

[Design Issues, Volume 19, Number 1 \(January 01, 2003\)](#)

1 [Introduction](#)

Richard Buchanan, Dennis Doordan, Victor Margolin.
Introduction. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 1-3

5 [Graphic Design in the Digital Era: The Rhetoric of Hypertext](#)

Alejandro Tapia. Graphic Design in the Digital Era: The Rhetoric of Hypertext. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 5-24

25 [The London Underground Map: Imagining Modern Time and Space](#)

Janin Hadlaw. The London Underground Map: Imagining Modern Time and Space. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 25-35

36 [Products or Bodies? Streamline Design and Eugenics as Applied Biology](#)

Christina Cogdell. Products or Bodies? Streamline Design and Eugenics as Applied Biology. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 36-53

54 [The Shoe Shine Boxes of Turkey](#)

Victor Margolin. The Shoe Shine Boxes of Turkey. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 54-56

57 [Hybrid Form](#)

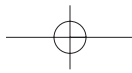
Kostas Terzidis. Hybrid Form. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 57-61

62 ["The Sun's Only Rival:" General Electric's Mazda Trademark and the Marketing of Electric Light](#)

Leigh George. "The Sun's Only Rival:" General Electric's Mazda Trademark and the Marketing of Electric Light. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 62-71

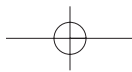
72 [The Backtalk of Self-Generated Sketches](#)

Gabriela Goldschmidt. The Backtalk of Self-Generated Sketches. *Design Issues*, Volume 19, Number 1 (January 01, 2003), pp. 72-87



Introduction

Design Issues serves as a forum for the discussion of design history, theory and criticism. No professional discipline or intellectual area of study can endure in any meaningful form without ways to consider the past and probe the future. To thrive, a forum requires lively engagement, persuasive demonstrations, and critical reflections. The vitality of this—or any other forum—thus depends upon the topics, questions, and strategies contributors and readers alike bring to it. This issue of the journal brings to the forum a rich variety of material. Two articles explore the implications of new tools and strategies: digital hypertexts and morphing. Alejandro Tapia revisits the enthusiastic claims of design commentators that digital hypertext formats represent a fundamental break with past design practices and reading habits. Tapia provides a more nuanced understanding of hypertext. The author suggests that it is both a continuation of long-established principles of design and an extension of these principles in novel ways. Tapia's argument is based, in part, on an appreciation of rhetoric. Unfortunately, in contemporary popular culture, rhetoric is often treated as a synonym for an oratorical style devoid of substance (as in the phrase, "empty" rhetoric). Tapia, however, employs rhetorical concepts according to their fundamental meaning and demonstrates how an understanding of rhetoric can inform design strategies. Kostas Terzidis characterizes morphing as "the interconnection between seemingly disparate entities" and describes ways in which the hybrid nature of morphing challenges basic concepts of form-making and long-held assumptions about the role and identity of the designer. A trio of articles in this issue draw upon design history to investigate the relationship between design and modernity. Janin Hadlaw examines a classic of modern information design—Harry Beck's map for the London Underground—to reveal the way successful designs articulate assumptions about the nature of time and space in the modern era. Christina Cogdell's discussion of the relationship between streamlining and eugenics during the 1930s reminds us that the cultural fabric of any period is composed of a complex interweaving of multiple threads. The author poses the question: what points of reference do designers turn to at different moments in history not just for particular solutions to specific problems but for a general orientation—an understanding of what is necessary, what is possible, and a sense of purpose? Leigh George's case study of General Electric's marketing strategy for electric light in the early twentieth century draws upon histories of advertising, technology, and design





to unravel this fascinating story of early corporate branding. George's essay is significant both for its portrayal of the emergence of "a new professional class of imagemakers" and its description of the crafting of a "complex visual language to naturalize GE lighting technology." Two articles included here remind us that design is a pervasive and fundamental human activity. Gabriela Goldschmidt's article on sketching weaves together insights gained from research on the development of drawing skills in children with observations about the role of drawing for designers. Victor Margolin's short visual essay on shoe shine boxes in Turkey demonstrates that the genesis of design resides in the human spirit and the need for self-expression even more than in the definitions of professional groups or academic categories.

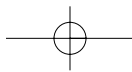
Richard Buchanan
Dennis Doordan
Victor Margolin

Augusto Morello, 1928–2002

Augusto Morello died after several months of illness on September 4, 2002, in Milan, Italy. He was one of the most thoughtful and energetic members of the international design community, a man of deep learning and humanism whose vision and leadership will be sorely missed.

Originally trained as a chemist at the University of Turin, Augusto Morello became one of Italy's most influential marketing experts, with special impact at Olivetti. However, from an early age he had a natural appreciation for design and an intuitive understanding of the close relationships among design, business, society, and culture. A practical man as well as an intellectual, the elements of his character combined and found their focus in service to the institutions and organizations that sustain design as a social profession and a cultural art.

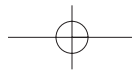
As a young man in the 1950s, he worked for the legendary Rinascente Department Store in Milan. While there, he was named the administrator of the Compasso d'Oro, the prestigious design prize that is awarded annually to Italy's best industrial products. He remained involved with the Compasso d'Oro for most of his career. He was also President of ADI (the Association of Italian Designers), and he served in a variety of other organizations that celebrated design and brought the accomplishments of designers to greater public understanding. For example, he served as President of the



design jury of INTEL, the Italian association for lighting and electro-mechanical products. The INTEL Premio Prize will now be known as the Augusto Morello Prize. At the time of his death, he was President of the Triennale di Milano, which he was energizing with plans for a series of important exhibitions. Late in his career, Morello was elected President of ICSID (the International Council of Societies of Industrial Design). He served that organization for an unprecedented two terms.

While President of ICSID, he sought to make that organization more effective in addressing regional concerns and, at the same time, led the effort to focus attention on the role of design in culture and social process. With intensity and charm, he always argued that design is an integral part of culture that gives deep meaning to life. He also recognized that design education and design research are integral parts of the advance of professional design practice, and he championed their place in new, more substantive international design congresses held by ICSID. His unfinished work with ICSID was an effort to unite that organization with the other major international design organizations for a common effort to serve all design professionals and, collectively, raise public awareness of the importance of design. This project continues with the effort of his successor at ICSID, Peter Butenschoen, and many other like-minded individuals who believe that the artificial division of the major international design organizations initiated by Misha Black at the time of ICSID's founding does not serve the long-term interests of the design community in a world of changing practice.

A man of wit and charm, Augusto Morello was better read than many humanist scholars. He could quote as easily from ancient philosophy and Italian intellectual history as from the contemporary literature of economics and marketing. He did not write frequently, but his essays in the *ICSID News* set an urbane tone and cultural agenda for the organization. The editors of *Design Issues* are proud to include him as one of our contributors. Individually, we have benefited in many ways from his friendship, advice, and mentoring, whether in Chicago, Pittsburgh, Milan, Seoul, Sydney, or elsewhere. We hope that we can continue his spirit in the debates and inquiries that are represented in the pages of the journal.



Graphic Design in the Digital Era: The Rhetoric of Hypertext

Alejandro Tapia

Translation by Helen Hodgkinson.

The graphic media have, for some time now, been constructors of the social imagination, structures of thought, and devices for discussion in public forums. Their visual nature does nothing to lessen their cultural importance. On the contrary, the image is a powerful way of bringing home a point, both logically and emotionally. As David Olson¹ has pointed out, the way information is presented in the graphic media has helped to position us in the world, at least in those cultures such as ours where the use of the symbolism of visual communication is predominantly social.

In the world of writing and the editorial media, design objects have allowed the construction of a particular type of discourse and the highly developed use of verbal and visual communication. In the conscious articulation of syntax and punctuation, in the organization of paragraphs, pauses, silences, and digressions, visual signs and their history play a considerable part. Different typefaces, grids, and graphic signs in a text are not only important for their perceptual or formal qualities, they also play a cognitive and symbolic role, and regulate our interpretation as we read. In Western tradition, this matrix has facilitated the generation of numerous devices from books to encyclopedias, magazines, and journals. More recently, with the development of design, the regulation of graphic-linguistic reading can be seen on television screens, in corporate images, and on posters.

The technology of reading in our culture is quite sophisticated, as it has been built up over centuries of tradition. Nonetheless, the contemporary era has provided it with new devices and the advent of electronic microsystems has brought the most recent of technological transformations in graphic discourse: the digital revolution. Impetus has been given by the constant search for the expansion of textual and graphic code, the production of knowledge, the storing and exchange of information, and the expansive development of the global marketplace and of telecommunications to a technological synthesis. The set of mechanisms for graphic expression developed to date can be administered in the unique medium of the computer screen; the digital media has become foremost among production processes, allowing for a greater and faster flow of information.

1 David Olson, *The World on Paper* (Cambridge: Cambridge University Press, 1994).





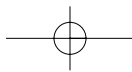
The digital revolution rests on the capacity of electronic bits to encode the information making up an image, a text, or a sound, using a simple binary principle. This makes it possible to manipulate, fragment, and connect these images, texts, or sounds. As in the process of perception, the printing of information in analogical formats is continuous rather than in a collection of dots. Digital transcription, on the other hand, is discontinuous, the data being processed via numerical code. This makes formats, typefaces, grids, colors, and textures easy to process and store, fragment, or partialize, and any of their structural vectors can easily be joined with any other. The transformation of analogical into digital data has given rise to a new logic in the production of symbols and signs, and new rules and networks for cultural exchange and communication. According to G. Bettetini, this new technological device has changed the “scene” because, when analogical data is transformed into digital data, “similar variations of different magnitudes are substituted by numerical equivalents allowing, on the one hand, the transmission of many more signals on the same wavelength and, on the other, the possibility of transmitting on the same channel signals which are not in themselves homogenous, but which can be made similar and reciprocally compatible by reduction into numerical entities.”²

The other characteristic of this digitalization of information is its electronic nature, which makes the data processed both more virtual and nonmaterial and also more ephemeral. This is substantially different than analogical predecessors. Information contained in this way is more easily transferable, reproducible, and modifiable; it takes up very little room and weighs nothing, so transmission is practically immediate. It also frees discursive production from the physical and material volume by which it was bound.

This evolution of devices or supports towards the electronic screen, the consequences of which have without doubt been surprising, has led to numerous new possibilities for the exchange of information, and for the rules underlying its production and diffusion. Images can be transported; sounds can be modulated and mixed at a distance. On a digital soundtrack, for example, a tone of voice easily can be modified or mixed with another. A photograph can be altered by manipulation of its pixels, and its traditional referral procedure can be substituted by electronic randomness. The presence of artifice in the creation of textual or visual discourse, which, under previous design genres always had been implicit, has now become evident. More than ever, there is a new awareness of the mutability of systems that had seemed firm and permanent.

Digital production and the possibilities created for global interconnection and simultaneous discourse on-line thus has raised a series of new questions on the nature of reading and interpretation, and of communication and the very “status” of signs. Its expansion also has created new problems. In the first place, an elec-

2 Gianfranco Bettetini and Fausto Colombo, *Las nuevas Tecnologías de la Comunicación* (Barcelona: Buenos Aires, 1995), 15–16.





tronic surface, like any other kind of surface, manifestly conditioned the approach to information on the part of the reader. Readers could vary the way they looked at the information; they could change the context of the information: they could move agilely from one genre to another and make immediate connections between processes with different symbols or between systems of information from different latitudes or languages. This led to the unprecedented possibility that the universe of global information could be brought up to date via the computer screen, giving a new form of hyperencyclopedia existing virtually in cyberspace, and granting simultaneous sensations of infinity and volatility to the reading process.

Enthusiasm for the agility of these processes gave rise to new theories of reading that even questioned the viability of the old concepts. There also was an excessive appreciation of computers. It was thought that units of significance had been broken, that a new and surprising multi-relational mechanism of information was appearing to substitute and completely eliminate the old systems, such as books, which were now said to be passé or retrograde. This inordinate valuation of the technological and of digital culture led some to believe the computer was the solution to every problem, and that technology would even bring about a new kind of man and a new system of thought.

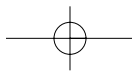
This can be seen in the enthusiasm for the first theories on hypertext, which rushed to proclaim that the multicursivity of reading and the reader's power to "freely" navigate between different parts at the same time was something resulting only from the digital device and previously unknown. In classic theories of hypertext, such as Bolter's³ or Nielsen's,⁴ it also was said that the novel possibility of thinking in complex and multiple structures, with different ways of approaching the text available to the reader, with nonlinear processes which were better than the old "surpassed" linear systems, and with textual systems than have no beginning, middle or end, was quite unheard of, and that one now must think in terms of interconnectivity and multiorder rather than consecutiveness and hierarchies. George Landow, for example, said that "present-day conceptual systems based on such notions as center, margin, hierarchy, and linearity should be left behind and substituted by others such as multilinearity, nodes, links, or networks."⁵

But without denying the impact of electronic devices on the culture of communication, how far can the thesis of the absolute revolutionary power of the computer and nonlinear reading systems be taken? According to the new digital discourse, the operation of reading was now supposed to imply a new syntax based on change and multi-order. Semantic procedures now were not only for shaping referents, but also cross mechanisms, manifestly showing the interdependence of concepts. In pragmatic terms, a set of inferences, based on the assumption that the reader no longer had physical pages which progressed but rather a screen on which various

3 Jay David Bolter, *Writing Space, The Computer, Hypertext and The History of Writing* (Mahwah, NJ: Lawrence Erlbaum Associates, 1991).

4 Jakob Nielsen, *Hypertext & Multimedia* (Boston: Academic Press, 1990).

5 George P. Landow, *Hypertext: The Convergence of Contemporary Critical Theory and Technology* (Baltimore: Johns Hopkins University Press, 1992), 2.





systems of information were being updated, established a new pattern for reading and for the way information is presented. With hypertext, the habit of multicursivity in reading becomes patent.

The fact that these mechanisms are so present in this digital era should not blind us. It must be said that neither the artifice of hypertextuality is completely new, or necessarily associated with computers, nor have the old rules of the communication game and of thought organized by language really been reversed. Instead, they have been ratified and given new potential within the same framework. The most pertinent analyses of the topic therefore appear to postulate the need to understand the reorganization of reading mechanisms and their possibilities, without creating a new dichotomy between past and present, and between the linear and nonlinear. Walter Ong, for example, has pointed out that the revolution of the digital era is the continuation of a tradition begun many centuries ago, in which the organization of signs used in social life into words, not only written but also spoken, and images, had become devices for the mobilization of ideas.⁶ Espen Aarseth also stresses the fact that a definition of hypertext cannot be established on the basis of the support, but rather on that of the interrelation between text and user (That is, in the pragmatic situation). In this respect, it could be said that the notion of hypertext goes back as far as such ancient books as the *I Ching*.⁷

Actually the hypertext experience and nonlinear reading is nothing new. The linear organization of texts was conditioned by the support, but this in itself is pragmatic. Printed or handwritten texts have always managed to build hypertextual nodes when they have been necessary. For instance, the illustrations in medieval manuscripts expanded referential and interpretative relationships, and the *exegeses*—the notes explaining or interpreting the *diegesis*, or text—became extensive. The connecting thread of a discourse and its fragmentation, or the consciousness of being able to fragment it so as to produce multiple routes through the text, already had, for a long time, been present in the consciousness of writing. The book shown in figure 1, from a German library, is a chronicle of world history written about 1595, in which there can be multiple reading routes because, although historical facts may be chronologically linear, their importance for thought is not because time is not linear for consciousness.

The mechanisms of hypertextual organization, with leaps not only within the order of a discourse but also from one discourse to another, also have been developed in almanacs, encyclopedias, and newspapers. This experience of nonlinear reading already existed, and its presentation on computers obeys pragmatic conditions relating to the reader—the very same reason why the above-mentioned genres came to be organized in that way. Even in books, the *exegeses* or explanations of the text have been normalized within the structure of the page into what we know as footnotes, to

6 Walter Ong, *Orality and Literacy: The Technologizing of the Word* (London and New York: Routledge, 1993).

7 Espen Aarseth, *Cybertext, Perspectives on Ergodic Literature* (Baltimore: Johns Hopkins University Press, 1997).

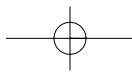




Figure 1
A Chronicle of World History,
 written on strips of paper which cover events
 from the Creation up to 1595.⁸
 © Copyright 1993 by Dorling Kindersley and
 the British Library Board.

8 Karen Brookfield, *La Escritura* (Madrid and Buenos Aires Biblioteca Visual, 1994), 29.

9 Bruno de Vecchi, *El Hipertexto y su Lenguaje. Afternoon de Michael Joyce y Rayuela de Julio Cortázar, un Estudio Comparativo*, Master's Degree Thesis, (Mexico City: Universidad Iberoamericana, 1998), 143.

10 de Vecchi, *El Hipertexto y su Lenguaje. Afternoon de Michael Joyce y Rayuela de Julio Cortázar, un Estudio Comparativo*, 148.

which the text refers. This operation now can be done on the screen, so that a node can not only refer to a source but actually put us directly in touch with said source—the computer on its screen does what was indicated as a necessity in the book.

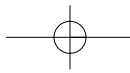
In a study of hypertext comparing the work *Rayuela* by Julio Cortázar with an electronic novel *Afternoon* by Michael Joyce, B. de Vecchi shows that both “codex and computers are capable of adequately managing linked nonlinear structures.”⁹ In terms of writing, therefore, the nonlinear allows for one kind of experience, an experience which already existed before the computer, but this does not take the place of linear writing or cancel it out. “Both forms can continue to coexist since, although there are those who argue that multimedia and interactivity alone will survive into the future, the writer believes that pure text also will have a place while there are still those who have something to say in this form”¹⁰ and that the possibilities of nonlinear literary writing have yet to be explored.

The linear or nonlinear character therefore is not definitive under these circumstances; it is only a pragmatic determinant of the way in which a text can be approached, one which defines certain specific rules of syntax. But this is not all that determines the reading experience; there also is its semantic character, where its link

with opinions and thoughts also are displayed. This distinction has to be made because this is how signs, words, or images lead to cross-references and relationships, point to universities and encyclopedias which are available on-line (as can be seen in the case of metaphors) and within one text, even a linear one, these can be developed, so linear or nonlinear organization becomes simply a circumstance of format. In fact, linear writing cannot be confused with linear thought (if we hold this to be a viable metaphor, which often is the case in postmodernist thinking, and if we believe that just because a text is nonlinear this is something cognitively new, all of which is open to doubt). Actually, the structure of thought can be shown by establishing the relationships between things. Complex thought, with multiple cross connections, can be expressed in both structures, since the circumstances of format and the order in which it is set out must be adapted to conditions of expression and, more specifically to the needs of speech. Thus, and this is decisive for contemporary design theory, the mere fact that the format of a text is nonlinear, or that it is a digital hypertext, does not imply that it is based on open or complex thinking. Judging by many existing electronic pages, the use of multimedia or nonlinear devices sometimes only serves to present highly conservative thought processes or mechanisms for different readings and associations that are really quite insignificant. This is the case of some encyclopedias, where the addition of sound or movement to certain definitions does little to improve the understanding of the concept and even less to overcome the cognitive "limitations" of the older methods. The capacity for storing data in a compact, portable device is certainly decisive, but the layout of the parts and the semantic links of the signs would require setting up special rhetorical conditions in order to use the possibilities of discourse to their full potential.

Some texts in linear format may contain complex thinking; the signs within a text may be, in themselves, the result of the mobilization of different places and encyclopedias. An example of this can be found in the work of the Brazilian writer João Guimarães Rosa. Here every paragraph, every structure, every word, even every sound, is the result of a complex mechanism of association between different cultures, different literary traditions, and different languages (the author studied more than fifteen in order to construct his work, and also used other dead languages). Rosa used these associations to set the voice of the narrator "in a world whose center was a piece of writing such as the *Popol Vuh*, with referents that were inaccessible to the Western reader,"¹¹ and even to point out the impossibility of the reader's ever being able to access such a totally distinct vision of the world. Valkiria Wey, who translated this work, found that, in order to do so, she had to undertake extremely complex research into ancient forms of thought and expression. Thus, although one reads Rosa linearly, the semantic-syntactic experience requires one to follow a variety of planes, demonstrating that

11 Valkiria Wey, "Prólogo" João Guimarães a Rosa, *Campo General y Otros Relatos* (México City: Fondo de Cultura Económica, 2001), 15.

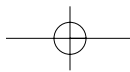


the cross-connection of concepts and structures, established in theoretical discourse on the nonlinear, also is present in texts of this kind. This shows that there can be multi-cursivity without the computer screen, and that it would be better to say that the computer screen makes this type of experience metaphoric.¹²

Such mechanisms were identified by the theorists known today as the first postmodernists and deconstructionists. Studying writing as something that had been organized linearly and with the idea of challenging the apparent causal mechanism sustaining it, they proposed that a text really could be seen as a framework that holds various fragments and paths, and that the notion of nodes and connections was more appropriate to describe the experience of reading (in which case, an imposed order would be a form of control and power). Michel Foucault, in *The Order of Discourse*, had shown that the organic hierarchical organization of thought imposed by books was a way of translating the order of social hierarchies into actions (such as that of teaching and access to knowledge).¹³ This is fundamentally true, and it explains the rise of rhetoric. But once one is aware of the random nature of the order within the framework, then it becomes possible to move the places involved. Other authors such as Roland Barthes¹⁴ Gilles Deleuze and Félix Guattari,¹⁵ or Jacques Derrida,¹⁶ began to talk of the text as no longer being a line but a network. There should be no imposition of hierarchical organization of the parts in sequence from a beginning to an end; the text and the signs should be seen as products of other sequences, other books, or other discourses. These new theories pointed the way to what would later be achievable by “browsing” on the computer. In *The Archeology of Knowledge*, for example, Foucault said that “the frontiers of a book never are clearly defined despite its apparent linear flow, since it lies within a reference system of other books, other texts, and other phrases; it is a node in a network.”¹⁷ And Barthes, talking about literature in *S/Z*, points out that “the unique text is not the (inductive) point of access to a model, but rather one entrance to a network with a thousand entrances. To take this entrance is to spy in the distance, not a legal structure with norms and deviations, a narrative, or poetic law, but rather a perspective (of fragments, of voices coming from other texts, from other codes).”¹⁸

The deconstructivist image of reading revealed that, in spite of its apparent linearity, fragments of text (Barthes’s *Lexias*) are crossed by other lines, and so even within linear discourse one connects to a network. These ideas would be put into practice on the computer screen, and not simply interpreted in hypertext. What can again be seen as important is the nature of the places, topics, and units of opinion as the only way of approaching the nature of the route through the discourse, because they actually do establish a network. Deconstructivist theory was based on the idea of “scattering the text rather than gathering it.”¹⁹ Thus, Deleuze and De

- 12 Rosa sets out a multiplicity of layers behind each word and each syntactic structure. This can be fully appreciated in his novel *Grande Sertão: Veredas* or in his collection of short stories *Primeras Estórias*. Some of his narratives even include images created by the author himself, which add other levels of meaning. Thus, structures of ancient myths, medieval romances, archaic language, Latin constructions, and word neologisms are superimposed in a single synthesis. Some authors suggest that his narrative forms could be analyzed as if they were palimpsests, surfaces used more than once, and this form might also throw light on the hypertextual experience. For a study of these works, see Mary Lou Daniel, *Guimarães Rosa: Travesia Literaria* (Rio de Janeiro: José Olympo, 1968).
- 13 Michel Foucault, *El Orden del Discurso* (Barcelona: Tusquets, 1987), 18. This work has been published in English in “A Discourse on Language,” *Archeology of Knowledge* (New York: Pantheon Books, 1972).
- 14 Roland Barthes, *S/Z* (New York: Hill and Wang, 1974).
- 15 Gilles Deleuze and Félix Guattari, *Rizoma* (México City: Premiá, 1983).
- 16 Jacques Derrida, *Of Grammatology* (Baltimore: Johns Hopkins University Press, 1997).
- 17 Cited in de Vecchi, *El Hipertexto y su Lenguaje. Afternoon de Michael Joyce y Rayuela de Julio Cortázar, un Estudio Comparativo*, 39.
- 18 *Ibid.*, 18.
- 19 Roland Barthes, *S/Z*, 19.





Gutari's *Rizoma*, or Derrida's *Gramatología*, and even Eco's *Open Work*,²⁰ broached the idea of open reading, of polysemia, of a galaxy of significance instead of hierarchical and stable sequences. This idea, which was based on a reinterpretation of rhetoric (the proposal that unique truths do not exist only places arranged within different argumentative structures), became extreme when it not only questioned the idea of a text having a fixed meaning, but even suggested that language was autonomous with respect to the intentions of the speaker and that, as Derrida said, "given that it does not refer to anything, it does not mean anything."²¹

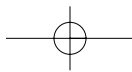
Thus, the Derridian deconstructivist idea suggested not only that a text had several levels, or that there were many different readings of it possible, but that it was not a clear way of communicating anything, that each path through it was individual, and that its meaning was a kind of infinite drifting. Not only would such an extreme imply, as it has been said before, the non-observation of the devices established by places in the way opinion was made up (which grant social power to discourse) or of the dialectic nature (which cannot be reduced to the linear/nonlinear dichotomy) of, for example, metaphors it also would generate an absolute irrationality that would do little to improve the situation which gave rise to this criticism of purely logical or rational discourse. Extreme deconstructivist theses seem—as Alejandro Adán says—to be a return to Pirronism, the extreme form of skepticism dating back to the ancient Greeks.²² The rise of hypertexts, however, led to discourse of this kind within design theory, and seemed to be taking over all discussion during the eighties and at the beginning of the nineties.

The deconstructivists' stance and their thesis on opening up and interconnection within the reading process have led to the new approaches in today's media. Their capacity to show that topics and arguments are changing and can be reorganized, and the idea that inter-textuality is a dynamic process which is always there, has given rise to an image which is characteristic of what happens on the digital information network. Nevertheless, the deconstructivist discourse, which was very highly thought of during the early digital explosion, became excessive, generating a purely symbolic image that tried to bring about a break with the past by affirming total irrationality. For the deconstructivists, writing is said to be drifting, a kind of apparently erudite concatenation of (not always well-founded) ideas: this idea tried to set itself up as the new model. The dichotomies between linear/nonlinear, chaos/order, construction/deconstruction, seemed to set innovative parameters for interpreting the new circumstances. But very quickly, numerous fallacies arising from this new fashion also became evident. For example, a case known as "The Sokal Affaire" showed up the crisis of post-modern discourse. This conflict took its name from an article entitled "Transgressing the Boundaries: Toward a Transformational Hermeneutics of Quantum Gravity" which was sent to the journal

20 Umberto Eco, *The Open Work* (Cambridge, MA: Harvard University Press, 1989).

21 Bruno de Vecchi, *El Hipertexto y su Lenguaje. Afternoon de Michael Joyce y Rayuela de Julio Cortázar, un Estudio Comparativo*, 41.

22 The relationship of the deconstructivist model with ancient Pirronism, which was one branch of the philosophical skepticism of the ancient Greeks, has been suggested by Alejandro Adán in "Una Lectura en los Márgenes de Derrida. Escepticismo y Deconstrucción," *Egipán de Vidrio, Revista de Filosofía* 1 (Spring 2000) On-line text at www.artea.com.ar/egipan/9.htm



Social Text in 1995 by a physics professor at New York University, Alan Sokal. The text was written in postmodernist style and contained numerous quotations from Derrida, Deleuze, Kristeva, Lacan, Lyotard, etc. *Social Text* published it a year later, and it was praised by the intellectual community. But then, in a subsequent article, Sokal himself said the text was a parody intentionally constructed so as to expose certain fraudulent facets of the literature of the day in cultural studies.²³ This whole business showed up the mythicizing of the deconstructionist discourse, exposing the large dose of charlatanism involved in postmodern literature. Later, in *Fashionable Nonsense*, Sokal went on to analyze the case and to reveal that many postmodern authors use scientific concepts in an inadmissible way, such as “(1) holding forth at length on scientific theories about which one has, at best, an extremely hazy idea; (2) importing concepts from the natural sciences into the humanities or social sciences, without giving the slightest conceptual or empirical justification...; (3) displaying a superficial erudition by shamelessly throwing around technical terms in a context where they are completely irrelevant...; and (4) manipulating phrases and sentences that are in fact meaningless....”²⁴

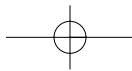
Nonlinear reading processes and digital information systems thus brought out numerous theoretical paradoxes and contradictions so, in order to understand the nature of design in the digital media, we should start off from more careful foundations. For example, it could be said that:

- 1 Because of their semantic mechanisms, both texts and hypertexts present both unidirectional and multidirectional possibilities;
- 2 The organization of parts, in the case of the book, obeys the need to fit thought into the order available in that format (the needs of the *dispositio*—arrangement of ideas—and *elocutio*—expression of ideas—in that pragmatic situation), whereas in hypertexts the same need (semantics and order) obeys its own situation with respect to the reader (who, when faced with a computer screen which provides for alternation must decide on a significant order);
- 3 Nonlinearity is not exclusive to computers, being a very old resource; and,
- 4 Nonlinearity does not necessarily imply open thought processes.

