Secondary Participation in a Joint Problem Space

Abstract: The research reported on in this paper develops a notion of primary and secondary participation in joint problem spaces from the perspective of two different collaborative writing platforms. Participants move into and out of *points of collaboration,* which have both primary and secondary participants. A primary participant contributes to the joint problem solving and a secondary participant can later review the action at the point of collaboration. Both kinds of participants benefit from the learning event.

Keywords: collaboration, joint problem space, primary and secondary participation

Introduction

Two students are closely working on a problem together in a shared conceptual space in front of a white board. They are working in a *joint problem space* (JPS) (Teasley & Roschelle 1993; Roschelle 1992). One part of the JPS is the problem solving they do. A second part of it is the infrastructure work they do to maintain the collaboration as they work together, creating and sharing knowledge: "collaborators must have ways of: introducing and accepting knowledge into the JPS; monitoring on-going activity for evidence of divergences in meaning; repairing divergences that impede the progress of the collaboration" (Roschelle & Teasley 1995, p. 76). A third element is the social interaction required to establish and maintain interpersonal connections (relational space: Barron 2003). When collaborative problem-solving and the JPS is interrupted, due to temporal and/or sequential dislocations, the collaborators engage in "bridging activities" to bring the shared space and artifacts back into collective focus (Sarmiento & Stahl 2008).

The research reported on in this paper develops a notion of primary and secondary participation in joint problem spaces from the perspective of two different time/different places collaborative writing platforms. Because of the distributed nature of these collaborations, the construction and maintenance of the JPS is not a continuous activity. Rather the participants intermittently move into and out of such collaborative states. These *points of collaboration* are sandwiched between periods of time where the participants are working in parallel, while sharing the products of their work. The event defined by the point of collaboration has both primary and secondary participants. The primary participants in a joint problem space contribute to the joint problem solving and a secondary participant has access to a "transcript" of the action at the point of collaboration (secondary, primary participation: Alterman & Larusson 2013). The data will show that both kinds of participants benefit from the learning event. The data presented here derives from the implementation of two types of collaborative, different time/different place writing. One collaborative writing scheme was wiki-based and the other was blog-based.

This study examines two *points of collaboration* for each scheme: student efforts to 1) use the writing assignment to better understand the assigned texts, and 2) work together to complete the writing task. For each of these points of collaboration, the students work in a JPS intermittently, both as primary and secondary participants. As a part of their collaborative work, the students must engage in some bridging activities, managing the coordination, content and social elements as they do so.

This paper presents a case study of a class of 116 students in a course on Internet & Society. There were 19 small teams of students, ranging in size from five to seven students.

Each team completed four collaborative writing projects during the semester, alternating between wiki-based and blog-based collaborative writing. The data shows, regardless of platform, that only a small subset of the team are primary participants at each point of collaboration. Secondary participation in these events is larger, and in many cases is of equal or greater value. In general, primary participation for all members of a group has (sometimes prohibitively) high overhead/coordination costs, making its achievement problematic at runtime, whereas secondary participation is much easier to achieve while still providing valuable learning experiences. The focus in this paper will be on one group, Group 3, which was an "average" performing group both in the extent of student participation in online learning activities (number of participants and contributions) and grade-wise.

An overview of the case study is followed by a detailed analysis of the collaborative work of Group 3 throughout the semester. For each of the platforms, examples of joint problem space are presented for both the collaborative writing task and the collaborative task to better understand the assigned texts. Both primary and secondary participation are featured in the analysis. Two wiki-based assignments and one blog-based assignments are presented. The second wiki assignment is presented to show how Group 3 adjusted to the difficulties that they encountered while problem solving over how to collaboratively write a text using the wiki.

Case Study

The study was conducted on a course on Internet & Society in Spring 2015. The course was organized around four books that examined different issues relevant to the subject. The class consisted of 116 mostly undergraduate students from a variety of majors.

The students were given one assignment per book to be completed on the class website, working in small groups (small groups: Stahl 2006). Each student remained anonymous and was randomly assigned to a group upon their first log-in to the system. Each group consisted of between five and seven students; there were 19 teams. Students worked on the same team throughout the semester.

For the first and third books, the collaborative writing was wiki-based. Each student was responsible for a 500-word summary of one chapter of the book and the group as a whole was responsible for a 1,000-word summary of the main argument of the book. In addition to being responsible for a chapter summary, each student was assigned the role of discussant on a different chapter and editor on a third; assigning roles brings aspects of individual learning into a typically collaborative space (West 2008; Altanopoulou 2014; Wichmann 2013). Each team had a single discussion space. Some contributions were mostly intended for single recipient, like when a student fulfilled her role of the discussant for a chapter written by another student. In these cases, even though there was a primary recipient, other members of the group could read the contribution as secondary participants, thus keeping track (aware) of the overall progress of the group for their joint project (to produce a book review) and also seeing examples of the kinds of feedback that "discussants" were giving to the authors. Each team also had access to a history of edits and a "differential function" that compared any two versions of the text in the history.

