Optics in Wearable Displays—James Wyant's Influence on my Professional Career

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ABSTRACT

Professor James C. Wyant made profound impacts on many people as a stellar scholar, an educator, a mentor, a collaborator, a master entrepreneur, a philanthropist, and a friend. This paper is not really about optics in wearable displays, but about a story how Professor Wyant influenced my professional career development as the Director and then the founding Dean of the James C. Wyant College of Optical Sciences. Without Prof. Wyant's influence, most of my research in optical technologies for wearable displays would not have happened and I would be living in a very different world.

Keywords: Wyant Tribute

1. BEACHES IN TUCSON, SERIOUSLY?

After receiving my Ph.D. degree in optical engineering with a minor degree in computer science, I became an Assistant Professor in January 2003 in the Department of Information and Computer Sciences at the University of Hawaii (UH) at Mānoa. The UH Mānoa campus (Figure 1 Left) is located in beautiful Mānoa Valley, minutes away from the world-famous Waikīkī beach (Figure 1 Right). My research then was focusing on the development of novel wearable display technologies and human-computer interaction techniques in virtual and augmented reality environments. I was assigned to teach courses on computer graphics. After setting up my 3D Visualization and Imaging Systems (3DVIS) Laboratory and talking to many of the graduate students, I quickly realized that I could not find any students in the Department who would have some background training in optics to support my display research. I of course did not find any infrastructure support that allowed myself to carry on the display research on my own. I had to adapt and started to shift research to more software-oriented for which I naturally could find plenty of resources easily. Though I was doing quite well for the shift, I was sad that my years of optical engineering training appeared to be wasted.

Figure 1. (Left) Campus of University of Hawaii at Mānoa (Photo Credit: UH website). (Right) Beautiful Waikīkī beach, minutes away from the Campus (Photo Credit: Hawaii-guide.com).

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It took me by surprise that I received an invitation from Prof. Jose Sasian in April 2003 to visit the then Optical Sciences Center (OSC) at the University of Arizona (UA) and I was delighted to take the opportunity. The visit went well and Professor James C. Wyant (a.k.a. Jim), who was the OSC Director then, decided to hire me as an Assistant Professor. I was very impressed by the beautiful UA campus (Figure 2 Left) and the desert scenery of Tucson (Figure 2 Right). The visit was in the middle of April. The pleasant April weather and the beautiful palo verde bloom somewhat deceived me from realizing Tucson is a place with plenty of sandy "beaches" but no water. Nevertheless, I moved to Tucson in December 2003. Jim rescued me from a real beach and resumed my career path as an optical engineer. I happily shifted my research focus back to optical technologies for wearable displays, which plays my strength of training. My research group has started to bloom and flourish since then.

Figure 2. Figure 1. (Left) Campus of University of Arizona (Photo Credit: UA website). (Right) Beautiful desert landscape (Photo Credit: visitarizona.com.

2. THE MOTIVES

Professor Wyant is world-wide known as one of the finest optical metrologists and had many achievements in the field. He is also a technology futurist and is interested in all kinds of technologies. Jim always expressed a strong interest in trying new technologies prototyped in my lab. When I first set up my SCAPE (an acronym for Stereoscopic Collaboration in Augmented and Projective Environment) platform in the OSC building in 2004 [1], Jim tried out all the demo applications and played the technology for hours with the late Professor Dror Sarid who was also an enthusiast for 3D technology. He had been a frequent visitor to my lab since then to try out new prototypes we built, which was his way of expressing support to my career development and success. Figure 3 is a photo where Jim was playing a game with a modern AR display headset when the technology just became available.

