

# High-Presence, Low-Bandwidth, Apparent 3-D Video-Conferencing with a Single Camera

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## **ABOUT THE INVENTION**

Video-conferencing has become a very convenient and popular form of communication in today's business world. However, its widespread use has been limited because of a lack of available bandwidth in small portable devices such as laptops, PDAs and cellular phones. High frame-rate video-conferencing typically requires high bandwidth. Therefore, users of portable devices with small digital video cameras tend to be constrained to low frame-rates and poor quality transmission during video-conferencing. As well, current video-conferencing technology lacks a feeling of co-presence, affecting the dynamics of a video conversation and possibly causing participants to feel uncomfortable.

Some video-conferencing systems achieve co-presence by creating a sense of three-dimensionality. This is often accomplished with binocular disparity technologies like stereoscopic displays. The alternative approach to achieving three-dimensionality is using motion parallax, simulating a 3-D environment by rotating a 3-D model of an object based on the user's viewing angle. Motion parallax is thought to provide a greater degree of co-presence than binocular approaches, but entails the use of elaborate and expensive motion-tracking systems. Whether the 3-D display technology is binocular or motion-based, generation of an image previously required the use of specialized motion capture equipment or at least two cameras.

The current invention is a real-time, high frame-rate video-conferencing system that creates a feeling a co-presence without the use of expensive motion-tracking technologies or multi-camera arrays. A sense of three-dimensionality is achieved via motion parallax with only one commodity camera, making the invention particularly useful in small portable devices. Active Appearance Models (statistical representations of the face) are utilized to track and recreate each participant's face so that only the model parameters need be transmitted for each frame. Because fewer parameters are sent across the system, considerably less bandwidth is used (only a few hundred bytes per frame). This makes possible near-photorealistic video-conferencing for devices such as cell phones, PDAs and laptops. Because the invention makes video communication more comfortable and efficient, it can also help revolutionize the online gaming industry, animation technology and other media applications.

## **VIEW A DEMO**

Visit a brief demo movie of the technology in action online at:  
<http://faculty.virginia.edu/humandynamicslab/media/WIAMIS2009.mov>