

You Can't See the Picture When You're in the Frame

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Abstract

This paper outlines a view of tomorrow's communications future, facilitated by a rich set of tools that are labeled the VIVID¹ tool set. These tools will be prototyped and tested in a multi-disciplinary research Center, the new Center for Information Technology and Society at the University of California at Santa Barbara. The paper presents some examples around learning concepts and distance learning to postulate some possibilities for more effective business communications — and thus, to illustrate some avenues of research for which the Center might be expected to enable unique results.

1. Introduction

Twenty years ago the Internet was an e-mail network between a handful of scientists; today Internet-based start-ups consume 60% of America's VC funding, and Internet stocks help drive the current boom in the stock market. Twenty years ago computers were used mainly for data processing; today micro-controllers and microcomputers impact virtually every aspect of American lives. Think of PC, PalmPilot, pager, clock radio, microwave oven, door locks, traffic signals, even drug dispensers and pacemakers -- our digital chip-based world is paramount.

Similarly, twenty years ago, telecommunications meant telephones, or broadcast radio and television. Today electronic commerce rides the Internet packet network, while the circuit-switched telephone network carries more data than voice traffic. Wireless networks have expanded the use of telephones in the Third World by a tenfold rate in less than a decade.

And, all of a sudden, public policy issues are "hot" in Washington D.C., in London, in Bonn, in capitals around the globe. No longer just

questions of tariffs on phone connections, the topics range from regulation of electronic commerce to control of Internet content, to control of access itself. Many are important issues for which computer scientists can provide crucial input. These include: Internet governance (including the controversial domain names issue), Next Generation Internet, universal service, privacy, copyright, database, patents, government information policy, information security, content controls, educational technology, electronic delivery of health care, e-commerce, and digital libraries. In 1999 alone, computer-related legislation considered in the United States Congress included bills on copyright, cryptography, filtering, e-commerce, identity theft, Internet, privacy, research, wiretapping, and Y2K.

But nearly all of these issues, while the result of the activity and products of computer scientists, require input and judgment from people from all disciplines and all sectors of society. Regrettably, these topics have gone unconsidered in the main, and the leadership of our society is largely ill equipped to deal with them. The purpose of this paper is to focus inquiry on the context and breadth of the value and societal impact of these revolutionary capabilities. Hopefully, this will help to stimulate consideration and provide guidance for their development in advance of a societal discovery of their pervasiveness and import.

2. Communication is the most universal intellectual human desire and activity

It is more diverse in breadth and depth than any specific human skill, and more frequent and ultimately more satisfying than any other human activity. Effective communication is the basis of most *organized activity*, and is especially critical to modern business. It is seldom *taught* or *studied* in a holistic fashion because it is so

¹ VIVID, is my term for Voice Integrated with Video Integrated with Data.

pervasive. Communications *schools* are usually Journalism or Creative Writing (the literary side), or Advertising or Filmmaking (the graphic arts side). Political Science and Sociology programs emphasize Leadership and Crowd Behavior. Communications *technologies* include Signal Processing, Network Queuing, Switching Systems, or Bit Rate / Bandwidth / Frequency Spectrum studies -- in EE and CS departments. Business schools often study Communications as an Organizational Behavior topic, and sometimes as a Motivational or Leadership issue.

Our priorities at the UCSB Center-are to study afresh, and from a more holistic context, the wide range of Information Technologies issues and perspectives. We may quickly characterize this as three foci: (1) the range of individual and small group communications that pre-dominate in questions of family, relationship, institutional and business effectiveness arenas; (2) the range of large group communications issues that are more prevalent in community, national, and global arenas, plus entertainment and political structures; and (3) the backdrop of cultural behaviors and normative patterns, plus infra-structural possibility, that determine what is said, heard, conveyed. While each point is broad in itself, the interconnectedness of the set is the compelling element of our program.

2.1. There has been but modest study of the specific character of effective business communications methodologies

To be sure, M.I.T.'s Media Lab and XeroxPARC have done substantial work. Lucent has done much, including alternative technologies and some useful sociological testing. Microsoft's Virtual Presence Laboratory in San Francisco is worth a mention, as is the Internet II lab in Armonk, NY. The requirements of Business Communications are challenging, as a result of substantial restructuring with e-commerce, broadband communications networks, and computer-supported co-operative work-tools. Yet, the current set of tools and methodologies have largely evolved in response to specific improvements in each extant technology, rather than eschewing incremental improvement and starting with a clean slate. Part of the thesis underlying our work is that small focused laboratories, seeking to answer the right questions, have produced great results on occasion. Caltech, Brown, Carnegie, Johns

Hopkins, Princeton, and, yes UCSB, in universities; Hewlett-Packard Labs and XeroxPARC in industry — examples of institutions or organizations that contributed far more substantially to new paradigms than their proportionate spending profiles would have predicted at the time. Hindsight reveals that in most cases, they asked a new and more fruitful set of questions. This seems entirely consistent with the thesis of the currently popular Harvard Business School book by Clayton Christensen, *The Innovator's Dilemma* [5].

There is no question that digital communications Technologies are dramatically impacting our ABILITY and our METHODOLOGIES to communicate, which clearly are creating new mechanisms with scant study of their meaning or impact. Thus, it seems particularly opportune to study such topics as e-Commerce, networked labs, and synchronized wide-area groups of people collaborating alongside such problems as hackers, *spamming*, *flaming*, access to pornography, and virtually immediate Grand Jury exposure of evidence along with myriad other privacy issues.

This requires a multi-disciplinary approach. It is important to recall that when XeroxPARC tried to understand the flow of paper in an office, they used cultural anthropologists and linguists to develop the *Office Document* metaphor, and *then* they used Computer Scientists to create better solutions. Similarly, we believe that the various threads of Communications, from the *Personal* abilities and perceptions, to the *Institutional* opportunities, to the *Societal* technology solutions and cultural impacts --all merit serious inter-acting contextual study.

2.2. Weaving the multiple perspectives together

Whenever one attempts a holistic study of sizable magnitude, it is worth recalling advice that has been proffered along the way. Nobel Laureate, Murray Gell-Mann at ACM97, the Association for Computing Machinery's semicentennial meeting embodied one particularly insightful set of observations re the current condition in the keynote address.² He made three points:

² Murray Gell-Mann won the 1969 Nobel Prize in physics for his work on the theory of elemental particles. He followed that up by discovering quarks, the fundamental building

- The central question these days is how to encourage and value *holistic* solutions, or even efforts, which seem, in the main, infrequent or nearly non-existent.
- Most institutions value specialties highly, and reward them deeply. The corollary is that they discourage multi-discipline work. How to redefine this culture seems particularly unclear.
- Even crude systems solutions have more value today than excellent component solutions (it is wildly imbalanced).

Nonetheless, he noted that his own biases betray him when he considers whom might qualify as an adequately qualified generalist. Holistic efforts are not easy to encourage; it is more than suggestive that NAE's study regarding Collaboration found the major impediment to collaboration between universities, or between university and industry, to be centered in the individual prejudices and anxieties, and firmly supported by the reward system of the institutions [6, 8].

We anticipate that our efforts will help with the re-definition, particularly as it demands multi-disciplinary work. To illustrate some of the concepts that we feel can be explored via the combination of several disciplines working together; the following discussion will expand on one area — business communications over distance. But to do so in a meaningful way, we will first look at personal learning needs, using a Skill-Awareness grid usually found only in texts for Educators. Then we will consider a Listening-Speaking grid from the Psychology and behavioral studies fields, and we will weave its themes together with work from organizational and leadership concepts from Business. Then we will explore a thesis for four inter-related attributes of effective communication in modern business that is built around a Distance Learning example from Stanford University's graduate education program. This should give us a basis from which to hypothesize some experiments worth staging. Although it is premature to anticipate the priorities that we will be selecting, we will nonetheless cite some of our current beliefs and probable directions.

