

THE WORLD OF

CHARLES AND RAY EAMES

Edited by Catherine Ince with Lotte Johnson

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Charles Eames admired the circus as a highly structured, moveable city that functioned on precision, discipline and imagination. It showed 'apparent license on the surface ... Everything in the circus is pushing the possible beyond the limit.' Filled with visual riches and focused staff, 901 Washington Boulevard was the Eameses' three-ring circus: furniture, films, exhibitions. By the 1960s, exhibitions were in centre ring (death-defying acts not required, time-defying ones certainly). Charles was impresario and ringmaster; Ray, his 'artistic conscience'.²

What we might call the Eameses' 'exhibition era' began in 1961 with *Mathematica: A World of Numbers ... and Beyond*, installed first in Los Angeles, then Chicago and, five years later, Seattle, all three iterations sponsored and maintained for years by IBM. *Mathematica* was followed by the IBM Pavilion at the 1964–5 New York World's Fair; *Jawaharlal Nehru: His Life and His India*, which started its global travels in 1965; *Photography and the City*, which opened at the Smithsonian Institution in Washington DC in 1968; and *A Computer Perspective*, presented in early 1971 at IBM's Madison Avenue showroom in New York with changing corner-window displays on astronomy. The era came to an end when *The World of Franklin and Jefferson* commenced its international tour in Paris in early 1975. A prodigious output.

Exhibitions are inherently ephemeral, yet more than fifty years after its first installation *Mathematica* continues to delight at two American museums, soon to be three.³ It is a brilliant visualization of mathematical theories and a classic manifestation of the intense Eames design process. Reflecting on its making, Charles observed: 'For the better part of a year we have been working, trying, building, talking and battling with mathematics – and with a patient mathematical consultant. It has been much the same hair-raising experience that accompanies any design problem, but with the added exhaustion that comes from perpetual excitement peaks.'⁴ The 'patient consultant' was Raymond Redheffer, mathematics professor at the University of California, Los Angeles (UCLA). In Redheffer, Charles found an intellectual sparring partner with infectious enthusiasm and an endless ability to brainstorm ways in which to present abstract ideas. On occasion, to make a point or ease tension, Redheffer, an able gymnast, would grab the office wall ladder and flip himself horizontally into a human flag.

In the spring of 1973, more than a decade after *Mathematica*'s opening, concept work on *Franklin and Jefferson* was burgeoning. Writing to his superiors at the United States Information Agency (USIA) after an exhaustive six-day, four-city photographic research trip with Charles and two Eames Office staffers, programme officer David Paul expressed the commitment required of an Eames client:

Eames' attack on a subject seems to be that of a discoverer – an inductive amassing and shifting and re-shifting of the data to find a meaningful pattern. It is the opposite of the more usual deductive approach – choose a thesis and then set out to document it, to build a case to prove it. This difference in approach makes some difficulties for us, for USIA. Discovery is hard to schedule, and the price of discovery is hard to quantify in the usual units. But if there was any logic in USIA's original choice of Charles Eames to do this exhibit ... we ought to make every effort, within the limits of our contractual process, to allow Eames to do his work in his way. I don't minimize the heroic patience this may entail.⁵

Ultimately, Charles convinced the USIA to transfer the project to the American Revolution Bicentennial Administration and secured the imprimatur of the Metropolitan Museum of Art, New York, with funding from IBM.

In creating exhibitions, one is often asked to grapple with such questions as: who is the audience? What do they want to experience? What will this hypothetical 'they' understand and find interesting? For Charles, these questions were irrelevant. He would typically respond, 'Don't tell me what you think others will find interesting or will understand, what do you find interesting?'⁶ Thus, those of us creating the exhibitions had to be personally excited about an idea, or we should not advocate its inclusion. At the same time, there was an underlying goal to serve all comers – 'to convey *our own* understanding, limited though it may be, in such a way that it has meaning for a non-specialist but isn't trivial or embarrassing for the person who knows most about the subject'.⁷

A formula that began with *Mathematica* – personal enthusiasm for a subject; a belief that, through the right design,

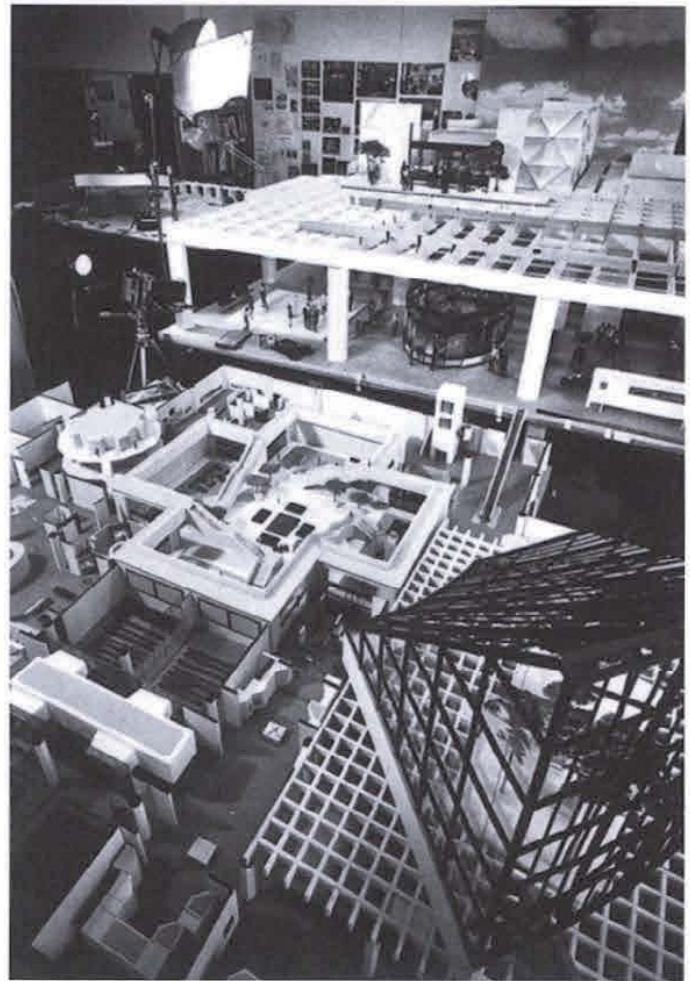


the Eameses', especially Charles's, excitement would be infectious to the exhibition's visitors; creative consultants with whom the Office could explore ideas and wrestle out solutions; and a willingness on the part of Charles and Ray to commit virtually the whole staff, not to mention clients and colleagues, to investigating myriad aspects of the topic at hand from diverse angles – was inherent in the development of all subsequent exhibitions. Three projects from the very heart of the centre ring – the National Aquarium, *Photography and the City* and *Nehru*, each commissioned by government agencies and developed without IBM patronage – offer different windows into the Eameses' exhibition-making process.

