

**VISUAL PEDAGOGY IN COLD WAR AMERICA: BERENICE ABBOTT, WILL
BURTIN, AND THE INTERNATIONAL VISUAL LITERACY ASSOCIATION**

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This dissertation explores a Cold War moment in which artists, intellectuals, educators, and businessmen urgently argued that modern life was being newly defined by constant interaction with visual media. Many responded to the increased presence of photography, film, and TV in all sectors of society by proposing that an ability to skillfully consume and produce images was essential to participating as a free-thinking citizen in a modern liberal democracy. This notion was based on the assumption of deep connections between photography and human cognition and profoundly shaped education targeted at American youth and the general public in the period from the 1950s through the 1970s. Photographer Berenice Abbott, graphic designer Will Burtin, and the International Visual Literacy Association all engaged in practices of visual pedagogy that aligned the use of photography and other visual media with individual subjectivity, freedom of thought, and democratic access to knowledge. This dissertation connects these practices to show the role that visual pedagogy played in the articulation of American citizenship in the context of the Cold War.

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PREFACE

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1.0 INTRODUCTION

In the 1950s and 1960s, discourse on strategies of visual pedagogy took on a specific character. Driven by an impulse to address the social and political implications of the role of technology in modern times, new practices of visual pedagogy were focused on education that used visual media, such as photography, film, and television as a method, but also took “the visual” and visual communication as their subject matter. Writing in 1956, New Bauhaus educator and artist Gyorgy Kepes expressed a sentiment shared by many: “We lack the depth of feeling and the range of sensibility needed to retain the riches that science and technique have brought within our grasp...It is an integrated vision that we need.”¹ This set of concerns manifested mainly in books, exhibitions, conferences, and educational infrastructure, but involved seemingly unlikely actors in these areas, such as artists, designers, businessmen, and scientists. This new formulation of visual pedagogy, and the images that were produced to implement it, answered to Cold War-era concerns about the nature of liberal democratic subjecthood, viewership, and agency, and the associated relationships between humans and technology. This dissertation addresses this chapter of the history of the relationship between the political and the visual in the United States.

The field of visual pedagogy that solidified during this time, as well as the subfield of visual literacy, continues to be a major force in education today, represented by organizations such as the International Visual Literacy Association, “a not-for-profit association of researchers,

¹ Gyorgy Kepes, *New Landscape of Art and Science*, (Chicago: Paul Theobald, 1956), 20.

educators, designers, media specialists, and artists dedicated to the principles of visual literacy.”² In the 1970s and 1980s, the theories and terms that had been constructed to deal with film and television were adapted to apply to digital images and the computer, as these made their way into classrooms. Today, based on commonly accepted ideas about visual technology as the indicator of modern progress, schools, universities, museums, and various industries are pressured to make use of visual media as much as possible, as a marker of their understanding of the operations of today’s world and their commitment to communicating within it. Despite decades of analysis questioning our increased dependence on technology, and critiquing the influence of technology corporations in the educational sphere, pedagogy that makes use of visual media is dominant today across our major institutions.

There is scholarship in the field of education that analyzes the history of pedagogical uses of visual media, but it resides mostly in the realm of promoting visual pedagogy as an approach, continuing the work begun by the practitioners that are my subject here. Brian Goldfarb argues that a “bias” persists that “the visual is a more base, even primitive, and often untrustworthy form of knowledge transmission and production” and visual media are “the pedagogical tools of global capitalism,” therefore it is still urgent that educators conduct research and scholarship to promote the use of visual tools.³ The field of visual pedagogy and responses to it have not yet been approached from the outside and situated in their broader historical origins, nor have the images that resulted from key practices of visual pedagogy in the U.S. been analyzed. To do this, it is necessary to examine certain projects that linked education, design, and industry, and to place them within the broader political and cultural context of the United States during the Cold

² International Visual Literacy Association, “About Us,” <http://ivla.org/new/about-us/>, accessed April 14, 2018.

³ Brian Goldfarb, *Visual Pedagogy: Media Cultures in and beyond the Classroom* (Durham and London: Duke University Press, 2002), 3

War. In these practices, it becomes clear that the driving motivation behind visual pedagogy was to secure the ideals of individuality and democratic citizenship in the midst of global tensions over the destructive potentials of science and technology and competing ideologies about human progress. Specific practices of visual pedagogy arose to meet the needs of a liberal democratic system at mid-century, in which corporate power needed to be able to expand without appearing to impinge upon individual agency or freedom. A definition of subjectivity specific to the Cold War period emerged in these approaches that rooted the articulation of an independent but democratic individual in the consumption and production of visual media.

The three practices that will demonstrate the nature of Cold War visual pedagogy occurred between the late 1950s and the mid 1970s in various educational contexts. Berenice Abbott, who is part of the canon of twentieth-century American photography, and well-known for her portraiture and her documentary photographs of New York City, spent the latter half of her career on pedagogical science photography. She created an influential body of photographs for a high school physics curriculum designed by the Physical Science Study Committee at MIT and partially funded by the National Science Foundation. In these images, Abbott used photography to visualize the mathematical abstractions of physics as specific observable instances in the world, and as resonant with human aesthetic values. She was worried about a growing distance between the average human's experience and developments in scientific knowledge, and the harmful effects of specialization in expertise, writing that science needed "the vivification of the visual image, the warm human quality of imagination added to its austere and stern disciplines."⁴ She saw the potential for democratic Americans to share in scientific progress if they could be made to engage with it seriously and take responsibility for how it may

⁴ Berenice Abbott, letter to Charles C. Adams, April 24, 1939, Box 6, Folder 28, Berenice Abbott Papers, Manuscripts and Archives Division, The New York Public Library (hereafter Berenice Abbott Papers, NYPL).

change social relations. She felt that through photography, individuals could be made to see how the principles of physics and chemistry were operative in their everyday lives and that what scientists did was merely an extension of human tendencies of observation and experimentation. The aesthetic experience of photography could be put to pedagogical use in ways that would protect the whole humanity of the individual student. This goal was coherent with the concerns of the scientists of the Physical Science Study Committee and their government backers, who wanted to make sure American science education created as competitive a field as possible for the coming years, while also unfolding according to humanistic values and progressive aspirations. Abbott's work articulates a precise plane of intersection that could be found in the material techniques of photography between the techno-utopic aspirations of modern art, progressive efforts in education, and Cold War government strategy. Photography was put into service here in ways that had lasting effects on educational media.

It was not just in classrooms however that visual media were being framed as conducive to producing democratic, free-thinking citizens of the modern world. Exhibition design, a field which took on a new character in the post-World War II era, also manifested new notions about how and why visual pedagogy was valuable. Graphic Designer Will Burtin, one of the key figures of this period in which designers enjoyed intimate and influential relationships with big businesses, is best known for creating scientific visualizations for corporations. Especially in his large-scale science models for the pharmaceutical company Upjohn, which depicted subjects such as a human cell and human brain in the form of abstract sculptures made of lights and plastic, Burtin produced educational experiences for audiences that were based on the power of visual media to operate as an analytical tool in the comprehension of new science and technology, especially with regard to things that were not otherwise visible. Burtin translated

complex biological knowledge into the terms of modern design and felt that by doing so he and the models served as interlocutors, enabling the viewer to actively engage with the subject matter using their senses, intellect, and emotion. In his words: “To enlarge and define this vocabulary of visual language, and thereby contribute toward integration of our culture, is [the designer’s] social responsibility as a man, his job as a designer.”⁵ Burtin’s attitude about the usefulness of his work for corporations was motivated by a feeling that the future of a society inhabited by free-thinking individuals depended on integration between artistic, “human” values and scientific, technological ones. His work demonstrates certain principles of visual pedagogy that shaped the field of design at mid-century, which had begun to intersect with many other spheres in profound ways. Importantly, these principles of visual pedagogy – notions of integration between art and science, the naturalization of technology as an extension of the human, and the value of aesthetic experience in communication – were formulated in collaboration with corporations at this time.

By the late 1960s, the proliferation of visual pedagogical material, and the increasing feeling that television had now profoundly influenced a generation of children made it possible for John L. Debes, an employee of Kodak in Rochester, to propose a new theory to educators based on using visual media in classrooms. His efforts constituted the birth of visual literacy, a field that transformed ideas about the potential of the visual that had permeated federal and corporate educational efforts into a much more specific theory about relations between images, words, and thought. According to Debes and one of his collaborators, Roger Fransecky, visual literacy would “revitalize” education for the new generation, giving them “a new power, a new

⁵ Will Burtin, “Integration: The New Discipline in Design,” *Graphis* 27 (1949): 232.

language facility, that they haven't felt with words.”⁶ It built on the broader emergence of audio-visual departments, as teachers looked for ways to use new technology, and the media industry attempted to access this market. At Kodak, Debes spearheaded the publication of a set of materials that teachers could use to implement these ideas in their classrooms (using Kodak products), and built a following of educators with whom he formed the International Visual Literacy Association. Visual literacy enthusiasts argued that a new proliferation of visual material in the world, meaning photography, film, and television, presented an opportunity for broad, democratic access to knowledge, but only if individual citizens were equipped with the tools to engage with it. In this way, they built on the same set of concerns that had motivated Abbott and Burtin. Like these artists, they saw their interests mesh with the needs of the mid-century American liberal democratic system, founded on a belief in technological progress and individual freedom expressed through the use of visual media.

In each of these cases, individuals saw the harnessing of new visual tools and strategies as the key to modern life and as a crucial link between education and democracy. Also in each case, the projects fit with the broader needs of American political and economic power. By tracing the notion of individual agency through the technological consumption and production of visual objects from Abbott's experiences in the 1950s through to education and design in the 1970s, we see that this way of defining the power of visual technology profoundly linked artists, teachers, politicians and salesmen. This project will illuminate precisely how these practices achieved this, and demonstrate the kinds of citizens and the kinds of images that visual pedagogy engendered.

⁶ Roger B. Fransecky and John L. Debes, *Visual Literacy: A Way to Learn – A Way to Teach*. Washington D.C.: Association for Educational Communications and Technology, 1972, 7.

In the practices that constituted this field, artists, philosophers, and educators proposed a specific definition of “the visual,” and a role for it in the definition of American subjectivity that is a crucial component of the cultural history of the Cold War. This project will analyze the process by which this occurred, which will include investigations of the role that photography took on, how the subjects of science and technology were treated, the effect of corporate involvement, and the proposals about overlap between the visual and the verbal. It will shed light on relationships between technology and subjectivity that were established in the context of the Cold War but continue to play out in our present time. In various pedagogical contexts of mid-century America, through formulations of visual technology as extensions of natural human abilities, and of individual subjectivity as an outcome of interacting with technology, democratic citizenship was articulated as the free and flexible viewing of visual media.

The reshaping of individual subjectivity in terms of vision and visual technology is obviously not unique to the mid-twentieth century, even in the specific realm of educational technology.⁷ In addition, in the 19th and early 20th century, urbanization, electricity, photography, film, and radio, just to name examples, were all thought by individuals in their times to have radically altered the human sensorium. Visual technologies such as photography and film had long been used in educational contexts, and were studied and promoted as part of the field of visual instruction, especially during World War II. This discourse is the forerunner to Cold War visual pedagogy, but by the 1950s, we confront a situation shaped by new factors. The first is the increased access on the part of schools to media technologies such as affordable cameras and

⁷ Jonathan Crary’s *Techniques of the Observer: On Vision and Modernity in the Nineteenth Century* (Cambridge: MIT Press, 1990) for example addresses the definition of vision as embodied and subjective, and the resulting effect of visual technology on subjectivity, in the early nineteenth century. On educational uses of the stereoscope, radio, and film and their relations to individuality and citizenship in earlier twentieth century America, see Brent Malin, *Feeling Mediated: A History of Media Technology and Emotion in America*, (New York: New York University Press, 2014).

projectors. In addition, over the course of a decade or so, television had gone from a rarity to an ordinary object in the American living room.⁸ The market was also full of various easy-to-use cameras targeted at amateurs. In the 1950s and 1960s, communication theory also began to influence the field of educational technology on an institutional scale, through publications like *Audio-Visual Communication Review*, which was founded in 1953.⁹ John Debes himself also cited structural linguistics, programmed learning, and semantics as precursors to visual literacy.¹⁰ Finally, it is essential to address how these developments intersected with the anxieties about technology and freedom that were specific to the Cold War era, changes in the federal approach to education related to military concerns, and to the nature of corporate marketing activities during this period. Many thinkers of the postwar and Cold War period were proclaiming that these issues were newly urgent, that their age was even “more visual” than all those that had come before, and that this was part and parcel of both the dangers and achievements of the cybernetic age.¹¹ In an atmosphere shaped by the ideas of commentators on technology and society such as Buckminster Fuller and Marshall McLuhan, many felt that the only possible response to this situation was more and better uses of visual technology. In a bit of a contradiction, the human sensorium had already been changed, but it also needed to actively

⁸ For more on this point see Thomas Doherty, *Cold War, Cool Medium: Television, McCarthyism, and American Culture*, (New York: Columbia University Press, 2003), 3-6.

⁹ I am referring here to the mathematical theories of information and communication associated with the postwar era and the work of Claude Shannon. See Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication* (Urbana: University of Illinois Press, 1963). Paul Saettler discusses this in *The Evolution of American Educational Technology*, (Englewood, CO: Libraries Unlimited, Inc., 1990), 263-285.

¹⁰ John Debes, “Communication with Visuals,” *ETC: A Review of General Semantics*, vol xxv, no. 1, March 1968, 34.

¹¹ The field of cybernetics refers very generally to the study of regulatory systems, or systems of control and communication, as they apply across machines and living beings, although it has been defined and applied in many different ways. It can be rooted in the interdisciplinary Macy conferences that took place in New York from 1946 to 1953. The Cold War era was often described as the cybernetic age, in which the principles that govern the operations of machines were applied in theories not just in computing but across technological, biological, and social systems. See Ronald R. Kline, *The Cybernetics Moment, Or Why We Call Our Age the Information Age*, (Baltimore: Johns Hopkins University Press: 2015).

respond. In spite of consistent critique of mass media, technology, and society by scholars of communication and political philosophy throughout this period such as Herbert Schiller, Herbert Marcuse, and Hannah Arendt, it was also possible for film critic and theorist Gene Youngblood to write statements such as “only through technology is the individual free enough to know himself and thus to know his own reality.”¹² Youngblood’s 1970 book, *Expanded Cinema*, is primarily about the potential of interdisciplinary, educational, and communicative uses of visual media. To understand how visual pedagogy was formulated and promoted in mid-century America, we must identify how notions of visual media, individuality, and freedom drew on earlier discourses to meet the political, social, and cultural needs of the time, and what forms of visuality functioned successfully in this context.

There is rich scholarship on the importance of visual knowledge, and the use of images for educational purposes in various historical contexts, and this literature forms part of the background for this study.¹³ However, this scholarship primarily focuses on establishing that images indeed generated knowledge, and how they did so, with slightly less emphasis on examining the surrounding discourse of the time that emerged to establish the utility of images in that particular context. My project engages with this different set of questions, namely, historical definitions of visual knowledge, and by extension, definitions of their target, the subject being taught. I am less focused here on demonstrating that visual knowledge existed than in showing how individuals defined it, and how they argued for its centrality or importance. The forms of

¹² Gene Youngblood, *Expanded Cinema*, (New York: P. Dutton & Co., Inc., 1970), 419.

¹³ Examples are Susanna Berger, *The Art of Philosophy: Visual Thinking in Europe from the Late Renaissance to the Early Enlightenment*, (Princeton: Princeton University Press, 2017), Klaus Hentschel, *Mapping the Spectrum, Techniques of Visual Representation in Research and Teaching*. (Oxford: Oxford University Press, 2002), Martin Rudwick, “The Emergence of Visual Language for Geological Science, 1760-1840,” *History of Science* 14 (1976), 149-195, Bruno Latour, “Visualization and Cognition: Thinking with Eyes and Hands,” *Knowledge and Society* 6 (1986), 1-40.

visual pedagogy that emerged during the Cold War, which are essential for understanding the discourse of visual pedagogy today, are in need of examination.

