

What is Telepresence?

By Steve McNelley, PH.D., and Jeff Machtig, DVE founders

Digital Video Enterprises

(949) 347-9166

(949) 347-9167 FAX

www.DVEtelepresence.com

Introduction

Psychology dictates that there are certain key elements that allow for effective communication and interaction between two or more individuals. How successfully we relate to one another depends greatly upon eye-to-eye contact. Unfortunately, with most of today's teleconferencing options, this key element is lost due to poorly placed cameras. Business relationships can flounder as a result. But this doesn't have to be the case. Enter True Telepresence that allows eye-to-eye contact between individuals while conferencing. The founders of DVE created this patented technology, based on their extensive understanding of visual communication fundamentals, thus fulfilling videoconferencing's unfulfilled promise of combining human factors of communication with the latest videoconferencing technologies. We call this the art and science of telepresence.

Visual Communication Fundamentals:

Before we define the "Art and Science of Telepresence" or explore "Videoconferencing's Unfulfilled Promise" it is best to review the basics of human communication. Psychological researchers have now documented key elements of how human beings communicate. Of course, we hear and see other people. But how important is one over the other? How do they interrelate in the quality of communication?

Mastering Subconscious Cues of Sight and Sound

The phone enables us to hear another person. We can sense emotion in the tone of the voice. We can sense a personality and a whole host of emotions just by hearing another's voice. Seeing is even more powerful.

When we see a face, we are able to see a full range of emotions or lack thereof. We also see what they are wearing. We see their body language. We see their eyes, whether they gleam with interest or disclose disinterest. We gather and process information – beyond that of any supercomputer – a whole host of nonverbal behavioral cues from others. That information is absorbed primarily as unconscious (out of focused awareness) cues. Since infancy, this is the way we have processed human interaction.

When one learns to ride a bike, he/she is very aware of the task in order to master it. Upon mastery, bike riding and the immense complexity of balancing a body on two wheels becomes second nature. We forget we are riding when we are riding. The task of bike riding has been mastered. Likewise, humans from infancy on have mastered the gathering and processing of nonverbal communication cues. It is second nature to us, and it is foundational to who we are and how we see others. It is an essential part of our humanity.

The Importance of Eye Contact

The chief of all nonverbal cues is eye contact. Humans are amazingly perceptive of the gaze direction of another. A gaze direction even a few degrees off from true eye contact is very noticeable. When conversing, we can certainly sense whether a person is not looking at us in the eye, even if he/she is looking at another part of our face. For example, a person can tell if another is looking at the forehead rather than his or her eyes. True eye contact is essential to quality communication. There is no such thing as “almost eye contact” or “near eye contact” as a replacement for true eye contact. People who are eye contact-avoidant have been shown to be greatly disadvantaged both psychologically and socially (see below for relevant studies).

Communication technologies that hinder this natural information gathering and processing of nonverbal cues are seriously flawed. Some behavioral researchers believe that as much as 70% to 80% of communication is nonverbal. It is therefore paramount that a technology intended for people to see nonverbal communication accurately enables the transmission of nonverbal communication, especially true eye contact.

Does videoconferencing deliver? Do other specialty videoconference integrators who claim to have “telepresence systems” actually enable true and correct eye contact or are their claims marketing exaggerations? Continue reading.

Videoconferencing’s Unfilled Promise

From its inception, the point of videoconferencing was to allow participants to see nonverbal communication. The phone and conference phones had worked just fine for us to hear people, but videoconferencing was intended to enable people to see what we were missing in phone calls. A few big conference manufacturers built and sold codecs with bundled solutions, and people bought in on the promise of “the next best thing to being there.” However, that is not what they got.

Overcoming Technological and Other Hurdles

Over the years, the conferencing industry has faced one hurdle after another: the cost of ISDN, image quality, fire walls, QoS, ease of use, cost of deployment, real return on investment, etc. DVE applauds the pioneering firms in our field for their efforts to try to bring videoconferencing to the mainstream. However, these efforts have resulted in little market penetration. Videoconferencing has only reached less than 5% of its potential installs (Frost & Sullivan). And, according to other analysts, the number may actually be less than 2%. Why? Certainly all the hurdles above have added to such a dismal market penetration.

