From Memory Arts to the New Code Paradigm

The Artist as Engineer of Virtual Information Space and Virtual Experience

RICHARD K. MERRITT

ABSTRACT

This paper examines contemporary developments in the creation and experience of immersive 3D art projects in the context of spatial and information design. It takes into consideration historic forebears, particularly the ancient Greek art of memory, contemporary theorists, and current new media artists who are pushing code and application design to new limits. The essay specifically addresses the role of the artist as "coder" and application engineer and anticipates concerns and possible technological developments in data visualization and virtual spaces. As new media artists write their own code, current boundaries between disciplines and sectors become blurred and new aesthetic judgments become pivotal. Additionally, current management and organizational structures are challenged to confront a world that increasingly visualizes and communicates in 3D.

This century marks an acceleration in the use of new media technologies and changes in the way viewers define and interact with art produced by means of these technologies. As new media artists engage this new and dynamic paradigm, their roles, expectations, and necessary skills change. Correspondingly, computer languages and systems are expected to be flexible, adaptable, and multisensory. The creation of future platforms and applications has to take new experiential and aesthetic possibilities into consideration. In varying constellations, all of these aspects will be relevant for creating experiential and immersive data structures that are increasingly intuitive, engaging, visceral, and virtual.

For a discussion of current methods of visualizing data and its role in information aesthetics and immersive experience, it is helpful to first consider how data was organized and recalled for utilitarian purposes in earlier periods. The ancient Greek art of memory seems to be a good starting point. Based on a system that relied on organized categorization of real world artifacts and corresponding metaphorical and semiotic content, the art of memory required a clear methodology. The classical Greek method of "experience" relied on the use of internal mental construction of virtual spaces. Though mnemonic in nature, these systems were essentially complex symbolic immersive environments used to impress places and images on the mind for varied purposes of information retrieval. These objects and places (loci and imagines) would mentally be linked to a linguistic or conceptual corollary. These "mental gymnastics" mostly served the classical art of rhetoric.

Mnemonic techniques would evolve into various metaphysical and occult practices. One practice of particular interest in this context is that of Bocampagno da Signa, which he describes in the *Rhetorica Novissima* [1]. The book categorizes a mnemonic system for recalling business data. Published in 1235, it is the product of an offshoot of the classical art of memory tradition. Referred to as Ars Dictaminis and arising out of Bologna, it was a school that shaped the art of memory into a form of letter writing and administration. Similar to the work of Albertus Magnus, the school assumes that there is a supernatural origin to the art of memory, but still relies on a classical definition in that it ascribes the preeminent aspects of mental organization to the art of memory. Despite this classical definition, Bocompagno da Signa's work

Richard K. Merritt, Assistant Professor of Computer Art, Design and Art History, Luther College, Decorah, Iowa, 52101, U.S.A.
E-mail: merritri@luther.edu

closely follows the medieval sensibilities of virtual spaces, the nature of the soul and its connection to the primordial memory of the fall from grace as well as to the temporally dislocated memory of paradise and hell. Although partially an occult practice, da Signa's work relied on the belief in a primordial spatial memory, in which all historical events, data, and information could be housed in a system of discreet hierarchies. This system of hierarchies served the purpose of engaging corporeal experience via a mentally constructed 3D space and the application of utilitarian mnemonic devices. Bocompagno da Signa's 13th-century text seems a prescient moment for those concerned with immersive data and its potential for management, with organizing aesthetics and art that explores dynamic systems.

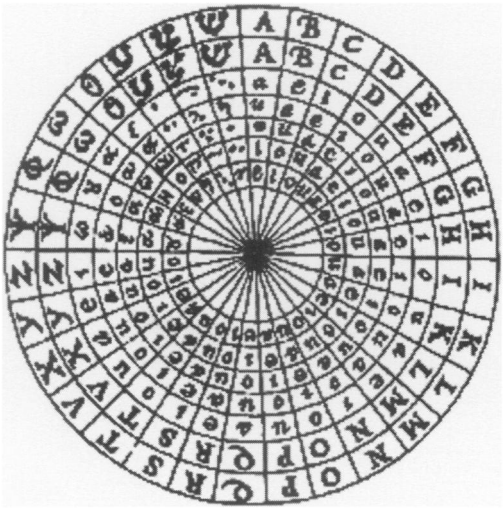

Fig. 1. The "Memory Wheel" in Giordano Bruno's *De Umbris Idearum* (1582).