For the second and fourth books, the interaction was a blog-based. The assignment for the blog-based collaboration was to write a 1,000-word editorial about an issue raised in the book. Each student posted an editorial to his/her own blog, which was accessible only to the other students on the same team. The assignment was broken into two phases: a draft phase and a comment phase, each lasting roughly one week (drafting: Alterman & Gunarsson 2013). During the draft phase, students were not able to see the work of their teammates and

they were required to complete a "reasonable" draft of the assignment. At the end of the draft phase, the drafts became available to the entire group. During the comment phase, students were required to comment on the posts of at least two teammates. Based on the comments of their teammates, the students made revisions to their editorial posts. Students were graded on the quality of their final post.

Each platform collects large amounts of information about student activities online. Transcripts were used for ethnographically-oriented data analyses. The transcripts can also be treated as an event log file and accessed using database queries, which can be used to count various features of a student's online activity. For the purposes of this paper, each visit to a wiki or text page, post, or conversation was counted as a student reading online content. This measure of reading has been used in numerous previous studies (e.g, Gunnarsson & Alterman 2013).

Group 3: Using the wiki

Students in Group 3 could create points of collaboration while either writing the central argument on the wiki-text page or while discussing their work on the talk page. The points of collaboration that emerged rarely involved more than one task focus. In other words, a point of collaboration was either related to the writing task or the task to understand the assigned reading, but rarely both.

During the first wiki-based assignment, the team struggled with the wiki style of collaborative writing. Contributions were not coordinated among the group members and the writing was decidedly individualistic. There were only 10 contributions to the talk page, and only 3 students participated in writing the summary of the central argument. The grade the group received on the collaborative portion of the wiki was lower than the class average. By the second wiki assignment, however, the quantity and quality of joint problem solving while writing the book review was much improved and so was their grade.

Joint problem solving on the chapter summaries happened almost exclusively between two participants, the author of the chapter summary and the discussant on that chapter. Problem-solving on the content of the central argument was largely absent from the talk page.

Talk page: points of collaboration

Chapter summary

Figure 1 shows a point of collaboration on the talk page for one of the chapter summaries. The problem, as introduced by Billy, concerns flash mobs (see highlighted text). This initiated a short interchange between the author of the chapter summary and the student who was officially the discussant for that chapter.

This example constitutes a *point of collaboration* where the two students engage one another in an effort at collaborative meaning making over the content of the assigned reading (meaning making: Stahl et al 2006).

> Billy: … I found your summary to be a fascinating explanation of the chapter. *(1)* You gave some excellent examples to back up your points about collective action and the speed offered by various modern social tools. …*Why not just a regular street protest - what makes flash mobs so unique and successful?* Also, *(2)* what do you think about the three levels of awareness that Shirky mentions in the chapter?

Robert: … I have checked my friend's group page, *(3)* it seems that we are do very well and pretty much on track. Let's keep doing this. … Well i think flash mob is more successful because the government or people in the public will not even know if protest is taking place. I called flash mob the surprise protesting. This give participators advantage to get their message out and people will definite listen to them. … *(4)* I total agreed with Shirky awareness, I think Shirky is right on point on how internet has revolutionize society and the means of communication…

Billy: … *(5)* I agree with your sentiment about the surprise factor in regard to flash mobs - they don't give government the time or ability to control them…

Figure 1. Meaning making at a point of collaboration on the talk page. (Numbers and italics added.)

The example in Figure 1, exists in a JPS. The students reason about the chapter and the student's summary of it while they integrate goals (2), provide descriptions of the current state of the problem (1), indicate an awareness of problem solving actions (3), and monitor agreements (4,5). As such, this interchange is a point of collaboration**.**

Coordinating the construction of the central argument summary

On the first wiki-based assignment, Group 3 did very little problem solving around how to organize themselves to collaboratively write the central argument summary. This coordination problem was an issue for all 19 groups. Some groups never solved this problem. Other groups had a suboptimal solution, where, for example, one student wrote over 90% of the central argument summary by herself. The most effective groups spent a lot of energy problem-solving in support of organizing themselves to write the summary of the central argument. Group 3 did not get over the coordination threshold on the first wiki assignment, and on the second one they did, as one student stepped forward and lead the problem-solving work required for coordination of writing efforts on summarizing the central argument.