The new technological tools for reading are really meta-media, and they have not, as this apotheosis of tools would have us believe, in themselves revolutionized thought. The problem still lies in terms of cognitive processes and in the way pragmatic inferences are displayed, that is to say in the rhetoric of the discursive proposal. The novelty then is in the speed of information, in its profuse availability, in the possibilities offered by tools which allow one to generate, mix, and interconnect different textual material, icons, and

23 Edison Otero, “El ‘Affaire’ Sokal, el Ataque Posmodernista a la Ciencia y la Impostura Intelectual”, in *Estudios Sociales*, Chile, No. 100, 2nd Quarterly, 1999. This reference was taken from the on-line version of the text at www.physics.nyu.edu/faculty/sokal/otero.html.

24 Alan Sokal and Jean Bricmont, *Fashionable Nonsense*, taken from the on-line version of the text at www.nytimes.com/books/first/s/sokal-nonsense.html.²⁵ Espen Aarseth, *Cybertext, Perspectives on Ergodic Literature*, 8



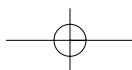
sounds, and in their capacity to produce new metaphors relating to experiences that were not possible with books.

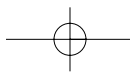
The position of authors such as Espen Aarseth and Richard Lanham, for whom the network or labyrinth does not imply a break from previous media, but rather a diversification, therefore is appropriate. Aarseth, for example, sees the division between the linear and the nonlinear in this limited sense, because he suggests that the book opened the way for nonlinear texts (which no one denies). He further proposes “going back to the double meaning (unidirectional and multidirectional) of the word labyrinth, so as to be able to analyze the very different literary labyrinths, and to analyze unidirectional and multidirectional texts using the same theoretical framework.”²⁵ Arguments and the way they are organized are adapted to fit the circumstances. The linearity of oral discourse does not arise from a reductionism of thought, but because of the nature of the human body and voice. In books the factors of printing and format have encouraged the organization in parts so as to favor its adaptation to the readers (who, in addition to those ideas made explicit in the book by quotations and references, also interconnect other ideas themselves on the basis of the text). Linear discourse takes on this form because delivery is over time, and not because the thought is narrow or one-dimensional. In the case of hypertext and multimedia, it is the diversity of paths and codes that, with their own organization, produce their own adaptive circumstances, assembled in the system of links into the configuration of an organic whole. Nevertheless, in all cases, the main point is to produce an argument for the reader.

The analysis of contents cannot then be substituted by a mere description of the functioning of the format or the technology. Nor can the instrument be made more than it is. The medium does not make the message; it is only one of its dimensions. On the same lines, Lanham maintains that humanities and rhetorical systems can be what give coherence to the image of dispersion generated by information networks. Nonlinear hypertexts are still built up from fragments of linear text and what is now needed is a capacity for writing in multiple circumstances and across various disciplines. The teaching of rhetoric provides an indispensable basis for this capacity, because comprehension and knowledge through electronic images, words, and sounds call for a further reactivation of the processes of invention, of layout, and of eloquence appropriate to an era which is dominated by hypertext. Lanham also goes back to the over-determinism of technology, since, as this work has been arguing, “technology does not control, but rather follows, the *Zeitgeist* (the spirit of the age).”²⁶

The central aspect for understanding the new media and the role that design and writing play in them must then be the argumentative situation specific to digital communication, where its discursive mechanisms come from. Many designers now create Web

26 Richard Lanham, on-line interview on *The Electronic Word*, www.vispo.com/writings/essays/lanhama.htm





pages, so they have to assimilate interpretative rules arising out of hypertext and the possibilities of multimedia. What happens on an electronic screen and how do its rhetorical mechanisms work? Let us look at the question using the following points:

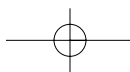
1 A Web page is established as a hypertextual browser, where there is no linear sequence, but rather a diagram of possible paths. Hypertext can be described as “a system of accessing textual data in which the data is understood to be stored in no particular sequence. The data must, of course, be stored in an orderly manner, but this order is not intended to influence the order in which it is accessed. The data is accessed sequentially, but the sequence is determined by the end-user rather than by the original author.”²⁷

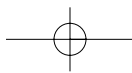
2 The system of access generates free mobility up to certain point, since the order of the parts and their contents are prearranged by the author. In this sense, the layout of the parts offers an outline of possibilities, and the nature of this outline constitutes an argumentative element, because it represents the way in which a topic can be approached, or how it is intended to be thought about or experienced.

3 Hypertexts are presented as a matrix of possible accesses, but their parts are developed, in turn, using linear texts and possible interactions with fixed or moving images or sounds. Traditional editorial features of reading are not suppressed, but rather take on greater force: typographies and the metaphorical value granted to the order of thought are maintained as decisive instruments of discursive organization. The same applies to grids, columns, and headings: the architectonic metaphor and the idea that the underlying organization of a page symbolizes the order on which its reasoning is based (as happens in classical canon) is redeveloped. Web pages are presented according to the metaphor of the portal; the beginning of the journey (the starting point) is thought of and “iconized” as “home.” This layout is set within a frame, the classic format of Western culture. The layout of browsable spaces thus is configured as an inhabitable space with various possibilities in terms of size and content. Each page refers to a certain environment, and navigation through this virtual territory is like a trip through an architectonic space. Not only are the metaphors traditional to the organization of texts not suppressed, they are even highlighted, their possibilities being greater.

4 In order to navigate within the text, readers make a series of inferences. These inferences are based on the established rules of the screen. In the first place, they know that the content of each electronic page is presented within a wider context, and that it can vary with the choice of different links, which can be identified by words

27 B. Ingraham, T.Chanier, et al, “Language Training for Various Purposes in Several Languages on a Common Hypermedia Framework” *Computer and Education* 23:1/2, (1994): 107–115. On-line at www.jime.open.ac.uk/00/ingraham/ingraham-07.html.

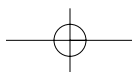




whose color changes or by sensitized icons. The assumption is made that each of these choices can lead one to another “window” (a metaphor which also uses the iso-morphism between houses as architecture and the screen as a system for navigation). The comprehension of the text depends both on the routes offered and on the assumptions made by each page as to the behavior of the reader, who is accustomed to making these choices. The Web page does not contradict the codex format; it reorganizes it in terms of the electronic presentation. The order of a book (beginning, chapters, and end) is restructured in terms of a new pragmatic situation, but the portals or windows are still thought of as “pages,” and they share many of their traditional aspects.

5 The hermeneutic experience of navigation is driven, in the same way as with other formats, by the search for significance. Any link or any window, one infers, will have something to contribute. The dimensions in which the electronic page moves, the nonlinear structure of its parts, the interactivity, and the multimedia are only pertinent insofar as their existence contributes to cognitive production. If the pragmatic or thematic context offers information that can be assumed implicitly, then the explicit must be significant. This, besides being a rule for reading which is pertinent for languages in general (for example, in the cinema this idea allows one to pare down narrative systems which are set up on the basis of moving images and alternating planes), is something which highlights the problems of redundancy. All reading depends on the continuance of elements of redundancy (we get used to the characteristics of navigation, and to the logic of links, just as we recognize the guidelines that define a topic). At the same time, the readers’ interaction with the statements is determined by the contribution that different parts of the page allow them to discover. If, for example, we find an “entry” in a traditional encyclopedia with a satisfactory definition, on the Web page this definition might be accompanied by a moving image or a sound. But if this additional material does nothing to enrich the comprehension of the term, and is redundant for such comprehension, then the rhetoric specific to hypertexts has not really been understood or assumed. Many Web pages are developed with the idea of traditional reading in mind, without understanding of the inferential rules specific to hypertext. The prerogatives of significance, and even more of clarity, define one of the rhetorical principles for the production of hypertext (that with the incorporation of movement and sound the rules of oral rhetoric are needed more than those of the written word).

6 The hypertext format then, like other languages, sets its rules of interaction by optimizing the possibilities of electronic operations with respect to the nature of thought, memory, attention, and mobility (in this sense, the rules for hypertext reading are rhetori-

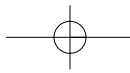


cal). As Bergson has pointed out, a person's experience develops linearly in time, but memory and mind are not linear, since they set up links between different planes.²⁸ The discursive languages and productions designed will take advantage of these circumstances in a sophisticated way. Web pages act in this way, molding themselves to the working of the mind, and even, we might say, metaphorizing its operations. For example, if the mind sets up associations and is able to analyze a concept on different planes or scales, the Web page can emulate this mobility and bring it onto the screen, establishing different dimensions. This is rather similar to what is done in film montages, only that here it is in relation to our experience with the Web page. Furthermore, the contribution of preestablished devices in other graphic genres, such as the identity image, editorial composition, and informative or argumentative images, will follow the same cognitive guidelines they have always had, and new ones also will appear. For example, one of the novelties of digital discourse is that it makes it possible to metaphorize new (non-textual) situations that have not previously been experienced in written texts. The electronic screen can, for instance, metaphorize the working of:

- a. An appointment book
- b. A book
- c. An encyclopedia
- d. A newspaper
- e. A visit to a store
- f. The experience of a reader looking for specific material in a bookstore
- g. Carrying out operations in a bank
- h. A visit to a museum
- i. A photograph album
- j. An institution's organizational chart
- k. A magazine
- l. A map
- m. A city tour
- n. Hi-fi equipment, and so on.

This implies a universe of unknown possibilities, but insofar as each of these experiences is built up as a situation which depends on a set of specific determinations, the Web page or the hypertext has to construct the metaphors in the appropriate way so as to replace said experience and extend it to its full potential. This is why it needs rhetorical organization, and why it is significant as a product of design. One good example of this is the Web site Amazon.com. This site reproduces the experience of someone visiting a bookstore. It is, in fact, (or attempts to be) better than conventional, physical book selling systems because not only does it show the covers and descriptions of books, but it also refers to other books by the same author, to comments by those who already have bought and read the text shown, and even to other books bought by its

28 Henri Bergson, *Time and Free Will: An Essay on the Immediate Data of Consciousness* (New York: Dover Publications, 2001).

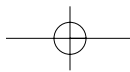


readers and other books related to the topic. A Web site designed such as this enters into the experience of the people accessing it and into the multiple determinations that lead them to look for something, improving on what they could have done physically at a bookshelf, and thus contributing to the enrichment of the experience and individualizing the organization of consumption.²⁹ The rule for setting up these experiences would be that of the progressive metaphorizing of the actions and thoughts involved in the specific situation, and the appropriate organization of this within the navigation system.

7 The electronic page, then, has a series of devices for helping navigation and for building the experience. These devices are rhetorical insofar as they come from an *Inventio* (discovery of ideas or arguments) based on places. (The notion of place becomes crucial again because, as was held by ancient rhetoric, places are starting points for discursive action and they define the orientation of the argument. In Web pages, these “places”—in the metaphorical sense of the old concept — actually become physical places once more, since they are displayed in windows.) These places also are organized using a *Dispositio*, or Arrangement (the laying out of parts is, for designers again, a facet which is explicitly considered to be decisive) and a strategy for *Elocutio* (the way the ideas are expressed), with metaphorization and clarity which undoubtedly are necessary. As Ingraham, Chanier, and Emery point out, the access strategies based on this matrix have been developed for navigation in so-called cyberspace and include “variations in font, color, size, or face to signal possible hypertextual links or various search algorithms to provide still more open linking. Similarly, a variety of menus, maps, and labeling systems has arisen to preserve one’s orientation within a particular hyper-information environment. These emerging navigational strategies and tools are analogous to the use of italics, brackets, quotation marks, and so forth referred to above. They are “extra,” or perhaps “supra,” textual rhetorical markers that can serve to advance an argument, or at least place it within the wider discourse.”³⁰

8 As to icons and punctuation and navigation systems on the page, digital reading processes have reactivated an awareness that the marks that direct reading take on visual forms in order to facilitate and contribute to the delivery of the discourse. In classical times, letters and punctuation marks were visual devices used to emulate the flow of oral discourse. Periods, inverted commas, question marks, exclamation points, commas, and spaces between words or between paragraphs were visual marks which first were used intuitively to show the advancing delivery. This has been extensively studied by Lupton and Miller under the history of punctuation. These authors support delivery rather than a grammatical

- 29 The idea of individualizing consumption as a new frontier in marketing in the contemporary age offers new aspects for the study of, and approach to, the public. These ideas can be seen in authors including Fuat Firat, who has even proposed the existence of “radical marketing” on the basis of the new tools. See *Philosophical and Radical Thought in Marketing* Fuat Firat, Richard P. Bagozzi, Nikhilesh Roy Dholakia, eds. (MA, D.C., Heath; Lexington Books, 1987).
- 30 B.ingraham, T. Chanier, et al, “Language Training for Various Purposes in Several Languages on a Common Hypermedia Framework,” 107-115. On-line at www-jime.open.ac.uk/00/ingraham/ingraham-07.html



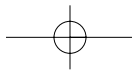
origin for such systems because “such marks are thought to have been cues for reading aloud.”³¹ We have said that this rhetorical origin has turned the visual signs into something more than just the representation of oral discourse because, over time, graphical organization began to regulate them and written language became prominent. When these patterns were standardized by printing, the marks became institutionalized and, as their visual rhetoric origin, that is to say the function that intuitively linked thought with the graphical form, was forgotten these marks came to be considered as grammatical norms. Grammar made use of them in establishing normative structures for language, but they came not from the adaptation of the morphology of words but from the adaptation of the needs of elocution to those of readers. Grammar, as rational discourse on language, imposed itself on rhetoric, but had its origin in it. With digital discourse, however, the elocutionary productivity of visual signs for the reader is reactivated and the path established by rhetoric for early punctuation is once more important for the creation of marks—this time obeying the expressive needs of navigation. This is what makes one think of a rediscovery of rhetoric as the generating process that acts upon reading devices. In the same way as rhetorical action brought about early punctuation, writers and designers in the new media “have been using punctuation marks for expressive ends.”³² Thus form, color, and the different semantic operations contributed by graphics to the organization of thought once more assume a place as instruments in the building of cognition and expression. Richard Lanham in *The Electronic Word* says that “Concomitantly with the explosion of the authoritative text, electronic writing brings a complete renegotiation of the alphabet/icon ratio upon which print-based thought is built.”³³ This was fundamentally the crucial discovery for Macintosh, the understanding that the digital universe would modify the traditional course of thought organized on standardized alphabetical signs, and that icons would reemerge as an appropriate means to a new punctuation. This phenomenon, in turn, reminds one of the role of commonplaces in the construction of discourse. On the computer, figures which are used for interaction such as a home, an envelope, a trash bin, a magnifying glass, a file, a loudspeaker, a musical note, a camera, arrows, a pencil, and a paintbrush regularly appear, and these embody the presence of places in our understanding of the discourse—they are commonplaces made graphic. If commonplaces referred one to proverbial and commonly accepted knowledge, this “proverbial wisdom, for example, becomes visual. Digital expression has resurrected the world of proverbial wisdom, but through vast databanks of icons rather than words. We buy what are, in effect, catalogs representing commonplace situations and appropriate responses to them: faces, hand gestures, and signage of all sorts. The traditional dependence on commonplaces in rhetorical education has been transmuted from word to image.”³⁴ These mecha-

31 Ellen Lupton and Abbot Miller, *Design Writing Research* (London: Phaidon Press Limited, 1996), 35.

32 Ibid., 39.

33 Richard Lanham, *The Electronic Word: Democracy, Technology, and the Arts* (Chicago and London: University of Chicago Press, 1994), 34.

34 Ibid., 37.

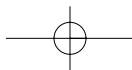


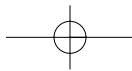
nisms, which refer to the capacity of manifesting the role of places in text, also revive the ancient figure of speech known as *ecphrasis*, which refers to the descriptive capacity of certain signs for illustrating concepts. If the object of *ecphrasis* were to update a common concept using an image, this would describe the way the new icons work. (Lanham defines *ecphrasis* as talking, dynamic pictograms.³⁵) This also goes back to the traditional opposition between alphabetic and ideographic writing, on which the canon of the book was built. This opposition must be renegotiated, taking into account the cognitive role of images.

9 With these devices, the reading experience via Web pages becomes dynamic. Their constructive foundation, however, is based on the cognitive coherence supplied by the situations that are metaphorized and by their pragmatic needs. Alphabetical writing does not disappear, but its rules change because a new kind of textual organization becomes necessary on the screen. The need for constant movement on the screen, together with the needs of the reader who can only look at an electronic text for short periods, mean that texts must now be written in terms of brief packages of information. The abbreviations within the reading process generated by icons and the constant resource of the possibility of interaction call for the permanent availability of links. In this sense, writing and icons are adapted to the ergonomic needs of the user at the screen. This makes certain experiences leading to the constant mobility of thought possible. Intelligent page design consists of finding how to develop a possibility on the basis of an understanding of the particular reading circumstances. Jakob Nielsen, in an attempt to identify the character of the rules for reading on Web sites, points to the following as examples of errors: (a) understanding web pages to be simple pamphlets rather than a new way of organizing the work of an institution within the economy of the Web; (b) designing interfaces to reflect the way in which an organization is structured, rather than reflecting the users' information needs (inconsequent design); (c) thinking that the page should be "attractive" before thinking of the way in which one must travel through the information; (d) writing in a style which is inappropriate for the Web, where users are used to looking for the essential at a glance; and (e) offering a closed view of the site, as if it were the only important one, instead of setting up links to other sites, using well-structured entry points (which is one of the expectations of reading in this format, the possibility of continually linking to other related interest centers).³⁶ These observations allow one to see the nature of actions made possible by Web page discourse. On the other hand, it is not so easy for Web pages to do what a book does with a long discourse. At one time, it was thought that electronic writing would completely substitute the codex format, just as it once was thought that cinema would displace theater or photogra-

35 Ibid., 34.

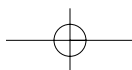
36 "Usabilidad y Desempeño de los Sitios Web," *Revista Espacios* 4:21, México, Diana Cárdenas de Ghio ed. (2001):13. This article is based on Jakob Nielsen, *Designing Web Usability* (Indianapolis: New Riders Publishing, 1999).





phy, or painting. Actually, the new media are not substitutes for earlier ones; they contribute new resources that must find their own rules. In this sense, rhetoric provides an epistemological basis just as in the other cases (precisely because it is a discipline which reflects on the possibilities of delivery in different contexts, and it can be seen that discourse is based on comprehension of the communicative situation and of the audience). The exaggerated hypothesis that, with the coming of computers, books would disappear so far is still unfounded. There has been a great increase in the number of Web pages, but the production of electronic books has been held back. Readers of discourse in these different formats (which fulfill needs which cannot be met by electronic pages, and vice versa) refer to each of the reading processes in the corresponding format. Many publishers therefore have decided to suspend publication of electronic books, because each of the media has its own possibilities and conditions, and it seems that both forms will continue to exist side by side. The Web page is not, therefore, a substitute; it generates another kind of experience, another kind of metaphor for human action.

10 The Web page as inserted on the Internet must not then be thought of in terms of Beginning—Development—End, but rather using the idea of Opening—Accesses—Closing. In this sense, the traditional notion of *Dispositio*/Arrangement is displaced by a new framework, but order still remains important. Discursive nonlinear strategies still are structured in function of persuading the audience. A balance, for instance, between mechanisms of logos, pathos, and ethos as devices that allow one to grant character to the speaker, an argumentative logic that renders the information credible, adaptation to the conditions of the exchange, and organization that rewards the emotional participation of the audience, still regulates the structuring of the parts and the linking mechanisms. Some Web pages, for example, have had recourse to a reactivation of what in the *Dispositio* (arrangement) of traditional rhetoric was known as *Exrordio*, a part destined to the introduction of the discourse to awaken the public's interest. This can be seen in the so-called "flash entries" that usually present the Web page with movements and sounds (logos or slogans build up, words are put together, and so on). But this mechanism is not used in all Web pages, and some take us straight to the information. It would seem that, if we adapt to reader's expectations that the Net should serve as an active and fast way to seek information, these entries are superfluous, unless the introduction effectively enriches the reading or the understanding of the content. The Web page demonstrates its character on the basis of the atmosphere produced and the links it allows for. This structuring can be thought of rhetorically if one is aware of the conditions it needs to fulfill. Some researchers into the rhetoric of Web pages have precisely thought of these structures according to their

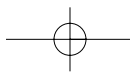


conditions of persuasion. For example, Orujo Millon points out that “writing for the Web has its own unique rhetorical devices. The use of hyperlinks, for example, affects the overall visual impression of a Web document, the bits of colored text adding credibility and suggesting further avenues of exploration, thus adding depth and authority to the document.”³⁷ Thus, an intelligent navigation system demonstrates the credibility due to the institution or person it represents, and therefore would be a decisive instrument of persuasion. With the atmosphere and the navigation system, the character of the orator is felt, and a style is adopted; the links and the interactive proposals speak of the culture supporting the discourse, as was proposed in classical rhetoric such as Cicero’s. Thus, in the art of Persuasion, Arrangement, Invention and Style were talked of as objects upon which the strategies of discourse were built, and electronic pages are organized according to these principles.

The hermeneutic experience at the computer screen which has been analyzed here shows, on the one hand the continuity of the discursive principles which were set out from classical days and, on the other, the extension of these principles into unknown situations within the written and graphic print tradition. One can speak of the digital revolution in the sense that new ways of reading, education, and communication have been opened, but it is also necessary to understand that these are based on a deepening of previous habits of persuasion. The reordering of these possibilities gives the *raison d’être* to design as a vehicle of reflection and production for these innovations. Nevertheless, if the traditional order of discourse was held to impose a kind of power on the basis of the hierarchical organization of thought (the idea on which the criticism about the linearity of discourse is built), it must be said that with this new nonlinear, multi-access order, the power and control have not disappeared but rather have taken on new forms. Among the precursors of postmodernism the need to transgress had been turned against linear structures, and the central theme was control arising from the hierarchization of the parts. Foucault said that “in every society the production of discourse is controlled, selected, and redistributed by a certain number of procedures whose function is to ward off power and danger, dominate random happenings, and evade their powerful and frightening materiality.”³⁸ Something similar can be said about the digital organization of information, which in its nonlinear form has expanded the realm that grants discourse its persuasive power and its capacity to generate social action, especially since its expansion globally. Many people these days consider that organizations registered on the Internet are vouched for on the new information scene, and their presentation and organization on the Web are new ways of obtaining credibility (which is why they must be seen as subjects of rhetoric). In this sense, nonlinearity is not neutral nor does it reduce the sense or desire to conquer, but rather it reinforces it by bringing a metaphor onto the screen which is, in turn,

37 Orujo Millon, “The Rhetoric of Hypertext”, (1999) on-line text: www.quaypress.com/creativecontent/rhetoric.html.

38 Michel Foucault, *El Orden del Discurso*, 29. The English version is “A Discourse on Language” in *Archeology of Knowledge* (New York: Pantheon Books, 1972).

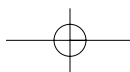


equivalent to the modern order of things and the rules of economics. Just as cities no longer have only one center but many (mainly commercial centers that, in many ways, in part or wholly reproduce the same order), electronic pages on the Web also show this multi-centrality, symbolizing in this way their adhesion to the new economic and social order. The theses which suggest irrationality or purely technocratic discourse do not allow one to see the role played by these new events, even though they exist, especially the social events present in this process. As De Vecchi points out, “the debate on the book versus the computer is not always approached from a neutral standpoint because behind it lie all kinds of interests, behind each kind of media there are several industries which have something to lose. Probably this is why discourse so often has been seen on a merely technological level, on the level of interfaces, and almost pure ergonomics.”³⁹ That is why there is so much insistence that digital media do things which cannot be done by other media. Although this is not always revolutionary, it is often used to maintain conservatism and commonplaces—even the discourse on nonlinearity has become commonplace.

However it may be, the digital era triggers numerous reflections. Initially, these are related to rhetoric and its central role in education and communication, insofar as this used to be the art that took into account the organization of discourse and established guidelines for discursiveness. Janice Walker, for example, suggests that rhetoric’s classical canon—Invention, Arrangement, Memory, Delivery, and Style—could be drawn up anew according to the changed circumstances. Invention must be related with commonplaces because, in classical times, a common reserve of knowledge was considered to exist from which all discourse started. This communal participation in knowledge was lost with the coming of printing and the notion of authorship, which implied the idea of property over ideas, as in copyrights: places were no longer common, each author possessed his or her own place. But with global on-line writing, says Walker, “we are, perhaps, returning to a communal view of Invention as a shared ‘database’ of knowledge, in which our Western notions of plagiarism and ownership of intellectual property are called into question.... We need to reconsider both our definition of Invention and our rules of attribution as we consider how to write and teach writing in this era of global and collaborative information.”⁴⁰ On Arrangement, one must think of the new possibilities of organization offered by hypertext, and the introduction of sound and videos into the multi-ordered argumentative construction. Memory, another part of rhetoric for oral delivery (and maybe forgotten with the coming of print), in turn could be reactivated as collective memory, available on-line, since it could be built up electronically (computers reactivate the notion of memory, this time digital memory, as a decisive support for discursive participation and reading) and be located in a communal database.

39 de Vecchi, *El Hipertexto y su Lenguaje. Afternoon de Michael Joyce y Rayuela de Julio Cortázar, un Estudio Comparativo*, 145.

40 Janice Walker, “Reinventing Rhetoric: The Classical Canon in the Computer Age” (University of South Florida, 1997), on-line at www.cas.usf.edu/english/walker/papers/rhetoric.html.

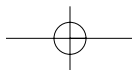


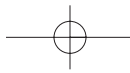


Delivery, a phenomenon in which oral rhetoric relied enormously on gesticulation and expressed emotions, also could be reactivated with the participation of emotive elements (sound and images) which animate reading. Walker says, “Nonverbal elements are a very important part of communication. When we consider Delivery in the on-line world, we also must consider the types of files we are ‘delivering’, the protocols or software that will be necessary to ‘view’ or ‘read’ the files, and how the various elements of the on-line world, such as different browsers, might affect the presentation of our masterpieces.”⁴¹ The new stylistic rules of electronic writing also must be taken into consideration, and its own norms by which its stylistic and cognitive clarity are established. In spite of the innovations and experimental procedures which are taking place through computers and their connection to the Worldwide Web, and despite the possibility of digitally manipulating information, a new canon is being drawn up, a canon that does not contradict the classical discursive sources of the Western world, but is in tune with them. And this is why R. Lanham also points out that “to explain reading and writing on computers, we need to go back to the original Western thinking about reading and writing—the rhetorical Paideia that provided the backbone of Western education for 2,000 years. Digital expression indeed fulfills the postmodern aesthetic, but also a much larger movement that comprehends and explains that aesthetic—a return to the traditional pattern of Western education through words. We are still bemused by the three hundred years of Newtonian simplification that made “rhetoric” a dirty word, but we are beginning to outgrow it. Digital expression, in such a context, becomes not a revolutionary technology but a conservative one. It attempts to reclaim, and rethink, the basic Western wisdom about words. Its perils prove to be the great but familiar perils that have always lurked in the divided, unstable, protean Western self.”⁴²

41 Janice Walker, “Reinventing Rhetoric: The Classical Canon in the Computer Age,” (University of South Florida, 1997), on-line text: www.cas.usf.edu/english/walker/papers/rhetoric.html.

42 Richard Lanham, *The Electronic Word*, 51.





The London Underground Map: Imagining Modern Time and Space

Janin Hadlaw

It is only a map after all.

Denis Wood and John Fels, 1986

***One wonders just how many errors, or worse,
how many lies,
have their roots in the modernist trio, triad, or trinity
of readability-visibility-intelligibility.***

Henri Lefebvre, 1991

I. Modern Cosmologies: Cars, Cathedrals, and Maps

In one of his short essays in *Mythologies*, Barthes equated a new Citroën with the great Gothic cathedrals. He based this equivalence not on any physical resemblance, but on similarities he perceived at the moments of their production and consumption. Barthes saw each as “the supreme creation of an era, conceived with passion by unknown artists, and consumed in image if not in usage by a whole population which appropriates them as a purely magical object.”¹ I would like to consider the London Underground Map in the context of Barthes’s list of “supreme creations,” and I would like to adopt his argument as the starting point of my observations.

Like the Citroën and the cathedral, the London Underground Map was produced in relative anonymity, the lifework of an unacknowledged, if not unknown, artist. It, too, has been consumed—“devoured” in one account—by “a whole population” both as an object-in-use as well as a way-of-imagining space.² Its magic is such that it, in turn, “consumed” the spatial relations which existed before its creation. It is the double movement of anonymity, which Barthes describes, that gives these objects their mythic qualities. Both at the moment of production and consumption, these objects seem to exist outside of human intervention. “Nobody” seems to have made them and “everybody” seems to have the use of them. They seem to have “fallen from the sky.”³

The London Underground map that I am referring to is one that appeared in 1933 originally designed in 1931 by Harry Beck. Although it was not the first, nor the last, it is indisputably the archetypal Underground map. One does not have to have been to London or traveled on the Underground to be familiar with it. It often is represented in British tourism advertisements, on souvenir T-shirts, and on postcards of London. Subway maps the world over

1 Roland Barthes, *Mythologies* translated by Annette Lavers (New York: Noonday Press, 1972), 88.

2 Design historian Ken Garland described the public as “devouring the map” in an interview about the London Underground map on a television program on the London Underground map that was part of the TV series *Design Classics*, broadcast in 1994 by the BBC.