My concentration here is on how the idea of visual knowledge itself was articulated and mobilized in relation to historically specific concerns.¹⁴ As mentioned above, there is also a robust field of work in the vein of visual pedagogy and visual literacy as continuing practices, in the sense of how to do visual pedagogy (and in some cases, the appropriate role of technology). This scholarship is relevant to education in the broadest sense, as well as to the pedagogy of art history and visual studies. James Elkins, for example, wrote in his edited volume *Visual Literacy* that he hopes that “visual literacy, paradoxical and old fashioned as it is, can be a useful expression for a very pressing problem,” by which he means the need for the use of more images in education. This volume includes essays by writers such as Jonathan Crary and W.J.T. Mitchell.¹⁵ Efforts at delineating visual pedagogy as a field, however, have not been addressed as historical phenomena, and the visual practices that the field of visual pedagogy engendered as it was being formulated have not been analyzed.

It is more in work on 1960s media-based art practices as responses to a society changed by technology that analysis of visual pedagogical practices has taken place, as well as in scholarship on the circulation of American exhibitions in relation to ideology and the Cold War.¹⁶ Other writings focus on the role of designers in technology corporations that were in the

¹⁴ I take as models of this kind of inquiry include Lorraine Daston and Peter Galison, *Objectivity* (Cambridge: MIT Press, 2007), Josh Ellenbogen, *Reasoned and Unreasoned Images: The Photography of Bertillon, Galton, and Marey*, (University Park: Penn State University Press, 2012). Jennifer Tucker, *Nature Exposed: Photography as Eyewitness in Victorian Science*, (Baltimore: Johns Hopkins University Press, 2013).

¹⁵ James Elkins, ed., *Visual Literacy*, (New York: Routledge, 2008), 3.

¹⁶ See Pamela Lee, *Chronophobia: On Time in the Art of the 1960s*, (Cambridge: MIT Press, 2004); Arindam Dutta, ed., *A Second Modernism: MIT, Architecture, and the ‘Techno-Social’ Moment*, (Cambridge: MIT Press, 2013); Orit Halpern, *Beautiful Data: A History of Vision and Reason Since 1945*, (Durham: Duke University Press, 2014); Beatriz Colomina, *Domesticity at War*, (Cambridge: MIT Press, 2007), Caroline Jones, *Machine in the Studio*, (Chicago: University of Chicago Press, 1996).

process of proposing new relations between technology and humanity.¹⁷ However, a study taking the frame of Cold War visual pedagogy and the definitions of technology and subjectivity that it produced can show the interrelatedness of these different kinds of visual spheres, and can link the specific educational field of visual pedagogy to this broader context of Cold War art and media. Visual pedagogy could be found not just in design or technology or art or business but in visual practices that traversed or linked these areas. This dissertation will trace Cold War visual pedagogy across exhibitions, publications, classroom materials, and advertising, thus changing our perspective on how these domains functioned, and clarifying the definitions of terms such as “visual,” “communication,” “media” and “education.” It will identify the relevance of visual pedagogy to the art world, to the corporate world, and to education, showing the broad valence that it had across boundaries that we still sometimes imagine as being sacred, such as the commercial and non-commercial, the artistic and non-artistic.

Visual pedagogy largely involved a cautious optimism about technology. These practices were rooted in genuine beliefs in the potential of visual media to ensure a future that was both technologically-enhanced and democratic. In a context that was increasingly defined by corporate power, and American military aggression, as well as by critiques of the role of visual media as an extension of both, visual pedagogy nevertheless established itself as a progressive force. The dream of empowering artists and designers to take a lead role in providing a humanistic compass for the development of technology arguably did not materialize in its ideal form. However, the progressive sheen of visual pedagogy persisted through the sharp increase in critiques of modernity, capitalism, and American power, and the fracture of the collaborative

¹⁷ John Harwood, *The Interface: IBM and the Transformation of Corporate Design, 1945-1976*, (Minneapolis: University of Minnesota Press, 2011); Reinhold Martin, *The Organizational Complex: Architecture, Media, and Corporate Space*, (Cambridge: MIT Press, 2003); Pamela Lee, “Aesthetic Strategist: Albert Wohlstetter, the Cold War, and a Theory of Mid-Century Modernism.” *October* 138, 2011, 15–36.

space between art and corporate capitalism that was apparent by the 1970s.¹⁸ By understanding how the artists and thinkers of the 1950s and 1960s operated in their institutional contexts, we can grasp the nuances of the ways in which visual media were defined, and the way a subject of a liberal democracy was defined, in answer to Cold War concerns about science and technology.

It is also crucial to note that the practices I address here have escaped sustained scholarly analysis.¹⁹ In part, this may be because they bridge various narratives about Cold War visual culture. Visual pedagogy constituted neither a critique of technocracy nor could it be described as propaganda. Rather than a situation in which specialists in visual media naively entered into a non-visual sphere, expecting their goals not to be questioned, artists and educators truly stretched themselves, genuinely hoping to be interdisciplinary, modern, and politically productive. Similarly, in contrast to cases in which corporations mainly sought to take advantage of artists for cultural capital, in these instances, scientists, businessmen, and politicians operated outside of their comfort zones, strategically aligning their goals with individuals who would not typically have power in their world.²⁰ It is essential that we examine how collaborations like these operated for understanding the cultural shifts of Cold War America, and to articulate the nature of this functional ground that was established between education, industry, and the American government.

¹⁸ See Anne Collins Goodyear's discussion of this in relation to the work of Experiments in Art and Technology (E.A.T.) "From Technophilia to Technophobia: The Impact of the Vietnam War on the Reception of "Art and Technology."" *Leonardo*, Vol. 41, No. 2, (2008): 169-173.

¹⁹ Abbott's science images have only been analyzed art historically by Terri Weissman (*The Realisms of Berenice Abbott: Documentary Photography and Political Action*. (Berkeley: University of California Press; Washington, D.C.: Phillips Collection, 2011). Flora Lysen has written about Burtin in the context of exhibition history ("Blinking Brains, Corporate Spectacle, and the Atom Man: Visual Aspects of Science at the Stedelijk Museum (1962)," *Stedelijk Studies*, Issue #2, 2015), and Josh Ellenbogen and Adam Jolles have written the only art historical article on the visual literacy materials ("Visual Literacy and 1960s Photography," forthcoming).

²⁰ Alex J. Taylor has investigated some of the 1960s instances in which collaborations between artists and corporations had this more complex character. See Alex J. Taylor, "Forms of Persuasion: Art and Business in the 1960s," PhD diss., Oxford University, 2014.

A history of Cold War visual pedagogy will also allow me to intervene in an issue that has mattered deeply to the discipline of art history, the history of relationships between the visual and the verbal, or the seeable and the sayable, in Foucault's terms. This question has been taken up by many as a way of delineating aspects of the discipline of art history, specifying its methods of inquiry but also reframing and expanding its reach. In the opening passage of *Iconology: Image, Text, Ideology*, W.J.T. Mitchell explains his aim of examining "what is at stake in marking off or erasing the differences between images and words?" or how does the question of the difference between images and words answer to ideology?²¹ It is this vein that a history of Cold War visual pedagogy contributes, as an instance in which ideas about images and what they shared and did not share with language can be shown to "fall back into prior questions of value and interest that [can] only be answered in historical terms."²² The educators and artists that I present here each had notions of this question that served his or her purposes as practitioners of visual pedagogy. Their ideas about the visual and the verbal were at times clearly contradictory, which allows us to see what kinds of stakes gave their claims power. Rather than endeavoring to affirm or reject their specific proposals, I will show the precise ways in which they used these concepts, and what it meant for the definition of a citizen of a democracy in Cold War America. Linguistic metaphors were crucial to this period's engagement with "the visual" as a humanistic, progressive force. Psychiatrist Jurgen Ruesch and poet Weldon Kees, in an unusual collaboration, produced a study called *Nonverbal Communication: Notes on the Visual Perception of Human Relations*. Published in 1956 and making use of photographs as "data," Ruesch and Kees argued that the verbal represents the potential for distortion of meaning, more

²¹ W.J.T. Mitchell, *Iconology: Image, Text, Ideology*. Chicago: University of Chicago Press, 1986, 1.

²² *Ibid*, 3.

so than the visual.²³ Abbott, Burtin, and most especially the visual literacy educators also embraced the idea that visuals more genuinely represent human experience and interaction than words do. However, visual pedagogy is broadly characterized by the translation of the act of looking at an image into something similar to the act of reading words, with varying degrees of specificity. In the discourse of visual literacy, even though it was entirely framed around the superior emancipatory qualities of the visual, it was language that was presented as the key to unlocking this potential. Structural linguistics provided the tools by which the visual was supposedly going to supersede the verbal, in the sense that according to visual literacy educators, images needed to be broken down into their organizing components, so that the codes that produced their meaning could be learned. Our task then becomes to better understand what it was that language provided here, and how the field of visual literacy is related to projects like that of Ruesch and Kees, which combined semiotics, communication theory, psychology, and media theory. Gyorgy Kepes' influence on Cold War visual pedagogy will also become crucial, as writers on Kepes have noted that for him, a visual language was not just a grammar or dictionary of visual elements, but a communicative faculty that actually shapes the world, providing it with structure and rendering it less chaotic.²⁴ Kepes found models for this kind of modern communication in advertising, which is instructive for understanding how utopian relations between business and individual that were set up during this period, via visual technology, could ultimately open the door for corporations to have more leeway in how they pursue their goals.

²³ Jurgen Ruesch and Weldon Kees, *Nonverbal Communication: Notes on the Visual Perception of Human Relations*, (Berkeley and Los Angeles: University of California Press, 1956).

²⁴ See Leigh Anne Roach, "A Positive, Popular Art: Sources, Structure, and Impact of Gyorgy Kepes' Language of Vision," PhD diss., Florida State University, 2010, and Anne Collins Goodyear, "The Relationship of Art to Science and Technology in the United States, 1957-1971: Five Case Studies," PhD diss., The University of Texas at Austin, 2002, 112-114.

It has also remained relatively unexamined how exactly it was that photography, as the chief manifestation of a broad discourse around “the visual,” and as a technology that had long been thought of as a democratizing force, played a key role in affirming the notion that an American citizen was mentally free.²⁵ What were the precise visual and technical aspects of photography that were called into service here? The significance of photography as factor in historical change is sometimes taken for granted for the mid-twentieth century, and it is true that by this point photographic technology had long been a major social and political influence. However, it was, of course, being continually reformulated in new ways in relationship to new contexts, and to the thinkers in this study, it did not seem old at all but instead was taken to be one of the most decisive, dangerous, and exciting tools of their time.

I will show that practitioners of visual pedagogy in the United States between the 1950s and the 1970s created a situation in which by using photography in specific ways in educational contexts, Americans could assert their individuality and subjectivity. They built on long-standing links between photography and the ideals of liberal democracy, reframed them, and built new links in ways that allowed them to push forward a progressive agenda that also answered to the needs of the U.S. during the Cold War.²⁶ This had lasting ramifications that we can see in the

²⁵ Terri Weissman has identified how Berenice Abbott, in collaboration with Elizabeth McCausland, rooted her notion of photography and photographic realism, which was the drive behind her 1930s *Changing New York* project, in specific goals of American democratic viewership that were linked with historical perspective and practical social action. It was specifically a kind of photographic realism that required the viewer to add their own subjective position to that which was shown in the image. Terri Weissman, *The Realisms of Berenice Abbott: Documentary Photography and Political Action*. (Berkeley: University of California Press; Washington, D.C.: Phillips Collection, 2011). Abbott and McCausland would have agreed with Lincoln Kirstein’s appreciation of Walker Evans 1938 MoMA exhibition, which according to him looks with “frankness” at the decadence and corruption of the past and promotes a future based on the spirit of the common man. Lincoln Kirstein, “Photographs of America: Walker Evans” in *Walker Evans: American Photographs. Seventy-Fifth Anniversary Edition*. New York: The Museum of Modern Art (2012): 191-200.

²⁶ In addition to the discourse cited above, photography has also long been framed as democratic outside of the realm of artistic photography, in the sense of the proliferation of commercial portraiture, family albums, and amateur photography in general. Robert Hariman and John Louis Lucaites argue that photography, particularly photojournalism, developed very specifically alongside modern liberal democracy in *No Caption Needed: Iconic*

intersection of education and consumer culture in the present day. Photography came to signify individual agency as well as the humanization of technological progress. Moreover, the use of photography and photographic tools in science education transferred these qualities to science itself. The individual mastering of how photography altered space and time seemed like a pathway to the individual mastering of how science and technology were doing this in general. These connotations shaped the ways in which images were used in education, by corporations, and by the government, in intersecting ways, to establish a definition of citizenship in an American liberal democracy in the twentieth century that modernized education while glorifying the ideal of individuality and linking it with corporate success. This context allowed Abbott, Burtin, and Debes to accomplish their goals.

Works by Ruesch and Kees, and of Kepes, are a key part of the background for the mid-century practices of visual pedagogy that are the focus here, and these authors primarily argued their ideas about the visual through the technology of photography. In *Nonverbal Communication*, Ruesch and Kees claimed that communication using photographic images engages more genuinely with the human personality, and is less susceptible than the verbal to manipulation for propagandistic purposes because it bears a more natural relation to its referents.²⁷ Kepes argued in his 1944 book *Language of Vision*, his 1956 *The New Landscape in Art and Science*, and his 1965-1966 edited series *Vision and Value*, that art and science could be productively united through a broad universalizing field of “the visual,” and often used

Photographs, Public Culture, and Liberal Democracy, (Chicago: University of Chicago Press, 2007). Photography has also been linked with democracy in the sense of the emancipation of the oppressed, the extension of citizenship to those to whom it has been denied, as by Frederick Douglass in his 1961 speech “Pictures and Progress.” See Maurice O. Wallace, Shawn Michelle Smith, *Pictures and Progress: Early Photography and the Making of African American Identity*, (Durham: Duke University Press, 2012).

²⁷ Ruesch and Kees, *Nonverbal Communication: Notes on the Visual Perception of Human Relations*, 1956.

photography to put this into practice.²⁸ He positioned art and design as the answer to helping humans synthesize new scientific understanding and a chaotic modern world. By learning this new “language,” viewers would themselves be more whole and would contribute to a more just society. His teaching methods, writing, and artistic practice were often centered on the use of photographic images, both viewing them and producing them, as part of identifying visual commonalities between disparate things in the natural and human-made worlds.

The power of these pedagogical uses of visual technology was also based on the specific ways in which vision was defined in 1950s and 1960s America. As a set of capabilities, the faculty of vision was identified as modern, creative, and spiritually and morally redemptive. Kepes wrote that the education of “creative vision” would restore “visual integrity” to society, and help to improve man’s relation to nature, to other men, and his understanding of his inner self.²⁹ As mentioned above, Burtin wrote that designers have a “social responsibility” to use their visual skills to work towards the “integration of our culture.”³⁰ Even when vision was redefined as technologically enhanced rather than biological, mediated rather than direct, it still constituted a humanization and democratization of communicative exchange, or in the words of Ruesch and Kees, “a renewal of emphasis on the individual, with all his personal and unique characteristics.”³¹ These new implications of “the visual” also depended on reconfigurations of thinking into a process that could be described as picturing, and thus to an integration of

²⁸ Gyorgy Kepes, *Language of Vision*, (Chicago: Paul Theobald, 1944); Gyorgy Kepes, *The New Landscape in Art and Science*, (Chicago: Paul Theobald, 1956); Gyorgy Kepes, ed., *Vision and Value Series*, (New York: George Braziller, 1966).

²⁹ Gyorgy Kepes, ed. *The Education of Vision*. *Vision and Value Series*. New York: George Braziller, Inc., 1965, i-vii

³⁰ Burtin, “Integration: The New Discipline in Design,” 232.

