Facilitating transdisciplinary sustainable development research teams through online collaboration

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Facilitating transdisciplinary sustainable development research teams through online collaboration

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Abstract

Purpose – The purpose of this paper is to discuss the potential of online communication technologies to facilitate university-led transdisciplinary sustainable development research and lower the ecological footprints of such research projects. A series of case studies is to be explored.

Design/methodology/approach – A one year project is conducted in which a series of research tasks are carried out on an online communications platform. Findings are compared to other examples from the literature.

Findings – Online communication technology can be used to facilitate transdisciplinary research tasks, saving time, money and with less environmental impact than that of face-to-face meetings. However, in order for online collaboration to be successful the researchers must be very organized and have strong facilitation skills.

Research limitations/implications – The research takes place in a North American setting. Time zone issues and access to sufficient internet technology can be a barrier in global research collaboration.

Practical implications – Online communication technology can be a practical way to lower the environmental impact of the research process and lower the cost of collaborative meetings.

Originality/value – The outcomes of this research suggest online collaboration can play a much larger role in student and faculty research, including but not limited to online research analysis, data collection and field exploration.

Keywords Research, Sustainable development, Communication, Communication technologies, Canada

Paper type Research paper

Introduction

Conducting research in the area of sustainable community development provides a series of challenges to professors and the graduate student researcher alike. As ecological and social systems are interconnected, complex and unpredictable, their study falls outside of the usual disciplinary structure, and frequently bridges both the natural and social sciences. One notable international example is the United Nations Intergovernmental

Panel on Climate Change assembled in 1995, which brings together over 100 social and natural scientists from around the world. Other examples include the scientific consensus around the hole in the ozone layer. An organizational example is the Canadian Consortium for Sustainable Development Research that brings together natural and social science researchers from post-secondary research and teaching/research programs from across Canada (http://ccsdr.crcresearch.org/index-hp.htm).

In the case of such issues where the social and environmental aspects of an issue must equally be considered, it is clear that interdisciplinary research teams must be assembled at the beginning of the research project to address both the scientific, specifically ecological, and social aspects of the issue. As social-ecological systems are trajectory dependent, however, research in the area also often requires the participation of local knowledge experts as they understand the histories of the ecological and social systems under study. The state of a community and its surrounding ecosystems is formed by past behaviour, and thus history is an important key to understanding the system. Study of such systems is thus transdisciplinary, as it involves collaboration between local knowledge experts, stakeholders and academic researchers. It also requires the participation of practitioners and key decision-makers if implementation gaps between research, policy and action are to be avoided. This series of complex interactions and dependencies on past events and relationships could explain why transdisciplinary study is commonplace in community sustainable development research. Such transdisciplinary teams provide for unprecedented collaboration between key community actors, academic researcher and practitioners and provide a pathway for the translation of research into action on the ground. As a complicating factor, many sustainable development research initiatives employ action research methodologies, which require frequent and time-intensive meetings between the researcher/practitioner and the community practitioners.

The authors routinely research issues that bridge the social, environmental and economic aspects of large-scale issues and their impact upon the local context. The first author is known for her leadership of, and building of, transdisciplinary teams around research projects, a more recent example being a one-year funded sustainable infrastructure collaboration (www.sustainableinfrastructure.org). The challenges of assembling such teams, however, are many. Travel costs and times, for example, can be a serious disincentive to participation in such research. Transdisciplinary teams are meeting intensive, as much work must go into the bridging of disciplines, perspectives, the sharing of intellectual frameworks and even developing a common language around the critical research questions to be addressed. Time is also needed to build trust, and to understand differing research cultures, values and methods. In previous online discussions the authors found that particularly in the case of contentious areas of research such as those often found in the environmental field, particularly when stakes are high and values deeply held, such trust can be time consuming to establish and often only occurs gradually over a sustained series of dialogues (Dale and Newman, 2005).