3 Roland Barthes, *Mythologies*, 88.



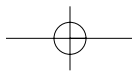


have appropriated its spare, color-coded geometry. It is acknowledged as a seminal work in both the history of graphic design and cartography. It is commonly held out by designers and cartographers as possessing a visual logic and clarity that makes it easy to interpret and comprehend. Even without having seen it or any of its many variants, it is fairly certain that anyone would be capable of making sense of it.

Despite taking Barthes as my starting point, I am not as interested in “skimming off” the messages Beck’s map might contain as I am with exploring the logic that informs it. The very certainty we have of its legibility renders transparent the fact that “reading” the Underground map relies on the possession of particular knowledges of modernity and urbanity. That is to say, the Underground riders of 1933 were able to make sense of the map not because they were versed in the shorthand of information design, but rather because both map and riders shared a common sensibility. It was comprehensible because the logic that underpinned it was coherent with their experience, as modern individuals, of a historically particular time and space. It is this idea of the map as a way-of-imagining not only geographic but, more importantly, social space and (ultimately) time that I wish to explore.

Getting at the meaning of space in maps is particularly problematic because multiple forms of space—the “real” geographic space it reproduces, the coded space of scale and topology, and the presentational space of its design—are overlaid and laminated together in a map. A map also is an object which occupies space in its own right and it is, as Marx points out, the nature of objects to obscure the conditions of their own production. Geographers Denis Wood and John Fels affirm that “there is nothing natural about a map. It is a cultural artifact, a cumulation of choices every one of which reveals a value.”⁴ From a pragmatic perspective, a map is designed to fulfill specific purposes or functions: it demarcates national or regional boundaries, guides tourists to historical sites, or assists commuters to negotiate a subway system. But it does so as a presentation of space which is removed from any real experience we are able to have of that space. It is a way of coding a reality we “know” but can never really see for ourselves. As such, maps temper our personal conceptions of the world and mediate our understanding of geographic space. A map is a device by which particular meanings can be imposed on the world: it orders priorities and naturalizes hierarchies of place. Because these factors all collaborate to act as its criteria and its discursive strategy, a map is both a practical and ideological document. In addition, each map has a tense, even though it may appear to be atemporal. It refers to a specific moment (a period, an era) in time (past, present, future) which is revealed in the information it conveys, as well as the style in which it does so. It has a physical form (size, shape, color) which is determined by prevailing conventions and economies of produc-

4 Denis Wood and John Fels, “Designs on Signs / Myth and Meaning in Maps,” *Cartographica* 23: 3 (1986): 65.





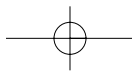
tion and distribution. And because it is conceived in the context of that particular moment, a map is a historical document as well.

Looking at this map as a practical/ideological/historical document and as a cultural artifact brings us closer to understanding it as “representation of space” in the sense that term is employed by Henri Lefebvre. Lefebvre would argue that to attempt to make sense of this map by locating it in the history of cartographic innovation or design history’s stylistic classifications would act precisely to obscure its significance. In *The Production of Space*, Lefebvre asserts that each historic moment generates its own unique type of space, a space which is peculiar to a given society, and to its forces and relations of production. In his conception, modern space is a “product” of capitalism and a social order dominated by the bourgeoisie, just as medieval space was a characteristic of feudalism and the rule of God and king. But social space does not arise as a direct, causal effect of the forces and relations of production. The production of space is a dialectical process, one that is mediated by the social imaginary, the rhythms of daily routine, and perhaps most notably, by the conceptions or representations of space that underpins social life.

For Lefebvre, a representation of space is space as it is conceptualized by “a certain type of artist with a scientific bent:” urbanists, planners, designers, and engineers. “[S]hot through with a knowledge (*savoir*)—i.e., a mixture of understanding (*connaissance*) and ideology,” they are at once “objective” (scientific and universal) and provisional.⁵ By virtue of the fact that representations of space are intellectually worked out, they possess a “representational logic” that shapes how we see, experience, and imagine social space. They also have a potent effect on social and political practice, Lefebvre states, because “producers of space” always act in accord with representation, and so produce and reproduce—via architecture but also by more abstract means such as maps, images, and texts—the spatial relations of a given moment. In the Middle Ages, manuscripts, paintings, and architecture reflected spatial relations that were organized around symbols and values. Size signified importance. It was common in paintings and drawings for human beings occupying the same visual plane to be represented in different sizes: scale in representation was a reflection of social power and influence. Lewis Mumford noted that medieval cartography, too, had no concern for factual representations of space, in fact “no interest in anything except allegorical correspondences.”⁶ The cathedral was the focal point of the medieval city much the same way that religion was central to the organization of everyday life. The spatial metaphors of rank and power, and place and meaning, were in one sense arbitrary but, like the verticality of the Gothic cathedrals, they are representations of space that are consistent with the spatial relations of the feudal period.

5 Henri Lefebvre, *The Production of Space*, translated by Donald Nicholson-Smith (Oxford and Cambridge: Blackwell, 1991), 38 and 41.

6 Lewis Mumford, *Technics and Civilization* (New York: Harbinger Books, 1963), 19.



In so much as they are bound up with forces and relations of production, and the social order they impose, representations of space are provisional and mutable: transformations of productive forces and relations give rise to new representations. Lefebvre points to the appearance of classical perspective in paintings by the artists of the Siena school, as the emergence of new representations of space that can be traced to transformations of socio-spatial practices and relations associated with the rise of merchant capitalism in thirteenth century Tuscany. The desire of the nascent Tuscan bourgeoisie to provide the urban markets they controlled with a steady supply of food and resources resulted in traditional forms of agriculture being replaced with a system of *métayage* in which the *métayers*, no longer indentured to the landholder, worked in exchange for a portion of what they produced. Lefebvre notes that changes in agricultural practice not only transformed the relations of production, but also altered the layout of the countryside as the *métayers'* houses, or *poderi*, were arranged in a circle around the landholder's villa. Avenues of cypress trees ran between the *poderi* and the villa, dividing and organizing the land, and giving it dimension and significance. The arrangement of the landscape, its echo in the layout of the piazza appearing at the same time in the towns, and the alignment of the countryside with the town as if each other's vanishing-points were, according to Lefebvre, themselves "evocative of the laws of perspective."⁷ He observes that the painters of the Siena school "'discovered' perspective and developed the theory of it because a space in perspective lay before them because such a space had already been produced."⁸

Perhaps then it is possible to consider the London Underground map as a new representation of space that, like perspectival painting, in some way captured or "discovered" within its logic of visualization a reality that already had been produced through transformations of productive forces and relations. Such an interpretation might explain how this image, which presented space in as yet unimagined ways, came to be instantly accepted and seen as not only intelligible, but eminently reasonable.

II. The London Underground Map: A Capital Idea

Beck's Underground map was conceived and created during a period that has come to be identified with monopoly capital.⁹ Described by Lenin as the "age of imperialism," it was an era marked by the explosive and erratic expansion of the economy, the final stages of colonization, the internationalization of capital, and the emergence of the world market. Rapid technological change, the transformation of processes of labor, and the ascendance of the modern corporation led to occupational redistribution within traditional industries, both altering the composition of the working class and giving rise to a new managerial class. Modern technologies had opened up a new terrain of production. Industrialization transformed both the

7 Henri Lefebvre, *The Production of Space*, 78.

8 *Ibid.*, 79.

9 Although this period also has been described as the age of finance capitalism, or the age of imperialism, my use of the term monopoly capitalism derives from its use by noted Marxist scholars such as Paul Baran and Paul Sweezy, Harry Braverman, and Fredric Jameson.

process and the product of work. The requirements of mass-production elevated efficiency, functionality, and standardization as new social values representative of the modern era. Experienced in everyday life in the repetitive tedium of factory work and the predictability of mass-produced goods, the ideals of efficiency, functionality, and standardization came to be embraced by certain groups of artists and designers, such as those of the Bauhaus in Germany, who came to see them as the means of eradicating human want and leveling social hierarchies. Increasingly, industry and commerce looked to art and design to create products that appealed to the modern consumer or to create corporate identities that embraced these modern concepts—and obscured the sometimes turbulent processes by which corporations had come into being.

The era of monopoly capitalism generally is thought to have its beginning in the last quarter of the nineteenth century and extending to World War II, roughly the same period that saw the earliest experimentation with electrified urban transportation and the eventual mergers and consolidations of local transit lines into extensive regional networks administered by corporations such as the London Transport Passenger Board (LTPB). By the late 1890s, the electrification of urban transportation came to be considered an instrument of social policy because it allowed the families of industrial workers to escape the squalid conditions of central London's crowded streets and tenements by moving to the outskirts of the city. Tramways were electrified as early as 1888, but the lack of capital investment delayed the electrification of trains. In 1901, American railroad magnate Charles Tyson Yerkes, realizing that the costs of electrification could be more than offset by profits generated by property development, offered to provide financing for the construction of three tube lines on the condition that authorization was granted to extend them beyond the city limits into the outlying country. Yerkes established the Underground Electric Railways Company of London (UERL) in 1902, raising capital for the most part from American investors. Over the next few years, he oversaw the building of the three UERL tubes lines as well as the acquisition of railway, tramway, and omnibus lines. Other entrepreneurs work similarly, building and consolidating transit lines so that, by 1913, Greater London's transit network was divided between the Metropolitan Railway, the London County Council's tramway network (LCC), and the UERL.

It was during these years, too, that the first transit maps, folders, and posters were produced. While mergers had acted to consolidate London transit by reducing the number of operating companies, the system—if it could be called that—was largely disorganized. Their finances depleted by the intensity of competition, the UERL and the other transit companies agreed in 1907 to coordinate their schedules and fares, to operate collectively under the trade name “Underground,” and to produce a comprehensive

map showing all their routes. The first map appeared in 1908 and included the routes of the Waterloo and City Line, despite their decision not to participate. Ken Garland points out that the map created an illusion of a unified system that belied the real status of London's transit system.¹⁰ While on the one hand the map of the newly "branded" Underground could be seen as nothing more than a good way to promote the common interests of the companies which underwrote its production, it also can be said that it gave form to an idea of urban transit that was imminently logical in the context of the moment's drive towards the concentration and centralization of capital.

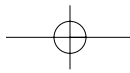
In the years following World War I, there was growing support at different levels of government for the creation of a single traffic authority for the entire London area. After some delay, the UERL, the Metropolitan Railway, and the LCC were amalgamated in 1933 as a public corporation, the London Transport Passenger Board (LTPB). The Board's first chief executive, Frank Pick, was determined to create a transit system which was "rational, scientific, and efficient" in its management, and he saw design as the means of symbolically conferring these values on the newly merged system.

It must be noted that the turn to design at this period was as often motivated by genuine utopian impulse as it was by commercial self-interest. In Britain, the belief that the reintegration of art into everyday life was the only panacea for the excesses of industrialization could be traced to the ideals expressed by William Morris and John Ruskin, and embodied in the English Arts and Crafts Movement of the late nineteenth century. Michael Saler writes that Frank Pick was, perhaps, one of the most active of "a network of prominent individuals in England" devoted to these ideals and to the commitment "to integrate modern art with modern life." He set out to make the Underground "a model of aesthetic integration, [commissioning] modern artists to fashion a unified style for the Underground, from the design of its waste bins to the architecture of its stations."¹¹

It is interesting, then, to consider the London Underground map in the context of the LTPB's creative activity, because it was *not* conceived as part of Pick's redesign of the London Transit system. It was neither the product of a corporate strategy nor the brainchild of the designers and artists hired to create promotional materials for the new Underground. As we now know, Harry Beck, a London Transport electrical engineering draftsman, had designed the map in 1931 while he was laid-off in one of the company's many economy drives. His map, with its geometric rendering of the Underground system and its stylized representation of the River Thames, was enthusiastically received by Beck's co-workers. But when he presented his unsolicited design for the Underground card folder to London Transit officials, it was summarily rejected. The London Transit publicity department felt that it was too revolutionary, and

10 Ken Garland, *Mr. Beck's Underground Map* (London: Capital Transport, 1994), 9.

11 Michael T. Saler, *The Avant-Garde in Interwar England: Medieval Modernism and the London Underground* (New York and Oxford: Oxford University Press, 1999), 3, 27.



that its abstract rendering of the transit lines would be incomprehensible to the public.

A year later, at the urging of his fellow engineers, Beck resubmitted his design to the publicity department. This time, the department heads decided to print what had come to be referred to as Beck's "diagram," distribute it without charge at centrally located stations, and solicit the public's response to its design. It made its original appearance in January of 1933, on the eve of the official inauguration of the London Transit Passenger Board. This first edition of the diagram bore the message: "A new design for an old map. We should welcome your comments. Please write to Publicity Manager, 55 Broadway, Westminster, S.W. 1": a less than ringing endorsement of Beck's work on the part of London Transport. However, the popularity of Beck's map with the riders of the Underground was overwhelming. Despite the concerns of London Transit, commuters apparently had little difficulty understanding and using it. Within two months of its initial printing, there were at least 850,000 copies of Beck's diagram in the hands of London's traveling public.¹²

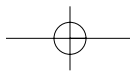
While Harry Beck is not quite as anonymous as the builders of the Gothic cathedrals, he did not receive the acknowledgment his work deserved. His fame is a contemporary and not a historical fact. Beck was given nominal payment for his design and artwork, and his name was engraved on a border of the map.¹³ In 1937, he signed over his copyright on the diagram to the London Transport Passenger Board in return for the promise that he alone "should continue to make, or edit and direct, any alterations that might have to be made to the design."¹⁴ Even this incredibly modest pledge was difficult for the Board to keep, and Beck had to vigorously defend his right to supervise and approve changes to his design to a procession of LTPB managers. In 1947, during another period of temporary employment at London Transport, Beck was offered a position at the London School of Printing and Kindred Trades. Recognizing the tentative nature of his job, he left the LPTB and joined the school's faculty.¹⁵ At about the same time at the Central School of Art and Craft, Anthony Froshaug and Herbert Spencer began using Beck's Underground map as a prototype to advance ideas which would later come to be known as information design. Beck never did receive what he most longed for: the value of his contribution to the London Underground seemed never to be fully understood or appreciated by the administrators of the LPTB. Ironically, more than any of the improvements undertaken by Pick and his successors, Beck's diagram became the most sustaining image not only of the London Underground, but of London itself. Beck was never offered a permanent position in the LPTB publicity department. He continued to work on improving and updating the map, most often on his own time and without remuneration, until his death in 1972. That year, his name disappeared from the map.

12 There is some debate as to the quantity of the diagram's first print run. Beck's account states that the initial run numbered in "the hundreds," which would seem appropriate given the publicity department's lack of confidence in the public's ability to make sense of the diagram. Historian and curator Ken Garland notes, however, that there is no record of this initial test run and that all existing documents indicate that the first print order (not, as Beck suggests, the second order) placed in January 1933 was actually for 750,000. According to Garland, this was an immense order, especially in light of the London Transit's apparent reluctance to endorse the design. It was followed up with a second order for 100,000 in February of that same year. See Garland, 18.

13 Beck often stated that he was paid five guineas for the design of the diagram, as he does in a letter to Christian Barman dated January 14, 1960. Ken Garland notes that records show that Beck was paid ten guineas for design and artwork, and that he was paid five guineas for the artwork for a station poster. See Garland, 19, 32, and 53.

14 Ibid., 32.

15 Garland writes that among the subjects Beck taught were "theory and practice of typographic design, colour theory, the history of type design, lettering and general drawing." Ibid., 42.





Wood and Fels observe that “everything conspires to [the] end of naturalizing [a] map, [...] making the decision to produce [it] seem less of a decision and more of a gesture of instinct, [...] making its cultural, its historical, its political imperatives transparent: you see through them, and there is only the map.”¹⁶ Perhaps even more than most, the London Underground map appears as a “magical object,” unencumbered by the strategic intentions of corporate or urban planners. Its creation, it can be argued, was a “gesture of instinct,” unsolicited and widely acclaimed by the public despite corporate reservations. In a strange way, the history of the conditions of production of Beck’s diagram colludes with design history in its nomination as the consummate icon of information graphics, the suddenly obvious solution to the problem of representing London’s sprawling transit system. But what goes largely unquestioned in histories of the diagram is the conception of space that underwrites it.

III. “There’s no geography down there.”

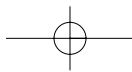
What set Beck’s map apart from the Underground maps that preceded it was that it bore no relationship whatsoever to the geography of the area it represented. The early maps collaboratively produced by London’s transit companies were “literal” representations of distance and topography. Some simplification was attempted as the system expanded and the maps became increasingly complicated to render and to read. In the mid-1920s, a version of the map was produced which eliminated topographical details and used color-coding to differentiate the lines, but it remained “grounded” in geographic space. While this version may seem to have been the precursor to Beck’s map, it was distinctly unrelated in conceptual terms.

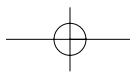
Examining Beck’s map of the Underground, it is easy to see why it was referred to a diagram. The River Thames, rendered geometric, is all that links this map to the landform it represents. Gone is the pretense of reality which cartography maintains. Colored lines fan out and interlock. The center puffs out, the margins crowd in. For Beck, the decision to “ignore geography” in the underground map was quite straightforward. He commented in an interview with Ken Garland, director of the London Transport Museum, that it simply “seemed common sense. If you’re going underground, why do you need bother about geography? It’s not so important. *Connections*,” he observed, “*are the thing.*”¹⁷

Geography can be seen as expendable only as it ceases to present formidable obstacles to the movement of people and goods. With the introduction of the bicycle, the automobile, and the railway itself, the distances of everyday life seemed to collapse. Simultaneously, the nature of time underwent a transformation, coming to be imagined as something that could be saved in the manner of an object. Contemporary German historian Karl Lamprecht noted

16 Denis Wood and John Fels, “Designs on Signs / Myth and Meaning in Maps:” 65.

17 Ken Garland recounted his conversation with Harry Beck, *Design Classics*. (Emphasis added.)





that, with a marked increase in the ownership of pocket watches at the end of the nineteenth century, people began to imagine time plotted out in short intervals: “five minute interviews, minute-long telephone conversations, and five-second exchanges on bicycles.”¹⁸ This temporal accounting was at its most profound in the workplace, where time savings translated directly into savings of money, but soon rituals of punctuality and time-thrift swept through everyday life.

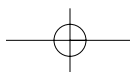
By “ignoring geography” in representation, Beck’s “common sense” perception resonated with the emergent concepts of distance and duration. Earlier Underground maps represented localities in the context of their relationships to each other and to regional features, such as bodies of water or green spaces. By deferring to geography, they also left temporal relations intact. Beck’s map reorganized geographic space, making it conform to the exigencies of the technology. Now, proximity of place was determined by *typographic* (as opposed to geographic) concerns: that is to say that the representation of the distance between stations had to do with the layout of text and graphics rather than the actual geographic relationship between places. In setting aside geographic space in favor of graphic space, Beck’s diagram also dispensed with conventional notions of time, most notably the temporal relationships between places. It set aside the notion of time and space as enduring categories, and presented them instead as highly malleable. Instead of places being linked to places, now points were linked to points (or rather to be completely accurate, “ticks” to “ticks”). While all maps are abstractions, cartographic convention makes use of various visual codes to represent the specificities of place, for example, to identify the size of a town, or to differentiate between towns and cities. Beck’s diagram did away with these spatial distinctions, maintaining only a distinction between stations (ticks) and interchanges (diamonds). Localities were essentially “standardized” for reasons of visual clarity and balance.

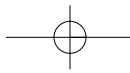
Henri Lefebvre notes that standardization is one of the most marked manifestations of spatial production under modern capitalism. He argues that, with the obliteration of local identity, (social) space is rendered abstract, it becomes “strange”: “homogeneous, rationalized, and as such constraining; yet at the same time utterly dislocated. Formal boundaries are gone between town and country, between center and periphery, between suburbs and city centers. [...] And yet everything [...] is separated, [...] the spaces themselves are specialized just as operations are in the social and technical division of labor.”¹⁹

The places illustrated in Beck’s diagram exist purely in the context of their utility within the Underground system, as stations or interchanges. In representation, their function is, as Lefebvre describes, both standardized and specialized. And like the operations in the division of labor, these spaces are profoundly interde-

18 Karl Lamprecht, *Deutsche Geschichte der jüngsten Vergangenheit und Gegenwart* (Berlin, 1912) I, 171. Cited in Stephen Kern, *The Culture of Time and Space, 1880–1918* (Cambridge: Harvard University Press, 1983), 110–1.]

19 Henri Lefebvre, *The Production of Space*, 98.





pendent, but only in the context of the operations of the Underground itself. Because the places on the various lines were no longer distinguishable from each other, the map's representational priority essentially shifted from the particularity of the *places* the Underground linked to the *idea* of the Underground as a *conduit* for the flow of trains and people, and ultimately, capital itself. Contemporary critics of the diagram insinuated that the real purpose of the reconfigured map was to deceive the commuting public into believing that the more remote stations were much closer than they really were. But (and here lies the iconic beauty of Beck's map), the fact that the map was unsolicited by the Transit Board discredits the idea that such marketing strategies were a part of the motivation for its design.

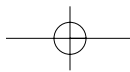
David Harvey notes that the "conquest of space" by transportation in the mid-1800s "shifted the whole sense and valuation of time for all social classes." He points to "[t]he rise of the journey to work as a phenomenon of urban living" which partitioned not only space but time as well.²⁰ The erosion of the boundaries between urban and rural spaces already was well under way with the beginnings of suburban expansion around London in the early 1900s.²¹ One might speculate that the reason Beck's map made no reference to the boundaries between town and country, and between the city and the suburb, was because these boundaries already were disappearing in the public's imagination. The urban center was engorged with importance in contemporary life as well as Beck's map. It was the hub of business, culture, and consumption. The map reproduced the relationship between the city and the localities at its periphery. It rendered these localities within the urban sphere of influence, linking them to the activities and, by association, to the concerns of the urban center. Connections, as Beck observed, were the thing.

The misrepresentation of distance in Beck's map quite accurately represents modern capitalism's notions of time. The distances between stations are arranged in more or less uniform intervals, a strategy more typically employed in the representation of time than of space. Despite the pervasiveness of the idea that "time is money," we know that, in reality, not all time is valuable. Time spent working is valuable and is scrupulously accounted for by employer and worker alike. Leisure time is valuable to those who must rest from their labors and to the leisure industry which profits from the time spent pursuing entertainment of all kinds. But time that is used for neither work nor leisure, such as time spent commuting, is really time without value. As such, not recognizing its duration in representation is completely logical.²² More important was the speed with which the Underground transported individuals to sites of production and consumption. It permitted the rapid circulation of workers and consumers, and their transformation from one into the other. Lefebvre observes that "[t]ransportation grids exemplify productive consumption [...] because they serve to move people and things

20 David Harvey, *The Urban Experience* (Baltimore: Johns Hopkins University Press, 1989), 173.

21 In a speech to the Royal Society of Arts in London on December 11, 1935, Frank Pick commented that the merging of urban and rural space had more to do with the growing popularity of the automobile than with the extension of railway lines and arterial roads. He noted that "[t]he motor car is planting villas sporadically all over the countryside without any regard for a reasonable economy in the employment of land, so that the distinction between town and country around London is almost wholly breaking down." He argued that, while the "ribbon development" along the railway lines and express coach routes extending from London was seen as the manifestation of this breakdown, these communal modes of transportation were less at fault than the automobile, which permitted far more arbitrary and disorganized expansion. Frank Pick, "The Organization of Transport," *Journal of the Royal Society of Arts*, 84 (1936): 207–219.

22 It is important to note here Beck's own relation to time without value. The diagram was conceived and created at the time Beck was "redundant," laid-off from his job at the London Transport Corporation.





through the circuits of exchange” and ultimately they also help to create them.²³ While it was the access afforded by transportation—in other words the Underground itself—which promoted the development of commercial and cultural enterprises at stations sites, the map made it possible to imagine the city as an arrangement of accessible venues laid out for the purposes of consumption: shops, theatres, museums, and sports and leisure activities all within easy access.

IV. Modern Representations and Modern Ideals

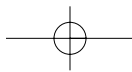
In 1994, Beck’s map of the London Underground became the subject of a television series called *Design Classics*. In the program, Gert Dumbar, professor of graphic design at the Royal College of Art in London, called Beck’s map of the London Underground “a breakthrough, [...] revolutionary.” Design historian Philip Meggs refers to it as “the prototype of the modern map.”²⁴ A copy of the map is in the masterpieces of modern design collection of the Museum of Modern Art (MOMA) in New York City. That the London Underground map can be considered at once “revolutionary” and “classic” in its conception and design, that it can be admired at the MOMA and pocketed daily by commuting Londoners, and that it can occupy these dual positions simultaneously, to look forward and look back, to enter history by rejecting history, attests to its mythic status. But it seems that Beck’s map is all this precisely because it is more. Like the Gothic cathedral, or the paintings of the Seina school, the Underground map captured the emergent spatial relations of its historical moment.

Modern representations are complicit with modern ideals, and this fact has implications for the meaning of things. Beck’s Underground map “is only a map after all”: it identifies stations by name and proximate location, and it shows transfer points. It helps people get around. But it also is an ideal image of modern time and space: orderly, lucid, regular, efficient, and entirely functional. Lefebvre writes that capitalism has “produced abstract space, which includes the ‘world of commodities,’ its ‘logic’ and its world-wide strategies”—a space that is established on flows of capital, communications, and transportation.²⁵ This might then be Beck’s real achievement: his map was so effective, and so easily comprehensible, because it acknowledged that new developments in transportation and communication rendered existing notions of time and space anachronistic. It acted to overlay everyday life with modernism’s concept of space and time as malleable and serviceable.

23 Henri Lefebvre, *The Production of Space*, 345.

24 Philip B. Meggs. *A History of Graphic Design* (New York: Van Nostrand Reinhold Company, 1992), 304–5.

25 Henri Lefebvre, *The Production of Space*, 53.



Products or Bodies? Streamline Design and Eugenics as Applied Biology

Christina Cogdell

In 1939, *Vogue* magazine invited nine well-known industrial designers—including Walter Dorwin Teague, Donald Deskey, Raymond Loewy, Henry Dreyfuss, Egmont Arens, and George Sakier, among others—to design a dress for the “Woman of the Future” as part of its special edition promoting the New York World’s Fair and its theme, “The World of Tomorrow.” While focusing primarily on her clothing and accessories, many commented as well on future woman’s physique, predicting that her body and mind would be perfected through the implementation of eugenics.

Figure 1

Donald Deskey, “Radically New Dress System for Future Women Prophecies Donald Deskey,” *Vogue* (1 Feb. 1939): 137.

Copyright © 1939 Condé Nast Publications Inc. Reprinted by permission. All rights reserved.



For example, Deskey proclaimed, “Medical Science will have made her body Perfect. She’ll never know obesity, emaciation, colds in the head, superfluous hair, or a bad complexion—thanks to a controlled diet, controlled basal metabolism. Her height will be increased, her eyelashes lengthened—with some X-hormone.” Because of her beautiful body, she would no longer need to wear underwear, he thought, and having passed through a stage of nudism, she would clothe herself in toga-like, semi-transparent draperies [figure 1].¹ Teague’s design showed that he also believed that most women would have “beautiful bodies, and the present trend toward nudity [would] continue at an accelerated pace.”² Sakier stated that “[t]he woman of the future will be tall and slim and lovely; *she will be bred to it*—for the delectation of the community and her own happiness.... Her view-point will be clear and direct. She will be free from complexes and inhibitions.”³ Balking the fashion trend, Loewy’s dress design focused less on transparency and more on efficiency. The lightweight wool suit had sleeves that zipped on and off for a quick transition between the office and the nightclub. However, this pragmatic costume also was due in part to Loewy’s vision of women’s bodies. Although films about the future succeeded in showing men and women in “various scanty and often attractive-looking attire” owing to the actors’ youth and good looks, Loewy felt that “this type of clothing doesn’t seem adapted to contemporary individuals.” However, he did not rule out the possibility that in the future, “eugenic selection may bring generations so aesthetically correct that such clothes will be in order.”⁴

These predictions about the actualization of eugenics were reiterated throughout the entire issue of the magazine in the text of numerous articles. One piece was accompanied by an illustration [figure 2] depicting chemically-controlled reproduction of scientists and policemen (note the varied ratio of brain to body size), as if taken from the opening chapter of Aldous Huxley’s *Brave New World* (1932) in which human embryos are transported on an assembly-line conveyor, receiving injections that determine their future occupations. The text of the *Vogue* article declared that, in the next century or so, reproduction would be “separated from marriage. Somewhere along about 2050 A.D. the first ectogenetic child, fertilized and grown in a glass tube in a laboratory, and then born outside the mother’s body, will be just entering school.” The author believed that “[g]enetics, by then, will be an old story. By the right combination, which almost anybody can reason out mathematically then, the world will have the kind of people the world wants. If someone wants them, it will not be difficult to produce some ‘fifty-thousand irresponsible, if gifted, mural painters.’”⁵ Earlier in the issue, a description of “To-Morrow’s Daughter” proclaimed, “To-morrow’s American Woman may be the result of formulae—the tilt of her eyes, the curve of her chin, the shade of her hair ordered like

- 1 Donald Deskey, “Radically New Dress System for Future Women Prophesies Donald Deskey,” *Vogue* (1 Feb. 1939): 137, and David A. Hanks and Jennifer Toher, *Donald Deskey: Decorative Designs and Interiors* (New York: E. P. Dutton, 1987), 74.
- 2 Walter Dorwin Teague, “Nearly Nude Evening Dress Designed by Walter Dorwin Teague,” *Vogue* (1 Feb. 1939): 143.
- 3 George Sakier, “No Mechanistic Clothes for Future Women Predicts George Sakier,” *Vogue* (1 Feb. 1939): 144. Italics added.
- 4 Raymond Loewy, “Raymond Loewy, Designer of Locomotives and Lipsticks, Creates a Future Travel Dress,” *Vogue* (1 Feb. 1939): 141.
- 5 Allene Talmey, “A World We’ll Never See,” *Vogue* (1 Feb. 1939): 90, 91, 164. Near the end of her article, she envisioned that, in 4000 A.D., “all race problems will be solved. Through genetics, natural amalgamation, and some force that no one can put his finger on, there will be one race. Man will be pale, with a coffee-coloured skin, Mongoloid eyes, and he will be only a little shorter than the average Englishman today. Woman, however, will be about six feet tall, with muscles bulging like a bag of oranges, and she will definitely be the sum of enchantment.”

