Effects of Annotations on Student Readers and Writers

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ABSTRACT

Recent research on annotations has focused on how readers annotate texts, ignoring the question of how reading annotations might affect subsequent readers of a text. This paper reports on a study of persuasive essays written by 123 undergraduates receiving primary source materials annotated in various ways. Findings indicate that annotations improve recall of emphasized items, influence how specific arguments in the source materials are perceived, decrease students' tendencies to unnecessarily summarize. Of particular interest is that students' perceptions of the annotator appeared to greatly influence how they responded to the annotated material. Using this study as a basis, I discuss implications for the design and implementation of digitally annotated materials.

KEYWORDS: Annotation, reading, note-making, paper, annotation systems design, composition instruction.

INTRODUCTION

Annotations have been a popular topic at recent conferences hosted by the ACM. Most of these papers have either presented prototype applications for annotating texts such as XLibris [18]and Dynomite [22], or have focused on studies of how and why readers annotate paper texts. This research has found that annotation is an important component of deep reading [11] and that readers annotate for a wide range of reasons, including improving comprehension of the source materials [2, 21], marking passages to quote in the readers' own texts or for later review [9, 13-15, 21], facilitating critical thinking [16], interpreting and commenting upon the text [11], and recording the reader's immediate and unselfconscious reactions to the text [13]. In general, these researchers conclude that annotation can serve as a bridge between reading and writing and is often a tangible reflection of a reader's engagement with the text [11, 12].

In contrast to these studies examining annotations from the viewpoint of the annotator, very little research to date has examined annotations from the perspective of a subsequent reader of the annotations. The few studies conducted from the perspective of a subsequent reader have focused on the effects of annotations upon recall. These studies generally conclude that reading texts that have been highlighted by expert readers improves recall on the emphasized items [3, 4, 7, 20].

However, we might also expect annotations to have a social impact as well as a cognitive one. At the very minimum, encountering another reader's annotations suggests that someone else has read and interpreted this text. This reminder that others share the text might have a communal effect, encouraging individual readers to see themselves as part of a public composed of former readers. Moreover, annotations that appear to evaluate the primary text either positively or negatively might influence a reader's perception of that text. Readers might find their opinions swayed by the biases or observations of previous annotators, or they might find themselves reflecting more thoroughly on material that had been annotated by a previous reader.

Despite their potential to influence readers, the socio-cognitive dimensions of present-day annotation practices have been largely unexplored. This question is significant since one of the main benefits of annotating digital library documents will be the ability to publicize and share what are now primarily "private" annotations. Since recent research has found little difference between annotating digital documents with an electronic pencil and annotating in a traditional paper and pencil condition [21], digital librarians have every reason to expect that electronic annotation will soon be as common as paper and pencil annotation is today. A major challenge will be to understand how to classify, filter and display these annotations so they can be useful to subsequent readers of the electronic texts. An improved understanding of how annotations interact with the primary document to shape a readers' perception of the material should therefore be of high importance to those interested in extending the annotation capabilities of digital libraries.

Annotations in Composition Instruction

Educators in general and composition instructors in particular are a major audience for the new annotation systems under development. Not only are students frequently asked to annotate one another's papers in peer review workshops, but annotated texts are often used in textbooks to model critical reading practices and to start dialogue about particular works or topics. For instance, the textbook, *The Presence of Others* includes nine essays with the annotations of four different readers appended [10]. Other textbooks frequently employ similar annotated readings. Additionally, many instructors ask their students to annotate readings and then share these annotations with the class as a way to stimulate dialogue and build communal knowledge[1].

The practice of using annotations to enhance composition instruction is clearly valued by both teachers and students alike. Yet no one knows for certain what effect reading particular annotations has on students. As digital libraries become increasingly popular and as their annotation capabilities expand, students will be exposed to increasingly diverse annotations with a wide range of quality and usefulness. How these annotations will affect students' critical thinking and writing, both positively and negatively is an important question for researchers and instructors.

In this paper I examine how annotated materials influence essays students write based on these materials. Of particular interest to digital librarians will be how annotations affected student responses to the primary texts.

METHOD
Overview

123 undergraduate students were randomly assigned to one of four treatment conditions based upon the annotations on the materials they received. Students were asked to write a persuasive essay based upon the primary texts and then were given a post-writing questionnaire. The written products were analyzed for quality, overall position on the controversy, and types of rhetorical activities employed. The post-writing questionnaire was analyzed for recall of information that was annotated, overall attitude toward the controversy, and evaluations of individual claims from the source texts.