Paradoxically, one of the most crucial issues to face Canadian society, climate change, makes such transdisciplinarity even more imperative. However, climate change and fossil fuel scarcity provide a moral and economic incentive not to travel as the economic and ecological transaction costs of assembling large research teams could possibly be prohibitive. Moreover, intellectual capital is not place-specific and large countries must develop more sustainable methods to convene the best minds together, both

domestically and internationally around critical public policy issues, in particular, sustainable development. The large questions that must be addressed: land use patterns, large-scale transportation and sprawl, transition strategies to more sustainable infrastructure, reconciliation between rural, small and large urban centres will only be met through assembling diverse teams of the best minds locally and globally.

This paper describes the outcomes of a one year research project in which the authors explored the role that electronic communications technologies can play in the successful utilization of transdisciplinary teams.

Electronic communications technology is playing a growing role in mitigating the time, travel and funding stresses of assembling a transdisciplinary team, but these technologies raise their own set of questions. Though e-mail is ubiquitous in the academy, online document crafting, the online development of research programs and outcomes, and online dialogue are still very much developing techniques within the research community. One of the key questions for an interdisciplinary or transdisciplinary team is "how to communicate" (McNeill, 1999), and it is important to assess various interpersonal and inter-organizational processes that either facilitate or hinder a group's effort to produce deliverables (Stokols, 2006).

Transdisciplinary research and sustainable development

Transdisciplinary research is common in the area of environmental research and particularly critical in the domain of sustainable development (Robinson, 2008). Defined in the early 1970s by Jantsch (1972) as taking disciplinary knowledge and making it useful for socially relevant issues, transdisciplinary study has also been described as an approach to problem solving suited to settings where disciplinary modes prove inadequate (Century, 1999), a process or activity that produces, integrates and manages knowledge in technical, social and scientific areas (Thompson Klein, 2004). Transdisciplinary research maintains a focus on application; much transdisciplinary research is associated with a notion of creating change, the desire to contribute to solutions (Wickson *et al.*, 2006), and the production of useful knowledge. The characteristic features of transdisciplinarity include problem focus (research originates from and is contextualized in "real-world" problems), synthetic methodological practice (the research involves iterative, reflective processes that are responsive to the particular questions, settings and research groupings) and collaboration (between researchers, practitioners and external actors; Russell *et al.*, 2008).

If transdisciplinary research is a critical necessity of sustainable development research, there are nevertheless several barriers to successful transdisciplinary research identified in the literature. As a practice defined by collaboration (Wickson *et al.*, 2006) in order to create coherent knowledge (Ramadier, 2004), transdisciplinarity requires that a diverse coalition work together.

Online collaboration, capturing the spaces in between

The collaborative dialogue central to transdisciplinary research can be very rich, creating the "mutualized chaos" that helps participants overcome assumptions (Hammond and Sanders, 2002) and create consensus. In order to mitigate expense and reduce the time requirements of collaboration, the principal investigator has explored internet communication technology over a seven-year period (Dale, 2005; Dale and Naylor, 2005; Dale and Newman, 2006a, b). The authors are not alone in

pursuing this option; it has been argued that the internet is transforming scholarly communication (Ball, 2000).

Electronic dialogue, hereafter referred to as e-dialogue, can eliminate the constraints and barriers of physical space (Mitra and Schwartz, 2001). The geographical location of team members is not important, and subsequently participation costs are lower (Ridings *et al.*, 2002). The expected time savings have also been documented in the literature (McLeod, 1999), field studies have demonstrated that the elimination of travel time is significant, which is particularly important given the frequency of weather delays during much of the Canadian winter. Lower costs are particularly important to community participants; electronic communications technologies can give marginalized people a voice, as they do not have to be located at the *locus* of power (Mitra, 2001).

Though the principal investigator's online work has been successful in engaging diverse audiences and experts from across the country (www.e-dialogues.ca), the occurrence of some of the communications barriers noted in the literature has also been observed. Overall, adoption of virtual collaboration has been lower than expected, as noted in fieldwork conducted by Pervan *et al.* (2004). This is partly explained by difficulties specific to electronic communication. Though geography is not a physical barrier as it is with physical meetings; there remains a "transactional distance" as defined by Rose (2004). This artefact of the geographical distance includes issues such as coordinating a team across multiple time zones – participants are out of sync with respect to each other's rhythms of the day. The second research dialogue occurred quite early in the morning, and for those participants in the western section of the country this did impact functionality of the exercise.