2.2.1. The Skill-Awareness grid

blocks composing the atom's nucleus. He is Professor and Co-Chairman of the Science Board of the Santa Fe Institute.

The Skill-Awareness grid (Figure A) is a simple locational device for assessing the degree of consciousness and skill that any individual or group of people might possess at a given time on any topic. A historical traversal path can be described with such a grid, as can a value for various technical support tools.

Figure A portrays four quadrants of *skill* versus *awareness* level. Working from the lower right-hand corner, where there is little to no skill, and little to no awareness, people traverse counter-clockwise as a function of training and development.

The lower right-hand quadrant is the beginning phase for anyone who is both ignorant on a topic, and unaware of the level of his or her ignorance. By the time they have become aware of their lack of skill, learned the requisite skills, and practiced them enough that they become second-nature, they arrive at the lower left-hand quadrant, so skilled that it has become intuitive behavior, and they're no longer aware that this is a skill that they possess. It has become an *unconscious* or innate behavior or skill at this point.

This chart or a variant has been published many times, notably in James Adams' *Conceptual Blockbusting* [2] and David Thornburg's *Edutrends 2010* [13]. We might extend the idea, however, for purposes of considering some of the learning modalities that can facilitate the movement from *Happily Ignorant* to *Happily Accomplished* (Figure B).

For example, someone in the lower right-hand quadrant might be considered an *unaware* consumer, who could be *educated* by advertising on television to the desirability and virtues of a product. Someone who is in the upper right-hand quadrant is logically a student, amenable perhaps to the teachings of a mentor or trainer in order to move to the upper left-hand quadrant. This quadrant is one where most employees of a company may typically be found. They have learned the basic skills, some in college and some on the job, but they have not yet become practiced, and certainly they are not yet intuitive, about their skills. Rather, they are in a constant process of learning from and with their peers. This is particularly true in high technology, high knowledge-development worlds of most professionals in science, engineering and medicine. The fourth quadrant is where really skilled practitioners reside; they are often so good that they don't even know or fairly appreciate how good they are. A student is said

to *apprentice* to the master, particularly for highly craft-oriented skills.

The last point to make with Figure B, however, is one of the more interesting and least noted. That concerns the question of how a Master moves from a place of high intuitive knowledge to return to a state of new ignorance, with comfort. I term it here *interdisciplinary learning*, but this is scarcely adequate to describe the depth and context of the issue. What seems true from observation is that very highly skilled folk who have become at-ease with their skills are very often so comfortable with their knowledge that it becomes a serious inhibitor to seeking new input. This may surface as arrogance, resistance, or a simple lack of curiosity. Often, in situations that require interaction with erstwhile colleagues, argumentative, confrontational, or guarded behavior is exhibited. Thomas Kuhn described it in *The Structure of Scientific Revolutions* [9] by noting that frequently it required the physical demise of the believers of one paradigm before a new and more accurate paradigm could be accepted, facts notwithstanding.

One of the more interesting situations is to observe highly skilled folk in different professional sectors that share little common background. I saw a great encounter recently where Story Musgrave, the astronaut who is a neurosurgeon, was interacting with a small group of elite computer scientists whose backgrounds were quite dissimilar. The discussions were pretty one-sided, in that Musgrave had no problem displaying ignorance and a child-like curiosity about their field, but the reciprocal exploration about his field, or even his life experiences, was modest by comparison. *And how do you like neurosurgery?"; "Done any good operations lately? , "Was the Shuttle launch exciting?"* It is very hard to have a conversation where the two parties lack a common code, a *lingua franca*, whether the code in question is language (*e.g.* French vs. English), discipline (*e.g.* neurosurgery vs. computer science), or life experience (space travel vs. commercial airlines).

2.2.2. Multi-faceted issues of communications between individuals and groups

The charts above provide a basis for discussing the *Personal* qualities, those issues relating primarily to the individual and his/her skills and perceptions. This can be expanded greatly, of course, to include values, motives, personality,

bias for action, and a wide range of human behavioral characteristics. Obviously, the issues of *interdisciplinary learning discussion* are rich for discovery and possible contribution.

Taken *en toto* however, these are but one of the three branches of significance for our work. Turning to the *institutional* opportunities, we can define this as a question of communicating or learning more broadly than that which occurs on the personal level. Usually these are small- to medium-sized groups, united by common goals of some type. The groups need to develop a communication structure in order to function. This is harder if the members are not geographically co-located, but the common goals usually unite them.

In our experience, though, the common goals are laudable and necessary, but it really works best when a project or a problem of real consequence has to be solved. Think of the bonding experiences of soldiers on the front lines in World War I or II, or the stories of the Manhattan Project, the safe return of Apollo 13, and the heroism shown in major disasters such as earthquakes, volcanic eruptions, or war atrocities.

Institutional communication is often described in terms of *leadership, management, group dynamics*, and other such concepts. It includes the questions of how an institution disseminates and inculcates its dogma or thesis, and obtains concurrence from its membership. Institutions such as the Catholic Church and volunteer fire departments, not to mention garden clubs, self-help groups and AIDS support teams all face substantially similar issues of ensuring clear communications and understanding from and between their members and the wider community within which they interact.

So, what is it that we need to study, given these examples from Story Musgrave to questions of how AIDS support groups maintain integrity? One obvious source of inquiry is how to facilitate *interdisciplinary discussion*, which is more a function of psychology, sociology, and interpersonal skillsets than technology toolsets and network structures. Another clear issue is how to facilitate *group cohesion*, which entails both sociological and possible enhancement tools. Yet a third might be how to facilitate *creative collaborative design*, whether or not at a distance, but probably against a time deadline — issues which may invoke organizational, behavioral, and cultural study as well as toolsets and networks.

3. Questions that come into play for institutional communication

Several factors have significance for institutional communications. First perhaps is the stature or prominence of the individual in the organization. It is much easier for the President to be able to have communication access to all members than an entry-level worker. It is much easier for someone who has had Toastmasters training to walk to a podium without acute nervousness. And it is much easier to have access to people locally than in remote facilities. Coffeepots served as a dissemination spot for the historic rumor mill, and e-mail provides a virtual coffeepot spot and fulfills a similar function today. So the reality of rank, skill, and location are still meaningful for what can be communicated, and indeed who is likely to, or able to, listen.

In addition, though, there is a rich interplay of context, where the personality and dynamics of the speaker(s) and the listener(s) affect the quality of the communication. This is quite apart from, though not independent of, the questions of skill and competence raised in the previous section. This has more to do with speaking and listening skills and desire, as well as the level and comprehension, and even the textual vs. graphical nature, of the material. This is also affected by the way the communication mechanisms are constructed. Perhaps an example, using a staff meeting as a metaphor, could illustrate this point effectively. So, with that thought in mind, let us posit a staff meeting of ten people, all located at the same facility, for our beginning example.

3.1. Example of a meeting

Imagine a Monday morning staff meeting between a supervisor and her eight line managers. They all come in, sit down around a rectangular table, and begin the meeting. The supervisor talks for a while about general interest topics, then in turn queries each manager for a status report of goals, activities, results, and issues in their respective area. As each manager shares information in turn, the supervisor's expectation is most likely that each manager will listen to the others' reports, note any points of intersection with his/her own department, and respond or carry away useful information to their respective group to facilitate interaction. We can model this as shown in Figure C.