Subjects

Subjects in this study were 123 undergraduate students enrolled in composition courses at the University of Texas at Austin. Nearly half were freshmen enrolled in introductory composition courses; the remainder were enrolled in advanced composition courses. This study was conducted as a reading and writing exercise during regularly scheduled class periods.

Prompts

The prompts for reading and writing consisted of a series of letters to the editor of the *New York Times* responding to a 1997 controversy sparked by the protest of five Orthodox Jewish students against Yale University's policy requiring all students to live on-campus for their first two years of attendance at Yale. The first letter in the series is a lengthy statement entitled "College Life vs. My Moral Code" written by Elisha Dov Hack, one of the five students protesting the residence requirement. Hack's letter describes the history of the issue and goes on to critique the lax sexual morals of dorm life. Hack's letter is followed by six short responses, all critiquing to various degrees his position. The writers of these letters to the editor include a Yale student, the Dean of Yale, a law professor from another university, and a rabbi.

This issue was chosen because the stakes and history of the controversy were easy to grasp and because the topic was one likely to interest students. Moreover, since several instructors had successfully used these letters as discussion material in their classes, these materials are representative of texts that students might be asked to analyze in an introductory composition course.

A pilot study of annotations by instructors was conducted to identify six "hot spots" in the letters that at least one-fifth of the instructors had annotated in some form (see Table 1). Using these "hot spots," four variations of the letters to the editor were constructed:

No Annotations. "Clean" primary texts without annotations or other markings.

Underlining Only. Primary texts with the six "hot spots" underlined; no commentary accompanies the underlining.

Evaluative Annotations 1 (+/-). Primary texts with hand-written comments noted in the margins next to the six "hot spots." Three of these six comments are clearly positive evaluations of the source text (e.g., "great metaphor--clear presentation of the claim") while the remaining three are clearly negative evaluations of the source (e.g., "logical flaw--bad analogy and possibly racist"). Where possible, these comments were taken directly from annotations made by instructors. The first annotation made in this set was positive, the next negative, the next two were positive and the last two were negative.

Evaluative Annotations 2 (-/+). Same as the previous group, except the pattern of positive and negative comments is reversed (e.g., the positive comment "great metaphor" is replaced by "unfair--distortion of Yale's policy" while the negative comment "logical flaw" is replaced by "good analogy"). The first annotation in this set was negative, the next positive, the next two were negative and the final two were positive.

See Table 1 for a description of six "hot spots" receiving annotations in the primary text and the distribution of positive and negative annotations in the two evaluative annotation conditions.

Table 1: Description of the Passages and the Annotations they received in the two Evaluative Annotation Conditions.

Description of Passages in primary text that received annotations.	Annotation for Evaluative 1 (+/-)	Annotation for Evaluative 2 (-/+)
1. By Elisha dov Hack opposing Yale's dorm policy and criticizing Yale's "anything goes" residential religion.	"great metaphor--clear presentation of the claim" (+)	"unfair--distortion of Yale's policy" (-)
2. By Jewish student describing his positive experience at Yale and claiming that unlike Hack, he is glad to be here.	"is this true? ouch!" (-)	"great ethos! yes!" (+)
3. By Dean defending Yale's policies and expressing willingness to accommodate students.	"sounds like Yale is doing all it can--works for me." (+)	"specifics? sounds like typical administrator 'b.s.'" (-)
4. By a law professor critiquing the irony of Hack's desire to return to the residential policies of the 1950's when Yale had a quota limiting the number of Jews admitted.	"wow. great point. enforced segregation in the 50's. self-segregation now." (+)	"but Hack doesn't argue that we should return to this policy. Why this misrepresentation?" (-)
5. By a Texan opposing Hack and comparing his lawsuit to suing a restaurant for serving non-Kosher foods.	"logical flaw--bad analogy and possibly racist" (-)	"good analogy" (+)
6. By a New Haven resident suggesting that Hack circumvent Yale's policy by maintaining two residences.	"is this for real? harsh!" (-)	"I agree--he has options" (+)

Procedure

Copies of the four variations of letters to the editor described above were randomly distributed to the class. Students also received blank paper, an instruction page, and a demographic information questionnaire. After the researcher read aloud the instructions which asked students to write a persuasive essay based upon the letters to the editor, students had 35 minutes to read the letters and write their essays. Students who received annotated materials found a statement on their instruction sheet (which was not read aloud) informing them that the hand-written comments on their materials were made by an composition instructor planning to use this assignment in class.

