FARMSCAPE Online: participatory design of Internet meetings with farmers

Dean Hargreaves[1], Stefanie Kethers[2], Margot Brereton[3], Bob McCown[1], Zvi Hochman[1], Peter Carbery[1], Mark Antoniades[2]

1. ITEE-UQ / CSIRO
203 Tor St, Toowoomba, QLD 4350.
AUSTRAIA
+61 7 4688 1458

2. CSIRO ICT Centre
71 Normanby Rd, Clayton VIC 3168
AUSTRALIA
+61 3 9545 8457

3. University of Queensland, ITEE-UQ
Brisbane, QLD 4072
AUSTRALIA
+ 61 7 3365 4194

ABSTRACT

This paper presents aspects of a longitudinal study in the design and practice of Internet meetings between farmers their advisors and researchers in rural Australia. It reports on the use of Microsoft NetMeeting (NM) by a group of agricultural researchers from Australia's CSIRO (Commonwealth Scientific and Industrial Research Organisation) for regular meetings, over nine years, with farmers and the commercial advisers. It describes lessons drawn from this experience about the conditions under which telecollaborative tools, such as NM and video conferencing, are likely to be both useful and used.

Categories and Subject Descriptors

H.5.3 Group and Organization Interfaces: Computer-supported cooperative work, Evaluation/methodology, Synchronous interaction

Keywords

Participatory Design, Microsoft NetMeeting™, video conferencing, Internet, Agriculture.

BACKGROUND

In 1991 a small group of Agricultural Scientists from CSIRO were relocated to Toowoomba in rural Queensland. They were to develop computer based Decision Support Systems (DSS) for farmers, with a focus on Australia's northern cropping region. However, after a major workshop with local farmers and their commercial advisers, it quickly became apparent that there was little enthusiasm among clients for new DSS's. Confronted with this, the CSIRO team decided not to build more DSS's, but rather to attempt to understand why DSS software was not more widely used (Carberry 2002).

In spite of the initial lack of enthusiasm among clients, by "... the end of 1998, both internal and external evaluation was indicating the FARMSCAPE activity had created significant market demand for access to system simulation..." as a tool to aid farmer decision-making. Demand for FARMSCAPE tools and services was exceeding the team's capacity to deliver. "Over 100 simulation scenarios were conducted and delivered in one year. In fact, the demand for APSIM (Agricultural Production Systems sIMulator) simulations by 1998 had increased rapidly to the point where it could not be met...(Carberry 2002).

In 2000 internal restructuring at CSIRO meant that the FAMRSCAPE team was now faced with two key challenges: i) how to meet the high demand for FARMSCAPE tools and services, and; ii) how to service farmer groups located around Australia. The priority question for the team became how to deliver FARMSCAPE tools and techniques in a cost-effective and commercially sustainable manner, as the transaction costs of researchers interacting with farmers in remote areas are high.

INTRODUCTION

This paper examines an experience over recent years where farmers, their advisers and scientists have engaged in online meetings across rural Australia using NM. These meetings featured discussions about alternative farm management practices, aided by the use of a computer-based cropping systems simulator.

Typically farmers would supply researchers with data concerning their local soil characteristics, rainfall and information relating to other local management practices (eg planting date, fertiliser rate etc). This data and information is then used by researchers to specify APSIM in preparation for simulations. APSIM is a cropping systems simulator that has the capacity to model 25+ crops under virtually any specified conditions, and is in use in Australia, Indonesia, South Africa, Zimbabwe, Malawi, China and Argentina, among others.

The design of the simulation runs are driven by farmers' questions, typically concerning the effects of variable seasons on supplies of water and Nitrogen (N), such as 'What yield would I have achieved if I had planted a week earlier?'; 'What if I increased the rate of Nitrogen fertiliser by 50 units of N?'; 'What is the probability of achieving this yield given my current stored soil water?' Often farmers would pose questions during the course of a meeting. This created a highly dynamic, interactive experience for both researchers and farmers. This has been coined "What if? Analyses and Discussions" (WifADs) (Carberry et al. 2002).