Note that the dynamics here have changed greatly from the *one-on-one* kind of meeting that typifies the classical learning model of the previous section. And because it is a group of less than ten people, it can be characterized as *some* rather than *many*. But, nonetheless, some very different kinds of communications are required in this meeting. There is a portion where the supervisor is talking to me *and* everyone else; there is the section where I am talking to the supervisor mostly, but the others are listening; and there may well be a section where we all have give-and-take to solve a problem or discuss an issue together. Depending on the supervisor's skills, the meeting can have a collegial tone or an interrogative tone, but that doesn't change the location of the interaction dynamics on this diagram. On the other hand, it likely may feel to the managers that it is a series of publicly observed *one-on-one* meetings.

Working with this same diagram, we can imagine a larger group meeting. Perhaps it is a department-wide meeting, held at the end of the day on Friday to discuss achievements of the week and answer questions from the audience at large. Or a shareholders meeting, with an auditorium rented for the occasion. Or it might be a company party to celebrate a successful quarter-end, held in the cafeteria after hours. If the President stands up to talk, his or her effort is shown down the left column -- one person talking to many listeners. Alternatively, those in the audience are on the top row -- many listening to one person talking. If several speakers stand up, the middle columns and rows come into play. If the meeting becomes fully interactive at the end, with a large-scale Q & A session, where many folk talk and all get a chance to hear what is said, the meeting has moved to the lower right-hand-corner of the diagram.

3.1.1. Talking and listening vs. other forms of communication

All of the senses are involved in communications. Sights, sounds, touch, taste, smells, and the "sixth" sense or intuition, all play parts for different people on a nearly constant basis. From a business communications standpoint, we tend to think first about "data" such as numbers and figures, (*e.g.* shipments, scrap rates, profits), and sounds, primarily conversations, as the communication modes. A number of folk focus on designs — graphical or visual representations. But many folk "read"

other signs as clearly, including who is paying attention in a meeting, who is dressed slovenly, who sits attentively and who is dispirited. Who can vs. who can't look you in the eye when you describe a problem to them.

Educators and psychologists have studied these kinds of questions in terms of learning retention for new material, and the studies over a very long period are remarkably consistent. In general, people retain about 7% of the information they hear orally, versus a much-improved 23% for material that is visually presented. Good teachers learn early that "learning by doing" is much more valuable than either lecturing orally or showing graphical illustration. The retention rate for material where it is "practiced" in some way is usually in the 60-70% range for minimal *hands-on* training, especially if the later usage is done within reasonable follow-up time and the material was not overly complex.

3.1.2 Modifying the staff meeting model to include other sensory data

For this section, it is important to add some dimension that can account for additional sensory data that can be communicated in a meeting context. The "zero" column for listening, and the "zero" row for talking, are shown in Figure D to represent data transmission that is visual, tactile, aromatic, or "felt". The degree to which these other forms of communication are effective seems to be much more variable, person-to-person, than studies show for aural or textual data in general (assuming adequate speech or data facility).

Just to provide some context for Figure D, we all have experienced teachers and managers who talk, talk, talk, and seemingly never look up to see if anyone is listening. This is shown as the left-hand column. Similarly, many classmates, and not a few managers, can sit through a course or a meeting and never say a word. They may be listening attentively to everyone, or no one; they may be closely watching someone while someone else talks. They are shown on the top row of the figure. A few *talkers* are superb audience-watchers as they speak, and tailor their talk on the fly to reach their intended mark. Some of the most famous historic politicians are accorded this quality. Arthur Schlesinger Jr. opined that Franklin Roosevelt, John Kennedy, and Winston Churchill were masters of this technique, and that it accounted for a great deal of their success as leaders.

4. Technologies to facilitate communication across distance

Since the beginning of civilization, people have sought to amplify communications. Shouting allows being heard at a distance, smoke signals and semaphore flags can be seen further away than sound could carry. Runners carried word of the results of a battle (*e.g.* the origins of the 26+ mile marathon). The fast ponies of the Pony Express could carry mail across the continent in a few days, much faster than Clipper Ships around Cape Horn (which in turn were better than classic sailing vessels). Electronics, starting with the telegraph and the telephone, and then Marconi's miraculous ship to shore wireless which anticipated radio and television, decoupled communications from physical transportation. And certainly for the 20th century, we have grown accustomed to the notion of communicating at a distance routinely, both by electronic means and with frequent travel for business or pleasure.

This has affected much about our society. Americans watch more television, read less, and travel by car and plane far more than any other people do. We live further from home than our forebears, and move more frequently. And our employers take advantage of this; some suggest that they are primal in causing it. (*e.g.* IBM stands for I've Been Moved for many insiders.)

And a current manifestation of this phenomenon is seen in the way companies grow. They are less often *grown from within*, and more frequently by M&A (merger and acquisition). An outgrowth of that is the decision often to manage the merged company with remote leadership joining the *home team* via remote electronic link weekly. Let's rejoin our staff meeting, this time for a group with attendees from some off-site locations, and see how well it works (Figure E).

4.1. Meeting modes with remote participation

In the simplest case, we have a remote telephone connection from any one or several sites into the main meeting room. Using ordinary telephones at each end, which is the typical situation for better than 90% of American businesses (and more than 98% of European businesses), it is possible for attendees at a

remote site to hear and speak in the meeting. Unfortunately, for multiple participants at the *main* meeting, and but one or two at each remote site, a couple of classic phenomena occur. First of all, the phones are usually half-duplex, which means that when one side is speaking, all of the classic interrupt signals (*e.g.* clearing your throat, waving a pencil, catching a gaze, or even shouting) fail to gain the floor if the speaker is long-winded, or uses but infrequent short pauses in a string of run-on sentences.

So one typical scenario is that remote participants get fairly frustrated for lack of ability to jump in and when they finally do get the floor, they tend to talk longer and string several stored-up thoughts together. This in turn is *non-interruptible* from the main meeting floor, so a number of participants in the *real* meeting get frustrated, first for lack of ability to directly respond to the statements as they occur, and then for lack of ability to shut off a perceived rambling talker, or worse, a talker who is revisiting topics that the rest of the audience considered completed.

Another typical situation is that the main meeting will have a succession of speakers, all of whom tend to look at and speak to each other, not to the telephone, and in fact usually the telephone handset is left stationary in the middle of the table (or worse, near the original speaker when the call was established) so that each new participant is heard at varying volume and distinction on the remote end. Any noise (sidebar conversations) that are as near to the phone as the extant speaker get inserted as noise, as does a projector, a computer fan, or even a pencil scribbling on paper. And, worse, the remote participant can't even get the floor easily to say *I cannot hear you, would you mind speaking up or moving the phone*, a phrase that in such a meeting gets said a dozen times per hour in my experience. It is truly maddening at both ends; tempers rise, and communication reduces.

For all of these situations, a directional microphone deskset (*e.g.* Polycom Soundstation) provides an incredible improvement for each end. Multiple participants at each end can sit naturally quite a distance from the unit and be heard clearly and distinctly, with background noise muted, and with multiple additional features easily included (such as muting, and side conferencing), and all discussion is conducted full-duplex, so audio cues for interruption work very nicely. These sets are

less than \$500 per conference room, delivered next day from any of the large office supply chains, and believe me, they are indispensable, even for the home, if used for remote conference attendance. For all of that, my cursory surveys reveal that less than one out of two hundred home office workers in America have made this investment some eight years after its major introduction.