A number of techniques were used during this project to overcome some of the constraints of the medium, notably its flatness due to its impersonal nature though the use of active expert moderation and deliberatively designed diversity of scholarship and practice to act as a wider attractor to "listen in" to the conversation. In addition, the authors have experimented with the use of an expert diverse transdisciplinary panel whose conversation can be listened in by an e-audience, who can chose to actively listen to the panel discourse, or to dialogue among themselves as well. Regardless, the e-audience can pose questions to the e-panel through the moderator, allowing for more dynamic online engagement.

Several researchers have noted problems that arise in online dialogue due to the lack of subtle cues present in face to face communication. This can inhibit the development of ties and communication norms, an important first step in collaboration. (Haythornthwaite, 2002) A lack of visual cues hinder trust (Ridings *et al.*, 2002), and this reduction in cues can slow group development (Haythornthwaite, 2002). It is also more difficult to direct online conversation as we can see or hear others, which can lead to interruption and interleaving, where separate threads become entangled (Pilking and Walker, 2003). It can also be more problematic to address personality issues within the group; aggressive speech or large amounts of speech from one source can hinder communication (Mowbray, 2001). The principal investigator has employed a number of innovative techniques to ensure that some of the benefits of face-to-face meetings are not lost, notably, spontaneity and emergent creative sharing of ideas. These techniques include the use of strategic questioning (Peavey, 1994), role-playing to facilitate dialogue, active reaching out to more silent panellists and conversational facilitation based on 23 years of public service experience.

In addressing these issues, many competing factors must be evaluated; for example it has been argued that in order for an online collaboration to work well a longer time for information deliberation is advisable (Becker, 2001). The authors agree in general, but projects that continue for too long can tax participant ability to commit time to the project; many people find virtual overload unappealing (Geyer, 1996), although the e-dialogues that engaged the public the most were sustained over a longer period of time. Rose (2004) has argued that in his work with student collaborations more structure gave a better result, but excessive structure can hinder transdisciplinary dialogue as the group needs to change opinions to come to agreement (McLeod, 1999) and a certain reflexivity is needed, must be able to stand back and change one's position in face of argument (Dahlberg, 2001). Many of the e-dialogue participants have stated this method of communication allows the expert panellists to have more space for reflection, as they can pace their comments and in the privacy of their own offices, reflect on the conversation and in some cases, verify a reference during the dialogue (Dale, 2005; Dale and Naylor, 2005).

The research project

This one-year research project built upon the six-year e-research program of the first author (www.e-dialogues.ca). There were three specific research outcomes the authors used to test the efficacy of the existing e-platform for moving transdisciplinary research collaboration. The first was to determine its effectiveness in peer reviewing a draft academic journal article, the second to determine its efficiency in drafting a chapter by three interdisciplinary experts for a peer-review book manuscript and the third, to test its efficacy in leading a series of research meetings on a specific sustainable development issue, urban sustainability, with both national and international participation. The latter was held in conjunction with a key civil society actor, the International Centre for Sustainable Cities (ICSC).

The work was conducted using the principal investigator's existing e-software platform, which was originally designed to host both asynchronous discussion and real-time synchronous online e-dialogue conversations designed to increase literacy, particularly sustainable development, through the creation of dialogue among experts from across the country. The project was originally conceived as a way for a small, new university to be able to expand its access to diverse intellectual capital and to optimize its critical mass of scholarship and make novel linkages to the policy development community. There was one very successful e-Forum on climate change led in 2003, and to date over 27 e-dialogues on a diverse range of topics have been led, chaired in some cases by high-profile Canadians to act as an attractor, in others as a method for MA data research methodology, and in others, to bring expert speakers directly into online classrooms. In addition, a number of commercial applications have been tested, one for the federal government on the recruitment of the scientist of the future and the other, on behalf of the Nuclear Waste Management Organization examining the management of used nuclear fuel in Canada. In addition, this research has been highly policy-relevant in that one of the key audiences is the mid-policy analyst community in Canada. Other key audiences include young learners, notably science and business undergraduate and graduate classes, the leaders of the sustainable development research community across Canada, community decision-makers and practitioners, business and some civil society leaders and researchers. The platform, however, has not been specifically used for the

creation of collaborative research outcomes, and it is that potential of synchronous online meetings that we wished to examine in this new research project.