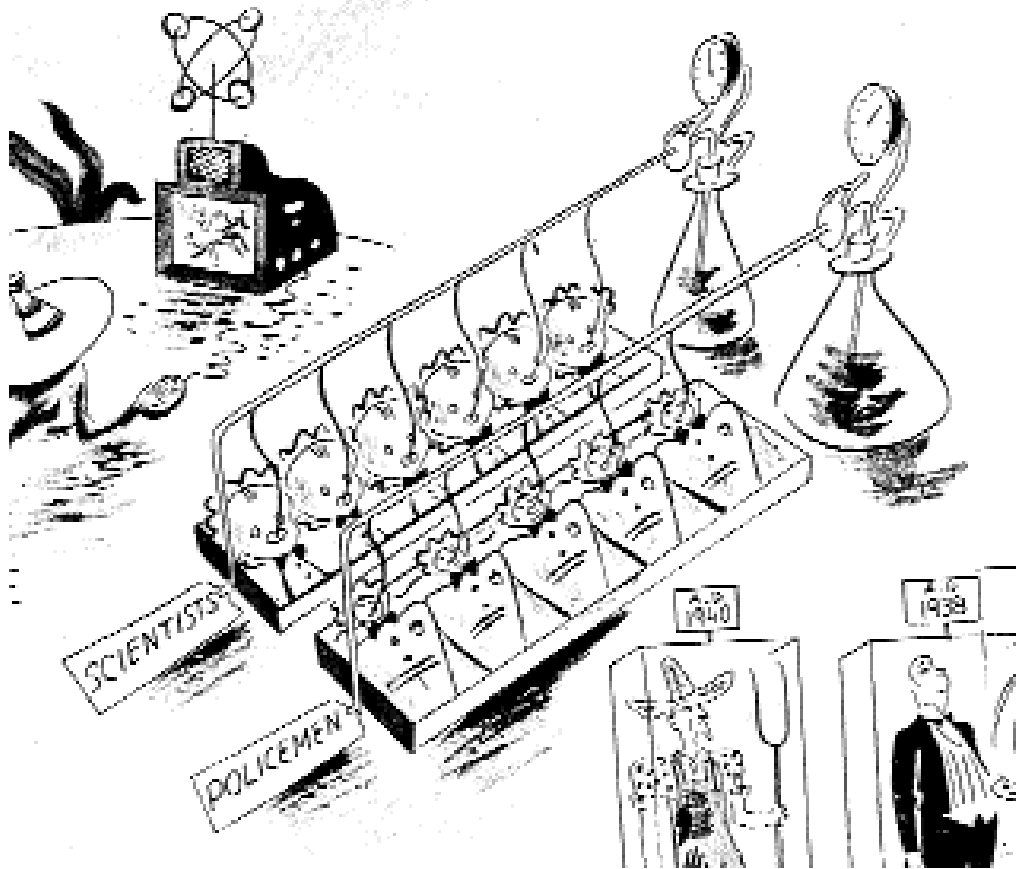


Figure 2
 Illustration accompanying Allene Talmey, "A World We'll Never See," *Vogue* (1 Feb. 1939): 90. Copyright © 1939 Condé Nast Publications Inc. Reprinted by permission. All rights reserved.

crackers from the grocer. She may be gentle, sympathetic, understanding—because of a determinable combination of genes." Furthermore, "her face will be beautiful, but that beauty will not be merely an 'assembly-line' product.... [H]er body will be a perfectly-working machine, unencumbered with pain.... [H]er mind will work clearly, unfogged; with cold logic and warm sympathy.... Tomorrow's American Woman may, indeed, be close to perfection."⁶

As these descriptions clearly reveal, ideas promoted by the eugenics movement during the 1920s retained their appeal throughout the 1930s. Although anthropological publications such as Ruth Benedict's *Patterns of Culture* (1934) were asserting that many human traits previously considered to be genetic were in fact cultural, such proclamations failed to reach readers of the 1939 issue of *Vogue*, who could ascertain from its contents that one's occupation, intelligence, beauty, and personality stemmed from one's genetic makeup.⁷ Based upon the assumption that the inheritance of such traits followed Mendel's laws, eugenicists had been striving since the 1910s through their own research and through education of the public to produce the easily stated but ever-elusive "kind of people the world wants." Because they believed that advances in medicine and sanitation were displacing the once-purifying role of natural

- 6 "To-morrow's Daughter," *Vogue* (1 Feb. 1939): 61. Three other references to eugenics in this *Vogue* issue deserve mention. An article on "Good Form in America," which plugged the use of corsets, began by stating that "[I]t is not just an accident of Nature and heredity that American women, as a group, have the most admirable figures in the world." (114) Another article praising the cleanliness of the American woman, entitled "Bathing Beauty: An American Institution," asserted that "We are born and bred in the tradition of cleanliness." (95) Another, "Clothes America Lives In," extolled her fashion sense, extending her eugenic qualities to her clothing: "These are the clothes born out of our own background, that we love, that we live in, that we do better than any one else in the world . . . which have given us our 'mass' reputation for being a race of extraordinarily well-dressed women." (101)
- 7 Ruth Benedict, *Patterns of Culture* (Boston: Houghton Mifflin Company, 1934).
- 8 Letter from Charles Davenport to Frederick Osborn, 13 Feb. 1930, folder "Frederick Osborn," Charles B. Davenport Papers, American Philosophical Society.⁹ Christina Cogdell, "The Futurama Recontextualized: Norman Bel Geddes's Eugenic 'World of Tomorrow,'" *American Quarterly* 52:2 (June 2000): 193-246.
- 10 Sheila Weiss, *Race Hygiene and National Efficiency: The Eugenics of Wilhelm Schallmayer* (Berkeley: Univ. of California Press, 1987), 53, 62.
- 11 "Population of the Empire: Falling Birthrate," and "Warning Figures," the *Times* (London), 10 Aug. 1935, folder "Newspaper Clippings - England, 1935-36," Herbert Spencer Jennings Papers, American Philosophical Society.
- 12 See article by Henry Fairfield Osborn, *Forum* (Aug. 1932), as quoted in a letter from Charles Davenport to Frederick Osborn, 29 July 1932, folder "Henry Fairfield Osborn," Charles B. Davenport Papers.
- 13 Sheila Weiss, "The Race Hygiene Movement in Germany, 1904-1945" in Mark Adams, ed., *The Wellborn Science: Eugenics in Germany, France, Brazil, and Russia* (Oxford: Oxford Univ. Press, 1990), 26, 49.

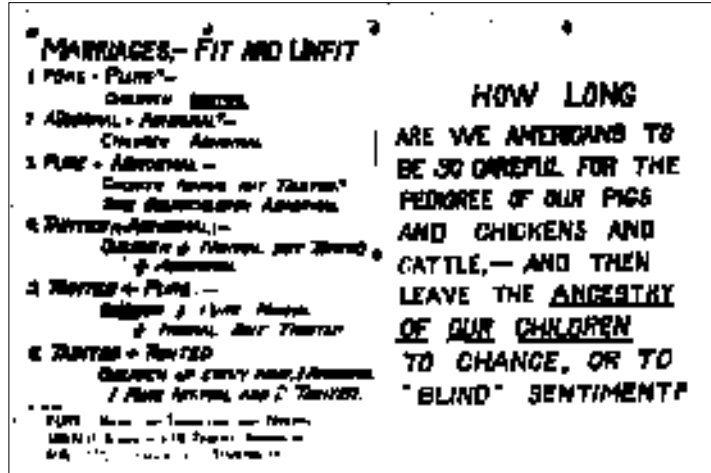
selection in the process of human evolution, thereby permitting the continuation of the "unfit," eugenicists proposed replacing natural selection with "rational selection." By carefully controlling human reproduction in favor of selected traits, eugenicists hoped to gain control of evolution itself. Charles Davenport and Frederick Osborn, two leading U.S. eugenicists, clearly stated this goal in 1930: "When we understand the processes directing contemporary evolution, we will be in a position to work actively toward the acceleration of these processes and especially to direct them in what seems to us the best way."⁸

Eugenicists' notions of directing and accelerating human evolution in many ways metaphorically paralleled industrial processes of assembly-line manufacture. These parallels posed the basis for Huxley's fictional eugenic scenario in a world that began during the year of "Our Ford," the father of the assembly line. Industrial designer Norman Geddes perhaps furthered this parallel in his staging of Huxley's opening scene through the format of the Futurama at the New York World's Fair.⁹ *Vogue* writers, too, reaffirmed this idea in their suggestions that desirable qualities might be "ordered like crackers from the grocer" (issued with the reassurance that the resulting female would be more than "an 'assembly-line' product," despite the fact that her body would be a "perfectly-working machine"). In fact, technology's processes and products offered so compelling a model of managed production and profit that many of its aspects—from its terminology to its conceptualization and applications—were applied by eugenicists to humans. Phrases referring to humans as "material" and "products" frequently recur in the eugenic literature from various countries.

For example, one German eugenicist equated a minister of public health with "an agricultural, trade, or railroad minister," because each administered "goods" of significant value.¹⁰ An article warning of racial population flux in Britain and its colonies, saved by geneticist Herbert Spencer Jennings from the *Times* (London) in 1935, lamented "the unpredictable changes in the masses of human material on which the statesman has to work."¹¹ Using an analogy of import in light of the ideals of the streamline style, Henry Fairfield Osborn, father of Frederick Osborn and director of the American Museum of Natural History in New York, characterized "defectives" as "drag nets on the ship of state" in an article in 1932 in *Forum* magazine.¹² Historian Sheila Weiss points to this underlying "technocratic logic" of eugenics, rather than to its racism, as the most ethically perverse and damaging aspect of the movement. Once people of any sort were reduced to the status of less valuable products of a nation or considered as human "wreckage," their inutility logically demanded their disposal in the interest of efficiency, continued evolutionary progress, and enhanced national strength.¹³

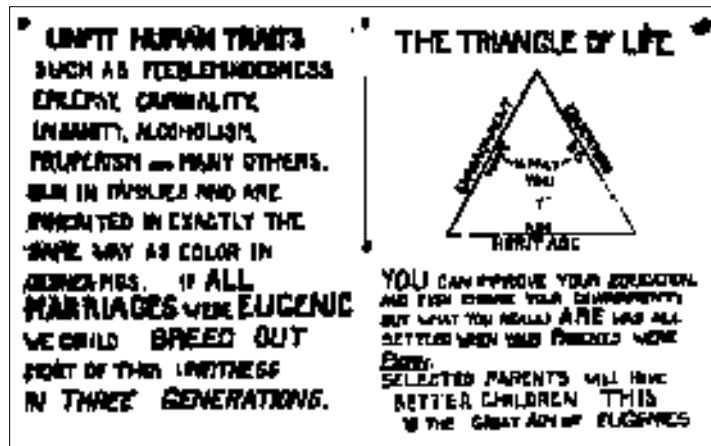
Figure 3

American Eugenics Society (AES) display, "Marriages—Fit and Unfit," Kansas Free Fair, Topeka, 1929, in the AES photo scrapbook, AES Papers. Courtesy of the American Philosophical Society, Philadelphia.



14 In another article, I have argued more completely for the continued popularity of eugenics in the U.S. during the 1920s and 1930s, and its influence upon industrial designer Norman Geddes. For example, more than 36,000 sterilizations had been performed in the U.S. by the beginning of World War II, with some states maintaining their sterilization statutes into the 1970s. Eugenics was the primary reason behind the Immigration Restriction Act of 1924; as Rep. Robert Allen of West Virginia summarized, "The primary reason for the restriction of the alien stream, however, is the necessity for purifying and keeping pure the blood of America." Seventy percent of forty-one high school textbooks written between 1914 and 1948, surveyed by historian Steven Selden, promoted eugenics as a legitimate science. Furthermore, a poll by *Fortune* magazine in 1937 found that sixty-three percent of the U.S. population endorsed compulsory sterilization of "habitual criminals," while sixty-six percent supported the sterilization of "mental defectives." See Cogdell, "The Futurama Recontextualized," 198–205; Daniel Kevles, *In the Name of Eugenics: Genetics and the Uses of Human Heredity* (New York: Knopf, 1985), 106, 115–116; and Steven Selden, *Inheriting Shame: The Story of Eugenics and Racism in America* (New York: Teachers College Press, 1999), 64.

15 Norman Geddes, "Ten Years from Now," *Ladies' Home Journal* (Jan. 1931), repr. in *Rassegna* 60 (Winter 1994): 19–21.



During the 1920s and 1930s, however, in pursuit of their goals, eugenicists implemented a two-pronged approach to maximize the efficiency of their programs for the genetic improvement of the race. "Positive eugenics" targeted the "fit" and worked to increase the quality and number of their offspring through propaganda offering simplistic explanations of Mendelian formulae [figure 3], and encouraging the production of large numbers of children from the well-endowed. Contrarily, "negative eugenics" worked to limit the reproductive capacities of the "unfit" and their supposedly deleterious influence on the national bloodstream. Such policies took form politically through legislation aimed at enforcing anti-immigration (the federal Immigration Restriction Act of 1924), the distribution of birth control to "less desirable" populations (the goal of Margaret Sanger's American Birth Control League), and "voluntary" sterilization of criminals and the feeble-minded (twenty-nine states had passed such statutes by 1938).¹⁴ Geddes likely referred to the latter in 1931 in the *Ladies' Home Journal*, where he predicted in "Ten Years from Now," that "[M]edical and surgical treatment will reduce crime to a fraction of its present-day proportion."¹⁵ The implementation of "positive" and "negative" eugenics

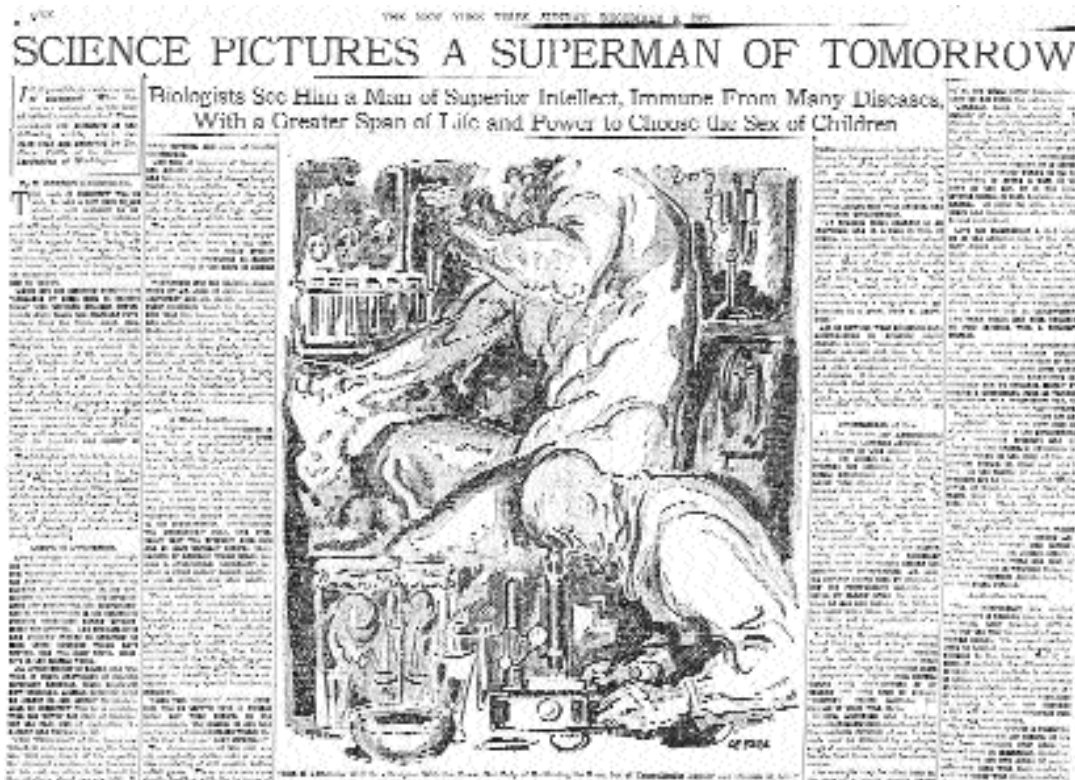


Figure 4
 New York Times article and illustration,
 "Science Pictures a Superman of Tomorrow,"
 8 Dec. 1929. Copyright © 1929 The New
 York Times. Reprinted by permission. All
 rights reserved.

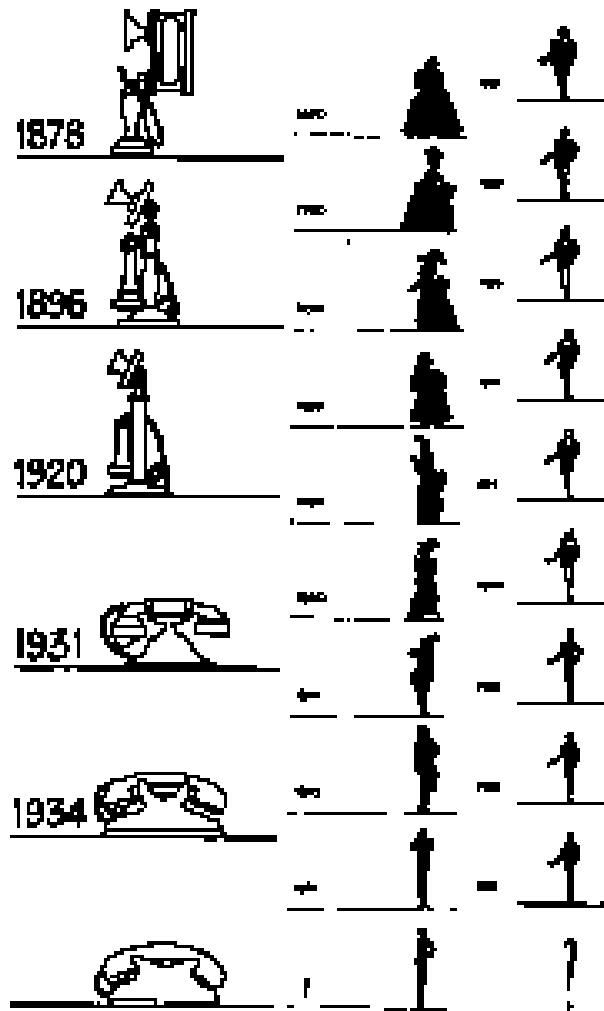
depended upon the participation of an enlightened public, both in their support for eugenic legislation and in their personal choices, the latter of which *Vogue* authors took for granted. In part, this support arose from public acceptance of the humanitarian goals promoted by eugenics enthusiasts; as Sakier phrased it, good breeding was intended "for the delectation of the community" and an individual's "own happiness." Despite the important role played by the public, however, the media often portrayed the eugenicist himself, through his scientific research, as the mastermind producing the "Superman of Tomorrow" or, as compellingly, "various human types at will." [figure 4]¹⁶

Beyond the fact of the continued popularity of eugenics, its technocratic theoretical background conflating bodies with products, and designers' references to its possibilities in *Vogue* and the *Ladies' Home Journal*, what were the connections between eugenics and streamline design? Loewy's "Evolution Chart of Female Dress" [figure 5] offers an appropriate place to begin examining this question, for it expresses the designer's conception in the mid-1930s of the evolution of both the typical female costume and the female figure, from 1630 and 1890, respectively, into the indefinite future. In its inclusion of the female body, this chart differs dramatically from others by the designer such as the "Evolution Chart of the Desk Telephone" or those of any number of designed products such as automobiles, ships and houses. As was certainly intended by

16 H. Gordon Garbedian, "Science Pictures a Superman of Tomorrow," *New York Times* (8 Dec. 1929), folder "Oscar Riddle, 1929," Charles B. Davenport Papers - Cold Spring Harbor Series, American Philosophical Society. The second quote is drawn from Arthur A. Stuart, "Someday We'll Look Like This," *Popular Science Monthly* (July 1929), in folder "Art Education," Box 58, Egmont Arens Papers, George B. Arens Research Library, Syracuse University.

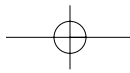
Figure 5

Raymond Loewy, "Evolution Chart of the Desk Telephone" and "Evolution Chart of Female Dress," 1934.



Loewy, who displayed one of these diagrams in his mock-up of an industrial designer's office at the *American Industrial Art* exhibition at the Metropolitan Museum of Art in 1934, these charts strongly but silently pointed to the industrial designer himself as the chief agent of product evolution. In the case of the female figure, however, this agency (as well as the end product) was more ambiguous, perhaps owing more to the eugenicist than the industrial designer, given the concurrent publicity of the eugenicist's powers.

In many ways, this ambiguity was appropriate to the roles of both professions, for both industrial designers and eugenicists (aspiring designers, as well, of humans and society) considered themselves to be primary agents of evolutionary progress. Enacting a role shared only by plant and animal breeders, both types of designers rationally selected between desirable and undesirable traits to reform "primitive," "criminal," and "degenerate" products and bodies from the inside out into functional, "fit" forms suitable

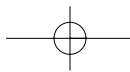


for mass (re)production. In both the arenas of eugenics and early industrial manufacture, designers bemoaned the all-too-rapid rates of reproduction of undesirable, unhygienic products and human “types” (for supposedly the “unfit” were more fertile and productive than the “fit” owing to their lesser intelligence and restraint, and heightened sexuality).¹⁷ That industrial designers and modern architects such as Adolf Loos (in his seminal essay “Ornament and Crime”), however, applied the terminology used by eugenicists for human evolution (“primitive,” “criminal,” and “degenerate,” among others) to manufactured products deserves notice, for it points out the reciprocal conceptual force which each powerful modern realm—industrial manufacturing and evolutionary thought—endowed the other.

These evolutionary characterizations of products derived from a common art historical presumption that stylistic evolution paralleled human evolution, owing to the conception of style as a mental expression given physical form.¹⁸ Historian Carlo Ginzburg has beautifully elaborated this concept for art history generally; its prevalence as well in the field of architecture and design is clearly manifest in the writings of modern practitioners. To return to Loos’s essay, his thesis that “modern” design cannot contain ornamentation and still be considered “modern” derives from his understanding of Ernst Haeckel’s theory of evolutionary recapitulation, in combination with the above understanding of style. Loos opens his essay by explaining recapitulation: “In the womb the human [i.e., white male] embryo goes through all phases of development the animal kingdom has passed through. And when a human being is born, his sense impressions are like a new-born dog’s. In childhood he goes through all changes corresponding to the stages in the development of humanity,” passing through the stages of a “Papuan... a Germanic tribesman...Socrates... Voltaire” to then become a “modern adult.” Loos, therefore, reasons that “[w]hat is natural in the Papuan or the child,” such as delight in ornamentation and tattooing *as shown through the style of their art*, “is a sign of degeneracy in a modern adult... The evolution of culture is synonymous with the removal of ornamentation from objects of everyday use.”¹⁹

Loos’s deduction was given graphic form by Loewy in his evolutionary charts which, as a whole, depict the evolution of design moving from the intricate, gaudy, and ornamental to sleek, simplified forms. The indexicality of an object’s style to the racial essence of its creator perhaps was most pointedly stated by Louis Sullivan, however. “The Parthenon was, in fact, the Greek nature, mind, heart, soul, beliefs, hopes, aspirations, known, felt, and interpreted by a great Greek artist,” he wrote. “[I]t was a direct product sign and image of Greek civilization.... Ask yourself the question: not in what *style*, but in what *civilization* is this building.”²⁰ Geddes, from his own extensive knowledge of late-nineteenth-century

- 17 On differential fecundity and intelligence, see Kevles, *In the Name of Eugenics*, 89; Linda Gordon, *Woman’s Body, Woman’s Right: A Social History of Birth Control in America* (New York: Grossman, 1976), 136-158; Cynthia Russett, *Sexual Science: The Victorian Construction of Womanhood* (Cambridge, MA: Harvard Univ. Press, 1989), 123; Cogdell, “Eugenics and Streamlining as Top-Down Reform,” in “Reconsidering the Streamline Style: Evolutionary Thought, Eugenics, and U.S. Industrial Design, 1925-1940” (Ph.D. Diss., University of Texas at Austin, 2001), 209-210; and Sheldon and Eleanor Glueck, *Five Hundred Delinquent Women* (New York: Knopf, 1934), 310.
- 18 Carlo Ginzburg, “Style as Inclusion, Style as Exclusion” in Peter Galison and Caroline Jones, eds., *Picturing Science, Producing Art* (New York: Routledge, 1998), 27-54.
- 19 Adolf Loos, “Ornament and Crime” in *Ornament and Crime: Selected Essays* (Riverside, CA: Ariadne Press, 1998), 167, 173. Brackets added for clarification. Because only white males occupied the evolutionary apex, only they could pass through *all* the stages of their predecessors to become “modern adults.”
- 20 Sullivan, “Towards the Organic” in Lewis Mumford, ed., *Roots of Contemporary American Architecture* (New York: Grove Press, 1959), 78. On Sullivan’s notions of race, see David S. Andrew, *Louis Sullivan and the Polemics of Modern Architecture: The Present Against the Past* (Urbana, IL: Univ. of Illinois Press, 1985), 45, 49, and Christina Cogdell, “Reconsidering the Streamline Style,” 57-59.



evolutionary thought, or from reading Sullivan or Claude Bragdon's descriptions of Sullivan, took these ideas one step further by asserting that the process of evolution was a direct force shaping style itself. "There is said to be a law of nature that higher forms must, before maturity, pass through all stages of evolution of their predecessors. This seems to hold true for the modern art of building." In a reference perhaps to the stylistic cacophony of nineteenth-century American architecture, he continued: "Mankind has had to re-experience the architectural development of the Egyptians, the Greeks, through the Gothic, the Renaissance and the Baroque, before it could express its own time in its own terms."²¹ For Geddes, then, functionalist design as embodied in streamlined forms resulted from this process, which reaffirmed its preeminent position (and their own as well) as a "higher" evolutionary form.