Bear in mind, now, that the audio participant has no access to the *listener/watcher* or the *talker/watcher* modes we earlier described, so *persuasive arguers* who rely on body language and facial expression to gauge their presentation, are still bereft of most of the cues on which they usually rely. On the other hand, all of the attendees at the *real* meeting site have access to the cues, and they, much more quickly than a remote presenter, can sense when something has *gone south*. And it is like the kiss of death. No proposal can easily survive and re-emerge intact from an initial remote presentation *gone south*. The net effect of this, for anyone who has experienced it more than once, is to ensure that you never get caught in this situation. Which of course robs the *joined meeting* of any real shared participation in decision-making. No one at a remote site would ever make a serious proposal without traveling to headquarters to make the case. Which inevitably builds a hub and spoke company, for its organizational power structure and consequently its communication system. Some companies overcome this, but it is via organizational structure rather than by communication system that they have historically done so.

One of the clear areas for our future research, taking advantage of the multi-disciplinary nature of our composition, is to study how these factors can be mitigated, and remote participants can be truly empowered and *heard* in companies that increasingly have their key employees traveling or living remotely. In an age of virtual companies, this seems like an imperative set of requirements for successful commerce. While we believe that toolsets can be constructed that will help greatly, we also believe that much opportunity exists for new understanding of management techniques and employee behaviors. This could dramatically affect such issues as technology transfer and collaboration between disjoint teams, and interpersonal relationships. It is not hard to imagine extending such learning to situational negotiations, even nationally and internationally.

4.2. Whiteboarding and data sharing for conferences is proving invaluable

Much research has been done, earliest and most extensively by XeroxPARC, and later by wide groups of people, into the value of shared whiteboards, and shared datasets, primarily for use in analytical discussions (engineering drawings, budget numbers, slide bullets for presentations, even the newest animated PowerPoint slides with zooms, pans, inserts and music playing). And with inclusion of Microsoft NetMeeting in Windows 98 and Windows NT, the PC user-world now has these capabilities much more widely available. They are pretty powerful tools, and permit sharing screen control with pointers, keeping an audience in multiple sites "looking" at the same slides in the same order, even allowing virtually immediate access for all participants to see the overhead projections being shown in the *main* meeting room. This is a major step for useful shared meetings, and we may expect much improvement in the tools as time passes. There are today a few major limitations — remote sites need two phone lines, one for audio and one for NetMeeting, unless you are willing to put up with the poor VOIP (Voice Over Internet Protocol) that is built into the current product (no serious remote-site participant will do that with the current state of affairs). If multiple sites are involved, and the images being projected are high bit-rate for motion (including most graphical or picture-image PowerPoint slides), the network loading is so high that interactivity goes away quickly. On the other hand, the notion of passing cursor control around very widely in multi-site meetings is about as nonsensical as passing the chalk and the blackboard around to every member in a proximate meeting, so this limitation probably is not too insurmountable.

4.3. What about video conferencing?

Video Conferencing is perpetually the next Killer Application. From the earliest Picturephone days of Bob Lucky's unlucky venture at AT&T in the sixties, to the struggling PictureTel, V-Tel, and other vendors of videoconferencing equipment today, there has been great enthusiasm and a belief that this technology holds enormous potential, but it somehow has always fallen short. The same weekend that Gordon Bell, the peripatetic

visionary who originally designed DEC's PDP and VAX architectures, was proclaiming to 2000 industry leaders at ACM97 [1] that this was the killer application of the early 21st century, he and twenty colleagues were unable to get Bay Networks' spanking new cross-continental teleconferencing center to work for a Board meeting of the bi-coastal Computer Museum Board. Irony? Message?

There are, to be sure, a number of highly-satisfied users of Video Conferencing equipment, and in fact their loyalty and dedication to this technology is startlingly high, according to Will Strauss and associates, the long-time industry analyst who authors the Future Concepts series of market studies [7]. He observed, somewhat wryly, that this is one of those strange markets where the non-users show remarkable lack of enthusiasm to try it again, even when they have had some experience with it in the past, while the users are passionate about adding further capability and functionality on a nearly continual basis. The problem is, the latter set of folk is a small one. At the moment, there is renewed interest on the part of the Distance Learning folk, who have recently used WWW databases, widespread PCs, and the educational crisis to generate plans that have VCs lining up for another turn. Another set of potential users are the NSF-funded Collaboration experimenters, many from the Department of Energy at atomic energy facilities with the obvious mission-critical emergency issues as a backdrop.

What are some of the issues that need solving for Video Conferencing to succeed? Intel's efforts with ProShare and TeamStation were spurred by the belief that the cost-per-seat had to be driven down drastically. They succeeded admirably. But the basic desktop PC model suffered from off-axis camera placement, so you are guaranteed to look the other person squarely in the eyelid, never the eye. This, while seemingly minor, directly confutes every cultural norm we hear — *look em in the eye ; seeing is believing ; don't shoot until you see the whites of . . .* ".

At least as big a problem, much more insurmountable for most users, is the bandwidth limitation — no matter how it is sliced, at least 384Kbits seems required to have a large enough picture with enough frame-rate transmission for it to *feel* right. Sure, many people, usually marketers, argue that ISDN lines can work, and even that 56Kbit modems offer value, but no one trying to use this technology for serious work

finds that credible in any way. The third flaw is that the design paradigm assumes that you can easily invoke the system; using the built-in phone directory, you can instantiate a call to any colleague with ease from your desk to theirs. In practice, of course, this network has the same issues that Bob Metcalfe noted years earlier for the Internet — the value grows as the square of the network members increases — and so far the video-enabled membership is too small to have critical-mass value. For the more traditional videoconference-equipped meeting rooms, this problem is not mitigated much. Other issues, such as complexity of equipment, hook-up of computer-support facilities, image and sound quality for multiple participants, remote steering of cameras, and the ability of the speaker to watch the faces of his or her audience (especially for multiple simultaneous sites) become daunting issues.

The list is unfortunately a fairly long one past these points. It includes lighting issues, people being self-conscious about their appearance on camera, extra cost of the higher-bandwidth channel, extra cost of a higher-quality picture monitor, extra difficulty of multiple simultaneous site participation, and so forth. These, however, are the traditional list of drawbacks and shortcomings, and I think that this misses both the essence of the problem and flirts only simplistically with the value of the potential contribution. Here again, we anticipate that a multi-disciplinary inquiry might be able to provide some differential contribution to our understanding of the key issues that need resolution, along with some proposed solutions.

4.4. A more holistic look at meetings for business communication learning

If we consider again some of the issues surrounding the Monday morning staff meeting, we might summarize them as $M^4 = \text{Meeting, Memory, Mobility, and eMotion}$. The Meeting itself is usually more successful as a function of the preparation, agenda, content, presentation, data, and meeting moderation or leadership. Additional factors include the degree to which attendees provide debate, discussion, synergistic discovery, collaboration, and agreement. We have just argued strongly for tools that enable remote-site attendees to participate synchronously in this hypothetical meeting, via better audio (and video) conferencing and shared whiteboards. So this model makes that

assumption already: that every major site is fully equipped, and all presenters take advantage of the staging facility so that all presentations are *live* for all attendees regardless of location.