This e-platform has been extensively tested and are described in Dale (2005) and Dale and Naylor (2005). This platform also allows archiving of the conversations, deemed a critical component of the e-research agenda for several reasons. First, it allows scholars from across the country to continue to access the dialogue for potential research questions and to collect data. Second, it allows for the direct voice of the experts to be published without interpretation, providing immediate access to ideas and intellectual capital as it is being developed. Third, it allows for references by the media to a more national cross-section of more diverse expertise outside of the centre of Canada. Fourth, the archived allow public policy practitioners to continue to analyse where the points of consensus and divergence are in critical public policy issues, which is key intelligence for policy implementation.

Participants for the three research deliverables were deliberately selected to bring together the critical expertise and knowledge necessary to address the content and test the research outcome. They were drawn from the principal author's extensive research and public policy networks from across the country. A potential bias was that the sample for the second deliverable were all interdisciplinary experts, while for the first and third outcomes, they were drawn from a wide cross-section of Canadian society and some international experts for the third outcome.

For the first deliverable, the critique of a draft journal article, a six person transdisciplinary team was assembled including an economist from the private sector, a well-known civil society activist, and several academics from various disciplines (landscape ecology, planning, environmental management and environmental studies). For the second deliverable, the drafting of a book chapter, three co-editors of a manuscript being written with the principal investigator were brought together; an interdisciplinary team of an ecologist, a planner and a social scientist. For these two deliverables, an e-audience was not opened nor publicized.

For the last deliverable, four e-dialogues were led on critical public policy issues affecting urban sustainability – indicators (five), youth engagement for cities (seven), the implementation of integrated community sustainability plans (five) and emerging forms of regional governance (three). Transdisciplinary expertise in this sample included planners, city program managers, a chief executive officer, senior fellows from the Global Research Network of Human Settlements, Federal University of Parana, the International Institute for Sustainable Development, an architect, Imagine Durban, South Africa, Youth Engagement Coordinator, Dar es Salaam, and genuine progress indicators, Atlantic Canada. Interdisciplinary expertise encompassed planning, children's health, psychology, urban studies, indicators, ecological footprinting, urban and regional planning, geography and landscape ecology.

For these e-dialogues, an e-audience was opened up and widely publicized to both research and ICSC internal networks. As well, the e-audience space remained open for 24 hours following the expert panel discussion, to allow participants to make a contribution and share intellectual capital across the differing international time zones.

Although the e-audiences have to date varied in participation from 20 to 50 people from across the country and further afield, there remain some technical barriers concerning separation of the audience from the expert panel. Few people in the audience raised questions (no more than two for each dialogue), these were directed to

the e-panel by the moderator, both during and after the conversation. The majority of audience members seemed content just to "listen in" to the e-panel dialogue. On two occasions the audience was more animated – developing discussions amongst themselves, not necessarily directly connected with the panel; but these still only involved two or three audience members.

Direct feedback e-mailed to the research team during the discussion suggested that some audience members were disappointed not to be able to comment directly to the e-panel, and there was also no attempt to moderate audience discussion during or following the two-hour e-panel conversation. Anecdotally, we have observed that there may be a relationship between the quality of content and speed of dialogue with whether or not the audience chooses to dialogue among themselves while simultaneously listening to the e-panel audience dialogues. In other words, when the expert panel dialogue is lurching or conflict-ridden, the audience tends to be more interactive. As well, there appears to be an age variable with younger people being able to multi-task more easily, especially electronically, simultaneously dialoguing among themselves and listening to the expert discussion. Survey data from panellists, however, did not suggest that contributors themselves feel held back along age or technical grounds.

The analysis of the capacity of e-dialogues to achieve the desired research outcomes was conducted using triangulation through a multiple methods approach. Members of the research team observed the dialogue as it took place, and then immediately following each dialogue an online survey was administered to the participants.