In the spring of 1966, the United States Department of the Interior, under the leadership of the pioneering environmentalist Stewart Udall, commissioned the architectural practice of Kevin Roche John Dinkeloo and Associates (KRJDA) to create a National Fisheries Center and Aquarium in Washington DC on an island in the Potomac located to the south of the National Mall. Roche invited Charles to develop the visitor experience. 'He had an ability to address the heart of the problem as he saw it. He dealt with process always, very carefully and methodically; he searched and searched. He had no preconceptions.'⁸ Malcolm S. Gordon, a specialist in marine locomotion at UCLA, was enlisted as scientific consultant. Gordon stressed the importance of research at the future institution, as well as aquatic environments that would educate as much as they would entertain. Conservation should be an underlying theme. Gordon's ideas were embraced by Charles and the team at 901 Washington Boulevard, as were the challenges Gordon noted – one of the most significant being how to dispose of large volumes of seawater without affecting the Potomac's ecosystem. 'If the Aquarium comes off well, it should produce a revolution in the nature of public aquarium.'⁹

To better understand the challenge (and provide images for the filmed concept report), saltwater tanks with more than seventy-five species of marine life were set up in the back of the Office, normally the domain of furniture design. Lights and a movie camera stood by, ready to take quick shots of interesting developments, such as the delicate movements of the tiny *Polyorchis haplus* or the antics of a small octopus. Numerous models also had to be built – at a scale of 1:12 for the main interiors and tanks, and still larger for specific elements, such as the multilevel coral reef and the rooftop ‘ecological greenhouse’, which Roche likened to the spine of a sleeping cat.¹⁰ In the spring of 1967, those of us making the models could barely stay ahead of the demanding shooting schedule to complete the film in time for Udall to present it to Congress later that year, just after its summer recess.

The National Aquarium was arguably the most ambitious project ever undertaken by the Eames Office. The answering of queries and the sharing of details with the office of KRJDA as it finalized construction documents continued periodically into 1970. In total, \$3 million of the \$10 million authorized by Congress was spent on planning, research, design and engineering. President Nixon recommended that the project be abandoned, however, and impounded the balance in early 1971. The National Aquarium survives today only as a small booklet and the concept film, a ‘fiction of reality’, created as a report to gain congressional approval.¹¹ If funding were forthcoming, it was hoped that the Aquarium would embody ‘the virtues of beauty and intellectual stimulation that one would be embarrassed to fall below’;¹² and if it were not, wrote Charles, the film would serve ‘to document our concept and to set a term of comparison for any further attempts’.¹³ Although never built in Washington DC, the project succeeded in influencing a generation of aquariums and gave



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Barbara Fahs Charles and Charles Eames discussing the installation of *Photography and the City*, May 1968
 Photograph by Margaret Thomas for the *Washington Post*

Glen Fleck and Ray Eames working on the model for the National Fisheries Center and Aquarium, June 1966

This page

1-inch scale model of the National Aquarium, 1967
 Photograph by Charles Brittin

School students visit *Photography and the City*, Smithsonian Institution, Washington DC, 1968

Opposite

Installation view of *Photography and the City*, 1968

Graphic design by Paul Brühwiler for Eames Office
 Poster for *Photography and the City*, 1968

Photomechanical print on paper, 88.9 × 58.4 cm (35 × 23 in.)

Collection of Robert Staples and Barbara Fahs Charles



Charles and staff at the Office a brief, intense opportunity to explore the natural world and advocate for its protection.

During the summer of 1967, with the Office working frantically to complete the film report for the Aquarium, Charles learned that Frank Taylor, director of museums for the Smithsonian Institution, was seeking the ideal consultant to develop *The Changing City*, an exhibition of 250 to 350 photographs exploring photography's relationship to the city – as a recorder of moods and tempos, as a tool for planning, as a reflection of the city's human inhabitants.¹⁴ It was planned as the first of six photographic exhibitions, precursors to a new museum of photography.

Initially, Taylor did not have Eames in mind for the role, but Charles's enthusiasm for the concept was infectious. It embraced three of his primary interests: photography in all its forms, architecture and urban planning, and science applied to understanding the environment. Despite an extremely tight budget of \$45,000 to research, design and produce the exhibition, the Office took it on with gusto. 'You know, of course, that this will have to be just about the best photographic show ever', Charles effused as we started our research.¹⁵ It was tempting to imagine an urban equivalent of *The Family of Man*, Edward Steichen's landmark photography exhibition at The Museum of Modern Art, New York, twelve years earlier.

By December 1967, the exhibition had a new title: *Photography and the City: The Evolution of an Art and a Science*. 'It is not a catchy title,' Charles noted to Frank Taylor, 'but we feel great enthusiasm for the way the material supports it.'¹⁶ Taylor's original concept of 250 to 350 photographs exploded to 1,500 as we gathered original negatives, first-generation copy negatives or fine prints from more than one hundred institutions and individuals in eleven countries.¹⁷ Charles searched the files of news agencies, and met with urban planners in London, New York and Boston. Newsreels, televised news reports and computer analyses expanded the visualization of urban activities and concerns. Images spanned both technique and time, from the first in-camera photograph, taken by Nicéphore Niépce in about 1827, to the most current events. Days before opening, photos were still coming in from Paris, showing the student protests, and from Resurrection City, the encampment of the Poor People's Campaign on the National Mall, just a short distance from the exhibition's venue.¹⁸ The vast majority of prints were made in the darkroom of the Eames Office.

