

THE BIG BANG OF ONLINE READING

Alan Liu

"Reading" has adapted to multimedia, networking, mobile computing, and text-encoding, even as, reciprocally, the new technologies actively remember older habits of reading. Using a browser, search engine, or blog site, for instance, subtly inflects reading; but, equally, familiarity with historical reading technologies--with "documents," "pages," or "indexes"--shapes the use of new technologies. Despite such cross-adaptation, however, we hardly understand the relation between older and newer ways of reading. . . . Online reading is Transliterations's topic because this is the staging ground where humanists, social scientists, and computer scientists all have equal contributions to make.

(Transliterations 2005, 2)

The above is taken from the original funding proposal for the Transliterations Project, a University of California multi-campus research group under my direction that ran from 2005 to 2010 with the assistance of research faculty, graduate students, and guest industry researchers from many institutions. Transliterations explored the technological, social, and cultural practices of online reading. Its working groups on the history of reading, new reading interfaces, and social computing began by conducting an extensive survey of the topic, resulting in a large number of research reports and papers now available through the project's online Research Clearinghouse. Ultimately, Transliterations focused on one research area especially ripe for

innovation: the use of social computing to augment traditional scholarly reading methods with Web 2.0 reading practices. For example, the project created an experimental system called RoSE: Research-oriented Social Environment (subsequently further developed to beta state on a NEH Digital Humanities Start-up grant) to model bibliographies as a social network of authors and documents allowing users to navigate, and interactively revise, intellectual networks as if they were "friends" with the dead.

The overall result of Transliterations (and of such similarly wide-angled projects as the Transliteracy Research Group in the United Kingdom, INKE: Implementing New Knowledge Environments in Canada, and more recently the TRANSLIT project in France) was to expose to view the sheer breadth and multifariousness of the phenomenon of online reading.¹ Above all, the study of digitally networked reading shows that only by perceiving the totality of recent changes in reading technologies and practices can we grasp the unfolding new universe of literacy. I choose the metaphor *universe* (rather than the more conventional *age*, *epoch*, or *revolution*) to draw a specific analogy to cosmology. The analogy is to the Big Bang. Today, we are witnessing a Big Bang of online reading whose early stages are like the first instants of the universe as now theorized by physicists--i.e., an explosively rapid generative sequence of phases from which emerges, almost all at once, a multiplicity of forces, materialities, forms, and dimensions.² To understand "transliterations" as a general idea--i.e., reading in all its media and networked forms today--requires a similarly cosmological horizon of perception in which we focus less on particular changes than on the totality of changes. Seen as a whole, I will speculate, this totality becomes a research problem in its own right--one whose technological, social-policy, and philosophical implications do not appear at lower levels of scale and that the

digital humanities have an opportunity to approach in ways that intersect with, yet also differ from, those of other fields and stakeholders.

But, first, let me start just by commenting on some of the chief particular changes in reading--literacy reconfigurations, as I will call them--enabled by the new technologies, each of which is a digital-humanities research opportunity. *Reconfiguration* implies that the essential change occurs at the level not of discrete novelties but of phase shifts in ensembles of new technologies and practices remixed with older ones.

Media Reconfiguration

Online reading, obviously, is enabled by a reconfiguration of literacy media. But this statement alone tells us little, since the concept of "media" currently functions as a kind of black box for *something* that is happening among such older or underlying concepts as technology, communication, information, and language for which we lack an adequate explanation. This is why, for example, it is currently unpredictable whether online reading is referred to in the research literature as a media technology, information technology, information media, information and communication technology (ICT, as it is called in the social sciences), and so on. Where in the past the mature codex book locked together the ideas of technology, communication, information, and language in a stable configuration (so that one could simply say "print," for example, without needing to specify "print technology used to communicate information and language"), today's technologies have destabilized the configuration. Wrapping the idea of *media* around everything that is happening among underlying elements creates the illusion of a unified new "convergence."³ It's as if media were an API (application programming

interface) allowing us to concentrate on the inputs and outputs of the new system without needing to program the circuits inside the black box.

Reconfiguration of Materialities

Much of the current discussion of new-media literacy concerns specific new material technologies--for example, e-books, tablets, mobile phones, flexible screens, augmented reality interfaces, and so on. The Transliterations Project also studied less commonly discussed materialities of literacy such as readers for the visually impaired, digital scrolls, digital coffee tables, retinal projection displays, interactive "FogScreen" projection systems, and so on (as well as digital art projects or installations that invent surprising new materialities of literacy--e.g., riding a bicycle to navigate text).⁴

However, focusing on specific material instruments is deceptive because ultimately it is the *idea* of materiality that the new media reconfigures. This is occurring in two steps. First comes the realization that the virtual is indeed fully material. One of the important recent developments in the digital humanities relevant to the study of online literacy is thus a material-history approach similar to that in the history of the book field. Just as scholars of book history such as Peter Stallybrass, Roger Chartier, and others have innovatively studied the material surfaces of writing in the Renaissance (e.g., erasable notebooks or tablets [Stallybrass et al.]), so Matthew G. Kirschenbaum--whose training originally spanned textual and digital studies--explores with theoretical generality the materiality of digital inscription "mechanisms" (Kirschenbaum 2008). Jean-François Blanchette ("Material History" 2011) similarly emphasizes the materiality of the digital in discussing the way "trade offs" between efficiency and

abstraction in modern modular software betray the irresistible gravity of materiality. Meanwhile, the computing industry itself is well aware of the material constraints of the digital. Not only is "Moore's Law" (of exponentially increasing density of transistors) running up against the fundamental limits of physics at the nano and atomic scales, but at the macro scale computing is confronting the limits of Earth's ecosystem. Heeding the early warning of such activist organizations as the Silicon Valley Toxics Coalition, the industry has evolved "green" computing initiatives and become sensitive about its carbon footprint.⁵

