Dataism

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ABSTRACT

Dataism is a term coined to designate computer art. In contrast to the iconoclasm of Modernism, in general, and Dadaism, in particular, Dataism restates traditional aesthetics through formal practices. Dataist works are not singular *objets d'art*, but algorithmic procedures and digital data bases that have a symbolic description. They can be perfectly duplicated and widely distributed. Dataist artworks can appear to exist in three dimensions and move in the time dimension, but they may be entirely synthesized, that is, a manifestation of imagination.

Dizzyingly rapid changes in the fine arts during the past century have induced a measure of exhilaration. When Dadaists promulgated a Manifesto, their critical attack on the mystique of illusionist art was bracing and refreshing [1]. Defiance of tradition was liberation, and the arts again brimmed with raw creative energy. Much as a log fire can be stoked to burn with renewed vigor until its last fuel is exhausted, each emerging art movement was excoriated long before it could impose its nascent discipline on an entire generation of artists. The twentieth century has given us little to build upon other than an institutionalized iconoclasm. Now this process has run its course. Today the dead embers of modern art may be feverishly stirred by contemporary cognoscenti, but there is no new light. Those who have championed Schnabel are fully worthy of the double entendre implied by his assemblages of cracked pots [2].

What has happened? The twentieth century obsession with novelty for its own sake is reviewed in Robert Hughes' study of Modern art, *The Shock of the New* [3]. Contemporary artists fly in the face of established aesthetics, reasonable expectations, conventional wisdom, or other constraints forced upon them by social norms and art history. Theirs is an Age of Outrage; they have a compulsion to offend. Hughes pronounces Modernism moribund. This sentiment is seconded by critic Suzi Gablik, whose treatise, *Has Modernism Failed?*, raises the specter of a self-perpetuating art market in which aesthetic base metal is transformed into gallery gold through an arcane curatorial alchemy [4].

Central to the alchemical formula of successful art marketing is the purveyance of unique collectible objects. Original *objets d'art* are distinguished from copies by a broad divide. The premier scandal of the collector's world is to be defrauded by a copy. Since the singularity of an object becomes a measure of its worth, the emergence of reproducible media such as lithography and photography creates a dilemma. This dramatic shift from painting, a technology little advanced since the Stone Age, seems to intimidate even the unflappable Robert Hughes:

> Because nothing could be retrieved or reproduced . . . the pretechnological eye was obliged to scrutinize—one thing at a time. Objects and images could not, except at the cost of great labor, be reproduced or multiplied. . . . Today, the object splits into a swarm of images of itself, clones, copies. Mass production strips every image of its singularity [5].

One solution to the marketability of reproducible media, actually practiced in lithography, has been the deliberate destruction by the artist of a master template after it has produced a finite number of copies. While this approach might satisfy the craven dictates of the marketplace for *objets d'art*, the consequences are regressive to the culture as a whole. The evolution of literature from handwritten manuscripts to printing press reproductions illustrates my point. Hughes' protests notwithstanding, the availability of books sharpened appreciation for the written word, even among collectors. To have limited the number of copies for the sake of enhancing the market worth of each copy would have ill-served our civilization, to say nothing of how it would have limited the circulation of John Hughes' thesis.

The issue of duplicable visual art media will not go away. With the advent of computers, the problem has resurfaced. Digital copies are identical to their masters. Scratching an original plate does not work here. Since each digital copy is itself a perfect master, the artwork is the data that describes it. For the purpose of this inquiry, I will call computer art Dataism and its proponents Dataists. A contrary allusion to Dada is deliberate.

FOUNDATIONS

Our cultural heritage has been transmitted to us, and the arts have played a key role in the transmission. A dynamic culture such as ours has accommodated change. Constructive or destructive, the changes are premised on a knowledge of precedent, for it is knowledge that is evolving. A broad foundation of precedent offers many choices for artists seeking expression, because they enjoy a broad set of aesthetic premises.

How do visual artists formalize an aesthetic so it can be transmitted? Obviously the works of art themselves embody aesthetic intent, but is there a detailed formalism expressing the process of creation? Certainly art historians have been able to identify cultural periods that produced works sharing a common aesthetic. However, these analyses have proceeded without the benefit of a specialized language that was invoked by the artists during the creative act. A clear contrast exists with Western music. It has compositional formalism complete with a notational system.