Although Donald Bush and other historians of design refer to the influence of evolutionary ideas upon the style's development, they have done so largely to point out that organic forms such as birds and dolphins modeled the adaptations selected by nature in conformance with the principles of air and fluid dynamics, with the emphasis on the latter.²² These principles, derived from physics, determined that for vehicles to travel through air or water efficiently with the least amount of resistance and energy expenditure, they required a minimum of protuberances, smooth external shells, rounded fronts, and tapered backs such as those exhibited by numerous organic forms. Hence, the style's sleek shape and its attendant qualities of maximized efficiency and hygiene. Historians also have agreed that, in addition to these qualities, streamline designers embraced the goal of producing "ideal" product types (despite their practice of planned obsolescence in product design) that would, at least in rhetoric, contribute substantially towards the realization of an imminent utopia. Jeffrey Meikle, in particular, has elucidated the important role that new materials and production processes played in the development of the style, in addition to establishing the most widely accepted ideological interpretation of the style as an appropriate response to the varied economic and psychological effects of the Great Depression.²³

As shown above, however, the influence of evolution on modern architects and designers occurred at much deeper theoretical level than simply offering models of aerodynamically streamlined forms. If the biological evolutionary basis of the style is examined more closely, especially in consideration of the close relationship between evolutionary thought and eugenics at that time, new questions are raised about the message and meaning of the style as the first major expression of industrial design in the U.S. This article contends, therefore, that biological theories of evolution served as a primary ideological and historical *context* for designers' development of theories of streamlining; it does not consider evolution, as other historians and the designers themselves have, as a

-
- 21 Norman Bel Geddes, *Horizons* (Boston: Little, Brown and Company, 1932), 283-4. On Geddes's evolutionary knowledge, see Cogdell, "The Futurama Recontextualized," 194-198, 205-209, and throughout, as well as Geddes's personal library at the Harry Ransom Humanities Research Center at the University of Texas at Austin.
- 22 Donald Bush, *The Streamlined Decade* (New York: George Braziller, Inc., 1975), 4-14, and Claude Lichtenstein and Franz Engler, eds., *Streamlined: A Metaphor for Progress* (Princeton: Princeton Univ. Press, 1995).
- 23 Jeffrey Meikle, *Twentieth-Century Limited: Industrial Design in America, 1925-1940* (Philadelphia: Temple Univ. Press, 1979); *American Plastic: A Cultural History* (Rutgers, NJ: Rutgers Univ. Press, 1995); and "Domesticating Modernity: Ambivalence and Appropriation, 1920-1940" in Wendy Kaplan, ed., *Designing Modernity: The Arts of Reform and Persuasion, 1885-1945* (London: Thames and Hudson, 1995), 142-167.



Figure 6
New York Herald Tribune photo and caption, "Streamlined Beauty Treatment in the Evolution of Railroad Locomotives," 5 Mar. 1936, a copy of which is located in file "Railroad," Microfilm Roll 16.20, Walter Dorwin Teague Papers. Courtesy of the George B. Arents Research Library, Syracuse University.

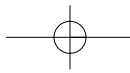
progressive force actually at work in the dual arenas of human and product development. When viewed in this context, the style's close theoretical correlations to eugenics becomes clear. Just as deep concern over controlling the progress of evolution compelled many people to accept eugenics, so in many instances designers' applications of evolutionary principles to the realm of product design crossed the line between evolution and eugenics.

On one side of this line, according to *evolutionary* thought, natural selection and independent modification directed evolutionary progress; on the other side, according to *eugenic* thought, rational selection and controlled modification determined the paths of the future. Just as eugenicists tried to apply biological laws, as they understood them, to control the outcome of evolution by paring away the "parasite drag" caused by the "unfit," so too did streamline industrial designers apply biological principles when theorizing how to stylistically shape products into a modern aesthetic suitable for a "civilized" nation. In their equation of products with bodies, in their choice to focus on the elimination of "parasite drag" (as Geddes biologically termed the physically turbulent eddies that slowed a vehicle's forward progress), in their choice to foreground efficiency, hygiene, and the pursuit of the utopian "ideal type" as the preeminent goals for product design, and simply in their role as evolutionary agents reforming products for mass production, streamline designers *exactly* mirrored the theoretical doctrines, rhetoric, and role espoused by contemporary eugenicists.

Countless examples could be given of evolution as the primary conceptual model informing theories of streamline design, down to such remarkable intricacies as Egmont Arens's assertion of the role of "natural selection" in weeding out too-slow typographic fonts, or various designers' ruminations whether "bastard offspring" and "mongrelism" in product design restored "vitality" to modern design through "hybrid vigor" or desecrated its principles of "purity."²⁴ Instead, I will offer three particularly good examples (in addition to those already mentioned) in which designers' applications of evolutionary thought crossed over the line from evolution proper into the more historically improper realm of eugenics.

The first comes from a comparison of a German rail poster from 1935 with two remarkably similar images published in the U.S.: an advertisement for *Collier's* magazine that same year, and a brochure distributed by the U.S. Department of Agriculture during the previous decade. During the 1930s, numerous brochures and exhibits promoting "ultra-modern" streamlined trains lined up past and present locomotives in a row, facing the same direction, symbolically depicting the forward linear thrust of their evolutionary development [figure 6]. At times, the force and appeal of this forward progressive direction was heightened through comparison to a counter-directional motion. Although he does not explain the counter-directional imagery, Meikle discusses this trope of

24 On "natural selection" and the role of "bastard offspring" in typography, see Egmont Arens, "Creative Evolution of the Printed Word" (an address given before the Eastern Arts Association, 28 Apr. 1933), in Box 51 "Writings," Egmont Arens Papers, George B. Arents Research Library, Syracuse University. On "mongrelism" in design, see Henry Dreyfuss, *Designing for People* (New York: Paragraphic Books, 1955), 96, and Russell Flinchum, *Henry Dreyfuss, Industrial Designer: The Man in the Brown Suit* (New York: Rizzoli, 1997), 102, n. 40, 108, citing an inner-office memo. See also Cogdell, "Reconsidering the Streamline Style," 387.



“progress,” connecting past, present, and future, in a German poster bearing this type of imagery [figure 7].²⁵ The poster for the “100 Jahre Deutsche Eisenbahnen Ausstellung, Nürnberg” contrasts a fiery, elevated streamliner speeding towards the right with an earth-hugging, coal-powered, horse-and-buggyish train heading towards the left. Despite the blue smoke belching from the stack of this locomotive from the 1830s, this highly inefficient nineteenth-century train appears immobile, as stationary as the onlookers conversing with its passengers. Meikle astutely interprets the inclusion of this train as a transitional device that, through its allusions to the past, tempered the radicality of the streamliner of the future, making both more palatable to a culturally and socially conservative public. The streamliner thus became a “better version of [an] experience similar to those of the past.”²⁶

Comparison with two other images from the U.S., however, suggests an additional meaning for this counter-directional imagery. An advertisement soliciting advertisers’ business for *Collier’s* magazine replicated almost exactly the image in the contemporaneous German poster [figure 8]. Across the top half of the two-page ad, a streamliner speeds to the right, its shining headlight illuminating the darkness. The train is followed by a swoosh of forward-slanted text that proclaims, “Stream-Lined Editing Long Before Stream-Lined Trains Set New Standards.” In the bottom left quarter of the pages, moving towards the left, are a mid- to late-nineteenth-century, coal-burning locomotive and railcar. But they seem to be moving so slowly that they do not even threaten to displace the blocky print stationed in front of them, which reads, “A Slow Ride for Your Money.”²⁷

As the copy makes clear, the streamliner represented both the quick sales of *Collier’s magazine* and the fast-moving merchandise of manufacturers who advertised in its pages. Its swooping progressive curve foretold “an immediate upward response in your sales curve!” in addition to symbolizing through its forward-looking direction “the alert and progressive” purchasers who read the magazine. *Collier’s* promised that its readers and advertisers would be enthralled by “[t]imely, incisive articles—never dragged out in length,” for as both eugenicists and designers had publicized throughout the previous decade, “drag” posed a primary hindrance to progress.²⁸ The slow train, on the other hand, signified a slower-moving medium, one unlike *Collier’s* burdened by extraneous articles that targeted the “slow-minded, self-satisfied type of reader who buys, if at all, when he gets around to it.” By targeting the “active,” wealthy, mentally superior individuals, and “side-tracking” the “slow-minded” ones, *Collier’s* claimed that it had “segregated the very heart of the most responsive market in the United States.”

Through its terminology, this advertisement evoked various evolutionary and eugenic images: the side-tracked train, derailed from the line of progress, following an evolutionary dead-end; the

25 Meikle, “Domesticating Modernity: Ambivalence and Appropriation, 1920–1940,” 148–149.

26 *Ibid.*, 148.

27 *Collier’s* advertisement, 1935, in folder “Streamlining, 1933–1936,” Egmont Arens Papers. Italics added.

28 For examples of eugenicists’ use of the term “drag” to refer to the effect on human evolution and society caused by the “degenerate,” see the brochure “Eugenics at Work,” 1931, in folder “American Eugenics Society: Printing Orders, 1926–1942,” American Eugenics Society Papers, American Philosophical Society; George Benedict, “Sermon 47,” delivered at the Jewish Temple Emanu-El, Roanoke, VA, 1926, in folder “Rufus Baker, Sermon 21,” American Eugenics Society Papers; “Sermon 19,” 1928, in folder “Henry S. Huntington,” American Eugenics Society Papers; Charles Davenport, “Some Social Applications of Modern Principles of Heredity,” a speech given at the International Congress of Hygiene, 1912, in folder “Heredity Lectures,” file “Charles B. Davenport,” Charles B. Davenport Papers. The references are too numerous to include here. See also Loos’s statement in note 29 below.

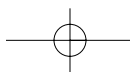


Figure 7

Poster designed by J. Wiertz, "100 Jahre Deutsche Eisenbahnen Ausstellung, Nürnberg, 1935," in "Domesticating Modernity: Ambivalence and Appropriation, 1920–40," by Jeffrey Meikle, in *Designing Modernity: The Arts of Reform and Persuasion 1885–1945*, ed. by Wendy Kaplan (New York: Thames and Hudson, 1995), 149.

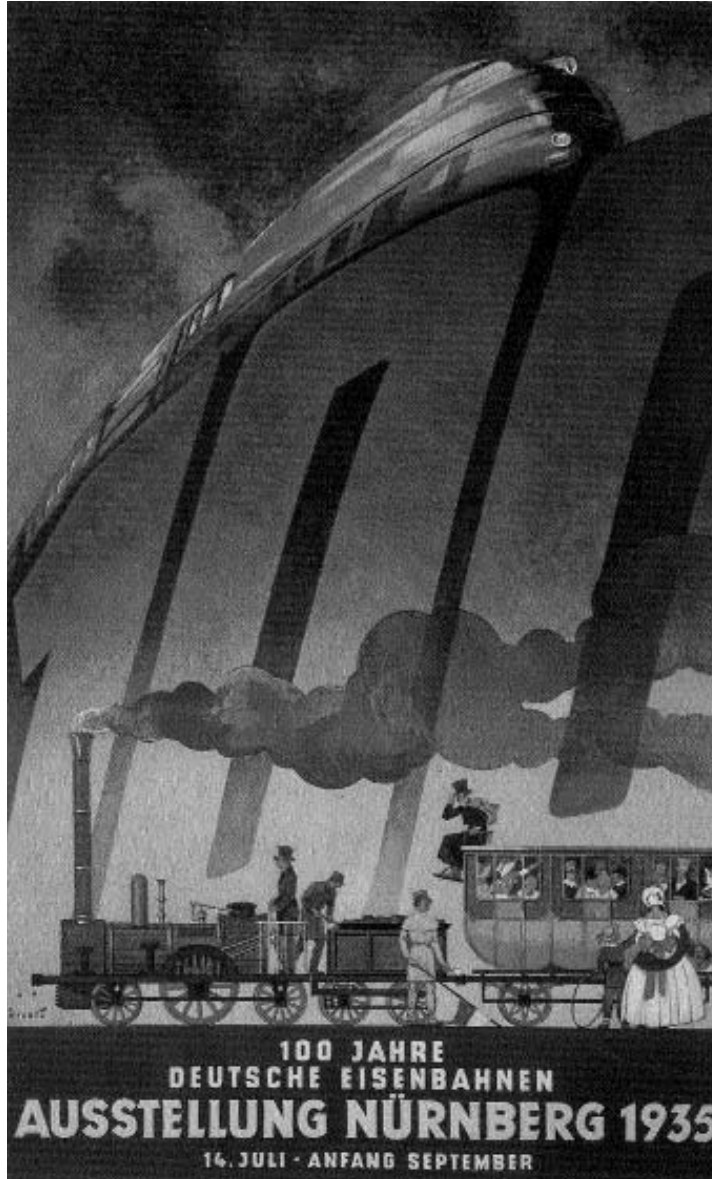


Figure 8

Collier's advertisement, 1935, in folder "Streamlining, 1935-1936," Box 59, Egmont Arens Archive, courtesy of the George Arens Research Library, Syracuse University.



Figure 9

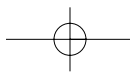
Flyer for the "Better Sires, Better Stock" Campaign, United States Department of Agriculture, c. 1921. Courtesy of the American Philosophical Society, Philadelphia.

29 Adolf Loos, "Ornament and Crime," 169–70. Loos's statement, "It is a misfortune for a state if the culture of its inhabitants stretches over too great a time span," is based upon the evolutionary idea of arrested development, according to which individuals might exhibit the racial and cultural development of an earlier phase of human evolution, as if the evolutionary process had been arrested and their own development stagnant for decades or centuries. The statement was preceded by his pronouncement that "I am living, say, in 1912, my neighbor around 1900, and that man over there around 1880." It was followed by "On the occasion of the festival procession to celebrate the Emperor's jubilee we shuddered to learn that here in Austria we still have tribes from the fourth century. Happy the land that does not have many cultural stragglers and laggards. . . . These people who lag behind are slowing down the cultural development of the nations and of humanity." This latter statement reflects the notion of evolutionary drag as promoted by eugenicists before the popularization of the concept in streamlining.³⁰ Brochure for the "Better Sires, Better Stock" Campaign, U.S. Department of Agriculture, c. 1921, in folder "W. S. Anderson," Charles B. Davenport Papers. On Laughlin's exhibit, see *A Decade of Progress in Eugenics: Scientific Papers of the Third International Congress of Eugenics, held at American Museum of Natural History, New York, August 21–23, 1932* (Baltimore: Williams and Wilkins Co., 1934), 488, 503. It must be noted, as was apparent from the name of the campaign, that apparently a person joined the pure-bred parade by procreating from a perfected *paternal* line, not because all females were presumably already of a uniformly high quality, but rather because of genetic researchers' faith in the overpowering vitality of the male seed.



institutional segregation of the poor, unproductive, developmentally-arrested people who were a "drag" on national efficiency; the association of progress and streamlining with the physically, fiscally, and mentally active. The dual-directional flow thus broadly symbolized evolutionary progress in opposition to evolutionary degeneracy. When viewed from this perspective, the German poster for the Nürnberg exhibition elicited a warning similar to, but more subtle than, that emphasized by Loos in "Ornament and Crime" (which he revised in 1929). "The speed of cultural development is hampered by the stragglers," Loos warned. "It is a misfortune for a state if the culture of its inhabitants stretches over too great a time span."²⁹ Streamlining, of both man and machine, promised to pare away all protuberances that hindered cultural and evolutionary progress by bringing both into line.

This interpretation is strengthened through additional comparison with a promotional pamphlet published by the U.S. Department of Agriculture that was widely distributed through county agents and agricultural colleges [figure 9]. As a push to "Join



the 'Better Sires, Better Stock' Campaign," the top half of the image portrays a group of healthy, well-fed purebred animals marching upwards to the right on a road towards a well-kept, modern farm. Their scrawny, sickly counterparts in the bottom half of the picture tramp downwards to the left on the "Scrub Route" towards a disheveled, collapsing hovel. "Which Way Is Your Live Stock Going?" the flyer asks, and if the road to progress was still unclear, the text exhorted farmers to "Let YOUR Animals March with the Purebreds." This recommendation, although officially directed at farmers and ranchers, pertained to human improvement as well. Harry Laughlin, director of the Eugenics Research Office at Cold Spring Harbor, New York, made this clear through his exhibit of "the elimination of mongrel chromosomes by the pure sire method" at the Third International Congress of Eugenics, held at the American Museum of Natural History in 1932.³⁰ Although the text of the *Collier's* advertisement implied as much, in comparison with the message of this agricultural brochure, the streamliner thus symbolized the quick intelligence, good form, and high productivity that resulted from a solid genetic foundation.

This relevance of genetics to streamline design is furthered through the last two examples, alternately from Arens and Teague. Between 1934 and 1936, Arens toured the country lecturing on "Streamlining in Nature" at high schools, colleges, junior leagues, and executive meetings of industrialists.³¹ He accompanied his talks with numerous lantern slides that gorgeously displayed streamlined adaptations in natural forms including trees, flowers, fish, birds, horse and dogs. For the latter two, he used thoroughbred forms ("Purebred Arabian Horses" and greyhounds), noting as eugenicists did that trainers and breeders could select and shape animals to produce beautiful, functional forms. In his talk, he contrasted a white greyhound [figure 10] with an Irish setter. "Champion greyhound. Here is the same thing without the benefit of the trainer. It comes almost naturally to a greyhound. *It is in his blood.* Men have selected for breeding dogs who showed good form.... *Greyhounds were being bred for lines like these long before the engineers discovered the slipstream.*"³² Arens emphasized the primacy of purebred genes as a basis for the streamline form over the physical requirements of fluid dynamics, a primacy that reiterated the visual message of the opening slide of his lecture [Figure 11]. For this slide, Arens created an abstraction of two curves to represent "Stream Lines" that more closely resembled the torso of the greyhound than they did the typical representation of a vehicle in the "slipstream." Given the visual similarities with the greyhound and his comments about breeding, his textual separation of the words "Stream" and "Lines" even left room for an association of streamlining as being connected to *blood-stream lineage*.³³

Teague, too, compared industrial designers with breeders, for in creating perfect designs they were metaphorically functioning

30 Brochure for the "Better Sires, Better Stock" Campaign, U.S. Department of Agriculture, c. 1921, in folder "W.S. Anderson," Charles B. Davenport Papers. On Laughlin's exhibit, see *A Decade of Progress in Eugenics: Scientific Papers of the Third International Congress of Eugenics, held at American Museum of Natural History, New York, August 21-23, 1932* (Baltimore: Williams and Wilkins Co., 1934), 488, 503. It must be noted, as was apparent from the name of the campaign, that apparently a person joined the purebred parade by procreating from a perfected *paternal* line, not because all females were presumably already of a uniformly high quality, but rather because of genetic researchers' faith in the overpowering vitality of the male seed.

31 Egmont Arens gave versions of his streamlining lectures at: General Electric in Schenectady, NY, in late 1936; the Lions Club in Bridgeport, CT, in late 1935; the Auditorium High School Building in Owatonna, MN; the Rhode Island School of Design; a public school in Providence, RI; the Design Laboratory, part of the Works Progress Administration in New York City; the Advertising Club of Wilmington, DE with Du Pont advertisers in attendance; the Dayton Art Institute in late 1936; and the Youngstown, OH, Junior League. See various folders, including "See America Streamlined, 1935-36," Box 51 "Writings," and folders "Streamlining Out of Depression," "Publicity," and "Clippings about Egmont Arens," Box 46, all in the Egmont Arens Papers.

32 All information about Arens's series "Streamlining in Nature" can be found in Box 51 "Writings," and Box 57 "Writings/Lecture Notes/Slide Captions," Egmont Arens Papers. Italics added.

33 Sometimes the word was written "streamline," sometimes "stream-line,"

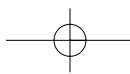


Figure 10

Egmont Arens, lantern slide of a greyhound that accompanied his lectures on "Streamlining in Nature," Box 57, Egmont Arens Papers. Courtesy of the George B. Arens Research Library, Syracuse University.

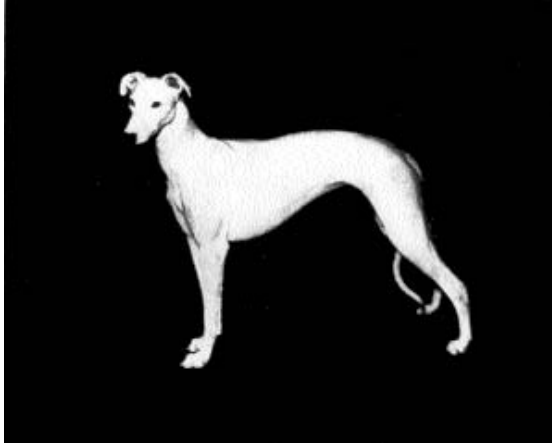


Figure 11

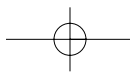
Egmont Arens, lantern slide of a diagram of "Stream Lines" that accompanied his lectures on "Streamlining in Nature," Box 57, Egmont Arens Papers. Courtesy of the George B. Arens Research Library, Syracuse University.



in much the same way as breeders and eugenicists who strove to ever improve the "purity" of selected biological strains. Teague believed that the "aim of design [was] a perfectly functioning organism" and that "certain universal principles" (elsewhere he referred to them as "the basic, unchanging laws of design") were "exemplified in *all* good design." Teague felt that these principles held true regardless of whether the "organism" were a racehorse, panther, oak tree, sword, ox cart, airplane, or motor car.³⁴ If, for a certain problem, a designer asked himself, "What is this thing for? What is it made of? How is it made?" Teague thought that the composite answer to these questions would gradually reveal "the *ultimate form* which that thing ought to assume," an ultimate form that was, in essence, genetic, as his subsequent explanation made clear. "This *ultimate form* is latent in the thing itself, as the color of our eyes and the shape of our fingers are latent in the uniting cells with which our lives begin."³⁵ He compared the industrial designer with "some divine designer" (or the accomplished breeder) who could transform a "clumsy, barrel-shaped draft animal" into an efficient, graceful racehorse with "fire and courage in its heart and health in its

34 Walter Dorwin Teague, "The Basic Principles of Body Design," in folder "Miscellaneous," Box 58, Walter Dorwin Teague Papers, George B. Arens Research Library, Syracuse University. Italics added.

35 Walter Dorwin Teague, "Art of the Machine Age" (an address given at the Art Week Luncheon in Boston, 10 Apr. 1934), folder "Writings—Articles," Box 79, Walter Dorwin Teague Papers, and here "stream line."



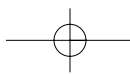
- 36 Walter Dorwin Teague, "Rightness Sells," repr. from *Advertising Arts*, no citation, in Box 79 "Writings," Walter Dorwin Teague Papers. Henry Dreyfuss characterized the relationship between engineers and industrial designers as a marriage that was producing "highly satisfactory offspring"; see Dreyfuss, "The Industrial Designer's Best Friend and Severest Critic" (an address given to the American Society of Engineering Educators at Stanford University, 18 Feb. 1950), on Microfiche #6 "Lectures/Articles by Dreyfuss, 1933-49," Henry Dreyfuss Papers, Cooper Hewitt National Design Museum, New York.
- 37 Paul T. Frankl, *Form and Re-form: A Practical Handbook of Modern Interiors* (New York: Harper and Brothers, 1930), xiii.
- 38 Mark Adams, "Toward a Comparative History of Eugenics," in *The Wellborn Science*, 220-221. On the Jewish promotion of eugenics, see Noam Zohar, "From Lineage to Sexual Mores: Examining 'Jewish Eugenics,'" and Raphael Falk, "Zionism and the Biology of the Jews," both in *Science in Context* 11: 3-4 (1998): 575-585, 587-607.
- 39 Adams, "Toward a Comparative History of Eugenics," 220-221; see also Kevles, *In the Name of Eugenics*, 64; and Diane Paul, "Eugenics and the Left," *Journal of the History of Ideas* 45 (1984): 570.
- 40 Stefan Kuhl, *The Nazi Connection: Eugenics, American Racism, and German National Socialism* (Oxford: Oxford Univ. Press, 1994), 79, 83 and 91.
- 41 "Population of the Empire: Falling Birthrate," the *Times* (London), 10 Aug. 1935," and other clippings in folder "Newspaper Clippings - England, 1935-36," Herbert Spencer Jennings Papers. Although two of the articles in this collection documented the plan of the Nazis to exterminate the Jewish people and the current deprivations of Jews in Germany, the majority of the articles focused on other developments in German political policy. A few of the articles even applauded German eugenic policies for increasing the German birthrate.

veins, so that its eyes flash and its coat is sleek and shining."³⁶ Once a designer had effected this transformation, his work on that design would *theoretically* be finished and redesign would become, almost de facto, an impossibility. As Paul T. Frankl summarized, "Good forms are few, but they are eternal."³⁷

In giving material form to eugenic ideology, streamline designers were not automatically aligning themselves with extremist political positions. Eugenacists, after all, came from a wide array of ethnic backgrounds and expressed highly varied political preferences. Although Anglo-Americans and Nordic Europeans formed the largest contingent of eugenics supporters, many Jews both in the U.S. and in Europe, African-Americans, and Asians also participated in the movement.³⁸ Of these groups, supporters adhered to a variety of social and political philosophies from the far right to the far left, including "democratic" capitalism, socialism, anarchism, fascism, and feminism.³⁹ Given that eugenics enthusiasts espoused a wide spectrum of political philosophies, the comparison of streamline designers with eugenacists does not imply that designers supported fascism and totalitarian politics. In no cases do the archival records of the designers in this article suggest that any of them supported Hitler's political totalitarianism or racial policies. Dreyfuss was Jewish, Geddes had many Jewish friends, and Teague possessed such a strict definition of and dislike for totalitarianism that he even criticized Roosevelt's New Deal as too heavy-handed.

However, to be opposed to political totalitarianism did not necessarily require one to also be opposed to eugenic ideals and policies which, in hindsight, seem to us today to tend strongly in that direction. Historian Stefan Kuhl states that the shift away from support of the Nazis by members of the American Eugenics Society in the 1930s was due not to disapproval of the German eugenics program, but rather to Hitler's political totalitarianism, and in many cases where international criticism did target Nazi ethnic racism, in fact most of these critics did not question the fundamental principle of race betterment.⁴⁰ The English newspaper clippings about European political developments saved by Herbert Spencer Jennings between 1935 and 1936 support Kuhl's conclusions. Many of the articles criticized German totalitarianism in contemporary international conflicts, while making almost no mention at all of Germany's eugenic social policies.⁴¹

Political philosophy and socio-scientific beliefs apparently fell into different ideological domains, as shown in part by the wide range of political groups who espoused eugenic principles but used these principles to argue, in many cases, opposing viewpoints. The facility with which this was accomplished owed in part to the malleability of eugenic ideas—to the imprecise and relative definitions of widely used terms such as "fit" and "unfit," the lack of clear understanding about the roles of "nature" and "culture"—and to the overall appeal of human betterment. Together, these aspects





allowed eugenics to appeal to an array of different groups who used a diverse set of rationalizations based upon their personal political beliefs to defend their particular take on eugenic social policies.

Clearly, some prominent advertisers and designers during the streamline era promoted strongly hierarchical, even racist and classist, viewpoints in their speeches, advertising copy, and urban planning visions. Both Meikle and William Pretzer have asserted the totalitarian tendencies of the style. Meikle notes that the key metaphor of streamlining—eliminating resistance and friction—implied “smoothing away, through social engineering, all potential disturbances, whether of action or expression.” He posits that the decline in streamlining resulted from a general recognition of the similarity of its ideals to the “destructive concept of a thousand-year *Reich* in Germany.”⁴² In his Marxist analysis, Pretzer describes the style as an anti-democratic, corporate “fiat” that “did not allow for regional, ethnic, popular, or class variations,” one that “emanated from a panic that sought refuge in the planned, orderly and, ultimately, the authoritarian.”⁴³ The top-down approach of its designers and advertisers, by which they considered the upper classes to be more “civilized” and “modern” and their goal to be the elevation of national taste up to an upper-class ideal, in addition to the eugenic implications of the style’s features, confirm Meikle’s and Pretzer’s interpretations.

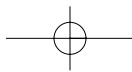
Yet, in some instances, designers and eugenicists expressed humanitarian concerns for the less privileged and included the latter group in their visions of the “world of tomorrow.” For example, in his *Democracy* exhibit for the New York World’s Fair, Dreyfuss envisioned a clean and orderly garden city adjacent to factory towns, mining towns, and agricultural towns, all of which he saw as being as interdependent as the various types of workers they housed. “Even Wall Street and Nebraska wheat growers can’t get along, each without all the others.” During the *Living Mural* part of the exhibit, film, music, and lighting were combined to produce a utopian, multimedia spectacle parading images of the workers of the world—including farmers, miners, religious and educational leaders, and “men and women representing all the occupations”—across the domed sky of the “Perisphere” in a flash reminiscent of the Aurora Borealis.⁴⁴ In Arens’s exhibit at the fair, *Three-Thirds of a Nation*, he argued that in order to preserve democracy, the lowest portion of American society in terms of income, health benefits, nutrition, and sanitation needed to be improved, for otherwise the symbols of technological progress would only serve as a “mockery to the dispossessed.”⁴⁵ In *Land of Plenty* (1947), Teague also expressed his concern that “the elevation of the lower levels” was “our Number One national imperative,” for “deficiencies in living conditions produce deficiencies in health, mentality, and morals, and these in turn reduce ability to contribute to the national welfare.” Although his ultimate intentions resembled those of eugenicists

42 Meikle, *Twentieth-Century Limited*, 186, 187, 210.

43 William Pretzer, “The Ambiguities of Streamlining: Symbolism, Ideology, and Cultural Mediator” in Fannia Weingartner, ed., *Streamlining America*, Ex. Cat. (Dearborn, MI: Henry Ford Museum, Sept. 1986–Dec. 1987), 88, 91, citing Ernest Elmo Calkins from *Printers’ Ink* (23 Sep. 1930).

44 Henry Dreyfuss, “Scheme for the Theme Exhibit: A Resume of What Will Take Place in the Perisphere at the New York World’s Fair, 1939,” 13 Dec. 1938, on Microfilm Roll #3 “World’s Fair,” Henry Dreyfuss Papers.

