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THOUGHT PAPERS

How Social, Web-Based Activity Can Help Students More Deeply Engage Texts

BY BILL GARR

"Written speech is the algebra of speech."
- L. S. Vygotsky[1]

How can web-based tools, which seem to be changing every corner of life, impact how our students learn when they read and write? How can we make the best use of these new tools to encourage our students toward their deepest engagement with the material we've selected for them?

Lev Vygotsky, the influential Russian theorist credited with founding cultural-historical psychology, asserted that the process of acquiring the skills of reading and writing requires a fundamentally deeper, more abstract understanding of language than the process of acquiring verbal speech.[2] This doesn't seem like too much of a stretch. For example, an actor reading a script must be able to abstract from a collection of lines of dialogue the essence of a character in conflict in order to render that character in speech and action. Many interpretations are possible, and some are more or less valid from certain points of view. That richness of interpretation seems to be facilitated by the abstraction of the written word, which in itself can only hint at the cadence, volume, actions, and emphases we get from a live speaker.

There is another comparison involving algebra and learning, less famous, but especially interesting when considered in the context of Vygotsky's quote. In *Changing Minds*,[3] Andrea diSessa argues that, because of algebra's remarkable parsimony of expression, the introduction of algebra marked a qualitative shift in the practice of science. Algebra provided a compelling new way to consider related ideas: it could accommodate multiple, related arguments within a single statement. In practice, this can be accomplished by providing measured values for some of the unknowns in an equation with multiple unknowns, and then solving for the remaining one. Depending upon which unknowns you provide and which one you derive through your solution, the equation makes dif-

Abstract

This paper examines the fundamental learning activities of reading and writing as they are practiced by students in the contexts of web-based applications. The paper borrows the concept of "reentrance" from computer science, which it uses to postulate a cognitive strategy of provisional interpretations that students can take when reading or writing a text. The mechanics of certain reading and writing practices on the web are then framed in light of the these concepts, and the paper continues to explore methods by which those reading and writing practices can be improved.

About the Author

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ferent, but related, assertions about the system that it describes. diSessa gives a dramatic example[4] by recapitulating Galileo's six theorems of uniform motion in text and then showing how all six are completely defined by a single algebraic equation (summarized in Figure 1).

> Since all of Galileo's theorems of uniform motion are based on comparisons between the distance (d), rate of speed (r), and elapsed time (t) of two motions, each motion is expressed using those ratios:
>
> d1 = r1 * t1
> d2 = r2 * t2
>
> The comparisons are then given by this expression:
>
> d1/d2 = r1/r2 * t1/t2
>
> Each of the six theorems can be expressed as a special case, when, for instance, the distances traveled are equal, making d1/d2 = 1, and thus expressing a relationship between the rates of speed and the elapsed times.

Figure 1. Galileo's Theorems of Uniform Motion Expressed Using Algebra[5]

This may seem simplistic, but that is in part diSessa's point. We see this system of statements as simple, because we are comfortable with an expressive technology that renders the ideas clearly and succinctly. diSessa refers to a technology used in this way as a "material intelligence," which acts as a "leg up" for anyone attempting to understand Galileo's ideas. diSessa goes on to argue that programmable computer environments introduce another revolution in parsimony for scientific reasoning. In these environments, complex physical situations can be encoded by a few simple program statements. To illustrate his argument, he has developed Boxer, a programming environment used to teach science and mathematics concepts in elementary grades by giving students a tool with which to explain phenomena by writing code that enacts it (Figure 2).