Beyond the “that’s kind of cool” emotion of the first week of a VTC installation, many if not most companies just don’t get into the rhythm of using the technology. Despite numerous

claims of “it’s just like being there,” for most, it does not feel like being there. Some companies and organizations bring in top audio/visual firms to design showcase conference rooms for hundreds of thousands of dollars, yet they fall flat. Something isn’t quite right. Poor image quality, the size of the people on screen (either too small or too big), the awkward sense that the people on the monitor are looking away and not truly toward the viewer add up to a less than satisfying experience.

The Importance of Embracing the Needs of the People

By its very nature, videoconferencing is a high technology system that needs to simulate a very human experience. The dichotomy of technology and humanity has been the chief problem with videoconferencing. Imagine the world of personal computers if “Windows” had never been developed. There is no doubt that the “Windows” operating system took a very complex piece of technology and made it fit the human. Videoconferencing, whether it is desktop or group conferencing, has never really fit the human being. Its inherent flaws in design and deployment have pushed people away.

The key to the success of videoconferencing is to fully embrace the need to design systems around the multidisciplinary approach of both Engineering and Psychology. Human factor product and system design is essential in creating a two-way visual communication experience that is truly “as good as being there.” Ideally, image quality is superb, audio is superb, there are life-size images of people with body language, the people displayed appear to share the meeting space as if at a table, and most importantly, there is a means to present correctly the chief of all nonverbal cues — eye contact.

The frustration with all old legacy-type, bundled solutions is that the camera is mounted on top of the display. Of course, people will then appear to look down and not make true eye contact. Imagine a news anchor that never looked into the camera or a friend that could not make appropriate eye contact – a very strange reality that has greatly frustrated the potential effectiveness of videoconferencing. Without a True Telepresence eye contact solution, videoconferencing will never truly fit the human.

DVE has the solution. DVE is the sought-after leader in the art and science of telepresence.

The Art and Science of Telepresence

Telepresence is substantially different from videoconferencing, which has all but ignored the human factors of communication. Whether it's a web camera sitting on top of a computer monitor or an expensive high-resolution camera atop a custom, built-in room projection screen, these and all typical videoconferencing systems ignore visual communication fundamentals.

True Telepresence is a multidisciplinary art and science that foundationally integrates engineering, psychology, and the television broadcast art.

Defining True Telepresence

1. A camera that is optically aligned with the eyes of the person on the screen. If the camera is on top, to the sides or at the bottom of the display screen it is not True Telepresence.
2. A life-size image, at best, with upper body arm gestures clearly seen. For desktop conferencing, smaller images are acceptable but no less than about 70% of life-size.
3. Correct cultural distance where the image of the person is at table height and the image resides just beyond that, as sitting on the other side of a meeting table. A face on a plasma or CRT on the other side of the room is not True Telepresence.
4. Image quality is broadcast quality or better in resolution. CIF resolution is usually inadequate.
5. Audio quality is superb -- voices sound crisp and clean, free from distortion.

Continuous Presence vs. Switched Presence

When multiple conferees are to be seen in a conference, a decision needs to be made in the conference design. In continuous presence, if six people are to be seen from the distant site, the local room displays six life-size people. This is continuous presence where everyone is displayed simultaneously. However, in reality, these systems often are forced out of a continuous presence mode and into switched presence mode during multipoint conferences. Take for example, three sites with six people each. Each site can

display only six life-size people, but there are a total of 18 participants. Continuous presence for group conferencing almost always is required to also include switched presence (i.e., reduced in size or removed from view).

Switched presence for group conferencing has been the de facto standard in the conferencing business. DVE makes a distinction between types of switched presence systems. "Unintelligent Switched Presence" involves manual panning and tilting activation of a camera where participants see someone trying to direct a conference. Trying to control a panning and tilting camera image is frustrating for the operator as well as the viewers. So, what do people do with their common conferencing systems? They wide shot the camera and watch tiny people on the screen, negating the telepresence requirement of displaying life-size images. This serious problem has plagued nearly all bundled solutions from major codec manufacturers and integrators.

A quick design reaction to the problem above is to add more displays or one large display to show all people life-size as is common in continuous presence systems. This creates even more problems. The effective resolution drops substantially when the image is displayed on a large screen or multiple screens. Also, the human factors of camera placement become very problematic, because not only does eye contact become an issue, but each person's head appears to be aimed 10 to 30 degrees away from the intended person.

Lastly, multiple codecs and multiple cameras are often added to overcome resolution loss, but the sheer expense, including the extra bandwidth, becomes enormous and deployment is limited to only a few showcase rooms in a few large corporations.

