

Culture and Contingency in Scientific Collaboration

Peter H. Jones, Ph.D. Redesign Research, USA peter@redesignresearch.com

I am submitting a position paper for *Computer Supported Scientific Collaboration* even though I am organizing another ECSCW workshop scheduled the same day. In case my workshop is underattended (being late in acceptance and posting, and since I am not as well-known as other workshop organizers) I wish to find the most appropriate venue for sharing my research topics. I see overlap between my rather specialized research questions and the broader scope of Workshop 10; my interests address 3 of the themes:

- Is scientific collaboration different from other types of collaborative work? How does it differ?
- What are the varieties of scientific collaborations studied? Do they however have some commonalities (in comparison with other areas of work)?
- What are the challenges scientific collaborations pose for CSCW?

Many intellectual professions that regularly involve collaboration - such as science, law, and engineering – exhibit minimal use of computer-supported collaboration. We find coordinated and collaborative *practices* in intellectual work environments such as laboratories, law firms, research centers, and product development. But if we define intellectual collaboration as joint activity between two or more peers engaged in similar investigation and *motivated by discovery*, as opposed to output, we find interpersonal factors, timing and proximity, and other contingencies determining much of the success and style of the collaborative relationship.

As some (e.g., Kraut) have pointed out, collaborative tools have focused on the productive work-related activities once a collaboration is formed. Looking at the overall “lifecycles” of real collaborations, though, production phases often constitute fairly minor roles compared to the time involved in the intellectual partnership. My current research conducted in a molecular biology research center shows cognitive distinctions between collaboration and work product. As found in other creative collaborations (such as in jazz or film) collaborating researchers often do not intentionally direct joint activity toward a defined work product. That might characterize a *project* or non-peer relationship; it might be considered collaborative in a business domain, but not as such by scientists themselves. Scientific collaborations are often contingent, unarranged, described as serendipitous or a “happy accident” (these accidents, of course, being a major reason we attend so many conferences!) The goal or motivation of the collaboration appears to be more characterized by joint *discovery*.

Of course, in scientific collaboration we find determinant structural and institutional factors that don't play in purely creative work. Collaborative practices may differ significantly by *discipline* (e.g., physics vs. life sciences), *project size* and funding (individual vs. multi-institutional), and access to *tools* (not every lab has their own spectrophotometer). We should not overlook the role these structural factors have in determining the level of collaborative activity, the duration, and division of labor in scientific collaborations. However, these factors have less to do with the *quality* of the collaborative effort than the complex interests and individual and interpersonal differences that constitute an effective scientific collaboration. The structures and work products can be seen as an *outcome* of the effective

relationship, once started. But the *object* of the collaboration may be seen as joint learning and discovery.

Among questions for technology use, we might problematize *initiation and sustaining effective research collaborations*. In studying the information use practices of researchers over time, many have found minimal adoption of coordination technology. Well-known studies (Markus, 1994, Orlikowski, 1991, 1992, Kraut et al, 1988, 1990) demonstrated cultural and organizational hindrances to adoption and sustained use of collaboration technologies in intellectual work. While many tools have been designed to support the *production* of joint work, as Kraut also pointed out in 1988, CSCW tools have also been found to restructure activity and fundamentally alter the collaborative process. Perhaps very different types of tools might be of value for different “phases” or practices along the lifecycle of a research collaboration. While CSCW may have focused more on production practices, less attention has been given to enabling the initiation of collaboration.

Study of Information Use in Molecular Biology Research Collaboration

A recent field study I conducted at Case-Western’s RNA Center for Molecular Biology explored the motivations and practices of research collaboration, both for individual researchers and as an effective social practice promoted and sustained in the organization by the PIs. I also attempted to analyze the effect of collaboration on information behavior, to understand how information use and production was mediated by collaboration. We chose to analyze research *projects*, allowing analysis of activity over a defined period of time, with clear boundaries and objectives.