Discussion of results

The participants in the three research outcomes of the e-dialogues rated the process as very effective; there was little repetition of earlier critiques of the tool in its inception, 2000-2005. Overall, the majority of participants felt that the medium was conducive to the research goals and outcomes as planned. In the first research outcome, the critique of a peer-reviewed draft journal article, the co-authors felt that the transdisciplinary critique did not significantly strengthen the quality of the draft paper. Although the experts rated their experience as qualitatively significant and meaningful, an emergent finding was that there was significant disagreement among the experts on the central premise of the paper which the authors took as a given; that is, that gentrification has some unanticipated inequitable outcomes. There was clearly a values difference among the transdisciplinary team and the co-authors, underscoring the highly normative nature of sustainable development discourse. The other observation by the authors was that the paper was submitted in very draft form, and the critique did reveal that they were unclear in their central premise and consequently that was sharpened as a result of the transdisciplinary feedback. It may well be that academic publication demands only interdisciplinary rather than transdisciplinary critique, especially when the target audience is peer-reviewed academic journals.

The gender differences in conversation styles observed by Barrett and Lally (1999) were also observed here. The research confirmed that men send more and longer messages, but women send messages that are more interactive and refer to past messages, although further dialogues are needed to provide more text samples to further test the post length and content – Figure 1 shows the frequency of posting, highlighting the male and female panellists, for one of the dialogues. This gender difference did not seem to hinder dialogue, which also agrees with the earlier study.

Figure 1.
Posting patterns in one
of the dialogues
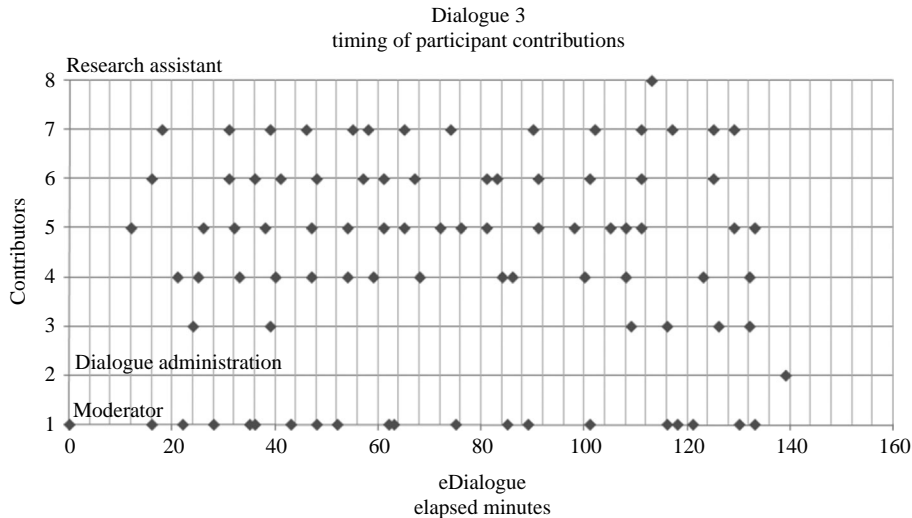
Note: Female panellists are Nos 1, 3, 5 and 6

(The earlier study only found the difference problematic as it was concerned with online coursework where participation was evaluated.)

The timeplot also illustrate the ebb and flow of conversation. There is initial slowness in posting as panellists familiarize themselves with the technology, the topic and each other. Panellists seem to contribute in bursts with thinking time between posts.

The problem of scheduling and time zones remains a challenge as well but the removal of the travel element does open up opportunities for transdisciplinary researchers that might otherwise not be available. As well, the experiment of keeping the dialogue open for an addition 24 hours to accommodate time zone differences did not significantly increase greater participation; the real-time interactive conversation appears to be the main attractor to wider audience participation, as well, as the subject matter.

The satisfaction of panellists with the e-dialogue process is very positive, with a rating scale of 1 (low) to 5 (high). Of the 34 panellists that took part in e-dialogues completed to date during the study period, 69 per cent (20) completed the survey questionnaire. All panellists except one of those surveyed felt they were able to contribute to the discussion sufficiently, and the individual who did not believe they had sufficient opportunity was neutral on that point. More crucially (Figure 2), the survey data revealed that all but one participant agreed completely (5) or somewhat scale of (4) that the technique was "professionally significant", all but two agreed that it "contributed to their understanding of the subject matter", and all but three thought the process was "effective in bringing people together with diverse experiences from different sectors".

