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# Using Wikis to Generate Learning at ICIS 2007

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# USING WIKIS TO GENERATE LEARNING AT ICIS 2007<sup>1</sup>

*Utiliser les wikis pour générer de la connaissance durant ICIS 2007*

*Completed Research Paper*

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## Abstract

*Exploratory learning during academic research presentations, such as at ICIS, is essentially a process of what has been referred to as 'perspective taking and perspective making'. Technology support has generally been limited to back-channel conversations, such as chat, discussion boards, or instant messaging. Wikis, however, provide additional affordances that make it possible to support not only back-channel conversations, but what we call "back-channel contributions". We found support for the proposition that "backchannel contributions" made in a first-ever use of wikis at ICIS would overcome process losses associated with the audience not being able to speak simultaneously with the speaker, and allow the audience to share reactions to the speech not just with the speaker but with others in the room, and, as a result, would help participants generate new ideas and learn not just from the speaker, but from each other.*

**Keywords:** Web 2.0, Online communities, Collaboration technology, Wiki

## Résumé

*L'apprentissage exploratoire durant des présentations relève essentiellement d'un processus se référant à une « perspective de prendre » ou une « perspective de faire ». Les wikis fournissent le moyen de créer des canaux retours de conversations et de contributions, ce qui aide les participants à générer de nouvelles idées et à apprendre, pas uniquement de l'orateur, mais de la part de chacun.*

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## Introduction

On December 11, 2007, at about 2:05 p.m., the call was heard: “Wiki Users rev your engines and start wikiing”. So began an experiment at ICIS 2007 that had been months in preparation. Based on theories of perspective-making/taking, the questions that drove the research were: *Will participants generate new ideas and learning from each other when they are given technology that supports “back-channel contributions” for others to see while listening to a speaker? If so, what contributes to the learning?*

Perspective making is the process in which participants interact with others in their community to refine their own understanding of a topic through more refined definitions, ontologies, and relationships (Boland and Tenkasi 1995). At a community-level, perspective making involves participants being cognizant of others in the community and the refinement that is acceptable to the community (Boland and Tenkasi 1995). Perspective taking is the process in which participants interact with others in their community and with other communities to attempt to understand the contributions of others with very different perspectives on a topic and identify ways to enlarge or restructure their own perspectives to accommodate these alternative perspectives. (Te’eni 2001; Boland and Tenkasi 1995). This is done both at an individual level, when individuals indicate a restructuring of their mental models on the topic (Vandenbosch & Higgins 1996), and at the community level when individuals are cognizant of the changing perspectives of others in their community.

Learning in an academic research conference setting may be described as a process of perspective taking and perspective making at both the individual and the community level. In an academic research conference, community is often fluid and loosely defined around a topic and perspective as, for example, when a participant learns about another’s research and now realizes that they share a similar perspective on the research topic. .

In traditional conference settings, a speaker offers his/her perspective on a topic for 20-30 minutes, during which the participant is individually considering how to both refine and enlarge his/her own perspective on the topic. Then, traditionally during a question-and-answer (Q&A) session that follows the speech, comments are directed at the speaker’s perspective on the topic. This process may help to lead to an individual potentially enlarging his/her own perspective relative to that of the speaker’s perspective. However, this process provides little opportunity to interact with others who hold perspectives different from that of the speaker or discover perspectives that are similar to one’s own perspective. Therefore, individuals are unable to develop their own perspectives in light of the views of other’s within their own community, or within communities with different perspectives.

There are a variety of possible methods for providing an opportunity to interact with others’ perspectives. The most obvious is to redesign the speaker-Q&A format into a seminar format. A disadvantage of that approach is the lack of knowledge about what each person knows about the topic (Argote 1999). As such, the seminar is likely to degrade into a series of speeches from each seminar participant instead of creating interaction among all participants. An alternative is to have a speaker essentially provide a “prototype idea” around which each participant can react. That is, the speaker’s viewpoint can provide a boundary object that helps participants to share knowledge in order to co-generate new perspectives (see Carlile 2002, 2004; Gasson 2005; Levina & Vaast 2005, 2006; Star 1989, 1996). However, such an approach often results in focusing on only one or two prototype ideas as the audience is limited to either discussing each idea as presented and slowing or derailing the presentation, or waiting until the end and then trying to go back through the list of ideas and losing track of some of the ideas.

An alternative method for providing an opportunity to interact with others’ perspectives is to maintain the presence of the speaker’s prototype idea (i.e., speech) as a boundary object for cross-community sharing, but to supplement the presentation with technology that facilitates “back channels” among the participants throughout the presentation. Most technology options support “back-channel *conversations*”, such as text messaging, instant messaging, and discussion threads, involving question/reaction and response format (Reinsch et al., 2008). Back-channel conversations have been found to be quite helpful in exploitation-based problem-resolution, such as addressing individuals’ specific concerns and problems or conveying simple information (Reinsch et al., 2008), with the more concrete the problem, the more helpful the conversational approach (Ou 2007). However, for exploration modes of search such as those found in such fuzzy tasks (Zigurs & Buckland 1998) as abstracted problems of intellectual work (generating a new research direction on a scholarly topic at an academic conference, for example), participants need the opportunity to dynamically define and redefine questions, assumptions, perspectives, concerns, issues, and understandings, and easily build on each others’ definitions and redefinitions in a way that helps the participants to sense how their own evolving perspectives compares with that of others’ perspectives on the problem (Boland and Tenkasi 1995). While Q&A discussion threads can certainly support this perspective-making and taking, participants in discussion threads often find that, as the thread gets longer and more divergent (as is common with exploratory discussions), it becomes increasingly difficult to remember the different perspectives on a topic. Moreover, the linearity of discussion threads makes it difficult to return to issues raised earlier (Reinsch et al. 2008).

Finally, perspective-taking and making is more likely to occur in the context of joint decision making (e.g., Carlile 2004). A Q&A format allows participants to meet their obligations to the community (by raising and answering questions) but does not encourage them to accept the more difficult task of jointly taking and making perspectives (Wagner & Bollogu 2005).

Wikis may provide an alternative means for supporting exploration that overcomes the limitations of conversationally-based technology support. The format of a wiki is not Q&A, but rather short statements that participants make that can then be modified or added to by other participants, what we refer to as “back-channel *contributions*”; as such, it is easier for participants to observe the emergence of differing perspectives on multiple issues simultaneously, build on these different perspectives, and return to issues raised earlier. The organization of a wiki into subpages can facilitate the ability to quickly skim others’ contributions on a subtopic to determine if a community view on an issue is emerging, as well as return to issues raised earlier on other pages (Leuf and Cunningham 2001). Finally, wikis are often introduced into a context of co-generation and therefore involve a set of norms in which participants are expected to engage in perspective taking and making (Wagner & Majchrzak 2007).