Second comes the realization that while the virtual is material, it also changes our very understanding of materiality. Steam, gas, and electrical machinery (all the way through the era of the mainframe computer) were associated with mass and energy effects. But today's digital machineries are increasingly also associated with network and system effects. They witness the fact that today our idea of materiality is morphing into one of systematicity. After all, for decades late- or post-Marxist theorists (e.g., Harvey; Soja; Deleuze and Guattari) have argued in parallel with complexity theorists (e.g., Nicolis and Prigogine) that old-fashioned ideas of materialism have been superseded by new geographies of space-time compression, "a thousand plateaus," chaotic systems, and so on. Matter today is a differential substrate (like a semiconductor) on which, at nodal points, specific material intensities or knottings rise like signal from noise to mark out--and, in a sense, to fabricate--the structure of what really "matters," which is a system of configurations, spacings, timings, channels, and flow rates. An example is the way that it is impossible to discuss Apple's iPod, iPhone, and iPad as material devices without appreciating the entire iTunes and apps system that multiplies the value of those devices. With regard to digital literacy, the Amazon Kindle is tied into the whole Amazon cloud service

in a similar way.

Sensory Reconfiguration

The computing industry continues to experiment rapidly with the tactile, visual, and audio modalities of digital literacy--for example, exploring new formats of e-readers and tablets, trying out new combinations of multimedia in online newspapers or magazines, and so on. It may be that in the near future the clichéd complaint of book lovers that "you can't take a computer to bed (or the bath, the beach, etc.) with you" will be obsolete. Not even the smell of books may be unique much longer, since a parfumeur recently bottled the smell of books in a fragrance called "Paper Passion," which could conceivably enhance future e-reader technologies for readers who desire a retro literacy ambience.⁶

All of this speaks to changes in what may be called, using vocabulary that remembers the historical book, the sensory bindings of literacy or, choosing alternative vocabulary connoting open-ended complexity rather than closure, the sensory manifold of literacy. I refer to the way that the sensory experience of reading coheres as an operational and phenomenological whole.⁷ A simple illustration: any parent will remember wincing as their child first learns how to turn the pages of a book, crumpling and twisting each page to discover through trial-and-error (and imitation) exactly how the surprisingly complex tissues and joints of the codex work together. Functional literacy, we may say, begins even before the mastery of written language when one first internalizes the book as a unified perceptual field in which simply seeing, touching, and smelling the codex summons up bodily/mental programs for making it "work" (as Johanna Drucker puts it).⁸

Currently, online reading is reconfiguring the sensory bindings or manifold of literacy. For example, at the present moment as I am writing, I am sitting in an American microbrewery pub with a codex book propped open next to a laptop computer. I also have on the side my iPad, which I use to consult e-books (linked to the Google and Amazon clouds) as well as articles in PDF format (linked to my other computing devices through the Dropbox online storage service). This is a reconfigured cocoon of phenomenological experience that remixes old and new literacy media. What essential difference the new sensory bindings or manifold of online literacy will make on reading is an open research question.

Social Reconfiguration

It is a short step from the sensory reconfiguration of online reading to the social reconfiguration of such reading.⁹ My example of writing this essay in a pub surrounded by other people and also by ambient network connectivity is telling. The example makes it clear that whether we think of newspapers, books, laptop computers, tablets, e-readers, or smart phones, the sense-surround of reading is inseparable from social surroundings. Literacy is an experience that is not just bound in upon itself in stand-alone forms but also closely mapped over spatial, architectural, and social habitats. Consider, for example, the period from the Enlightenment through the nineteenth-century when both manuscript correspondence and print publication were at a height. In that era, literacy acquired its distinctively split modern personality as both an individual and social act: one enjoys a letter or novel in solitude, but one also wants to chat over a newspaper in a coffeehouse (as Habermas theorized in his notion of the "public sphere"). The identity of the modern democratic individual, in other words, arose in a dialectic of retreat from

and immersion in sociality in conjunction with habits of literacy. Now consider the way our present era of Web 2.0, social media, and mobile computing is characterized by an equivalent, but reconfigured, sociality of literacy. Netizens today are torn dialectically between protecting privacy (a voyeuristic individualism allowing one to be in public while retreating from publicity) and valuing social computing (which is like chatting over a newspaper in a coffeehouse or pub, except in distributed and asynchronous fashion through blogs, wikis, Facebook, Twitter, and so on).¹⁰

Cognitive Reconfiguration

It is also a short step from considering the sensory reconfiguration of online reading to hypothesizing that such reading may lead to cognitive reconfiguration. After all, the relation between "percept" and "concept" in cognitive-science research is a close one (the well-known cognitive science and artificial intelligence researcher Douglas Hofstadter, for example, builds models of cognition based on the computational equivalent of underlying processes of perception [Hofstadter et al., esp. 192-93, 210-11]). More broadly, the cognitive science (and artificial-intelligence) fields are fascinated by the relation between lower and higher cognitive events-- e.g., between neuronal activity, on the one hand, and ideas or feelings, on the other; or between cellular automata and emergent higher patterns. The so-called "F-Shaped" pattern of visual scanning that online readers follow when browsing Web pages (observed by Jakob Nielsen through eye-tracking studies [Nielsen 2006]) is thus an example of lower- and middle-level sensory literacy practice that may correlate with mentalities such as the hyper-attention of scanning or skimming theorized by N. Katherine Hayles in her "Hyper and Deep Attention" and

"How We Read: Close, Hyper, Machine."

At least in regard to individual human thought (leaving aside the largely metaphorical discussion of Web 2.0 social thought as "collective intelligence," "hive mind," and so on), cognitive and neuroscience research into digital literacy has boomed in recent years.

Publications such as Nicholas Carr's *The Shallows: What the Internet is Doing to Our Brain* and the Hayles articles mentioned above have surveyed and publicized research on the topic.