The literature in scientific information behavior emphasizes institutional motivations for collaboration. Some notable studies indicated collaborations emerged among research institutions to spur greater productivity as required in the academic career, by writing more papers through co-authorship. Others pointed out the need for sharing of resources between labs, and the general sharing of knowledge among researchers. Although we found some of these factors at the RNA Center, these were not consistent with their described practices and values. Instead we found all 5 PIs (and many grad students) participating in collaborations, but for different reasons than typically supposed.

Molecular biology is considered a highly competitive discipline, and we might expect to find collaboration only when it truly serves all researchers involved. But the RNA Center director described an open cooperative approach he noted as perhaps unique:

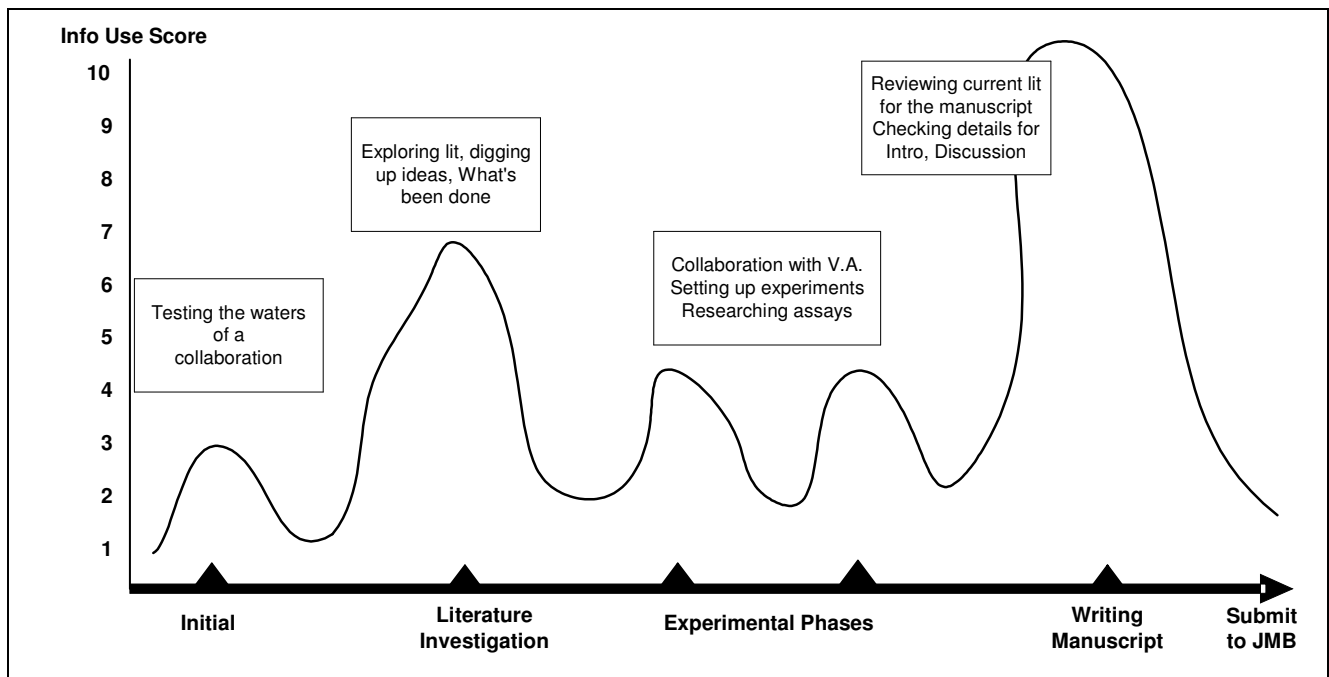
“Molecular biologists can be very tight about what we have – I think we all recognize the strength (people that DO collaborate) – if you have a reputation for being open, then people will come to you, they will seek advice, and it’s a mutually beneficial thing.”

Collaborations with other molecular biologists were not as common as those with experts from other contributing disciplines. They collaborated based on mutual and somewhat exclusive capabilities between researchers, to strengthen the quality of research:

“If you bring a set of observations to the table, and the other person brings a set of observations and they are complementary, then it makes sense to collaborate. Because the strength of the story together is much stronger than the story separately told.”