The role of notation in the development of Western music has been significant. Without the compositional score, the evolution of now-familiar harmonies and orchestrations would have been stunted. The notational system reflects an aesthetic, a system of discrete sound frequencies

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and temporal progressions. From this foundation rose musical creations that rank among our culture's greatest intellectual achievements. The transmission of these works from their composers to our ears depends largely on the acceptance of a formal abstract language and its notation.

There is some precedent for abstract formalism in the visual arts, particularly in architecture. The rigorous mathematical discipline of geometry gave artists and artisans notational and computational tools for designing buildings and decorations. During the Renaissance the formalism of perspective drawing was introduced, and this procedure has been employed by many subsequent generations of visual artists. But for the large part, image-making has been an intuitive pursuit, carried out by talented individuals whose inspirations are manifest in their work but whose methods are subjects of conjecture.

Dataism brings with it an innate formalism, because computers are machines programmed using procedural languages. In order to create images on a computer, the artist must invoke specific processes that are expressed in a defined notation. Images that are themselves very large data bases may be created from compact and manageable algorithms that automatically calculate complex images point by point. Even so-called 'paint' programs, which mimic the tactile application of color on canvas, are precise, detailed programs. Computer art calls upon the mathematics of geometry, including perspective rendering, linking Dataism with the extant foundation of visual formalism. Future developments promise to be much broader than any precedent, because mathematics has broadened enormously since it last played a role in the arts.

Mathematics is not a visual art. The void that separates the creative artist from the creative mathematician rarely has been bridged, the Renaissance being a period of notable exceptions. Yet recently, collaborations have spontaneously formed around the computer screen. In the sciences, the flood of data pouring from engines of calculation has been dammed up behind the CRT, triggering a need for visual thinkers. Artists stand at the ready, for they have already been drawn, moth-like, to the flickering light.

These Dataists will now build a foundation for aesthetic structures. Their work will enjoy an integrity that is possible only when a common language is used to communicate the processes of creation from generation to generation.

PRACTICES

When photography was invented, the status of representational painting began to wane. The camera produced realistic images with such facility that, by the turn of this century, the talent of a draughtsperson could be eclipsed by any rank amateur toying with his Kodak box camera. Photography, a triumph of technology, precipitated a diversion in the fine art mainstream away from illusionism.

Photography may have diverted some artists from traditional practices to forms of expression beyond the reach of technology, but many artists embraced the emerging image-making technologies. These artists then had the challenge of bringing the traditions of art to technology. Photographs intrinsically possess much of the realism found in representational painting, but there is a catch. Commonplace reality is not necessarily as beautiful as the ideal imagery depicted in the great classics. In fact, photography may have proven better at capturing the banal, the pathetic, the comic, and the ugly than ideal beauty. Ideals exist only in the mind. The photograph documents reality, not fantasy.

To reach the ideal, an attempt was made to place fantasies in front of the camera. This invoked the appearance of other arts as the subject for the photographer, particularly theater with its retinue of writers, players, directors, set designers, costumers, cosmeticians, puppeteers, et al. When motion pictures were invented, so was the 'fantasy factory' of the film industry. The camera operator became primarily a technician serving at the pleasure of other creative artists who preconceived the work and took primary credit for its success.

Limitations aside, moving pictures altered a basic assumption about visual art—that images were static. The manipulation of time gave the filmmaker an awesome new power of expression. The camera operator could dynamically change the window of view with a mere twist of the camera. Armed with no more than a pair of scissors and a pot of glue, the editor could alter time and place. As in music and theatre, deep emotions could be evoked by artificially changing images. This artifice was an art. It was visual art. It was new art. However, it remained dependent upon what was placed in front of the camera for initial recording.

The ultimate cinematographic technique for the manipulation of time is animation. For fine artists dedicated to bringing aesthetics to technology, stop action photography provided a path to outwit the uncompromising realism of photography. Since the audience could not see what was going on while the camera was not looking, media magicians were able to practice the sleight of eye, the *trompe d'oeil*, that makes imagination manifest.

Painters and draughtspersons were attracted to animation, but the price exacted in toil and treasure tended to compromise artistic integrity. An individual practicing creativity in the tradition of the solitary artist was faced with the Herculean task of feeding a medium that consumes up to 24 images a second. Pioneers such as Oskar Fischinger and Len Lye made heroic efforts, but both artists ultimately returned to the creation of objects: paintings and sculptures [6].