For an academic conference, then, a wiki could be structured to support back-channel contributions, as well as back-channel conversations. To maintain the role of the speaker’s speech as a prototype boundary object that encourages focused sharing of alternative perspectives among the participants, the wiki could be seeded with the speaker’s main points and structure used to create the subtopics. To encourage perspective-taking and making, participants could be tasked not simply to share their own ideas, but to engage in a collaborative co-generation project, such as the generation of a white paper that others might read in which new research directions on the topic are identified (and possibly published). Finally, to encourage effective co-generation, the participants could be trained on the wiki way norms, such as sharing in short statements and focusing on ideas not people (Cunningham 2001). Such a use of technology and practice – to support participants to engage in back-channel contributions for exploration-based learning - has not been examined in previous research.

At the individual level, exploration-based learning has been described by Vandenbosch & Higgins (1996) as “model building learning”. Model-building learning is defined as the state in which an individual has obtained and integrated new knowledge in a way that causes a restructuring of his or her mental model of that domain. Restructuring of a mental model is manifested by assumptions of existing mental models being challenged, taking on a new perspective on the domain, or identifying creative ways of thinking about the domain. Model-building learning is to be distinguished from model maintenance learning, in which existing mental models are refined, standardized, and confirmed by the integration of new knowledge. Perspective-taking requires model-building learning; perspective-making involves model maintenance learning. At the community-level, exploration can be manifested by the emergence of new themes on the topic that were not addressed by the speaker (Boland & Tenkasi 1995).

In summary, we proposed that back channel contributions would facilitate individual model-building learning and emergence of new issues during a speaker-focused research conference session because a) the speech provides a boundary object around which the participants react, b) the reactions that participants share will help others to see how their own reactions are the same or different from the reactions of others, and c) that the sharing of these reactions helps people to refine their own perspectives and take on others’ perspectives provided they are encouraged to do so.

Therefore, we offer two specific propositions:

**P1: Providing participants with the ability to make back-channel contributions will lead to the emergence of ideas or issues raised by multiple participants that were not raised by the speaker.**

**P2: Providing participants with the ability to make back-channel contributions will lead to model-building learning and useful ideas attributable to other participants, not the speaker.**

The opportunity to take and make perspectives from back-channel contributions raises an exploratory research question. In any exploration-based activity, there is likely to be variation in participation, learning, and emergence. At the individual-level, then, variation is likely to occur in the degree of model-building learning experienced. The literature on collaborative learning suggests that learning is greater with a moderate degree of expertise in the field (not too much to create rigidity but not too little to create an insufficient basis for building new knowledge) (Hinds & Pfeffer 2003), some degree of familiarity and comfort with others from whom one is learning (see Edmondson 2003’s work on psychological safety), and some comfort with the technology being used (Davis 1989). Therefore, we raised an exploratory research question: *What factors explain variations in individual learning?*

## Procedure

A speaker was recruited months in advance who was willing to participate in a “first-ever event” at the ICIS 2007 conference in which participants would be using a wiki to co-create a white paper on the topic while the speaker was giving his speech. Dr. Robert Zmud agreed to be the speaker. He was asked to prepare a speech on a topic of his choosing, provided the topic required exploration in the field of I.S.(i.e., a topic for which review articles, meta-analyses, and consensus did not yet exist). The speaker chose to present on the topic: “Crossing Cognitive Boundaries with Diverse Practice Communities”.

Participants representing different perspectives on the speaker’s topic were invited months in advance to participate in the event. The different perspectives included different disciplinary foci (e.g., design science, behavioral IS, cognitive science), different methodological orientations (e.g., inductive, deductive, experimental), and different degrees of depth of knowledge about research in Information Systems (I.S.) in general, and the topic in particular. Therefore, the participants constituted a rich context for potentially taking others’ perspectives on the topic.

Participants were informed that the purpose of the event was to encourage greater exploratory discussion during a conference session by using wikis simultaneously with a speaker. Unlike a standard Wikipedia page, which encyclopedically catalogs facts, the purpose of this wiki was focused on co-creation. To increase the willingness to share their ideas, the participants were asked to co-create during the session a white paper on the topic that would describe a set of perspectives on the topic to encourage further research by IS scholars. If completed, the white paper would be distributed to the I.S. community via ISWorld. Participants ranged in level of expertise on the topic, from some who had more than one publication on the topic, to others who had never heard of the topic or key terms. Therefore, the degree of different perspectives among the participants was substantial.

A total of 15 individuals participated in the event (not including the four panel organizers and three people who started using the wiki and stopped early in the session due to technical difficulties). In addition to the 15 participants, there were approximately 65 more people in the room who arrived at the start of the speaker’s presentation to listen to the speaker give his traditionally-delivered speech. The 65 “observers” were informed that there were 15 people in the room engaged in their own activity of creating a white paper on the topic. The 65 observers did not interact with the 15 wiki users, and engaged in a traditional conference session by first quietly listening to the speech, and then engaging the speaker in a Q&A session, during which the 15 participants could choose to listen to the Q&A discussion and/or continue to make contributions via the wiki.

The 90-minute session was split into: 1) a 10-minute introduction by panel organizers, 2) a 20-minute presentation by the speaker, 3) 30 minutes of Q&A moderated by the speaker, and 4) a 30-minute open audience discussion moderated by panel organizers about using a wiki for future ICIS conferences. The wiki participants were asked to type their comments and edits directly into the wiki during the second and third time periods, for a total of 50 minutes.

### Technology Support for Back Channel Contributions

Prior to the start of the session, a wiki was created to support the back-channel contributions. The front page of the wiki is shown in Figure 1.

**Figure 1: Front Page of Wiki Providing Technology Support for Back Channel**



To create the boundary object for the participants to use for reactions, the wiki was split up into 10 hyper-linked pages, one page for each of the speaker's Power Point slides. The content of each slide was posted into the wiki page for that slide as a "seed" for the participants. In this way, the participants could use each page to react to the speaker's ideas that were pertinent to that page. An eleventh wiki page was added as a miscellaneous page as first in the list.