At this point, I'd like to appropriate a term from computer science. I'll say that algebra and programming both offer affordances for abstract thinking about mathematics and scientific argumentation because their statements can be *reentrant*. In its original context, reentrant means that a piece of code can be called again while it is still executing from the first call, adding new information to the result that is ultimately returned. This feature allows you to direct a complex action in a simple, elegant way, such as scanning a whole hard drive, with all of its subdirectories, using the same simple scanFiles function, which just calls itself every time it encounters a directory nested in the file structure. Each result feeds back into its preceding call, until you get back to the original call, which then returns the whole structure of directories and files (Figure 2).

```
function scanFiles(directory, files=none){
    elements = read directory contents;
    for all elements do to |element|
        if element is a file, add to files
        if element is a directory add
scanFiles(element, files) to files
    end for loop
}

calling scanFiles(rootDirectory) returns:
root
  a file
  another file
  first sub-directory
    a nested file
    …
    more nested files
    a sub-sub-directory
       deeply nested files…
```

Figure 2. Pseudo-code demonstrating a reentrant function

Going back to the example of an actor interpreting a text, a different kind of reentrance plays out. As he reads, the actor creates multiple, provisional interpretations of the dialogue text. Holding some features of his interpretation constant, the actor tests it against subsequent lines. Asking questions like "If my character was feeling this at this moment, how would he address his antagonist at this other point?", the actor holds off executing an interpretation until it can play out in the new context and either support or contradict his working interpretation. Based upon how satisfied he is with the result, he may have to revisit and reevaluate earlier lines.

This is, of course, just a special case of reading for depth of meaning. Performing exegesis on a sacred text is likewise a reentrant process. Situating the original text in the context of its original audience, deepening one's understanding of the original language in which the text was written, along with other strategies, are all ways of problematizing a given interpretation, and reentering the text with that interpretation made newly provisional. This is the kind of deep reading practice that students need to master at all levels of reading and scholarship. Furthermore, when students share their interpretive decisions as they make them, they make possible the frequent decision and feedback interactions associated with high-impact teaching practices.[6]

Historically, writing, and then printing, represented advances in the thinking that was possible with speech, because they allowed speech to become persistent and public to a much greater degree than before. Now that written speech has become simultaneously persistent and evanescent (in electronic versioning systems), and nearly simultaneously personal and public (in which publishing to a community is as simple as unsetting a privacy checkbox), we again have the opportunity to think more deeply, and more abstractly, about language. In particular, I suggest that the recent development of certain tools makes this evolution in thinking and practice inevitable.

Before considering individual tools and what impacts they may have on our reading and writing practices, I'd like to discuss a framework through which to consider them. I am loosely borrowing from Activity Theory,[7] a set of theoretical constructs for describing human activity generally attributed to Alexei Leont'ev, a contemporary and colleague of Vygotsky's. Later, Yrjö Engeström[8] and others advanced and expanded Leont'ev's ideas in the West. I cannot claim that I am using Activity Theory as a theoretical grounding, but I will assert that one understanding of it suggests ways of designing for and assessing provisional interpretation and reinterpretation of texts in both collective and individual contexts.

Activity Theory holds that human activity is best described in terms of the coordination of various related elements involved in action: the individual actor, the community in which she acts, and the tools (cognitive, physical) through which her action in the community is mediated. As Activity Theory began to be used to characterize human computer interactions,[9] additional terms, such as rules (e.g. computer code, social norms) were added. Even in its simplest form, however, Activity Theory suggests the kind of reentrance that has been attributed to an algebraic equation. Activity Theory can be read as constituting an individual's conceptual model of her own activity as the interaction of a set of related mental models: (a) of herself as an agent in the community (roughly captured by terms like "self efficacy"), (b) of herself as a user of a particular set of mediating tools ("skill" or "mastery"), and (c) of the mediating tools in the context of the community ("norms" or "best practices"). In an Activity Theory-based description of reading or writing, all of these models would be variously taken as constant or made provisional, as the existing or emerging text is continually reentered. To exploit the value of this construction, we should design (and assess) for transitions between which models are challenged and which are held constant. We should strive to make those transitions more visible to readers and writers, to help them reflect more deeply on their practice.

Much has recently been made of new publishing formats (Web, ePub, interactive PDF, etc.), reading devices (iPad, Kindle, etc.) and reading software (iBooks, Acrobat X, etc.), which offer new activities to accompany the acts of reading texts. Also, new collaborative writing environments such as wikis, Dropbox, and Google Docs allow documents to be shared easily and even collaboratively edited in real-time. At CNDLS, our own examination of social and personal reading and writing has involved a variety of tools and approaches. From blog use on campus and the changes in writing practice that accompany the different social modes that blog writing affords among classmates, to the personal and social interpretation of an extended text in the MyDante project,[10] to treating discussion threads responding to a piece of learning evidence as yet another class of evidence for reflection in an ePortfolio tool, we have looked at how students use web-based tools to coordinate between their roles as individual learners and their roles as members of learning communities.