Later Italian memory systems, such as the work of Giordano Bruno *(De Umbris Idearum ... Ad Internam Scripturam and Non Vulagares per Memoriam Operationes Explicatis,* Paris 1582) relied on a diagrammatic system [2]. Bruno's system used two concentric wheels, each of which was inscribed with letters that represented the symbols of the zodiac, Egyptian sidereal deities, planetary gods and talismans, and complex astrological influences (Fig. 1). All of these were supposed to be "stored" in memory or on an astral level, which—according to occultists' beliefs—was visited when one used a systematic mnemonic device or "artificial memory."

Magically empowered by the center wheel, the exterior wheel used a complex system of "astral human images." These images consisted of letters and represented historic individuals who had contributed, through their inventions, to the advancement of civilization. Bruno used the wheel as the receptacle for images which in turn would trigger virtual experiences in the mind. Through the inter-revolving wheels one could potentially access a vast network of places and images by conjuring them up in one's mind. Users could create a seamless synthetic system of virtual experience if they were adept at this form of organization and had mentally catalogued a virtual universe by recalling the totality of forms organized according to principal topics. Giordano Bruno's system is particularly relevant to us for its graphic design element and its relationship to mnemonic utility.

Mapping Cosmology and our Place in the Universe

The Enlightenment of the 17th and 18th century, with its proliferation of scientific and philosophical literature, had a profound effect on the future of immersive data. This effect can be traced most clearly in the advent of orthogonal extrusions in 2D mapping. Also called axonometric projections, these maps were hypothetical bird's-eye views of cities, designed to engage viewers viscerally so that they could create what Edward Tufte called "micro readings"—stories contextualized by the map itself and personal connections to the realized space. One of the most famous of these maps is the *Plan de Paris* (1739) by cartographers and artists Michel Etienne Turgot and Louis Bretez [3]. Prior to the 17th century, mapping had been decidedly non-scientific, its purpose being divided between "finding a place or location" and locating the soul with respect to the divine. Oscillating between multiple purposes such as the above, the map was an artifact of primordial memory, cosmology, social agency, and geography.

By the 17th century, science had taken a firm step out of the metaphysical and occult into a realm governed by the notion of the observable. Hence, maps had become a tool for locating ourselves in the physical world. The axonometric/extrusion map makes it possible for users to engage the interface in a way that forces them to consider their own corporeality. I refer to this effect as the cognitive/corporeal map. The cognitive/corporeal map is essentially grounded in the human propensity towards finding balance and guidance on the basis of internalized mental constructs or expectations. Similar to the Greek art of memory, these constructs are embedded systems created through the act of living.

Dance notation during the 18th century recorded temporal instances. The movement of dancers was mapped in orthogonal perspective, thus locating the body not only in space but also in time. Kellom Tomlinson's *The Art of Dancing,*

Fig. 2. A plate from Kellom Tomlinson's *The Art of Dancing* (London, 1735). Book I, Plate XII.

Explained by Reading and Figures (London 1735) [4] embodies an aesthetics of information that does not only include corporeal/temporal relationships but also links fundamental movements to places within music notation, thus creating a four-dimensional graphical taxonomy (Fig. 2).

The early 17th century also marks the beginnings of what can be called global capitalism. With the formation of the English, Dutch, and French East India trading companies (1601, 1602, 1604 respectively), the necessity for storing economic information in a form that was

graphically easy to read and efficient became paramount. The 17th and 18th century also saw the birth of the graph as a tool for managing economic data. With the massive influx of goods and materials from colonies located throughout the world, more easily discernible graphical explanations became useful and led to the development of the economic graph. Its basic structure was sublime: two perpendicular axes, one representing costs/revenues or expenses, the other representing linear time. For the following three centuries, the hegemony of this graphical form as an aesthetic device in the rendering of commercial data would predominate.

In current visualization models, we still see the prevalence of 2D graphical representation. However, 3D data models are becoming increasingly relevant in the current aesthetics of dynamic visualization. A preeminent example of this is the "New York Stock Exchange Three-Dimensional Trading Floor" [5], powered by five Silicon Graphics Onyx2s, which drive the overall solution, and an additional Onyx2 Reality, which runs the application and content development. This environment is housed in the New York Stock Exchange's Advanced Operations Center. The virtual trading floor consists of a 3D representation of trading posts, representations of trading activity and real-time data monitoring, including television news. Once data has been extruded from two to three dimensions, additional features are activated. Color, form, and line become linked to space, time, iconography, social symbology and "cognitive/corporeal mapping."