Charles wrote all the accompanying texts, some in the last few days of preparation, dropping them down from his desk on the



balcony overlooking the exhibition to our workstation below to be marked up and sent off to the typesetter. The poster for the show states: 'Photographs selected and exhibit designed for the Smithsonian Institution by the Office of Charles and Ray Eames' – a direct assertion by the Eameses that they and their staff were as capable as any museum curator, and that they were proving it at one of America's most prestigious museums.

A gala opening in the Smithsonian's Arts and Industries Building was planned for the evening of 5 June 1968. Early that morning Robert Kennedy was shot in Los Angeles. The party was cancelled. *Photography and the City* opened quietly to the public the following day, not long after we learned that Kennedy had died, and would be on display until 1 January 1969. There was no newspaper coverage. To those of us who had worked so hard to create the exhibition, it felt like a non-event. Nearly four weeks later spirits were lifted when Wolf Von Eckardt, architecture critic for the *Washington Post*, wrote a review – the only review – praising the show for making 'an already interesting subject positively exciting ... [The Eameses] have made exhibition design a new art form, much as documentary films have become a new art form.'¹⁹

Von Eckardt's endorsement was extremely gratifying, but Charles's own assessment also rang true: 'The show is too large – we started it on too broad a front and became perhaps overzealous in trying to upgrade material in areas that were not familiar to us. Still I feel it is a needed show.'²⁰ In the months that followed, Charles and Office staffer Glen Fleck reprised the material as a film, *The Image of the City*, with increased emphasis on recent analytical technologies, including the latest images of earth taken from space, which Fleck had negotiated to receive from NASA shortly after the return of Apollo 7. In linear format, even with the Eameses' affection for rapid-fire images, the film

presents a focused message that often eluded visitors immersed in the towering visual overload of the exhibition. Later, the Smithsonian toured an abbreviated version of the show, but pursued neither an ongoing series of photographic exhibitions nor a museum of photography. Despite its faults, *Photography and the City* was a loving salute to photography, an insightful statement on urban planning, and a prescient look at the urban environment and the new tools for its analysis.

The India Report, compiled by Charles and Ray Eames in 1958, led to the foundation three years later of the National Institute of Design (NID), India's first national design school. There, students and instructors working together on real projects would be a core aspect of learning. In August 1964 Indira Gandhi, at that time India's minister of information and broadcasting, commissioned the fledgling institute to prepare a biographical exhibition about her recently deceased father, Jawaharlal Nehru, India's first prime minister. The show would open in New York City less than six months later. It was a huge challenge – their first major exhibition – for NID's young faculty and initial batch of students. 'Our first thought was to reach Charles as our godfather', Dashrath Patel, NID Design Director for Visual Communication, reported.²¹

It was uniquely challenging for the Eameses, too. All their other projects were created by staff and consultants working in the insular world of 901 Washington Boulevard, and built by established fabrication firms. Now, the Eameses and key members of the Office would be working day and night, half a world away, with instructors, newly graduated architects and beginning design students – two dozen or so in total – in the pigeon-occupied upper levels of the recently built Sanskar Kendra, the city museum in Ahmedabad designed by Le Corbusier. Ray spent nearly three months in India, searching for images and objects and considering layouts. Deborah Sussman, the first Office staff member on site, stayed the longest, orchestrating the graphics. Glen Fleck flew out for a short while, for research and content development. Robert Staples, the last of the Eames team to make the journey, was sent for ten days in late October 1964 with a plan and model photographs to help finalize the three-dimensional designs. Ten days turned into two months as he and H. Kumar Vyas, NID Design Director for Product Design, worked closely together to convert the designs into elegant teak and brass structures, upholstered in a kaleidoscope of traditional Indian fabrics. The majority of these structures were crafted at NID under master carpenter Haribhai Panchasara, with brass castings and larger panels fabricated in small workshops around Ahmedabad, a city with strong traditions of craftsmanship. Alexander Girard, designer of the exhibition *Textiles and Ornamental Arts of India* (MoMA, 1955), responded to the Eameses' call for assistance and spent three weeks helping to source fabrics and many of the other elements that would add to the visual feast. Charles, who had negotiated the agreement with NID and discussed initial ideas during a two-week visit in August before developing concepts and spatial layouts with Office staff in Venice, California, was back in Ahmedabad by mid-November, having researched photos along the way in New York and London.

As its title suggests, *Jawaharlal Nehru: His Life and His India* told the story not only of Nehru, one of the architects of India's independence, but of India itself. Clearly, the design intent of the exhibition was to reflect the country's visual intensity. Rich textures and colours underscored a dramatic storyline told in 1,200 photographs and 30,000 words, mostly quotations from Nehru, many taken from the books he had written during his nine imprisonments for the cause of independence. H. Y. Sharada Prasad, editorial adviser to the project, media adviser to Indira Gandhi, brilliant journalist and freedom fighter with personal experience of the struggle that Nehru had led, selected the



quotations and crafted the texts. Indeed, Sharada Prasad's role in shaping *Nehru* should not be underestimated. One visitor to the exhibition described it as 'a spiritual exploration of a great man and the monumental challenge he faced';²² another remembered it as 'an overwhelming experience ... it engulfed you with emotion'.²³

More than fifty years old and part of the DNA of hands-on science centres everywhere, *Mathematica* is arguably the most influential exhibition the Eames Office created. *Jawaharlal Nehru: His Life and His India* still resonates strongly as a model for exhibition design and, perhaps more importantly, as a lesson in what it means to be a designer. Vikas Satwalekar, one of the young postgraduate students who worked with Deborah Sussman on the *Nehru* timeline, notes that his 'first experience of exhibition design became an invaluable lesson in how a conductor extracts the best out of each musician in the orchestra without compromising the harmony of the whole' – a lesson that would serve him well when he was named executive director of NID in 1989.²⁴ Like Satwalekar, that first generation of Indian designers and design students who created *Nehru* have, in turn, influenced subsequent generations of designers. It was H. Y. Sharada Prasad who articulated the message that many of those involved in the exhibition, if not all, would take with them as they moved forward in their careers: 'The secret of design, Eames used to say, is to care. The more you care, the more you find within yourself.'²⁵