At the end of the reading and writing period, the essays were collected and students were given a post-writing questionnaire testing recall of information that had been annotated, recall of similar information that had *not* been annotated, perceptions of the annotated and non-annotated claims in the source materials, and general orientation to the controversy.

SELECTED FINDINGS

Recall

Since undergraduate writers frequently fail to note the rhetorical context of materials that they read (e.g., the identity of the writer, the venue of publication), I wanted to determine if annotating information about the writers would stimulate students to independently note other similar information about the rhetorical context. The ability to make connections between a text and its rhetorical context is a major difference separating expert and non-fluent readers and any intervention that might encourage students to make such connections would be welcomed by composition instructors.

Table 2 presents the mean correctness scores for recall of annotated and non-annotated information about the rhetorical context. This data suggests that annotating information about argumentative context improves recall of material that has been emphasized, but does not improve retention of contextual information that was not emphasized.

Table 2: Mean correctness scores for recall of contextual information. (min=2; max=10).

Annotation Condition	n	Recall of Annotated material identifying writers	Recall of Non-annotated material identifying writers	Recall of Non-annotated material about argument venue
No annotation	*33*	7.12 [a]	7.70	6.85
Underlining	*30*	7.83 [ab]	7.23	7.40
Evaluative 1 (+/-)	*31*	8.55 [b]	7.45	6.94
Evaluative 2 (-/+)	*29*	8.34 [b]	7.14	7.07
F (3, 122) statistic		3.76 *	0.43	0.74

* $p < .01$.
Different superscripts are significant at the p < .05 level.

The first column of Table 2 shows that students in the three conditions receiving annotated materials were more likely than students receiving no annotations to recall information identifying authors if it had been emphasized. Moreover, a post-hoc analysis shows that annotations that evaluate the source text (and involve words) are more

effective than simply underlining text in improving retention.

However, this high recall of annotated information did not stimulate students to retain information identifying authors when it was not emphasized. Columns two and three indicate that students receiving annotated materials were no more likely than others to recall contextual information when it was not specifically annotated. This finding is consistent with previous research on annotations and recall [3, 4, 7, 20].

Global Attitude

Students receiving annotated materials were no more likely than those receiving non-annotated materials to support or oppose the position taken by Elisha dov Hack (the initial letter writer). Students in all annotation conditions were overwhelmingly opposed to the lawsuit. Thus, annotations did not appear to influence students' overall attitude to or position on the controversy. This should not be surprising since students receiving the evaluative annotations received equal numbers of positive and negative annotations interspersed throughout the entire set of letters to the editor. It is quite possible that receiving a set of annotations that is more clearly slanted to a particular point of view *would* affect students' global attitudes. However, the finding that students' global positions are not swayed when positive and negative annotations are interspersed will interest composition teachers who might be concerned about unduly influencing students' opinions.

Immediate Attitude

To assess the effects of annotations on the claims in the source text, the post-writing questionnaire asked students to rate the persuasiveness of nine passages from the source materials. Appended to these nine passages, students in the evaluative annotation conditions received positive annotations (3 items), negative annotations (3 items), and no annotations (3 items). Table 1 shows that the assignment of positive and negative annotations to individual passages in the primary texts was alternated both within and across conditions.

The passages in the source texts were next consolidated into three groups based upon the type of annotation received:

Passage Set 1. Positive annotation in Evaluative 1 (+/-) and negative annotation in Evaluative 2 (-/+). (3 items). See passages one, three and four in Table 1.

Passage Set 2. Negative annotation in Evaluative 1 (+/-) and positive annotation in Evaluative 2 (-/+). (3 items). See passages two, five and six in Table 1.

Passage Set 3. No annotations in any of the groups. (3 items).

Table 3 shows a main effect for passage set, $F (2,112) = 31.13$, $p < .0001$, indicating that the different passage sets were not equivalent in their base persuasiveness. A Duncan's post-hoc analysis shows that Passage set 2 is significantly more persuasive than the other passage sets at the $p < .01$ level. This finding indicates that evaluative annotations do not over-ride the base persuasiveness of the source materials.

A main effect for annotation condition was not found. This suggests that all four groups of students were fairly equivalent in their baseline willingness to be persuaded. The annotations did not appear to affect their gullibility or skepticism toward the arguments in the source text.