METHODOLOGY

In broad terms the theory of multi-methodology (Mingers & Gill 1999) influenced this research. This provides a way to mix methodologies based on different epistemologies and ontology's during a single, or over several research interventions.

We employed mixed methods and this research methodology was heavily influenced by the traditions of ethnography, in particular the method of participant observation. This involved the primary

In PDC-04 Proceedings of the Participatory Design Conference, Vol 2, Toronto, Canada, July 27-31, 2004, under a Creative Commons license. CPSR, P.O. Box 717, Palo Alto, CA 94302. http://www.cpsr.org ISBN 0-9667818-3-X

researcher being located with the farmer group during a meeting, designing and supporting the technical environment, note taking, and conducting post and pre session evaluation.

We drew heavily on the traditions of Action Research (AR) which is based in the *interpretivist* traditions of social research as a means to engage practitioners *in situ* within their real world problems.

Methods

The FARMSCAPE team undertook 15 Internet meetings with farmers from eight groups across Australia, including- Moonie and Bongeen (both in Queensland); Walgett (Northern New South Wales), Brim and Birchip (both in Northern Victoria); Liebe and MIG (both in Western Australia). We collected data by video recording meetings (where possible at both the farmer and researcher ends) using a mix of pre and post workshop questionnaires, participant evaluation, and employing post workshop farmer and researcher interviews. We additionally undertook periodic longitudinal evaluations, which involved interviewing project participants in order to assess impact (if any) on farmer intentions, thinking and practice. We have selected one of these, the Moonie group, to illustrate the characteristics of an online interaction.

We used Video Interaction Analysis (VIA) (Jordan and Henderson 1995) to analyse the video data. We made eight video recordings of four separate farmer groups over a period of two years (2000 – 2002). Having interpreted the FARMSCAPE online experience using VIA, we have found it helpful to present our analysis by drawing on the writings by Olson and Olson. We additionally used participant observation to collect additional data.

The Moonie Farmer Group

Moonie is a small farming community about 320 km west of Brisbane and is located in Australia's climatically variable northern cropping region. Farming in this region has traditionally relied on wheat and cattle. For each of these online meetings, a telephone conference was established between a farmer's house, where local farmers typically meet, and the researchers in Toowoomba. Often, an interested observer would be invited to join by phone and NM from a third site. Simulation outputs were shared with the farmers via Excel™ spreadsheets and PowerPoint™ using NM's application sharing; with a telephone conference used for audio. Internet bandwidths were low, typically less than 28 kb/s, and Internet connections would occasionally prove unreliable. For later analysis, both the researcher end and the farmer participants were recorded on video. The following section describes one of these online meetings in more detail.

Example Moonie Group Meeting

The meeting we report on took place on 6 October 2000 and was the fourth meeting in a series of six. Participants were distributed over two sites, the researcher's (R1's) office in Toowoomba in Southern Queensland, and the house of one of the farmers (MF5) in Moonie. In Moonie, 8 farmers (MF1 – MF8) were seated around the speaker phone and facing a laptop with an external monitor attached showing the application data via NM as sent by R1 (see the seating plan shown in Figure 4). In addition, a member of the FARMSCAPE team (RTS) acted as technical support and also captured the meeting on video. In Toowoomba, R1 presented the simulation results as Excel graphs to the farmers via NM, and also acted as facilitator. R1 was sometimes joined by another technical support person, RTS2, who helped solve several technical problems during the meeting.

The focus of this meeting was a discussion of the performance of various crops, including relative gross margins, compared to their potential environmental impact. Despite numerous technical problems with this meeting data collected from an external evaluator led him to conclude:

"This new combination clearly works, notwithstanding early teething problems and the limitations caused by slow land-lines. The teething problems have been overcome, and the land line technology is developing rapidly." (Van Beek, P.)

However, what stands out from undertaking VIA of this meeting is the degree to which both farmers and research are able to *repair* frequent technical and social *breakdown*. VIA revealed several facilitation, group interaction, and knowledge & information issues resulting from technology breakdowns

For example, graphs would appear truncated or significantly delayed at the farmers' end. In such cases, the researcher, unaware of the problem, would often start explaining the graph and the farmers would have to stop him.

