

Brain Wave Rider: A Human-Machine Interface

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Brain Wave Rider (*BWR*) is a game machine controlled by the player's brain. The player/rider commands a simulated vehicle by changing the state of his or her brain activity. The player can learn to make the vehicle speed up, slow down, shoot missiles and fly upwards.

BWR reads the player's brain waves, changing the speed of the vehicle as it moves forward in a computer-generated landscape. The brain-wave data are known as electroencephalograms (EEGs) in the medical field, and have been used primarily as measurements of brain activity. *BWR* uses the Interactive Brainwave Visual Analyzer (IBVA), a multimedia biofeedback system, to detect and analyze brain waves [1].

Standard brain-wave classification recognizes four kinds of waves: alpha, beta, theta and delta. *BWR* displays "symbols" corresponding to each brain-wave type and transmits the vibration of an imaginary engine to the player's body through a body-sonic board and chair (Fig. 1). Sound comes from speakers that are attached to the player's chair and helmet. In addition, flashing light-emitting diodes (LEDs) placed in the goggles worn by the player synchronize with brain-wave frequency.

Following is a list of brain-wave types and their corresponding symbols:

- alpha wave: missile launch (Fig. 2)
- beta wave: meteorite attack (Fig. 3)
- theta wave: explosion of substances in the brain (Fig. 4)
- delta wave: psychedelic patterns (Fig. 5)
- eye movement: flying image (Eye movement signifies ocular muscle signals with lower frequency than the brain waves.) Through these symbols, the player can visually recognize the waves his or her brain is emitting.

The most salient feature of *BWR*'s human-machine interface is that it uses the brain wave as a trigger that causes physical change without physical action.

Without button-pushing or other direct action upon an objective interface, the player can control the computer-graphic image, sound and vibration he or she perceives through meditation or mental calculation, i.e. by changing the state of his or her brain waves.

Digital Therapy Institute set up two *BWR* systems at "Psychoscape: Mind Observation through Art," an exhibition organized by ARTLAB [2].

BWR players begin by sitting down in a simulated cockpit, then put on a headband equipped with brain-wave detection sensors and don helmet and goggles (Color Plate B No. 4).

Their brain-wave data are analyzed by two computers. A third computer reads the analyzed data and controls the devices for the sound and images [3].

The LEDs in the goggles flash in sync with the players' brain-wave frequencies, which are fed to the eye apparatus by the computers.

If player A should emit a higher-frequency wave, such as a beta wave, while player B emits a lower-frequency wave, such as a delta, B could be influenced to accelerate by A's brain waves and A could be influenced to slow down by B's brain waves, as brain frequencies tend to be influenced by the frequency of light or sound.

As mentioned earlier, the speed of the video image changes according to brain-wave frequency: higher frequencies cause the movement of the image to accelerate, while lower frequencies slow it down.

If both player emit higher-frequency waves, they can travel as if flying, while they will seem to crawl if both emit low-fre-

ABSTRACT

Brain Wave Rider (BWR) is an interactive artwork produced by Digital Therapy Institute, an electronic-art group based in Tokyo. The author presents a brief description of the mechanics and ideas behind *BWR*. He then discusses various influences and related concepts, citing ethnographic accounts of religious rituals and postmodern theoretical writings.

Fig. 1. Digital Therapy Institute, *Brain Wave Rider*, interactive computer game controlled by the player's brain waves, installed at ARTLAB's Psychoscape exhibition in Tokyo (1993). The player's headset is connected to computers that read and interpret his brain waves. He watches a terminal that displays imagery corresponding to his brain-wave type. The vibration of an imaginary engine is transmitted through a body-sonic board and chair. (Photo: ARTLAB, Canon, Inc.)



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vehicles cannot depart from this world if they are not burned.

Usually, a vehicle denotes a means of transportation over land. Once a vehicle leaves the land, however, its categorization is unclear. Vehicles that travel through space, for example, are known as spaceships. There are innumerable vehicles and ships flying through the sky in the world of religion and myth.

In the case of certain religious rites performed on the water, ceremonial ships sail for a very short distance in this world, then pass into the other. They transcend the boundary of the real world and its images of space.