Opposite

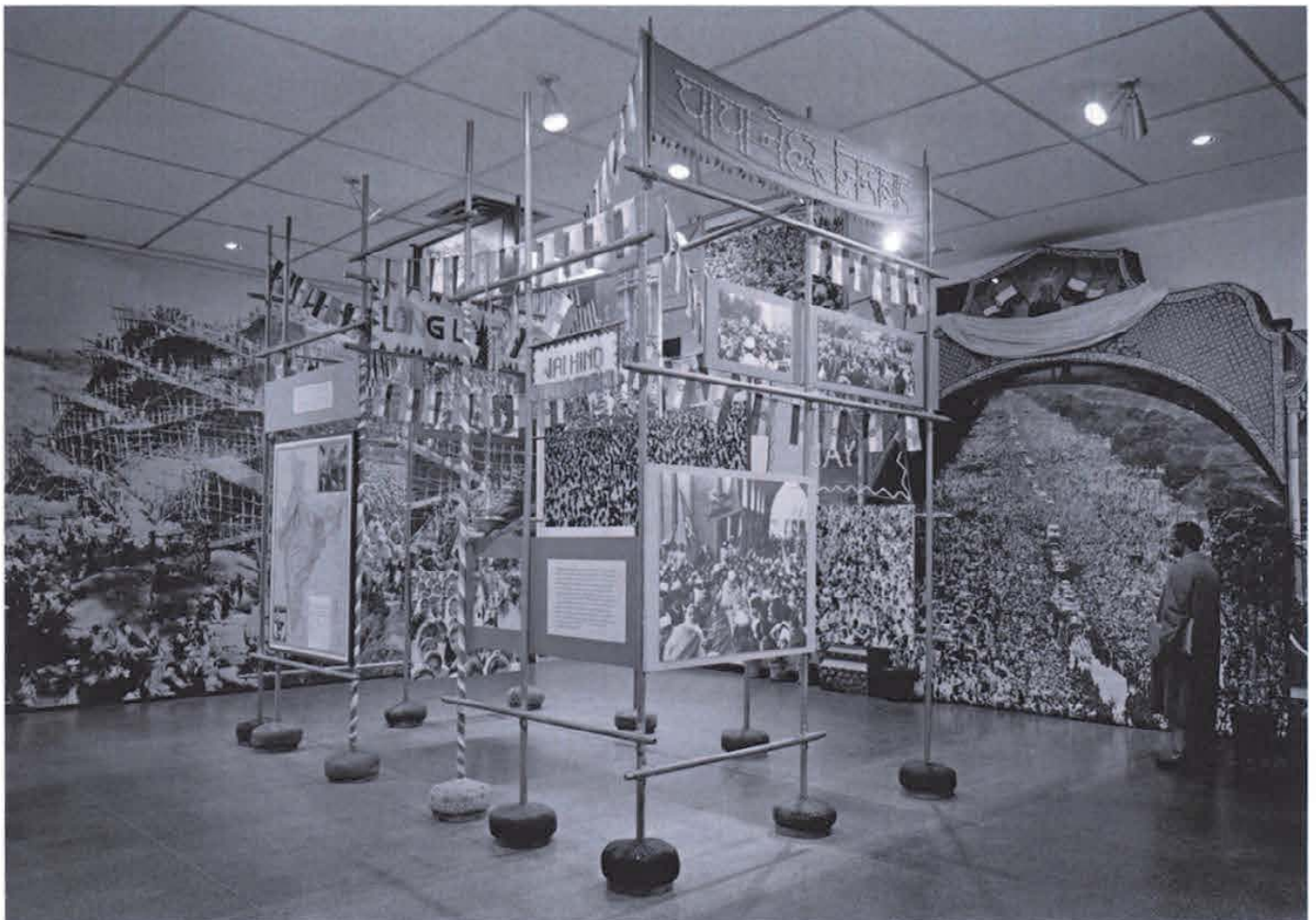
Graphics in production for *Jawaharlal Nehru: His Life and His India*, National Institute of Design, Ahmedabad, India, 1965
Photograph by Charles Eames

Alexander Girard and Robert Staples
assembling fabric panels for *Nehru*, 1965

Key members of the design team from the National Institute of Design who worked on *Nehru*. Standing, from left: P. M. Dalwadi, photographer; Padmaker Kerve, architect; H. Kumar Vyas, Design Director for Product Design; Christian Staub, lecturer in photography; Dashrath Patel, Design Director for Visual Communications; Minakshi Jain (Shah), architect; Ishu Patel, graphic designer; Nagar, administrator; and N. V. L. Narashiman, administrator. Sitting, from left: M. Y. Thackrey, architect; Rohit Modi, graphic designer; Haribhai Panchasara, master carpenter; and Suresh Banker, engineer

Below

'Speaking to the Masses' section of *Nehru*, Museum of History and Technology, Smithsonian Institution, Washington DC, 1965



Sam Passalacqua photographing one of the live aquarium tanks at 901
 Photograph by Charles Brittin

Following a 1962 act of Congress requiring the development of a National Fisheries Center and Aquarium in Washington DC, appointed architects Kevin Roche John Dinkeloo and Associates commissioned the Eames Office to work with them on the proposal. The progressive initiative was intended to house educational exhibitions, live-specimen galleries, an aquatic garden, a 30-metre-high (100 ft) greenhouse, research facilities and administrative offices; the Eames Office was asked to design the exhibitions, graphics, films and other material. Assisted by Malcolm Gordon, a member of the biology department at the University of California, Los Angeles, Office staff immersed themselves in research for the project. Tanks with marine habitats were set up at 901 so that staff could study behavioural patterns and understand how to convey them to visitors. They took numerous photographs and live footage, compiling them into a poetic three-screen slideshow, *Tanks* (see pages 257–64), and a short film, *A Small Hydromedusa: Polyorchis Haplus* (1970), which follows the movements of a diaphanous jellyfish. As part of the formal proposal to Congress, the Office produced graphic panels and a meticulously executed scale model of the centre. They also created a film (1967) and a booklet (1969), each explaining the features of the centre and underlining the importance of such a project in terms of increasing the public's understanding of the natural world and the urgent need to protect the environment.