DVE is committed to both very carefully designed continuous presence systems for limited applications (see [DVE Immersive Meeting Room](#)) and also, and most importantly, is a strong proponent of [Intelligent Switched Telepresence](#) pioneered by DVE that draws upon success of the broadcast production art. Intelligent Switched Telepresence resolves the problems that plague legacy unintelligent switched presence systems and expensive continuous presence systems with poor eye contact.

Beyond Image Quality

Codecs are evolving. Images are getting better and better. HDTV conferencing is now a reality. However, the fact remains that the more the image quality improves the more apparent the eye contact problem becomes!

Imagine HDTV images of people who you can clearly see are not looking at you and they appear disinterested in the conversation. Clearly, eye contact solutions are as equally important to the future of conferencing as the codec itself. A high-resolution codec alone does not make for True Telepresence. In fact, a high-resolution codec can further exacerbate the human factor problems common to videoconferencing.

Beyond The Hype

DVE defines *telepresence* based on years of research, development, scientific literature, and experience in the television broadcast art. Over the years, the terms *virtual presence*, *immersion*, and *telepresence* have been used interchangeably by DVE. The marketing puffery by other firms in the videoconference business has caused a great deal of confusion in defining terms.

Recently, major codec manufactures are using these same terms to define their product's abilities. Just as for years they've advertised that their systems provide "eye contact," (which is plainly exaggerated) so also they are seizing upon these words now to bolster their marketing and confuse the market space to promote old time legacy bundled solutions. As a result of this confusion, DVE makes a distinction with often adding "True" to Telepresence. "True" because there is much exaggerated marketing claiming to be telepresence.

Beyond The Labs

Numerous universities have had graduate projects that include very complex immersive conferencing systems. Often these systems require the users to where 3-D glasses or

involve so much technology that it is impractical for real-world deployment. Also, many times, these immersion systems have such large screens that it makes people physically ill to sit so close to the image. As a parallel example, people do not enjoy sitting in the front row at a movie theater.

DVE has tremendous knowledge in the 3-D display field and holds patents in the field. It was the first company to commercialize a 3-D system used for unique conferencing applications. Inherently, 3-D is highly complex and, for the most part, impractical and unnecessary to providing high quality telepresence. HDTV is a more practical immediate industry goal, where human forms appear more solid and, thereby, more life-like. DVE has also designed and deployed the world's first digital HDTV telepresence system for a large Wall Street financial firm. DVE is highly focused on real world solutions that work to help clients connect with True Telepresence. Our R&D has led an industry and is practical, affordable, and ready for today's solutions.

The following is an executive summary of just some of the relevant psychological literature on the importance of nonverbal communication.

Psychological Literature

The following literature highlights are the tip of the iceberg of the research demonstrating the importance of nonverbal communication in general and specifically, the importance of natural eye contact.

- One of the preeminent theorists in the cultural variations of nonverbal behavior, Hall (1966), referred to the unconscious phenomenon of nonverbal communications as the “hidden dimensions” of culture.
- Birdswhistell (1970), one of the forerunners in the field of nonverbal communication, expressed the importance of the role of nonverbal processes in communication when he offered his estimation that in typical dyadic interpersonal encounter, the nonverbal channel conveys approximately 2/3 of the social meaning of a situation, while the verbal component of communication carries only about a 1/3.
- Hall (1966) defined four basic types of cultural space (proxemics). They are intimate distance (0 - 18 inches), personal distance (1.5 - 4 feet), social distance (4 - 12 feet), and public distance (12 - 25 feet). Various nonverbal communication cues are apparent at the varying distances.
- Argyle and Cook (1976) pointed out that philosophical psychologists and sociologists like Simmel and Sartre noted that mutual gaze was the key to the awareness of the thoughts of another.
- Kendon (1976) described eye gaze as providing the communication functions of providing feedback, regulating (turn taking), and expressions that punctuate emotion.
- An infant’s eyes, within weeks of new life, are drawn to the principle caretaker to establish the first relational bond (Haith, Bergman, & Moore, 1977).
- There are physiological responses when humans experience eye contact, such as effects on blood pressure and heart rate (Wellens, 1975).