The "New York Stock Exchange Three-Dimensional Trading Floor" consolidates data from a variety of sources. This data is then generalized and when a particular market sector or data stream requires attention, the viewer or immersant is notified by a blue activity meter. In order to engage with the data in a more specific way, the viewer can use a bank of virtual computer monitors and gather numerical data. This system, which balances the corporeal with the cognitive and linear for commercial purposes, to a certain extent is a direct descendant of Bocompagno da Signa's *Rhetorica Novissima* of 1235. Through the use of virtual, cognitive/corporeal mapping, an easily understandable GUI (Graphic User Interface) and generalized aggregate data displayed in 3D, the virtual trading floor diminishes response time to trading, as well as geopolitical and social issues.

The firm that worked on the New York Stock Exchange virtual trading floor, Asymptote Architecture, specializes in virtual architecture and 3D data imaging and uses immersive virtual environments as means of data organization. Asymptote also created the "USA Interactive" section of the understandingusa.com Web site, which features a variety of visualization models for data on the US [6]. "USA Interactive" uses VRML (Virtual Reality Mark-up Language) to produce interactive 3D graphical data. Asymptote's work transforms statistical data into organic forms but, as opposed to their New York Stock Exchange, this work does not engage the viewer in a corporeal way. Understandingusa.com extrudes data into three dimensions but the graphical display, though aesthetically viable, is one of datanoise—partly due to amorphous and dicontinuous structures. Although it is engrossing and interactive, the overall effect lacks direct utility without a distinct shift in the users thinking.

The Emergence of the New Paradigm and The Erosion of Discipline Boundaries

The new paradigm of 3D data visualization relies heavily on the conceptualizations by virtual reality pioneers and theorists such as Jaron Lanier and David Gelertner. Gelertner's book *Mirror Worlds, The Day Software Puts the Universe in a Shoebox... How It Will Happen and What It Will Mean* offers an interesting model. Gelertner's core thesis is that the construction of a virtual, immersive experience should engage the user through models of real world structures that roughly follow the laws and properties of reality, that is, the physical world. This "mirror world" would exist contiguous to our physical one, streaming real-time data from the physical into the virtual realm [7]. The mirror world concept is essentially a means of governing and organizing the massive flow of information created in the "real" world every nanosecond.

The new paradigm also reflects the ideas and concepts of a virtual, transactional commercial space, which is the core of Cyberpunk science fiction. Cyberpunk literature and film typically stresses the relationship between individuals, corporations, and social groups in a world of highly visual networks—ideas that prominently feature in the novel *Neuromancer* by William Gibson. Gibson, credited with coining the term "Cyberspace," created a world in which information can be accessed via neurally wired maps that interconnect with the world-wide lattice of information flow, which registers the user's/immersant's location within the system. Gibson's innovation lies in the description of how a user might not only process information but visualize, feel, and interact with it. His work is also valuable as an exploration of how corporate power and wealth might manifest itself in the virtual and the "real." Gibson's world consists of complex interactions between individuals and factions of information haves and have-nots—a prescient vision of our own virtual transaction space in the near future?

Another important aspect of Gibson's pioneering work *Neuromancer*, as well as the sequels *Count Zero* and *Mona Lisa Overdrive* [8], are the intuitive immersants, the people who sift through the patterns and wakes of information that each individual creates while "swimming" through the digital universe. Through their daily activities, the inhabitants of Gibson's world make signatures on Cyberspace, denoting their presence and intentions. The "intuitive fishers for patterns" in Gibson's novels offer us a model for understanding and interpreting interactive data and aesthetics of virtual organizing. Gibson's concept of data that is organized and rendered so that it can be understood immediately and intuitively directly anticipates the New York Stock Exchange's virtual trading floor. The "users" in Gibson's novels are immersed in experiential data structures that are general-

ized and intuitive yet become specific and incisive if one needs to drill into the data.

