

The evaluation of subjective techniques to assess the value of webcams for internal business communication

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Abstract: Existing research concentrates on the effectiveness of written language and face to face communication. So how effective is the telephone, videophone, and internet based communications? This study builds understanding of the influence of live moving images in electronic communications and how the benefit can be measured. For BT, the organisation investigated by the experiments, this means identifying better use of communication through optimised communications interfaces to save peoples time and avoid mistakes. This report describes the motivation and results of a series of tests, establishing the experimental landscape for further quantitative testing.

1 Introduction.

Within the business organisation traditional circuit switched voice infrastructure has been almost completely replaced by IP infrastructure. For voice and video this means sharing a converged IP infrastructure, with voice competing with data and video for bandwidth, and different attributes impacting voice quality. Prioritisation of time critical applications such as voice is being managed through the identifying different packet classes, and introducing rules for routers when possessing these packets. Choices are being made about how to manage voice through the network, and how much to compress the voice information through developing coding technology, both standards, and the supporting processor technology. This has resulted in changes in the way poor quality is perceived, for example from crackle in the past, to clipping in the future (Ding, Radwan, El-Hennawey & Goubran 2006). The technology to exchange live video information is also changing rapidly, with web camera's costing only a few pounds, providing cheap and nearly ubiquitously available capability to communicate over video. Compared to only 10 years ago, when camera and codec equipment was priced in the thousands, and needed to be permanently connected to a fixed network interface. More recent technical innovation has seen video camera's being built into mobile devices, for example smart phones, giving potential for ready access for video communication. This developing technology has allowed the geographically dispersed virtual business teams to grow.

There are many challenges to the technical introduction of better video. The bandwidths of IP Networks are contended, so bandwidth is inconsistent. Delay & Jitter are particularly relevant when including international participants; new technologies such as bandwidth optimisation are emerging to optimise performance of IP traffic over challenged networks. Echo disrupts communication, particularly for the caller being echoed, but is no longer commonly observed using modern telecommunication equipment. Volume as well as being a user issue, is impacted by the quality of network equipment. Ease of use is still a challenge for video calls, with one to one calls being relatively easy to set up, but involving more than 2 participants introduces some usability issues. Clipping of voice and video is becoming more common in IP network environments, also Bluetooth can introduce clipping. There are new challenges around availability, including mobile phone coverage, less reliable IP networks, and the use of wireless within the working environment.

Within the large organisation there is a move towards more flexible and agile working. In BT there are 60,000 workers who have no permanent desk, and 16,000 full time registered home workers. Homeworking directly benefits the organisation in saving the cost of a providing a desk which is around £8000 a year.

A series tests, interviews and questionnaires were conducted. These are described. The results are discussed, and recommendations are made to help create the realisation of the benefits. The activities so far support the outline above, and are encouraging that these benefits are available to be realised.

Benefits of using webcams to enhance telephone calls were identified; including more connectedness (Agamanolis, 2008), help with stress & disenfranchisement, better collaboration with clearer and faster decisions, and ensuring secure and manageable adoption of potentially disruptive technology. The consequences of not following the recommendations include the continued cost of mistakes caused by poor communication; time wasted clarifying information; further increases in stress and disenfranchisement; and allowing competition to exploit this technology, to provide their customers with a superior end to end customer experience.

2 Experiment Design

A quick poll of colleagues revealed that no identified BT colleagues were currently using webcams in their work. Attempting to plug a webcam into a BT Webtop build PC proved fruitless, because the machine was locked against unsupported devices. BT Webtop PC's are prebuilt to support the VX3000. An order and installation guide was created, and sent out which included basic guidance on using plugging in, and using camera's during a call. It is known that BT people connect to the internal network in a variety of ways, including working in BT buildings on fixed and wireless LANs, and working from home on fixed and wireless access. The speed of the ADSL connection varies for each user, mainly depending on the distance from the home to the exchange. Some home workers perceived video delays upto 500ms.