45 Egmont Arens, “Three-Thirds of a Nation—The Problem of Distribution” in folder “World’s Fair,” Box 36 “New York World’s Fair 1939,” Egmont Arens Papers.

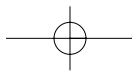
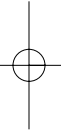
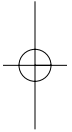




trying to increase national efficiency, the population he proposed to target reveals his humanitarian intentions.⁴⁶

By aligning themselves with eugenicists in their shared role as the chief agents of evolutionary progress, and by approaching products as bodies in need of the same types of reforms as those promoted by eugenic ideology, streamline designers exhibited their faith in contemporary science, technology, and their own newfound profession to serve as the true progenitors of an orderly future world.

46 Walter Dorwin Teague, *Land of Plenty: A Summary of Possibilities* (New York: Harcourt, Brace and Company, 1947), 221.



The Shoe Shine Boxes of Turkey

Victor Margolin

All photographs courtesy of the author.

One of the most distinctive vernacular objects in Turkey is the shoe shine box. Just like the moveable kiosks where vendors sell the pretzel-like coiled hot bread called *simit*, shoeshine boxes are prominent artifacts in the public spaces of most Turkish towns. Seasoned artisans of the high shine sit behind them in main squares and bus stations, ready to put a sheen on a pair of shoes that would rival Narcissus's mirror. The elaborate boxes, which are plated with thin veneers of hammered brass, lend dignity to the art of shining shoes in a way that a cobbled together wooden box could never do. I doubt that the shoe shine men make their own boxes and I imagine some small shops where craftsmen with expertise in hammering brass turn out custom shoe boxes rather like artisans who make special instruments for musicians.

One can see two basic typologies; elaborate boxes with stepped sides that serve as bins for multiple bottles of polish—each topped with a shiny cap—and simpler flatter boxes, usually with fewer bottles. In some cases, the boxes display original paintings, like miniature murals on building walls, and in other instances collages of cut out magazine pictures are pasted on the box facades. In travels throughout western Turkey, I never saw two boxes that were exactly alike. The variety of these boxes, which fit no existing category of decorative art or even folk art, is a testament to the popular imagination and to the potential of finding aesthetic pleasure in the most unexpected places.



Taksim Square, Istanbul



Bus station, Ankara



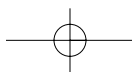
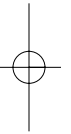
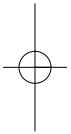
Selcuk

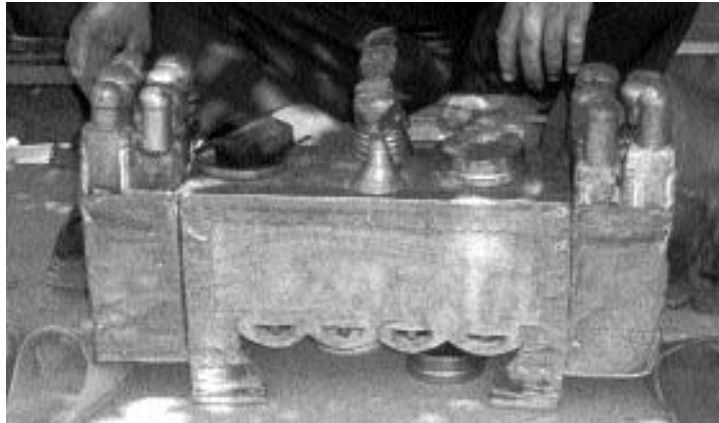
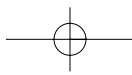


Istanbul



Urgup





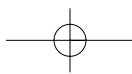
Bus station, Ortaca



Taksim Square, Istanbul



Istanbul



Hybrid Form

Kostas Terzidis

Morphing is a term used to describe a process in which an object changes its form gradually in order to obtain another form markedly different in appearance, character, condition, or function.¹ Familiar to most people as a cinematic device, in the movies morphing involves screen-based apparent rather than actual or substantive changes on the form itself. However, the significance of morphing for contemporary design discourse is not confined to cinematic special effects. Morphing is a powerful formal device that embodies one of architecture's most existential struggles: to express and identify itself through its own form. A distinctive characteristic of architecture is that it is both dynamic and static. It is dynamic when viewed as the design process which has its roots in historical precedents of culture and the arts, and which manipulates entities, that typically are of an elastic character. It becomes static when it has to freeze at a certain state so that it may be built. In other words, architecture is static when viewed through individual buildings. It is dynamic when these buildings are viewed as instances of a continuum, which derives from the past and projects into the future. In its dynamic stage, morphing involves transition, progress, continuity, interpolation, and evolution. In its static stage, it involves expression, connotation, mixing, combination, and bonding. Surprisingly, in architecture, morphing is not about change, but instead about a particular moment in time when the past and the future overlap within the same form. It involves transitional continuity and dynamic stasis. The identifiable characteristics of morphing are both unified multiplicity and intermediate distinctiveness. The architectural implementation of morphing suggests geometrical and topological transitions. Such processes involve operations that affect the geometry of a form, while preserving its topology. Morphing is the interconnection between seemingly disparate entities. In its dynamic stage, it is the struggle to connect the unconnected, dissimilar, unrelated, and unlike. In its static stage, morphing is the bond between the past and the present. It embodies a formal definition of reminiscence in its most primitive and primordial state.

The process of morphing differs from the biological process of metamorphosis. While metamorphosis is the change in the form, and often function, of an animal during normal development after the embryonic stage, morphing is a man-made, artificial process of mapping between often unrelated entities. The transformation of a maggot into an adult fly, or a tadpole into a frog, follows natural biological laws. In contrast, morphing follows artificial rules. It is

¹ An extensive introduction to morphing and warping for computer graphics is given by Jonas Gomez, ed. *Warping and Morphing of Graphical Objects* (San Francisco: Morgan Kaufmann Publishers, 1997).



the simulation of a mathematical interpolation. Thus, it appears to be a process of magic or sorcery, and the effects often may look strange, awkward, or surprising.

Recent theories of form in architecture have focused on topological geometry. They refer to “smooth spaces described by continuous yet differentiated systems resulting from curvilinear sensibilities that are capable of complex deformations in response to programmatic structural, economic, aesthetic, political, and contextual influences.”² A topological transformation, or a homeomorphism, of one figure into another is described as a bi-univocal and bi-continuous correspondence between the points of the respective figures maintaining the connection and vicinity of the points of the figure.³ Topological operations involve folding, stretching, and compressing, but not tearing or cutting. Topology may be regarded as the unifying force that preserves the integrity of an indefinitely changing geometry.

In this context, architectural morphing preserves the topological integrity of the objects involved, that is, an object changes into another object as a single entity. A cube, for instance, may be gradually transformed into a pyramid. From the viewer’s point of view, there are always two objects: the “original” (or source), to which the transformation is applied, and the “destination object” (or target), which is the object one will get at the final step of the transformation. However, theoretically, there is only one object, which is transformed from one state (original) into another (destination). This object combines characteristics of both parent objects, which are involved in the transformation and is called the “hybrid object.” This object actually is composed of the topology of the one object and the geometry of the other. It is an object in disguise. Although it is topologically identical to the one parent, it resembles the geometry of the other parent.

Interpolation is a method for estimating values that lie between two known values. The hybrid object derives its structure from its parents through formal interpolations. While it is easy to derive hybrid children from isomorphic parents, a challenge arises for heteromorphic parents. In an isomorphic transformation, a one-to-one correspondence applies between the elements of the two parent sets such that the result of an operation on elements of one set corresponds to the result of the analogous operation on their images in the other set. In the case of heteromorphism, the lack of homogeneity among the parents necessarily leads to a selective process of omissions and inclusions of elements between the two sets. The guiding principle in this mapping process is the preservation of the topological and geometrical properties of the hybrid object. For instance, in the case of a square mapped to a triangle, the addition of a fourth point to the triangle preserves the topology of the square and yet, its disguised location, preserves the geometrical appearance of the triangle.

2 This is Greg Lynn's interpretation of Gilles Deleuze's *The Fold: Leibniz and the Baroque* and Rene Thom's catastrophe diagrams. See Gregg Lynn, "Architectural Curvilinearity" in G. Di Cristina, ed., *Architecture and Science*, (Chichester: Wiley Academy, 2001), 27.

3 See G. Di Cristina, "The Topological Tendency in Architecture" in G. Di Cristina, ed., *Architecture and Science*, 7.

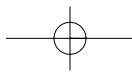




Figure 1

In the case of a square mapped to a triangle, the addition of a fourth point to the triangle preserves the topology of the square and yet, its disguised location, preserves the geometrical appearance of the triangle.

What makes morphing problematic for architects is that they have maintained an ethos of accumulative progression during the design process. Because of the artificial nature of design, architects traditionally follow an additive build-up approach. By contrast, morphing is a process of homogeneous transition. No elements are added or subtracted from the scene. Hybrid design is an alternative to the incremental design approach, which starts with components and builds towards increasing complexity as, for instance, building blocks. Instead, it starts with complex models or constructs, which get compared and transformed from one into the other. This allows an architect to impose a new condition or configuration on an existing design, create an evolution from one design to another, or explore the implications of contrasting design positions.

Traditionally, in architecture, skeletal shapes are used as abstract organizational schemes for the analysis or synthesis of buildings. These gestalt shapes are commonly known as “partis.” They are symbolic configurations or patterns of elements so unified as a whole that their properties cannot be derived from a simple summation of their parts. The formal value of these shapes is tremendous since they not only describe the organizational structure of the building but also express in diagrammatic terms certain archetypal ideas and values associated with the theme of the building.⁴ In partis, enclosure, balance, direction, rhythm, hierarchy, and symmetry are depicted through the use of Euclidean shapes and geometrical configurations. A parti is not only a descriptive underlay, but also a symbolic manifestation. As the hybrid form strives to express itself through its parents’ identity, a challenge arises in the selection of the parents. If partis are used as parents, then hybridization will occur between these archetypal shapes. The process of interpolation becomes the connecting bridge between interpretations. For instance, morphing a foursquare parti into a circle is not about four shapes that merge into one, but rather about the concept of hard, sharp, and equilateral changing into the soft, smooth, and concentric. The more the contrast between the parents, the higher the chances are for the hybrid form to juxtapose, cross-pollinate, and emerge.

One of the main differences of morphing, as it compares to deformation, is in the duality of its identity. Deformation is understood as change relative to an initial state. As a point of reference, an archetype is needed to assess the degree of deformation. However, as the deformation persists, form reaches a threshold beyond which it becomes “unrecognizable,” meaning that it is impossible to asso-

4 Handbooks such as Francis D.K. Ching's *Architecture: Form, Space and Order* (New York: Van Nostrand Reinhold Publishing, 1979) and R. Clarke and M. Pause, *Precedents in Architecture* (New York: Van Nostrand Reinhold, 1985) are also useful sources for establishing a foundation of architectural abstraction, a foundation, like all foundations, to build upon, and to exceed. Also see Rudolph Arnheim, *The Dynamics of Architectural Form* (Berkeley: University of California Press, 1977).

ciate it with its pivotal archetype. That is not the case in morphing. In fact, as the interpolation persists, the hybrid form oscillates between the identifiable shapes of its parents, allowing comparisons to be made at any point. This formal atavistic property is very important, because it becomes a means of expressing change through form itself, and not through juxtaposition. The duality of its identity is a unique compositional and unifying theme of the hybrid form.

In the interpolation process, a mapping applies between the elements of the two parent sets such that, the elements of the one set correspond to their images in the other set. Practically, multiple mappings can be constructed between the elements of the two sets. For every element in one set, any element of the image set can be mapped. While certain mappings appear to be more “natural” than others, every mapping is a valid transformation between the two parent sets. A “mutation” is an unexpected alteration to the hybrid’s structure resulting in the creation of a new character or trait not found in the parental type. Mutation is an alteration that occurs during the creation process, and certainly not after. Since the creation of hybrid forms involves parents and mappings, a mutation may be defined as an “abnormal” mapping. The value of mutation is important since it represents a deviation from the ordinary, the common, and the predicted. It is about the exploration of alternatives, missing links, and new traits. A mutation has a high formal value, because it is associated with controversial interpretations. What appears to be a monster also may be worshipped as a god.

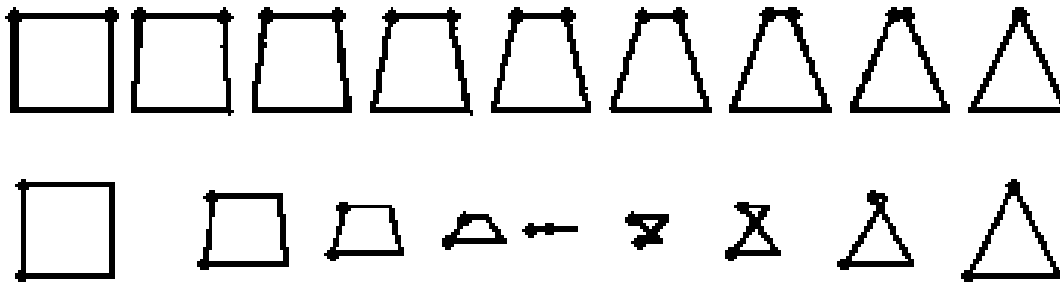


Figure 2

A “normal” (above) and an “abnormal” mapping (below).

The term “extrapolation” is used to describe the method of inferring or estimating by extending or projecting known information. By assuming that estimated values follow logically from known values, extrapolation estimates values outside a known range from values within a known range. Extrapolation is similar to interpolation. The method is the same, except the range of jurisdiction is antithetical. Because extrapolation is a logical extension of a known process, its formal value is not instantly understood. While interpolation is about middle ground, average, transition, and oscillation, extrapolation is about inversion, reversion, extension, and extremeness. Extrapolation represents a gateway to infinity. It is the starting point of inverted logic, in which the one parent is present If

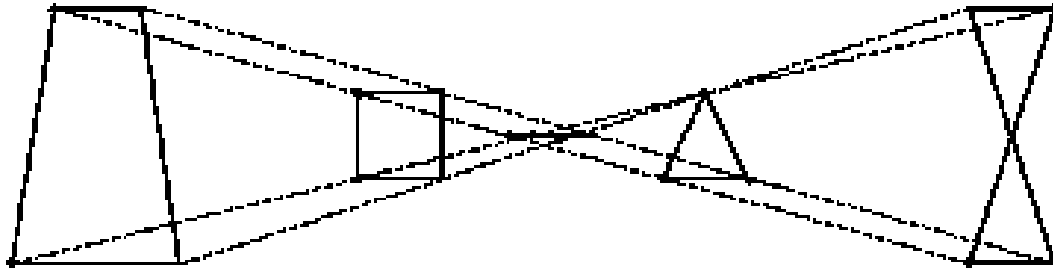


Figure 3
Extrapolation of a square through a triangle and vice versa. Notice that the child of two extrapolated parents is identical to that of the two Euclidean parents.

architecture is to approach morphing as an alternative design method, its design technologies also should incorporate factors of time and change. The power of computation is in its ability to extend the human mind, and set the stage for experimentation into through its mirror image. The extrapolated form still is a hybrid. It may appear awkward, and yet it is perfectly consistent within the morphing scheme. In fact, the child of two extrapolated parents is identical to that of two normal parents.

the unknown. The processes of interpolation and extrapolation are essentially mathematical processes and, as such, they can get codified into quantitative methods. In contrast, manipulations, evaluations, and combinations of these processes are qualitative processes and, as such, can be handled by the architect.

As a design tool, the process of morphing can be implemented within existing computer-aided design systems. "Orchestration" is a term used to describe the actions of selecting, assigning, directing, and evaluating the performance of objects which participate in the morphing process. Transformations can happen concurrently or at a different pace. The result is a truly dynamic design space, the behavior of which becomes the responsibility of the architect. As in an orchestral performance, the architect/composer selects a number of objects to participate, assigns the proper paths and momentum for each one, and then directs the performance through time, form, and color.⁵

A challenging point is the fact that this new aesthetics is about the unknown, the unpredictable, and the unforeseeable. It requires the cooperation of two brains: that of the human and the computer because without one another it is impossible to plan or execute the hybrid objects. Most important of all, they lead to the creation of computational schemes, which are available for experimentation, analysis, or play across disciplines. The hybrid object contributes to our understanding of aesthetics, and creates a new dimension of how it may change our perception. It also brings up a social point: who is the creator? How will it change our perception if science and mathematics can be merged into the creative process?

5 One of the first attempts to use morphing in architecture was reported by Terzidis in 1989. Its intention was to introduce the hybrid object as an architectural parti. It is worth noting that the word "morphing" was invented later. See K. Terzidis, "Transformational Design," *ACADIA Proceedings* (1989).

"The Sun's Only Rival:" General Electric's Mazda Trademark and the Marketing of Electric Light

Leigh George

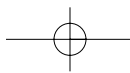
Introduction

In 1909, the General Electric Company launched an intense advertising campaign to promote "Mazda," a new trademark for incandescent light bulbs. Rather than identifying an individual product—the corporation did not introduce any new lamps that year—the Mazda name designated a service guarantee spanning the line of lamps produced by GE and its subsidiaries. By the turn of the twentieth century, GE exerted unparalleled control over the electric light bulb market in the United States. However, in contrast to earlier monopolies established through the exclusive access to raw materials, GE's market dominance was built upon innovative research and development. The Mazda mark was an attempt to symbolize the imperceptible research and technological improvements pioneered by GE for the public in a market in which all bulbs essentially looked the same. Significantly, the etymology of the word "Mazda" suggests neither service nor electrical technology. Ahura Mazda is the English name for the god of light in Persian mythology, and GE used fantasies of an idealized, preindustrial past to market Mazda. In doing so, the corporation naturalized the technology of an anonymous mass-produced commodity, the electric light bulb, for an American public attempting to cope with the dislocations of a new, and increasingly urban, industrial society.

Corporate Consolidation and Technical Innovation

Through mergers and acquisitions, national and international patent agreements that promoted the sharing of technological developments and research, and court victories over patent infringement, at the turn of the century, GE was recognized as the most powerful company in the incandescent lamp industry in the United States.¹ Following a series of mergers that began in the late 1880s, by 1892—with the merger of the Edison General Electric Company and the Thomson-Houston Company to form the General Electric Company—ownership of the electrical industry in the United States was concentrated in just two corporations: GE and Westinghouse Electric & Manufacturing Company. And, in 1896, through a patent-sharing agreement, the two titans effectively controlled the market

1 Arthur A. Bright, Jr., *The Electric-Lamp Industry: Technological Change and Economic Development from 1800 to 1947* (New York: The Macmillan Company, 1949), 137.



2 This agreement was designed to resolve struggles over conflicting patents that arose from the mergers with, and acquisitions of, other companies upon which the two leaders of the electricity industry had been built. And, in fact, during the next fifteen years for which the agreement lasted, there was little patent litigation. See Bright, *The Electric-Lamp Industry*, 102–103.

3 This position was guaranteed through the National Electric Lamp Association or NELA, a coalition of smaller competitors in the incandescent lamp industry set up as a holding company in which GE owned controlling stock. GE established this association, through which it entered a pricing agreement for incandescent lamps with Westinghouse, to fix prices following the intense competition among incandescent lamp manufacturers that resulted, in 1894, in the expiration of the patent for the basic Edison lamp. See Bright, *The Electric-Lamp Industry*, 102–103. With the incorporation of NELA in 1901 as the National Electric Lamp Company, command of 90 percent of the incandescent lamp market in the United States was split between Westinghouse, GE, and National. If agreements struck with producers who had not joined National are taken into account, only a scant 3 percent of the lamp market was not controlled by GE. See Bright, *The Electric-Lamp Industry*, 148. Even a 1911 antitrust ruling did not significantly effect the dominance of General Electric. See Bright, *The Electric-Lamp Industry*, 156–9.

4 Bright, *The Electric-Lamp Industry*, 143.

5 *Ibid.*, 229.

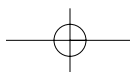
6 David E. Nye, *Image Worlds: Corporate Identities at General Electric, 1890-1930* (Cambridge, MA: The MIT Press, 1985), 1314. Between 1904 and 1909, GE, looking to capitalize on research in incandescent lighting abroad, signed licensing agreements with AEG (Allgemeine Elektrizitäts-Gesellschaft), as well as with the British Thomson-Houston Company, the French Thomson-Houston Company, and the Tokyo Electric Company “in all of which GE held controlling or large minority stock interests.” Bright, *The Electric-Lamp Industry*, 155.

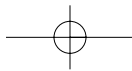
for electricity.² Although the 1896 agreement covered patents for various kinds of electrical equipment, it did not include lamps. This significant omission suggests that GE perceived that its lamps, unlike its other products, were distinct from the lamps of its competitors in the lighting industry. Indeed, it was GE’s patents on lamps and related equipment that gave the corporation an unrivaled position among incandescent lamp manufacturers.³

Unlike previous monopolies based on the control and processing of raw materials such as oil and lumber, GE’s dominance was built upon technological innovation and product development, resources fundamentally new to the marketplace. It was this strength, based on teams of highly skilled technicians, which enabled GE to maintain supremacy in the electric light industry from 1897 to 1912, a time of unprecedented growth and development in the industry worldwide.⁴ By 1912, GE controlled 80 percent of the lamp market in the United States and, through patent agreements, licensed the majority of the other 20 percent.⁵ The company’s emphasis on research and development, moreover, allowed GE to expand into new markets, making it possible for the company to achieve a virtually limitless dominance.⁶

During this time of accelerated growth in the electrical lighting industry, electric light came to be “taken for granted” as a part of everyday life in the United States.⁷ People encountered lamps at home, at work, and in the streets. According to the United States Census Bureau, by 1907, 8 percent of all dwelling units had electrical services. By 1912, the number had jumped to 15.9 percent and, by 1917, to 24.3 percent.⁸ In the early years of the twentieth century, with production totaling 66.7 million in 1909, the production of electric light bulbs in the U.S. out-paced that of all other electrical products combined.⁹ It is no surprise, then, that among GE’s varied products including everything from transformers and turbines to trolleys, lamps were, according to one historian, one of the company’s “most substantial and most reliable sources of profit.”¹⁰

Not only was lamp use widespread, but light bulbs and their production were made more efficient through the standardization of incandescent lamp design and improvements in manufacturing methods and filaments. By 1909, lamps using tungsten for filaments were replacing the carbon filament lamp. The tungsten filament produced a more cost-efficient, brighter lamp.¹¹ However, because advancements in lighting such as improved filaments and other improvements that increased the efficiency and life of the bulb occurred at a nearly imperceptible level and did not affect the design of the bulb, they would not be noticed by potential consumers. In the competitive lamp market in which all products essentially looked exactly the same, the challenge for GE, as understood by its executives, was how to effectively communicate the superiority of the company’s technology to the public.¹²



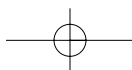


A Service Guarantee

Rather than struggle to explain the complex technological innovations of its lamps to consumers, GE instead chose to market the more accessible concept of service excellence. Interestingly, corporate executives and attorneys selected the name “Mazda” after the Persian god of light to symbolize such a guarantee.¹³ In his book *Lamps for a Brighter America: A History of the General Electric Lamp Business*, written in 1954 in celebration of the Diamond Jubilee of electric lighting at GE, Paul W. Keating explained that: “In Persian mythology, the god of light was known as Ahura Mazda. To the Persians, light was synonymous with knowledge and goodness, and so was the name Mazda.”¹⁴ The name signaled not microscopic and complex technological details, but instead served as a more general guarantee of the research and development, testing, and manufacturing techniques—the “knowledge and goodness”—that stood behind the mark. Nor did the name apply solely to a specific product. In 1909, the year the Mazda logo first appeared, General Electric did not offer any new lamps. Instead, the service guarantee of the brand could be found on any lamp manufactured by GE and its subsidiaries—so long as the product met the standards of excellence established by the Mazda service system. The Mazda assurance thus allowed GE to unify its various companies and brand names under a mark of superior service. The strength of the Mazda brand also allowed GE to set the standard for industry excellence. Through cross-licensing agreements with GE, other companies could use the Mazda trademark, but only if their lamps met the Mazda standards. Even Westinghouse sold Mazda bulbs. As described by Keating: “Not until the Mazda service authorities agreed that the lamp was produced with the benefits of ‘the latest and best research and manufacturing techniques’ did it receive the Mazda mark.”¹⁵ Yet another effect of the Mazda system was the standardization of the production and distribution of lamps. Consequently, Mazda became an extremely powerful mark of excellence throughout the electric light industry.

To understand this shift in marketing focus from the attributes of an individual product to the technological excellence of a particular brand of products, the rapid rate of technological innovation and obsolescence in the lighting industry at this time must be considered. A significant example here is the impact of the invention of ductile tungsten. In 1911, the commercial production of ductile tungsten, a thin, incredibly pliable, and tremendously strong wire, instantly made previous tungsten filaments obsolete. John Winthrop Hammond, author of *Men and Volts: The Story of General Electric*, described it as “a revolution, almost an upheaval, at the Edison Lamp Works” in which the company lost a million dollars as it was forced to junk equipment used for the manufacture of previous kinds of filaments, including jettisoning machines still in the box and writing off losses on reserves of obsolete lamps.¹⁶ Clearly,

- 7 Bright, *The Electric-Lamp Industry*, 143.
- 8 United States Department of Commerce, Bureau of the Census, *Historical Statistics of the United States, Colonial Times to 1970*, Vol. 2 (White Plains, NY: Kraus International Publications, 1989), 827. Dwelling units include farms, urban, and rural non-farm dwellings.
- 9 Paul W. Keating, *Lamps for a Brighter America: A History of the General Electric Lamp Business* (New York: McGraw-Hill Book Company, Inc., 1954), 79.
- 10 Bright, *The Electric-Lamp Industry*, 149.
- 11 Keating, *Lamps for a Brighter America*, 64–5.
- 12 *Ibid.*, 75.
- 13 The name “Mazda” had been proposed at a meeting of top executives and patent attorneys by Frederick P. Fish, a well-known patent lawyer of the day retained by GE. See Keating, *Lamps for a Brighter America*, 75–6. See also Bright, *The Electric-Lamp Industry*, 156 and 295.
- 14 Keating, *Lamps for a Brighter America*, 75.
- 15 *Ibid.*, 107. See also Bright, *The Electric-Lamp Industry*, 155.
- 16 John Winthrop Hammond, *Men and Volts: The Story of General Electric* (Philadelphia: J. B. Lippincott Company, 1941), 338–9.



the same level of devastating obsolescence would occur in advertising and publicity campaigns for individual products. Rather than lose huge sums on advertising with increasingly brief shelf lives, GE shifted its publicity emphasis away from individual lamps and towards its continued commitment to the service excellence of its Mazda brand.

Crucial to such an effort would be to educate a public weary of the rapid rate of industrialization and unfamiliar with technology. In choosing “Mazda” to represent the excellence of its lighting technology, GE associated modern lighting technologies with ancient conceptions of the “knowledge and goodness” of light. Yet, to effectively sell electric light as a desirable and accepted part of peoples’ daily lives and to distinguish its Mazda certified lamps from those of its competitors, GE needed more than a trademark. Thus, beyond considering corporate consolidation and rapid technological change in the American lighting industry, it is essential to examine the specific visual languages used to market Mazda to the public.

“The Sun’s Only Rival”

At the end of the nineteenth century, as the United States economy shifted from multiple, regional markets to a single, national marketplace, General Electric changed the way its bulbs were marketed. Initially, light bulbs were sold through wholesale dealers to retailers but, by the 1880s, with the emergence of department stores and chains such as Woolworth’s, most of the public had access to bulbs.¹⁷ As an increasingly diverse range of these retailers sold bulbs to the public directly, including supermarkets, drugstores, and hardware stores, a network for the mass consumption of electric light was in operation. GE’s monopoly helped to establish a vast distribution system for its products to these stores that contributed to a national market for their electrical products.¹⁸ This shift from multiple, local clients to a single, national market concurrently was facilitated by new mass-market magazines such as *McClure’s* and *Munsey’s* that attempted to appeal to a broad, national audience. For magazines that were sold all over the United States, advertising became a crucial way for anonymous corporations to create the illusion of personal contact with tens of millions of readers on a monthly basis through friendly, identifiable trademarks and logos. The marketing of Mazda was indicative of this trend.

The national campaign to publicize the Mazda trademark was launched in 1910 with “The Sun’s Only Rival” advertisement. Towards this end, the ad was featured in popular monthly pictorial magazines of the day including *Harper’s Magazine*, the *Saturday Evening Post*, *American*, and *Pictorial Review*. Similar to the Mazda trademark, which draws on the symbolism of a preindustrial Persian god of light to represent excellence in modern lighting technology, the ad works to establish a connection between a seemingly

17 Nye, *Image Worlds*, 115.

18 *Ibid.*, 113.



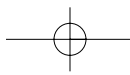
Figure 1

Cartons No. C-6212 and no. C-6287.