The Cyberpunk model envisioned by Gibson can clearly be identified throughout many cyberspace fictions. We see Gibson's disturbing vision of a bleak corporately controlled world echoed in Neal Stephenson's *Snow Crash* and Bruce Sterling's *Islands in the Net*, among others [9]. Gibson's vision alerts us to the potentials and pitfalls of immersive experience as it is applied to data transfer, visualization, and interaction. The prescient working of the hero who is intuitively able to trace the lattice of cause and effect throughout the global virtual labyrinth has also manifested itself in the character Neo from the film *The Matrix* [10]. The highly visual and experiential nature of the cyberworlds envisaged by Gibson has created a shift towards aesthetic forms that engage the flow of information in virtual spaces.

The way in which we engage this aesthetic also establishes a space wherein the boundaries between a myriad of disciplines are eroding. This probably is nowhere more apparent than in the work of artists from varied disciplinary backgrounds. Contemporary new media artists have made use of new technologies in order to create experimentally valid and experientially plausible realities. One of them is Char Davies who eschews the overall nihilism of the Cyberpunk model. An artistic and applications development director for Softimage, a company that produced a state-of-the-art 3D rendering program used in both film and gaming industries, Davies created the works *Osmose* (1995) and *Ephemere* (1998). Using a body vest and stereoscopic VR head-set display as interfaces, *Osmose* invites the viewer or "immersant" to experience multiple worlds that simulate natural environments. Through the use of a simultaneous live video projection, the experience of the immersant can be shared by other viewers in an environment that transforms the notion of viewership, reality, and control. As the single immersant engages with the virtual world of *Osmose*, other gallery viewers share the experience of a single user as she controls the expansive confines of the work's multi-world universe. Davies' work establishes a dynamic tension between code and space, text, and environment. As viewers experience the piece, they keep wandering deeper into the space, encountering bits of code and text that float in 3D space. As the first feature-length VR installation, *Osmose* is not only a pioneering work but challenges the capabilities of the medium and blurs the boundary between "coder" and artist.

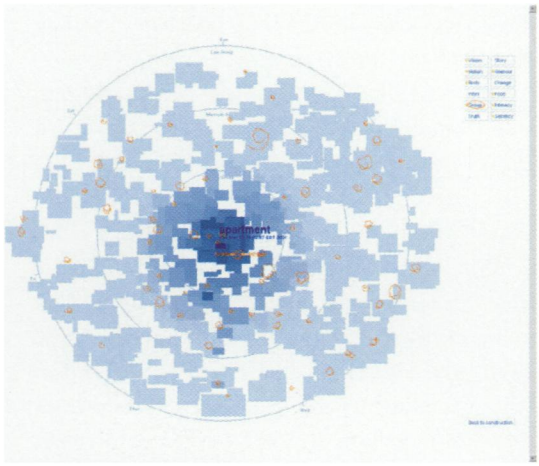

Fig. 3. The city interface of *Apartment* by Martin Wattenberg and Marek Walczak (2001).

Other artists—such as Will Bauer and composer Steve Gibson in their collaboration *Object of Ritual*—intertwine physical and symbolic resources in order to create a memory device or mnemonic structure in which users examine their own relationship to space, object, and memory. *Object of Ritual* explicitly establishes the connection to earlier memory arts by letting the viewer use a series of mnemonic tools (virtual objects placed in virtual places in specific hierarchies) in order to allow for the storage and recall of information for a variety of social and spiritual purposes. Another work inspired by mnemonic devices and the memory palace, in particular, is *Apartment* by Martin Wattenberg and Marek Walczak [11]. The piece uses the metaphor of apartments and cities as a form of visualization for the semantic relationships between words and sentences typed in by users (Fig. 3).

Jeffrey Shaw's installation piece *The Legible City* (1988-91), examines the nature of memory and learning with regard to the interplay of corporeal learning with language and concept learning [12]. Shaw's work creates a complex balance between visceral memory, similar to the arts of memory, and textual learning. In *The Legible City*, this juxtaposition creates a system in which one practice of learning must necessarily marginalize the other. The immersant pedals an actual bicycle through a virtual world composed of gigantic text. The viewer is simultaneously engaging the left and right brain as she pedals through the virtual world while reading. Though initially confounding and contradictory, the piece becomes comprehensible as a poetic narrative of the city through the act of play.

The Internet has provided the world's largest gallery for new media artists. This new venue becomes an exhibition space for projects that challenge the notion of art and aesthetic experience as well as the boundaries between disciplines. Marius Watz from Oslo, Norway—a programmer, print and multimedia designer—produces primarily Java-based work to render evolutionary forms that mutate and undulate [13]. Users are able to customize their experience by changing parameters of line color and texture.