At the Shaara boat ceremony, held on the last day of the Bon festival in Nishinoshima Mita, in the Oki islands, people build a straw boat and decorate it with small colored flags bearing the Buddhist sutra "Namuabidabutsu." They attach the flags to ropes stretched from the mast and send the boat out to sea, heaped with offerings. Some children actually climb aboard the Shaara boat and ride as a second boat tugs it out to sea, staying until the ceremonial boat starts to sink. Then the boat heads for the other world, with spirits of ancestors on board.

Voodoo also uses a boat for the ceremony of Agwe, God of the Sea. Each voodoo divinity is expressed as a symbol called a "vever." Agwe is represented by a sailboat on which the word "Immamou" is written. The boat used for the ceremony of Agwe, as depicted in Maya Deren's documentary film *Divine Horsemen: The Living Gods of Haiti* and her book of the same name [5], resembles the Shaara boat of the Oki islands. This boat is also decorated, and disappears with its burdens of offerings to the sea. In this case, Agwe first makes his appearance by transmigrating to the priests performing the ceremony on the boat, then the boat heads for the world of the gods.

Both the Shaara boat and Agwe's boat leave the shore to sail for only a short distance on the ocean, moving through images of religious space after they sink and their physical travel ends. These boats and *BWR* are alike in a certain respect: all three are vehicles that move through images of space.

LANDSCAPE

Anyone who has driven a car in the United States has probably noticed the warning that appears on many rear-view mirrors: "Caution: Objects in this mirror may be closer than they appear." It is

necessary to be prepared for every contingency in the land of product liability.

Jean Baudrillard quotes this warning at the outset of "Vanishing Point," the first chapter in his book *America* [6]. He describes discovering the warning at the outset of his automobile trip through the vast southwestern desert, and uses the quote to express the emptiness of the United States.

The landscape that appears on the monitor of *BWR* was created through popular landscape-simulation software programs [7]. Such programs may be of limited business use, but they are nonetheless elaborate, and they allow the user to easily enjoy traveling through computer-generated landscape simulations. The high degree of detail they are able to achieve is evident when one looks up through the leaves in a digital tree to see blue computer sky beyond.

Interestingly, the companies that make these programs also produce pre-generated data that allow one to travel—in three dimensions—through the grand views of America: the Grand Canyon, Yosemite National Park, and so on. A new series of data has now jumped off the American continent and will take the consumer as far as the extraterrestrial landscape of Mars.

Baudrillard's *America* resembles a road movie, depicting a passage through the desert, talking about people and towns. However, this road movie belongs to the video age of the 1980s:

We'd need the whole film of the trip in real time, including the unbearable heat and the music. We'd have to replay it all from end to end at home in a darkened room, rediscover the magic of the freeways and the distance and the ice-cold alcohol in the desert and the speed and live it all again on the video at home in real time, not simply for the pleasure of remembering but because the fascination of senseless repetition is already present in the abstraction of the journey [8].

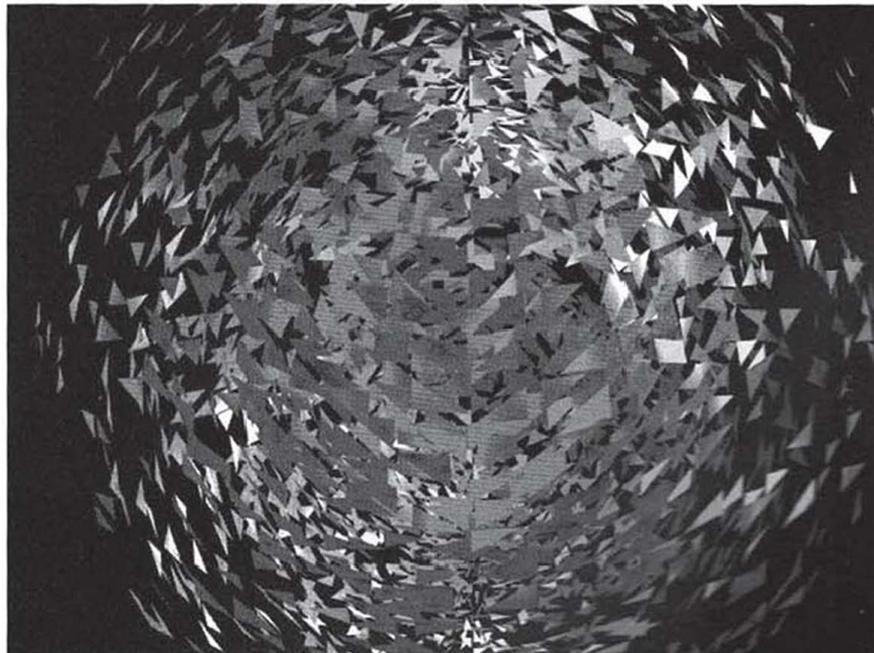
The trip through a computer landscape differs from the road trip in that Baudrillard actually drove through the real America. His trip was not a simulacrum: objects in his mirror just looked smaller. His trip becomes simulacrum only when recreated on video. The media—in this case, computer and video—make the difference.