³¹ Ruesch and Kees, *Nonverbal Communication: Notes on the Visual Perception of Human Relations*, 1956, 193.

perception and cognition, linking vision with intellectual power.³² Psychologists Rudolph Arnheim and J.J. Gibson, who were cited repeatedly in the field of visual literacy, defined “visual thinking” as a process of creative organization, of actually generating and ordering visual objects in the mind, rather than a process of mental representation of already extant visual phenomena.³³

This formulation of vision as perceptual and cognitive had the potential to integrate human brains with surroundings in a relationship of feedback that suggested a regaining of control and agency in an increasingly chaotic and expanding environment. In the work of designers such as Charles and Ray Eames, vision was redefined to seem more like thinking, in the sense that perception involves not just passive intake, but the active processing and synthesis of visual stimuli. Vision was framed as an activity that one could practice and refine, rather than something that happened to a person. In addition, this perceptual-cognitive faculty was now thought to engage with an interconnected environment, rather than to mediate individual objects in the world. Based on wartime developments in computing, cyberneticians, psychologists, and designers imagined vision as an algorithmic process that makes sense of a general visual field by noticing patterns and reacting to feedback. As Orit Halpern has noted, vision was defined as a system that simultaneously extended inward to the brain, and out into the world.³⁴

³² While this was formulated in ways that are specific to the mid-century American context I treat here, it is far from the first time that photographic picturing was positioned as being like thought (See Josh Ellenbogen, see “Camera and Mind,” *Representations* 101 (Winter 2008), 86–115). Also relevant are the ways in which our vision had already been specifically theorized as being like picturing. (See Joel Snyder, “Picturing Vision,” *Critical Inquiry*, Vol. 6, No. 3 (Spring, 1980), pp. 499-526. For the Cold War “age of the visual,” both angles mattered a great deal; that pictures could be aligned with the operations of our vision, and that our vision could be aligned with the operations of our intellect.

³³ Rudolf Arnheim, *Visual Thinking*, (University of California Press: Berkeley, 1969). See also Arnheim’s essay “Visual Thinking” in Gyorgy Kepes, *Education of Vision*, Vision and Value Series (New York: George Braziller, Inc., 1965) and J.J. Gibson, *The Perception of the Visual World* (Boston: The Riverside Press, Houghton Mifflin Company, 1950).

³⁴ Orit Halpern, *Beautiful Data: A History of Vision and Reason Since 1945*, (Durham, N.C.: Duke University Press, 2014), 7.

This dissertation will thus argue that one of the main ways in which visual pedagogy answered to the needs of the Cold War was the way it framed human relationships to science and technology. Strategic uses of visual media often served to foreground a sense of physical human immediacy and individual agency while still embracing scientific and technological developments. In Burtin's words:

The emergence of science as a major factor in our contemporary lives is a disturbing as well as a challenging factor. Humanity is deeply concerned about a radically altered relationship of forces which determine now the course of national destinies. As much as the scientist, the designer of communications and industrialized products has been catapulted into a position where he cannot divorce himself from these changes and from the problems which people face collectively. The importance of design is growing because of the help it can give toward a clearer, easier understanding of the new world image, and of reassuring the individual of his value and central position. This fact is still questioned by many people who cling to "the old days" of a more arbitrary and unplanned use of art and design, or of a designer's exclusive concern with the aesthetic aspects alone.³⁵

Design could have a comforting effect that corporations and the American government used to their advantage in pedagogical projects. By the mid-twentieth century, science and technology were framed as generalized categories and caused both optimistic idealism and tense anxiety. The experiences of war and the violent ramifications of advances in chemistry and physics intersected with the "shrinking" and "accelerating" of the world that had been caused by the telegraph, telephone, radio and now television. This meant that it seemed more and more possible that the average person could feel overwhelmed by the results of scientific progress and new technology. As the Cold War intensified, computers were increasingly doing things people found unnerving. The U.S.S.R. had launched *Sputnik I*, stoking fears about surveillance and nuclear missiles. The general public did not understand how human brains and bodies worked in

³⁵ Will Burtin, "On Corporate Images," *Graphis* 104 (1962), 633.

relation to invisible forces like electricity or radiation. Popular culture imagined various outcomes of space travel, nuclear bombs, and artificial intelligence, which often centered around what it meant to be human and whether or not those qualities were enough to ensure that humanity would survive.³⁶ Marshall McLuhan was suggesting that “in this electric age we see ourselves being translated more and more into the form of information, moving toward the technological extension of consciousness.”³⁷ In this environment, as Americans grappled in different ways with the new developments, and charted various paths forward, it was often a broad notion of “the visual” that served as a reference point for the progressive possibilities of technology. The human faculty of vision, visual tools, and visual material, all took on powerful significance in discussions about tethering science to human values, securing the sanctity of human subjectivity in interactions with machines, and harnessing a technological society to liberal democratic values. As mentioned above, visual pedagogy took a stance in this context that was neither utopic nor skeptical. It did this by explicitly proposing to merge human qualities, framed as perception and sensory experience, with the scalable systems provided by new technology.

Cold War visual pedagogy is also deeply connected with the history of corporate involvement in the arts. As scholars have identified, the enthusiasm on the part of corporations to build art collections, organize exhibitions, support museums, and commission artists is a

³⁶ Scholarship on anxious responses to Cold War technology in various popular and intellectual spheres includes David Crowley and Jane Pavitt, eds., *Cold War Modern: Design 1945-1970* (London: V&A Publishing, 2008), Peter J. Kuznick and James Burkhart Gilbert, eds. *Rethinking Cold War Culture*, (Washington, D.C.: Smithsonian Institution Press, 2001), M. Keith Booker, *Monsters, Mushroom Clouds, and the Cold War: American Science Fiction and the Roots of Postmodernism, 1946-1964* (Westport, CT: Greenwood Press, 2001), and Paul Erickson, Judy L. Klein, Lorraine Daston, Rebecca Lemov, Thomas Sturm, and Michael D. Gordin, *How Reason Almost Lost Its Mind: The Strange Career of Cold War Rationality*. (Chicago: University of Chicago Press, 2013).

³⁷ Marshall McLuhan, *Understanding Media: The Extensions of Man*, (New York: McGraw Hill, 1964), 64.

hallmark of the 1960s.³⁸ These collaborations often intersected in complex ways with the government's efforts to fight the Cold War, in the sense that corporate philanthropy and support of culture could appear as evidence of the natural link between capitalism and humanistic progress. My research shows that the fields and discourses of visual pedagogy were further opportunities and instances in which corporations, especially in science and technology, sought to attach their brands to ideas, not just to products, and could treat the sphere of education as a market. This was possible because of new discourses that defined visual media and human subjectivity in certain ways. The mid-century period is known as the "golden age" of capitalism and the concentration of its power, while also being an era of radical counterculture and resistance in the name of human rights, and the situation my project addresses takes place at a time when debates about the relationship of corporations to social responsibility were raging.³⁹ Artists and other specialists in visual media took on a variety of places in relation to these debates in powerful and conflicting ways, doing work that disrupted corporate power, extended corporate power, or in some cases, both. Artistic practices, sometimes because of assumptions about their nature as occupying a separate sphere, could often push forward the objectives of the powerful entities from which they set out to differentiate themselves, and it is these complex instances that reveal the subtleties of the relationship between art and economics during this period. My research extends this kind of inquiry to interrogate the social operations of images, but focuses on visual practices that did not endeavor to maintain these boundaries. They rather strove to extend the emancipatory potential of art to much broader categories of visual material,

³⁸ For histories of the art world, visual culture, and corporations in the 1960s, see Neil Harris, *Cultural Excursions*, (Chicago: University of Chicago Press, 1990), and Michelle Bogart, *Artists, Advertising and the Borders of Art*, (Chicago: University of Chicago Press, 1995).

³⁹ See popular critiques of consumer culture such as those of Vance Packard, *The Hidden Persuaders* (New York: The David McKay Company, 1957) and *The Waste Makers* (New York: The David McKay Company, 1960), but also conversations amongst economists and policy makers, and proponents of economic liberalism such as Milton Friedman. See Milton Friedman, *Capitalism and Freedom* (Chicago: University of Chicago Press, 1962).

to “the visual” as not only a type of physical object but a psychological and social force that could operate in the realms of educational imagery, design, and scientific visualization. These practices need to be examined in order to understand the broader ramifications of these collaborations.

My approach to investigating the forms of subjectivity, including illusory forms of independence and individuality, that emerge via mass media and may capitulate to capitalist oppression, owes much to the context of Frankfurt School critical theory, as well as to critiques of surveillance and spectacle by Foucault and Debord, and to critiques of the aesthetic and sensory experience of postmodern visual culture by Jean Baudrillard and Frederic Jameson.⁴⁰ As Martin Jay has pointed out, much of this work constitutes a denunciation of the visual as oppressive, whether in the sense of the individual being the object of the gaze of the state, or a passive, uncritical viewer of “the perfect image of the ruling economic order.”⁴¹ Throughout the postwar period, however, visual pedagogy enthusiasts were proclaiming the oppressiveness and antiquatedness of verbal culture, and the democratic modernity of the visual. Visual pedagogy in fact emerged alongside these debates around the psychology and status of the viewing subject in a mass media culture, delineating and defending visual communication as potentially distinct from verbal propagandistic power. It also reckoned with the question of the relation of signifier to signified, and of the confusion between image and reality that occupied theorists of the visual culture of capitalism and modernity throughout the twentieth century, but proposed the use of

⁴⁰ I am thinking of writings such as “The Culture Industry: Enlightenment as Mass Deception” in Theodor Adorno and Max Horkheimer’s *Dialectic of Enlightenment*, 1944, and Herbert Marcuse, *One Dimensional Man*, (Boston: Beacon Press, 1964). See Michel Foucault, *Discipline and Punish*, translated by Alan Sheridan (New York: Vintage Books, 1979), Jean Baudrillard, *Simulacra and Simulation*, translated by Sheila Faria Glaser (Ann Arbor: University of Michigan Press, 1994), and Frederic Jameson, *Postmodernism, or the Cultural Logic of Late Capitalism*, (Durham: Duke University Press, 1991).

⁴¹ See Martin Jay, *Downcast Eyes: The Denigration of Vision in Twentieth Century French Thought* (Berkeley: University of California Press, 1994). I quote here from Guy Debord, *Society of the Spectacle*, trans. Donald Nicholson-Smith, (New York: Zone Books, 1995), 15.

more visual media as the solution. Rather than positioning visual pedagogy as acquiescent to systems of power however, I aim to demonstrate why it was able to gain traction. This is crucial as notions of visual “literacy” are a continuing and consistent part of contemporary modes of cultural critique. It produced ideas about a distinct realm of visual signification, and ways of linking visual images with educational goals, which persist today as part of the framework of a “pictorial turn” in scholarship.⁴²

I join other scholars in searching for nuanced ways to understand cultural production in the context of mid-twentieth economic and political conditions by asking how exactly individual image-makers pursued their goals while navigating a political landscape, and avoiding the overuse of a dichotomy of the artistic and the commercial, or of the radical and the mainstream.⁴³ Additionally, while my project critiques some of the underlying formulations of the field of visual studies such as the idea of visual literacy, it is, of course, indebted to it in the sense that I take images, across distinct media and spheres of knowledge, as appropriate subject matter for art historical interpretation.⁴⁴ It seems crucial for understanding our current visual culture, including the presence of corporate power in the educational sphere, to find new ways of describing the agency of images in the history of liberal democratic systems and structures. The practices I examine here were not nationalistic, nor instruments of commerce, nor institutional

⁴² See W.J.T. Mitchell, *Picture Theory*, Chicago: University of Chicago Press, 1994, and Neal Curtis, ed., *The Pictorial Turn* (London: Routledge, 2010).

⁴³ See work such as Alex J. Taylor, “Forms of Persuasion: Art and Business in the 1960s” (PhD diss., Oxford University, 2014), John R. Blakinger, “The Aesthetics of Collaboration: Complicity and Conversion at MIT’s Center for Advanced Visual Studies,” *Tate Papers*, 25 (Spring 2016), <https://www.tate.org.uk/research/publications/tate-papers/25/aesthetics-of-collaboration>, accessed 9 July 2018, Jennifer Josten, *Mathias Goeritz: Modernist Art and Architecture in Cold War Mexico*, (New Haven: Yale University Press, 2018), and John J. Curley, *A Conspiracy of Images: Andy Warhol, Gerhard Richter, and the Art of the Cold War*, (New Haven: Yale University Press, 2013).

⁴⁴ Taking as models for this approach Michael Baxandall, *Patterns of Intention: on the Historical Explanation of Pictures* (New Haven: Yale University Press, 1985), and Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983), for example.

critiques, but rather could be said to be working to find ways to reinforce the increasingly fraying connections between democratic subjectivity and the modernist impulse towards the new. My subject here is what happened as a result of their strategies.

In addition, as Fred Turner has shown with regard to postwar exhibition design and experimental art practices in the 1960s, approaches to the visual can retain the ability to produce specific modes of viewership while simultaneously having their politics reshaped over time.⁴⁵ As we have also seen in the case of the global circulation of art during the Cold War in collaborations between corporations, the government, and artists, visual objects can be put towards political or ideological purposes in flexible ways.⁴⁶ I draw attention here to how images were instrumentalized by parties with differing political investments in the definition of American citizenship during the Cold War. This research is based on the well-preserved and extensive personal archives of the three main practitioners of visual pedagogy that I focus on here: Abbott, Burtin, and Debes, as well as the archives of the International Visual Literacy Association. I draw heavily from correspondence, drafts of publications, planning documents, administrative records, and period press coverage and criticism. We are also fortunate to have materials related to the production of visual material, such as Abbott's negatives, and small-scale models for Burtin's exhibitions. These archives make it possible to follow the development of visual pedagogy proposals from their origins, note both successes and failures, investigate the nature of the obstacles and resistance they encountered, and trace negotiations between competing priorities.

⁴⁵ Fred Turner, *The Democratic Surround: Multimedia and American Liberalism from World War II to the Psychedelic Sixties*, (Chicago: University of Chicago Press, 2013).

⁴⁶ For some examples, see Greg Barnhisel, *Cold War Modernists: Art, Literature, and American Cultural Diplomacy*, (New York: Columbia University Press, 2015) and Michael L. Krenn, *Fall-Out Shelters for the Human Spirit: American Art and the Cold War*, (Chapel Hill: University of North Carolina Press, 2005).

Cold War visual pedagogy involved framing visual technology as a method by which individual minds could actively and independently unlock knowledge that was encoded into an otherwise unknowable world, thus performing their role as citizens of a democracy and independent thinkers. While this was conceptualized by progressive educators who aimed to empower all members of society, it functioned in much more elastic ways in corporate and political contexts. In effect it was crucial to the definition of American citizenship in the twentieth century. Seeing this requires observing the common grounds that were established between different spheres. Art, education, and government collaborated on investments in using visual technologies to nurture and define the ideal of individual scientific learning and thought, linking technology, science, and American identity on a deep level. As a discourse, visual pedagogy and visual literacy secured a shared space between educators and corporations, artists and the state, and the government and industry. Educators and the powerful companies who supplied them with tools could then work together seamlessly, developing cutting-edge methods that served both of their needs. In this yoking together of art, government, the corporate world, and the academy, collaboration could often seem progressive while inviting corporate or political power into the most vulnerable places. It was an emphasis on a specific kind of technology-driven image-making, and its attendant connotations of individualization and agency as offered by notions of visual pedagogy, that made this fusion of artistic innovations and corporate or political agendas possible. In endeavoring to bring human values to bear on scientific and technological progress, visual pedagogy formulated a viewing subject that we would still identify with today, one who empowers herself by actively using visual media to articulate her identity and freedom of mind. Moreover, as it did at the time, this notion that easily adaptable and exchangeable visual media could be a tool for individual empowerment continues today to also

increase corporate power. I am interested in the process by which we gave visual technologies this ability to emancipate, and what the consequences are, both positive and negative.