Due to the audio-only feedback from the farmers' end and the low quality of the audio, the remote researcher facilitator later reported that he had felt 'disconnected' from the farmers – he later commented, "it was like trying to chair a meeting with your eyes closed" (Hargreaves and Hochman 2003). A side effect of this lack of (visual) feedback for R1 was a very passive style of facilitation. However, the farmers often used these enforced breaks to have animated discussions about what they had heard so far, and attempt to explain unclear issues for each other.

The overwhelming conclusion drawn from the VIA, together with accounts of changed farmer intentions and practice (Van Beek 2001) and farmer interviews was that the meetings were highly valued by farmer participants.

"Decisions effected by the interaction through FARMSCAPE and running the model farm through APSIM included substantial increases in fertiliser, split application of fertiliser, investing in side dressing equipment, and not planting mungbeans and cotton." (VanBeek 2001)

Additionally, VIA undertaken of later meetings with farmers at Walgett, Liebe and MIG show that all of these issues have either been overcome, or their effects ameliorated through introduction of robust procedures (eg checking that screen resolutions are the same at both ends, and that the entire graph can be seen by farmers before speaking discussing it's content).

WHAT MAKES A SUCCESSFUL ONLINE MEETINGS?

What can we learn from this experience about the conditions under which telecollaborative tools are likely to be both useful and used? We propose that there are three key factors that led to the success of these online meetings: i) motivation of participants- both the commitment of the researchers, and the high value farmers placed on accessing information derived from APSIM; ii) mutual understanding- sufficient opportunities must be provided

for farmers and researcher to build *common ground* and *social scaffolding* for subsequent meetings, and; iii) effective interaction- the interaction must suit the telecollaborative tools, and the people involved must be ready in terms of both use of the technology and have collaborative activity. Here we draw on the work of Olson and Olson (2000) and others to help interpret and structure the experience.

Motivation

It is clear that farmers were willing to endure the unreliability, uncertainly and inconvenience of malfunctioning technology because the alternative was certainly less access to both the tools and researchers.

Unlike many teams within organisations, farmer participation in these meetings was voluntary. Motivation is raised by both Olson and Olson (2000) and Dourish (1996) as a key feature of success "Motivation has been established as one of the major sources of failure in adoption of groupware in general"

One farmer indicated that the potential for the technology to reduce the remoteness and isolation of rural life was a significant motivator for continued participation.

"One of the boys had a motorbike accident and I could attend that and come back (My wife was working). Without the technology I would not have been there. This technology helps to break rural isolation." (Birchip Farmer, 2003)

Mutual Understanding

We propose that two ideas that can be grouped under the broad heading of *mutual understanding* Habermas (1984) in terms of online meetings. These are the concepts of *common ground* and the *social scaffolding*.

Common ground

Farmers often indicated 'knowing' the researchers was important when interacting online. This was variously expressed as 'knowing what they [the researchers] are on about', and how 'knowing' researchers would guard against the potential 'vested interests' of 'unknown' researchers.

One farmer suggested that they, "Felt comfortable [meeting online], especially seeing we knew them [researchers], and what they are on about; it might not be quite as easy if we went in cold, not knowing them." (Birchip Farmer, 2001)

We observed that a well-respected locally based farmer facilitator or coordinator plays a central role in developing common ground between farmers and researchers "We do need a facilitator (who) needs to know the persons at the other end so that they are comfortable, talk freely, cut them off if necessary, make it flow better. The facilitator also needs to know us..." (Brim Farmer, 2003)

Social scaffolding of an interaction

During the work with the Moonie group there was an initial face-to-face meeting, of which part was conducted online. At this meeting farmers provided morning and afternoon tea with lunch. These provided important opportunities for farmers and researchers to talk and interact informally. Researchers brought combinations of cake, meat or wine to these events.