In his work *Collaborative Design and Visualization*, Jarek Rossignac, a professor at the Georgia Institute of Technology, emphasizes the need for interfaces to become more intuitive and integrative [14]. Pivotal to fulfilling this need is the creation of new and dynamic academic departments at universities and colleges throughout the world. Many of these departments are heavily influenced by the pioneering work of the Massachusetts Institute of Technology's Media Lab, which explores fields as divergent as engineering, artificial intelligence, art and graphic design. When it comes to challenging the artificial boundaries between fields, one MIT working group of particu-

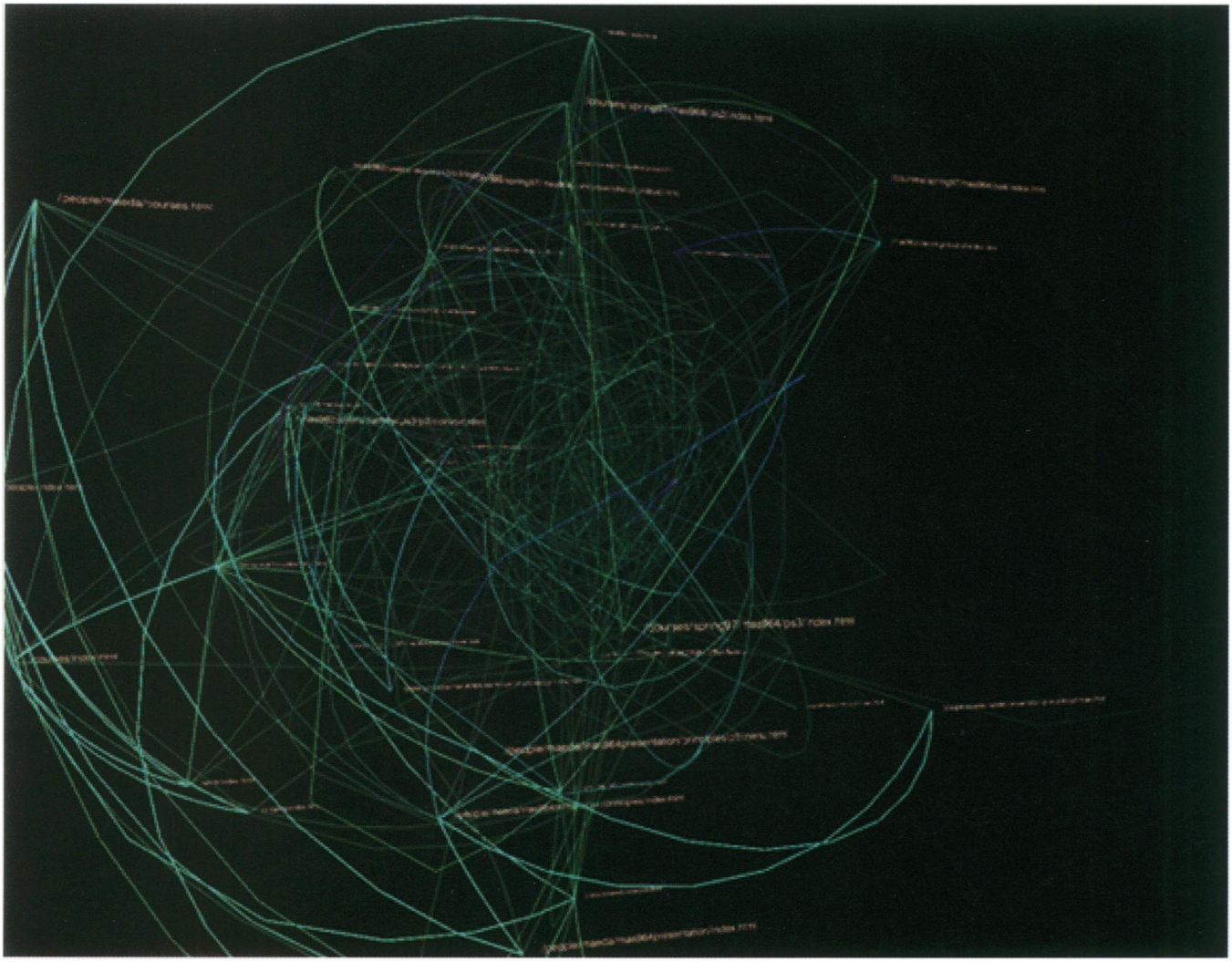

Fig. 4. Ben Fry's *Valence* software used for the visualization of Web site traffic.