Figure 2 shows excerpts from the talk page on the second wiki assignment where Group 3 are coordinating their efforts as they collaboratively write the summary of the central argument.

Billy: *(1)* I see you've started the second section of the summary

Billy: I will make sure to edit it once you're ready for me to. *(2)* What's word count right now?

Billy: thanks for adding that part. Do you think 936 is good? Now that we're this close to the maximum, is it still necessary to add more?

Jessica: *(3)* I have add a paragraph includes arugement from chapter 8 to chapter 11 before "Second life". If you can, could you combine your arguement about second life with arguements in Ch.12 to Ch.14? we might end up having too many words.

Jessica: To everyone: we probably also need to shorten the first part of summary

Jessica: Also, *(4)* since we are still missing some points from ch13 and 14, *(5)* I will add few pints from these chapter tonight. ---by s

Figure 2. Points of collaboration where the students are coordinating their contributions to the central argument.

Contributions to the talk page like these support the participants to converge on a procedure to collaboratively write the main argument summary, thereby creating a point of collaboration. The participants report on the status of subtasks (1), coordinate on assignment requirements like word count (2), manage the construction of the argument of the text (3,4), and schedule activities (5).

Secondary participation on JPS for talk page

Each of the entries to the talk page exists as a part of a point of collaboration. Each student that makes a contribution to the talk page is a primary participant to that point of collaboration. Anytime a student reads the talk page, he/she is a secondary participant. Table 1 shows primary and secondary participation for all points of collaboration on the talk page.

Table 1: Participation across assignments

	Assignment 1	Assignment 2
Primary Participation	10	30
Secondary Participation	56	105

Secondary participation is larger than primary participation by a factor of over 5 on the first wiki-based assignment and a factor over 3 on the second.

A collaboration on the talk page persists and is much more accessible to those who are not primary participants. Some problem-solving activities have educational value for both primary and secondary participants, like problem solving over the content or writing of a particular chapter summary. Other problem-solving activities, like a report on word count, have limited value for a short period of time.

Wiki-text page: points of collaboration

Each time a student makes a contribution to the wiki-text page for the central argument summary, he/she is operating at a point of collaboration. His/her edits are integrated in the current state of the shared summary artifact. The *problem* to be solved is how to edit the current version of the document. The history of edits and the differential function provide *infrastructure* for managing the collaboration. There are no explicit social elements.

During the construction of the central argument for the first wiki-based writing assignment for Group 3, there were only four contributors to the summary of the central argument. Three contributors added 227, 309, and 469 words, respectively over a series of 5 distinct contributions, and the other provided one round of copyediting. There was no discussion of the central argument on the discussion page; all but one of the comments on the discussion page were made in the last 24 hours of the assignment as the deadline approached. The resulting summary was disjointed, leading to a low grade for this part of the assignment.

In writing the central argument for the second wiki-based assignment, all five team members made at least some contribution to the main summary. Four contributors made contributions of 536, 455, 169, and 62 words over a series of 15 distinct contributions. The contributor of 62 words and the remaining group member made edits to the main summary

totaling 4 distinct contributions. There was a good deal of conversation on the talk page (21 contributions) regarding coordination of the summary of the central argument.

Secondary participation for wiki-text collaboration

Think of progress at writing the central argument as analogous to getting prescription glasses. The optometrist flips different lenses in front of your eyes, gradually moving towards the best clarity. Ideally, writing wiki-text functions the same way. Gradually the students converge on a summary with the greatest clarity at describing the central argument of the book. All students, especially those who participate in the writing, benefit from reading and re-reading the wiki-text as the argument of the book comes into focus. Engaging in this way has tremendous learning value.

The data shows that it was not working that way for Group 3. During the first wiki-based writing assignment, everybody read the central argument summary several times (secondary), but only 4 made contributions to the writing of the summary of the central argument (primary), and one of those only did copyediting. Team members visited/read the main wiki page 143 times, which is a significantly larger number than the total contributions (primary participation) to the main page (34). The students with the lowest primary participation, making 0 and 1 contributions, respectively, were the two largest secondary participants in the group. For the second wiki-based assignment the ratio was a little better, but secondary participation still dwarfed primary. One of these students was an international student. She stated to her teammates at one point "As a non-native speaker, my writing skill is limited I am wondering if some of you could help" and at another point said "To be honest my writing skill is not very good. Editing job might be challenging for me." This student made some contributions to the summary for the second wiki-based assignment, but participated in a secondary fashion 61 times, which is close to half again the secondary participation of any other member of the team. Clearly, for this student, secondary participation had the double benefit of working on content while improving writing skill.