The RNA Center researchers target the top-tier journals, and reject faster, productive “incremental” publishing in favor of much longer writing cycles, in attempts to publish in Nature or Science. They used opportunities to improve quality but not *number* of articles.

“(One researcher) had some results that were complementary to some of ours, **we had just sort of serendipitously came together** – I had strongly advised him to write together, and then it would be published in a higher profile journal – and he insisted on submitting his work to a higher profile journal, and it got rejected – and in the end they were published separately, but not with the kind of strength they might have had if published together.”



The diagram illustrates a model used to capture information use and collaboration over the full period of a research project as defined by the scientist. This scientist’s description was similar to others in the RNA Center, in information use and collaboration. Collaboration was involved in “testing the waters,” or identifying an appropriate area and joint project. It was evidenced again in the experimental work; however, the writing phase involved more of a division of labor, and was largely written by the single researcher. The phases involving collaboration here were associated with a much lesser degree of information use and exchange (Info Use Score) than the individual phases of activity. Although these phases of activity are in no way canonical, they were similarly described by researchers, and may lend themselves to identifying specific CSCW tools for different types of joint research practice.

Importance of Collaborative Culture

One place where scientific collaboration may differ from other types of work is in the organizational culture of discovery-oriented research. I find it interesting how the verbal data shows researchers frequently ascribing an improvisational character to collaboration, such as the Center director’s quote above about serendipity. The attitude is somewhat like that of top-level jazz musicians recognizing the possibility of working with each other on a creative project – both the process and the work activity involve improvisation, respected experts contributing to a dialogue more than a structured project.

Because these types of stories were told by all the PIs, it reinforces the association of their research culture enabling their ability to effectively collaborate. While their collaborations were all uniquely individual situations, the RNA Center's organization fostered an openness to following unplanned collaborations.

While cultural barriers have been interpreted as constraining the adoption of collaborative technology in several studies, the RNA Center reveals a culture where collaboration is valued and promoted by the PIs. The researchers are given full independence, yet encouraged by leadership, values, and daily practice to work collaboratively among the PI's separate labs and with external partnerships. The organizational environment has been collaborative since the beginning of the Center, as a culture:

“I find it here, in Cleveland, we have much more contact with people than in Boston, for example – the atmosphere in Harvard Med is every lab to himself, you don't even talk to the lab next door. Here, we talk to everybody in the world – it's a different culture.”

Some pointed out the difficulties in managing collaboration – while collaboration may be valuable in broader research programs, it was considered somewhat risky as well. A post-doc's perspective was that collaborations required some effort to maintain, and to be effective must be based on sharing strong capabilities, “In my experience collaboration is a very involved process that is entered into with as much hesitation as a marriage.”

Observations and Questions

Perhaps we might support collaborative participation in different way with these inherently collaborative professionals. The issue may not be one of effective technology design, or fitting tools to practice, or other “traditional” approaches to solving these issues from a CSCW perspective. We may find other social, cultural, and practice factors in these domains of activity that require inquiry into motivations and drivers, not tasks. We may find different time horizons affecting intellectual collaboration, necessitating very different design approaches. The very question of “what is collaboration?” may be answered in unexpected ways by such practitioners as scientists (who may build collaborations over years), lawyers (driven to unusual collaborations by strategy or a client problem), or engineers.

Finally, I propose we further explore collaborative participation as dialogue, (e.g., sharing of ideas) and improvisation (exploring novelty and issues in an emerging discussion). I also propose a design agenda that explores tools that encourage these practices. But given the human factors involved in scientific collaboration, the issue may not be one of effective technology design, or fitting tools to practice, or other “traditional” CSCW approaches. We may find social, cultural, and practice factors in these activity domains that require our inquiry into motivations, social networks, and institutional/organizational cognition. We may find different time horizons affecting intellectual collaboration, necessitating very different design approaches. The very question of “what is intellectual collaboration?” may be answered in unexpected ways. These questions could lead to some interesting collaborations themselves.