We continue to develop tools that focus particularly on the confluences between these various entrées into texts. In MyDante, an online environment for the study of Dante's *Divine Comedy*, students can associate text annotations, images, and sounds with selections from the text. We have also added discussion threads that spring from, and refer back to, those selections and annotations. We are currently revising (reentering) MyDante; based on student reflections on their social and personal activities using the current tool, and we are developing a Proust Project, which seeks to illuminate a complex text through comparisons between full passages and ones with strategic excisions, as well as through animations of particularly evocative passages.

A final tool I'd like to consider goes back to software and programming. In the Open Source software community, an essential tool is the version control system. This is typically a web-based tool, which is used by a group of programmers who are all working on the same code. It is essential for this task, where the slightest typo can render a program useless, in order to keep track of who changed what, and when, and to make sure that everyone is always working with the latest version. Tools like this have been around for some time now, but of particular interest is a new variation, called a "distributed version control system." Distributed version control is perhaps best typified by Git, the version control system designed by Linux creator Linus Torvalds, and by github.com, where many open source projects are housed using Git. This type of version control is distinguished by the fact that each user has his own repository of code, which he can update, revert, fork into multiple concurrent revisions, and merge back into a single stream. From this private workspace, the user can draw from the collective repository (usually on github.com), and create a completely private version history, analogous to the group's evolving version of the code. This "fork in the road," taken by one or a few developers, can be folded back into the history of the group project, pending discussion and approval from the group. At CNDLS, we have discussed developing a tool with features somewhat like this in an application for doing collective scholarship. Interpretations of a text could be rendered separately, developed personally, and then (with attribution and permissions) folded back into a group work. At last year's HASTAC conference, I was delighted to hear a presentation by Joshua M. Greenberg, director of the Alfred P. Sloan Foundation's Digital Information Technology program.[11] In his presentation, he asked, "What if we wrote scholarship like code?" and he considered github as a model for a new breed of online scholarship tools. While the demands of textual interpretation are not the same as those of writing executable code, there may be a github-like model for explicitly rendering personal interpretations of a text against collective ones, exposing for individual learners their processes of reading and writing within, and for, a community of learners.

Endnotes

[1]Lev Semenovich Vygotsky, *The Collected Works of L.S. Vygotsky*, vol. 1, ed. Robert W. Rieber (New York, NY: Plenum, 1988).
[2]Ibid., 204-205.
[3]Andrea DiSessa, *Changing Minds* (Cambridge, MA: MIT Press, 2000).
[4]Ibid., 12-15.
[5]Ibid., 15.
[6]George D. Kuh, "High Impact Educational Practices: What They Are, Who Has Access to Them, and Why They Matter" (Washington, DC: AAC&U, 2008).
[7]A. N. Leont'ev [Leontyev], "The Problem of Activity in Psychology," in *The Concept of Activity in Soviet Psychology* (Armonk, NY: ME Sharpe, 1979).
[8]Homepage of Yrjö Engeström, http://www.edu.helsinki.fi/activity/people/engestro/.

[9]Bonnie Nardi and Victor Kaptelinin, *Acting with Technology: Activity Theory and Interaction Design* (Cambridge, MA: MIT Press, 2006).
[10]Frank Ambrosio, et al., "MyDante: An Online Environment for Collaborative and Contemplative Reading," *Journal of Interactive Technology and Pedagogy*, no. 1 (2012), http://jitp.commons.gc.cuny.edu/2012/mydante-an-online-environment-for-contemplative-and-collaborative-reading/.
[11]Joshua Greenberg, "Data, Code, and Research at Scale" (lecture, HASTAC Annual Conference, Ann Arbor, MI, December 2011).

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