lar interest is the Aesthetics and Computation Group [15]. Headed by eminent graphic designer John Maeda, MIT's Sony Professor of Media Arts and Sciences, the Aesthetics and Computation group stresses the dynamic interplay of code/programming and art. Ben Fry, a member of the group who has produced a series of qualitative 3D data visualizations [16], asserts that the most essential information evolves from the contextualized interplay of individual elements. One of Fry's experiments is a method for plotting text in 3D space. By seeking out the most used words and strings of words in Mark Twain's *The Innocents Abroad*, Fry's piece *Valence* displays the text in a sort of evolving, contextual 3D data map (Fig. 4). His current experiments include dynamic statistical visualizations that display data such as Web site or server traffic.

A very different example of a visualization model is *Fiat Lux*, a short film by computer scientist/artist Paul Debevec—formerly of the University of California at Berkeley—that is characterized by a profound dynamism and luminosity [17]. A highlight of the 1999 SIGGRAPH conference, the work stitches still images from St. Peter's Basilica to simulate a 3D space. As viewers are taken through the environment by the camera's choreographed movements, they are engaged by a symbolic representation of Galileo's historic struggle with the catholic church. Fiat Lux draws its imagery from Galileo's discovery of the principle of the Pendulum (while attending mass as a young man) and the way in which this event initiated a life time of important and critical scientific discoveries—many of which were in direct conflict with church doctrine. Debevec's pioneering technique of "image-based lighting" captures the full range of luminosity in a series of photographs and applies the effect of this lighting to virtual objects. This now licensed technology is currently being used by Pixar and Industrial Light and Magic, the two special effects giants behind the films *Toy Story* and *Star Wars: The Phantom Menace*, respectively. Debevec's and Fry's projects as well as those of many other artists who code and develop tools, push the boundaries between aesthetics and commercial/work application. There are other related developments that are similarly expansive, many of them validating the use of human cognitive/corporeal mapping and virtual space for the management of systems, data transactions, and the visualization of complex processes. What we have here is a congealing of the ideas first espoused by the Ancient Greeks, then crystallized by da Signa and finally given a dynamic and variable computational expression in this era. How can we define this new paradigm in data visualization and immersive art? I have selected four core attributes that will,

in all likelihood, define and challenge the coming generation of visualization, data modeling systems, and immersive aesthetic experience. These core attributes will allow us to engage the challenges presented by the new paradigm.

Cognitive/Corporeal Mapping-Adaptation to Psychology.

Future modeling systems will probably employ some form of multi-dimensional paradigm not unlike the model established by the New York Stock Exchange's virtual trading floor: a GUI that relies primarily on the human tendency to create internal visual worlds, which operate in correspondence to the natural rules of the material world (though currently many would argue that this approach creates undue cognitive burden). Thus, data visualization systems would function similarly to Gelertner's concept of "Mirror Worlds" wherein data is initially viewed superficially or metaphorically and upon closer examination becomes specific and incisive. Cognitive/Corporeal mapping, similar to the Ancient Greek Art of Memory, will rely on a system of correspondences based on objects and places that represent information which is useful in the physical world.

Boundary Shifts in the Role of Artist and Designer, Engineer, and Technician.

We see this tendency in seminality today, with the advent of new, integrated academic departments and media labs that seek to provide spaces for experimentation for the future creators of new media art aesthetics and information design. An offspring of this shift will likely be the redefinition of beauty, art, and commerce.

Determining Data Relevance and Avoiding Noise in Effective Communication.

The future validity of new technologies will depend on their efficacy. Useless graphics create cognitive burdens on the user's mind, as we can see in the Internet's growing resemblance to a North American stripmall. As data visualization expert Edward Tufte said, "Good design is clear thinking made visible" [18].

Work Place/Play Space.

The immersive experience that is applied to commerce will increasingly flow freely between work and play. The integration of these seemingly disparate human experiences will continue to grow. Navigation interfaces have to some extent been established by the gaming industry and virtual work environments will increasingly embrace these navigation paradigms. As the boundaries between the work and play space blur, this development will be used to surprising effect by corporate interests. New software will increasingly incorporate elements of play, and data and information workers will be engrossed by work in a way people conventionally engage in play.