In all these cases, those that did not agree were neutral on these questions. About 55 per cent of panellists also agreed that the real-time nature of the dialogue was a more satisfactory way to collaborate than the more traditional online forum that operated asynchronously (30 per cent did not answer the question, and one panellist preferred the asynchronous environment). In addition, the majority of respondents stated that
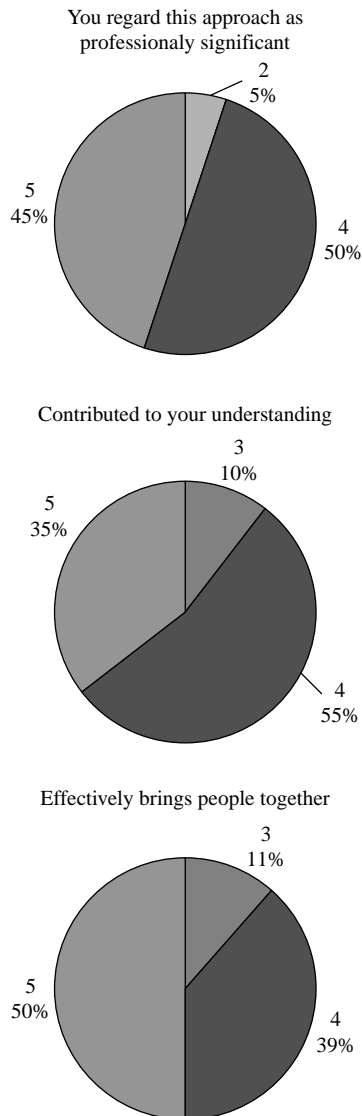
You regard this approach as
professionaly significant

2
5%

4
50%

5
45%

Contributed to your understanding

3
10%

5
35%

4
55%

Effectively brings people together

3
11%

5
50%

4
39%

Figure 2.
Satisfaction with the
e-dialogue process

the economic/ecological benefits of using the e-dialogue tool more than offset any technical difficulty as compared to face-to-face meetings.

In terms of practical use for panellists, there is no apparent correlation between computer proficiency and satisfaction with the system. In fact, the individual with the least experience (completely and somewhat disagreeing with statements on computer, typing and technical skills) was one of the most satisfied with the platform (consistently agreeing with statements concerned with participation). This may be in part due to the provision of panellist training in advance. Expert moderation was

evaluated as critical to both the quality and facilitation of meaningful dialogue.
All panellists apart from one considered moderation necessary (the dissenter being
neutral on the question) and all except one appreciated the moderation process
(with one being neutral on the question and one who did not appreciate the moderation,
although agreed it was necessary which is a somewhat contradictory position).
The dissenters did, however, agree strongly or completely to other statements relating
to their satisfaction with the flow and opportunity to meaningfully contribute.

The point around which there was most disagreement was in the consideration of
the flow of conversation. The statement that panellists were asked to agree or disagree
with was "The time delay between responses inherent in the online dialogue medium
inhibited the conversation". About 10 per cent completely disagreed, 20 per cent
somewhat disagreed, 35 per cent were neutral, 25 per cent somewhat agreed and
10 per cent completely agreed (Figure 3).

This cannot be explained by technology as the responses to this statement do not
match operating system use or browser use and all panellists were connected through
high-speed connections. Nor on this sample can it be explained by gender or age
characteristics of the panellists. In any event, the slight dissatisfaction with the flow
was not mirrored by dissatisfaction with the process as a whole.

Our most interesting finding was that 65 per cent of the e-panellists found that their
sense of connection with other panellists changed during the dialogue in spite of the
anonymity of the medium. Of those that did not agree most were neutral on the question
or did not answer it. There were only two panellists that disagreed, both of whom were
consistently less positive about the conversation and its impacts than the others
surveyed although generally positive in their assessment. In addition, both these
panellists were higher than average in age, and lower than average in reported technical
ability, which may explain the lack of connection felt during the process (Table I).