2.0 BERENICE ABBOTT AND AMERICAN SCIENCE EDUCATION⁴⁷

I begin with the work of American photographer Berenice Abbott, whose turn to scientific photography exemplifies the unique roles for artists that appeared in educational contexts as part of Cold War visual pedagogy. Abbott is well known for her 1920s portraiture and her 1930s documentary series *Changing New York*. Scholars have paid much less attention to her subsequent shift to science as a photographic subject, an endeavor that defined the latter half of her career.⁴⁸ Abbott's interest in science has appeared to some as an abrupt shift in focus, but in fact grew out of her earlier work, which was consistently related to the new role photography was taking on in American political life. As scholars, especially Terri Weissman, have acknowledged, throughout Abbott's portraiture and her New York images, she positioned photography as a method by which one could participate in the modern world. She saw this

⁴⁷ Material from this chapter has been published as "Pedagogical Interventions: The Physics Photographs of Berenice Abbott," *RACAR: Revue d'art canadienne/Canadian Art Review* 41, no. 2, 2016, 72-85, and was adapted for the paper "Berenice Abbott, the Physical Science Study Committee, and Visual Pedagogy in Cold War America," *Athanor* 36, 2018, 89-95.

⁴⁸ For Abbott's full biography, see Julia Van Haften, *Berenice Abbott: A Life in Photography*, (New York: W.W. Norton and Company, 2018). Monographs on Abbott include Berenice Abbott and Hank O'Neal, *Berenice Abbott: American Photographer* (New York: McGraw-Hill, 1982), Berenice Abbott, *Berenice Abbott, Photographer: A Modern Vision*, edited by Julia Van Haften (New York: New York Public Library, 1989), Gaëlle Morel, Sarah M. Miller, and Terri Weissman, *Berenice Abbott* (Paris: Éditions Hazan and Toronto, Ryerson Image Centre, 2012), and recent volumes published by Steidl, spearheaded by Ron Kurtz, who held Abbott's archive at Commerce Graphics before it was transferred to the MIT Museum and the Ryerson Image Center. Scholars of Abbott who focus on her portraiture and *Changing New York* include Peter Barr, Sarah Miller, and Bonnie Yochelson. Histories of the science work are found in Van Haften's 2018 biography, Hank O'Neal's introduction to his 1982 collaboration with Abbott, and Terri Weissman's *The Realisms of Berenice Abbott: Documentary Photography and Political Action* (Berkeley: University of California Press, 2011), chapter five. Abbott's science work and related archival materials were also the focus of an extensive 2012 exhibition at the MIT Museum entitled "Berenice Abbott: Photography and Science: An Essential Unity" curated by Gary Van Zante.

question of active participation, by photographer and viewer, as vital to twentieth-century America and identified photography as having the potential to be “a great democratic medium...by the many and for the many.”⁴⁹ Abbott saw photography as a communicative medium, with the responsibility to reach a diverse and inquisitive public. “The photograph,” she wrote, “full of detail and objective, visual facts, speaks to all people.”⁵⁰ The principle that the visual technology of photography was inherently connected to modern democratic progress was also circulating more widely, and Abbott tapped into this discourse when she first turned to scientific subject matter in 1939. Her scientific photographs appeared in magazines, books, and exhibitions throughout the 1940s and 1950s, and ranged in scope from biology and physics to industry and technology. As she continued to engage with this topic, her work helped to solidify a role for photography in American concepts of progress in more and more direct ways, culminating in her position with the Physical Science Study Committee (PSSC) at Massachusetts Institute of Technology from 1958 through 1960.

The Physical Science Study Committee was a venue for the unique intersections between the work of ex-military scientists, growing industries in visual technology, and Cold War politics that characterize this period. While it took a series of fortunate circumstances for Abbott to become involved, it was no accident that in this program she found the most suitable scenario for making the images she had in mind and that her photographs found a home in this context for decades afterward. In 1956, physicists and educators formed the PSSC to reform high school physics curricula and made plans to produce a new textbook, teacher materials, and a series of films. The idea was to make high school curriculum more richly reflect modern physics and to

⁴⁹ Berenice Abbott, “It Has to Walk Alone,” *American Society of Magazine Photographers NEWS*, November 1951, 14.

⁵⁰ Berenice Abbott, *A Guide to Better Photography*, (New York: Crown Publishers, 1941), 167.

use visual media to do so. At the same time, in the post-war and Cold War period, politicians and the American public tended to view science education as a matter of national security, and federal support for curriculum reform was strong.⁵¹ After the launch of Sputnik in 1957 things became even more politically urgent, and the PSSC received funding from the National Science Foundation, as did other programs in curriculum reform.⁵² Because scientists like those at MIT enjoyed close contact with the federal government at this time, we must situate the PSSC in a broader context of American politics, to which Abbott was very much attuned.

This chapter will interpret the specific approach to using photography to explain physics that Abbott developed while working for the PSSC, and show that her approach positioned photography as having a crucial role to play in the pedagogy of modern science in America. On the front cover of the new 1960 PSSC textbook, an image of a ball repeats itself through a strobe exposure as it bounces, drawing four diminishing arcs against a flat, black background.⁵³ The potential for this image to convey its content – a law of motion – relies on the viewer’s understanding of how photographic technology works. In this image and others, Abbott strategically makes use of certain traces in the prints that viewers recognize as manifestations of the photographic process, drawing on conventions of photography already established and visually familiar. The viewer is invited to approach the images of the ball as points in a diagram, with the help of information provided by accompanying text, equations, and drawings. This chapter will argue that Abbott’s images are intelligible based on the placement of the

⁵¹ For more see John L. Rudolph, *Scientists in the Classroom: The Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002). Rudolph notes that while federal funding for projects to improve science education in this period was tied to the Cold War, the scientists themselves had many and varied goals that they often objected to having tied to nationalism or political ideology.

⁵² For a history of the PSSC, see James R. Killian, Jr., *The Education of a College President: A Memoir* (Cambridge: MIT Press, 1985), 166-173, Oscar L. Brauer, “Conventional physics against PSSC Physics”, *Science Education* Volume 49, Issue 2, (March 1965): 170-171 and George F. Smith, “PSSC Applied Physics,” *The Physics Teacher* Volume 3, Issue 7 (1965): 312-317.

⁵³ *Physics*, Physical Science Study Committee (D.C. Heath, 1960), 74.

conventions of the visual technology at the forefront. The images both call upon the viewers' previously formed expectations of photographic images, and teach the viewer to make use of their understanding of the photographic process to access knowledge of physics. In the context of physics lessons, photography is positioned as an extension of the viewers' active process of observation and analysis.

This role for the viewer is what makes Abbott's work important here. As I will show, it illuminates key aspects of twentieth-century discourse around photography and communication that emerge at multiple nodes of intersection between politics, industry, and education. Abbott's images operate by tapping into the viewer's understanding of how photographic technology mediates the world, and invite the viewer to compare this to the operations of their own mind. This quality of Abbott's images manifests the broader stakes of educational uses of photography in the Cold War period. In educational contexts such as the PSSC, photography was called into service in ways that helped to articulate the agency of individuals in the modern world, which had to be established in a way that reckoned with the rapid changes in science and technology, and affirmed the superiority of American liberal democracy in a global context. Photographs that placed knowledge-making power in the hands of a viewer who had the freedom to choose which media they consumed, and also had a facility with visual technology, could help to define this mid-century American subject and imply the sanctity of their individual thought process.

2.1 ABBOTT'S SCIENCE PHOTOGRAPHY PRACTICE

Abbott's interest in science throughout her life and her successful development of a scientific photography practice have only been treated by a few scholars, which include Julia Van Haften, Terri Weissman, Hank O'Neal, and Gary van Zante. The images themselves have not been analysed from an art historical perspective nearly as much as her other projects have been. However, Abbott saw her science work as her major achievement, rooted in the same principles she had explored all her life, and was focused on it for decades. Abbott moved towards scientific subjects in the late 1930s, as her *Changing New York* project wound down. In April of 1939, she wrote to a friend, Dr. Charles C. Adams, zoologist and director of the New York State Museum in Albany. This letter contained what she called a "treatise," which laid out a role for the photographer as "a friendly interpreter between science and the layman" that would ensure that the discoveries of modern science would have their maximum benefit for humanity.⁵⁴ Abbott wrote frequently about photography and about her own work, and published in periodicals, exhibition catalogues, and in two books for photographers called *A Guide to Better Photography* (1941) and the revised version, *New Guide to Better Photography* (1953). Abbott's words in this early text on her intentions for science as a subject resonate with the broader conversation that was occurring at the time, about the need to integrate new science with human values, and to bring the new scale of the unknown into the grasp of the average person. These exact ideas gave photography the power not just to communicate science, but to establish individual American subjectivity as the Cold War developed.

⁵⁴ Letter to Charles C. Adams, April 4, 1939, Box 6, Folder 28, Berenice Abbott Papers, NYPL.

Abbott applied in 1941 to the Guggenheim Foundation for a grant to pursue scientific photography and referenced in her application the aspiration to contribute to “democratic life” by means of photographic images.⁵⁵ Around this time Abbott also began to experiment on her own, and took commercial assignments to document laboratories; a spread on agricultural research was published in *Life* magazine on June fifth of that year, leading to an invitation to publish that image in a science text from Ginn and Co. Educational Publishers.⁵⁶ In her 1941 *A Guide To Better Photography* Abbott concluded by expressing her view that science was the ideal subject for the future of the field of photography, a subject that would release photography from the influence of other art forms, and allow it to become a “broad, human art, as wide as the world of human knowledge and action.”⁵⁷

In the 1940s Abbott developed her “Super-Sight” technique, which she also called Projection Photograph, to obtain an extremely high level of detail very close up. This involved projecting and enlarging an image before exposure. In a dark room, the object was lit from the front inside a closed box with a lens on the outside, which projected an enlarged image onto film outside the box. By enlarging the object instead of a negative, Abbott achieved prints with more tones and less grain, meaning extreme close-ups with striking levels of detail. This visual quality, of the human senses extended by technology, was an example of what Abbott felt photography could do, and of the visual strategies that make her work so resonant with the concerns of this period. Examples of subjects that received this treatment ranged from a tangle of grass roots, an apple, and a fish, and eventually she experimented with during portraiture this way. A precedent

⁵⁵ See Van Haften’s explanation of this in *Berenice Abbott: A Life in Photography*, 251. Van Haften quotes here from the Guggenheim Foundation Archive.

⁵⁶ Letter from Ginn and Co., November 20, 1939. Box 6, Folder 28, Berenice Abbott Papers, NYPL.

⁵⁷ Abbott, *A Guide to Better Photography*, 174.

for her later work, this technique demonstrates her interest in shaping photographic technology so that it would produce scientifically useful images.

Throughout this period, Abbott further sought to acquaint herself with publishers and scientists who shared her interest in images that could help the general public understand science, and continued to experiment. She developed specialized photographic techniques and equipment and started a business, the House of Photography, to patent her inventions. From 1944 to 1945, Abbott worked as photography editor of *Science Illustrated*, selecting and also creating photographs for publication. She was hired for this position by Gerald Wendt, known for his popular science lectures and his roles as director of science and education for the 1939 New York World's Fair, and science editor at *Time Magazine*.⁵⁸ Wendt and Abbott had been in touch previously about her interests in scientific communication.⁵⁹ Ideas for *Science Illustrated* jotted down in a notebook include a series of Super-Sight photographs of everyday objects, a series on "laws of nature" and a series on the seasons, in the context of which she was thinking about photography's ability to represent the non-visual. In pondering her series on the seasons she asked herself, for example, "can we photograph sensations" such as the feeling of cold.⁶⁰

In 1947, plans for an exhibition in Paris included several Super-Sight photographs, and in 1948, Abbott exhibited them at the Museum of Modern Art in *In and Out of Focus*, a show curated by Edward Steichen.⁶¹ The Super-Sight photos also appeared in an exhibit at the Akron Art Institute in 1950.⁶² In 1948 Abbott contributed several photographs, such as a close up view

⁵⁸ "Gerald L. Wendt, Had Aided Unesco," *The New York Times*, December 24, 1973, 16.

⁵⁹ Letters from Wendt, c. 1941, Box 6, Folder 28, Berenice Abbott Papers, NYPL.

⁶⁰ Notes, Equipment improvement ideas, undated, 1, Box 10, Folder 2, Berenice Abbott Papers, NYPL.

⁶¹ "List for Paris exhibition, October 1947," Box 15, Berenice Abbott Collection, MIT Museum Archive. MoMA loan receipt for exhibition "In and Out of Focus," April 6 to July 11, 1948, c. April 1, 1948, Box 5, Folder 65, Berenice Abbott Papers, NYPL.

⁶² Letter from director of Akron Art Institute, March 10, 1950, and checklist, Box 1, Folder 8, Berenice Abbott Papers, NYPL.

of a magnolia plant, to the *American High School Biology* textbook, published by Harper and Brothers. This textbook featured her photographs prominently and called attention to her authorship and technique.⁶³ In 1946, Abbott also taught part of Moholy-Nagy's "New Vision in Photography" seminar at the Institute of Design in Chicago, also known as the New Bauhaus.⁶⁴ In the late 1940s, with the support of science historian I. Bernard Cohen, Abbott considered ideas for a book on electricity. She also had plans for an unrealized book of Super-Sight images in collaboration with Muriel Rukseyer and the publisher Doubleday. By 1953 her reputation in the field of science photography had led to an invitation to publish an image on the cover of *Scientific Monthly*.⁶⁵ Abbott's *New Guide to Better Photography* contained science photographs, including an experiment in photographing waves, a technique she would employ six years later at MIT.⁶⁶ Despite many unrealized projects and an overall lack of strong support, Abbott remained committed to the subject of science and continued to experiment.

Abbott was encouraged to contact the Physical Science Study Committee by Richard Winslow of the publisher Doubleday and Company, who wrote to her to say that Dr. E.P. Little, director of the PSSC, had been told about her work by George H. Waltz Jr. of *Popular Science*

⁶³ Charlotte L. Grant, H. Keith Cady, and Nathan A. Neal, *American High School Biology*, New York: Harper and Brothers Publishers, 1948. Abbott's images appear on the frontispiece and in several places inside including pages 67, 68, 243, 427, 771, and 772.

⁶⁴ Abbott is known to have taken issue with some New Bauhaus teaching methods, and she saw her scientific image-making practice as radically different from that of Gyorgy Kepes, who was based by this time at MIT. (See her interview with Hank O'Neal, recorded between August 30 and September 8, 1980, at her house on Lake Hebron, near Monson, Maine, Berenice Abbott Collection, MIT Museum Archive). However, the New Bauhaus and Kepes' work were undeniably parts of the context in which her practice gained traction. She was very specific about photographic technique, and about what a scientific photograph should do, and Kepes' work differed from hers in the sense that it was not designed for teaching actual science but rather the set of interdisciplinary visual skills he considered crucial in the modern era. This is an important distinction, and an interesting one, because of how both individuals made use of the same discourses of visual technology, pedagogy and interdisciplinarity that were circulating at this time.

⁶⁵ Abbott's collaborations with Cohen and Rukseyer are discussed in the 2012 MIT Museum exhibition *Berenice Abbott: Documenting Science* and in Van Haften, *Berenice Abbott: A Life in Photography*, 241-267. Letter from *Scientific Monthly* November 5, 1953, correspondence M-Z, Berenice Abbott Collection, MIT Museum Archive.