Below and opposite
 Pages from the *National Fisheries Center and Aquarium* booklet, 1969
 Photomechanical print on paper,
 14 × 28 cm (5 1/2 × 11 in.)
 Private collection

THE SITE

The National Aquarium is in Washington, D. C., on the island that forms East Potomac Park. The site is about one mile south of the Mall; it is a square whose diagonals coincide with the major axes of the city. The configuration of the building establishes a relationship to the Capitol building and the Washington Monument.

Plan

2

THE BUILDING

View from the north

A prominent landmark for large numbers of people entering and leaving Washington each day, the great curving greenhouse is a symbol and a reminder of our increasing national concern for the natural environment. The square podium on which it rests is the principal floor of the aquarium, housing the main concourse, the tank galleries, theaters, exhibition halls, and research facilities.

3

THE SPACE

The Aquarium Building will house, in approximately 166,000 square feet, five different kinds of activity:

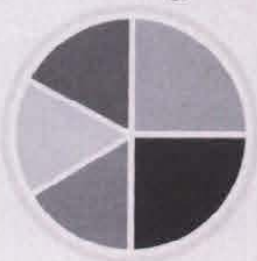
18%
Main concourse and public facilities.

16%
Gallery space that will hold flexible arrangements of tanks and live specimens.

16%
The special exhibitions, orientation shows and graphic materials that back up the live exhibits.

In addition to the enclosed area, there is an open terrace that can help hold and entertain the large numbers that come on peak fairweather days.

4



25%
Research and administration,

25%
Living ecologies, where water animals, birds, insects and plants are kept in a near natural balance.



THE PURPOSE

The authorizing Act of Congress of October 9, 1962, commits the National Fisheries Center and Aquarium to a high level of scientific research, and to the display of aquatic organisms and environments for "educational, recreational, cultural and scientific purposes."

The fulfillment of these goals could bring to the word "aquarium" a broader meaning than it has normally held. The display of aquatic life will include birds, insects, amphibians, and growing plants, with special stress on the delicate balance among them. The educational and recreational aspects will be built on a framework of scientific discipline.

Our present national environmental crisis gives a new sense of urgency to this commitment. To the millions of students, citizens, lawmakers and businessmen who visit the capital each year, the Aquarium will dramatically present the principles on which the biological world operates. It will introduce these visitors to the pleasures that come from an understanding of the great aquatic environment—they will be shown much of what can be done to preserve and protect it; and they may come to have a more informed respect for it.

5



A close-up look

Sea anemone tentacles



22



Nudibranch

Tube blenny



SMALL TANKS AND INTIMATE VIEWS

Much of the drama and the beauty of aquatic life occurs at a scale best experienced with a magnifying glass or a microscope. This is the scale of the fantastic and the colorful—at this size, the normal living functions are performed with equipment and configurations that are unfamiliar and with action that can be both hair-raising and beautiful.

Burrowing sea anemone



Sun starfish

This experience includes isolated views of biological functions and some good lessons on the appropriate size of things. The National Aquarium will attempt to bring the great rewards of the micro world to the attention of the interested viewer.



23



MAINTAINING THE WORLD'S ECOLOGY

The theme of conservation is implicit in the whole aquarium program; the experience, and the exhibits, are designed to foster the kind of personal involvement and responsible interest which effective conservation presupposes.

A strategically placed area is given over to presenting and discussing some of the aesthetic and functional aspects of conservation:

- the problems of management of aquatic resources;
- the urgency of the restoration of degraded environments;
- the techniques being developed to study environments—(infra-red and radar photography, sonar, satellite observations);
- the global effects of water pollution; man's direct and indirect encroachment on aquatic habitats.

The earth



Colorado river delta

Dry lake bed



35



Barbara Fahs Charles, Henry Beer and Robert Staples working on a full-scale mock-up of the 'History Wall' for *A Computer Perspective* at 901, 1970