During the testing of equipment recording of calls was practiced, and a serendipitous outcome was the promotion of call recording to assist with knowledge management, and reducing the exclusion for people unable to make calls on the day, but able to review a recording at a later date.

The experiments are confined within a small sample base, and the analysis has been qualitative. Blandford, Adams, Attfield Buchanan, Gow, Makri, Rimmer & Warwick (2007) propose an evaluation framework; PRET A Reporter which suggests a study should consider purpose, resources, ethics, techniques, analysis and reporting. The purpose of this trail was to use webcams to support team calls, and therefore, through the improved communication through the adding of the video component, to be able to reduce the frequency of face to face meetings, and therefore save money. Also, through improved communication to realise some of the less tangible benefits, such as emotional contracting (Nardi 2005), faster decision making, etc. The ethical approach of the project has been clear with the use and level of confidentiality of data collected from participants, and the project has explicitly stated its voluntary status at each stage. Questionnaires, interviews and less formal data collection techniques have been used.

3. Results

The study has identified a number of non-verbal communication channels (Argyle 1993). To consider which of these are suitable for evaluation within the telecommunications environment the following observations have been made against each channel. Facial expression can be transmitted through video with impact limited by resolution and frame rate. Gaze effect is limited in direction and detail by current technology, which places camera separate, usually on top, of the viewing screen; this means that effective gaze interpretation is difficult. Future cameras may be placed behind the screen, enhancing the impression of gaze communication. The direction of focus is near impossible to detect when observing a viewer of multiple participant virtual meeting, because of the way they are arranged on the screen. Gestures may not be fully transmitted due to camera field of view, most people were observed placing little care in the positioning of the webcam with little regard to the camera's field of view, often concentrating on the head, and not allowing the viewer to observe gestures. Posture can be observed and can indicate engagement, attention, and well-being. Concern about personal appearance can cause anxiety in the user; attention to appearance is not the norm for home workers. Tone of voice can be hard to interpret over poor quality phones; increasing use of mobiles and IP phones is causing this problem to increase. Speed of word delivery has been observed in research mentioned earlier to slow down, that is to reduce the number of words per minute when video is used. Volume differentials

between callers are commonly experienced on conference calls; call bridges use equalisation software to try to compensate, with limited success. Background noise is also commonly observed on conference calls. There is room for additional research in the matters discussed in this paragraph.

3.1 Initial Questionnaire

Conducted by email; findings include the information that a significant number of team members did not want to take part and a few were very keen and enthusiastic. All but one worked from home, and all had ADSL connections. One used webcams outside of work. Useful learning included the need to get responder data in a more standard format so that it can be more easily analysed using a spread sheet or database. Useful responder feedback included *“People still do business with people...it is difficult to build rapport with colleagues on the phone.”*

A process for the production of future questionnaires was established, draft, cognitive walkthroughs, talk aloud analysis, management authorisation, small sample testing, and publish. By following this process questionnaires have become progressively more useful, less ambiguous (in question and analysis), easier and quicker to complete, and increasingly respectful for the participants time, because the use of formal review has enabled questionnaires to be refined.

3.2 Semi Structure Interviews

Interviews were conducted remotely and transcribed. The interviewees were selected as people who had used webcams recently within their work, were people of varying experience of using the webcams and were willing to participate. These were based on a semi structured question list. The interviews were of strictly 20 minutes in duration, with the first half using just the telephone, and the second 10 minutes enhanced by the use of a 2 way webcam. The transcripts were coded to help identify trends and patterns. The interviews were analysed using basic coding around functional, positive, and negative attributes.

Positive themes included references to the benefits of being able to see body language, facial expressions, noticing demeanour, the way people look around a room in a meeting, the possibility of having more meetings a day, focus and concentration, the importance of building rapport when kicking off projects, the importance of what people don't say is less visible on a phone call, stress. Negative themes included some early minor technical issues, the lack of knowledge and understanding around webcams, and the fear of something new. Some interesting responses during the interviews are included below.