In an interview with a farmer [BF1] from the Bongeen group I asked "Is the online meeting as good as the face-to-face meeting?" The farmer replied "No... it is far better, because we can get more frequent access to you guys and it eliminates travel." He then added "... as long as we can get together with you guys once or twice a year, maybe at x-mas for a beer or something, like we do with our fertiliser guys." The role of informal events such as barbeques and morning and afternoon tea are important in terms of creating effective social fields and bonds that then scaffold future interaction. Video provided a way to engage in more informal communication, thereby providing opportunities for creating social fields.

Effective Interaction

In broad terms there are a number of basic conditions that need to be satisfied for online meetings to proceed effectively. These are: i) ensuring all participants are looking at the same graphical representation; ii) that there is common understanding about how to *interpret* a representation?; iii) is there common understanding about what a representation means, and; iv) correct technical function eg. the Internet connection remain 'up' during the interaction? To the degree to which any of these conditions are not met during an interaction- *breakdown* can be said to occur. (Winograd & Flores 1997)

Coupling in work

During the weeks leading up to an online meeting there would typically be a series of interactions via phone, email, fax, and visits by technical field staff. Activities include: i) farmers sending weather and soil to the researchers- usually via email or fax; ii) researchers would then negotiate with the farmers about the simulation runs to undertake (eg range of planting dates, range of fertiliser rates, combination of crops etc); iii) researchers would run the simulations and check the results with either the local facilitator / convenor or a lead farmer- as a result the simulations may then be further localised, and; iv) the simulations are then presented back to the farmer group using NM.

Olson and Olson (2000) characterise an aspect of work they term *coupling*. "Tightly coupled work... typically requires frequent, complex communication among the group members, with short feedback loops and multiple streams of information. In contrast, loosely coupled work has fewer dependencies or is more routine. [...] In loosely coupled work, there is common ground about the task goal and procedure; it merely needs to be played out. Loosely coupled work requires either less frequent or less complicated interactions".

In the above described sequence of activities (i) is loosely coupled and quite routine (except for researchers checking the validity of the data); (ii) and (iii) are more coupled with farmers and researchers having to engage in discussions to negotiate simulation specifications, while; (iv) is a highly coupled activity with simulations being re-run during a meeting based on farmer discussions, comments etc.

Collaboration technology readiness

The FARMSCAPE team provided the Moonie group with a high level of technical support leading up to and during on online meeting. This effectively alleviated the need for technical skill and knowledge in the use of NM.

Additionally the farmers over time became more skilled in and attuned to the use of and performance of the technology. For example, when the research facilitator at Moonie consistently

'scrolled' the graphs a farmer commented "Stop scrolling... it causes scribble over the screen..." [M2F].

When does video add to an online meeting?

Researchers valued the addition of video more so than farmers. Researchers could use video to better 'read' the audience. Farmers did not gain the same value - "Why do we want to see Peter?" as stated by one farmer.

Video was seen as extremely useful to the research facilitator at the Walgett meeting, who explicitly commented that he was "getting a lot out of the video" because he could see people as they talked. He then proceeded to joke about the fact that seeing him was not exciting and that he didn't even have a nice photograph on his wall to show them. He then briefly pointed the web camera at a second researcher in the room, thus reminding everyone that the second researcher was still there. Switching the video off during the different chunks of presentation was an effective technique to manage the limited bandwidth available.

"You can actually see each other. Talking to a telephone or a blank screen doesn't have the same sort of impact as actually still being able to speak to somebody face to face." (Walgett Farmer 2002).

"I don't know whether you actually need to see everybody while you're talking." (WF - DR) "it's just one question to have a series of graphs up there, but then we can add questions that are 'what if's' that relate directly back to what we're doing at home, that made a huge difference to me last season". (WF-DR)

"I didn't need the faces like, once you've seen someone's dial it doesn't really matter. The information where you could transfer graphs that was important I felt.– (Walgett Farmer 2003)

CONCLUSION

Online meetings featuring the use of crop simulation shared via NM allows remote farmers to conduct long-term 'virtual experiments' on their own properties using paddock-specific data. For such an approach to be valued by a farmer, the content of the sessions must be viewed as significant to his/her management. These 'what if' sessions feature an information rich environment including graphs, interactive spreadsheets and simulation. The combination of audio and application sharing worked well, even using low cost, readily available software and hardware and typically with low speed Internet connections over often unreliable rural phone lines.