A significant interaction, however, was found between passage set and annotation condition, $F (4, 224) = 13.72$, $p < .0001$. When students received a positive annotation, they tended to rate the passage to which it was appended more positively than other groups. Similarly, when students received a negative annotation, they tended to judge the passage to which it was appended as significantly less persuasive than other students.

This interaction indicates that while the entire set of evaluative annotations did not have a global effect upon students attitudes, the valence of individual annotations interacted with the base persuasiveness of the passage to shape students' evaluations of individual claims in the primary text. The first column of Table 3 indicates that persuasiveness scores for all three annotation conditions were significantly different at the $p < .01$ level (Duncan's multiple range). Thus, students in the first evaluative annotation condition who received positive annotations for this passage set, not only rated these passages as significantly more persuasive than the students who received negative annotations for the passage set, but also rated these passages more favorably than the students receiving no annotations or underlining only. Similarly, students in the second evaluative annotation condition, which received negative annotations for this passage set, rated these passages less favorably than the other groups. The strong effect for annotation valence in this column, $F (2, 113) = 13.35$, $p < .0001$, suggests that the content of an annotation uplifts or depresses students perception of the immediate source material in congruence with the valence of the annotation.

The second column of Table 3 indicates that only the students receiving negative annotations for this passage set were significantly influenced by the annotation valence. Students in the second evaluative annotation group and who received positive annotations for this set of passages did not rate these passages significantly more favorably than students in the no annotations or underlining condition. These positive annotations may not

Table 3: Mean persuasiveness scores for the three passage sets. (min=3; max=15)

Annotation Condition	Passage Set 1 : positive annotations in Evaluative 1 (+/-) and negative annotations in Evaluative 2 (-/+)	Passage Set 2: negative annotations in Evaluative 1 (+/-) and positive annotations in Evaluative 2 (-/+)	Passage Set 3: no annotations in any of the annotation conditions
None & underlining	9.78 [a]	11.81 [a]	9.62
Evaluative 1 (+/-)	10.97 [b]	9.78 [b]	9.64
Evaluative 2 (-/+)	8.43 [c]	12.90 [a]	9.79
F statistic (2, 113)	13.35*	16.78*	0.09

* p < .001;   Different superscripts are significant at the p < .01 level.

have affected students because the base persuasiveness of these passages was already high. However, this finding does suggest the possibility that negative annotations may be generally more influential upon attitudes than positive annotations.

Argumentative Activity
Since annotations have been described as a tangible reflection of a reader's engagement with the text [11, 12], it was hypothesized that reading annotated materials would help students understand how readers approach texts. In particular, it was theorized that annotations would make students more sensitive to the fact that readers bring their own knowledge, assumptions and values to a reading. All too often, students seem unaware of this fact, writing essays that are "information dumps" of everything the student knows about a topic, rather than taking the time to organize the available information into an argument that appeals to a specific readership[5, 6, 8, 19]. Since annotations provide evidence that others are already familiar with the primary texts, we might expect student writers receiving annotated texts to spend less space summarizing information the reader could be expected to know and spend more of their essays engaging in persuasive tactics such as offering claims, reasons, evidence and support.

To examine how annotations affect students ' written products, their essays were divided into t-units (an independent clause and all of its modifiers) and each t-unit was coded as either summary, exposition, argument, ethos, concession, or irrelevant. These six types of argumentative activity are described below.

Summary. Factual summary of material found in the source materials. (ex. Five students are suing Yale University.)

Exposition. Factual information that cannot be directly found in the source materials or attempts to synthesize two or more of the source materials. (ex. Yale is one of the most prestigious colleges in the United States.)

Argument. Direct or indirect statement or support of a position on the issue. (ex. I agree with Dean Brodhead that dorm life is crucial to a Yale education.)

Ethos. Claims establishing the writer's qualification to speak on this topic. (ex. I myself am not only a freshman like Elisha dov Hack, but I also was raised under a strict moral code.)

Concession. Concession of a point to the opposition. (ex. I can sympathize with Hack's position.)

Irrelevant. Information unrelated to the argument or the writing task. (ex. I really need a tissue right now.)