Thus, in his book *Simulations*, Baudrillard writes,

Abstraction today is no longer that of the map, the double, the mirror or the concept. Simulation is no longer that of a territory, a referential being or a substance. It is the generation by models of a real without origin or reality: a hyperreal. The territory no longer precedes the map, nor survives it. Henceforth, it is the map that precedes the territory—PRECEDENCE OF SIMULACRA—it is the map that engenders the territory [9].

The computer-generated landscape is a simulacrum, unlike the real landscape Baudrillard describes in *America*, as it can take infinite forms never seen before. It is "a real without origin or reality: a

Fig. 4. Digital Therapy Institute, *Brain Wave Rider*, interactive computer game controlled by the player's brain waves. A theta-wave image.



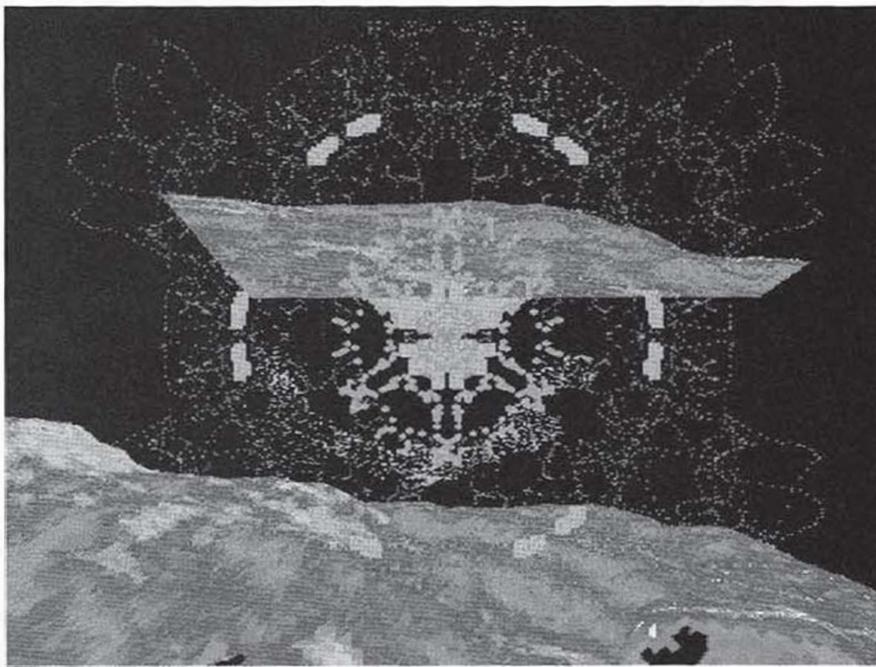


Fig. 5. Digital Therapy Institute, *Brain Wave Rider*; interactive computer game controlled by the player's brain waves. A delta-wave image.

hyperreal." The only person who can experience this hyperreality is the one operating the computer in order to enter the landscape. *BWR* allows the rider to travel through a hyperreal landscape at hyperreal speed, controlling them both with only his or her brain waves.