Interdisciplinary research communities such as the Society for Text and Discourse place a strong emphasis on neuro-cognitive approaches to both print and digital literacy.¹¹ And the

Transliterations Project itself included some attention to the approach by studying such software projects as the University of Memphis's Coh-Metrix online tool for measuring the cognitive coherence of prose texts, publishing Monica Bulger's "Beyond Search: A Preliminary Skill Set for Online Literacy" (which in part discusses cognitive-science approaches to new-media reading), and hosting participants such as Nicholas Dames and Andrew Elfenbein who work on cognitive-science approaches to literature.¹²

The result of neuro-cognitive research into online reading is that we are now able to ask such questions as follows. Does the Internet constrain us to "shallow" or "hyper" reading? Or, instead, will new nuances of digital reading evolve to expose the limitations of metaphors like "shallow" themselves? After all, it may be noted that the common metaphors used to debate the mental experience of digital reading--shallow versus deep, extensive versus intensive, hypertextual versus linear, focused versus distracted, or close versus distant--tend to be skeuomorphic sensory or physical tropes inherited from past ages of reading. In the past, "shallow versus deep" may have been more analytically meaningful because literacy engaged

with flat pages of text suggesting a phenomenology of surface (what Plato called "external written characters" in his critique of the invention of writing) versus depth (what Plato called true "memory" and "wisdom").¹³ But the "shallow versus deep" binary is clumsy today when the screens of online reading devices are not flat in the same way; they are complexly both shallow and deep because they interact with underlying software "layers" or "stacks" and bottomless (or ceilingless) "cloud services" so as to augment human reading with clever machine literacies (as Hayles emphasizes [2010, esp. 72-78]) for which we lack adequate descriptive terms. For example, could we instead say that a reading screen linked to a database or the Internet is deeply shallow? or comprehensively, complexly, and emergently shallow?

Reconfiguration of Form (and Scale)

Form is a new horizon in research on online literacy. A comparison to print will again be useful. As a generalization, we can say that once the platform of print media became standardized in its medial, material, sensory, social, and cognitive affordances--so that books or pages came in certain common sizes; circulated in known social or economic tranches (e.g., trade publications versus mass market); and established particular conventions of sensory, social, and mental use--then discussion of print literature could proceed in terms of form. Thus, literary criticism from the Enlightenment onward made an art of critiquing forms from genres down to stylistic syntax or vocabulary. This was even more the case in the early to mid twentieth century, when the Russian Formalists studied generic and stylistic forms with technical precision (e.g., "systems of genres," "devices," "motifs," "rhythms") and, in parallel with the New Critics, raised awareness of form to a philosophical level as the *differentia specifica*, or essential

distinguishing feature, of literary language.¹⁴

In the realm of online literacy, by contrast, platforms are still so changeful that formal thought continues to focus on underlying technical protocols, schema, and templates. Consider, for example, such content management systems as WordPress that publish many of today's database-driven Web sites. These systems evolve so rapidly through multiple updates each year that their formal "themes" (template files and CSS style sheets, augmented with plug-ins) often require fine adjustments to maintain.¹⁵ Ambitiously customized WordPress themes require even bolder hacks (sometimes of the core WordPress system files themselves). The most careful formal thought is thus still impelled by concern for the platform, with the result that true formal discussion remains rudimentary or, at best, descriptive. In terms of genre, for instance, we simply describe: *this is a listserv, blog, tweet, wiki, or social network site*. And in terms of the digital micro-forms that are today's equivalent of rhetorical topoi (commonplaces), we similarly just say: *this is a banner, sidebar, post, comment, or hash tag*. Advanced formal critique occurs only in the specialized fields of human computing interface research (HCI), graphic design, or usability research (e.g., Nielsen 1999). The bottom line is that we do not yet have an adequate common framework in which to address such formal questions as: what difference does it make that we choose the form of a blog, tweet, or online magazine to narrate beautiful, comic, or tragic events? Are there formal or stylistic differences between tweets on public and private events? What haiku- or graffiti-like formal effects arise from the 140-character limit of a tweet (and how would it be different if everyone used 247 characters, at one point the actual secret maximum that Twitter's back end accepted through its API [Caufield])?

The fact that my formal questions above end on a question of scale (140 versus 247

characters) is emblematic because the lack of an adequate framework of formal analysis often forces us to treat fine features of form as if they were just gross effects of scale. For example, an inordinate amount of recent debate concerns the properties of short online forms (such as posts and tweets) versus long forms. It's as if we were to say that the only essential difference between an epic and lyric poem, or between a novel and a letter, were length.

However, the ease with which analysis of form slides into measurement of scale does reveal something fundamental about the nature of online form. To suggest why, let me try out the following conceptual equation: *modularity* + *transmissibility* + *indexibility* = *form*. Again, the history of the book (and, more generally, of writing) is a good thinking tool. In the West, we know, early writing was relatively void of form. Designed to be recited by oral speakers who gave it form through pauses and emphases as they spoke, writing was a *scriptio continua* or undifferentiated stream of alphabetic characters without even spaces or punctuation (Svenbro, 44; Cavallo, 75). Gradually (as simulated in an elegant Flash animation of the history of the book that the Transliterations Project produced [Warner et al.]), form arose through the invention of word spacing, punctuation, capitalization, paragraph breaks, chapter titles and divisions, and so on. The lesson is that writing evolved to meet the combined demands of *modularity* (standard component units such as words, sentences, paragraphs, chapters), *transmissibility* (when transmitting a communication to another, it is important to be able to do so modularly so that only a sentence, paragraph, page, or book can be handed off), and *indexibility* (referring to the entire repertory of metadata and management devices such as chapter titles, tables of contents, page numbers, or indexes that made books one of our most important random access media even before computational media). All of that is what produced form. Modular, transmissible, and

indexible structures are form.