- It has been demonstrated that there is an increased abundance of brain activity when humans make eye contact (Gale, Kingsley, Brookes & Smith, 1978).
- Direct eye contact has been shown to increase the perception of credibility (Aguinis, Simonsen & Pierce, 1998).
- Those who establish more eye contact are rated more favorably than those who do not (Droney & Brooks, 1993).
- Eye contact decreases when people are placed in embarrassing situations (Edelmann & Hampson, 1979).
- Gaze avoidant men have been correlated with being emotionally inhibited, over-controlled, and having psychosomatic and physical symptoms; and gaze avoidant women have been associated with higher degrees of psychopathology, hysteria, and traditional femininity (Larsen and Shackelford, 1996).
- Effective eye contact has been correlated to perceptions of interpersonal, academic, and occupational success (Hornik, 1977).
- Eye contact has been correlated to the perception of intelligence (Wheeler, Baron, Michell & Ginsburg, 1979).
- Higher gaze persons have been rated as more attractive (Kleinke, Staneski & Berger, 1975).
- Eye contact has been shown essential for job interviews (Amalfitano and Kalt, 1977).
- In a doctoral research project with 50 participants using both traditional desktop videoconferencing without eye contact and desktop videoconferencing with eye contact, nearly 90% of the participants preferred eye contact (McNelley, 2000).
- When participant users of traditional desktop videoconferencing without eye contact were asked if there was anything “awkward” about the experience, 68% responding in their own words commented on the lack of eye contact. Since none of participants knew the nature of the study their responses reinforce the need for an eye contact solution (McNelley, 2000).

REFERENCES

- Aguinis, Herman; Simonsen, Melissa M.; and Pierce, Charles A. 1998. "Effects of Nonverbal Behavior on Perceptions of Power Bases." *Journal of Social Psychology* 138, no.4 (August): 455-469.
- Amalfitano, Joseph G., and Kalt, Neil C. 1977. "Effects of Eye Contact on the Evaluation of Job Applicants." *Journal of Employment Counseling* 14, no.1 (March): 46-48.
- Argyle, Michael, and Cook, Mark. *Gaze and Mutual Gaze*. 1976. New York: Cambridge University Press.
- Birdswheistell, R.L. 1970. *Kinesics and Context*. Philadelphia: University of Pennsylvania Press.
- Droney, Joylin M., and Brooks, Charles I. 1993. "Attributions of Self-Esteem as a Function of Duration of Eye Contact." *Journal of Social Psychology* 133, no.5 (October): 715-755.
- Edelmann, Rober J., and Hampson, Sarah E. 1979. "Changes in Non Verbal Behaviour During Embarrassment." *British Journal of Social and Clinical Psychology* 18, no.4 (November): 385-390.
- Gale, Anthony; Kingsley, Eliot; Brookes, Sorrel; and Smith, David. 1978. "Cortical Arousal and Social Intimacy in the Human Female Under Different Conditions of Eye Contact." *Behavioral Processes* 3, no.3 (October): 271-275.
- Haith, Marshall M; Bergman, Terry; and Moore, Michael J. 1977. "Eye Contact and Face Scanning in Early Infancy." *Science* 198, no.4319 (November): 853-855.
- Hall, Edward T. 1966. *The Hidden Dimension*. New York: Doubleday.
- Hornik, Jacob. 1987. "The Effect of Touch and Gaze Upon Compliance and Interest of Interviewees." *Journal of Social Psychology* 127, no.6 (December): 681-683.
- Kendon, A. 1967. "Some Functions of Gaze Direction in Social Interaction." *Acta Psychologica*. 26: 22-63.
- Kleinke, Chris L.; Staneski, Richard A.; and Berger, Dale E. 1975. "Evaluation of an Interviewer as a Function of Interviewer Gaze, Reinforcement of Subject Gaze, and Interviewer Attractiveness." *Journal of Personality and Social Psychology* 1 (January 31): 115-122.
- Larsen, Randy J., and Shackelford, Todd K. 1996. "Gaze Avoidance: Personality and Social Judgments of People Who Avoid Direct Face to Face Contact." *Personality and Individual Differences* 21, no.6 (December): 907-917.
- McNelley, Steve H. 2000. "The Significance of Eye Contact While desktop Videoconferencing." Doctoral Dissertation, UMI Microform 9999473.
- Wellens, A. Rodney. 1978. "A Device that Provides an Eye-to-Eye Video Perspective for Interactive Television." *Behavior Research Methods and Instrumentation* 10, no.1, pp.25-26.
- Wheeler, R. Wade; Baron, Joan C.; Michell, Susan; and Ginsburg, Harvey J. 1979. "Eye Contact and the Perception of Intelligence." *Bulletin of the Psychonomic Society* 13, no.2 (February): 101-102.