⁶⁶ Berenice Abbott, *New Guide to Better Photography* (New York: Crown Publishers, 1953) illustration no. 9, n.p.

magazine.⁶⁷ The PSSC were receiving federal funding as part of the push during the Cold War to inspire youth to enter the field, especially after the launch of Sputnik in 1957.⁶⁸ Abbott's connections with Doubleday, paired with encouragement from Robert C. Cook, editor of *Genetics* magazine, whom she had met through the Biological Photographic Association, and from Cohen, who was working with the PSSC, resulted in her applying and being hired by Little in 1958 to help with the new physics textbook. This was the opportunity Abbott had been waiting for to focus on her goals for scientific photography, in a setting where she was supported financially and could collaborate with scientists. She later stated, "I was doing just what I wanted to do, and getting paid for it, for the first time in my life."⁶⁹ The goal of the PSSC course was to teach the basic laws of physics, the concrete rules that explain how the universe works. Classroom experiments instantiated these abstract concepts for students. As I will explore more fully in the second section of this chapter, the PSSC wanted to see science education reflect the actual work that modern physicists did. Their goal was to show the student that "physics is a developing subject, and that this development is the imaginative work of men and women like him."⁷⁰ The curriculum emphasized experimentation and the ability of students to understand the process of the discovery of fundamental laws rather than just to memorize facts. The students were to find their own answers through experiment rather than do experiments to show answers

⁶⁷ February 6, 1958 memo from Richard Winslow at Doubleday, Box 2, Folder 56, Berenice Abbott Papers, NYPL. See also Weissman, *Realisms*, 2011, 190 and Van Haften, *Berenice Abbott: A Life in Photography*, 347-348.

⁶⁸ For more on the federal government's particular interests in training future scientists at this time, see for example Daniel Lee Kleinman and Mark Solovey. "Hot Science/Cold War: The National Science Foundation after World War II." *Radical History Review* 63, 1995, 110-139.

⁶⁹ Interview with Hank O'Neal, recorded between August 30 and September 8, 1980, at her house on Lake Hebron, near Monson, Maine. Berenice Abbott Collection, MIT Museum Archive.

⁷⁰ James R. Killian's preface, *Physics*, Physical Science Study Committee (D.C. Heath, 1960), vi. See also E.P. Little, "PSSC: A Physics Program," *Educational Leadership*, December 1959, Vol 17, No. 3, 167-169, 192.

they already knew.⁷¹ In addition, in the post-war era, physics education went through significant changes as a result of the increase in students entering the field, new pedagogical techniques, and continuing developments in technology.⁷² While some teachers felt that the PSSC Physics course was too esoteric and did not focus enough on the real world information that students needed, others found it a revelation. As the PSSC scientists seemed to know, visual media had a role to play in defining this new era of American science, one with expanded boundaries and brimming with both optimism and anxiety. During the project Abbott collaborated with physicists and technicians to construct the scenarios that led to the photographs, experimenting with materials and equipment as she went along. She later described her time with the PSSC as very productive despite the difficulties of being a woman in a male-dominated environment, and an artist amongst scientists who were sometimes skeptical of her value.⁷³ However, she did not have control over how the images appeared in the text and had reason to be unhappy with the size and quality of the reproductions. After the 1960 edition of PSSC Physics was published, Abbott was pushed out of the project, and her job given to her assistant, but her images were still in use in the seventh and last edition, published in 1991.⁷⁴

⁷¹ *Physics*, 1960, preface by James R. Killian, v-vi. Killian writes: "...physics is presented not as a mere body of facts, but basically as a continuing process by which men seek to understand the nature of the physical world."

⁷² See David Kaiser's book on Feynman diagrams, the history of which is intertwined with character of postwar American physics and notions of academia and democracy, *Drawing Theories Apart*, Chicago: University of Chicago Press, 2005), 14-16 and 253-259.

⁷³ See Julia Van Haften's essay in *Documenting Science* (Göttingen: Steidl, 2012), 10 and Weissman, *Realisms*, 198 for more on Abbott's references to this.

⁷⁴ When being interviewed by Hank O'Neal in 1980, Abbott expressed it this way: "They gave my job to my assistant, who was just a ham...I never in my life was so unhappy." Abbott goes on in this interview to say that she felt that the scientists were always planning to replace her after the book was finished and her "boss" had left (meaning Little) She also mentioned here her displeasure with the appearance of the photographs in the final text (with Hank O'Neal, recorded between August 30 and September 8, 1980, at her house on Lake Hebron, near Monson, Maine., Berenice Abbott Collection, MIT Museum Archive). Abbott also discussed this in a 1975 interview conducted for the Oral History Project of the George Eastman Museum ("Interview with Berenice Abbott conducted at Miss Abbott's home in Maine during July of 1975 by James McQuaid and David Tait," Oral History Project of the International Museum of Photography at the George Eastman House, 1978).

In addition to their use in the textbook, which from that point on became one of the main options for high school physics curricula in the U.S., the images were also circulated in exhibitions and covered by the media soon after the book came out. A touring exhibition called *Portraits from Physics* was made available by Educational Services Incorporated (the distributor of the PSSC materials), and the images were also shown at the New School for Social Research in New York (where Abbott taught for many years). They were also published in several magazine articles in the early 1960s.⁷⁵ Abbott was also asked to send images for the *Harper Encyclopedia of Science* in 1962.⁷⁶ An exhibition titled *The Image of Physics*, organized by the Currier Gallery of Art in Manchester, New Hampshire, and circulated by the Smithsonian Institution Traveling Exhibition Service, traveled to dozens of schools, libraries and museums around the U.S. The press release for this exhibition described it as an “educational exhibition of high aesthetic quality.” It claims that Abbott was “photographically recording experiments with scientific detachment and eliminating all features that might be due to accident” in order to create “an imposing visual presentation of the basic laws of physics as they might be demonstrated in a laboratory under ideal conditions.” This release also stated that “multi-flash and high speed photography, which Miss Abbott used extensively in the studies of motion, not

⁷⁵ Letter from Harriet H. Gibney, March 29, 1960, on ESI’s *Portraits from Physics*, Correspondence A-M, Berenice Abbott Collection, MIT Museum Archive. “Portraits of Natural Laws,” *New York Times Magazine*, May 1959, 28-29 references the New School exhibition. Other articles included “Visualizing Science for Nonscientists,” *Current*, November 1962, 32-36; Kenneth L. Franklin, “Laws That Can’t Be Broken,” *Nature and Science*, Vol.1 No.13, April 3, 1964, 8-9; “Camera Catches Laws of Nature,” *Popular Science*, February 1960, 92-94; Julia Newman, “Berenice Abbott: Pioneer Past and Present,” *US Camera*, Vol. 23 No. 2, February 1960, 34-39; R. E. Martinez, “Photographic Approach to the Teaching of Physics,” *Camera*, (April 1964): 11-18; “Abbott’s Non-Abstract Abstracts,” *Infinity: American Society of Magazine Photographers* Vol XI, No. 1 (January 1962): 4-7; *Photo Methods for Industry*, July 1962, 47-51; See-It-Yourself Science,” *THINK*, February 1962, Vol 28, No. 2, 6-9; and “Portraits of Natural Laws,” *The New York Times Magazine*, 17 May 1959, 28-29.

⁷⁶ James R. Newman, ed., *The Harper Encyclopedia of Science*, (New York: Harper and Row, 1963), see examples on pages 259, 342, and 611. Contracts, November 5 and December 17, 1962, in Correspondence M-Z, Berenice Abbott Collection, MIT Museum Archive.

only record the experiments but are essential to their success since physics must use the camera as a necessary tool in these investigations.”⁷⁷

This press release betrays a certain struggle to reconcile the camera as witness with photography as an active process of crafting, selection, and specification. It is clear that part of the fascination with these images was rooted in the idea that photographic technology makes nature available in a way that is idealized and independent of what can be experienced in the real world but is nonetheless physically connected to it. The writers position photography as essential to scientific practice, and the images as a collaboration of the photographer with nature, showing how photography had come to serve as a special kind of intermediary. As mentioned above, the function of Abbott’s physics photographs is best understood as obtaining not a direct, passive, relation to natural phenomena, but a creative, active one that is considered useful through its connection to the viewer as well as to the subject. While the writers of this press release offer “detachment” as evidence of scientifically reliable content, it is also the active intervention of the photographer that makes the images pedagogically functional. Moreover, the photographs and the accompanying captions make these interventions visible, drawing the viewer in and offering them the possibility of mentally engaging with the technological process. It was in this way that Abbott felt that photography had the potential to allow individuals to educate themselves about the rapidly changing world, making positive use of advances in science and technology.

Throughout the 1960s, these images found another home in three science books targeted at general audiences, titled *Magnet* (1964), *Motion* (1965), and *The Attractive Universe* (1969), all published by World Publishing Company and produced in collaboration with E.G. Valens,

⁷⁷ See letter from Charles E. Buckley, Director of the Currier Gallery of Art, July 21, 1960, Box 2, Folder 41, Berenice Abbott Papers, NYPL, and Record Unit 290, Smithsonian Institution, Traveling Exhibition Service, Records, Smithsonian Institution Archives.

known as a journalist and non-fiction writer. These books were conceived with Abbott's full involvement, and feature text and images in equal prominence. At the same time, however, much of the mathematics were left out, and the concepts were presented in a more general, less technical way suitable for a wider audience.

Abbott was also included in *Once Invisible* at MoMA in 1967, an unusual exhibition of scientific photography from various sources curated by John Szarkowski, who made claims similar to those of Abbott and Gyorgy Kepes about how technologically produced images operate. In the press release, he wrote that these images are “in the most exact sense documentary photography,” but that they also expand our “visual imagination.”⁷⁸ In 1987, Abbott's work was featured in an exhibition called *The Beauty of Physics* at the New York Academy of Sciences.⁷⁹ From the beginning of her interest in scientific photography, and throughout the subsequent decades, Abbott's work moved back and forth across the boundaries of art and scientific pedagogy and was often discussed in relation to the boundaries of human vision and to the importance of compelling images in science education. For example, IBM's *Think* magazine introduced her physics photographs by explaining that “...by combining great imagination and several photographic techniques, such as time exposure and stroboscopic flash, Berenice Abbott has produced images so vivid that some of them show students more than they see in the lab.”⁸⁰ Despite the resistance she often encountered, Abbott pursued an image-making practice that was simultaneously educational and artistic.

⁷⁸ The Museum of Modern Art, “Checklist for *Once Invisible* exhibition, June 20 to September 11, 1967,” press release (June 20, 1967).

⁷⁹ A catalogue was published to accompany this as well. Berenice Abbott and Hank O'Neal, *The Beauty of Physics: Berenice Abbott*, (New York: New York Academy of Sciences, 1986).

⁸⁰ *Think*, February 1962, Vol. 28, No. 2, 6.

2.2 THE PSSC IMAGES: TECHNOLOGY AND VIEWER AGENCY

While Abbott was consistent in her belief in photography as a form of democratic empowerment through technology over the course of her career, it was during the short period at MIT that she made works that most exemplify her approach to this, both in their visual characteristics and in their institutional context. The first image I will focus on appears in the PSSC textbook in a section teaching students about vectors, which are quantities involving both magnitude and direction, usually depicted by a line segment. As explained in the text, “The length of the [straight line segment] gives the magnitude, and its direction specifies the direction in space” and the accompanying photograph is a stroboscopic exposure of two balls in motion.⁸¹ The caption explains that horizontal strings traverse the image six inches apart, information that can be used along with measurements of the spatial displacements and the flash speed to calculate velocity and analyze the motion of the ball in terms of vectors. The photograph thus operates like a graph; its placement alongside three drawn graphs is a further cue to use it in this way. Abbott here presents mathematics using physical objects and the technology of photography, making the principles available for analysis by the composition of the image and the accompanying text and graphs. The students can make calculations directly on the photograph.

To make this photograph, a mechanism at top left released the two balls at the same time, one outwards toward the right side of the frame and one straight downwards, both in front of a black backdrop and a set of strings positioned horizontally at equal intervals. A strobe light was then used to create a multiple exposure photograph, which was cropped to eliminate the setup. Far from merely capturing a phenomenon that exists in the world, the balls are manipulated to

⁸¹ *Physics*, Physical Science Study Committee (D.C. Heath, 1960), 83.

create a graph of their own motion through an elaborate process, customized to the technology, in order to be susceptible to the desired analysis. One needs to be following along in the vector lesson to understand the image in the way Abbott and the PSSC scientists intended. In this context, the image is given a system of constraints that allow the correlation of distinct parts with components of the real world, allowing it to work as a graph. Photography becomes a tool of analysis, not just observation.

Abbott's images thus push on the definition and function of a diagram. Nelson Goodman has defined a diagram as an image that consists of components with measurable relationships between them and is accompanied by a system of constraints that makes these relationships refer to external correlates. He argues that a diagram is less "replete" than other kinds of pictures, in the sense that it relies on distinct bits of information and has parts that can be ignored while retaining the diagram's intended meaning; its data is "articulated" rather than "dense."⁸² Building on Goodman's terms, John Bender and Michael Marrinan argue that a diagram has "some of the attributes of a representation but is situated in the world like an object."⁸³ They contend that diagrams, in a manner that developed specifically in 18th century in Europe, demanded active synthesis of multiple vantage points on the part of the viewer, who accessed knowledge through the process of making correlations between disparate but related things.

Bender and Marrinan identify a certain diagrammatic technique that can illuminate Abbott's PSSC photographs. Often in diagrams, components of the images that are correlated with objects in the world can be presented in a blank space, as opposed to a space correlated to ours. Formalization or idealization unmoored from a specific physical reality allows the discrete

⁸² Nelson Goodman, *Languages of Art* (Indianapolis: Hackett Publishing Company, 1976), 229-230.

⁸³ John Bender and Michael Marrinan, *The Culture of Diagram* (Stanford University Press, 2010), 7.

points the possibility of being applied in different or more general ways.⁸⁴ As Weissman notes, Abbott made phenomena “draw their own diagrams” to thus address the theory at hand rather than the individual instance, even though the photographic visualization suggests an individual physical occurrence.⁸⁵ She achieved this by photographing objects against a black background, cropping to remove the image from the set-up and a clear sense of real space, and using a high contrast of light to dark. The study of physics requires this kind of correlation between different kinds of representation, generalization from individual cases, and perception of connections across disparate objects. For Abbott, visual components of the image must be understood to represent a law that describes all phenomena, not just that particular ball in motion. At the same time, the image produces a kind of physical contact between the viewer and the ball in space, asking the viewer to make use of certain correlations between the image and the world. Not the usual indexical quality often attributed to photographs, in which the photograph is imagined as a passive consequence of a “real” occurrence, but rather a transformation of the photographic image of the ball into a functional equivalent of the physical one and vice versa. The viewer is called upon as an agent because they then actively make calculations, and because their knowledge of photography is necessary background to this transformation being productive.

Abbott positions an understanding of photographic technology as essential to the process of understanding the represented subject matter. Finding any relation in these photographs between the image and the scientific content depends on being able to recognize how photography produces images in reaction to events in the world. Their educational utility proceeds as much from connections to other photographs as it does from the degree to which the viewer can connect them to real phenomena. We are not born knowing how photographic

⁸⁴ Bender and Marrinan, *Diagram*, see chapters 2 and 6.

⁸⁵ Weissman, *Realisms*, 191.

technology works or that it looks a certain way; we build this knowledge through experience. In the case of the vector image, one must be able to recognize the traces of the photographic process in order to learn the concept at hand. Because of what we know about how light affects film and because of our experience with previous photographic images, if an object appears multiple times in an image, we deduce it was made with a strobe flash. We interpret the object as having been in motion and the photograph as relating to a specific length of time. An understanding of photography is thus intentionally and strategically employed by Abbott and her collaborators to support the pedagogical process.

The PSSC text directly calls upon the student to draw on their understanding of photography, and apply it to the task at hand, both reinforcing previously accumulated expectations of photographs and training the student in further photographic interpretation. The full caption to the vector image in the PSSC asked, “why do the strings appear to be in the foreground?” instructing students not just in the subject matter, but also in understanding the photographic process.⁸⁶ The student is led to surmise that the strings stayed still while the ball moved. They are exposed for longer, and thus appear brighter and closer. Instruction in how photographic technology works accompanied instruction on the natural laws, presenting its visual quirks as coherent with a broader explanatory system for nature. The forms visible in the print would not convey the intended information if one did not adopt a process of analysis that incorporated the interventions of visual technology. Practices of visual pedagogy in mid-century America positioned photography as a positive technological intermediary that could make knowledge available to individual minds who were aware of the tools they were using and actively employed them. In a manner both optimistic and cautious about the power of

⁸⁶ *Physics*, 83.

technology, Abbott created a method of visual pedagogy that sought to integrate subjective thinking with scientific reasoning.