This understanding of form has important implications for the study of online forms. For instance, it brings into question the foundational principles of text-encoding protocols such as TEI designed to encode written works for presentation and manipulation in digital media (so that a stanza in a poem, for instance, might be tagged digitally <lg> for "line group"). Implemented in XML, TEI practices the general philosophy of modern semantic encoding: separating the form of content into two components, logical structure and presentation (or formatting) structure.¹⁶ The goal is to allow a publisher, for example, simply to tag a set of lines with the logical descriptor <lg>, leaving it up to the reader's computer to decide what line and margin spacings to use to present a stanza. But if my conceptual equation above is correct, then the separation of logical structure from presentation structure cannot be correct all the way down, since the principles of modularity, transmissibility, and indexibility lie at the root of both kinds of structure to create the full sense of form. This is especially true in the era of modern graphic and typographic design (after the New Typography and International Style in the twentieth century), when designers exposed in their presentation style itself the principles of modularity, transmissibility, and indexibility—for example, through such elements as grid layouts allowing for modular design, sans serif fonts symbolizing the transmissive efficiency of communication, and dramatic white spaces and asymmetry used to give indexical emphasis.¹⁷ At the deepest level, in other words, logical and presentation structures are integral in the experience of form, and any attempt to separate them is arbitrary. In practice, therefore, creators of digital media find it difficult to be purist in keeping metadata and formatting structures separate. It always seems that *something*--whether imposed by a particular platform, program, plug-in, or design--

forces the use of ad hoc workarounds that transgress the divide between logic and presentation (resulting, for example, in occasional lapses of "in-line" formatting code mixed in with the source code for a Web page when all such formatting is supposed to be regulated by a CSS style sheet in an autonomous file).

Now we can see why formal issues are commutable with scale issues--something that is true for all media but especially for computational media where speed, efficiency, and flexibility depend on trade-offs between humanly recognizable form (e.g., a document) and humanly unreadable scale (e.g., an individual data packet or "big data"). The reason that form is convertible with scale is that modularity, transmissibility, and indexibility all bear on the form *and* size of the communicational act. For example, modules have to be defined by indexical metadata at a size balanced between the formal integrity of the communication (e.g., a whole document) and the efficiency and flexibility of transmission (optimized at the packet level). All of this means that it should be possible to decompose recent experiments in the scale of online reading into elemental terms of modularity, transmissibility, and indexibility that allow us to understand how such experiments in scale are a surrogate for formal experimentation. Consider, for example, the recent trend toward short, pamphlet-like online books (e.g., Amazon Kindle Singles, Apple iBooks Quick Reads, TED Books, Atavist publications) as that trend is counterbalanced dialectically against corpora-scale reading ("distant reading" and "culturomics" as popularized, for example, by the Google Books Ngram Viewer). Modularity, transmissibility, and indexibility are remaking online literacy into something like a "playlist" of songs in a gigantic, literate iTunes. The threat this poses for the "album" (in this case, the book) is a matter both of scale and form.

Reconfiguration of the Value of Reading

Other reconfigurations of literacy enabled or expressed by online media could be mentioned. But I will stop by reflecting on just one more, which may in fact be the most important of all: reconfiguration of the value of reading. Consider by comparison how different values of reading collaborated or competed in past media ages--e.g., to bring the codex into dominance. The early codex Bible acquired very high value for religious, social, and personal purposes. But precisely the same lower and middle classes who were the early milieu of the Christian faith also valued the little codex notebooks they used for ordinary life and accounting. Codex literacy, in other words, advanced over the previous authority of the Roman and Jewish scroll through a conjuncture of high and mundane literacy values.¹⁸ In the later print age, the literacy values of typeset sermons, ballads, newspapers, novels, and so on also variously came into convergence or divergence according to a complex dynamics of social, economic, aesthetic, entertainment, and other factors. Each past regime of reading never fully stabilized its literacy values, partly because new media of the time like broadside ballads in the Renaissance, television in the twentieth century, or blogs in the twenty-first century kept challenging established literacy values with what at first seemed to be trash, popular, or partisan devaluations of literacy. Yet over time any media age established a hierarchy of literacy values, or at least enough of an apparent hierarchy to sustain debate about what mattered most. Thus, for instance, novels were once supposed to be less valuable than just about anything else "respectable" people read; whereas now we bemoan the loss of reading fiction amid the flood of trashy new popular media.

Today, online literacy is once more altering the hierarchy of reading values. Most importantly, it is unclear what the highest value of reading will be in online society: information, opinion, entertainment, knowledge, or wisdom. As in the past when demotic discourses challenged established discourses, much of the current change is occurring in the chaotic gap between expert knowledge (discourse produced or filtered by academics, professionals, journalists, government agencies, etc.) and the new networked public knowledge (e.g., Wikipedia, the blogosphere, viral media). Not only has an overall hierarchy not been established to regulate this gap, but the boundary-spanning instruments for negotiating between expertise and networked public knowledge--technologies, practices, rewards, and institutional protocols for encouraging academics to write for Wikipedia or the blogosphere, for example, or for the latter to be used in the classroom--have only begun to be invented.

The following seem to me to be some of the most important questions for the future of online literacy. What do we value about online reading? Who is the *we* (e.g., expert, employer, regulator, consumer, worker, or citizen) who lies behind that question? And how will online reading strengthen or undermine the value of reading generally?

I conclude as promised by returning to a cosmological perspective on the multiplicity and rapidity of the reconfigurations surveyed above, whose sum amounts to what I have called the Big Bang of online literacy. As I suggested, seeing the totality of these changes leads to a research problem in its own right (the "transliterations" problem proper) with important implications for how society develops its technologies, policies, and philosophies of online reading.

Let me now reveal my underlying reason for analogizing online reading to the Big Bang, which might otherwise seem just an exaggerated, colorful metaphor. Contemporary theoretical physicists think about the Big Bang (more generally, about both the origin and future of the universe) in such new frameworks as string theory, M-theory theory, and multiple universes theory.¹⁹ All these compensate for the fact that while the accepted macro-cosmological and micro-physical models of the universe (e.g., the "standard model" of particles and forces) have proven to be precisely descriptive and predictive, they are not satisfying explanations that offer a picture of why the universe is the way it is (e.g., why these kinds of particles and forces related by these arbitrary physical constants?) The greatest stumbling block continues to be the one that Einstein spent the latter part of his life wrestling with: how to reconcile the universe at the macro scale of gravitational effects to the universe at the micro scale of quantum mechanics. The two universes seemed to be theoretically incommensurable to the point of mathematical absurdity. The recent physics frameworks I mentioned all try for such a reconciliation, which is why they emphasize concepts like "supersymmetry," a primordial unification of at least the three non-gravitational forces (and, with M-theory, possibly also gravitational force) preceding their differentiation after the earliest instants of the Big Bang. Thus they foreground the essential metaphysical question in contemporary physics: is there a so-called Theory of Everything (TOE)? In other words, is the universe fundamentally a unity that can be explained by a single comprehensive theory governing both the macro and micro?