Figure 1 indicates that the annotation condition did influence the types of argumentative activity in which students engaged, Chi square (<u>df</u> 15) = 151.9, p < .0001. Students in the No annotation condition wrote essays with the greatest amount of summary (11.0%) while students in the Evaluative 1 (+/-) condition had the lowest percentage of summary (4.4%) in their arguments and the highest percentage of argument (81.5%) in their essays. This result lends support to the hypothesis that annotations encourage students to write for audiences who are already familiar with the material. All three of the annotation conditions wrote essays with less summary than the no annotation group and appeared less likely to assume that the writing task called an "information dump" of all the available knowledge about the topic.
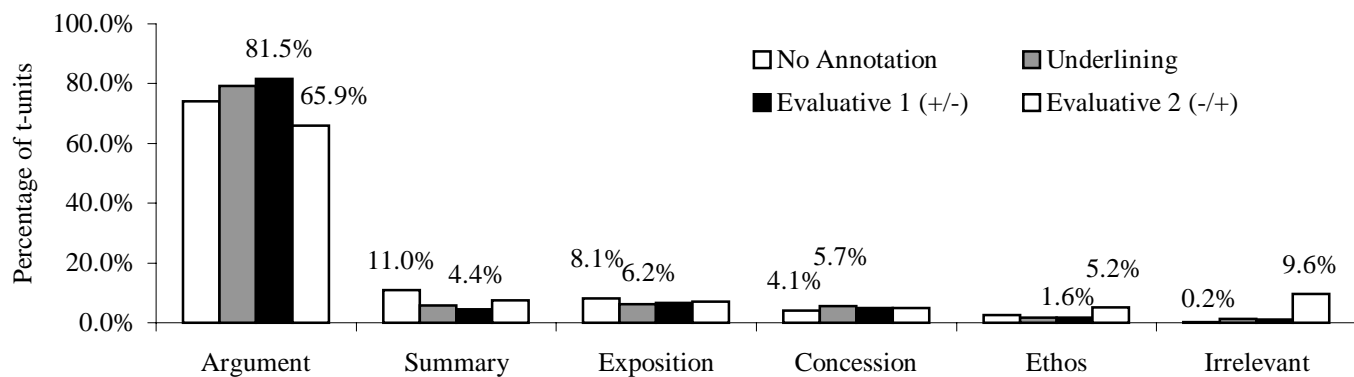
Figure 1: Distribution of Argumentative Activity by Annotation Condition

Surprisingly, the essays written by students in the two evaluative annotation conditions differed significantly. While the Evaluative 1 (+/-) annotation group wrote essays with the highest percentage of argument (81.5%), the Evaluative 2 (-/+) group used the least amount of argument in their essays. The Evaluative 2 (-/+) essays also contained a much higher amount of irrelevant material (9.6%) than the other groups and these students seemed more likely than others to write about their own backgrounds and qualifications for writing (5.2%). Overall, the Evaluative 2 (-/+) group appeared to be the least interested in the persuasive task.

Why did the two Evaluative annotation groups differ?

As Figure 1 above indicates, the Evaluative 1 (+/-) and Evaluative 2 (-/+) groups employed strikingly different types of argumentative activities in their essays. It was hypothesized that students perceived the annotators and their beliefs differently. Thus, since the first annotation in the Evaluative 1 (+/-) condition was positive annotation on a passage in the original letter by Elisha dov Hack, student readers might have assumed that the annotator favored the position in this letter and therefore supported Hack. Conversely, since the first annotation in the Evaluative 2 (-/+) condition was a negative annotation on a passage in Hack's letter, the student readers might have assumed that the annotator opposed Elisha dov Hack's lawsuit (the position that over 90% of the students adopted in writing their essays). These initial impressions would moreover be weakly supported by the distribution of annotations in the remaining letters. Students receiving the Evaluative 1 (+/-) materials saw three negative annotations and only two positive annotations on the set of six letters critiquing Hack's position, while students receiving the Evaluative 2 (-/+) materials saw more positive annotations on these critiques.

Thus, even though students in both of the Evaluative Annotation conditions saw equal numbers of positive and negative annotations, they may have nevertheless inferred different pictures of the beliefs and values of the individual annotating the materials. If the student writers perceived this individual as a potential reader of their own texts, then we might find that the students receiving the Evaluative 1 (+/-) materials believed their readers were inclined to favor the lawsuit. This belief would cause these students to adopt the cognitively challenging task of trying to persuade their audience to change their minds about the lawsuit. By contrast, the students in the Evaluative 2 (-/+) group might have perceived the annotator as already agreeing with their point of view. If this were the case, it seems likely that these students would have been less interested in attempting to persuade their reader who already seemed to agree with their position.