In another photograph, a caption drafted to accompany a strobe photograph of a ball traveling in an elliptical path helps the viewer to think through the physical laws at the same time as they think through the photographic process. “The photo shows a small brass ball swinging in an elliptical path around a central stationary object. The film was exposed at equal time intervals, and the camera was located directly above the plane of the ellipse. A line from the central object to the brass ball sweeps over an equal area between any two successive positions of the ball. This, of course, causes the ball to move more slowly at each end of the ellipse.” A subsequent caption suggests that “with ruler and graph paper you can determine that an imaginary radial line from center to bob sweeps out equal areas in equal times.⁸⁷ This accompanying text is, again, essential, as it is through both text and photograph that the viewer can mentally convert the form made by many iterations of the same brass ball into an understanding of motion. The text helps the viewer use their understanding of photographic technology to do this, and also provides parameters that allow the photograph to be used as a diagram. Something photography does – light creating traces of objects on film – is made to produce a visualization of a pendulum’s motion. This photograph was also used in *The Attractive Universe* (the third of the general audience books published with E.G. Valens) to discuss planetary motion.⁸⁸ We can note here the role played by formal concerns in Abbott’s photographs, such as a contrast between light and dark, a balanced, geometric composition, and the use of a light source and shading to indicate three-dimensionality. These choices both root the images in artistic traditions and in Abbott’s

⁸⁷ These are two of a series of draft texts that seem to have been drafted by E.P. Little in 1965 for the Horizon Press book that was published in 1970. These are held in the Miriam and Ira D. Wallach Division of Art, Prints and Photographs, New York Public Library.

⁸⁸ E.G. Valens, *The Attractive Universe* (Cleveland: World Publishing Company, 1969), 43.

personal style, which led critics to try to use a dichotomy of art versus science or of abstraction versus representation to understand Abbott's approach. For example, a writer in *Infinity: American Society of Magazine Photographers* in 1962 suggested that Abbott's formal choices meant that she had "abstracted" from her subject matter, albeit for educational purposes.⁸⁹ As Abbott insisted, however, while the images were indeed meant to refer to general principles instantiated in specific experiments, to mathematical abstractions, she in no way saw them as aesthetic abstractions.⁹⁰ For her, the aesthetic priorities contributed to the clarity of the content. Like other practitioners of visual pedagogy at the time, Abbott was convinced that artistic and scientific concerns intertwined to make pedagogically successful images.

Abbott's tactic in applying photography to wave motion – a principle that describes the behavior of light and sound as well as subatomic particles – was to clarify what one sees in a ripple tank experiment, a common classroom activity and one that the PSSC encouraged. To do this, she adapted the technique of the photogram, in which objects on photosensitized paper are exposed directly to light without the use of a camera. To photograph waves, the paper was exposed while directly underneath a glass tank. As with the multiple-flash images, in the photograms, Abbott created an image that caused specific aesthetic concerns to cohere with the idea of pedagogical clarity and with the principles of regularity in laws of physics. Abbott strove for a balanced composition, a play between light and dark, and crisp focus, and the photograph looks quite different from what one observes in the ripple tank in person. Furthermore, Abbott printed the images in negative. As with the vector and ellipse photographs, accompanying texts

⁸⁹ "Abbott's Non-Abstract Abstracts" in *Infinity: American Society of Magazine Photographers* (Vol XI, No. 1, January 1962)

⁹⁰ See the Eastman House oral history for her comments in this vein. "Interview with Berenice Abbott conducted at Miss Abbott's home in Maine during July of 1975 by James McQuaid and David Tait," Oral History Project of the International Museum of Photography at the George Eastman House, 1978.

explained the photographic process so that the viewer knew exactly how to use the information that appears in the image and knew to treat the photograph as a diagram of the results of a ripple tank experiment. In the PSSC textbook, students are encouraged to observe the ripples visible in the photographs to learn about the principles of wave motion and how they apply to light, as well as to sub-atomic particles.⁹¹

Another image from the 1960 PSSC *Physics* text shows a cycloid (a type of curve resembling a series of arches), in a section that explains the idea of “frames of reference” in order to analyse motion with vectors.⁹² Here we view a rolling wheel with a lamp attached as if we are on the road watching it go by. The light on one point of the circle draws an arcing path. The text explains that if the frame of reference (meaning the position of the camera and the edges of the photograph) for viewing this wheel were from inside a car attached to the wheel, a simpler, circular path of motion would be drawn. As the text explains, vectors are specific to their points of origin. This is crucial to understanding Copernicus’ observation that the simplest way of describing the motion of planets through measuring vectors is with their point of origin in the sun instead of earth. A photographic point of view is used to explain a completely different type of point of view; the camera stands in for the point of origin or the “mental” frame of reference. Photography thus is reinforced as a central part of the educational process.

In the *The Attractive Universe*, Abbott explored another strategy for photographic indication of motion. Instead of a strobe exposure, in some images, one prolonged, time-lapse exposure is used, and the ball appears as a continuous blur. Instead of discrete points, a solid, golf ball-textured line represents the ball’s path.⁹³ Abbott here represents speed using density

⁹¹ See wave images in *Physics*, 177, 271, 608 and back cover.

⁹² *Physics*, 90.

⁹³ Valens, *Attractive Universe*, 27-28.

instead of distance between separate images of balls or points that make up the paths. To understand the photograph, one must again refer to the technological process of photography. A fainter line indicates faster movement and a more solid line denotes slower movement. Density could, theoretically, be measured and used to calculate speed. This trait of the photographic process – the fact that images of objects appear on film in relation to how long they were present during the exposure, meaning that images in motion are blurry – is often thought of as unhelpful in terms of accuracy in photography. Here, this trait is deliberately employed as illustrative, a strategy that is only intelligible based on previous knowledge about photography.

Abbott used a similar method in *Magnet*, her first book with Valens. In a photograph of a hanging bar magnet above a compass, two smeared pie slices, a prominent blur, indicate to the reader the movement of the magnet as it takes a few seconds to waver back and forth before settling on the north-south axis. The text explains, “the magnet will spin slowly back and forth – as we can see from the blur in the photograph – until it finally comes to rest pointing north-and-south.”⁹⁴ A shape thus appears on the film that has no existence apart from the film. The photograph’s ability to serve as truthful record operates based on a set of learned conventions about photography, meaning that photographic technology again becomes an integral part of a learning process.

Also in *Magnet*, a large image is featured on a double-page spread. The caption explains, “a desert of iron filings is sculpted into a beautiful design by the presence of a magnet.”⁹⁵ Abbott shot with the camera pointed directly downward at iron filings on a flat surface that are being attracted and repelled by a magnet beneath the support. She then printed the image in negative, so the iron filings appear white on a black background. Magnetism, as a non-visual property or

⁹⁴ E.G. Valens, *Magnet*, (Cleveland: World Publishing Company, 1964), n.p.

⁹⁵ Valens, *Magnet*, n.p.

principle, is thus given a tangible shape through photography, and knowledge of specific photographic processes is necessary for the intelligibility of the image. It is this comprehension that enables a connection to be forged between the otherwise abstract photograph and the physical world, one that would not exist if the viewer does not understand how exactly camera and film were made to transform objects and invisible forces into the visible shapes and markings. The viewer was asked to buy in to a productive relationship between these transformations and the knowledge at stake. In addition to this, Abbott's visual strategies often work to suggest the ways in which the principles at hand are scalable, to encourage the viewer to draw analogies between the micro and the macro. The plane of iron filings against the blackness in this photograph also suggests galactic formations in outer space.

The spinning wrench, an image that demonstrates the principle of the center of an object's mass remaining stable as the object spins, appeared both in the PSSC textbook and in *The Attractive Universe*.⁹⁶ As in the above cases, the subject is a property of objects in motion, the displacement of the center of mass of an object in relation to the movement of the object as a whole. This is a property, not a visual occurrence, and Abbott here generates a visual form for it. Abbott transformed the object's motion into a diagram. The photographic process results in an image that can be measured: "points" on the print reflect points in the path of motion of the object and can be accordingly used in a formula. However, this visual formulation has little to do with how the wrench in motion would actually look. Abbott described the process of producing this photograph, which involved hanging the wrench on a string, and throwing it around in a circle while she followed it with her camera and an assistant followed it with a light.⁹⁷ As it appears here, though, the viewer can access a clear visual indication of the principle at hand

⁹⁶ *Physics*, 379, and Valens, *Attractive Universe*, 109.

⁹⁷ Abbott's comment is quoted in *Berenice Abbott*, Volume 1, (Göttingen: Steidl, 2008), 228.

while still looking at a photographic trace of the wrench in motion. Black crosses mark the center of the mass of the wrench (near where the handle meets the head of the wrench) and cue the reader to seek out the explanatory text that will give the crosses meaning. A caption drafted for this image's display in the Smithsonian traveling exhibition includes the phrase, "...A ruler laid across the photograph lines up the cross on the handle in a straight sequence. The law expressed is that of constant velocity..."⁹⁸ In other cases, numbers or rulers were actually included in the photographic image, as we see in an image depicting gravity in *The Attractive Universe*.⁹⁹ Further numerical information and text is required for the image to perform its pedagogical function, but the numbers and lines actually in the photograph both cue the reader as to its use and provide some of the constraints with which points in the image can be used in calculations. These components reinforce the function of photographic technology as an intentional intermediary between human and world.

Also in *The Attractive Universe*, Abbott presented a series of six photographs portraying a double-star system and to illustrate relativity.¹⁰⁰ We see a ball travel through space, then move in a path that shows how space is warped by the presence of another ball, which in turn takes a path that responds to the curvature of space caused by the first ball. The repeating balls, along with the textual explanation that they were photographed on a piece of pliable rubber that is invisible in the print, demonstrated how outer space is affected by objects and their gravity. The analogy of balls moving around on a rubber sheet is a standard way to teach a general and

⁹⁸ Record Unit 290, Smithsonian Institution, Traveling Exhibition Service, Records, Smithsonian Institution Archives.

⁹⁹ Valens, *Attractive Universe*, 12.

¹⁰⁰ Valens, *Attractive Universe*, 168-174.

simplified version of the concept of space-time.¹⁰¹ Here, the “stars,” as they are called in the book, are made to draw shapes in the two-dimensional space of the photograph, generating a visual form for an idea that again draws on photographic conventions for depicting motion. It is clear from the many trials conducted to achieve these images that Abbott required a specific formal result – several negatives show the balls refusing to create smooth arcs around each other.¹⁰² These aesthetic concerns and the others that characterize Abbott’s science images should not be seen as separate from how the images work with text and math to allow viewers to access complex knowledge. On the contrary, they should be understood as a set of visual references that cue the viewer to the knowledge contained in the image, the universal rules that govern a logical universe. The images needed to reference physical, measurable, phenomena, but they also needed to appear formally coherent with basic physics principles, which is not always how observable objects appear when they move in the world. Abbott’s formal goals were thus essential to her educational ones, and were specifically photographic in orientation. The images teach relativity using the viewer’s knowledge of photography, interweaving visual traces of that technology into a mental concept of bending space-time. It is Abbott’s process that creates a specifically photographic form for the concept at hand, offering up a physical scenario for the viewer to analyze using photographic thinking, merging their mind with the technological actions, while also remaining in the driver’s seat, taking a powerful place in the progress of science.

As in many examples of photography, scientific and otherwise, in the case of Abbott’s work, the visibility, not the suppression, of these image-making techniques makes photographs

¹⁰¹ For an explanation of the analogy and the ways in which it simplifies the theory but is useful for teaching it, see J.B. Kennedy, *Space, Time, and Einstein: An Introduction*, (New York: Routledge, 2014), 140-143.

¹⁰² Box 1, Berenice Abbott Archive, Ryerson Image Centre.

useful.¹⁰³ This is a key characteristic of the new form of visual pedagogy that took hold in Cold War America. While the idea that photography provided direct access to the world had a certain rhetorical value, upon closer examination, the value of photography came much more from the new forms it produced, and from the notion that it was naturally coherent with the mental operations of the image-maker. Abbott's work prioritizes visual images not found in nature, but rather ones generated through the active analysis involved in taking photographs, and the mapping of those forms back onto a natural world which no longer seemed accessible via older visual tools. Cold War visual pedagogy involved absorbing technology into subjective human processes of observation, communication, and analysis, and photography was positioned as a way for an individual person to navigate their modern surroundings.

Abbott felt strongly that we did not need to imagine photography as a purely mechanical process in order to trust it as an informative and communicative medium. She was also very skeptical of attempts to separate the art from the science in her images; she argued that photography was a perfect blend of human ideas and technology, drawing on the prevalent terminology and traditions in photography and attempting to resolve the ways in which they conflicted. On the one hand for Abbott, photography "sees" with absolute fidelity, and on the other, photography is separate from and goes beyond human vision and its abilities. She wrote in 1938 in an article on lenses:

¹⁰³ Scholarship that discusses these kinds of questions includes Josh Ellenbogen on Étienne-Jules Marey in "Camera and Mind," *Representations* Vol. 101 (Winter 2008): 86–115, Joel Snyder and Neil Walsh Allen, "Photography, Vision, and Representation," *Critical Inquiry*, Vol. 2, No. 1 (Autumn, 1975): 143-169, and Robin E. Kelsey, "Viewing the Archive: Timothy O'Sullivan's Photographs for the Wheeler Survey, 1871-74," *The Art Bulletin*, Vol. 85, No. 4 (Dec., 2003): 702-723. In *Nature Exposed: Photography as Eyewitness in Victorian Science* (Baltimore: The Johns Hopkins University Press, 2005) Jennifer Tucker demonstrates the discursive, rhetorical manner in which the authority of photographs had to be established in the nineteenth century. In "The Image of Objectivity," *Representations*, No. 40, (Autumn, 1992): 81-128, Lorraine Daston and Peter Galison explain how photography participated in complex and shifting discussions about what kind of truth scientific images should contain and how this can be policed.

Photography, we have said, is a new vision of life, a profoundly realistic and objective view of the external world. In the all-seeing and minute observation of the camera eye, we see what we never saw before, a wealth of minutiae, the broad sweep of panorama and cloud. What the human eye observes casually and incuriously, the eye of the camera, the lens, notes down with relentless and inescapable fidelity...This unique and powerful quality of the photograph has indeed established a new esthetic of art, an esthetic based on stern realism as the new vision of life. But the new esthetic could not function were it not for the tools and instruments with which present-day science has supplied photography.¹⁰⁴

With regard to scientific photography specifically, in *A Guide to Better Photography* she wrote that “when the first stroboscopic photographs were exhibited, it was evident that in them was to be seen a *real* hyperreality, a true fantasy beyond what the subconscious could concoct... here at last photography sees with its own eye, untouched by any memories of how painters saw in the past.”¹⁰⁵ In her 1951 address to the Aspen Institute, in which she criticized pictorialism, Abbott argued that photography should “walk alone” and “be itself” by drawing on both its fidelity to vision and its autonomy from it.¹⁰⁶ This tension between human and technological vision was of broad concern to those engaged in visual pedagogy of the Cold War era. Photography could suggest freedom from human limits, while still being grounded in human perception. While Abbott argued that in scientific work a new photographic aesthetic emerges, so physically rooted in natural processes as to be completely free of the precedent of other kinds of pictures, the photographic aesthetic is also composed through an investment of “human

¹⁰⁴ “Photography by Berenice Abbott, Lenses: Optics of the Camera Eye, Project: Training the Human Eye to See as the Lens Does,” Copyright, 1938, Art Adventure League, Inc., n.p. Box 15, Berenice Abbott Collection, MIT Museum Archive. These sentiments are also published in a chapter on lenses in Abbott’s *A Guide to Better Photography*, 56.

