

# The Artistic Origins of Virtual Reality

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The history of virtual reality is often obscured. It is easy to get the impression that the Big Bang occurred at NASA in 1984 and that virtual reality is a triumph of the technical establishment alone. What has been overlooked is the important contributions that artists have made to the development of the field.

The dawn of virtual reality in the technical community is most often traced to a paper by Ivan Sutherland presented at the National Computer Conference in 1965 and another written by him in 1968.<sup>1</sup>

There were also two relevant dissertations at the University of North Carolina in 1970 and 1976.<sup>3,4</sup> Otherwise, during most of the 1970s and the first half of the 1980s, the idea of virtual reality was dormant in the technical community, except for the classified work of Tom Furness in the U.S. Air Force. Even these efforts were highly specialized and directed at single applications. There was little effort to communicate to the research community, let alone society at large, the fact that an explosive culture-defining concept had been discovered and implemented.

Given the length of the hiatus following the early work, one is left to ponder what precipitated the resurgence of virtual reality in the mid-1980s. The premise of this essay is that the ideas were actively pursued in the arts from the beginning, that virtual reality's rebirth as a technical field was triggered by the efforts of artists, and that increasing the involvement of artists now would foster more rapid development of the field in the future.

In the 1960s, many of the issues that we now associate with virtual reality were under active consideration in the arts community. By the beginning of the 1960s, Mort Heilig had already built his Sensorama, a full-immersion experience involving stereo film and stereo sound, along with separate tracks for mechanical vibration, wind, and olfactory

stimuli.<sup>5</sup> In the 1960s, musicians in different locations were performing together in a virtual audio space. Among the most significant of these performing artists was Salvatori Martirano at the University of Illinois at Champagne-Urbana. His work also included attempts to create 3D sound experiences by using large numbers of speakers with separate synthesizers.<sup>6</sup> In the same period, Joseph Pinzarone attached 64 sensors to dancers and used their movements to control the generation of sounds.<sup>7</sup>

The efforts of Michael Noll, then at Bell Labs and now Dean of the Annenberg School for Communication in Los Angeles, were also important. While he was trained as a technologist, he made a series of contributions to computer art, a number of which should be included in any history of virtual reality. He created devices for stereo viewing, telepresence viewing, 3D drawing, and tactile communications that were motivated in part by a desire to use technology to redefine the arts. He also created a 3D graphics system for visualizing dance.<sup>8,9,10,11</sup>

Computer-controlled responsive environments trace back to the work of Dan Sandin and myself at the University of Wisconsin starting in 1969.<sup>12</sup> There were also large-scale outdoor environments created by the PULSA group at Yale led by Patrick Clancy.<sup>13</sup> Aaron Marcus implemented an interactive, symbolic, computer-graphic environment titled "Cybernetic Landscape" in the early 1970s.<sup>14</sup> These experiments fully understood and explicitly stated the vision of what is now seen as virtual reality.

The sense that virtual reality was of fundamental importance came from artists who communicated it immediately to the public through their work. In addition, many aspects of virtual reality including full-body participation, the idea of a shared telecommunication space, multi-sensory feedback, third-person participation, unencumbered approaches,

and the data glove all came from the arts, not from the technical community.

Beginning with my Metaplay exhibit in 1970 and the Videoplace installation at the Milwaukee Art Museum in 1975, the concept of a shared telecommunication environment was added to the virtual reality lexicon and implemented as well.<sup>15</sup> (The term Videoplace refers to the place created by the act of video telecommunication.) Videoplace was an official Bicentennial project, although it was not implemented on a world-wide scale using satellites as proposed. Several years later, Kit Galloway and Sherrie Rabinowitz did long-distance, two-way, video demonstrations creating what they called composite spaces.<sup>16</sup> Their efforts included performances in the virtual space as well as extended informal communication between people in two remote locations. In fact, during the 1960s, 1970s, and 1980s, artists performed more interesting experiments into the act of telecommunication than did the telecommunication industry.