Group 3: Using the blog

The first blog-based writing assignment was to write a 1,000-word editorial on one of the arguments presented in Lawrence Lessig's book on copyright law in the age of the Internet, Remix. Each member of the team posted a draft of his/her editorial by the draft deadline and then the commenting and editing period commenced. Each student was responsible for writing a comment on the blog posts of at least two of their teammates. For a team of 5 students, there should have been a minimum of 10 comments. For this assignment, Group 3 generated 26 comments: 9 of the comments were students responding to feedback they received on the draft of their editorial, 13 included elements regarding the meaning of the Remix text (content), 13 had feedback on writing, and 0 had some coordination factor. The distribution of the 17 comments on the posts of others was as follows: The editorial with the fewest number of comments received 2, the highest number of comments was 5, and the median was 3.

Point of Collaboration for Blog-based Writing

For the blog-based assignment, the conversations on each post are a point of collaboration. A sampling of the comments generated on the posts for the second assignment is shown in Figure 3. In each case, the problem being worked on is interpreting and understanding the Remix text from the context of a single editorial post. Student comments on each other's posts include some elements relevant to content and writing, and other elements relevant to

maintaining a joint problem space. For example, 1 and 2 align points of view between the author of the post and the commenter on the Remix argument. Comment 3 confirms a shared understand of the significance of Limewire. Phrases like "I like the way …" in 4 or "as you explained well …" in 6 add a social element to the relation space. Comment 5 is a contribution to a joint problem space focused on writing. 6 engages the author of the post over a specific part of the argument presented in the post, confirming a shared understanding of the significance of a particular example.

1. I agreed with some of things you mentioned. Well I think that amateur creativity should deregulated. You mentioned it should be regulated ... remix is essential for growth in society. AMV, is a remix made with pictures from different Japanese animate. Well that took a lot of time creativity.
2. I think Lessig was comparing the government action ins iraq to show they government is incompetence.
3. Limewire is indeed a good example of the directions that many young people have taken because they are so annoyed by the crippling copyright laws of today.
4. I like the way you interpret Lessig's points.
5. Perhaps breakout your paragraphs to a greater extent and work on a separate (and longer) conclusion.
6. With all the hype about Alibaba's IPO last fall, we could see clearly how it fit into the realm of commercial economy. But, as you explained well, a company like QQ and Tencent mixes the two types of economies in an interesting way.

Figure 3. A sampling of comments on various posts produced by Group 3.

Secondary Participation for Blog-based Writing

A significant part of the collaboration with blog-based writing is the amount of reading that the students do of each other's work after drafts are posted while the team members are making revisions on their editorials (Gunnarsson & Alterman, 2013). During the period of collaborative work, Group 3 members read posts of other students, and their accrued comments, 120 times. On average, the 5 students made 24 reads, 6 per post. This level of reading suggests a pattern of interaction that is not obvious from an examination of the written material. Students are sharing their ideas and reading the ideas of their peers throughout the revision period.

Concluding remarks

In a close analysis of the interactions of 116 students in 19 groups across two varied different time/different place collaborative learning environments, it was possible to identify points of collaboration that existed as intervals of convergence which appeared between longer intervals of parallel work over shared representations. These points of collaboration had both primary and secondary participants.

On the talk page of the wiki there was very little discussion of the content of the central argument for any of the groups. The talk page, however, included significant content-oriented points of collaboration with regards to chapter summaries. For blog-based writing, the points of collaboration were tied to the conversations that emerged and centered over the collection of individual editorial posts created by team members, with each post initiating a different point of collaboration.

The pattern of secondary participation outpacing primary participation was found across all four assignments for all 19 groups in the study. For the wiki-based assignment,

groups made an average of 148 and 85 reads of the main and talk pages, respectively. During blog-based assignments, groups made an average of 120 reads of teammate blogs.

For both wiki-based and blog-based writing, the collaboration over content was greatly enhanced by secondary participation, which is a significant basis for learning about the assigned readings and learning how to write. The students used secondary participation in a joint problem space as way to manage infrastructure and engage in meaningful explorations of content. For the wiki-based writing, primary participation in writing chapter summaries tended to be one-on-one between the author of the summary and the discussant; and secondary participation enabled broader access to these joint problem spaces to the rest of the team. The distribution of work for writing the central argument summary resulted many students with limited primary participation, but who could, nevertheless, learn by engaging in secondary participation. For blog-based collaborative writing, the benefits of primary and secondary participation approximate one another. Good primary participation enables greater value for secondary participation; and poor primary participation in discussing each other's drafts could be compensated for by students actively reading the draft posts of their teammates.

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