When the resources of the industrial fantasy factories were summoned to provide armies of draughtspeople, creative inspirations were diluted to conform to the economies of the mass audience. Fischinger tragically encountered this dilemma during the production of *Fantasia* [7]. Moreover, industrial factories were not capable of producing images of classic beauty. The term 'cartoon' came to imply a reduced standard of finesse in visual art. Characters were reduced to caricature, and stylization was often the forced by-product of an economy of means.

I do not wish to dismiss the sincere efforts of creative artists working in the media of photography and filmmaking but rather to identify a critical weakness in practice. There is a litmus test to assay the practical limits of a medium; namely, does it *make the imagination manifest?* In photography and film, so much depends on reality, i.e. the objects being recorded, that there is an unavoidable verisimilitude in style among all works in these media. Animation offers the potential for greater variety in visual style, but primarily through the intervention of the classical plastic arts: drawing, painting and

sculpture. Painting and sculpture are versatile art media, accommodating virtually any visual preconception. Artists of every stripe have expressed their divergent visions through these ancient art forms. Can photographs and films accommodate such diversity?

Consider this archaeological paradigm. To decorate their caves, Cro-Magnon artists used silhouettes deposited by objects held against a surface and sprayed with smoke or pigment. This process created permanent negative shadows, suggestive of photographic contact printing [8]. The creative horizons of such an art are limited. Although contact printing allows anyone to make some kind of image, it prohibits the making of most images. The medium that survived these Paleolithic times was another contemporaneous invention: painting. Over 10,000 years of practice have shown that, with painting, imagination alone is the primary limit of expression.

The visual similitude among films, at least in comparison with the varied styles found in painting, may partially explain the slow acceptance of cinema as fine art. Television seemingly would have fared no better, since it was originally conceived of as instant cinema. However, the translation of camera-recorded images into an intermediate representation as electronic signals presented artists with some, perhaps unanticipated, possibilities: processing and synthesis.

Most video effects are not far removed from process photography and have ample precedent. Superimposition, split screen, matting, blue screen recording, contrast enhancement, edge enhancement, and pseudo-colorization have photographic equivalents. However, video processing permitted the instantaneous production of these 'special' effects, restoring some of the creative spontaneity of painting that film had removed. Photographers work in the dark, both literally and figuratively, due to the delay between exposure and processing.

Video synthesis, the creation of images without cameras, has virtually no precedent in photography and filmmaking. An electronic signal is generated to fit the technical specifications of a camera signal, but the point of origin is within the electronic circuits themselves. Synthesis demands formalism both in the design of circuits and the resultant imagery. Typically, synthesizers produce two-dimensional geometric shapes, reminiscent of traditional decorative arts.

Video synthesis opened a new realm of expression—visual music. The visual vocabulary in video synthesis is relatively small, if carefully selected. Synthesizers are the kind of specialized, well-defined instruments that lend themselves well to communications protocols. Both traditional music and contemporary electronic music offer instruction on appropriate practices to formalize the new art. However, video synthesizers cannot begin to encompass the entire realm of visual imagination. The promise of visual music is that within its defined vocabulary of expression will be found an aesthetic of the same universality that makes aural music so emotionally evocative [9].

Whatever the limits of video synthesis, the production of images from nothing more than electrons is reminiscent of painting's startling economy—illusions formed from little more than colored mud. With the inception of the computer, a single electronic tool stands between the preconception and the conception of a visualization. The correctly programmed computer can synthesize virtually any image.

Taming electrons to produce pictures presents challenges, especially as the technology passes through early stages of development. For some artists the technology may seem forbidding; but if the Renaissance is an instructive precedent, artists will submit contributions that fall outside scientific intuition. Making imagination manifest requires imagination. During the Renaissance, artists posed the problem of perspective and provided key intuitive solutions [10].