In 1976, Dan Sandin, Tom Defanti, and Gary Sayers at the University of Illinois in Chicago invented the data glove under a grant from the National Endowment for the Arts.<sup>17</sup> (It is notable that Sandin and Defanti also oversaw the implementation of the Cave at SIGGRAPH '92.<sup>18</sup> A number of years later, the glove that triggered the current wave of development at NASA was patented by Tom Zimmerman.<sup>19</sup> His glove was very similar to Sandin's. Zimmerman's goal was similarly artistic—he wanted a device for playing air guitar.<sup>20</sup>)

The development of the original head-mounted display used for virtual reality at NASA was led by Mike McGreavy who had artistic training.<sup>21</sup> A year later, Scott Fisher, who had a degree from Rhode Island School of Design, joined NASA to work on virtual reality.<sup>22</sup> He had seen the Zimmerman glove demonstrated when he was at Atari, tracked it down,

contracted VPL to make an improved version of the glove for NASA, and directed much of the early NASA research. By that time, the rights to the Zimmerman glove had been bought by Jaron Lanier, a musician.<sup>23</sup> Similarly, Durand R. Begault earned an MFA in music and “for about 15 years mostly composed music designed to manipulate and exploit the spatial element of sound much as other composers might manipulate timbre, pitch, or rhythm.”<sup>24</sup> He wrote a doctoral dissertation on 3D sound before he joined NASA to spearhead the effort to add an audio component to virtual reality.<sup>25</sup>

Even in the present, there is a notable difference in the style of work occurring in the arts versus the sciences. Certain critical constraints of virtual reality are likely to be finessed in the scientific community. These include real-time performance, untethered freedom of movement, and minimal encumbrance. In contrast, almost all artistic efforts operate close to true real time. Whereas the technical community seems forever untroubled by the tether that connects the participant’s head to the processor, Los Angeles choreographer Mark Caniglio places sensors on dancers and radios the information to the computer.<sup>26</sup> Artist Graham Smith’s efforts to immerse viewers in images inspired VPL’s Videosphere demonstration at SIGGRAPH 89.<sup>27</sup> However, he was disappointed with the results and now projects his images onto a dome at the bottom of a swimming pool and the viewers swim inside to watch. Similarly, artists were the first to embrace unencumbered approaches to virtual reality. It is notable that over two decades later, Bell Labs, Xerox Park, Sarnoff Labs, and Seimans are just now starting to do the same.

Given that artists have contributed to bringing virtual reality to its current state, it is arguable that artistic participation should be increased. This is especially true if the results achieved are divided by the dollars spent. Under the pressure of the Cold War and with tens of billions of dollars, technologists developed incredibly sophisticated simulation technology. However, without exception, their paradigm comprised a sedentary operator directing the movement of a vehicle through a virtual world by means of hand-operated controls. The concept as well as the implementation of full-body, multi-sensory participation in virtual worlds as a general-purpose medium was instigated by artists operating with very modest budgets. By the bang-for-buck measure, the artists have outperformed the research community, particularly in knowing what was a promising direction to pursue.

Finally, virtual reality is more than a technology—it is a culture-defining medium like film or television. Its use will be judged by aesthetic as well as technical criteria, whether it is used for artistic expression or practical application. Furthermore, it is likely that the new artistic medium will lead to new markets that dwarf the so-called practical applications.

Virtual reality has already changed how we think. Its implications are so broad that it cries out for the participation of all elements of society. I sought to celebrate this powerful new idea in my artistic work and to invite everyone to the intellectual feast in my books.<sup>28,29</sup> Brenda Laurel observed that the relationship between human and machine had ceased to be purely technical and had entered the ancient realm of theater.<sup>30</sup> Architect Michael Benedikt started the Cyberspace Conference to provide a forum for the intellectual issues to be discussed. Michael Heim has written a book that considers how virtual reality will change how we think and how we see ourselves.<sup>31</sup> It was the beautiful concept and the opportunity to reunite our culture through new super-medium for scientific analysis and aesthetic expression that led artists to push the ideas and the technologies required to create virtual reality.

Note: The author would welcome any information about other artistic contributions that he may have overlooked.

## Notes

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