Participants were provided the opportunity for training on the wiki 2 weeks prior to the event. Of the 15 participants, 12 received training. During the training, it was determined that the participants felt uncomfortable editing others' words and therefore preferred to use the comment feature of the wiki and have the conference organizers place the comments verbatim into the wiki. Consequently, some of the practices around the use of the wiki in the event differed from that of a "traditional wiki". Despite these differences, however, participants continued to expect to make back channel contributions and see their role as that of co-generating a white paper.

## Methods

All wiki comments were captured on the wiki, chronicled by time and contributor. In addition, we video and audio-taped the interactions in the room. Thus, our primary data for identifying themes (as per Proposition 1) consisted of an integrated transcript of the speech provided by the speaker, the wiki comments provided by the participants in the wiki experiment, and the question and answer session in which wiki participants, the speaker, and the non-wiki audience participated.

To assess Proposition 2 about extent to which the session led to individual learning and useful ideas, we conducted an interview with each of the participants immediately after the session to ensure recall, in which the participants were asked: *Were there any parts of the unfolding contributions to the wiki that you found useful to your thinking?* We asked participants to focus on contributions to the wiki to ensure that their answers were not focused on the speakers' presentation, but rather the back-channel discussion that ensued on the wiki. Respondents indicating a "yes" answer were asked to provide specific instances of contributions. In addition, as the session was ending, we asked the wiki participants to complete a questionnaire measuring two indicators of model-building learning they had experienced from the session: 1) five items from the Vandebosch and Higgins (1996) scale on model-building learning: *"To what extent did the session a) foster your creativity, b) help you realize that IS artifacts can be thought of in a broader way, c) made you question your assumptions about IS artifacts, d) encouraged you to re-orient how you think about boundary objects as IS artifacts, and e) improve your insight into how to design IS artifacts"*(using a 7 extensiveness response options), and 2) four items asking if the session had sparked new ideas: *"Compared to other conversations you've had about IS artifacts, to what extent did you feel this session: a) produced a number of new ideas, b) produced significant ideas, c) produced useful ideas, and d) produced ideas in less time"* (using a 7 response options).

Finally, to address the exploratory question of the role of expertise, familiarity and use of technology on individual learning, we collected data on each of these factors for the 15 participants:

- An emailed questionnaire to each participant prior to the session to ask about their familiarity with other participants and experience with wikis. To assess familiarity, participants were provided the list of all participants and asked to provide an open-ended response indicating the type of working relationship (if any) they had with each person over an extended period of time. Examples provided included: reviewer/board, editorship, co-authorship, PhD committee, and advisor). Familiarity was counted as the number of other participants that the individual is familiar with. Experience with wikis was measured as a single 5-point response item asking the number of times they had used wikis before.
- A paper-and-pencil questionnaire completed by the participants immediately after the session which measured perceptions of the participants' *difficulty with the multi-channels of listening to the speaker and writing on the wiki* (one question asked: "how easy was it to handle two channels of communication simultaneously"; another set of 3 questions asked: "to what extent did you focus your attention on the speaker's presentation, on the wiki, and reading contributions of others), and *wiki ease of use* (using four items from Davis' ease-of-use scale: To what extent was the following true about the wiki: learning to operate the wiki was easy for me, I found it easy to do what I wanted to do with it, my interaction with it was clear and understandable, I found it easy to use").
- Analysis of each individual's vita to assess expertise in the domain, defined as the number of publications listed that had "boundary object" in the title, abstract or as keywords; number of articles returned from a Google search in which the individual's name and "boundary object" was entered as search criteria; and number of years past PhD in the IS academic discipline.

## Results

The results section is subdivided into those results related to Proposition 1, Proposition 2, and our exploratory research question.

### ***Proposition 1: Did ideas or issues emerge that were not raised by the speaker?***

Proposition 1 stated: Providing participants with the ability to make back-channel contributions will lead to the emergence of ideas or issues raised by multiple participants that were not raised by the speaker. To assess evidence related to this proposition, we examined the transcript which sequentially interwove into the same timeline the wiki comments (including the exact quote, the time the comment was entered, and the comment author), the speaker's speech, the speaker's seed in the wiki, and comments raised by the audience during the Q&A session.

During the 50 minutes in which wiki comments were contributed, a total of 149 posts were added to the wiki, with an average of 7.8 comments per participant, ranging from 3 to 17. There were a large number of posts during the presentation, and the rate of posting slowly decreased during Q&A. The rate of posts during the presentation averaged 4 per minute, and decreased to 2.3 per minute during the Q&A. The post totals were evenly distributed between the presentation (54%) and the Q&A (44%). On average during the entire event, a participant was posting a comment every 6 minutes. While the minimum number of comments across the participants of 3 indicates that all 15 participants participated by making contributions, the level of activity – one comment every 6 minutes on the average – was not as high as we had expected. However, one comment for every 6 minutes suggests participants had time to either listen to the speaker and/or read others' comments in the wiki to assess the perspectives that were evolving within the community of participants.

The wiki was organized into 11 pages. The first page was a page for miscellaneous comments. The remaining ten wikipages were keyed to each of the speaker's ten PowerPoint slides by titling the wikipage the same as the PowerPoint slide, and including a copy of the PowerPoint slide into the wikipage. All pages were available for posting during the entire 50 minutes. Individuals could post to any page in any order at any time. Table 1 presents the number of posts (limited to substantive comments and edits) made by the participants for each wikipage, followed by the number of different participants posting to that page.

**Table 1: Posts to Each Page**

Wiki Page	# of posts (comments & edits)	# of different participants who posted (out of 15)
General	8	4
Diversity across practices	11	8
Boundary crossing in Organization Science	1	1
Boundary crossing in IS	7	5
Syntactic, Semantic, Pragmatic pathways	8	6
Definition of Boundary object as I.S. artifacts	11	7
Purposes of Boundary Objects	10	6
Functionalities of Boundary Objects	9	6
Boundary Object types	7	7
Sample Research Questions	8	6
Research Opportunities	24	14