Datasists must engage in the process of reducing concepts to practice. One process is a recapitulation of the hand/eye coordination of the painter, carried out in the three-dimensional world of the sculptor. The artist grasps a stylus and draws in three-space—touching nothing, but imagining everything [11]. Another avenue is three-dimensional image acquisition, an extension of photography distinguished by the treatment of real objects as volumes rather than flat surfaces. Holographers have already pointed the way, but for Datasists the volumes must be captured numerically. Just as artists recognized the value of the *camera obscura*, their experimentation with range finding cameras will catalyze needed engineering developments.

Another major preoccupation for Datasists must be the display of their works. If they are three-dimensional, should they not float in space? Artists have already contributed to inventing these display technologies, such as filmmaker Lenny Lipton's electronically shuttered stereopticon [12] and the work of Dan Sandin, Mark Resch et al. in the field of parallax-barrier panoramagrams [13]. Artist holographers have developed their medium in the face of technical challenges that have tempered the enthusiasm of scientists. Today holography is best explored in museums specific to the process as an art [14].

Much of the three-dimensional work of Datasists is remarkable in that, unlike sculpture, its physical mass is that of the medium rather than the mass of a real object. The display itself is a real object, but the art is the image representation as data. With many implementations, one display can serve countless artworks, much as a television set exists as an entity separate from the videotapes it displays. This does not exclude a Datasist from making a solid sculpture based on the three-dimensional model, but such manufacture can postdate the formative creative process.

The dimension of time also falls well within the province of numerical analysis. Even a simple hand calculator is a tool of enormous utility in film and video editing. The strict formalisms of tempo in music may have evolved from an aesthetic necessity, and tempi deserve serious consideration in temporal visual art. Empirical data derived from recording video synthesis performances are one source of timing. These data can be characterized by analysis and can engender formalisms. Complex rhythmic structures that scarcely can be performed by a human [15] suggest that computed time relationships will open subtleties of expression.

Just as the economics of cinema are much more burdensome than those of still photography, Datasists must deal with the cost multiplier of making moving pictures. It can be argued that Datasist engines of calculation are an expense far greater than the price of paint. Just as artistic integrity is compromised by the huge budgets of the film studio, are not Datasists constrained by equipment costs? Again, I

turn to an archaeological example. In some primeval societies, red ocher was a decorative pigment available only to the privileged [16]. The silicon in a computer is smart sand, not a commodity destined to be forever dear.

When financial support is required, modest means can produce a telling sketch or sample of the funded work, inviting further investment. This is already the practice when a script, story board or pilot production is submitted to producers, but how can visual artists participate?

Consider that one expense in computer art is the measured resolution of the image. A motion image idea can be developed in low-resolution at low cost before a commitment is made to produce the final product [17]. Indeed, one low-resolution technology, the stroke display, presents a close analogy to the way in which a pencil sketch serves the painter.

Although large and expensive computers may be called upon in industrial production, a curious facet of the so-called Turing Machine is that any digital computer can achieve equivalent results. The tradeoff is solely in time of execution [18]. Although there is a thousand-to-one difference between a million versus a billion calculations a second, the humblest micro can take on the mightiest supercomputer when a timeless inspiration is at stake.

When the Dataist uses a computer, regardless of its size, some of the labor in production has been automated. In contrast to the practices of filmmaking, where large groups of collaborators must be organized, the Dataist calls upon programs and digital images from prior endeavors. With the development of their programming skills, Dataists can maintain the kind of creative integrity enjoyed by painters, composers and writers in their solitary pursuits.

The capacity to begin building where predecessors have stopped distinguishes Dataists from the devolving world of modern art. An impetus to refine and perfect prior art is a reversal of the iconoclasm found in Dada and similar anti-art movements. When practices of the past become resources of the present, practice makes perfect.

VENUES

Artists who use computers face a dilemma if they are lumped together by curators and critics solely on the basis of their medium. If computer art shows such as SIGGRAPH are primary venues, eclecticism blurs the distinction between styles of expression. The grouping of artists by their medium is a curator's convenience, but categorization of artworks by their style, content or historical cultural period is the preferred distinction for art historians and critics. The traditional media of drawing, painting and sculpture have been practiced throughout all history. They are generally grouped and exhibited according to their epoch.

On the other hand, the new media of photography, motion pictures, video and computers have burst on the scene within a single century. Moreover, their appearance has been sequential over time. In this unprecedented circumstance, it is not surprising to encounter the categorization of artists by their medium rather than by their style of expression. Different styles may be lost on those curators who cannot see beyond the medium each artist uses.