Today, the *Memory* element is provided primarily by notes that the individual takes at the meeting, not unlike the notes one takes in the classroom from the omniscient professor. Sometimes a recording secretary will take notes, and distribute them after the fact to attendees. These are seldom very complete, usually covering the leader's agenda and a few action items at best. But certainly they serve to record the main decision points, and in most Business Organizational studies, these serve as the best reconstructive record of *what happened here*. If you miss the meeting, there is little help. If you are remote, and miss the meeting, it is even harder.

The *Mobility* factor in modern business, especially for managers who usually compose an executive committee, or remote-site leadership who would regularly be expected to attend a weekly meeting, is quite high. My own informal studies indicate that only about 60% of the top twenty managers of numerous high-tech companies are able to attend as many as two-thirds of the regularly scheduled weekly meetings, unless drastic measures are taken (*e.g.* *NO ONE* travels on Monday morning, or at the least, must be at a remote-site with call-in capability). If meeting notes were available in some quasi-complete form, (say the next day via an attached e-mail file that had audio, video, and full data inclusions, all summarized and sped up with full pitch control), it is possible to imagine a VideoMemo that summarizes in a ten-minute segment each hour of the meeting, with virtually all of the meaningful interaction and discussion - with all audible and key person visible cues included. Why, that might even get viewed, and it would serve as a very effective long-term archive. Might even be better than attending!

Finally, *eMotion* in a business environment? The surprising answer is *yes*. Tone of voice, body language, eye contact and facial cues all are crucial factors during a presentation to *read* its acceptance, as earlier described. And this is true for even a hard-core analytical senior management team. It becomes more evident in training courses, in motivational leadership situations, in group participation meetings, and in collegial conversations. This is not the high-energy emotional content of Banquet Nets or Shared Holidays, but it does give ample

attention to the social status of all meeting attendees. Significantly, as I penned these lines (9/10/99 1:08:02 PM), we are an hour and eight minutes into an annual Strategic Product Planning meeting, and a Senior remote manager blurted out *Could you guys call us back on the */:&%* line, and ILL set up the conference bridge. This is REALLY a SAD EXPERIENCE out here!* This outburst followed at least five tries to configure the shared meeting for whiteboarding and audio conferencing across four sites. And an embarrassed reply by a senior VP — *Sorry, I didn't think to prepare this for remote visibility.* If this were an isolated incident, or one that few other companies experienced, it would be one thing. But the lamentable fact is that this is routine rather than rare.

5. Learning from a (fairly) quantified long-term distance learning experiment

Over the past thirty years, Stanford University has built one of America's stronger Distance Learning programs for engineers, with a series of incremental improvements that were instituted in order to improve the effectiveness of the students' mastering traditional material. The number of participants were sizable, relatively constant year-to-year, and graded per consistent, expected performance. The group as a set provides some great material for understanding the value of key ingredients in the technologies used. In retrospect there were four major developmental phases during this experiment. Phase 1 involved local Bay Area on-campus students; they were switched to a local closed-loop analog television narrowcast network, mailed-in essays and exams, and had non-synchronous audio feedback. After a short time, the project moved to Phase 2, where simultaneous audio feedback was provided into the classroom. Phase 3 was initiated as a rump movement by off-campus administrators who video-taped the classes for asynchronous viewing for their students who had heavy workloads and travel schedules not consistent with the normal on-campus teaching hours. Phase 4 was designed in response to this unauthorized videotaping in part, but also to handle the serious request for national participants, not just local student body. Phase 4 was thus designed for asynchronous wide-area

videotape distribution with local proctors off-loading the on-campus instructor. Note that this was all analog, maintaining television-quality images, frame-rates, and audio quality. The results, in terms of student performance, were not only interesting, but also compelling for our thesis. Some of the *incidental* sociological lessons of the system, however, are even more instructive.

5.1. The Stanford model and the meanings that we might extract from it

The GPA (Grade Point Average) achieved by the average on-campus and off-campus student during each of the phases described above, provides a very intriguing set of data. Prior to Phase 1, all students were pretty consistent in their average GPA, around 3.1 (slightly better than B, 3.0), whether they were full-time students or part-time industry-supported students. This was about a ten-year comparative study, from 1958 through about 1967. Phase 1 began with a microwave link throughout Silicon Valley. Several tens of students shifted to local video monitor stations set up at their own company to watch the professor stand at the blackboard and deliver the lecture. This was highly unsatisfactory, for at least four reasons. The students had no way to interrupt the class and ask questions, the camera seldom had adequate resolution to capture material scribbled on the blackboard, the professor resented the cameraman's intrusion into his/her lecture (with requests to move aside, etc.), and any classnotes done just before class as handouts could not be received in real time by the off-campus students. The grades plummeted for the off-campus students as well, to about 2.4 from 3.1. This was not a very happy phase for anyone, but fortunately, the experiment continued and significant improvements occurred.

Phase 2 was instituted to redress the interactive Q&A requirement. A centrally mounted speakerphone was installed in the campus lecture hall, and each off-campus site had a dial-up line active during the lecture. In addition, the professors (and importantly, their TA's) were persuaded to be more diligent about holding office hours for the off-campus students. The grades recovered a bit (to about 2.7) for the off-campus students, but the satisfaction index climbed much more. Interestingly however, the on-campus student satisfaction dropped during this period, almost as a correlation to how many

questions were posed by the off-campus students. This mirrors a phenomenon that has been seen often since — a main audience resents remote-site questions far more than even fatuous local questions. It is almost like someone *crashing the party* — an ethereal disembodied voice, usually crackling with static or background noise (*e.g.* a dog barking, a TV channel playing), suddenly interrupts, commands attention by its very presence, and completely disrupts the normal flow of things at the time. In 1970, this was a novelty, and an unwelcome one at that. Little did the on-campus students realize that they were preparing for a world of intrusive cell-phone pages in restaurants, movie theatres, etc.

5.2. The power of the asynchronous experiments

Lockheed instituted phase 3, without sanction from the Stanford administration. Lockheed and Hewlett-Packard course managers had long contended with students who could not easily attend every class due to work schedules, especially heavy travel loads. So they began videotaping the live broadcasts for later viewing (offline) and review. The reasons for Stanford's resistance were two-fold: (1) the value of the lecture and the synchronous Q & A had already been demonstrated and Stanford leaders were loathe to give up that component, viewing it as a key professor value-add for the student; (2) the Intellectual Property represented by the stored videotape was viewed by Stanford as their own proprietary edge — if copied, and illegally distributed, they feared losing their key component. The students viewed this argument as preposterous since the Stanford degree on the resume was often the major goal, and without registering, there was no way to obtain this prize. The companies, also, had shown no evidence that they would in any way condone purloining the course content. The facts, though, became clear — students with access to offline videotapes started delivering course grades around 3.0 and 3.1 on average, at parity with on-campus students, and much better than synchronous off-campus students.

This led inevitably to Phase 4, with companies arguing for national enrollment, and re-broadcast of the courses over their own private video networks. Stanford resisted, because this would result in videotapes that they themselves would not control.

However, Stanford did agree to produce tapes, and mail them to remote proctors *in their employ* -- qualified local instructors who could protect Stanford property and serve as TAs to preserve the full learning experience. Hewlett-Packard and Sandia Labs were given preliminary approval to admit truly remote students; students who would be required to spend one term on campus during their Masters Degree work, but otherwise could be located anywhere in America. This of course gave Hewlett-Packard a very significant recruiting and retention advantage for its engineers in Washington, Oregon, Colorado and Massachusetts to be able to offer degree-earning opportunity at Stanford.