A similar question applies to research into online reading, but with an important difference. Like physicists wondering about the theory of everything, we might ask: is there *one* phenomenon of online literacy whose media, materialities, sensory experiences, social

formations, cognitive operations, formal features, and values converge in an epochal transformation of literacy? The difference, however, is that online reading is an artifactual rather than natural phenomenon, meaning that its operations occur as much in the social as the physical universe. While theoretical physics is relatively free to be biased toward the mathematical elegance of unity, therefore (leaving for experimental physics the untidiness of a fractured universe), research on technologies such as online reading is not free of debate on the very ideal of unified explanation because that ideal is entangled in some of today's most pressing ideological contests about the future of society. The closest equivalent now of a "theory of everything" relating to information technology, it might be suggested, is thus economic neoliberalism, which develops technologies for online reading (and anything else) in ways that steer all transactions between private citizens and the public sphere into the economically "privatized" containment structures--aggregator databases, technological protocols, intellectual-property laws, organizational forms, etc.--of the corporate sphere along with privatized aspects of the governmental, health, media, educational, and other sectors that this sphere increasingly colonizes. Such is a vision of cultural rather than technological "singularity." The cultural singularity will occur when all knowledge and experience--in the present case, "reading"--are consolidated into a single system of ebook or tablet computers, "app stores," digital text publishing platforms, etc. We are far along that path of consolidation now, with several well-known information technology corporations contesting to be the supreme singularity yet all converging on the same premise that singularity is needed and will be rewarded on the stock market by that underlying cultural singularity for which information technology now so often serves as proxy: capitalism.

Arrayed against the vision of cultural singularity are a set of other understandings and "counterpublics." It is here that the digital humanities have a chance to contribute to, yet also differ from, the way other stakeholders conduct research and development in online reading. The digital humanities are inextricably (if not exclusively) rooted in a larger contemporary humanities milieu that during the past half century became committed to *disunity* as a matter of principle under such names as otherness, difference, historicism, contingency, and so on. While just a few years ago it was sensible to ask about the early digital humanities field "where is cultural criticism in the digital humanities?" (Liu, 2012), now in the wake of recent attention to both theory (e.g., Cecire) and cultural criticism (e.g., #transformDH and #DHPoco) it is clear that the successor question is not *whether* but *how* the field will advance the most deep-seated, passionate, distinctive, and, of course, controversial principles and methods of the contemporary humanities. Should society, or should it not, be building a unified field of technologies for online reading? Should there be a single socioeconomic policy or legal-governmental framework for regulating such technologies? And should the value of online literacy lie in knowledge, or knowledges? A goal for the digital humanities should be to research and develop answers to such questions that make a difference in two directions. Endogamously in relation to the humanities themselves, the digital humanities should inflect the discourse of difference in new ways (e.g., adapting the ethos of poststructuralism or critique to that of "building" through what James Smithies calls "postfoundationalism"). Exogamously in relation to other research-and-development communities, the digital humanities should contribute fundamental humanities insights into "difference" itself, both historical and contemporary. The highest-impact way to do so would be inextricably conceptual *and* practical. For example, digital-humanities research is

urgently needed to help influence the development and adoption of online reading technologies that serve scholars and students both as general citizens of the reading public and denizens of a differentiated institution needing its own affordances for fair use, citation, classroom presentation (more nuanced and collaborative than PowerPoint), and other practices while also needing to remain organically connected to the public sphere. Not Word files convertible into PowerPoints, as it were, but Word files convertible into Public Sphere Points.

By addressing such issues, the digital humanities would advance its humanities heritage and share it with society at large. It would help us envision that the most humanly good future for the multiple reconfigurations of literacy I outlined earlier is not a single coming "age of online reading" but instead an emancipatory multiplicities of online reading obeisant to the needs of people, institutions, nations, and cultures each of which reads humanity differently.

Works Cited

- #DHPoco (Postcolonial Digital Humanities). Home page. N. d. <http://dhpoco.org>.
- #transformDH (Transformative Digital Humanities). Home page. N. d. <http://transformdh.org>.
- Blanchette, Jean-François. "'Infrastructural' Thinking as Core Computing Skill." Presentation at the Digital Humanities 2011 conference. Stanford University, 21 June 2011.
- . "A Material History of Bits." *Journal of the American Society for Information Science and Technology* 62 (2011): 1042-1057.
- Breisinger, Marc, and James K. Ford. "Research Report on FogScreen." Transliterations Project, 12 March 2006, <http://transliterations.english.ucsb.edu/post/research-project/research-clearinghouse-individual/research-reports/fogscreen-2>.
- Bulger, Monica. "Beyond Search: A Preliminary Skill Set for Online Literacy." Transliterations Project, 13 September 2006: n. p. <http://transliterations.english.ucsb.edu/post/research-project/research-clearinghouse-individual/research-reports/beyond-search-a-preliminary-skill-set-for-online-literacy>.
- Carr, Nicholas. *The Shallows: What the Internet is Doing to Our Brains*. New York: W. W. Norton, 2010.
- Caufield, Brian. "The Longest Tweet in History." *Forbes*, 9 July 2009: n. p. <http://www.forbes.com/2009/07/09/longest-tweet-ever-technology-internet-forbes.html>.
- Cavallo, Guglielmo. "Between Volumn and Codex: Reading in the Roman World." In *A History of Reading in the West*, edited by Guglielmo Cavallo and Roger Chartier, trans. Lydia G. Cochrane, 64-89. Amherst, MA: University of Massachusetts Press, 1999.