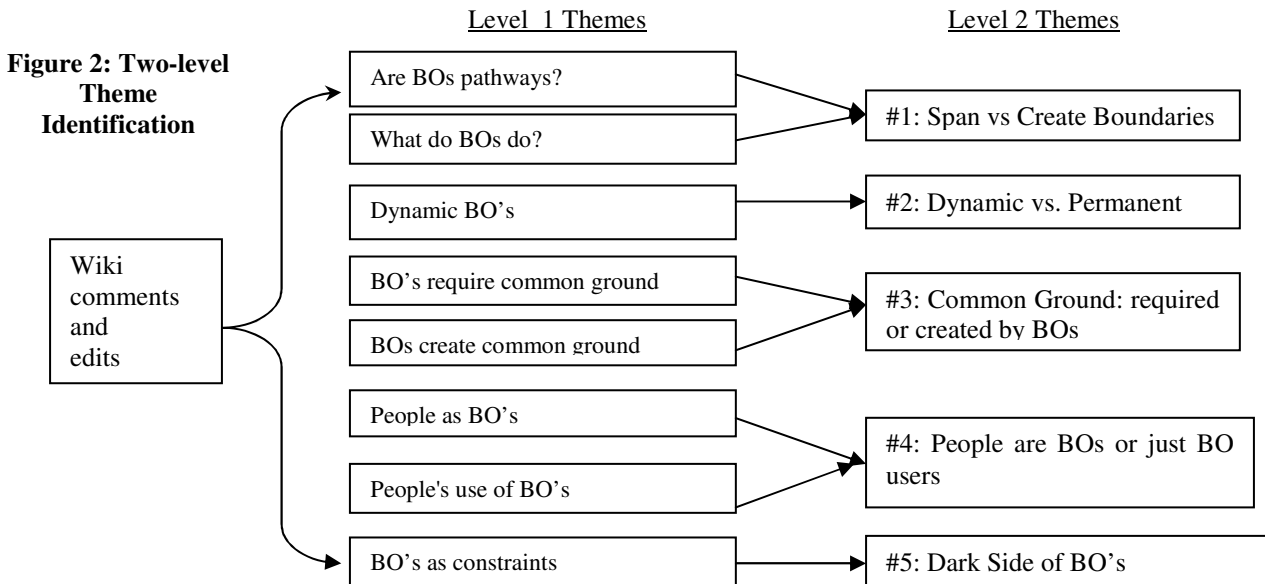
Table 1 indicates that all but one page (about a different field, Organization Science) received some attention by the participants, and nine of the 11 pages received similar levels of attention (this does not include the last page which consisted of a listing of research questions). In addition, for the same nine pages, 30-50% of the participants commented on that page. Thus, while there was approximately equal attention to each page (aside from the 2 pages treated as exceptions), the average of 7.8 comments per person plus different people commenting on the different pages indicates a diversity of participants contributing to the different pages.

Given that each page received some attention by the participants, we then proceeded to examine Proposition 1: the emergence of ideas or issues that were raised by multiple participants rather than the speaker. To identify the

emergence of ideas or issues, we adopted the notion of “moves” from Pentland (1992) in his study on how knowledge work is performed in software support hotlines. In his study, Pentland defined moves as an action or verbalization, followed by another action/verbalization, followed by an acknowledgement. Therefore, the 3 investigators examined the wiki comments for moves, coding “points”(i.e., Pentland’s actions) made by a participant, “counterpoints”, and “affirmations of counterpoints” as a resolved argumentative move within a wiki page. This coding determined that the PowerPoint slide of the speaker (that was copied into the wikipage) and the speech often were used as the initial points in an argumentative move within a wikipage, to which wiki participants offered counterpoints and affirmations within the page. Moreover, while there was at least one resolved argumentative move within each page, the moves typically included only 2 people: one participant’s counterpoint to a point in the speech, and another’s affirmation of the counterpoint. Moreover, on every page, there was at least one point and counterpoint that was *not* followed-up with any affirmation. For example, the speaker made a point that, “communication failures were due to cognitive differences, in addition to other differences.” A wiki participant raised a counterpoint that there were also pragmatic differences that were important. There were no follow-on responses to this point-counterpoint within the same wiki page. Thus, while we found argumentative moves within a page, we did not find issues or ideas that were raised by multiple (i.e., more than 2) participants. This suggested to us initially that Proposition 1 was not supported.

However, repeated re-reading of the transcript by the three investigators indicated that an assumption we had held was incorrect. We had assumed that moves would occur within each wikipage, since we had assumed that the wiki participants would follow the imposed structure of the presentation’s flow by responding to each other’s comments only within each page. Our re-reading indicated, instead, that moves were occurring between wiki pages, not just within a wiki page. That is, the speaker’s seeds sparked reactions from participants that were similar across wiki pages. Further, we found that posts by individuals to the wiki independent of the presenter’s material also served as seeds for further conversations.

Following established theme extraction protocols (Anand et al., 2007, Anand and Watson, 2004) we developed and verified the themes through an iterative process that initially grouped the comments by first level themes and then synthesized these first-level themes into a final set of second level themes. One investigator initially went through the transcript and video to identify an initial grouping first-level themes of moves and then again for second-level themes of moves. A second investigator then did the same thing independently and then the two investigators asked a third investigator to supply evidence of the themes from the transcript. After verifying that there was sufficient evidence to support each theme the three investigators discussed the differences before arriving at this final agreed upon list of five themes. Figure 2 shows the process for developing the first and second-level themes and below we present samples of the wiki postings supporting the second-level themes and the first-level themes embedded within them.





**Emergent Theme #1: *Do BOs span boundaries or do they create new boundaries?*** (23 posts across 7 pages and 7 participants). This second-level theme was composed of two first-level subthemes of moves: Are BOs pathways? and What do BOs do if they're not pathways?

The first subtheme in which there was significant posting effort was focused on the issue of whether BOs span boundaries or not. This set of moves was sparked by the speaker referring to BOs as "conduits" and "pathways".. This led to a series of counterpoints across seven different wiki pages with affirmations by others such as "What does "pathway" mean? Carlile used the term knowledge boundary? Why a change in terminology. Why pathways?" "Knowledge doesn't just flow, it gets integrated so that the whole is bigger than the sum of the parts". "Boundary objects are NOT conduits! This is a very different communication perspective that the boundary object perspective is not consistent with." Some tried to resolve the point-counterpoint discussion: "This is a very individualistic/cognitive perspective. Star and Carlile were both analyzing at the CoP level. So boundary objects may be equivalent to conduits if we constrain the analysis to the individual level."

The second subtheme related to the first subtheme since the posts ruminated on what BOs do if they're not pathways. Comments focused on the notion that BOs may not span boundaries, but in fact may help to create or reify boundaries: "BOs are process steps as in steps in systems development; these create boundaries", "I am not sure that wikis help overcome cognitive boundaries. My sense is that it creates new ones due to its fragmentation during communication"; "Is it not the case that boundary objects have purpose in separating communities"; "BOs define the boundary around the common enterprise to separate in-group members (e.g., project participants) from out-group (those who do not have the intellectual resources or the physical access to boundary objects).