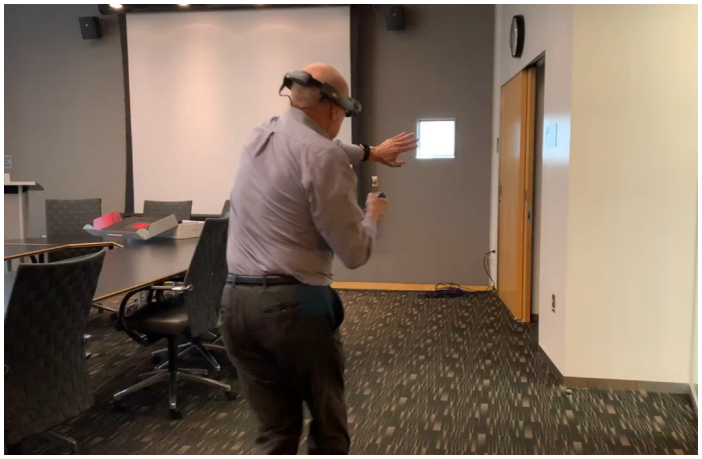

Figure 3 Jim play augmented reality games with a modern AR display headset

Twenty years ago, when virtual reality and augmented reality (VR-AR) technologies were hardly known in both the academic and industry worlds except few groups who worked in the subject matter, Professor Wyant foresaw the potential and hired me as a faculty to grow a seed. Of course, he hired several other faculties in related areas in the following years. Nowadays, VR-AR technologies are very hot topics and attracted billions of dollars of investment by all the major technology giants. Optics plays a central role in wearable display technologies for VR-AR applications, and thus naturally our students have become a major source of work force hired by these technology companies who have invested in this field. His futuristic vision and investment not only paved the way for my career path, but also had a major influence on our faculty and student body.

3. OPTICS IN WEARABEL DISPLAYS

After I relocated from Hawaii to Tucson, it takes me no time to find out the optics talents within OSC are plenty and the infrastructure support is great. Such resources enable me to explore a wide variety of optical technologies for the development of wearable displays and quickly grow my research program. We applied freeform optics to the development of compact, high-performance eyepieces for AR displays [2], developed vari-focal and multi-focal plane display architecture for enabling addressable focus cues in wearable displays [3-4], developed freeform tiling methods to expand the field of view of freeform eyepieces [5], developed one of the most compact means of integrating eye illumination, eye imaging along with display function through a monolithic freeform eyepiece [6] (Figure 4), designed one of the freeform eyepieces offering the best resolution (resolving pixels of about 5 um) for an assistive technology that helps people with severely compromised vision to live independent again [7] (Figure 5), developed the first high-resolution 6-focal plane depth-fused volumetric display with a custom-designed freeform eyepiece [8], we demonstrated the first high-resolution large depth-of-field see-through light field display with a custom-designed freeform waveguide as an eyepiece [9], and demonstrated the first digitally switchable multi-focal length array for light field imaging and display using freeform optics [10]. There are numerous other examples of research activities where optics play a key enabling role within and beyond the field of wearable displays.

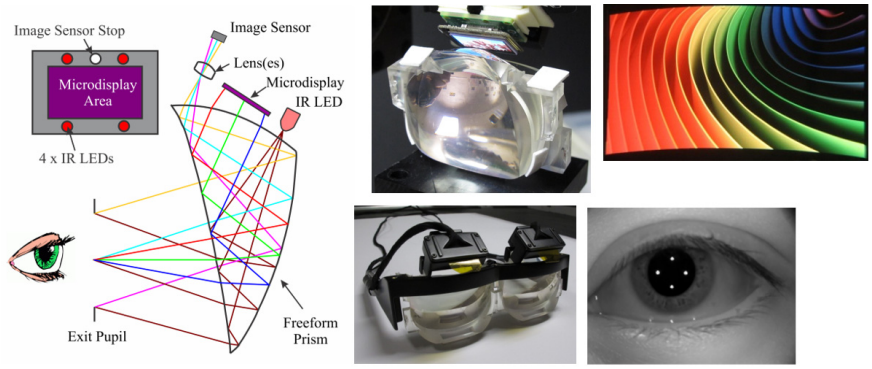

Figure 4 Example of integrating the optical paths of eye illumination, eye imaging, and virtual display through a single freeform eyepiece

Figure 5 A high-resolution freeform-eyepiece (Left) enables the development of a wearable display as an assistive technology (Right) for people with compromised vision (Credit for Photo on the right: eSight Corporation)

4. THANK YOU, JIM

Professor Wyant has made many contributions to our optics community and made powerful influences on many individuals' lives and careers. No words are enough for expressing our gratitude, but let me try anyway:

"Thank you, Jim, from the bottom of our hearts."

Optics community, your students, and your colleagues will remember you forever as stellar scholar, an educator, a mentor, a collaborator, a master entrepreneur, a philanthropist, and a friend.

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