¹⁰⁵ Abbott, *A Guide to Better Photography*, 174. Emphasis in original.

¹⁰⁶ Berenice Abbott, “It Has to Walk Alone,” address given at the Aspen Institute in 1951 and published in *American Society of Magazine Photographers NEWS*, November 1951. Box 2, Berenice Abbott Collection, MIT Museum Archive.

intelligence.”¹⁰⁷ She is very specific about the fact that the camera lens does not see like a human eye, and that in fact the photographer must learn to see like a camera.¹⁰⁸ It is the slipperiness that can occur in the question of relationships between humans and technology that is powerful here, because of a social and political context in which it was more and more accepted that humans would do well to model themselves on technology, whether that be cameras or computers. This does not always rely on the mistaken assumption that cameras do work like human eyes or vice versa, but rather on the idea that the mechanical and the biological somehow simultaneously aspire to each other in their development. In Abbott’s work, she designed ways for students to imagine their mental selves as having the relentless frankness and modern aesthetic associated with the camera.

In Abbott’s work, signals reveal the photographic process to a versed viewer and offer diagrammatic constraints, making principles in nature appear in a visual, photographic form that works as a piece of a broader explanatory system. Their ability to function as diagrams, a mode of scientific image making, securely roots them in a relationship with knowledge about the world that is based on the productive qualities of mediating technology. The presentation, rather than re-presentation, of data, has been a job for photography throughout its history. I refer again to Abbott’s oft-repeated sentiment:

Contrary to the idea of many, photography is not an involuntary reflex, like the heart beating or the lungs’ breathing. It is the product of centuries of

¹⁰⁷ See Abbott, *Guide to Better Photography*. Also, in “What the Camera and I See,” *ARTNews*; September 1951, Abbott wrote, “I see the photograph as a statement of affirmation, built of wonder and curiosity. By the choice of subject and the special treatment given a subject, it is as personal as writing or music; while by the fact that it works with an instrument to record a segment of reality given and already made; unchangeable so to speak, it is impersonal, to the highest degree: that is for me its interest the union of the personal and impersonal.”

¹⁰⁸ Abbott wrote that there is a great risk if photographers “accept the lens as being identical with or equal to the eye. On this fallacy, many a fine picture is wrecked.” Abbott, *Guide to Better Photography*, 56. She also described the complex ways in which a photographer must engage with optics in order to create the image he or she desires. The lens is both conceived using the analogy of the eye, but understood as very different from our eye. Abbott, *Guide to Better Photography*, 160-162.

investigation, culminating in the creation of a machine and a method with unique capacities for making pictures. But only when the machine and the method are guided by a human being can the photograph be made. In the widest sense, human intelligence creates photography.¹⁰⁹

Abbott believed that for people to feel connected to and motivated by scientific knowledge, it had to be visually portrayed in a compelling way, and that photography was “preeminently qualified to unite art with science.”¹¹⁰ In Abbott’s process for these photographs, artistic and pedagogical goals were realized though the same means. The nature of this complexity in her images is made apparent by her only partially successful efforts to shape their reception. She fought as hard for their circulation in museum exhibitions as she did for their publication in textbooks. They were not meant to operate solely in the art world nor exclusively in the scientific one. In the PSSC textbook, it is not indicated which photographs specifically are Abbott’s, nor is it made clear that she had certain non-arbitrary formal requirements such as smooth arcs, high contrast, sharp focus, or a specific composition that situated objects in an abstracted space. In contrast, when the images appeared in exhibitions or art books, Abbott’s formal goals and techniques were emphasized, and scientific information was sometimes left out. In a third context, science books for a general audience, Abbott’s role as author of the photographs is clear, and the images are a large and prominent part of the layout. The images are used to explain simpler ideas, but are still pedagogical in function. These various contexts reveal the disciplinary boundaries that her images challenged, and the expectations of science and of art that shaped how visual material was used more generally.

¹⁰⁹ Abbott, *Guide to Better Photography*, 4. In an interview for a WPA radio program called “Exploring the Arts and Sciences” in 1939, Abbott stated that “contrary to popular superstition which says that photography is a simple mechanical affair, actually it is the least mechanical of mediums...,” 7. Box 9, Folder 7, Berenice Abbott Papers, NYPL.

¹¹⁰ Berenice Abbott, “The Image of Science,” *Art in America*, no. 47, 1959, 76.

Terri Weissman shows that Abbott's interest in photography, rather than being driven by disciplinary expectations about representation, was based on its ability to maximize the communicative potential between photographer and an engaged, empowered viewer in "a continual process of transmission and dialogue."¹¹¹ She argues that this approach characterizes not only her science material but her entire career and that this linked her strongly with the goals behind the PSSC project. This framework productively leaves open the possibility of analyzing exactly how the photographs operate as visual pedagogy, suppressing neither Abbott's creative authorship nor the photographs' factual content. It is through their relation to other kinds of picture-making, to other examples of photography, drawing, and diagramming, that Abbott's images are pedagogically useful. They present themselves as carefully constructed photographic interventions, not as transparent windows, and incorporate visible traces of the photographic process and accompanying text or numbers that lead the viewer to understand the photograph in reference to other mediated representations. Weissman's assessment of Abbott's approach is essential to situating Abbott in relation to the other visual educational practices in this project. Weissman articulates a mode of viewership that Abbott identified as conducive to the creation of democratic citizens, something which mattered deeply to Abbott and gives us a fuller picture of her role as a twentieth-century American artist. This is the set of concerns that Abbott shared with the projects by Burtin and Debes discussed in the subsequent chapters, and that made it possible for visual media that appeared to empower individuals to help secure what it meant to be an American citizen.

Throughout her career, Abbott looked for ways to make photographic technology serve the scientific idea being taught. In working on these books, she and her colleagues were using

¹¹¹ Weissman, *Realisms*, 206.

photography to reference viewers' abilities to understand the medium itself, at the same time as they were teaching science. They used physics to bolster photography's status as a communicative tool at the same time as they drew on the intelligibility of photography to their audience. In addition, Abbott's photographs visualize things that are not inherently visual, and in doing so, often generate rather than illustrate the data being analysed. In the context of the PSSC, visual pedagogy came to signify the ideal of democratic access to information, freedom of thought and participation in modern American progress. Using visual media was linked with maintaining agency while also benefiting from technology-filled surroundings.

The history of computing is another piece to this puzzle of understanding how photography worked to navigate the new and complex territory of relations between humans and machines at the intersection of technology, corporations, and Cold War politics. Abbott worked at MIT work during the period when digital computing was on the rise, but her photographs decisively adopt an analog computing character.¹¹² In a world increasingly understood through the abstractions and models provided by technological tools, rather than immediate experience, Abbott combined the two, modeling motion through the material and continuous character of light on film. In Abbott's strobe photographs, the motion of the ball is represented by its periodic appearance, specifically generated in a pattern that makes it possible to obtain precise measurements that can be plugged into an equation. However, this is still based on the physical interaction of objects in the world, not a mathematical representation of their motion. The student can still think of herself as observing the instance of motion in earthly space.

Generalized notions of the analog and the digital as different kinds of "information," one continuous and physical, and the other made up of discrete components represented

¹¹² I am grateful to Alison Langmead for offering this insight and for encouraging me to link Abbott to 1950s and 1960s discourse on computing.

symbolically, had certainly made their way into cultural discourse about visual pedagogy by this time. According to Jurgen Ruesch and Weldon Kees, the visual constituted a realm of human communication that was essential to broad understanding and progress, and this realm must be understood analogically rather than digitally, which is made possible with photography. Like Ruesch and Kees, Abbott employed photographs as collaborators in human perception. Also, like them, she sees her ability to do this skillfully and knowledgeably as crucial in a world in which technology is developing faster than humanistic endeavors. As referenced above, in framing the issue for her purposes in her 1939 manifesto on the role of photography, she posited that “science needs...the vivification of the visual image...the warm human quality of imagination. She argued that photographs are science put “in terms [people] will understand.”¹¹³ Ruesch and Kees and Abbott would agree that not only do humans more naturally communicate analogically, but the true complexities of the natural world can only be fully understood with a combination of analogic and digital tools.

By using the visual traces of the photographic process as analogic representations of objects in motion, Abbott, like Ruesch and Kees, aimed to take advantage of the technological possibilities of photography while also incorporating sensory experience and a sense of immediacy, elements which Abbott felt were lacking from scientific pedagogy, but that were ultimately key to concepts of modern progress and the formation of democratic subjects. She herself did not refer to computing in order to explain her position, but Ruesch and Kees’ usage of the analog-digital framework can help us understand Abbott’s interest in bridging disciplines and how it was specific to a historical context in which ideas from computing had made their way

¹¹³ Letter to Charles C. Adams, April 4, 1939, Box 6, Folder 28, Berenice Abbott Papers, NYPL

into common parlance.¹¹⁴ Abbott was participating in a much larger atmosphere, specific to the postwar period, in which the tension of the role of machines in human society was often dealt with through visual objects that bridge art and science. Abbott's photographs drew on the period's specific expectations and apprehensions about visual media and their relationship to human thought.

2.3 IMAGES, INDEPENDENT THINKING, AMERICAN SCIENCE

I have argued that Abbott's images function based not on visual similitude to the natural world or on the effacement of representational convention, but rather on the viewer's previous experience of photographic images and conscious comprehension of the photographic process. The viewer is then able to access the image as a diagram and use it for understanding physical laws. Abbott's images were able to communicate their subject matter because she mobilized the viewer's understanding of photographic technique. This knowledge relied not only on other photographs the viewers may have seen but also on the textual parameters that turned them into diagrams. When published in books, the accompanying text and captions provided information about the process that transformed the marks and forms into signals to the viewer of the technological steps that led to the image. The images make use of the viewer's understanding of how photography works and mobilize this understanding towards the comprehension of the natural world. These techniques present the visual traces of photography as a logical system that can be used to access natural phenomena and expand the human sensorium, asserting a natural

¹¹⁴ For some discussion of the broad effects of the new field of computing on art and culture, see Jane Pavitt and David Crowley, "The Hi-Tech Cold War," in David Crowley and Jane Pavitt, eds., *Cold War Modern: Design 1945-1970* (London: V&A Publishing, 2008), 163-191.

superiority and modernity for the medium. At the same time, however, they position the viewer or student as a crucial part of the process of scientific knowledge building. The viewer is offered a kind of key to nature that she is expected to actively turn. The images thus purported to protect and perhaps encourage, rather than threaten, individual agency. This mattered because of a broader American context in which, because of the tension of the Cold War, and the fear of authoritarian regimes, many concerned themselves with individual agency in educational contexts, and were drawn to visual tools as a way to secure that agency.

The larger context of the PSSC, in which Abbott developed her ideas, can help in pinpointing exactly what photographic images were thought to do for education and for science as a component of modern American society. Individuals who were concerned with education thought of visual media as a set of more accessible and democratic tools that, if mastered, could secure the individual agency of the viewer. Thinking through this metaphor, how it was employed, and why it was useful will help to explain the appeal of Abbott's practice. Conversely, Abbott's translated claims about visual communication into a material form, which makes the implications of those ideas for the definition of liberal democratic subjecthood more clear.

James R. Killian, who was president of MIT from 1948 to 1959, and then chairman of the MIT Corporation from 1959 to 1971, helped physicist Jerrold Zacharias launch the PSSC in the 1950s. In his memoir, Killian emphasized two main innovations unique to this project. One, actual university scientists were working on pre-college education, and two, "physics was presented...not as a mere body of facts but basically as a continuing process by which men seek to understand the nature of the physical world."¹¹⁵ The PSSC was funded mostly by the National

¹¹⁵ Killian, *Education of a College President*, 168.

Science Foundation as well as by the Ford Foundation and Alfred P. Sloan Foundation. According to Killian, in 1957 it was tried out in eight schools, in 1958, 630 schools, and by 1970, 220,000 students in 5000 schools.¹¹⁶ As of 1985 when Killian published his memoir, it had been translated into 17 languages and “over a million copies have gone into use.” He pointed out that this was the “largest circulation of any coming out of the MIT environment except George B. Thomas’s *Calculus and Analytical Geometry* and Paul A. Samuelson’s *Economics*.” According to Killian, many other disciplines created programs inspired by the PSSC, many of which were also funded by the NSF.¹¹⁷ The course had international reach, and was tried in India, Chile, Uruguay, Argentina and Puerto Rico. It continued to be used and revised for decades.¹¹⁸

The PSSC was part of a much broader trend of educational reform in the late 1950s and early 1960s that was related to the Cold War push for American scientific advancement. It was also intertwined, from the very beginning, with efforts to use visual media for teaching. The impetus for the project came as much out of ideas about the role of film technology as it did out of ideas about science and education. Killian wrote that a “classic document” entitled “Movie Aids for Teaching Physics in High Schools” written by Jerrold R. Zacharias in 1956 was what launched the program. In this document, Zacharias argued that 90 twenty-minute films should be

¹¹⁶ These numbers differ in different sources, but they all claim that the numbers increased substantially each year. The 1960 PSSC textbook preface states that in that year, the course was being taken by 25,000 students in 600 schools across the country. John Dodge wrote that by the second edition in 1965, 640,000 students had used the book. “PSSC Physics: By One Who Saw it from Beginning to End,” in “PSSC 50 Years Later”, American Association of Physics Teachers, 2006, <http://www.compadre.org/portal/pssc/pssc.cfm>, accessed August 20, 2014.

¹¹⁷ Killian, *Education of a College President*, 166-173. Other programs from the time include Project Physics at Harvard, which began in 1962 with funding from the Carnegie Corporation, and received government funding in 1964. One of Abbott’s photographs, of a ball moving in a parabolic path after being ejected from a moving toy train, is actually also used in this book, with credit given to the Educational Development Center. It is used in a section about making strobe photographs. *The Project Physics Course: Handbook* (New York and Toronto: Holt, Rinehart and Winston, Inc, 1970), 61.

¹¹⁸ James R. Killian, *PSSC Physics*, (Boston: D.C. Heath and Company, 1960), p. v, and pieces by John Dodge, John Rigden and Uri Haber-Schaim compiled in the online publication “PSSC 50 Years Later”, American Association of Physics Teachers, 2006, <http://www.compadre.org/portal/pssc/pssc.cfm>, accessed August 20, 2014.

made to serve as the foundation of the course. He does not justify his interest in film but simply positions it as the basis for a new approach to teaching the discipline.¹¹⁹ The PSSC made between 50 and 60 films in the years around 1960 for teachers to use in classrooms, ranging from around twenty to around forty minutes in length.¹²⁰ They are notable in the sense that established filmmakers directed them, and they featured actual scientists explaining various topics in their own words. The fact that it was the scientists, not professional actors, doing the performing, gave the films a kind of unpretentious quirkiness which was likely understood to fit with the broader PSSC mission of making science approachable. There are also instances in which film techniques were used to produce specific visualizations for pedagogical purposes, as in the case of “Frames of Reference,” in which one of the scientists is shot hanging upside down, and the viewer is tricked into misinterpreting the location of the floor. The films also make use of slow motion and the combination of laboratory scenes with all kinds of other imagery. In “Elastic Collision and Stored Energy” (1961), hosted by James Strickland, who worked with Abbott on some of the textbook images, two of Abbott’s photographs are visible hanging on the wall in the background.

Seventeen scientists, industry men, educators, and some individuals who wore all three hats came together to form the steering committee of the PSSC in 1957. Among these were Frank Capra, famed Hollywood director, and Edwin Land, President of the Polaroid Corporation.¹²¹ In addition to his World War II propaganda films, his Oscars and many acclaimed movies, Capra had ended up producing educational science films in the mid-1950s for

¹¹⁹ Zacharias memo to Killian is reproduced in Jack S. Goldstein, *A Different Sort of Time: The Life of Jerrold R. Zacharias, Scientist, Engineer, Educator*, (Cambridge: MIT Press, 1992), Appendix B.

