my "New Links Suggested By Users" page of February 5, 2001:

<https://web.archive.org/web/20010205000000/http://vos.ucsb.edu/shuttle/unvetted/unvetted.html>.

I enrolled names of correspondents publicly on my "Contributors" page before their number made it impractical. See, for example, the archived "Contributors" page of April 1, 2001:

<https://web.archive.org/web/20010401043259/http://vos.ucsb.edu/shuttle/acknow.html#contribut>

ors.

¹⁴ For an explanation of SQL injection attacks, see Wikipedia:

http://en.wikipedia.org/wiki/SQL_injection. The basic idea is that a user can call on a database via incorrectly filtered characters or other means in a Web http request, thus injecting SQL statements asking the database to take actions otherwise disallowed to outsiders--e.g., reveal table properties or user information, delete or corrupt tables, etc.

¹⁵ My gratitude to Douglass for his reverse engineering of the hack. I summarize key facts here from his long email of December 15, 2005, to myself and Brian Reynolds detailing the probable attack vectors and origins.

¹⁶ Chapter 3 in Jeremy Douglass, "Command Lines: Aesthetics and Technique in Interactive Fiction and New Media," Diss. University of California, Santa Barbara, 2007. Available at <http://jeremydouglass.com/dissertation.html>.

¹⁷ Cited above in n. 3.

¹⁸ Cf. Edith Hamilton's telling of the Philomela myth: "He [Tereus] seized her and cut out her tongue. Then he left her in a strongly guarded place . . ." (*Mythology* [1940; New York: Signet, 1969]: 270)