Reproduced by permission of the Schenectady Museum.

timeless, natural and comforting source of light, the sun, and a recently invented source, the Mazda lamp. In the advertisement, electric light is compared to natural light in the form of a personified, masculinized, happy sun suggesting that Mazda lamps are not a new, technological invention, but as “natural” as sunlight. The sun even smiles at the lamp, which is positioned just over New York State, the home of the General Electric Company, a positioning associating North America with advancements in lighting. Looking closely at the bulb, we see the new tungsten filament tagged for us with a Mazda label. Though sun and bulb are pictured equal in luminosity, the sun is positioned to suggest that it is setting behind the earth, while GE’s lamp—drawn larger than the sun—rises, implying that electric light is not only “The Sun’s Only Rival,” but its successor as well, possessing all the reliability and familiarity of sunlight.

It is difficult to evaluate how familiar the general public of the day would have been with Persian mythology and, therefore, difficult to gage how many people would have made a connection between the modern Mazda trademark and its ancient namesake. Without such a connection, “Mazda” may have only served to identify the bulb’s technology for consumers. “The Sun’s Only Rival” slogan, however, is an attempt to establish a direct connection between the quality of industrial Mazda lamps and that of a



supposedly universal image of light that would have been difficult to miss. Moreover, the use of this image was widespread and diverse. Beyond functioning as an advertisement in magazines, the design could be found on all packaging until 1916, and on promotional items and serially in window displays.¹⁹ The saturation of multiple spaces backed by the repetition of a single image and slogan not only encouraged people to internalize the associations forged by the image of the sun, globe, and GE's Mazda lamp, but made such associations nearly impossible to resist.

As historians of this period of advertising have argued, this strategy of marketing mass-produced, industrial products as a natural part of traditional ways of life was not unique to General Electric, and could be found in a variety of advertising during these years including that for goods as diverse as Quaker Oats—whose religious figure evokes colonial life in America—and Kodak cameras—where, in one ad, the mass-produced picture machine is represented as a natural part of “a Christmas morning” shared by mother and daughter.²⁰ Yet, it also is important to recognize the sophisticated visual languages at the heart of GE's strategy, as well as the new graphics and advertising professionals who crafted them. A comparison with the first General Electric advertisement for its lamps placed in the *Saturday Evening Post* just ten years before the Mazda campaign is telling.²¹ Apart from a crude drawing of a lamp, the ad is dominated by text in a single, serif type emphasizing the function, wattage, and cost of the bulb. This ad could have been composed by a freelance copywriter or job printer, and then placed in a newspaper or magazine by an advertising agent.

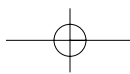
By contrast, the design and production of “The Sun's Only Rival” is dramatically different. The dimensions of the ad are much larger than the earlier one, and there is a new emphasis on the visual. The color illustration dominates the design and, while the text has been reduced to a slogan accompanied by product trademark and company logo, the visual qualities of the typeface receive greater emphasis than before. Rather than presenting a realistic representation of a light bulb and a description of its features, as the earlier ad had, the bulb in this ad appears in an imagined arrangement with the earth and sun framed by the dramatic claim of the slogan. On the packaging for the bulbs, there is a new attention to design elements such as borders, spacing, and symbols. These changes, from blocks of text outlining the practical qualities of a product to an awareness of the visual and emotional power of design, mark a new mode of public communication that combines images and text in an emotional appeal. General Electric's Mazda lamps were popularly recognized as “The Sun's Only Rival” then not on the basis of any scientific rationale, but because that association was forged by the design of their advertisements.²²

19 Ibid., 119.

20 See, for example, William Leach, *Land of Desire: Merchants, Power, and the Rise of a New American Culture* (New York: Vintage Books, 1993); Jackson Lears, *Fables of Abundance: A Cultural History of Advertising in America* (New York: Basic Books, 1994); and Richard Ohmann, *Selling Culture: Magazines, Markets, and Class at the Turn of the Century* (New York: Verso, 1996), 29.

21 The advertisement was published in the February 4, 1899 edition of the magazine.

22 Nye makes a similar point when he notes that GE's Mazda lamp rivals the sun through the sheer repetition of its message rather than by a scientific comparison of the two sources of light.



“The Sun’s Only Rival” campaign was produced by GE’s Publicity Bureau. As a testament to the high level of centralization in the company at the time, in 1897, General Electric combined its advertising, publications, and photography departments into a single, comprehensive, in-house office, the Publicity Bureau.²³ Before the 1890s, advertising developed as a heterogeneous field comprising job printers, publishers, freelance artists, and copywriters. Within this network of enterprises, ad agents only were responsible for the placement of ads. At the end of the nineteenth century, however, as giant corporations with their bureaucracies and specialists emerged from the mergers of owner-managed businesses, advertising changed. Like their clients, agencies such as N.W. Ayer & Son and J. Walter Thomson came to dominate advertising by promoting themselves as experts, offering a complete range of services including design, copywriting, lettering, ad placement, and art direction. This professional status was supported by schools, associations, organizations, and industry publications that codified proper design practice and legitimized certain expert personnel. Though an internal department, GE’s Publicity Bureau was as complex and as specialized as those of its independent peers. By 1917, the Bureau had a staff of 242 full-time employees who produced internally-distributed company publications in addition to photographs, slides, films, press releases, pamphlets, advertisements, and promotional materials including posters and calendars to constitute a massive publicity machine filling all available outlets of public communication with messages that sought to train people to be consumers. According to David E. Nye, author of *Image Worlds: Corporate Identities at General Electric, 1890-1930*, the Bureau was tremendously powerful:

The bureau was something fundamentally new in American life, and the public possessed no countervailing force to deal with its massive publicity.²⁴

Orientalism and the Marketing of Desire

Beyond advertising, packaging, and displays, GE’s Publicity Bureau also used “The Sun’s Only Rival” design as a decorative motif on printed materials including calendars. While drawing allowed designers at GE to represent what photography could not at that time—the image of the sun and the view of the globe, for instance—to fulfill other representational demands, photographs became more important. Unlike other forms of imagery, such as drawings or prints used in early advertisements, this relatively new representational technology produced the illusion of an immediate, indisputable truth. Rather than representing electric light as the inevitable successor of natural sunlight, such promotional items exploited the cultural connotations of the Mazda mark in an attempt to naturalize lamps through photographic fantasies of a preindustrial and mystical Oriental way of life.

23 Nye, *Image Worlds*, 35.

24 *Ibid.*, 36.

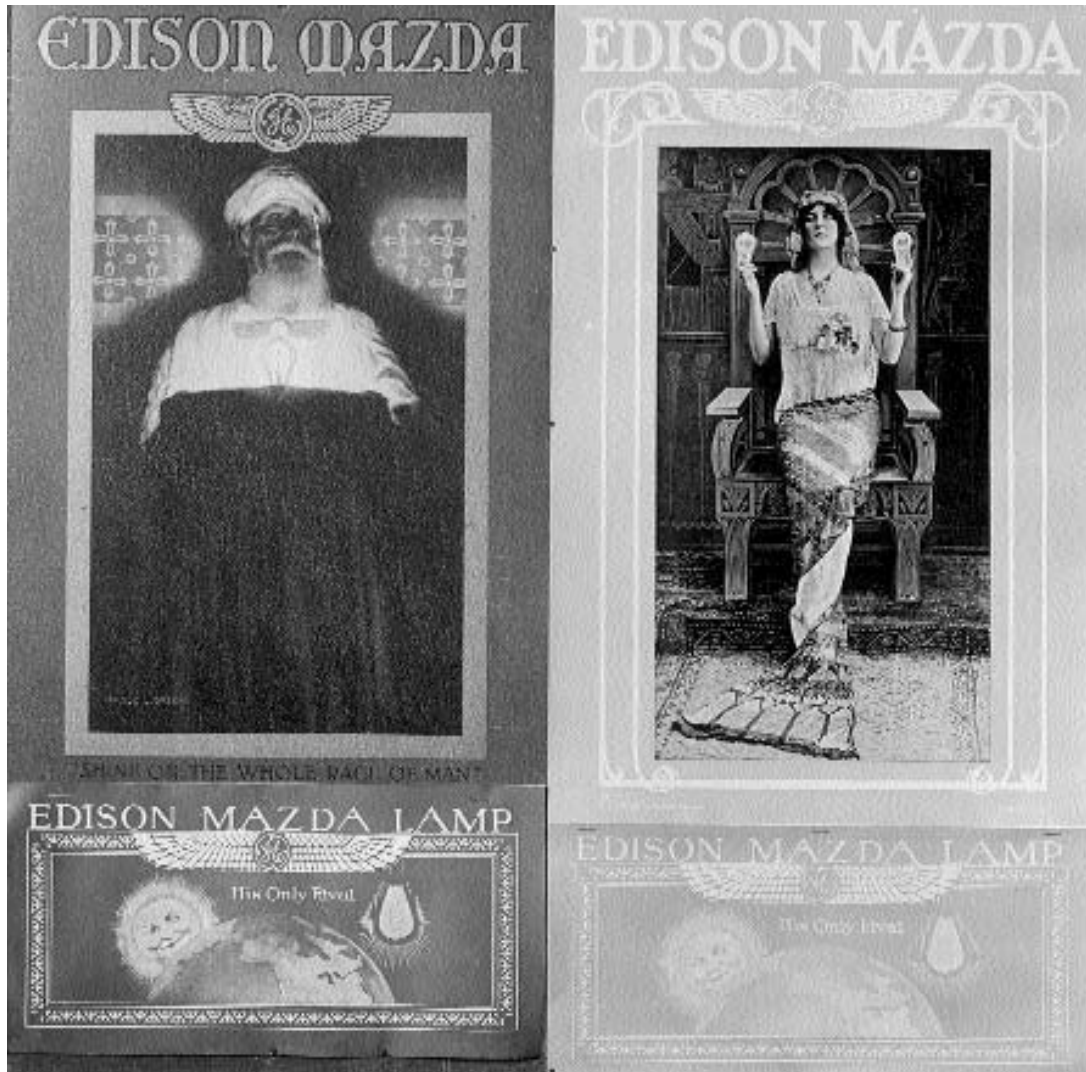


Figure 2
Incandescent Lamp Advertising Calendars
No. 112 and no. 113 for year 1913.
Reproduced by permission of Schenectady
Museum.

In 1913, General Electric published two styles of promotional calendars distinguished by their photographs of exoticized, Orientalist models. In one, a turbaned man stands behind a lectern surrounded by darkness except for a radiant light bulb he holds in front of his chest that dramatically illuminates his torso and face. In the other style, a woman wearing a headdress and wrapped in a light, patterned cloth and seated on an intricately carved, throne-like chair holds a light bulb in each hand. A scriptural font, Egyptian motifs, and decorative border details reinforce the Orientalism of the images. Far from technological, the light bulbs in these photographs are lit through human contact, glowing in the people's hands instead of in sockets, implying a familiarity and comfort with bulbs. The models hold the bulbs as though they are spiritual, ritual objects "in essential harmony with the past."²⁵ These

²⁵ Ibid., 120.

photographs, produced by GE's Publicity Bureau, appeared in advertisements for the bulbs as well.

Orientalist themes appear again in "The Lamp Seller of Baghdad," a 1922 calendar design by the professionally renowned commercial artist and illustrator Maxfield Parrish. With "The Lamp Seller of Baghdad," Parrish, who illustrated calendars for GE Mazda lamps from 1918 until 1934, uses the story of Aladdin to market Mazda bulbs.²⁶ In the illustration, a turbaned male lamp merchant is seated on a rug surrounded by his wares, while a woman wearing a turban stands and inspects a lamp. The two figures are in shadow, framed by an Islamic-styled archway. In contrast, the background is filled with turbaned men bathed in acidic light. Above the scene a banner reads, "Edison Mazda," the name separated by the image of a lit Mazda bulb. The illustration also uses many of the same Islamic motifs of the earlier calendars. By associating Mazda bulbs with an Orientalist vision of oil lamps, the illustration attempts to convince consumers that electric light is as magical as the mysterious East it pictures. A popular image, Parrish's illustration was reproduced in many sizes and colors.

The lamps represented in these G.E. calendars are neither a new, functional technology nor the successor of sunlight, as with "The Sun's Only Rival" ad, but part of a romanticized, Oriental culture whose traditions have yet to be affected by the upheavals of industrialization. Within this framework, the specific historical meaning of Mazda is sacrificed to present a generalized Orientalism. The trademark simply becomes one more element through which the fantasy is constructed.

Orientalism has been called "Perhaps the most popular of all merchandising themes in the years before World War I."²⁷ Thus, GE's turn to Orientalism to market Mazda bulbs was part of a larger advertising trend. In addition to Mazda, brands that were identified through associations with the fantasy of a decadent and luxurious East include Orient Delights candy and Fatima, Mogul, Omar, and Camel cigarettes. The vast commercial application of Orientalism in the United States can be attributed to the demands of commerce and the reach of national distribution networks and marketing. In *Fables of Abundance: A Cultural History of Advertising in America*, Jackson Lears argues that the generation of fantasies of an exotic East was "central to the expansion of the consumer market."²⁸ Lears suggests that the more industrial the United States became, the more images of the East functioned for the public as a fantasy of a return to life before industrialization.²⁹

Though images of an exotic Oriental culture typically were being used to sell mass-produced commodities such as cigarettes and candy, GE's use of Orientalist imagery marks a departure. The marketing of national, mass-produced brands, such as Oriental Delights, worked to mask the decidedly modern character of products behind an aura of the sensual pleasure of a culture whose tradi-

26 Parrish produced other Orientalist illustrations for magazine covers, candy advertisements, and commercial posters based on scenes from the popular novel of the day, *The Garden of Eden* by Robert Hichens. See Leach, *Land of Desire*, 52–5 and 110.

27 Leach, *Land of Desire*, 104. *Noble Dreams, Wicked Pleasures: Orientalism in America, 1870-1930*, edited by Holly Edwards (Princeton, NJ: Princeton University Press, 2000) and John M. MacKenzie, *Orientalism: History, Theory and the Arts* (Manchester and New York: Manchester University Press, 1995), 48 and 89 also discuss the use of Orientalism as a commercial trope in the United States at the turn of the twentieth century.

28 Lears, *Fables of Abundance*, 51.

29 *Ibid.*, 104.

tions have not been affected by industrialization. By contrast, GE's images for Mazda used contradictory appeals: the allure of a preindustrial Oriental culture and the benefits of modernization. On the one hand, the Orientalism of Mazda advertising draws on consumer desire for an imagined, primitive Orient and magical concepts of light to market advancements in lighting technology as though it were the next natural stage in the evolution of lighting. On the other hand, the Mazda brand signaled technological innovation and service excellence to the masses, and that cutting-edge industrial technology is literally tagged in the ads through a Mazda label that identifies the distinctive technology for consumers.

Conclusion

Mazda marked an important and innovative strategy that redefined what a brand could be. By branding the cutting-edge research and development of lighting technology upon which their market dominance was built, GE created a mark that, unlike previous brands, was not bound by the particular characteristics of an individual product. Yet, the development and use of the Mazda trademark was neither simple nor straightforward. GE's Mazda brand was caught up in a complex network of events at a time of dramatic and unsettling change in the United States. Its development was driven by the corporate consolidation of the American lighting industry and the centrality of research and development to General Electric's domination of a national lamp market. As compelling and complex as the changes in the lighting industry in the United States were the concurrent transformations occurring in advertising. The advertising, packaging, calendars, and other promotional materials through which the Mazda brand was marketed were crafted by a new, professional class of imagemakers who utilized dramatically new and complex visual languages to naturalize GE lighting technology. Initially, associations with the sun were used to create the illusion that Mazda lamps were a familiar and accepted part of life. Later, with the rise of Orientalism as a vastly popular and lucrative merchandising theme, electric light was naturalized through fantasies of a preindustrial Orientalist culture in which electric light naturally seemed to belong.

The Backtalk of Self-Generated Sketches

Gabriela Goldschmidt

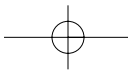
Introduction

Drawing and sketching are activities all humans engage in, at some level or another, as of a very young age (if not deprived of the sense of sight). In developed societies, toddlers use drawing implements to make marks on paper. In less-developed societies, children and adults use sticks to draw on sand. Why do children draw? It seems that for a child, drawing is a form of play, with developmental benefits similar to those of both symbolic play and construction games (play typology instituted by Piaget and Inhelder¹). Most people acquire enough drawing skills during childhood to make graphic production an accessible strategy whenever pictorial representation is more effective than linguistic representation in communication and reasoning. For some communication and reasoning tasks, however, ordinary drawing skills are not sufficient, just as linguistic skills acquired during childhood are not necessarily adequate for sophisticated verbal and written expression tasks. A better command of language makes for better orators and reporters, and a better command of drawing skills makes for better illustrators and decorators. A special class of representational skill, linguistic or graphic, is the one needed for inventive purposes: this is the case of the poet, the visual artist, and the designer. The inventive process does not require wider skills: not necessarily a larger vocabulary or unlimited graphic techniques. Rather, what is required is an ability to use the representational act to reason with on the fly. Usually, this is a “front edge” process in which partial and rudimentary representations are produced, evaluated, transformed, modified, refined, and replaced by others if need be, until their maker is satisfied with the results. The unique thing about such processes is that, since they involve ill-structured problem-solving, it is not clear at the outset where the process is leading to, and what the end result might be.

In this paper, it is our purpose to look at the way in which sketching assists in generating ideas and strengthening them by interpreting the “backtalk” of a sketch in progress,² or one that has just been completed. We use a developmental axis to illustrate our claims. We start with children and show how they “read” new information off their sketches or drawings, and use it to define or refine the rationale for their representations. We then show how designers habitually practice a similar process in the early idea-generation phase of the design process.

1 J. Piaget and B. Inhelder, *The Psychology of the Child* (New York: Basic Books, 1969).

2 D. A. Schön, *The Reflective Practitioner* (New York: Basic Books, 1983).



First Scribbles

Children under the age of three years produce scribbles to which they are able to attribute after-the-fact representational meaning.³ In fact, they do not attach meaning to a whole drawing, or scribble, but to parts of it that comprise angular curves.⁴ Researchers found that two graphic schemas are involved in the making of these early scribbles: smooth-inertial and angular-intentional curves. The latter require a slower production speed and a change in direction, and result in breaking points and more closed shapes, which are believed to be richer, that is, to convey more information than smooth lines. Young children who were asked to interpret line sections in drawings, attributed representational meaning to angular curves, whereas smooth lines were referred to in nonrepresentational terms (such as “line” or “circle”). However, the representational signification was suggested only when a child referred to a drawing he or she had just completed. Earlier drawings by the same child and drawings by a peer (or an adult) received a different or no representational interpretation. In addition, the attribution of meaning when it occurred was seldom spontaneous and for the most part, was given in response to a question. These findings lead to the conclusion that a very young child does not intentionally make a symbolic representation, but reads representational meaning into it after its completion. Although a certain amount of arbitrariness certainly is present in such “readings” (a different or no meaning given when revisiting the drawing later), they are not entirely arbitrary. Proportions of enclosed figures were reminiscent of those of the signified objects: for example, a narrow, oblong curve signified a banana, whereas a rounder one stood for a bulky object, such as a car.

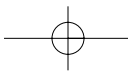
Somewhat older children produce preplanned representational drawings, and are particularly skilled when depicting favorite objects, people, or scenes that they draw repeatedly. Inventories of such favorite entities include several standard items (e.g., person, house, sun, tree) using conventional schemas, which appear to be largely universal. However, when attempting to represent something new, or when experimenting with new materials or media, children abandon their conventional representation behavior.⁵ The experimental drawing is more concerned with the act of drawing, and when experimenting, children are likely to attribute after-the-fact interpretations of their drawings.

Thus, it appears that even at age two, before a child produces preplanned representational drawings, he or she is able to infer representational meaning from certain elements of a self-produced scribble. The nature of the attributed meaning derives from two sources: the properties or shape of the figure referred to, and entities the child is preoccupied with (toy, food, family, etc.). Later on in childhood, experimentation and uncertainty trigger similar inference of representational meaning, as the experimental act produces results which are not entirely anticipated. In what

3 See, for example, H. Werner and B. Kaplan, *Symbol Formation* (New York: Wiley, 1963).

4 All references to young children's drawings pertains to E. Adi-Japha, I. Levin, and S. Solomon, “Emergence of Representation in Drawing: The Relation Between Dynamic and Referential Aspects,” *Cognitive Development* 13:1 (1998): 25-51.

5 NR. Smith, “How a Picture Means” in D. Wolf, ed., *New Directions for Child Development* 13 (San Francisco: Jossey-Bass, 1979), 59-72.



follows, we show that these characteristics of graphic production are especially robust. They are maintained through adulthood, and are exploited by expert sketchers in the process of designing. To fully appreciate the way in which sketching actually engenders meaning, we describe and analyze in detail one vignette from an older child's drawing activity.

Invention in Drawing

Naomi is nine years and seven months old. When she was younger (four to five years old), she liked to use building blocks to build "models," which also included improvised components such as small toys and various found objects. In these creations, she represented familiar buildings or sites (e.g., her home town), often with additional features that she must have desired to see added such as, in one instance, a swimming pool.⁶ Protocols of conversations with Naomi indicate that the additional, invented features were clearly intentional, although their inclusion in the construction may not have been premeditated.⁷ This pattern, observed in three-dimensional representation, appears to be preserved in later two-dimensional representation as well. Let us examine an example from Naomi's documented drawing activity.

Naomi, now a fourth grader, likes to draw and she is open to new, exploratory activities. She welcomed an opportunity to participate in what was termed "a drawing game." In this game, she is shown a picture (source) and she reacts to it by making a drawing (target), while talking out loud. Each game session is recorded and yields a protocol. The present source is a photograph [Figure 1] depicting three persons sitting on a bench. A man and a woman [M and W1, respectively] joined in an embrace, and another woman [W2] who leans her elbow on the man's shoulder. The photograph shows the backs of the three figures, a water body they face and a narrow built-up strip of the bank on the other side of the water body.

Naomi described the picture and its meaning as follows:
 ...And a man and a woman [W1] embracing, and another woman [W2], with a miniskirt, and this picture gives me this feeling that there are a man and a woman who are in love, and there's this woman, [who is] terribly ... She ... looks at the sea and thinks these deep thoughts to herself, imagining that she [W2] was with them, as if the other woman [W1] were not there... And the woman [W2] imagines she is with him She wishes that, one day, the [other] woman [W1] would die and she [W2] would be with him; or that they would break up and she [W2] would be with this man. This man, he is back from the army, you can see his uniform. And that she [W2] would be with him and the [other] woman [W1] would be jealous....

6 G. Goldschmidt, "Development in Architectural Design" in M. B. Franklin and B. Kaplan, eds., *Development and the Arts: Critical Perspectives* (Hillsdale, NJ: Erlbaum, 1994), 79–112.

7 Experiments with nine-to ten-year-old children who built three-dimensional "models" that represented invented houses for a heroine of a well-known children's story, yielded similar tendencies (see Goldschmidt, "Development").



Figure 1 (above)
Source photograph.⁸



Figure 2 (right)
Naomi's target drawing.

Naomi now proceeds to make a drawing “about the things she [W2] imagines”: her being with the man, while the previous girlfriend [W1], now rejected, looks on with envy. She starts by drawing a long bench, then she draws a couple—a man and a woman [M and W2] who stretch their arms towards one another. After the details are rendered (clothing, the man’s beard), she adds another woman [W1], with a cartoon-style bubble that elucidates her thoughts (“Why did you leave me and choose her?” in Hebrew). Naomi completes her drawing with a water body, buildings on the other bank (she confirms the scene takes place in the site shown in the source photograph), and she adds a large sun (upper left corner) and a cloud (above buildings). The drawing is reproduced in Figure 2.

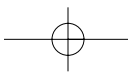
Source and Target Representations

We would now like to compare the two representations—the source photograph and Naomi’s target drawing. We are particularly interested in Naomi’s commentary on features of her drawing that are not traceable to the source photograph.

Naomi swings between standard symbols and drawing conventions, and representational features that are neither standard nor conventional. Standards include the depiction of the sun and cloud, but also some of the clothing items. For example, since she identifies the man in the photograph to be a soldier, she is upset when she discovers she had forgotten to draw his cap at first, and insists on adding it later. Facial expressions also are a case in point: an example is the way in which she draws the persons’ mouths, to indicate the mood they are in:

“... this one [W1, right] is sad, you can tell by the mouth. I made the mouth twisted downwards. And her [W2, left], the mouth twisted upwards.”

8 Courtesy of W. C. Rauhauser, *Untitled Photograph*, in catalog of *The Family of Man* (Exhibition curator: Edward Steichen) (New York: Maco Magazine Corporation for The Museum of Modern Art, 1955), 130. Black and White, 61/2" x 61/4".

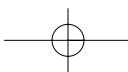


Of particular interest are instances in which Naomi used a convention, but one that is at odds with the photographic depiction. We would like to dwell on two examples: the buildings in the drawing, and the way in which hair is represented. The buildings Naomi draws are rather prominent—much more so than the ones in the photograph, which are barely hinted at. The buildings must have held a special meaning for her, as she starts her description of the photograph with them, before any mention of the “actors” in the scene. In the drawing, however, the buildings are added at the end. While drawing the buildings she says:

“And then there are these towns one saw in the back. These buildings... Everything was lots of tall buildings. It’s this kind of town, of the past.”

The experimenter asked what a “town of the past” was, and Naomi replied that they have “lots of tall towers.” The experimenter, who sought to reach a better understanding of the appearance of tall buildings in the scene, asked about them again in the debriefing after the session. Naomi explained: “That’s how I wanted it... I saw [in the photo] the tall towns...quite high. Like from far away.” She seemed to not comprehend what it is that the experimenter could have possibly failed to understand. Since she could not have inferred her vision of “tall towns” from the photograph, the experimenter speculated that she could have been under the influence of a previous “drawing game” played a few hours earlier, in which the source was a painting by Heronimus Bosch that features towers. She asked: “Do you think it could have something to do with the former picture, about which you said it was like many years ago?” Naomi answered: “No, there is no connection.” Influence of the Bosch painting would have explained Naomi’s image of an old town with tall buildings. If this is incorrect, as Naomi insisted, we have no information that could explain this move. We must conclude that interest in old and tall buildings that originated elsewhere penetrated the process, and was acted out in this drawing. As we shall see, several other moves Naomi made were not a direct consequence of the given information (photo), but rather her own interpretation of what was embodied in the source, reinforced by information she “imported” from extraneous sources.

The second example of “imported” information concerns the representation of hair. Unlike in the photo, the women in the drawing have long, straight hair. In the debriefing the experimenter asked Naomi: “...both have long hair, right?” Naomi replied: “Yeah. That’s how it says that they are women....” Her answer reminds us of her representation of the women’s mouths, intended to inform us in what mood they are. The experimenter asked Naomi to look at the photo again and asked: “Is it like that in the photo as well?” Naomi replied with confidence:



“In the photo—no, one has curly hair [W2] and the other has her hair gathered, sort of [W1]....But [in my imagination] she [W2] sees herself prettier than her [W1].”

She went on to explain that “...she [W2] sees the other [W1] like with long hair, and not very much hair.” The experimenter asks whether a lot of hair is prettier, and Naomi confirms: “Yes, like in her [W2] opinion.”

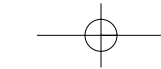
This exchange points to two conventions that Naomi apparently maintained: first, that long hair signifies a female figure in a pictorial representation; and second, that the longer the hair and the more there is of it, the prettier the depicted figure is supposed to be. Naomi did not remember that a few weeks earlier she attempted a portrait of the experimenter, who happens to have curly hair. In the portrait her hair was straight. When asked about it Naomi said, in congruence with her current statements, that this was how you drew a woman’s hair. But she also added that she had drawn it this way because she did not know how to draw curly hair. The convention is therefore double-fold: it reflects Naomi’s aesthetic values on the one hand, but on the other hand it bears evidence to her representational repertoire, which is limited and is not intended to reproduce reality but to interpret it using a set of predefined symbols.

This is a cogent example of the way in which Naomi constructs—designs, if we prefer—a situation whose elements are inferred from the source, from her memory, and from her repertoire of conventions equally forcefully. She subscribes to the view that female figure representations should exhibit straight hair, and this becomes an overriding imperative. Whether the knowledge and the conventions she relies on are valid or not, is of no relevance in terms of what gets represented.

Next, we look at the way in which Naomi dressed the women in her drawing. The seemingly naïve dresses turn out to be very surprising from a representational point of view. Clothing is an essential property of human figure representation. Naomi was attentive to what the persons in the photograph are wearing: she immediately noted that one of the women [W2] wears a miniskirt, and that the man is in uniform. When she drew the man she commented that he had “[a] short-sleeved shirt. Pants.” (As we have seen, she later added his cap which she had forgotten while drawing the soldier.) She proceeded to draw his present sweetheart [W2]:

“With a dress. I made a dress with a large heart in the middle. She is a little fat, because she is pregnant.... Yes. That’s how I want it. That’s what she dreams.”

She added the rejected former girlfriend [W1] and drew a heart on her dress, too. In the debriefing, the experimenter returned to this issue and asked why the girlfriend [W2] had a dress with a heart. Naomi explained:



“Because she loves him. And she is pregnant. As if she were his wife.... And the other one loves him too, that’s why she [too] has a dress with a heart. The other one, too.”