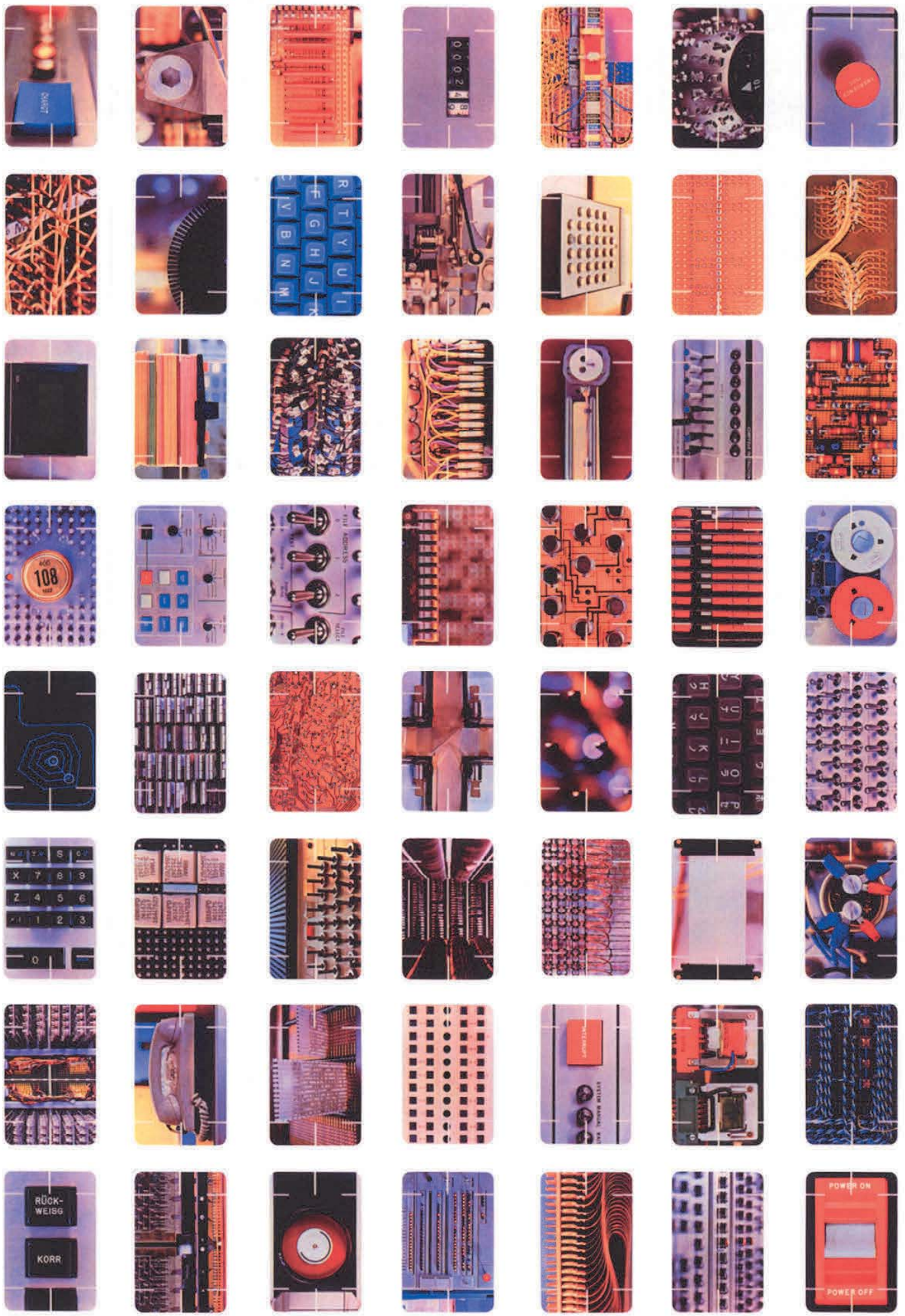
Installation view of *A Computer Perspective*, IBM Corporate Exhibit Center, New York, 1971

Opposite

Computer House of Cards, 1971
Printed card, each 8.9 × 5.9 cm
(3½ × 2¾ in.)

A Computer Perspective (1971–5) was the first of many exhibitions designed by the Eames Office for the IBM Corporate Exhibition Center in New York. The exhibition traced the evolution of those inventions that had led to the modern computer. The main feature was the 15-metre-long (50 ft) 'History Wall', a complex, 3D timeline made up of documents, artefacts and photographs, as well as both vintage and modern machines. Other exhibits included the 'Audiovisual Rack', a multi-screen slideshow of the latest advances in computer applications, and an interactive computer game, 'Twenty Questions'. The project took two years to devise and was organized and designed by Eames Office staff member Robert Staples working with Barbara Fahs Charles, Glen Fleck and Bill Tondreau, among others.







Jehane Burns and Jeannine Oppewall at 901, researching for the exhibition *Moveable Feasts and Changing Calendars*, 1973

Installation view of *Moveable Feasts*, IBM Corporate Exhibit Center, New York, 1973

Charles and Ray Eames at *Isaac Newton: Physics for a Moving Earth*, IBM Corporate Exhibit Center, New York, 1973



Between 1972 and 1977 IBM commissioned the Eames Office to research and produce a series of small, travelling exhibitions exploring the people and ideas that had shaped modern science. The Office developed a distinct vocabulary for the exhibitions. Visitors were confronted with a dense array of information – text, photographs, diagrams and objects – mounted on free-standing portable panels. Decorative elements were introduced according to the season in which the exhibition opened: potted plants for spring exhibitions, for example, and eighteenth-century festive artefacts for a Christmas exhibition on Isaac Newton.

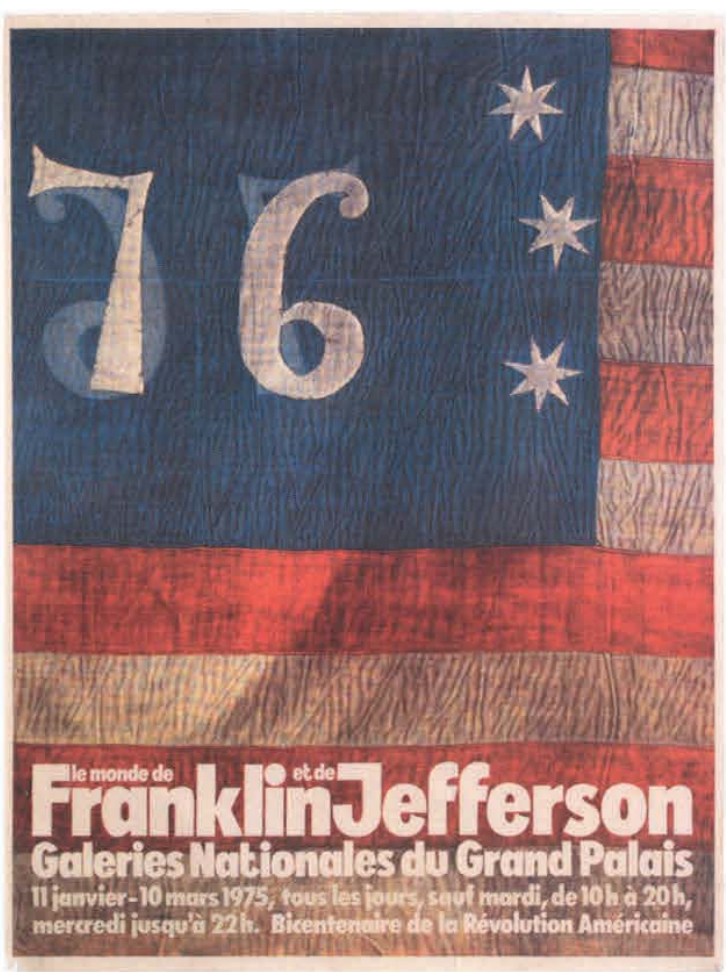
This multimedia approach was continued on a larger scale in *The World of Franklin and Jefferson*, produced for the American Revolution Bicentennial in 1976. This expansive exhibition toured both in the United States and internationally. Information was clustered on free-standing structures, which stood among dense displays of varied and sometimes surprising artefacts, including instruments, dress and even a stuffed bison.