Therefore, in this first emergent theme, the participants identified an issue that the speaker clearly had not raised: whether boundary objects may not be conduits of knowledge flow at all, and in fact may reify boundaries rather than cross them.

**Emergent Theme #2: *Should boundary objects be conceptualized as dynamic, changing over time vs. are boundary objects there to create permanence over time?*** (17 posts across 6 pages across 7 participants). There was only one first-level theme associated with this set of views that concerned the static vs. dynamic nature of BO's.

The speaker raised the initial point that pathways need to be overcome. Then a counter-point was raised: "could different boundaries present themselves at different points in time?" This was followed by a series of affirmation comments: "Can development of BOs be accelerated or is there an 'aging' process associated with them?", "How fast to span the boundary objects? Which factors will influence the boundary spanning and the speed of boundary spanning"; "A boundary objects would be helpful for X period of time and at this point it would be less helpful or not needed anymore. That seems interesting...life cycle of a Bo"; "so BOs are dynamic".

Therefore, in this second emergent theme, the participants identified an issue amongst themselves that the speaker had not raised: whether life cycle of boundary objects.

**Emergent Theme #3: *Is common ground a desired consequence of a boundary object vs. is the boundary object an antecedent?*** (17 posts across 6 pages across 7 participants). The posts related to this theme combined two subthemes. In the first subtheme, there was much discussion that BOs create common ground. In the second subtheme, the opposing view was raised: that common ground was required in order for BOs to be used.

This subtheme describes the discussion that ensued about common ground being consequence of a boundary object. The point that started this subtheme was a comment made by the speaker that comprehension failures impede collaboration. Several elaborated on this point: "Couldn't you use a BO to develop common understanding?" "Carlile would argue that a BO can provide common ground in the sense of a shared frame for joint action"; "Importance of surfacing ambiguities - Much of the difficulty crossing such boundaries is the very real possibility that people may use similar labels to refer to quite different topics or meanings. Therefore, it is critical that a mechanism be created (a "clearinghouse") to ensure that everyone shares the meaning of basic concepts.

However, in the second subtheme, several raised the counter-point that the purpose of the boundary object was not to develop a common ground, but needed to build on a pre-existing common ground. "I don't think a boundary object can establish common ground. If it is differentially perceived by different classes of participants, then by definition it is not shared. This is not the same as the classic definition of common ground (e.g., having experienced exactly the same thing together with someone)." "It seems to me that a boundary object fails because the community of practice in question has not developed in advance an

effective shared understanding of what it should be doing with and learning from a particular class of boundary objects ; “boundaries are crossed by accepting common foundations”. “ Effective boundary objects should first establish a shared syntax or language for individuals to represent their knowledge; and, second, provide a concrete means for individuals to specify and learn about their differences and dependencies across a given boundary (Carlile 2002)” “A shared understanding cannot really be created by a boundary object, can it? Would you not have to have some existing interpretation of the BO to begin with?”

Therefore, while the speaker surfaced the issue that boundary objects create common ground, the wiki participants raised an alternative: that boundary objects are the product of a common ground rather than catalyst.

**Emergent Theme #4: *What is the role of people with respect to boundary objects: Must boundary objects be used by boundary object spanners or can anyone use a boundary object and thus people are not a critical point of discussion?*** (7 posts across 5 pages and 5 participants). Posts in this theme focused on whether boundary objects need people to be useful as boundary objects, and whether or not people can be boundary objects.

In the first subtheme, comments were raised about whether people are needed to help boundary objects be effective. These comments were started based on a point raised by the presenter in which boundary objects were discussed independent of how humans would use them. Counter-points included: “ To engage in sense-giving across professional communities, would it not be necessary to deeply understand the other person’s community and in essence translate for them from your own? Can a boundary object accomplish this, or does it require human interaction, intentionality, etc.?”; “Levina and Vaast (MISQ 2005) argued that boundary objects and boundary spanners are complementary and together must habituate joint fields in which cross-disciplinary work gets done.”; “While the concept of boundary objects seems important, it seems that how people use the boundary objects is also key.”

In the second subtheme, comments were raised about whether people themselves could be boundary objects. “Can an IS professional “be” a boundary object?” said one participant. A counterpoint was raised by another: “ We need to distinguish between the agents (boundary spanners) and the objects (Boundary objects). People are users or interpreters of BOs rather than BOs themselves.”

This theme of the role of boundary objects vis-à-vis the humans that use them were not initially raised by the speaker.

**Emergent Theme #5: *The dark sides of boundary objects vs. boundary objects are there to be helpful*** (4 posts across 3 pages and 3 participants). Posts in this theme a subtheme about whether boundary objects intended to facilitate innovation can also constrain innovation, and even deceive, impede, and manipulate people.

This subtheme was stimulated by the speaker generally presenting a positive image of boundary objects as helpful. A wiki participant raised a counter-point: “Some forms of BO are selected to constrain knowledge transfer at the boundary to specific types of knowledge or interaction scope.” This point was affirmed: “It is also possible that a boundary object might present some aspects of reality as “given” to one community when in fact they are malleable, but it is not clear from the object that this is the case. So, to the extent that they lead individuals to believe that there are fewer dimensions of possibility than really exist, they would constrain creativity.” Another confirmation of the counterpoint: “Goffman argued that the best evidence for determining the truth is also the best for manipulating the truth. An artifact that others partially or differently understand is ideal impression management or even deception.”;

The speaker responded to these comments, some of which were echoed in the Q&A with: ‘You’re raising some issues that actually I’ve not thought about’, providing verbal confirmation that this was another example of an emergent theme.

In sum, the analysis of the wiki comments indicated that, as suggested by Proposition 1, emergent themes not raised by the speaker were stimulated through the back-channel contributions. We find it interesting that the emergent themes – unlike the presentation - could each be phrased as tradeoffs: between spanning vs. creating boundaries, between boundary objects as dynamic vs. stable objects, between common ground as a consequence vs. antecedent, between people as users vs. boundary objects themselves, and between boundary objects as helpful vs. harmful. This suggests that one of the values of the back-channel contribution might be to encourage perspective-taking by encouraging people to share and elaborate on their alternative perspectives – something that might be difficult to do during a presentation.