If computer art were routinely included in collections defined by style, the dilemma would be resolved; however, rarely is this the case. The new media are excluded from collections, in part because they are not collectible in a traditional sense. There is no singular *objet d'art* but rather a master template for striking endless copies. Collectors have small economic incentive to deal in cheap copies.

Ironically, the very media that are excluded from collections are routinely used as a service to document and study singular *objets d'art.* Computer image acquisition and analysis can produce objective data for archival documentation [19]. Lithographic reproduction of photographs can publicize specific pieces, augmenting market value of each object. Interactive video can tour through collections [20]; films can introduce practicing artists; computers can inventory collections.

The use of new media to document old media can be reversed. Works in old media—that is, drawings, paintings or sculptures—can be based on data generated by computers. The finished *objets d'art* then fit into conventional art collections. Ronald Resch's *Vegreville Pysanka* [21] and Jean-Paul Agosti's *Les Soixante-Treize Jardins* [22] are examples of this antithesis. Although ingenious, it is disingenuous to insinuate Dataism into the collectors' marketplace through a Trojan horse strategy.

A more enduring penetration of the fine art marketplace would call on the strength of Dataist art rather than mask it. For example, there is scarcely a museum that does not have an associated book store. These outlets provide some cash income for the museum, but the shops also bestow credibility on the works of art celebrated in the purveyed literature. Normally, one does not buy the curated artworks themselves in the museum book store, but Dataist art could prove the exception. Be it quality reproductions, videotapes or computer disks, the museum goer could return home with an equivalent to the art on display within the museum.

The museum book store venue presumes museum exhibition, not a likely scenario if collectors have a vested interest in non-duplicable art works. Yet risk-taking investors need not be deprived of their rightful earnings. Art patrons simply need to accept that one measure of worth will include the copyrighted works of music and literature. Ubiquitous distribution of perfect copies in these arts has not diminished the role of primary venues such as concert halls or libraries.

Exclusive social circles may consecrate artists from the avant-garde for exhibition in name galleries and prestigious museums [23], but Dataists can make a direct appeal to the public. The ubiquitous media of print and video can easily assimilate Dataist work. Color separations and video recordings are a windfall by product of computer graphics. Desktop publishing, electronic mail networks and computer bulletin boards give the Dataist communications routes to replace or bypass the cliques from which they are excluded [24].

A broadened marketplace for fine art does pose the question of univer sality, and this test of aesthetic merit presents a meaningful challenge. What makes a work of art attractive? Why do certain works endure? It takes far more than novelty to meet these criteria. The test is not how Dataism would fare as a yet another ephemeral 'Post Modern' fad laden with aesthetic non sequiturs. It is not sufficient to say, 'made with a computer'. The question is, How would a broad audience respond to ownership of these art works?

I believe that the qualities that will characterize successful Dataist art might be summarized in the word

'beauty'. This art will provide both immediate appeal and inexhaustible pleasure upon repeated viewings. Such criteria are not reserved for any one aesthetic. Dataism will encompass the work of many artists and many visions, but they will share an aspiration toward perfection.

SUMMARY

Conventions of the art marketplace, where objects are measured in worth by their singularity, are now challenged by Dataists, whose works are perfectly duplicable. Dataism posits that aesthetic merit determines worth. Dataists are developing a formalism by using computer programs to promulgate their artworks but, unlike sculpture, the works may have no physical mass. The time dimension can be invoked to produce visualizations that dynamically change. Limits in expression imposed by earlier forms of technological art such as photography, motion pictures and video are now being rolled back, because Dataist art is not camera-dependent. Dataism will supplant the moribund epoch of Modernism, its Establishment venues notwithstanding. In the arts, the power of beauty is greater than the beauty of power.

References and Notes

1. A section of the 1918 Berlin Dada Manifesto appears in Robert Hughes, *The Shock of the New* (New York: Knopf, 1981) pp. 68–71.

2. Gerald Marzorati, "Julian Schnabel: Plate It As It Lays", *Art News* (April 1985) p. 63ff. I cannot resist the temptation of labeling Schnabel a crack pot. He describes his method of assembling ceramic shards as "a prosthesis for painting". There is also a double meaning to the word 'prosthesis'. An argument could be made that Schnabel's work fits both.