Now, imagine everyone's surprise when the students in Phase 4 began averaging a 3.5 GPA. The first response was that they were cheating somehow, or that it was pent-up demand of a few supremely qualified students stuck in these remote sites. As the averages continued, though, and the situation was assessed more closely, a great discovery was made. The students were actually learning the material better.

The explanation for the Phase 4 students' success was relatively straight-forward: the TA and the student could stop the tape, rewind it, play it again, discuss it, and repeat this process *ad infinitum* until the point was fully understood. True learning, in other words, was happening.

What a happy surprise! Well, mostly happy. This troubled some at Stanford, who saw it as a threat to bricks and mortar. Off-campus TV-watchers, with mere TAs, who outscored the best and brightest who attend every class with the finest professors of our era, and had access to the great library, other classmates, etc?

6. What does this experiment offer us for business communication learning?

Recall now our points about $M^4 = \text{Meeting, Memory, Mobility, and eMotion}$. The *Meeting* itself is not much different than the classroom lecture. The weekly TA break-out sessions that many graduate courses include where one goes to the board and fields questions have parallels in our work environment. Just as we earlier argued for tools that enable remote-site attendees to participate synchronously in this meeting, Stanford students found those elements imperative in Phases 1 and 2.

Just as in class, the *Memory* element for a staff meeting is provided primarily by individual note taking. Sure, sometimes notes are taken and

distributed after the meeting to attendees. These are seldom very complete, and they almost never include meeting handouts, unless the note taker is especially diligent. As earlier noted, if you miss the meeting, especially if you are remote, there is little help. Recall the point of Phases 3 and 4: the TA and the student could *stop the tape, rewind it, replay it* and then discuss it until the point was understood. Try discussing a point over and over in the staff meeting with an impatient boss on a complicated issue. Imagine doing that if you miss the meeting, and there is no videotape to review! Has a staff meeting less content than a school lecture?

The *Mobility* factor in modern business can scarcely be understated. First of all, the current estimates are that some seven million road warriors currently commute by plane, car, and modem connection daily. The more elusive data has to do with the multi-tasking with which people *in situ* in a facility must contend. Anyone trying to schedule a meeting in Outlook, or another of the meeting scheduler programs, for even a half-dozen people knows the insatiable meeting pace that many companies maintain.

I would posit that most of these meetings are required precisely because we have such ineffective meetings. They masquerade as participant meetings, but they in fact are synchronization events, wherein people meet to see if the information taken from the last meeting has been acted upon correctly, and that all participants in fact participated at the right rate on the right topics. Yes, some have an element of new discovery surfacing in the meeting, but if so, the classic phrase is *oops, let's take this one off-line*. If a fast-forward archival version of each meeting were automatically recorded for each conference-room-staged meeting, how much easier could a manager or a team member, especially a member who missed a given meeting, do effective follow-up?

Finally, *eMotion*, which I earlier asserted is a larger factor in a business environment than is generally appreciated. This can be viewed several ways. The emotion surrounding a presentation soliciting support is palpable for the presenter; we've already discussed the difficulty with cues for the remote presenter. But think about the emotions going on in the Stanford examples: for interruptions by the voice in the box, for camera angles capture by the professor, for pique that off-site attendees couldn't attend synchronously. Ask yourself how often you

witness such emotions surfacing in your meetings? I submit these are active irritation factors in virtually every meeting that involves remote attendees.

But there is another way to think about this *eMotion* issue. Leadership, charisma, the satisfaction of goal achievement, are all lauded in the business literature. The emotion over missed schedules, misunderstood goals, and missed commitments is actually enormous. And the corollary of the pride, the satisfaction, and the glow of accomplishment for targets well-set and achieved are well known for building a successful business team. Such things as trust in colleagues, trust in joint activities, belief that you can count on another team to deliver a critical component, are built on the emotional base of past learning. Large successes are built upon a series of small successes, and archival trails help to establish those facts.

6.1. So, integrated communication tools could properly become a focus?

It is relatively easy to imagine multiple paths of inquiry as a consequence of the M^4 observations. In order to frame the discussion, it might be instructive to return briefly to the skill-awareness chart and compare some technologies for value in various learning contexts. Then we might be able to frame some potential experiments for a specific learning community.

Not surprisingly, different media forms provide varied value for learning at each quadrant. Moreover, some are considered normal, while others would be thought unusual in certain contexts. It is relatively easy, for example, to imagine raising awareness via broadband (*i.e.* television) advertising, but we would be surprised if a company such as Coca-Cola sent us a direct e-mail. On the other hand, *spamming* is an e-mail version of advertising that is used far more than many folk would like. Figure F illustrates in a gross way the relative value of various technologies for transitions across each quadrant. Note for example that the video channel can be particularly valuable for interdisciplinary learning -- the most famous historic example of this is perhaps the obsessive photography of Japanese businessmen touring American factories in the early 60s, which enabled their well-documented emulation and spectacular business success in the seventies and eighties. I believe the Japanese film archives were analogous to the *stop the tape, re-run it*,

discuss it point of the Stanford example? And the fact that the Stanford proctors had not themselves taken the courses they were proctoring is analogous to the fact that the Japanese photographers knew little about what they had photographed. The meat of the discussion is the learning vehicle, with peer agreement as output.

6.2. Information content and information transfer medium

The chart shown in Figure F a relative value of information transmission mechanism as a function of the information content being conveyed. For example, in terms of raising awareness, a factor for both trying to move from Quadrant 1 to Quadrant 2, and also from Quadrant 4 to Quadrant 1, video images have very high value compared to spoken or written words or data. Think of the adages we use: *a picture is worth a thousand words*; *seeing is believing*.

On the other hand, moving from Quadrant 2 to 3 is a concentrated, focused study. Here, electronic access to the incredible WWW databases is a treasure that has never before been accessible to the world's population. Some few local archives {e.g. the Smithsonian Institution, the Military Library of the USAFA (United States Air Force Academy), M.I.T. Humanities Library, the Yale Law Library, Cornell University Medical Library, and the New York Public Library's Central Branch} have been available in a specific geography for the lucky researcher who has time and access. Kew Gardens in London, and the New York Botanical Garden Library are crucial for the serious horticulture student. Students of the Communist influence in America, on the other hand, must go to Madison, Wisconsin for the McCarthy-era archives — they don't exist anywhere else.

6.3. Commercial ask: *How come the dogs won't eat the dog food?*" How to make useful tools more pervasive

One of the clear questions we have to ask as a consequence of Figure F re: Computer and Video Teleconferencing is *if this technology is so advantageous, why isn't it more widely adopted?* Which really is a subset of the set of questions that have to do with adoption of any new technology. Pretty obviously, there is a

range of adoption responses to any technology that run along four basic lines:

- The technology doesn't work
- The technology works as desired, but the users don't use it
- The technology works, and a few users adopt- and love it even, but the mass market user doesn't appear
- The technology is widely adopted

The classic business literature about technology adoption describes the shift (Figure F) from Level 2 to Level 3 as finding Early Adopters. Similarly, the shift from Level 3 to Level 4 is termed Crossing the Chasm in some circles and a Paradigm Shift in others. Early Adopters, described in Rogers [11] and in Moore [10] where the chasm idea is best explicated. Paradigm shifts were initially discussed with regard to scientific communities by Kuhn [9] and were popularized for business first by Barker [3] and Christensen [5]. We conducted a series of studies at Hewlett-Packard over a four-year period that outlined a series of sequential steps that mattered greatly to adoption rates and success rates. Our study target was a distributed group of eight thousand engineers, and the topics used were adoption rates of development tools that ostensibly were productivity aids — better compilers, better graphical layout systems for Printed Circuit Board or IC chip design, source code management systems, etc. A universal constant goal was imposed by top management — to improve productivity by a factor of two and quality by a factor of ten over five years. The metrics of choice to show improvement was allowed to be locally determined, in collaboration with the corporate review council. So, incentive existed, and much effort was launched. The results were impressive as the end of the five-year period approached, but the learning during the early phases is the most instructive for our example here of seeking better business communication mor s.