**Proposition 2: Was learning generated at the individual-level?**

Proposition 2 stated that: Providing participants with the ability to make back-channel contributions will lead to model-building learning and useful ideas attributable to other participants. We used three indicators to assess model-building learning and useful ideas. First were the responses to the open-ended interview question: *Were there any unfolding contributions in the wiki that you found useful to your thinking? if so, please list them.* Second, was the quantitative data on model-building learning from the questionnaire. Finally, we used the quantitative data on new ideas sparked by the session from the questionnaire. Table 2 presents the data for the 15 respondents.

Apparent from Table 2 is that, generally there was overlap among the 3 indicators. The first 5 respondents provided comments indicating that the contributions were useful to them, and had higher scores on both the model-building scale and the sparking new ideas scale. We labeled these five respondents as “learners”, as indicated in the last column of the table. The sixth respondent showed some equivocality, indicating that that some contributions were useful, and that the session had sparked new ideas, but a relatively low score on the model-building scale. Since other respondents were generally not equivocal in their view that they had failed to find the contributions on the wiki useful, we decided to label this equivocal respondent as a learner since they did not explicitly state that the contributions were not useful. Thus, out of 15 participants, 6 could be labeled as having obtained useful ideas from the use of back-channel contributions. Clearly, 6 out of 15 participants suggest that the experience was successful for some, but not others. In the next section, we explore differences between the learners and non-learners in an effort to find explanations for why some learned from this experience and others did not learn.

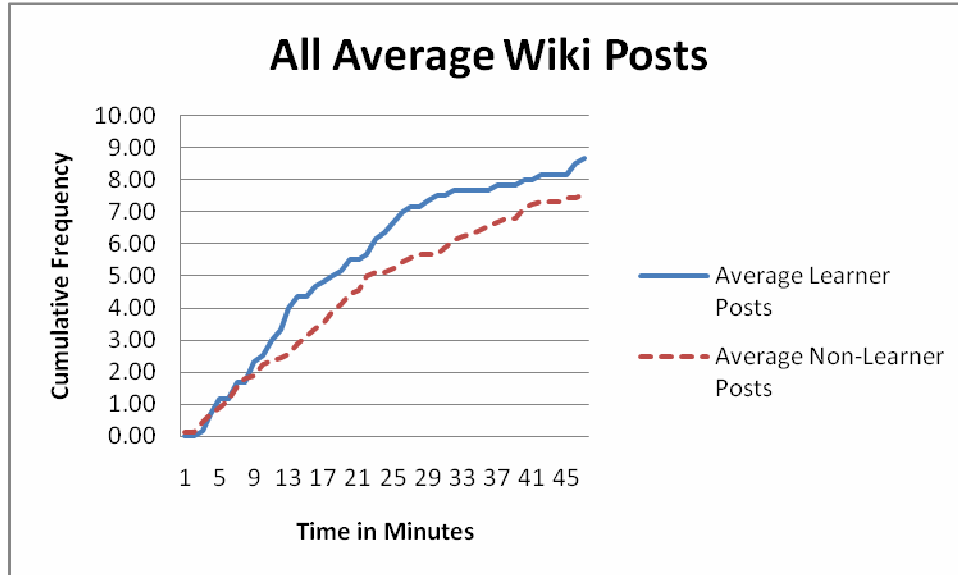
**Table 2. Participant Responses on What was Learned (n=15)**

<b>Interview Question: Were there any unfolding contributions to the wiki that you found useful to your thinking</b>	<b>Model-Building score (out of 7)</b>	<b>Did Session Spark New Ideas? (out of 7)</b>	<b>Learners(1) vs. Non-Learners (0)</b>
Ideas that sparked me, like the I.S. conduit being a Boundary Object. No, it is not. Structure vs. channels. Peter talked about something that helped me realize people were confusing the two.	6.8	6.2	1
Reply to reply, whether standard boundary objects or any object constrain creativity and thinking; sometimes constraints.	5.6	4.5	1
The whole discussion on the nature of the wiki. When we talked about the nature, to me, was what was interesting. What it is, and how to use it?	5.4	5.3	1
I was thinking more about boundary objects, thinking about a meta boundary object not in the (Zmud) presentation.	5.2	6.2	1
Several people in the audience know a lot about boundary objects. I found their comments to be useful.	4.2	4.5	1
There were some contributions that I followed and responded to there.	2.2	4.2	1
Didn't have time to read, less talking than typing is our loss.	4	4	0
No	3.2	2.2	0
No, I couldn't listen to the presentation and do the wiki...so I listened to the presentation. I thought the discussion was interesting	3	4	0
I would have to say no.	2.6	2.2	0
No	2	1.7	0
How someone pointed out that boundary objects are not conduits.	2	2.7	0
No	1.2	1	0
No, I didn't have time to read (others comments)	1.2	3.5	0
I had problems listening to Boundary object and thinking at the same time. I thought Boundary object went too fast for the wiki people. I suggest he pause and give others time to think	Missing	2.5	0

**Exploratory Research Question: What factors might explain the variation in individual learning?**

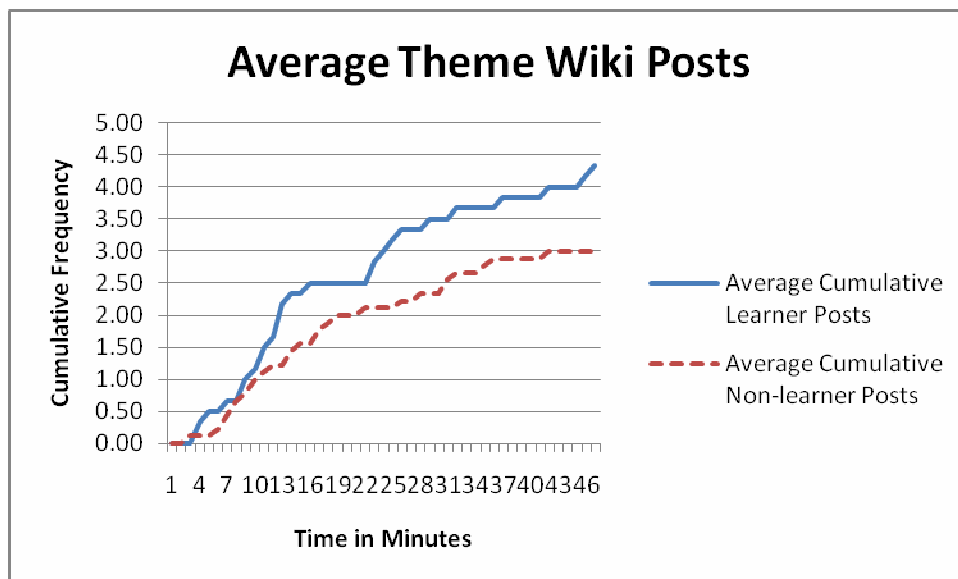
One possible factor that might explain the variation in learning was in the way that the learners contributed to the wiki process. We created a timeline to map the dynamics of the wiki conversations. Based on the timeline, we created a cumulative frequency graph to show how learners and non-learners differed in contribution specifically to the emergent themes. In Figure 3, we show, as a baseline, the cumulative frequency distributions for all wiki contributions for both the average of learners (N=6) and non-learners (N = 15). The cumulative contributions are similar until about nine minutes into the presentation at which time the average learner contributions increase beyond those of the non-learners.