“I am sometimes concerned for my colleagues that work from home all the time and don't travel. I am conscious that a number have suffered stress. I think webcams go a long way towards that personal intervention and relationship camaraderie, over and above what you experience on an audio call”,

“I was quite astounded actually at the impact on me actually being able to see my boss... All of a sudden the distance just closed down.”

“Maybe to demonstrate something practically and physically that can't be done any other way. You wouldn't be able to show origami on line.”

The interview experiment has provided some interesting quotes that may help others to better identify with the webcam experience. It has also provided an insight into user perceived benefits, which seem to be around communication better at an emotional level.

3.3 Operational Landscape Questionnaire

An online questionnaire was designed for respondents who do and don't have access to webcams. A base lining questionnaire, designed to collect information relevant to webcam usage, to help better understand some of the existing drivers and perceptions of webcams. It asks about the responder's computer and internet access; how and how much data sharing is currently used; how many and what type of calls and meetings fill a typical week; travel; and perceptions of webcam. Email requests to voluntarily complete the questionnaire were sent to just over a dozen colleagues, and the 7 responses received are discussed to discover what technology exists and current attitudes to it. All responders

were home workers. Most used wireless access. The answers to how fast is your access was not clearly answered, the questionnaire could be improved by embedding a speed tester.

Just over half thought webcams could improve communication in BT, but less than half were keen to embrace webcams themselves. Most were OK with using webcams within their BT work, but 2 were not. All responders felt connected with their team, and all but one thought we could collaborate better.

3.4 Webcam User Questionnaire

Responders to the webcam user questionnaire had recently used webcams to attend a team meeting. Most found webcams easy to use. Most reported that they did not feel more connected, or attentive; which is surprising given the interview feedback and anecdotal experiences. Nearly all reported they could pick up on posture and body language, but slightly less reported being able to pick up on facial expression. Few felt that eye contact was maintained; which was expected given that the cameras are not easily configured. Some apprehension about using webcams was reported, and it might be interesting to explore this further.

4. Conclusions & Recommendations

Assessing benefit of improved communication is complex. Rather than comparing virtual and physical environments (Friedman, Karniel & Dinur 2009) this study has looked at the perceived benefits when a webcam is used in a voice environment. Future experiments should aim to provide more quantitative certainty, because seemingly compelling anecdotal evidence of web-cam abound (Pizam 2010), but have not driven the investment required for profitable business adoption.

References

- Agamanolis, S. (2008).** At the Intersection of Broadband and Broadcasting: How Interactive TV Technologies can Support Human Connectedness. *Journal of Human-Computer Interaction*, Vol 24 No 2, 121-135.
- Argyle, M. (1993).** *Bodily Communication* (3rd Ed), Routledge.
- Blandford, A. Adams, A. Attfield, S. Buchanan, G. Gow, J. Makri, S. Rimmer, JJ. & Warwick, C. (2007)** The Pret A Rapporper Framework. *Information Processing and Management*. Vol 44 4-21.
- Ding, L. Radwan, A. El-Hennawey, M. & Goubbran, R. (2006).** Measurement of the effects of temporal clipping on speech quality. Instrumentation and Measurement, *IEEE Transactions*, Vol 55, Issue 4, 1197-1203.
- Friedman, D. Karniel, Y & Dinur, A. (2009).** Comparing group discussion in virtual and physical environments. *Presence*, Vol 18 No 4 286-293.
- Nardi, B. (2005).** Dimensions of connection in interpersonal communication. *Computer Supported Cooperative Work*, Vol 14 No 2 91-130.
- Pizam, A. (2010)** Virtual Meetings: If you can't fight them, join them. *International Journal of Hospitality Management*, Vol 30, Issue 1, 1-2

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