The contribution of this work is a rich longitudinal study of the participatory design of Internet conferencing for farm managers and agricultural scientists and the conditions under which Internet conferencing is successful.

REFERENCES

[1] Adler, P. & Adler, P. 1994. Observational Techniques. *In* The Handbook of Qualitative Research. Edited by Norman, D. & Lincoln, Y. Sage Publications, London, UK.

[2] Carberry, P.S., Hochman, Z., McCown, R.L., Dalgliesh, N.P., Foale, M.A, Poulton, P.L., Hargreaves, J.G.N., Hargreaves, D.M.G., Cawthray, S., Hillcoat, N., Robertson, M.J. 2002. The FARMSCAPE approach to decision support: Farmers', advisers', researchers' monitoring, simulation, communication, and performance evaluation. Agricultural Systems *74*, 141-178

[3] Checkland, P. 1981. Systems thinking, systems practice. Wiley, Chichester, UK.

[4] Checkland, P. 2000. Soft Systems Methodology: A Thirty Year Retrospective. Systems Research and Behavioral Science. Syst. Res. 17, S11–S58. john Wiley and Sons, UK.

[5] Checkland, P. Holwell, R. 2002. Information, Systems and Information Systems: making sense of the field. John Wiley & Sons, Chichester, UK.

[6] Dourish, P., Adler, A., Bellotti, V. and Henderson, A. (1996): Your Place or Mine? Learning from Long-Term Use of Audio-Video Communication. *Computer-Supported Cooperative Work*, 5(1), 33-62.

[7] Habermas, J. 1984. The Theory of Communicative Action: Volume One: Reason and the Rationalization of Society. Boston, Beacon Press.

[8] Hasan, H., and Gould, E. 2001. Support for the sense-making activity of managers. Decision Support Systems. 31. 71-86.

[9] Hochman, Z., Coutts, J., Carberry P.S. and R.L. McCown. 2000. The FARMSCAPE experience: Simulations aid participative learning in risky farming systems in Australia. P. 175-188. *In* Cerf, M., D. Gibbon, B. Hubert, R. Ison, J. Jiggins, M.S. Paine, J. Proost and N. Roling (eds). Cow up a Tree: Knowing and Learning for Change in Agriculture: Case Studies from Industrialised Countries. INRA Editions, Versailles Cedex, France.

[10] Jordan, B. and Henderson, A. (1995). Interaction Analysis: Foundations and Practice. The Journal of the Learning Sciences. Vol 4 (http://lrs.ed.uiuc.edu/students/c-merkel/document4.HTM)

[11] Mark, G., Grudin, J. and Poltrock, S.E. (1999): Meeting at the desktop: An empirical study of virtually collocated teams. *Proceedings of the 6th European Conference on Computer Supported Cooperative Work*, Copenhagen, Denmark, 12-16 September, pp. 159-178.

[12] McCown, R.L. 2001. Learning to bridge the gap between science based decision support and the practice of farming: Evolution in paradigms of model-based research and intervention from design to dialogue. Australian Journal of Agricultural Research. CSIRO Publishing, Australia.

[13] McCown, R.L. 2002. Changing systems for supporting farmers' decisions: problems, paradigms, and prospects. Agricultural Systems 74 (2002) 179–220

[14] Olson, G. M., and Olson, J. S. (2000): Distance Matters. *Human-Computer Interaction*, 15(2/3), 139-178.

[15] Sellen, A.J. (1995): Remote Conversations: The Effect of Mediating Talk with Technology. *Human-Computer Interaction* 10(4), 401-444.

[16] Suchman, L. (locate ref)

[17] . Van Beek, P. 2000. An evaluation of delivering APSIM and FARMSCAPE via the Internet: the Moonie component. SyTrec Pty Ltd, Gin Gin, Australia.

[18] Van Beek, P. 2003. An evaluation of delivering APSIM and FARMSCAPE via the Internet: the Birchip component phase 2. SyTrec Pty Ltd, Gin Gin, Australia.