7. Productivity improvement criteria

Attitudes are the most important early precursor to successful adoption rates. If people are interested and willing to invest in new tools, odds are that they can make the tools work; if they are convinced that tools cannot address the problem (or even deny that the problem is worthy of solution), then tools will likely not be bought. If a process group persists, and buys the

tools, they likely will not be deployed, or if deployed, will likely not be used. This can be termed, *you can lead the horse to water, but you cannot make him drink*.

If a group does believe that *Tools* can help, then three questions are of interest — (1) Adoption (2) Usage and (3) Satisfaction. *Adoption* involves several steps, usually (a) Costs of the tools; (b) Selection of one tool vs. others; (c) Discovering the equipment compatibilities; and (d) Deployment and training regarding the tool usage. For the process manager, though, the interesting questions at this point concern *Usage* -- (1) which tools were selected, and by what criteria; (2) comparison of these selections vs. the wider industry choices; (3) how many people selected tools and training and actually began usage of the tools; and (4) what were the retention rates for users after some period of time. Eventually, both process managers and the development leadership will want to know just how well the tools have helped. This is a *Satisfaction* index, having to do with results — what productivity and quality improvements were found, and what new adoption rates happened to share the benefits more widely.

During the course of setting up and managing the Hewlett-Packard Corporate Engineering group in the early 80s, these questions were approached multiple times on various issues, resulting in some quantitative data and much empirical understanding. Other companies, including Tandem, Motorola, AT&T, IBM, DEC, Boeing, and Informix, followed suit, primarily on questions of software productivity and quality. Xerox Corporation adopted the Corporate Engineering model itself, and has quantified its impact and infrastructure approach, and most recently M.I.T.'s Center for Learning has brought the Xerox Process Model into their center for transfer on a wide basis to American technical industry. The positive results of these continuing experiments is much of the basis for our belief that studying these issues as they relate to communication methodology is practical, and will be a fruitful pursuit.

8. The Center focus

An example may be useful to illustrate the above discussion above. These are some of the study objectives for the USCB Center for Information Technologies and Society. We hope

to construct some laboratories for studying several types of groups, each equipped with a series of tools, some of which are overlapping and consistent, while others are specific to the target group itself. Four groups may be identified as follows:

- *A distributed learning group*, each class with a teacher in one site and multiple (n) students at (n/x) sites, where x is small (1 in the limit) and n is perhaps 8 to 20. This may be expected to model the original Stanford experiments, and most closely approximates typical university outreach programs, including the Open University in London, National Technological University (NTU) for American business, and Northeastern and Phoenix universities in America;
- *A team environment* comprised of two groups of 4 to 10 people at each of two sites, trying to solve some common problems, such as a co-development project. This most closely models the classical team issue that XeroxPARC studied with its COLAB work, as well as the Lucent and Telcordia studies re: effective use of videoconferencing. This is the typical target for the classical videoconferencing companies, such as PictureTel and V-Tel, plus of course Intel's Team Meeting;
- *A distributed peer meeting*, comprised of n groups of 3 to 8 people at each of n sites, trying to co-develop some common understanding of a relatively multi-faceted issue such as a Standards group might face. This has not been modeled well, but is a common issue for professional societies around such questions as standards; for political action groups trying to develop a consensus; or even multiple teams trying to focus a question that has been elusive, yet bothersome (e.g.: cultural norms that impede progress in a corporation or organization);
- *A distributed staff meeting*, comprised of multiple people on the main site, and a series of ancillary sites with one or two key employees who are regular peer participants. Dialogic's Monday senior staff meeting is a quite typical occurrence of this kind of meeting, where status and issue resolution are the primary communication goals, but often strategic and tactical game plans are developed and iterated.

Obviously, other groupings can be identified. *Collaboratories* [12] are a blend of groups 2 and 3 above in most cases; troubleshooting teams on

intractable issues at a distance also are often a blend of groups 2 and 3 above. Individual desk-to-desk, such as the Intel ProShare system target, will not be a part of our primary study focus.

8.1. The tool set for the first experiments

We plan to build rooms that have several common characteristics. All rooms will be connected via high-definition video and data image projection, with Rich Audio surround-sound, insofar as is practical. This means that all of these will be run over high-bandwidth, high QOS Internet II lines, utilizing Multi-Cast protocols. The goal will be to have communication tools for this purpose that require little interaction by the user for setup or for easy usage. For each experimental set-up, we will have a different screen topology and a different interaction mode.

Interaction and a feeling of immersion in the meeting is an important ingredient, but we do not plan to take these experiments as far as the Cave or Teleimmersion projects that Internet2 university groups have done. We will instead equip remote users with steerable camera controls for the main site in Group 4 environments and for both sites in Group 2 experiments. All sites will have multi-screen viewing, with simultaneous video, data, and artifact display, or multiple-room attendance displays with data screens. How many screens, and how much sidebar interactivity, are important parts of the study.

Archival capability is a third major requirement, which is true in various forms for each of the groups. The video record is a key component of this archive, which changes in character significantly between group 1 and group 4. For group 4, and to some degree group 2, a stereoscopic film record of all attendees will be part of the experimental arrangement. Montage editing systems and a variety of experimental form factors will be part of the investigations into archival value. One ingredient that shows up in every focus study is the need for synthesized, time-compressed archival material; the second point is that it must be timely. We would add the third — multiple points of video scene to get both speaker and audience flow.

Two final points: (1) we anticipate that session management will be an important consideration, and will require tool attention for the session moderator; and (2) we anticipate that the archival record will also require tool attention for the

program moderator over an extended series of sessions. We want to get as close to an unmanaged session as practical, and we also hope to approximate an automated archive function for the general set of materials.

8.2. The purpose of the Center: Three Initial Target Areas of Research

Our initial plans for the Center are to focus on three main target areas for research. The first is remote collaboration, dealing with interactive technology for meetings and classrooms. It will focus on the development and analysis of multicast applications in light of theories of small group interaction, organization theory, and education. This track focuses on *information technology and the small group*, the subject of this paper.

The chief questions to be addressed are:

- What features of multicast meeting or teaching technologies are best suited to various organizational environments?
- In what ways are fundamental social and communicative processes altered when small group interactions are mediated by multicast technology?

The second area focuses on *information technology and large groups*: communities, societies, or states. It will deal with problems of social structure and forms of association, examining how these phenomena broadly defined are altered by new forms of technology. The chief questions to be addressed are:

- In what ways do fundamental community-level or social-level structures and forms of association depend upon the distribution of information and communication capacity?
- How do dramatic changes in the cost and availability of communication capacity affect basic social processes?

The third area deals *with information technology and culture*. It addresses problems of cultural change, values, meaning, the representation of ideas, identity, and related issues. Research in this area will focus on questions about the connections between technological change and the alteration or evolution of culture.

