Practical Applications of Low-cost Network-Based Video: Beyond Videoconferencing as a Substitute for Face-To-Face

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1 Introduction

For many years, video research has concentrated on videoconferencing as a substitute for face-to-face meetings. Videoconferencing systems are usually justified on the basis of increased productivity or cost-cutting as a direct result of a presumed reduction in travel. While there have been a number of successful installations and applications of videoconferencing, on the whole, the technology has failed to provide the anticipated benefits.

The literature offers a great number of reasons for it, but the fact is, videoconferencing as a substitute for face-to-face communication has never met expectations. Despite all the research in support of this conclusion, as well as the extremely low market acceptance of the technology in the commercial marketplace, vendors continue to focus their efforts on the substitution model.

The present work abandons the notion of video as a substitute for face-to-face communication, and in fact suggests uses that are not videoconferencing, in any existing sense, at all. Further, we conclude that another common application of videoconferencing, that implemented by most desktop software, specifically the person-to-person video call, is nearly void of utility, particularly for business communications.

Nor does the present work propose videoconferencing as a replacement for other technologies, such as telephony, but rather it suggests that video applications can augment and support other communication technologies and tools, rather than replace them.

2 Effective Applications of Video

Video for enhanced presence status is proposed as a key application of video. In this application, we refer to video-only, *without* audio. Audio and other media are considered separate applications. In the case of audio, the typical tool is a telephone, which of course in many real-world cases may be using VoIP, but it is considered distinct and separate for the purposes of the video applications presented.

3 Common Pitfalls

For three decades we have been conditioned to think of video in the context of videoconferencing and in comparison with other teleconferencing technology, usually considering face-to-face as the pinnacle of communications. Videoconferencing has mostly been examined as a substitute for face-to-face communication rather than as a distinct medium with unique characteristics. Users were expected to apply existing skills and practices to videoconferencing. Research has repeatedly demonstrated failure with this approach. While the reasons for this are many, a few of them include:

- inability to have side conversations during a meeting
- false assumptions that video provides useful non-verbal communication, such as gaze, expression and posture
- dialogue requires more structure to ensure people do not talk over each other
- cost benefit cannot be made on the basis of reduced travel expenses or increased productivity
- video can *detract* from the communication process if video is accompanied by a reduction in audio quality or audio delays
- self-consciousness about 'being on TV'

The evidence is clear that even high quality audio and video do not replicate the rich nature of face-to-face communication. The applications of video presented in this work consider video on its own terms, rather than as a lower form of communication, and thereby avoid most of the above pitfalls.

4 Enhanced Presence Status

Video can be used to provide information about group members' *availability for communication.* Video can provide fine grained presence and availability information beyond that available with the icon-annotated lists of a typical Instant Messaging (IM) system.

The *video buddy-list* would typically represent a sub-set of one's traditional IM buddy-list. People in daily contact stand to benefit from sharing a video signal for enhanced presence status, while people who only occasionally interact may not.

In a co-located setting, people rely on visual information to determine availability of others. Consider the office door. People glance into an office to check availability, but they follow established social protocols before entering the office. Video naturally builds on these social mechanisms, where the same kinds of familiar visual cues apply [1, 2]. Supporting technology, such as text chat, along with the video signal, can also facilitate these social negotiations of privacy and availability.

4.1 The Importance Of Opportunistic Communication

Studies of workplace communication show that most interactions occur spontaneously for short periods of time. These unplanned interactions occur naturally when group members are co-located. Despite research

from various disciplines showing the value of these informal interactions, evidence indicates that people in the workplace do not recognize their value. Workers tend to overuse formal arranged meetings and under-utilize impromptu communication relative to their value [2]. Data indicates that without visual information about the availability of others, connection failure is high. More than 60% of business phone calls fail to reach their intended recipient [3, 4]. The enhanced presence status provided by video increases the chances of successfully initiating an unplanned connection with a remote coworker, thereby increasing the frequency of these highly productive interactions as a natural consequence.

4.2 Privacy

Of course, awareness trades off against privacy. Users must be able to control the access to their video signal. Just as one can shut their office door, they must be able to turn off or block access to their video signal as needed.

4.3 Camera Position

It is important to note that the office door analogy implies that the video camera be positioned to provide a general view of the office and work-space, rather than a close-up talking-heads view. The information we are interested in is not gaze, expression, or body language of the party, but information such as whether they are on the phone, busy in a meeting, or otherwise occupied.

4.4 Persistent Always-on Video

The *video buddy-list* is essentially a list of persistent video sessions shared between group members. It approximates some aspects of sharing the same physical office, so that informal communications can be started with minimal effort between connected participants, and visual information about communication availability is persistently available. If a potential recipient is out of their office, the caller can monitor the always-on video channel, and establish the communication when they return, ensuring that a vital communication takes place[5].

People have been reluctant to maintain a persistent always-on session using prior technologies such as the telephone or traditional videoconferencing, knowing that this makes them unavailable for potentially important calls from other users. The *video buddy-list* concept avoids this problem. It does not tie up the telephone and allows parallel communication, including Instant Messaging or other communication vehicles.

4.5 Reaching Beyond The Primary Communications Network

In most business settings, interaction within one's group represents the vast majority of daily communications, but on occasion a worker needs to communicate with someone from a neighboring team or the executive layer above. The **enhanced presence status** application allows users to reach out to temporarily show members of neighboring departments. A *glance* feature lets a user establish a temporary video connection with another user to check availability, without cluttering the primary video buddy-list with these ad hoc connections.

4.6 Integration With Other Communications Applications

The prototype *video buddy-list* application integrates with several other business systems. These include a Jabber instant messaging infrastructure, on-line corporate directory (LDAP), and a corporate Intranet (web applications). As a result, the *video buddy-list* application is aware of the organizational structure as well as project and team organization, which can simplify creation of buddy lists and groups, and streamline the process of locating co-workers.

Clicking on a video buddy can open a Jabber instant messaging session, or open that employee's corporate directory page in a browser, showing a photo of the employee, contact information, department information, and other information as appropriate.

5 Video Quality Issues

This paper considers only low-quaility video (4-10 frames per second, low resolution) available with low-cost video cameras and requiring only moderate bandwidth (64Kbit/s). Technology limitations, cost considerations, and restricted network bandwidth make it critical that we understand the utility of low quality video [6, 1].

6 Summary

The performance of work groups is closely tied to interactions that foster group cohesion [7, 8, 9, 10]. The quality and frequency of personal interactions among group members has been demonstrated to have a direct impact on performance of the group [8, 11, 3, 12]. Physical proximity facilitates frequent interpersonal interaction among group members. Splitting groups across two floors of the same building can have a negative affect on group dynamics, yet in practice, groups are often distributed across campuses, cities, or states.

When team or group members are geographically distributed, **video for enhanced presence status** can provide significant qualitative value to group interactions, facilitating more frequent collaboration. Research suggests that such richer interactions lead to higher quality results and improved group productivity.

This work indicates that **video for enhanced presence status**, in particular, persistent video sessions (always-on video), offers significant value in approximating conditions of physical proximity for remote co-workers and in facilitating informal communications that improve group cohesiveness and effectiveness. Further, we believe these benefits apply not only inside EarthLink, but also to customers who may be part of workgroups.

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