THE BRAIN AND SPEED

Preparing to ride in *BWR*, participants ostentatiously put on the helmet like old-time race-car drivers. But what exactly is the significance of speed to the brain controlling the speed of *BWR*?

"Education and Development," a chapter in Marvin Minsky's book *The Society of Mind*, starts with a question asked by a parent: "If the younger children take so long to acquire concepts like conservation of quantity, can't we help speed up their growth by teaching such things earlier?" [10]

The question is interesting here because it demonstrates that parents sometimes seem to hope only to speed up the processing going on in their children's brains. A Japanese expression for cleverness translates literally as "the rotation of the head is quick," and English has its share of speed-centered phrases, such as "quick-witted" or "a nimble mind."

Both examples reveal the importance that is placed upon the speed of the brain's functioning. According to a University of California study conducted in

1985, Einstein's brain had four times more "oligodendroglia"—helper cells that speed neural communication—than the brains of 11 merely gifted people [11].

Fast processing speed is all-important to computers. No matter how we may insist that "great talents mature late" with respect to human beings, we still tend to choose a computer based on how fast it is. The Chinese word for computer translates as "electric brain." It goes beyond the original English meaning—"that which computes"—to suggest artificial intelligence as the most developed form of computer. The fact that we should not forget is that the computer is an extension of the human brain, and thus we know that humans will continue to seek even faster brains in the future. The human brain will never slow down.

The value of experiencing *BWR* comes through discovering that one can effect a physical change in the speed of the system by varying the state of one's brain waves. Normally, we do not have the chance to observe our own brain waves (unless we receive EEG exams after suffering a head injury). Few people are likely to think of changing their own brain waves in order to effect physical change in an environment. However, *BWR* participants gradually master control over their own brain waves, which may not be as immediately useful as mastering, say, tax evasion, but is still a real expansion of ability.

SUPPLEMENT

One of the Marvel Comics superheroes, Weapon X, is a mutant with fearsome combat skills honed through training with a battle-simulator helmet—a helmet that creates virtual combat scenes. His fictional helmet resembles the *BWR* helmet in both form and function: by donning these helmets, one can acquire new talents. The discovery of new ways of using the brain opens the possibility for further mutation.

William S. Burroughs, expounding upon his thought in his book *The Job*, quotes from *The Living Brain*, by Gray Walter: "The rhythmic series of flashes appear to be breaking down some of the physiologic barriers between different regions of the brain" [12]. Burroughs points out that a consciousness-expanding experience can be induced by a flicker—that is, a rhythmic light flashing in the retina at the rate of 10 to 25 flashes per sec, which produces effects characteristic of consciousness-expanding drugs.

The *BWR* helmet can be both an audiovisual apparatus similar to the one Burroughs used for his consciousness-expanding experience and a talent-acquisition trainer like Weapon X's helmet.

References and Notes

1. The Interactive Brainwave Visual Analyzer is produced by Psychic Lab, Inc., and is used with a Macintosh computer.
2. ARTLAB is an artistic organization backed by Canon, Inc. "Psychoscape: Mind Observation through Art" was held from 27 March to 7 April 1993 at O Art Museum in Tokyo.
3. Two Macintosh computers analyze the data; an NEC PC-9801 reads the data and controls the devices.
4. Paul Virilio, "The Last Vehicle," in Dietmar Kamper and Christoph Wulf, eds., *Looking Back on the End of the World* (New York: Semiotext(e), 1989) pp. 108–109.
5. Maya Deren, *Divine Horsemen: The Living Gods of Haiti* (London; New York: Thames and Hudson, 1953; New York: McPherson & Company, 1983).
6. Jean Baudrillard, *America* (London, New York: Verso, 1988).
7. Examples of such programs are AMIGA's Scenery Animator and Vista Pro.
8. Baudrillard [6] p. 1.
9. Jean Baudrillard, *Simulations* (New York: Semiotext(e), 1983) p. 2.
10. Marvin Minsky, *The Society of Mind* (New York: Simon & Schuster, 1988) p. 106.
11. *Newsweek*, "The Puzzle of Genius" (28 June 1993).
12. William S. Burroughs, *The Job* (New York: Penguin Books, 1989) pp. 131–132.