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<i>skilled</i>		<i>unskilled</i>		
<i>You Do Know</i>	<i>You Do Know</i>	<i>You Do Know</i>	<i>You Don t Know</i>	<i>fully conscious</i>
<i>You Do Know</i>	<i>You Do Know</i>	<i>You Don t Know</i>	<i>You Don t Know</i>	<i>conscious</i>
<i>You Don t Know</i>	<i>You Don t Know</i>	<i>You Don t Know</i>	<i>You Don t Know</i>	<i>dimly aware</i>
<i>You Don t Know</i>	<i>You Don t Know</i>	<i>You Don t Know</i>	<i>You Don t Know</i>	<i>subconscious</i>
<i>You Do Know</i>	<i>You Do Know</i>	<i>You Do Know</i>	<i>You Do Know</i>	<i>unconscious</i>
<i>You Do Know</i>	<i>You Do Know</i>	<i>You Do Know</i>	<i>You Do Know</i>	<i>unconscious</i>
<i>very skilled</i>	<i>moderately skilled</i>	<i>absolutely unskilled</i>		

Fig. A The Skill-Awareness Grid

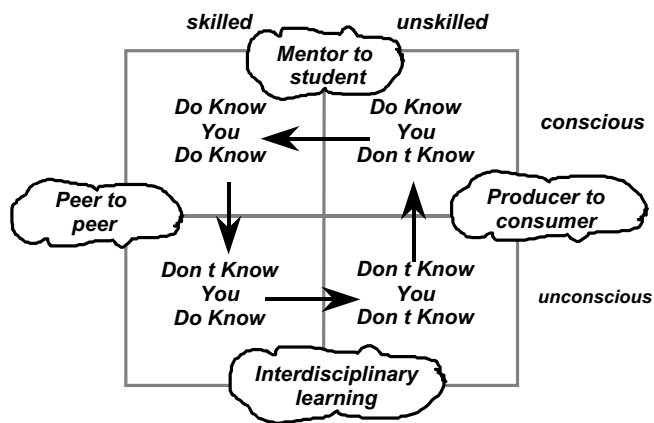


Fig. B Learning Modalities with the Skill-Awareness Grid

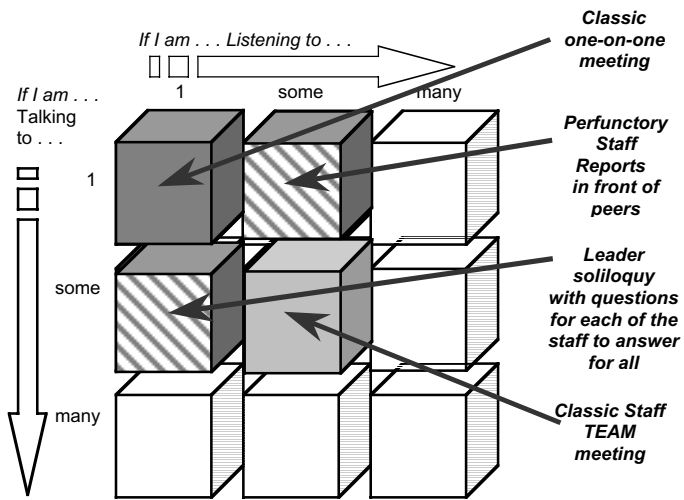


Fig. C Staff Meeting Modes of Communication

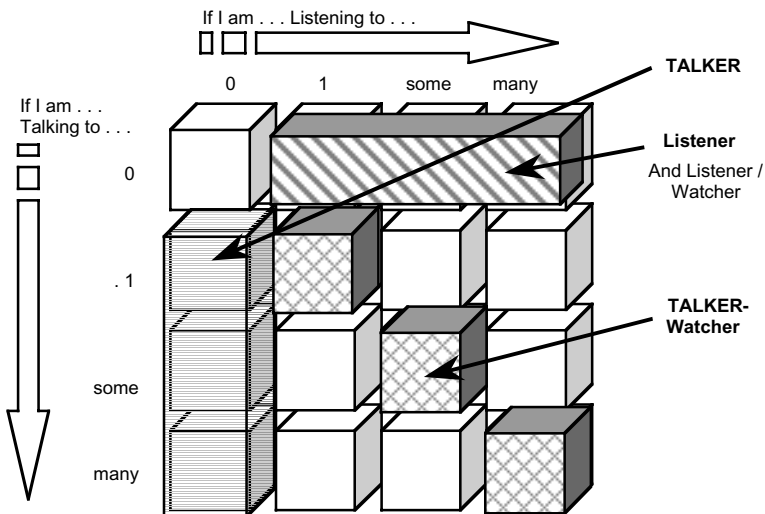


Fig. D Generalized Meeting Modes of Communication

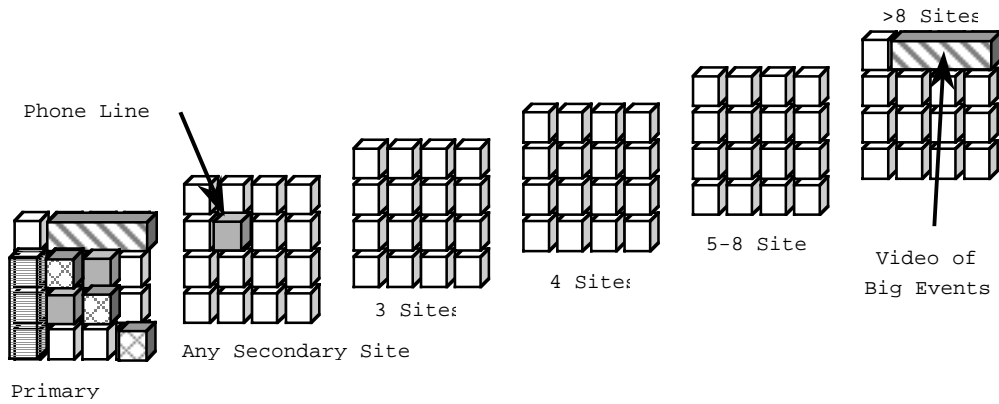


Fig. E Remote Participation for a Meeting

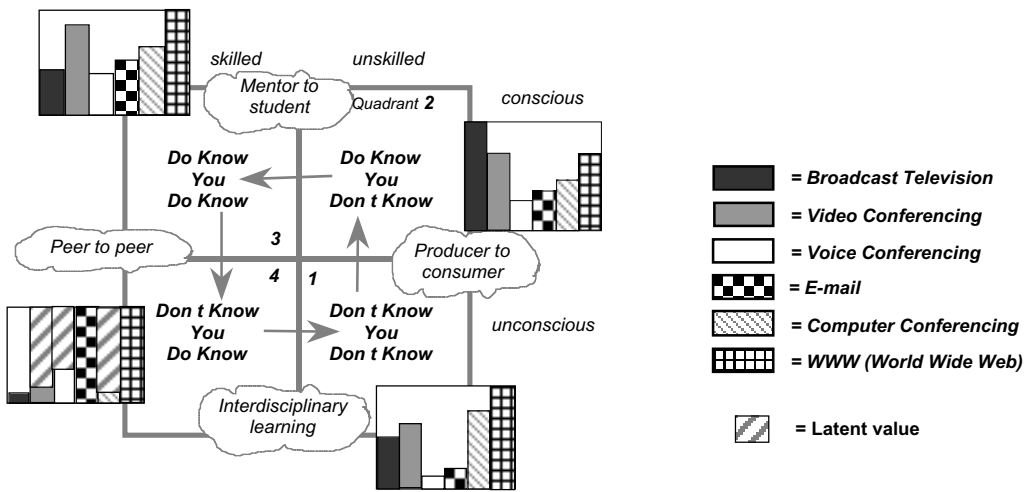


Fig. F. Information Media Value by Learner Type