3. Hughes [1].

4. Suzi Gablik, *Has Modernism Failed?* (London: Thames and Hudson, 1984) p. 63: "Increasing reliance is now placed upon a managerial elite of dealers and curators . . . ". Gablik's essay implies that the dematerialization of art, exemplified by conceptual and performance genres, is a way out of the economics of the art object marketplace. Unfortunately, she fails to address the dematerialization inherent in computer art, where the 'work' is an abstract algorithm or data base.

5. Hughes [1] pp. 324–325.

6. It is not surprising that Fischinger made hundreds of paintings after he stopped making films. He was one of the most prolific artists of this century, as his hand-animated films testify. Lye's kinetic sculptures demonstrate both the aesthetic of motion and the extraordinary technical finesse that appear in his films.

7. This story has been recounted to me by Elfriede, Fischinger's widow. The Disney animators insisted on including their anthropomorphic charicatures in what was supposed to be a work of pure abstraction. Oskar's uncompromising integrity caused him to quit the project, leaving him with a life-long sense of frustration and dooming his family to further poverty.

8. Alexander Marshack, "Exploring the Mind of Ice Age Man", *National Geographic* (January 1975) pp. 74–75.

9. John Whitney, *Digital Harmony* (New York: Byte Books, 1980); Tom DeWitt, "Visual Music: Searching for an Aesthetic", *Leonardo* **20**, No. 2, 115 (1985).

10. Fred Dubery and John Willats, *Perspective and Other Drawing Systems* (New York: Van Nostrand, 1983) p. 55ff; James Burke, "Point of View", in *The Day the Universe Changed* (Little, 1985) p. 72ff Renaissance artists used optics to paint images of startling realism, but it took Alberti, an architect and geometrist, to formalize what they were doing. One of Dürer's woodcuts shows artists experimenting with string to study perspective (cf. Burke, p. 76), but, of course, the process can be formalized mathematically.

11. Tom DeWitt and Phil Edelstein, "Pantomation A System of Position Tracking", *Proceedings of the Second Symposium on Small Computers in the Arts* (IEEE Computer Society, No. 455, 1982) p. 25.

12. L. Lipton, "Field Sequential Electronic Stereoscopic Projector", *Projection Display Technology, Systems, and Applications*, SPIE Proceedings, **1081**, Section 11 (January 1989).

13. D. J. Sandin, E. Sandor, M. Resch, B. Cunally, T. A. DeFanti and M. D. Brown, "Computer Generated Barrier Strip Auto Stereography", *Non-Holographic True Three-Dimensional Display Technologies*, SPIE Proceedings **1083**, Section 9 (January 1989).

14. There are museums of holography as art in New York, Chicago and Paris.

15. In my visual music videotape, *Philharmonia* (1974), time was divided into increments of 1/60th of a second over a total period of 25 minutes. A complex rhythm was developed which does not follow conventional tempo demarcation.

16. Some pre-Colombian societies used red ocher in their burial rituals. With no iron technology, they placed great value on this substance made from naturally occurring ferrous oxides.

17. Doug Lyon, "Mosaic" (RPI Image Processing Lab, 1984). Lyon's program produces 64 × 64 resolution test images to preview raytraced images that are then calculated to a resolution of 512 × 512.

18. Computers may vary vastly in their hardware, but they all share the same set of Boolean algebraic operators and generally can be programmed to perform the same algorithms. This similarity is sometimes referred to as Turing equivalence.

19. For example, Asmus and Berstein, "Computer Enhancement of the Mona Lisa" *Perspectives in Computing* **7**, No. 1, 11ff (1987).

20. William H. Honan, "The Museum of the Future: It's All in the Chips" *New York Times*, Section 2, p. 1ff (27 November 1988).

21. Melvin L. Prueitt, *Art and the Computer* (New York: McGraw Hill, 1984) p. 16.

22. Cynthia Goodman, *Digital Visions* (New York: Harry N. Abrams, 1987) p. 107.

23. Tom Wolfe, *The Painted Word* (New York: Farrar, Straus & Giroux, 1976).

24. For example, *F.A.S.T., The Fine Art, Science, and Technology Bulletin Board*, Raymond Lauzzana, ed. (International Society for the Arts, Sciences and Technology, Berkeley, CA, U.S.A.).