Right

Graphic design by Paul Brühwiler for Eames Office
Poster for *The World of Franklin and Jefferson*, Grand Palais, Paris, 1975
Photomechanical print on paper, 160 × 119.4 cm (63 × 47 in.)
Collection of Robert Staples and Barbara Fahs Charles

Below

Installation views of *The World of Franklin and Jefferson*, British Museum, London, 1975 (top left), and The Metropolitan Museum of Art, New York, 1976



exchanges and broadcasting. It closely followed the work of the Eameses, and often included Eames films in its libraries. The agency funded the international tour of *The World of Franklin and Jefferson* (1975–7).

- George Nelson, quoted in Stanley Abercrombie, *George Nelson: The Design of Modern Design* (Cambridge, MA: MIT Press, 2000), p. 164.
- Visual art also featured prominently. Visitors could see an exhibition of modern American sculpture and painting, as well as a version of the landmark photography exhibition *The Family of Man*. Curated by Edward Steichen, *The Family of Man* was first shown in 1955 at The Museum of Modern Art, New York. It consisted of 503 photographs of people from around the world, and was intended as an assertion of both global fellowship and photography as a universal language. The USIA funded a tour of the exhibition to thirty-seven foreign countries, where it served to promote associations between its egalitarian and democratic ideals and America's international reputation.
- The Eameses were unaware that the Russian name for the flowers (*nezabutki*) also directly translates as 'forget me not'. This fortuitous coincidence ensured that the image carried the same association of friendship for Russian viewers as it did for Americans.

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- In a letter to John E. Burchard, dean of the Massachusetts Institute of Technology, dated 13 July 1959, Charles wrote: "Ray and I have just finished the charrette to end all. We have been doing a film presentation for the American National Exhibition at Moscow, and tonight we go there – over the Pole – with the prints under our arms." II:16, Folder 'Massachusetts Institute of Technology, Cambridge, Mass., 1952–1959', The Papers of Charles and Ray Eames, Manuscript Division, Library of Congress, Washington DC.

Squaring the Hypothetical Circle: Getting Around Mathematica

Epigraph: Bertrand Russell, *Introduction to Mathematical Philosophy* (London: George Allen & Unwin, 1919), p. 3

- Eric Schuldenfrei, *The Films of Charles and Ray Eames: A Universal Sense of Expectation* (London: Routledge, 2016), p. 106.
- James R. Newman, *The World of Mathematics*, 4 vols (New York: Simon & Schuster, 1956), vol. 3, p. 1,485.
- Other devices and exhibits include 'Mathematical Model Case', 'Möbius Band', 'Multiplication Cube', funhouse trick mirrors and two double-sided stanchions containing didactic panels.

Special thanks are owed to my curatorial colleague and mentor Marc Greuther, director of historical resources and chief curator at The Henry Ford, who is the reason why *Mathematica* calls the museum its new home; to the Eames family, Foundation and Office; and to my friend Steve Aldana, who was the catalyst for my first writings about the Eameses, and co-pilot on many architecture-fueled adventures.

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- Architectural Record*, no. 7, July 1964, p. 2.

Peaks of Perpetual Excitement: Exhibition-Making at the Eames Office

- Charles Eames, 'Language of Vision: The Nuts and Bolts', *Bulletin of the American Academy of Arts and Sciences*, vol. 28, no. 1, October 1974, p. 17. The circus was a recurring theme in the Eames Office. I first heard Charles talk about it in the autumn of 1967 as I was sorting through some photographs he had taken of the Ringling Bros. and Barnum & Bailey Circus in the late 1940s.
- 'Eames', interview with Charles Eames by S. M. Pruys, *Algemeen Handelsblad*, 14 June 1969, translation in I:263, Folder 3, The Papers of Charles and Ray Eames, Manuscript Division, Library of Congress, Washington DC (hereafter cited as Eames Papers).
- The Museum of Science, Boston, since 1981 (originally at the Museum of Science and Industry, Chicago) and, since 2002, the New York Hall of Science (originally at the California Museum of Science and Industry,

Los Angeles). At the time of writing, the exhibition (combined elements from the New York World's Fair and the Pacific Science Center, Seattle) is due to open at a third venue, The Henry Ford in Dearborn, Michigan, within the next couple of years.