Another surprising conclusion was drawn from one of the recent e-dialogues in
partnership with the ICSC, which was exclusively composed of young people. The first
author has been moderating these conversations for over five years and the dynamics and
online interaction of the young people was totally different from other conversations. The
pace of the e-dialogue was initially very slow and it appeared that trust between the
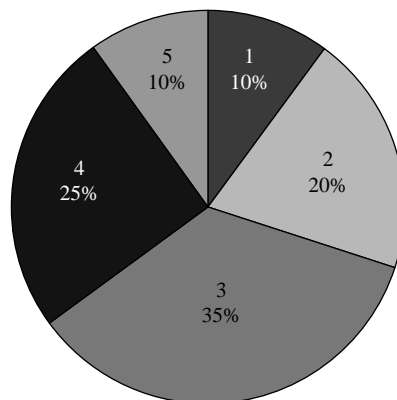
1 - disagree completely: 5 - agree completely

Figure 3.
The time-delay between
responses inhibits
conversation

	Your experience with the e-dialogue changed your sense of connection with other participants	You were accorded sufficient opportunity to contribute to the discussion	The e-dialogue contributed to your understanding of the subject matter	You regard this approach professionally significant	Age	You consider yourself to be highly experienced with computers
Panellist 1	2	3	3	4	50	3
Panellist 2	2	4	3	2	63	3
Average	3.8	4.5	4.3	4.3	43	3.9

Table I.
Dissenting panellists

e-panel build more slowly than with older participants. It is suspected that the digital divide is becoming more complex and is no longer about access, but rather, may be based on very different usages and values associated with the medium. For example, younger people, in their use of social networking sites based on personal relationships rather than professional use, ensure their privacy by creating other personas, and in some cases masking their real identities. It may well be that paradoxically their trust online is more "thin" than that of older colleagues. Although it took twice as long for trust to build, the pace and speed of their conversation increased exponentially nearer the end of the conversation. As well, their conversation was more targeted, shorter interventions, information-rich through web site citations, rather than longer reflective statements.

Conclusion
The authors were surprised and heartened by the very positive survey results, especially from participants new to the e-platform. The ubiquity of internet communications technology and increasing user sophistication could explain the lack of serious dissatisfaction with an e-platform that has not been significantly upgraded since 2004, although the team's increasing sophistication in online dialogic techniques may also be a factor. Earlier phases of the first author's research using e-dialogues had suggested anecdotally that there might be wider problems with use of this technology. This was not the case – although the survey does suggest there is a lingering but decreasing barrier for older users of the online environment. As well, the subsequent greater understanding and sophistication of internet users results in an enhanced online literacy that makes the software interface more opaque and less problematic, such as the time delay and sometimes lack of sequencing (threading) of the conversation.

The research reveals that e-dialogues create a novel space for in-between disciplines, for cross disciplinary bridging, allowing for greater sustained interconnection over time, and can contribute to enhancing literacy and understanding modern day complex public policy issues. They may also provide a more novel space for inter and transdisciplinary thought as we have nascent evidence that the medium is naturally more preferred by more lateral thinkers than literal thinkers, and perhaps leads to wider systems thinking, due to its tendency to stimulate more lateral thinking. It is difficult to determine, however, if this is a function of the medium, or a learning style of people attracted to participate, or both. The authors also believe that transdisciplinary e-dialogues have the capacity to speed the exploitation of knowledge between the research and practitioner

communities, and ideally, to decision makers through the deliberative design of the experts brought to the online space, to mutually inform and influence one another.

The search for the Holy Grail of continuous improvement and processes will continue now that it is known how important online dialogic tools are to creating novel transactional spaces that bring together the natural and social sciences, with diverse groups of practitioners, decision makers, policy makers and civil society actors, spanning geographical divides and reducing meeting transaction costs in very significant ways. The need for interdisciplinary and transdisciplinary research will only increase in a highly globalized and dynamically interconnected world of socio-ecological systems and online collaboration, with its greatly reduced transaction costs, and demand for greater sophistication in its functionality for online research collaboration.

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