**Figure 3. All Contributions to the Wiki for Learners and Non-learners (Average)**

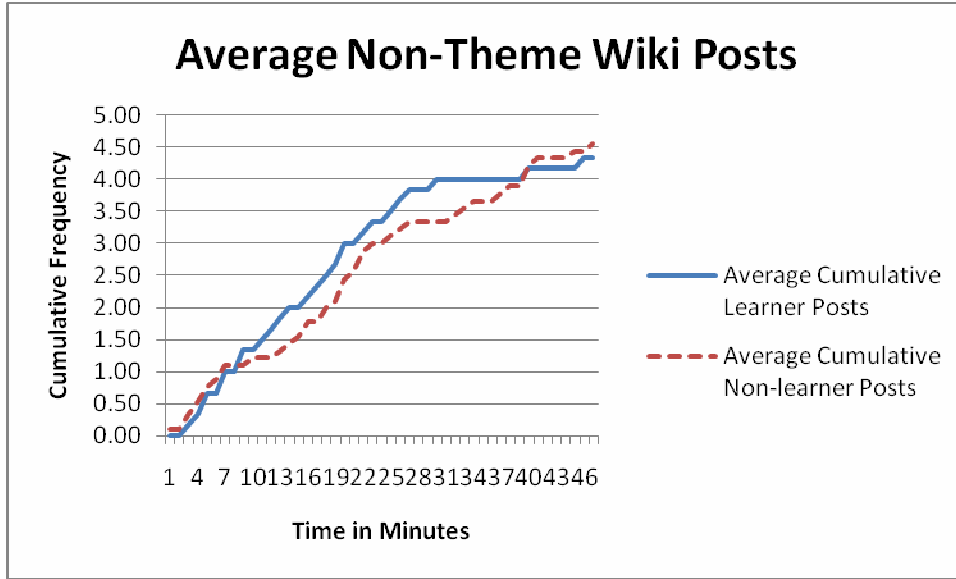


We then separated wiki posts for those that were specifically contributing to emergent themes (Figure 4) from those that were contributing to the wikipages as originally structured (Figure 5). Comparing the two figures show that, when the contributions to the emergent themes are separated from the non-theme contributions, the learners make many more contributions to the wiki for the themes than the non-learners.

**Figure 4. All Theme Contributions to the Wiki for Learners and Non-learners (Average)**



**Figure 5. All Non-Theme Contributions to the Wiki for Learners and Non-learners**



Not only do learners contribute more by themes than non-learners but the learners also respond to more themes than do the non-learners. The average learner contributed to 2.6 themes while the average non-learner contributed to only 1.9 themes. Thus, despite the number of posts between learners and non-learners being approximately the same, the contributions to the emergent themes appears greater among the learners, suggesting that learners were engaged more in the emergent themes than in the structured wikipages.

Finally, we conducted simple non-parametric statistics for the three factors of expertise, familiarity and use of the technology to determine if there were any differences between learners and non-learners. We found no differences for ease of technology use, wiki experience, familiarity with other participants, and domain expertise. .

Learners were marginally significantly more likely to attend to the contributions of others in the wiki ( $p=.06$ ) and less likely to attend to the speaker ( $p=.07$ ) compared to non-learners (see Table 3). This quantitative result is consistent with our qualitative analysis of the wiki posts discussed previously. Therefore, in addition to differences in how they used the wiki process, one possible explanation for the difference in learning among some of the participating individuals is that they were able to focus on others' contributions in the wiki, essentially "tuning out" the speaker.

**Table 3. Mann-Whitney U on Differences in Attention Focus for Learners and Non-Learners N=15**

	Learner=1	Mean(N)	Mean Rank	Sum of Ranks	Mann-Whitney U
Focus on Speaker	0	4.33 (9)	9.67	87.00	12 ( $p=.07$ )
	1	2.50 (6)	5.50	33.00	
	Total	15			
Focus on Wiki	0	4.89 (9)	6.78	61.00	16 (ns)
	1	6.00 (6)	9.83	59.00	
	Total	15			
Focus on Others	0	2.78 (9)	6.28	56.50	11.5 ( $p=.06$ )
	1	4.83 (6)	10.58	63.50	
	Total	15			

## Conclusions

This research addressed the question of whether back-channel contributions would affect learning and generation of useful ideas in a context of a “wicked problem” - exploration during an academic conference of new concepts and issues pertaining to an under-explored research topic. Using theories of perspective-taking and perspective-making, we proposed that support for back-channel contributions would facilitate emergence of themes in the collective as well as individual learning when:

- a) A diverse set of participants are asked to participate in order to obtain a variety of perspectives.
- b) The participants are induced to seriously consider others’ perspectives by being asked not simply to answer others’ questions but to co-generate a white paper on the topic with others
- c) A speaker offers a prototype idea to serve as a boundary object against which participants react
- d) The participants are provided technology support for not simply offering back-channel chat/Q&A, but offering back-channel contributions in order to revisit, reorganize, and reconsider previously raised issues.

We found, based on the participation of a collective of 15 academic researchers using a wiki during a 50-minute speaker-led session, five themes emerged from the contributions that were not identified by the speaker. In addition, the fact that all five themes were discussed as ironies can be used to help focus the further development of a white paper on the topic. We also found that six of the participants reported learning from other contributors, not just the contributions made by the speaker. Looking for explanations for learning behavior, we found that learners used the wiki differently by focusing less on the wikipages in general and more specifically on the emergent themes. We suspect that the emergent themes captured their attention, which they in turn maintained the interaction through further contributions, creating a positive feedback cycle. We also found that, compared to non-learners, learners focused on the contributions of others on the wiki; thus, helping to maintain energy level within the back-channel contributions.