- Cecire, Natalia. "Introduction: Theory and the Virtues of Digital Humanities." *Journal of Digital Humanities* 1.1 (2011): 44–53.
http://journalofdigitalhumanities.org/files/jdh_1_1.pdf.
- Dames, Nicholas. *The Physiology of the Novel: Reading, Neural Science, and the Form of Victorian Fiction*. Oxford, New York: Oxford University Press, 2007.
- Deleuze, Gilles, and Félix Guattari. *A Thousand Plateaus: Capitalism and Schizophrenia*. Trans. Brian Massumi. Minneapolis: University of Minnesota Press, 1987.
- Drucker, Johanna. "The Virtual Codex from Page Space to E-space." In *A Companion to Digital Literary Studies*, edited by Ray Siemens and Susan Schreibman, 216-32. Malden, MA: Blackwell, 2007.
- Elfenbein, Andrew. "Cognitive Science and the History of Reading." *PMLA* 121 (2006): 484-502.
- "The Humanities and the Science of Comprehension." Presentation for Transliterations Project, University of California, Santa Barbara, 3 May 2007.
- Fahey, Jonathan. "Google Reveals Energy Use to Show Search is Green." *Yahoo News*, 8 September 2011. <http://news.yahoo.com/google-reveals-energy-show-search-green-160247037.html>.
- French National Research Agency. "Métamorphoses des sociétés. Emergences et évolutions des cultures et des phénomènes culturels. (CULT) 2012 : projet TRANSLIT." N. d.
[http://www.agence-nationale-recherche.fr/en/anr-funded-project/?tx_lwmsuivibilan_pi2\[CODE\]=ANR-12-CULT-0004](http://www.agence-nationale-recherche.fr/en/anr-funded-project/?tx_lwmsuivibilan_pi2[CODE]=ANR-12-CULT-0004).
- Greene, Brian. *The Elegant Universe: Superstrings, Hidden Dimensions, and the Quest for the*

Ultimate Theory (1999; rpt. New York: Vintage, 2000).

----- . *The Fabric of the Cosmos: Space, Time, and the Texture of Reality*. New York: Vintage Books, 2005.

Habermas, Jürgen. *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society*. Trans. Thomas Burger with Frederick Lawrence. Cambridge, Mass.: MIT Press, 1989.

Hall, Stuart G. "In the Beginning Was the Codex: The Early Church and Its Revolutionary Books." In *The Church and the Book: Papers Read at the 2000 Summer Meeting and the 2001 Winter Meeting of the Ecclesiastical History Society*, edited by R. N. Swanson, 1-10. Woodbridge, England: Boydell & Brewer, 2004.

Hawking, Stephen. *A Brief History of Time*. 10th ed. New York: Bantam, 1998.

N. Katherine Hayles. "How We Read: Close, Hyper, Machine." *ADE Bulletin* no. 150 (2010): 62-79.

----- . "Hyper and Deep Attention: The Generational Divide in Cognitive Modes." *Profession* 2007: 187-99.

Harvey, David. *The Condition of Postmodernity: An Enquiry into the Origins of Cultural Change*. Oxford: Basil Blackwell, 1989.

Herbert, Nick. *Quantum Reality: Beyond the New Physics*. New York: Anchor, 1985.

Herzhoff, Jan. "The ICT Convergence Discourse in the Information Systems Literature: A Second-order Observation." 2009. *ECIS 2009 Proceedings*. Paper 407. 8 June 2009, <http://csrc.lse.ac.uk/asp/aspecis/20090218.pdf>.

Hofstadter, Douglas, and the Fluid Analogies Research Group. *Fluid Concepts and Creative*

Analogies: Computer Models of the Fundamental Mechanisms of Thought. New York: Basic, 1995.

The Independent. "Karl Lagerfeld Denies Involvement in Paper Perfume." 26 April 2011.

<http://www.independent.co.uk/life-style/fashion/karl-lagerfeld-denies-involvement-in-paper-perfume-2274995.html>.

INKE: Implementing New Knowledge Environments. Home page. 2013. <http://www.inke.ca>.

Jakobson, Roman. "Closing Statement: Linguistics and Poetics." 1960; rpt in *Semiotics: An Introductory Anthology*, edited by Robert E. Innis, 147-75. Bloomington: Indiana University Press, 1985.

Kaiser, Alfons. "Lagerfeld: Mit einer fettigen Note." *Frankfurter Allgemeine Zeitung* 16 April 2011. <http://www.faz.net/aktuell/gesellschaft/menschen/lagerfeld-mit-einer-fettigen-note-1621414.html>.

Kaku, Michio. *Hyperspace: A Scientific Odyssey Through Parallel Universes, Time Warps, and the Tenth Dimension*. New York: Doubleday, 1994.

----- . *Parallel Worlds: A Journey Through Creation, Higher Dimensions, and the Future of the Cosmos*. New York: Anchor, 2006.

Kaku, Michio, and Jennifer Thompson. *Beyond Einstein: The Cosmic Quest for the Theory of the Universe*. Rev. ed. New York: Anchor Books, 1995.

"Katherine" [no last name given]. "Nose in a Book: 'In the Library' by CB I Hate Perfume and 'Paper Passion' by Geza Schoen." *Mad Perfumista* 24 April 2012.

<http://madperfumista.com/2012/04/24/nose-in-a-book-in-the-library-by-cb-i-hate-perfume-and-paper-passion-by-geza-schoen>.

Katz, Jon. "Birth of a Digital Nation." *Wired* 5.04 (April 1997). Sequence of eight web pages beginning at <http://www.wired.com/wired/archive/5.04/netizen.html>.

Kirschenbaum, Matthew G. *Mechanisms: New Media and the Forensic Imagination*. Cambridge, MA: MIT Press, 2008.

Knight, Kim A. "Research report on the Coh-Metrix Project." Transliterations Project, 15 September 2006. <http://transliterations.english.ucsb.edu/post/research-project/research-clearinghouse-individual/research-reports/the-coh-metrix-project-2>.