To test the theory that students may have perceived the two annotators differently (a perception that might explain the differences in the essays produced by the two evaluative annotation groups), an additional 20 students were provided with sets of the annotated essays. These students were given a questionnaire with ten statements characterizing the annotator and asked to rate on a 5-point scale how strongly they agreed with these characterizations of the annotator. A score of five indicates strong agreement with the characterization while a score of 1 indicates strong disagreement.

Figure 2 indicates that students did perceived the annotator differently depending upon the materials they received. Students receiving the Evaluative 1 (+/-) set of materials were more likely than students in the Evaluative 2 (-/+) condition to agree that the annotator supported Hack, $F (1,19) = 10.8$, $p < .01$ (SAS glm procedure). Students in the Evaluative 1 (+/-) condition were also marginally more likely to perceive the annotator as sympathetic to Hack, $F (1,19) = 4.24$, $p = .05$, more likely to believe that the annotator was a teacher, $F (1,19) = 5.03$, $p < .05$ and more likely to perceive the annotator as biased, $F (1,19) = 10.37$, $p < .01$.
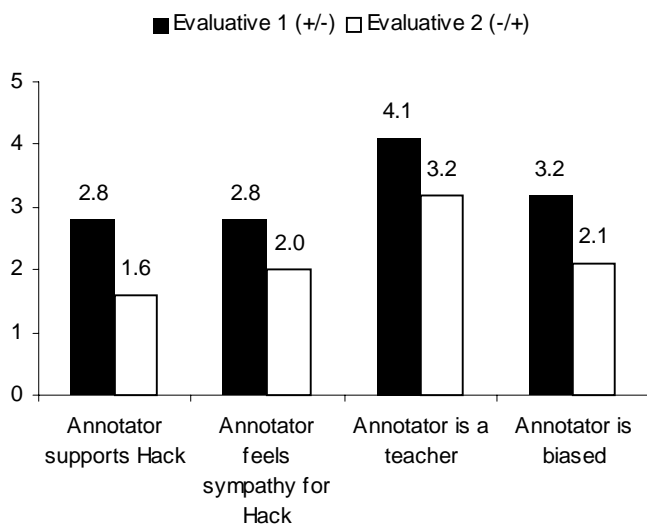
■ Evaluative 1 (+/-) □ Evaluative 2 (-/+)

Figure 2: Student Agreement with Characterizations of the Annotator (1=strongly disagree; 5 = strongly agree)

Thus, it does seem possible that student's perceptions of annotators and their positions on issues will affect how students respond to both the annotations and the primary text and may also influence their written products. Such findings are revealing for educators who might want to select or assign annotated materials to stimulate dialogue and critical thinking. A future version of this study will seek to further test the hypothesis that the perception of an annotator's beliefs and inclinations will affect how subsequent readers respond to the materials.

SOME IMPLICATIONS FOR ANNOTATIONS IN THE DIGITAL LIBRARY

The findings from this study strongly suggest that the content of an annotation (particularly whether the annotation is positive or negative) will influence how readers perceive the source text. Instructors as well as readers seeking a range of viewpoints on a particular text may want some way to select annotations based upon their positive or negative content. Following are recommendations for designing annotation systems in digital libraries.

Design annotation features allowing readers to retrieve annotations based upon the text in the primary document that is annotated.

Annotation programs should not be limited to keyword searches. Readers interested in a particular claim or argument in the primary text should be able to search for annotations based upon their location in the primary document. Instructors interested in providing students with more information about how readers process texts

might then search for annotations centered around a particular claim or rhetorical strategy in the primary text. Exposing students to a range of interpretations, perspectives and reactions to particular claims will underscore the fact that readers approach texts from multiple perspectives and for multiple purposes.

Provide capabilities to categorize annotations by positive or negative content.

Additionally, annotations might be categorized by their valence (i.e., their positive or negative relationship to the source text). This way, readers wishing to find additional arguments for or against a controversial claim could search annotations by their valence in order to ensure a range of viewpoints. Similarly, instructors presenting a topic that they expect their students will react strongly to, might search for annotations that will disagree with their students' positions. This capability would help instructors find audiences that challenge students and stimulate them to do more complex and critical thinking.

Provide information about annotators including their general position(s) on particular topics or texts.

Since the readers' perceptions of the annotator's beliefs and positions appeared to influence how they responded to the material, it would be useful to find ways to categorize annotators based upon their attitudes to particular topics, texts or controversies. Entire sets of annotations that reflect the critical activities of readers from different backgrounds and with different belief systems may provide students with additional insights into the critical and evaluative activities of other readers.

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