Only 15 people participated in the collective action and therefore, it is not representative. Moreover, we had no direct control group to compare our findings, such as a group in which only back-channel conversations were permitted, or a group in which no back-channels were permitted – controlled manipulations not possible in the context of an ecologically valid event in the middle of a conference. Thus, future research needs to compare learning outcomes between back-channel conversations vs. contributions. Additionally, it is possible that the six individuals who learned might have learned in any situation, and thus, their learning was a function of their personality traits. To explore the possibility of traits as explanation, we asked each individual, in the pre-event questionnaire an open-ended question about their expectations for learning from the event and found all 15 individuals reporting enthusiasm for learning. Moreover, since their participation was completely voluntary with no incentive provided to attend, we inferred that they had an inherent interest in learning. Thus, while it is possible that the six individuals who learned may be more predisposed to learning, we believe this explanation is probably too facile to explain the results. More likely are the behaviors of participating in the wiki discussion and their positive expectations about a discussion of BO’s. Finally, the fact that the emergence of the themes included comments from all 15 individuals – even the non-learners – suggests that learning was probably not completely predisposed to individual traits. Therefore, we hope these findings at least inspire – even tentatively so- breakthrough thinking in how technology might be used in conferences in particular and in exploratory contexts in general.

Our contributions are two-fold. First, theoretically, we have suggested refining the concept of multicommuting (Reinsch et al. 2008) to include not only back-channel conversations but back-channel contributions, which allows the consideration of a variety of alternative perspectives viewed as critical for the importance of perspective taking and perspective making to any exploratory activity – especially that of academic inquiry. Listening to 20-minute speeches at a conference may inform listeners of one perspective, but limits exposure to the other perspectives. The opportunity to learn about these other perspectives, as reactions to the speech, can be afforded through the use of back-channel contributions, in which participants are able to share their reactions and build on others’ reactions. By seeding the back-channel with the speaker’s presentation, participants are provided with the means to become exposed to others’ perspectives when all the participants are focused on the same boundary object – the speaker’s ideas. As such, bridging the gaps between the perspectives is made simpler. Moreover, we argue that, by encouraging participants to use the wiki to co-generate a white paper on the topic (rather than simply answering others’ questions) engages the participants in making the attempt to understand others’ perspectives. Finally, the persistence provided by the technology support for this back-channel allows participants to revisit earlier issues, addressing them out of the order in which they are raised, on other pages.. These affordances may help to facilitate the emergence of new themes – such as the ironies we observed – that were not raised by the speaker. Therefore, this research proposes a theory for understanding why back-channel contributions may help learning, and the conditions

under which learning is most likely to occur. Further research is needed to explore these tentative conclusions. Ideally, true, controlled, rather than natural experiments, would be conducted to assess the degree to which the different conditions are needed, and produce learning through the mediating effects of perspective-taking and perspective-making.

This theorizing suggests an avenue for further research: understanding the detailed process by which themes not initially raised by the speaker were surfaced by the collective. In this study, five themes emerged, all of which were ironies that were not initially identified by the speaker. The surfacing of the ironies is an important first step toward the development of a higher-order understanding of the phenomenon. It is impressive that, within 50 minutes, the collective of 15 participants was able to collectively identify five important ironies which provide a basis for organizing the research status and future research needs in that topic. This raises several interesting research questions. What led to the five themes emerging? We are in the process of a more detailed analysis of the comments, but so far it is not clear what explains why these five themes emerged and others did not emerge. If the collective had more time, would the participants have taken the five themes and not simply surfaced them, but also expanded them to identify ways to conduct research for resolving the ironies? Or would a conversational form of collaboration, rather than a contribution-based form, be required for moving forward? Recent theorizing on multicommuting (Reinsch et al. 2008) has suggested that communication tasks that require convergence of views may suffer if using the type of multicommuting embodied in wiki-based back-channel contributions because it encourages dividing attention among different subtopics and delaying comments that respond to others' contributions. Is there a natural limit on what back-channel contributions are able to accomplish, given limited time and attention focus?

Finally, our theorizing attempted to understand the variation in individual learning observed. To our surprise, learners had similar levels of expertise and familiarity with others than the non-learners; they also had the same perceptions of the difficulties of the technology and the same level of experience with the technology. Learners were marginally more likely to attend to others' contributions, however, which, based on perspective-taking theory, helps to explain their greater learning. However, what factors explain why some (i.e., the learners) were willing to attend to others' contributions in the wiki, while other participants (i.e., the non-learners) were not? Since, as we have argued above, that the participants generally reported the same expectation level of learning, we suggest the amount of learning experienced may not be pre-determined by traits or openness, but may be an emergent property of the interaction that occurs in the back-channel. We noticed that some participants initially posted comments that were essentially ignored by the other participants. Possibly, being ignored by others early in the interaction process may cause some individuals to lose their enthusiasm for the process and therefore their willingness to engage in the difficult task of multi-channel processing, attending to others' contributions, and consequently, model-building learning. Further exploration of this process is needed in order to offer managers suggestions on how to structure back-channel contributions.

Our second contribution is to the design of technology support for back-channel contributions. The dual requirement of using a new tool (wikis) and attending to multiple channels of communication simultaneously proved extremely frustrating to the participants. Therefore, this should be avoided in the future. One suggestion made by a participant in the room was to open a wiki prior to the conference. "Then let the people evolve the wiki prior to the conference and the discussion among the contributors at the conference could be the focus of the session. The paper, in a sense, would have been presented prior to the conference." In a somewhat different vein, we suggest that the wiki could be used not for specific sessions or speakers, but rather for the themes or topics that usually form a basis of grouping papers across multiple sessions. A wiki could be opened at the beginning of the conference on that theme or topic, and participants encouraged throughout the conference to contribute to that wiki as they visit sessions, talk to others, or simply desire to become involved. In this way, the requirement for simultaneous and multi-channel processing is removed, as well as the time constraint and the need to follow the speaker's structure. The wikis could be made public and displayed during the conference so others could see the evolution. Wikis that result in some sort of breakthrough or white paper could then be moved into a more typical publication development stream.

In conclusion, we believe that wikis should be further examined – not simply as an encyclopedia or knowledge management tool – but for their potential value for exploratory discussions. By providing the opportunity for back-channel contributions, learning from others (not just speakers) and new themes for exploration may emerge.

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