Liu, Alan. "From Reading to Social Computing." In *Literary Studies in the Digital Age: An Evolving Anthology*, edited by Kenneth M. Price and Ray Siemens, n. p. MLA Commons. Modern Language Association of America, 2013. <http://dlsanthology.commons.mla.org/from-reading-to-social-computing>.

----- . *The Laws of Cool: Knowledge Work and the Culture of Information*. Chicago: University of Chicago Press, 2004.

----- . "Transliterations: le big bang de la lecture en ligne." Trans. Françoise Bouillot. *E-Dossiers de l'audiovisuel* January 2012. INA Expert. <http://www.ina-expert.com/e-dossier-de-l-audiovisuel-l-education-aux-cultures-de-l-information/transliterations-le-big-bang-de-la-lecture-en-ligne.html>.

----- . "Where Is Cultural Criticism in the Digital Humanities?" In *Debates in the Digital Humanities*, edited by Matthew K. Gold, 490-509. Minneapolis: University of Minnesota Press, 2012.

Nicolis, Grégoire, and Ilya Prigogine. *Exploring Complexity: An Introduction*. New York: W. H. Freeman, 1989.

- Nielsen, Jakob. *Designing Web Usability: The Practice of Simplicity*. Indianapolis, IN: New Riders, 1999.
- . "F-Shaped Pattern For Reading Web Content." Nielsen Norman Group 17 April 2006. <http://www.nngroup.com/articles/f-shaped-pattern-reading-web-content>.
- Piper, Andrew. "The Past, Present, and Future of the Book." *Chronicle of Higher Education (Chronicle Review)* 5 November 2012. <http://chronicle.com/article/The-Past-PresentFuture/135490>.
- Plato. *Phaedrus*. Trans. Benjamin Jowett. Project Gutenberg, 15 January 2013. <http://www.gutenberg.org/files/1636/1636-h/1636-h.htm>.
- RoSE (Research-oriented Social Environment). Home page. 2012. <http://rose.english.ucsb.edu>.
- Shklovsky, Victor. "Art as Technique." In *Russian Formalist Criticism: Four Essays*, translated and edited by Lee T. Lemon and Marion J. Reis, 3-24. Lincoln: University of Nebraska Press, 1965.
- Silicon Valley Toxics Coalition (SVTC). Home page. 2013. <http://svtc.org>.
- Smithies, James. "Digital Humanities, Postfoundationalism, Postindustrial Culture." Forthcoming in *Digital Humanities Quarterly*. (MS. courtesy of the author.)
- Soja, Edward W. *Postmodern Geographies: The Reassertion of Space in Critical Social Theory*. London: Verso, 1989.
- Society for Text and Discourse. "Sixteenth Annual Meeting Program and Abstracts." 2006. <http://www.societyfortextanddiscourse.org/conferences/past/2006program.pdf>.
- Sperberg-McQueen, C. M., and Lou Burnard. "A Gentle Introduction to XML." <http://www.tei-c.org/P4X/SG.html>. In *P5: Guidelines for Electronic Text Encoding and Interchange*,

version 2.5.0 (26 July 2013), by the Text Encoding Initiative Consortium (TEI), section V. <http://www.tei-c.org/release/doc/tei-p5-doc/en/html/SG.html>.

Stallybrass, Peter, Roger Chartier, J. Franklin Mowery, and Heather Wolfe. "Hamlet's Tables and the Technologies of Writing in Renaissance England." *Shakespeare Quarterly* 55 (2004): 379-419.

Svenbro, Jesper. "Archaic and Classical Greece: The Invention of Silent Reading." In *A History of Reading in the West*, edited by Guglielmo Cavallo and Roger Chartier, trans. Lydia G. Cochrane, 37-63. Amherst, MA: University of Massachusetts Press, 1999.

Swanstrom, Lisa. "Research Report on the Legible City." Transliteracies Project, 12 March 2006. <http://transliteracies.english.ucsb.edu/post/research-project/research-clearinghouse-individual/research-reports/the-legible-city>.

Transliteracy Research Group [De Montfort University initiative]. "Transliteracy Research Group Archive 2006-2013." N. d. <http://transliteracyresearch.wordpress.com/>.

Transliteracies Project [University of California initiative]. Home page. N. d. <http://transliteracies.english.ucsb.edu>.

----- "Transliteracies Research Clearinghouse." N. d. <http://transliteracies.english.ucsb.edu/category/research-project/research-clearinghouse>.

----- "Transliteracies MRG Proposal (Abbreviated Version)." 2 May 2005. <http://transliteracies.english.ucsb.edu/docs/transliteracies-mrg-proposal-abbrev.pdf>.

Wallpaper. "Paper Passion by Geza Schoen, Steidl, Wallpaper and Karl Lagerfeld." 12 July 2012. <http://www.wallpaper.com/lifestyle/paper-passion-by-geza-schoen-steidl-wallpaper-and-karl-lagerfeld/5926>.

Warner, William, Kim A. Knight, and the Transliteracies Project History of Reading Group. "In the Beginning was the Word: A Visualization of the Page as Interface." Transliteracies Project. http://transliteracies.english.ucsb.edu/images/flash_projects/word.

Wikipedia, "Transliteracy." 15:07, 19 October 2013.

<http://en.wikipedia.org/w/index.php?title=Transliteracy&oldid=577852107>.

Notes

An earlier version of this essay was published in a French translation in 2012 in a French translation in INA's *E-Dossiers de l'audiovisuel* (Liu 2012).

1. The Transliterations Project, Transliteracy Research Group, and TRANSLIT Project are autonomous initiatives, though they share interests and their principal investigators have intersected at each other's inaugural conferences. For the Transliterations Project at University of California and the Transliteracy Research Group in England, see their home pages. (On the relation between the two, see Wikipedia, "Transliteracy.") On the TRANSLIT project, see the French National Research Agency's announcement.

2. See Greene (2000, esp. 345-56) on the sequence of events at the origin of the universe.

3. For a study of the way the term "convergence" is used in research on new media to stand for some combination of "alignment, interoperability, optimization, recombination, and correspondence," see Herzhoff.