The experimenter wondered: “But the one who is his girlfriend or his wife has a big heart, and the other one has a small heart?” Naomi came up with an unexpected answer, which she elaborated on when the experimenter asked what made her think that the woman was pregnant:

“...Besides, she is pregnant...” “First I made the tummy, like this, and also too swollen, so I thought OK, I won’t say she isn’t pregnant from him, ‘cause she’s his wife...that’s what I imagine she wants.”

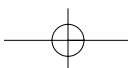
Sketching as Modulator of Problem Space

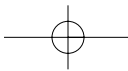
In addition to what we may learn about the remarkable grasp of the state of human affairs by this 9-year-old, we also gain a wonderful insight into her representational behavior. As a matter of convention, she draws a dress. The dress appears rather “swollen” to her, so she decides that it would make sense to attribute the swelling to a pregnancy. We do not know whether an event in her life made the connection between man and woman and a pregnancy a particularly attractive idea, or one that she was preoccupied with. But the most interesting thing about her statement is the fact that she decided on the pregnancy interpretation because the dress was accidentally drawn too large. In other words, this was not a premeditated notion, but one that resulted from Naomi’s reading of what Schön called the drawing’s “backtalk.”⁹ She also stated, when asked about the big heart on one woman’s dress versus the smaller heart on the other’s, that in the latter case “there was no room”: the dress was not drawn wide enough to place a big heart in it. The interpretation was not based on information contained in the stimulus or source photograph, but it was congruent with the meaning she attributed to the depicted scene and therefore could be adopted easily. It also is possible that it was the experimenter’s question that triggered the pregnancy response. If so, Naomi’s after-the-fact attribution of meaning to her represented figures resembles that of the younger children described above, and we believe that this is indeed the case.

Naomi illustrates a principle stating that “one reads off the sketch more information than was invested in its making.”¹⁰ When a sketcher, in this case Naomi, starts sketching, he or she often has only a vague and rudimentary idea of what is about to be represented. As the activity of sketching proceeds, new (graphic) relationships are created on the sketching surface. If the sketcher is attentive to them, he or she may see in them clues to further meanings that can be read into the representation: this frequently is the case in early stages of the design process, as we shall relate later on.

⁹ Schön, *The Reflective Practitioner*.

¹⁰ G. Goldschmidt, “On Visual Design Thinking: The Vis Kids of Architecture,” *Design Studies* 15:2 (1994): 158-74, cit. 164.

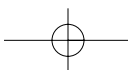


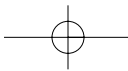


The added meanings enrich the rationale of the representation and a “story” (scenario) is developed. The more “layers” there are to the story, and the more “supportive evidence” can be built up through the details of the representation, the more consistent and credible, and therefore more powerful and “better” the story is. The ability to infer information from the self-generated sketch and to use it in order to enhance the sketcher’s ability to deal with a task or problem at hand may be seen as an expansion of the problem space within which the individual is working. As new arguments are generated and the story is being developed, it acquires a rationale of its own, with implications for the problem and its possible solution. As we shall see presently, sketching activity also may restrict the problem space. Therefore, we see the activity of sketching as modulating the problem space.

Two further examples from Naomi’s protocol illustrate the way in which sketching modulates the problem space. The first has to do with multiple justification. A case in point is the hearts Naomi drew on the dresses. For all we know, they may have originated from a mere wish to decorate the dresses, although it is quite possible that they were intended from the outset as symbols of their owners’ love for the man. However, whereas the hearts’ varying size reflects disparities in the ladies’ relationships with the man, we, also are told that the size difference results from a technical dissimilarity between the spaces in which the hearts were to be inserted. (Incidentally, an unbiased observer may find the two dresses equally wide or “swollen.”) In addition to demonstrating that the actual act of sketching produces new information that becomes a supplemental, dynamic resource, this episode reveals how important it is to the sketcher to build a strong rationale for his or her emerging story, or interpretation, through multilayering. This tendency is frequently displayed in design-related sketching, where a scenario is created that elucidates and justifies the designer’s decisions and choices.

The second example of problem space modulation has to do with representational techniques. In parallel with the use of conventions (e.g., the way in which the mouths and hair are drawn), Naomi deviates from the source photograph in accordance with what her skills allow her to do. In her drawing, the persons appear to be standing, whereas they are seated in the original depiction. A standing position is the default portrayal mode of the human figure, and easier to represent than a sitting figure. Had she been asked, it is conceivable that Naomi would have said that she drew them standing because she did not know how to draw reclining or sitting figures (similar to her earlier “confession” regarding her inability to represent curly hair). Likewise, Naomi drew her figures in profile, while in the photo “you see it only from behind.” Whereas the default representation of the human figure tends to be a frontal view, Naomi was a sufficiently skilled sketcher to be able to use the





profile mode. This was a better choice in this case because it made it easier to draw the figures stretching their arms and looking at one another. Had Naomi been less skilled, the representation may have been reduced to a frontal view that possibly could be less expressive. Technical skill and choices of technique therefore may contribute to either the expansion of representational expression (profile), or they may constrain them (standing position only). In the next section, we shall discuss how generic sketching evolves into a professional design activity, and we shall show how sketching skills may enhance design-like invention, whereas the lack of such skills may actually restrict design problem-solving.

Sketching Skill and Design Expertise

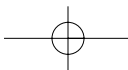
Paper and the Advent of Sketching

Sketching has a relatively short history: we detect its origins to the late-fifteenth century in Europe, an age of innovative developments in the arts and sciences, supported by inventions and novel technologies. One of the most important inventions of the renaissance was moveable-type printing, leading to the establishment of printing presses first in Rome (in 1467) and later elsewhere in Italy and throughout Europe.¹¹ The rapidly developing book printing trade paved the way for a growing paper industry, since the demand could no longer be met by handmade paper. It did not take long before artists and designers (who were one and the same, for the most part) started to consume paper for the purpose of making drawings. Since paper of good quality became affordable and readily obtainable, artists availed themselves, for the first time, of the luxury of making study drawings, better known as sketches. The desire to experiment, and to revise and look for alternatives which the activity of free-hand rapid sketching supported, of course was in perfect harmony with the innovative spirit of the renaissance. Therefore, the assimilation of sketching into artistic and design practices was quick to occur. Most appropriately, the incomplete, partial, rapidly hand drawn images on paper that we refer to as study sketches were called “pensieri,”¹² meaning “thoughts” in contemporary Italian. Sketches were then, and still are today, an aid to thinking and, we maintain, under certain circumstances, their making is thinking itself.

There is a marked difference between the way in which sketching on paper is utilized by different sketchers. As we have seen, young children do not make study sketches: they make drawings that represent objects, scenes, and events, real or imaginary. Older children and adults continue to make drawings with similar objectives, but they also attempt to represent abstract concepts via diagrams, patterns, and symbols. They draw to depict and describe complex configurations that are better conveyed through pictorial images than through words, and they engage in sketching in preparation for a neater finished rendering. None of these activities

11 F. Ames-Lewis, *Drawing in Early Renaissance* (New Haven, CT: Yale University Press, 1981).

12 E. J. Olszewski, *The Draughtsman's Eye: Late Renaissance Schools and Styles* (Cleveland, OH: Cleveland Museum of Art/Indiana University Press, 1981).

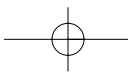


matches our definition of study sketching, which is practiced by individuals who attempt to conceive of a new entity, be it a work of art, a building, a technically-oriented invention or novel artifact, or a scientific concept. The description and specification of the new entity that is being brought into being in those instances entails shapes and forms. The sketcher represents candidate shapes and forms, their parts and features, and relationships among them. Freehand sketching is rapid and direct, and therefore cognitively economical, and provides instant feedback: the sketcher can enter into conversation with his or her materials.¹³ Because a search process takes place, the sketcher normally is highly sensitized to possible clues, including unintended configurations that result from his or her sketching activity, and which can potentially trigger development. Naomi's pregnant woman, as a result of a dress that has been drawn a little too wide, is a cogent example. We must also add that, since the problem the sketcher is trying to solve often is rather complex, the search comprises multiple steps, and normally numerous representations are produced, sometimes in long series of sketches.

How useful sketching is in search processes of this kind depends to a large extent on the designer's skill. Sketching skill comprises two independent components. The first is fluency: it is required for the sketcher to be able to use sketching without having to spare attention to the actual production processes. In that sense, exercising sketching skills resembles exercising any other skill. The second component of the skill applies only to designers of three-dimensional artifacts: a good command of the system of orthogonal projections. Orthogonal projections, another renaissance innovation, enable the precise and complete description and specification of any object on the basis of simple mathematical rules. It is the foundation of technical drafting that is used in engineering, architecture, and other design disciplines to describe and later to manufacture artifacts or construct closures for space. Among others, it enables the representation of aspects of artifacts and spaces that otherwise are impossible or very difficult to visualize. In Evan's words: "Few things have had greater historical significance for architecture than the introduction of consistent, coherent parallel [orthogonal] projection into architectural drawing...."¹⁴ A skilled sketcher (in the context of design) is one who is trained in the use of orthogonal projections, and whose fluency of production extends to include the representation of configurations using this system. Without it, the sketcher's studies are confined to "exterior" and readily visible aspects of the entity that is being designed. A truly skilled sketcher can be expected to take considerable liberties when making study sketches, such as the prioritizing of certain projections, shortcuts and incomplete representations, hybrid representations, and so on.

13 Schön, *The Reflective Practitioner*; D. A. Schön and G. Wiggins, "Kinds of Seeing and Their Function in Designing," *Design Studies* 13: 2 (1992): 135-56.

14 R. Evans, *The Projective Cast: Architecture and Its Three Geometries* (Cambridge, MA: MIT Press, 1995), 108.



Papert's Dilemma

The expert sketcher therefore is someone who can make and manipulate representations fast and with great ease while choosing the most appropriate projection(s). If he or she is a designer, this skill is indispensable in the search that is part of, indeed the most significant part of, the design process. The following vignette will illustrate this point. Seymour Papert (prominent MIT Media Laboratory professor emeritus) is an amateur cook who, according to his own testimony, spends considerable time in his kitchen and values its spatial and visual qualities.¹⁵ He described a problem he did not know how to solve: he lives in a small apartment in which the kitchen was an internal space, not adjacent to an exterior wall and, therefore, without a window. A hallway with a window along its side separated the kitchen from the exterior wall, so Papert cut a large opening into the partition between the hall and the kitchen, hoping to command an outdoors view across the hallway while working in the kitchen. The result was disappointing, because the vista he gained was more limited than he expected. In explaining this to a designer, he used a simple plan of the kitchen and hallway that he was able to draw quite confidently. He was very surprised when the designer suggested that they needed a different representation, and proceeded to sketch an approximate section on the basis of Papert's plan and description. On the section it was easy to point out which dimensions controlled the view Papert possibly could obtain (height of kitchen counter, windowsill, etc.). For the designer, this was a very simple problem and recourse to a sectional drawing was an obvious move. To Papert, a most original and creative thinker in other fields, and not a stranger to a drawing implement, it had not occurred that studying his problem required a representation other than a plan.

The Primacy of Sketching

Imagery has been acclaimed as the most useful cognitive faculty in tasks that require the solving of novel, design, and invention-like problems.¹⁶ Some researchers have claimed that imagery is, in fact, so powerful that paper-based sketching is redundant in designing.¹⁷ We propose that this is not the case, at least not when problems are complex, and we will present empirical evidence to this effect.

Imagery and Sketching

Goldschmidt¹⁸ has proposed that, in the context of design, sketching serves as an extension of imagery; she refers to it as "interactive imagery." Other researchers of design advance similar claims.¹⁹ This characterization implies a circular feedback loop between two kinds of pictorial representation: internal representation in imagery, and external representation on paper or some other sketching surface. In this view, mental images inform the making of a sketch, but the sketch-in-the-making includes "autonomous" properties that result

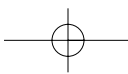
15 Personal communication, 1988.

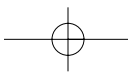
16 E.g., G. Kaufmann, *Imagery, Language and Cognition* (Bergen: Universitetsforlaget, 1980).

17 U. A. Athavanker, "Mental Imagery as a Design Tool" in R. Trappl, ed., *Cybernetics and Systems Research '96: Proceedings of the Eleventh EMCSR* (Vienna: Austrian Society for Cybernetics, 1996), 382-7.

18 G. Goldschmidt, "The Dialectics of Sketching," *Creativity Research Journal* 4:2 (1991): 123-43.

19 For example, J. Fish and S. A. Scrivener, "Amplifying the Mind's Eye: Sketching and Visual Cognition," *Leonardo* 23 (1990): 117-126; T. A. Purcell and J. S. Gero, "Drawing and the Design Process," *Design Studies* 19:4 (1998): 389-430; M. Suwa and B. Tversky, "What Do Architects and Students Perceive in Their Design Sketches? A Protocol Analysis," *Design Studies* 18:4 (1997): 385-403.



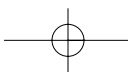


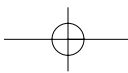
from emerging relationships among its elements (i.e., lines, dots, etc.), some of which may be unintended. These properties are interpreted in ways that are meaningful to the sketcher within the framework of the task, or within the problem-space in which he or she is working. In turn, these interpretations inform the generation of new mental images. Ascribing meaning to the unintended consequences of a rapidly made (freehand) sketch is what enables the sketcher to use it as a source of new information. This is what is meant by the previously quoted assertion claiming that “one reads off the sketch more information than was invested in its making.” If we accept these premises, an inevitable conclusion is that sketching is a tool that has the potential to enhance design reasoning. This is the case particularly in the “front edge” conceptual phase, when the designer is actively searching for ideas and information that may help generate, or fortify, a design rationale and a design story. It therefore would appear that, by definition, using sketching or interactive imagery in developing design concepts has advantages over consulting only images, which fade away rather quickly. By way of extension, we therefore would assume that other kinds of creative invention in imagery also would benefit from the use of sketching.

Finke²⁰ has reported the results of an intensive research program on creative invention in imagery. The tasks his subjects were given consisted of combining three arbitrarily selected shapes into meaningful new items, in two or three dimensions. (Some shapes depicted objects, others described geometrical entities. In each experiment, three shapes were drawn from a set of 15.) Blindfolded subjects performed the task in imagery within two minutes. The resultant configurations, which were to represent useful objects, were then described and drawn by their authors, and assessed for their creativity by naïve judges. The findings indicated that people could easily make creative discoveries in imagery. This work inspired a whole line of research that has come to be known as “mental synthesis.” As part of this research program, Anderson and Helstrup²¹ also asked whether allowing people to sketch while using imagery to develop inventive creations enhances creativity. They concluded that there was no evidence that sketching added significantly to the rated creativity of imagery-based inventions. (They did find that the use of sketching facilitates a larger number of creations.) These results provoked additional studies regarding the same question.²²

Kokotovich and Purcell obtained results similar to those of Anderson and Helstrup, with a few qualifications. In Verstijnen’s studies, subjects were divided into expert and novice sketchers who undertook combinatory creation tasks styled after Finke. As in other studies, Verstijnen et al. found that equal creativity rates apply across conditions. The next step was to classify configurations made by the subjects into two categories, according to the moves that were made: combinatory and restructural. The former included

-
- 20 R. A. Finke and K. Slayton, “Explorations of Creative Visual Synthesis in Mental Imagery,” *Memory and Cognition* 16 (1988): 252-7; R. A. Finke, *Creative imagery: Discoveries and Inventions in Visualization* (Hillsdale, NJ: Erlbaum, 1990).
- 21 R. E. Anderson and T. Helstrup, “Visual Discovery in Mind and on Paper,” *Memory and Cognition* 21 (1993): 283-93.
- 22 See, for example, V. Kokotovich and T. Purcell, “Ideas, the Embodiment of Ideas, and Drawing: an Experimental Investigation of Inventing” in J. S. Gero, B. Tversky, and T. Purcell, eds., *Proceedings of the International Conference on Visual and Spatial Reasoning in Design (VR’01)* (Sidney: Key Centre of Design Computing and Cognition, University of Sidney, 2001), 283-98; I. M. Verstijnen, C. van Leeuwen, G. Goldschmidt, R. Hamel, and J. M. Hennessey, “Creative Discovery in Imagery and Perception: Combining Is Relatively Easy, Restructuring Takes a Sketch,” *Acta Psychologica* 99 (1998): 177-200.





positioning of elements adjacent to others (horizontally, vertically, or diagonally), or inside of others. The latter comprised size variations among components, embedding, modification, subtraction (a component taking the shape of a void in another component), altered proportions, and complexity of junction (where one component penetrated another). These features of the configurations were counted and “transformation complexity” scores were assigned to the subjects (across trials). Results were then calculated for the two categories separately, and correlated with conditions (imagery with and without sketching) and expertise (experienced and inexperienced sketchers).

The distinction between combinatory and restructural moves turned out to be very revealing. Whereas no significant differences were found in the overall transformational complexity score between with-sketch and without-sketch conditions (as in Anderson and Helstrup, where no distinction was made between the two categories), this picture changed when the categories were pulled apart. Expert sketchers scored higher in restructural categories in the with-sketching condition than in the without-sketching condition; no effect was found on combinatorial scores. Novice sketchers did not score higher in one or the other category across sketching conditions. The main conclusion from this study is that “restructuring ... occurs when expert sketchers are allowed to sketch,”²³ and we believe that this has most important implications for design.

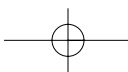
Real world design tasks are obviously far more elaborate and “messy,” and require more complex operations (and a larger inventory of candidate shapes to consider) than the two-minute, three-element synthesis tasks we have described. As we have shown, restructural operations involve a greater complexity (though not necessarily more sophistication) than combinatory actions. Therefore restructuring is all but a must in the solving of complex synthesis problems and in particular ill-structured problems, of which design tasks are an example. It is for this reason that Gestalt psychologists claimed that solving novel problems requires productive thinking, a process that involves restructuring of the problems.²⁴ Verstijnen et al. supplied empirical evidence that sketching is compatible with restructuring, where the problem requires visual manipulation and where the problem-solver is an experienced sketcher. It is our contention that it is the sketch’s backtalk, and the ability of the sketcher to read meaning into it and discover new plausible interpretations of it, that makes this possible. That imagery has limitations compared to perception is well known and documented; consider, for example, our poor ability to reverse ambiguous figures in imagery.²⁵ When it comes to conception and the reasoning that it entails, imagery is a powerful tool. Kosslyn²⁶ maintains that a special case of attention-based imagery makes it possible to create images of novel entities that had never been perceived. We have shown, however, that in the hands of expert

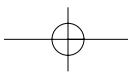
23 Verstijnen et al., “Creative Discovery,” 197.

24 Eg., K. Duncker, “On Problem Solving,” *Psychological Monographs*, 58: 270 (1945); whole Issue; M. Wertheimer, *Productive Thinking* (Chicago: University of Chicago Press, 1945/82).

25 D. Chambers and D. Reisberg, “Can Mental Images Be Ambiguous?” *Journal of Experimental Psychology: Human Perception and Performance*, 11 (1985): 317–28.

26 S. M. Kosslyn, *Image and Brain* (Cambridge, MA: MIT Press, Cambridge, 1994).





sketchers, sketching stretches and sustains the “trial and error” exercises that imagery allows one to engage in, and increases the complexity of cognitive operations that can be performed. It therefore is a design resource that can be tapped when a task calls for it, and an emerging body of research appears to support this assertion.²⁷

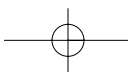
Reasoning With Self Generated Displays

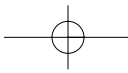
What do designers say about the role of sketching in the idea-generation phase of their work? And how can we assess their insights into their own processes? We should start by saying that designers vary in respect to their sketching activity, both in terms of how much they sketch (and their preferred styles of sketching) and how useful they find it. In addition to individual differences, there also are domain characteristics (e.g., architects are known to sketch far more than engineers) and task differentials. We will limit our comments to sketching in the area of architectural design.

Architects like to surround themselves with visual displays that serve, we postulate, not merely as décor for the workplace, but also as potential sources for visual information (shapes, colors, spatial relations) that may be useful in a new design task. Casakin and Goldschmidt²⁸ have shown that providing architectural designers with visual displays increases the rated creativity of their design solutions. (A further increase in creativity scores is registered when subjects are explicitly asked to use analogy in conjunction with these displays in solving the given design problems.) We may associate these findings with results from MacKinnon’s studies on personality correlates of creativity.²⁹ In these studies, architects (and particularly those rated “highly creative”) scored higher than other professionals (including scientists and artists) in the Gottschaldt Figure Test, in which subjects are required to isolate and identify simple geometric shapes that are embedded in larger, more complex figures. Taken together, these findings appear to suggest that experienced architectural designers are in the habit of searching for “hidden” information in visual displays, which they know to be useful for their work.

If viewing ready-made displays is so useful, one may ask why do architects go to the trouble of making so many sketches? Should it not be sufficient for them to ensure themselves of an adequate supply of displays, and make use of them as needed? The answer to this question is not so simple. That sketching is a contributing factor is suggested by the fact that architects still choose to sketch, despite the availability of already existing displays. There may be several reasons for that including, for example, the pleasure that can be derived from this activity, and the ability to use sketching to test, and not only generate, ideas and concepts. However, we know that architects sketch long before they have testable ideas, and even when failure to reach desirable results

- 27 Eg., O. Akin and C. Lin, “Design Protocol Data and Novel Design Decisions” in N. Cross, H. Christiaans, and K. Dorst, eds., *Analysing Design Activity* (Chichester: Wiley, 1996), 35–64; M. Suwa, J. S. Gero, and T. Purcell, “Unexpected Discoveries and S-Inventions of Design Requirements: A Key to Creative Designs” in J. S. Gero and M-L. Maher, eds., *Computational Models of Creative Design IV* (Sydney: Key Centre of Design Computing and Cognition, University of Sidney, 1999).
- 28 H. Casakin and G. Goldschmidt, “Expertise and the Use of Visual Analogy: Implications for Design Education,” *Design Studies* 20:2 (1999): 153–75.
- 29 D. W. MacKinnon, “The Personality Correlates of Creativity: A Study of American Architects” in P. E. Vernon, ed., *Creativity* (Harmondsworth: Penguin Books, 1970), 289–311.





fast enough leads to frustration and discontent. Therefore, we return to the hypothesis that sketching is useful in the generation of design ideas. What added value does sketching offer, as opposed to the scrutiny of other displays?

Two premises underlie our reply to this question. The first is simple and straightforward: we propose that sketches, too, serve as displays. We refer to them as self-generated displays. The second premise is a hypothesis: we propose that consulting self-generated displays is, for the most part, cognitively more economical than seeking useful information in other displays, whose potential to harbor such information varies randomly with the nature of those displays.

Most ready-made visual displays that architects utilize are not specifically selected to suit a particular task. Reference material can be gathered, including precedents (e.g., images of buildings that belong to the same type), but these have no advantage over random material when it comes to clues for new ideas in terms of spatial configuration. Indeed, most celebrated works of architecture that have documented process histories appear to rest on ideas that can be traced to concepts and images found far away from the building type in question, and often outside of the realm of architecture altogether. The self-generated display has the advantage of control over what goes into its making (but not over what can be read off it!). It is, therefore, not random, or much less so than a ready-made display. Moreover, the expert designer knows from experience what kind of display might prove useful and, without curtailing his or her propensity for experimentation, may avoid a cognitively costly search from which no useful outcome may be expected. Designers know this intuitively.³⁰ Here is how one of them described her sketching behavior at the “front edge” of designing:

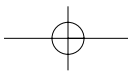
I can't get very far with just thinking about it without drawing something...I tend to overlay when I use pencil...they [overlays] are usually pretty similar.... I also do a lot of erasing. I like to erase because I like to have a lot of lines on the page. I like fuzzy stuff. I can see things in it more than I can in harder-lined things. So, sometimes I just get a lot of lines out and then I start to see things in it. A lot of times, I pick up things I think are important. I put down potentials and then erase down to them.³¹

We see how this designer customizes her display to achieve properties that she knows are potentially promising for her way of working. We should note her preference for “fuzzy stuff”—ambiguity of representation—is a known characteristic of the problem-space in ill-structured problem-solving. It is useful because it helps defer commitment to a solution.³² Of equal interest is the account of the use of overlays and the employment of an eraser. By using overlays, the designer achieves great flexibility in performing a variety of

30 Without elaborating on the concept of intuition and what it means to know something intuitively, we would like to offer the following insightful commentary by Harbot: “It [intuition] is a mix of constructs, such as imagery and narrative formation, with an underlying basis of experience... Operationally, in this context [the role of conscious intuition in structured problem-solving activity], intuition is the process of imagining something that turns out to be true. By “true,” I do not mean to imply correctness in the logical sense but only in the sense that the thinker is willing to act upon his or her conclusions.” B. Harbot, “Thought, Action and Intuition in Practice-Oriented Disciplines,” in R. Davis-Floyd and P. Sven Arvidson, eds., *Intuition: The Inside Story* (New York: Routledge, 1997), 129-44, cit. 135.

31 Goldschmidt, “The Dialectics of Sketching,” 129.

32 V. Goel, *Sketches of Thought* (Cambridge, MA: MIT Press, 1995).

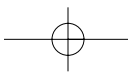


transformational acts she may choose to exercise and experiment with (e.g., shifting, rotating, and flipping over a layer in relation to other layers). It also supports experimentation in that layers may be easily removed (discarded or saved for future reference), should an idea prove futile.³³ The eraser allows her to delete whatever she decides to eliminate on a more permanent basis. Working with layers of trace paper on which one can make marks and erase them at will is very rapid and direct: no cognitive resources are invested in conversion from one representational system to another (e.g., computation language to graphic display or vice versa). Assuming that the sketcher is an expert and therefore fluent and a master of the language of orthogonal projections, this technique is most efficient in terms of the “mileage” one can expect from one’s investment in representation. As a “bonus,” sketching in general, and work with layers in particular, allows one to review the entire history of design moves in a given session concurrently. Revisiting concepts that were earlier abandoned for insufficient “design rationale” may become relevant later on when such a rationale is being constructed, and having a visible record of a previously entertained concept may help remember and reactivate it. These are the properties that make sketching so cognitively economical, and therefore so attractive to designers.

For our purpose here, the most important assertion in the vignette above is the designer’s statement that she can “see things in it” [her fuzzy sketch] more than in harder-lined drawings. Hard-line drawings are produced according to strict rules, and they usually are made when a design has reached considerable coherence and completion. They are necessary in order to examine and test many of the properties of the design, but they lack the qualities that make sketches so economical and therefore are not used in the early idea-generation phase of designing. A hard-lined drawing can easily be made by anyone, not necessarily by the original designer. In a sense, it is then quite similar to any other display that is not self-generated, and no longer has the same potential for harboring unexpected clues (nor is it expected to have that potential). In contrast, the fuzzy, incomplete, and inaccurate rapid sketch works in a manner somewhat similar to a Rorschach test inkblot, into which one can read meanings that are obviously derived from sources other than the inkblot. The self-generated sketch talks back, and its backtalk reflects some of the sketcher’s innermost, tacit, otherwise untapped knowledge, biases, concerns, and preferences.

As we have seen, the ability to interpret self-generated sketches and “excavate” them for information is inherent: children do it, and they start doing it as soon as they start to produce representations, as early as at age two. Experienced designers do not require an external prompt such as an experimenter’s question to infer meaning from a sketch: they produce the sketch in order to

33 Goldschmidt, “Serial Sketching: Visual Problem Solving in Designing,” *Cybernetics and Systems* 23 (1992): 191–219.



have a dialogue with it, and the sketch's backtalk is the reward they get for bringing it into being.

Conclusions

The special role of sketches in design processes is distinguishable from the role of other images and visual displays that are used to support the design process. Designers make sketches because the sketch is an extension of mental imagery, and therefore has the freedom of imagery to retrieve previously stored images and to manipulate them rapidly. At the same time, because it leaves a hard trace of these images on a visible surface, and because this is an additive process, the sketching surface soon contains unforeseen configurations and relationships among the graphic components. The resultant displays are open to new interpretations, and if one consciously looks for them, they can be generated with relative ease using additional input from the designer's memory structures. This is an inherent cognitive ability that we all share, and we have evidence that it is at our disposal as of a very young age. Designers cultivate this ability and exploit it, adding formal rules for efficiency and comprehensiveness of representation (e.g., orthogonal projections), because it benefits their idea-generation processes. At present, it is not yet clear whether mediated sketching such as is possible using computational tools can produce similar effects: this is a question that can and should receive high priority on our research agendas.

The writing of this paper was partially supported by a grant to the author from the Fund for the Promotion of Research at the Technion. A first version of the paper was presented in the VR'99 Conference, MIT, in June 1999, and published in the conference proceedings: J. S. Gero and B. Tversky, eds., *Proceedings of the International Conference on Visual and Spatial Reasoning in Design (VR'99)* (Sidney: Key Centre of Design Computing and Cognition, University of Sidney, 2001), 163–184.