Artists currently dealing with the burgeoning new media have discovered and embraced the new paradigm, engaging it in a fashion that creates meaning rather than being simply descriptive. New media artists such as Char Davies use the interactive possibilities of 3D graphics by giving embodiment to mental constructs. Other artists such as Ben Fry use aesthetic principles and code to produce new ways of visualizing data. As organizational and management structures become increasingly aware of new models of immersive 3D data environments, they will address the visceral needs of effective virtual experience. This process will create a vortex where seemingly disparate disciplines such as science fiction, new media art and commerce will coalesce and give rise to a new and challenging perception of spaces, virtual and real, transactional and transformative.

REFERENCES

1. F.A. Yates, *The Art of Memory* (Kent, UK: Maclays of Chatham PLC, 1997).

2. Ibid. [1].

3. E.R. Tufte, *Visual Explanations: Images and Quantities, Evidence and Narrative* (Cheshire, Conn.: Graphics Press, 1997).

4. Ibid. [3], p.27.

5. K. Moltenbrey, "Taking Stock," *Computer Graphics World* (Nashua, NH: PennWell, Oct. 1999), pp. 40-44.

6. Ibid. [5]. Web site: http://www.understandingusa.com

7. D. Gelertner, *Mirror Worlds: Or the day software puts the universe in a shoebox: How it will happen and what will it mean* (New York, NY: Oxford University Press, 1981), p.35.

8. W. Gibson, *Neuromancer*, (New York, NY: Ace Books, 1983), *Count Zero* (New York, NY: Ace Books, 1987), *Mona Lisa Overdrive* (New York, NY: Bantam Spectra, 1989).

9. N. Stephenson, *Snow Crash* (New York, NY: Bantam Doubleday Dell, 2000); Bruce Sterling, *Islands in the Net* (1988), out of print.

10. *The Matrix*, written and directed by Andy and Larry Wachowski; produced by Joel Silver, Warner Bros., 1999.

11. *Apartment* Web site: http://www.turbulence.org/Works/apartment

12. H.-P. Schwarz, *Media-Art-History*, Media Museum ZKM | Center for Art and Media Kalsruhe (Munich, Germany: Prestel,1997), pp. 148-149. Also see "Memory Palaces" in P. Anders, *Envisioning Cyberspace: Designing 3D Electronic Spaces* (New York, NY: Mcgraw-Hill Companies, 1999), pp 31-35; and *Bill Seaman's World Generator: The Engine of Desire* at http://www.235media.com/media_art/install/worls_generator.html, for work that explores this paradoxical model of aesthetic experience.

13. E. Kondo, "Hypnotic Flare," *I.D.* (New York, NY: F & W Publications, Jan./Feb. 2000), pp. 90-91. Web site: http://www.evolutionzone.com/hardwork/java/bezhorn/index.html

14. http://deslab.mit.edu/DesignLab/dicpm/position/rossignac.html; also see M. W. Firebaugh, *Computer Graphics: Tools for Visualization* (Dubuque, IA: Brown Publishers, 1993).

15. Aesthetics and Computation Group: http://acg.media.mit.edu/

16. Ben Fry Web site: http://acg.media.mit.edu/people/fry/; also see S. Cannon, "It's All Relative", *I.D.* (New York, NY: F & W Publications, Jan./Feb. 2000), pp. 94-95.

17. *Fiat Lux:* http://graphics3.isi.edu/~debevec/FiatLux; also see T. Vanderbilt, "Weird Science", *I.D.*, F & W Publications, New York, NY, Jan./Feb. 2000, pp. 96.

18. Ibid. [3].

Richard Merritt is Assistant Professor of Art History, Design, and Computer Art at Luther College. He has exhibited and lectured throughout the United States and internationally. His work is in private collections throughout North America. His recent scholarly work includes "Virtual Realities: The Desire for Control in Immersive Experience, The Ancient Greek Art of Memory, Pulp Novels, Science Fiction, and New Media Art," and "Intentions: Logical and Subversive. The Art of Marcel Duchamp, Concept Visualization, and Immersive Experience," presented at Information Visualization 2001 in London, England. Richard received a B.A. in History from Carleton College in Northfield Minnesota (1988) and an M.A. and M.F.A in Painting and Intermedia/Multimedia and Video (1992).