4. See the Transliterations Research Clearinghouse. On the FogScreen display technology that uses a thin layer of vapor for a projection surface, see Breisinger and Ford. On the *Legible City* art installation in which a reader sits on a physical bicycle to navigate through a virtual architecture composed of text, see Swanstrom.

5. On the Silicon Valley Toxics Coalition (SVTC), see the coalition's home page and my

discussion in Liu 2004, 267-68. In regard to the sensitivity of today's computing industry to its carbon footprint, see for example Fahey. In his "'Infrastructural Thinking' as Core Computing Skill" (2011), Blanchette discusses the energy and environmental impact of Google's server farms to illustrate a thesis about the unacknowledged materiality of "cloud computing."

6. I refer to the perfume called "Paper Passion" originally reported to have been created by designer, artist, and bookstore owner Karl Lagerfeld in collaboration with parfumeur Geza Schön (Kaiser; see also *Wallpaper* 12 July 2012). (Lagerfeld is also reported to have denied being involved after news of the perfume was widely circulated in newspapers and blogs; see *The Independent* [26 April 2011].). There was also an earlier perfume called "In the Library" (see "Katherine" 2012).

7. Cf. Andrew Piper: "Books have been important to us not just as vehicles of mental transport, but because our interactions with them span so many domains of sensory and physical experience. Whether it is through the acts of touch, sight, sound, sharing, play, or acquiring a sense of place, these embodied, and at times interpersonal, ways of interacting with books coalesce to magnify the learning that takes place through them. The same information processed in different ways and woven together is one of the profound secrets of bookish thought."

8. Drucker observes that one effect of thinking about digital e-books may be to force us to reconceptualize "traditional books" in terms "based less on a formal grasp of layout, graphic, and physical features and more on an analysis of how those format features effect the functional operation and activity of the work done by a traditional book." "Or, to put it more simply," she

immediately continues, "rather than think about simulating the way a book *looks*, we might consider extending the ways a book *works* as we shift into digital instruments" (Drucker, 217).

9. For fuller thoughts on the relation between social reading and "social computing," see Liu 2013.

10. "Netizens" is a now obsolete term for socially or politically engaged online citizens dating from an earlier moment in the political awakening of the Internet as celebrated by cyberliberarians and so-called "digerati" in journalistic media. See for example Katz. I use the term here because it captures the sense of the transition between private and public-sphere online literacy that I am describing.

11. See, for example, the programs for the Society for Text and Discourse annual conferences-- e.g., the Sixteenth Annual Meeting, Minneapolis, 13-15 July 2006.

12. For a Transliterations report on the Coh-Metrix project, see Knight. Bulger's essay. Dames, who participated in a Transliterations conference in 2005, is the author of *The Physiology of the Novel: Reading, Neural Science, and the Form of Victorian Fiction* (2007). Elfenbein presented a lecture for Transliterations on "The Humanities and the Science of Comprehension" on 3 May 2007. Transliterations researchers also discussed his essay, "Cognitive Science and the History of Reading" (2006).

13. From Plato's myth of the invention of writing in the *Phaedrus*: "But when they came to

letters, This, said Theuth, will make the Egyptians wiser and give them better memories; it is a specific both for the memory and for the wit. Thamus replied: O most ingenious Theuth, the parent or inventor of an art is not always the best judge of the utility or inutility of his own inventions to the users of them. And in this instance, you who are the father of letters, from a paternal love of your own children have been led to attribute to them a quality which they cannot have; for this discovery of yours will create forgetfulness in the learners' souls, because they will not use their memories; they will trust to the external written characters and not remember of themselves. The specific which you have discovered is an aid not to memory, but to reminiscence, and you give your disciples not truth, but only the semblance of truth; they will be hearers of many things and will have learned nothing; they will appear to be omniscient and will generally know nothing; they will be tiresome company, having the show of wisdom without the reality."

14. The Russian Formalist principle of "defamiliarization" in literature, for example, was linked to the principle of awareness of form. Victor Shklovsky wrote, "The technique of art is to make objects 'unfamiliar,' to make forms difficult" and "poetic speech is *formed speech*" (12, 23). The phrase *differentia specifica* was famously used by Roman Jakobson (147) to refer to the special nature of poetic language. "Systems of genres," "devices," "motifs," and "rhythms" are typical examples of the vocabulary and topics of Russian Formalist literary analysis.

15. WordPress may be run locally on servers under one's own control (or the control of one's organization) through open-source software downloaded and installed from WordPress.org.

Running the PHP and MySQL files of the platform on one's own server leads to the problems I indicate of keeping the system up to date and adjusting themes as one goes. However, WordPress is also commonly used through the hosting provider WordPress.com, which provides free accounts on its servers for users. In this case, the user does not have to update the system or worry as much about adjusting theme files, but the cost is that the ability to experiment with form is constrained to mixing and matching off-the-shelf themes (with such fine control features as custom CSS style sheets, for example, available only with a paid account). ("CSS" stands for Cascading Style Sheets, the standard formatting language and protocol for controlling the presentation of online documents whose content is structured through markup languages such as HTML.)

16. For exam, Sperberg-McQueen and Burnard's influential "A Gentle Introduction to XML" declares that "XML is more interested in the meaning of data than in its presentation" (section v.1). This was phrased more strongly in earlier versions as "XML focuses on the meaning of data, not its presentation."

17. For my fuller discussion of these design issues, see the chapter entitled "Information is Style" in Liu 2004, 195-230.

18. For a discussion of explanations that have been offered for the rise of the codex into cultural dominance, see Hall. Hall, 7-8, discusses the argument of Guglielmo Cavallo that early Christians from the lower and middle classes grew accustomed to the codex through the notebooks they used for everyday and commercial business.

19. I should make it clear, of course, that my knowledge of contemporary physics and cosmological theory is a layman's informed by some of today's articulate public-intellectual scientists who try to explain such theory in non-mathematical terms. My summary below (limited by my own understanding, and possibly misunderstanding) is especially informed by books Greene (2000; 2005); Hawking; Herbert; Kaku (1994; 2006); and Kaku and Thompson.