- Charles Eames, quoted in 'How "A World of Numbers ... and Beyond" was Created', California Museum of Science and Industry, Los Angeles, press kit for *Mathematica*, opening 24 March 1961, collection of Robert Staples and Barbara Fahs Charles.
- David Paul, 'Report of the Eames Photo Trip, April 20–30, 1973', memorandum to William R. Davis, 4 May 1973, collection of Robert Staples and Barbara Fahs Charles.
- Recollection of the author, especially during work on *A Computer Perspective*.
- Charles Eames, 'Language of Vision', p. 34 (emphasis in original).
- Kevin Roche, 'A Conversation', *Perspecta*, vol. 19, 1982, p. 169.
- Office of Charles and Ray Eames, 'Meeting with Malcolm Gordon', 26 May 1966, II:167, Folder 3, Eames Papers.
- Kevin Roche, interview with the author, 19 March 2013.
- Charles Eames, quoted in Paul Schrader, 'Poetry of Ideas: The Films of Charles Eames', *Film Quarterly*, Spring 1970, p. 12.
- Schrader, 'Poetry of Ideas', p. 13.
- Charles Eames, notes for a March 1970 presentation in Italy, II:167, Folder 5, Eames Papers.
- Frank Taylor, Director of Museums, Smithsonian Institution, to John Szarkowski, Director, Department of Photography, The Museum of Modern Art, 16 June 1967, I:172, Folder 10, Eames Papers.
- Charles Eames to Lloyd Herman, Administrative Officer, Smithsonian Institution, 30 October 1967, I:172, Folder 8, Eames Papers.
- Charles Eames to Frank Taylor, Director of Museums, Smithsonian Institution, 22 December 1967, I:172, Folder 10, Eames Papers.
- 'Miss Barbara Charles of our office, who is coordinating all data on the 1,500 photographs used, is on recuperation leave.' Charles Eames to the BBC, 18 June 1968, in response to a rather sharp enquiry as to why its photographs had not been quickly returned, I:170, Folder 10, Eames Papers.
- The Poor People's Campaign for economic justice was initiated by Martin Luther King Jr. Following his assassination in April 1968, it was continued by Ralph Abernathy and other civil rights leaders, who brought caravans of poor people from around the United States to Washington DC in mid-May that year. A total of 3,000 people were housed in Resurrection City. The documentary photographer Jill Freedman, who was living in the mud-soaked temporary community, shared her photographs with us; we shared with her the hot shower in our hotel room.
- Wolf Von Eckardt, "'Photography in the City" Show Exciting', *Washington Post*, 30 June 1968, p. G8.
- Charles Eames to Frank Taylor, 5 August 1968, I:172, Folder 10, Eames Papers.
- McCandlish Phillips, 'Designers of Show on Indian Leaders Find Task Is an Exciting Chase', *New York Times*, 20 January 1965, p. 1.
- Katherine Kuh, 'Nehru: A Visual Biography', *Saturday Review*, 20 February 1965, p. 42.
- Ashoke Chatterjee, interview with Shilpa Das and Sanchari Mahapatra, 2011, quoted in Shilpa Das, ed., *50 Years of the National Institute of Design: 1961–2011* (Ahmedabad: National Institute of Design, 2013), p. 76. Chatterjee was a young communications officer at the International Development Bank when he volunteered to work on the installation of *Nehru* in Washington DC. There, he met the Eameses, beginning a decade of discussions on design. In 1975 Chatterjee was made executive director of NID.
- Vikas Satwalekar, 'Heart of the Matter ...', *Indian Architect and Builder*, vol. 25, no. 1, September 2011, p. 55.
- H. Y. Sharada Prasad, 'A Master Designer Who Cared: Tribute to Charles Eames', *Communicator*, July–October 1978, reprint, I:46, Folder 3, Eames Papers.

The Artefacts of Innovation

- On 21 August 1978, just months before the 'Inventions' exhibition was due to open, Charles Eames died of a heart attack. A significant amount

of work had already been produced for the exhibition, but neither IBM nor the USIA would complete the project and it was never shown, suggesting it was the Eames Office that had been the driving force behind such initiatives.

- Charles and Ray Eames, 'Inventions: The Artifacts of Innovation Notes', 1 August 1978, Los Angeles, I:155, Folder 6, The Papers of Charles and Ray Eames, Manuscript Division, Library of Congress, Washington DC (hereafter cited as Eames Papers).
- Charles and Ray Eames, 'Inventions: The Artifacts of Innovation Notes', December 1977, Los Angeles, I:154, Folder 6, Eames Papers.
- The exhibition was to travel to Ottawa, London, Paris, Rome, Berlin, Athens, Peking, Jakarta, New Delhi, Tokyo, Moscow, Cairo, Tehran, Tel Aviv, Lagos and Brasilia.
- IBM and USIA, 'Inventions: The Artifacts of Innovation General Conditions of IBM/USIA Agreement', 1977, I:154, Folder 5, Eames Papers.
- The Eameses' preliminary study of the history of the pacemaker is incorrect, as the first fully implantable pacemaker was implanted in 1958 at the Karolinska Institute in Sweden.
- IBM and USIA, 'Inventions: The Artifacts of Innovation General Conditions of IBM/USIA Agreement'.
- Charles and Ray Eames, 'Innovation and Invention Preface', December 1977, I:154, Folder 6, Eames Papers.
- Eameses, 'Inventions: The Artifacts of Innovation Notes', December 1977.
- Charles Eames, 'Notes to Gerard Piel from Charles Eames', February 1977, I:64, Folder 2, Eames Papers.
- Charles Eames, 'Smithsonian Lecture Notes', 1977, Washington DC, I:217, Folder 24, Eames Papers.
- Charles and Ray Eames, 'First Notes on a Fine Arts Center Associated with the Metropolitan Museum of Art', 1977, Los Angeles, I:218, Folder 7, Eames Papers.
- Ibid.*
- Charles Eames, 'A Report to President Howard Johnson', 1969, Los Angeles, I:218, Folder 6, Eames Papers.
- Charles Eames, 'MIT Lecture Notes', 1 July 1976, I:217, Folder 19, Eames Papers.
- The conference's theme, 'Making Connections', related directly to the exhibition *Connections: The Work of Charles and Ray Eames*, held in Los Angeles in 1976: the organizer of the 28th IDCA, Ralph Caplan, had written an essay in the exhibition's catalogue titled 'Making Connections'. Charles Eames, 'International Design Conference Notes', 11 June 1978, I:217, Folder 27, Eames Papers.
- Charles Eames, 'Norton Lecture Four Notes', Harvard Norton Lecture Series, I:217, Folder 10, Eames Papers.
- Charles's notes continue: '(mathematician should no more think of delegating his film to "creative" film-makers than of delegating his journal article to a "creative" essay-writer)'. Eames, 'International Design Conference Notes'.
- Charles and Ray Eames, dir., *Cable: The Immediate Future*, 1972, 10 min.
- Ibid.*
- 'What Is a House?', diagram by Charles and Ray Eames in *Arts & Architecture*, July 1944.
- Eames, 'Smithsonian Lecture Notes'.
- Charles and Ray Eames, 'Innovation and Invention Notes', December 1977, I:154, Folder 6, Eames Papers.