¹²⁰ Some of these have been digitized by the Academic Film Archive of North America. <http://www.afana.org/psscfilms.htm>, accessed July 16, 2018. Geoff Alexander, director of this archive, writes about some of the films in his book, *Films You Saw in School: 1,153 Classroom Educational Films, 1958-1985* (Jefferson: McFarland & Company, 2014), 129-131.

¹²¹ Goldstein, *A Different Sort of Time*, see 152-190, and Appendix C.

the Bell Laboratory Science Series. Land was a self-trained scientist and contributed to military photographic technology during World War II and the Cold War. Zacharias and Killian had thus put together a group that specifically bridged federal efforts in education and communication, questions of global politics and military research, and the photography and film industries.

In addition, Zacharias and Killian were both direct science advisors to Dwight Eisenhower at the same time as they were launching the PSSC. Zacharias was a member of the President's Science Advisory Committee, and Killian was Special Assistant to the President for Science and Technology. Eisenhower's 1958 State of the Union, which was almost entirely focused on how the U.S. should react to the launch of Sputnik, announced a fivefold increase in funding for science education, in order to "create the intellectual capital we need for the years ahead, invest it in the right places -- and do all this, not as regimented pawns, but as free men and women!"¹²² We thus have to situate the PSSC as part of this larger political atmosphere, in which efforts in education that used visual media were thought of as both patriotic and democratic. This situation was complex, involving multiple conflicting stakes. It is crucial to understand the work of Zacharias and Killian as part of an anxiety-filled milieu, when scientists discussing education with the president would have to be directly related to the stakes of the Cold War. However, when doing academic work, it seems to have been relatively easy in the 1950s for these men to separate themselves ideologically from any kind of problematic compromise of education by either politics or industry. For men of their generation, who had been wartime scientists at the beginning of their careers, federal support for education, and

¹²² Dwight D. Eisenhower: "Annual Message to the Congress on the State of the Union," January 9, 1958. Online by Gerhard Peters and John T. Woolley, *The American Presidency Project*. <http://www.presidency.ucsb.edu/ws/?pid=11162> (accessed December 21, 2017). This online archive provides access to this document which is in the The Public Papers of the Presidents. On the place of MIT and Gyorgy Kepes' interdisciplinary work in the broader American project of defining collaborative scientific research as a national resource, see Anna Vallye's essay "The Middleman: Kepes' Instruments," in *A Second Modernism: MIT, Architecture, and the 'Techno-Social' Moment*, Cambridge: The MIT Press, 2013, 144-185.

federal collaboration with academia and industry, was appropriate and beneficial. It merely required the proper structural organization. For example, the formation of the PSSC led to the establishment of Educational Services Incorporated (later called Educational Development Center), a private non-profit. ESI was the actual publisher of PSSC materials and according to Killian, who served on its board, it could handle aspects of the efforts at curriculum reform that were tricky for MIT, such as working with publishers and manufacturers of laboratory equipment.¹²³ Zacharias' biographer, Jack S. Goldstein, phrases this more precisely; it was necessary that MIT, as a recipient of NSF funds, would not officially participate in the commercial aspects of the program.¹²⁴

To make matters more complicated, scientists had to perform a delicate dance of refusing to seem nationalistic and paranoid, without caving to McCarthyism and loyalty pledges. In his memoir, Killian wrote: "Let me emphasize that the Zacharias-PSSC curriculum reform was launched in 1956, a year before Sputnik. It deserves to be celebrated as the initiative that marked the return of the university scholar and scientists to direct concern with the teaching of their subject at all levels of the learning scale. It also had great influence in persuading foundations to make grants for curriculum reform."¹²⁵ While we must acknowledge that at least partially, this national funding arose from fears that the U.S. would lose global power, ostensibly the scientists involved in the project were more focused on the culture of education, hoping to counter skepticism of "elite" scientific activity. Zacharias' position, one that Abbott shared, was that a general appreciation of science and scientific methods was part of being "decent in this world," and is quoted as saying he was not interested specifically in creating more scientists but getting

¹²³ Killian, *Education of a College President*, 167.

¹²⁴ Goldstein, *A Different Sort of Time*, 181-182.

¹²⁵ Killian, *Education of a College President*, 171.

all people to appreciate “observation, evidence, basis for belief.”¹²⁶ His language sounds like a reaction to the idea that national funding for science education had nationalistic or military goals.¹²⁷

This complex territory between politics, education, and science is important for situating Abbott’s work. Her ideas about how photographers could contribute to the general improvement of a democratic society by exposure to science centered on the use of very specific visual characteristics of photographs, and clear comprehension of photographic technology by viewers. The technology is what actually protects science from becoming instrumentalized by those in power, and secures the sanctity of individual thought because it requires this active engagement, it cannot be completed without a free-thinking viewer physically or mentally acting. In this attitude, she was tapping into much larger shifts in American thinking about visual technology and media, which were quickly becoming an emblem for the American public of progress, modernity, and democracy, in direct response to tensions about the place of American capitalism on a global stage.

The PSSC textbook and Abbott’s photography were embedded in a broader American milieu in which scientists such as the ones on the steering committee had to think through how their work was related to political and national stakes. In doing so, they drew on new media technology to modernize and reform education. Zacharias worked at MIT’s Radiation Lab during

¹²⁶ Quote is in Goldstein, *A Different Sort of Time*, 164-165. See also Barry J. Zimmerman and Dale H. Schunk, eds., *Educational Psychology: A Century of Contributions*, Mahwah, NJ: Lawrence Erlbaum Associates, 2003, 413, for more, including Zacharias’ collaboration with Jerome Bruner on the psychology of learning.

¹²⁷ See Jessica Wang, *American Science in an Age of Anxiety: Scientists, Anticommunism, and the Cold War*, (Chapel Hill: University of North Carolina Press, 1999), for a history of the complex ways in which scientists navigated McCarthyism, and the political tensions around where science funding should come from. Progressive scientists worked to separate their fields from politics and from the military-industrial complex, but often had to frame their agenda as coherent with government or military aims because of paranoia about letting science out of military control, and “reds” in academia. Killian’s other memoir also provides insights into this: James R. Killian, Jr., *Sputnik, Scientists, and Eisenhower: A Memoir of the First Special Assistant to the President for Science and Technology*, Cambridge: MIT Press, 1977.

World War II and directed later defense projects at MIT, and as mentioned he and Killian both had strong government ties, being part of the generation of elite scientists who transitioned from wartime work to post-war advisory and administrative roles. Significantly, both also worked on projects driven by photographic media throughout their careers, and consistently demonstrated an interest in improving education through media. Killian wrote text for Harold Edgerton's book of stroboscopic photographs, sounding a bit like Abbott when he argued that "in the main the esthetic aspects of science are discernible only to the scientist, but here they appear in a universal language for all to appreciate."¹²⁸ In his work with government and legislation, he moved from science advisor roles to communication and television broadcasting. In his memoir, Killian lauded "Educational Films in Fluid Mechanics," an ESI project directed by Ascher H. Shapiro, professor of mechanical engineering at MIT, and funded by the NSF and the Office of Naval Research. According to Killian, "Professor Shapiro's mastery of photographing fluid mechanics phenomena led to a whole new approach to the teaching of fluid mechanics and to the formation of a National Committee for Fluid Mechanics films."¹²⁹ In the 1960s and 70s, Killian was chairman of the Carnegie Commission on Educational Television, and subsequently, Director of the Corporation for Public Broadcasting. In the 1970s Zacharias worked on *Infinity Factory*, a public television program about math that was specifically targeted at "inner-city" Black and Latino children. Killian took pride in this project as an example of "Zach's efforts to invent ways to mobilize the best talent of the nation for the hard work of solving difficult problems, whether they lie in education, research, or defense."¹³⁰ Both Zacharias and Killian clearly believed in a crucial role for visual media in the improvement of science education and collaborated to push

¹²⁸ Harold E. Edgerton and James R. Killian, *Flash! Seeing the Unseen by Ultra High-Speed Photography*, Boston: Hale, Cushman and Flint, 1939, 22.

¹²⁹ Killian, *Education of a College President*, 172.

¹³⁰ Killian, *Education of a College President*, 170.

this forward. It is possible that the PSSC project solidified reputations for both of these men that uniquely intertwined roles as established scientists and political actors with positions as experts in educational media. Their ideas about using visual media in education in the 1950s, which grew out of careers at the intersection of the military, academia, and industry, fed smoothly into trends that developed in the 1960s and 70s in terms of making education more democratic, egalitarian, and likely to serve the children of modern America. This shift also involved making education more dependent on technology.

Cold War federal education reform and intersections between visual media, American politics, and education are the key background and context for Abbott's practice. Conversely, Abbott's specific approach to pedagogical scientific photography provides helpful insights into this period, showing how this actually worked in visual images. If we look at concerns over individual freedom of thought and relations between humanity and science, we note that Abbott's photographs put many of these dynamics in material form by turning the visible traces of photographic technology into the point of interaction between people and nature. The fact that it was photography that could do this is related to the political context of Cold War America, to the need to define a subject of a liberal democracy, and to progressive intellectual discourse all at the same time.

3.0 WILL BURTIN AND CORPORATE SCIENCE DESIGN¹³¹

While scientists, politicians, and specialists in film and photography were exploring the potential of visual pedagogy for students, corporations were tapping into the same conversations about communication and technology to produce their own educational materials. Corporations largely did this in the context of the growing field of design, working closely with artists to develop new approaches to branding and communication with their customers. These approaches enabled them to position themselves on the forefront of new knowledge and democratic progress. As in Abbott's practice, artists sought to affirm the importance of visual media in these developing spheres, increasingly by referencing the values of individual creativity, agency and subjectivity. Abbott's practice establishes how the visible presence of photographic intervention encouraged the ideal of independence of mind that was important to the dream of American liberal democracy during the Cold War. Her project was embedded in the intersections between government, industry, and education that characterized this period. I move now to a situation in which we see what was possible when this set of ideas was turned more directly to corporate communication; the work of Will Burtin. In a manner similar to Abbott, because Burtin's work refused categorization, as art or science, and in his case as art or advertising, he has flown under the radar in comparison to his contemporaries. As with Abbott, it is precisely because of how his

¹³¹ Part of this chapter also appears in an article in *Visual Resources* entitled "Science, Politics, and Visual Design in Cold War America: Will Burtin's 'Cell'" (forthcoming).

practice traversed these boundaries that his work is important to understanding visual pedagogy in mid-century America.

Will Burtin was a German-born American graphic designer who built his reputation on large-scale models and exhibitions that introduced scientific topics to general audiences. In his work, he strove to define a special place for design in science. His projects were in the service of large corporations who invested in his exhibitions as a marketing strategy. By the 1960s, Will Burtin had become internationally known and had worked for entities such as Union Carbide, Eastman Kodak, IBM, the United States Information Agency, and Upjohn Pharmaceuticals. Burtin helped companies use science models, plus their circulation via television and photography, as a form of marketing, showing off the company's investment in current scientific research rather than just the products it brings into being. His models for Upjohn included a 24-foot dome-shaped model of a cell, a sound and light presentation on the human brain, and a large kinetic sculpture that represented a chromosome. For Union Carbide he designed a moving model of a uranium atom, and for Kodak, a giant eye.

It was Burtin's particular strategies for visual display, and their relation to a broader discourse about the visual as a progressive social force, that gave his science models the power to present the company as taking a broader humanitarian interest in the education of the public and American progress. They visually secured a relationship between new science, liberal democratic values, and Western capitalism, a connection of crucial relevance in the context of the Cold War. In a time of both optimism and anxiety about the superiority of American culture in a global context, visual objects helped to solidify a relationship between art and corporate values that humanized capitalism and made it unthreatening. Driven by notions of visual communication and perception as the method by which humans re-integrate with an expanded

environment, strategies of visual display secured democratic subjecthood as something that could be enacted through the consumption and production of visual technology. The performance of subjecthood occurred specifically in relation to photography and scientific thinking in the work of Abbott. Burtin drew on photography as well, but as part of a multi-faceted sensory experience that intertwined technological and human visualizations, and presented all of this under the umbrella of corporate activity. This chapter will explore how in Burtin's work, as in Abbott's, visual technology helped to suggest the agency of the individual mind in relation to modern science. In addition, it will describe more fully the ingredient of corporate involvement, and how this expanded the value of individual access to scientific knowledge through visual technology to one of participation in liberal democracy. In Burtin's exhibitions, corporations were driving the development of technologies such as electron microscopy, plastics, and computers, and subtly suggesting physical relations between these technologies and biological processes like thinking and perception. These relations were established through images that suggested very basic visual analogies between material in various realms, both scientific and artistic, natural and technological. While the analogies were not always direct, intentional, or presented as anything more than a display strategy, they were powerful and created the impression that human nature was developed through the operations of free enterprise.

Burtin worked as a typographer and graphic designer in Cologne and Berlin in the 1920s and 30s, starting an independent studio after his apprenticeship and working on brochures, posters, and catalogs for industrial clients. He and his wife, Hilde Burtin, who joined him in his design practice, fled Germany in 1938 to avoid having to work for the Third Reich. They were sponsored by Hilde's cousin Dr. Max M. Munk, an engineer who had been recruited by the U.S. Military after World War I. The Burtins settled in New York and over the next couple of years

were able to resume their design work, finding commissions at *Fortune* (where Burtin would serve as art director from 1944-49), *Life*, and *Architectural Forum*. The Burtins designed an exhibition about the public infrastructure projects executed by the Federal Works Agency, which appeared in the 1939 New York World's Fair but was also meant to travel, designed as modules that were easy to set up and take down. Also in 1939, Burtin began teaching at Pratt Institute, where he stayed on the faculty until he died in 1972. In 1940 Burtin did his first work for Upjohn, a booklet on the sixteenth-century anatomist Andreas Vesalius. In 1941 he designed a cover for its monthly publication *Scope*, for which he would eventually serve as art director. In 1943, he was drafted by the U.S. Army, and designed flight manuals from Washington, combining images and text to train aerial gunners and developing many of the design ideas that would inform his later work.¹³²

In 1948, A/D Gallery in New York presented an exhibition of Burtin's work called *Integration, the New Discipline in Design*. Created to tour the country, it incorporated colorful, transparent plastics, aluminum, and steel, and was accompanied by a booklet. This text, which was reproduced in *Graphis* in 1949, explained that four categories needed to be integrated in visual communication: man and his senses, the two formal categories of light/color/texture and space/motion/time, and "the extra-sensory reality of science." According to Burtin, the designer accomplishes this integration.¹³³ As this chapter will explore, the idea that visual perception is an intellectual process, and that science is now offering new "realities," are foundational for Burtin's later science work and indicate the relationships between his thinking and that of the

¹³² For this and more of Will Burtin's biography, see R. Roger Remington and Robert S. P. Fripp, *Design and Science: The Life and Work of Will Burtin*, Burlington: Lund Humphries, 2007.

¹³³ Burtin, "Integration: The New Discipline in Design," 230-237. His later writings continue the argument that design and the designer perform a crucial interlocutor function between humanity and scientific knowledge, "The Challenge of Science to Visual Design," *Neue Grafik*, no.7 (September 1960): 46-48, and "Modelling the Frontiers of Knowledge," 1963; in *Design*, no. 178 (October 1963): 30-35.

other mid-century educators and intellectuals that emerge repeatedly in this study such as Kepes and Rudolf Arnheim. Practitioners of Cold War visual pedagogy, as we will continue to see in Burtin's projects, took it upon themselves to propose the use of visual media as ethical interlocutors between an individual human mind and an otherwise overwhelming world.

3.1 BURTIN AND THE UNITED STATES INFORMATION AGENCY

As Burtin's career developed, he worked on government projects that also involved corporate interests, and was drawn in to work on exhibitions that were produced by the United States Information Agency for international audiences in the 1950s. In 1953, President Eisenhower had established the United States Information Agency to organize the presentation of American culture and policies abroad, and subsequent exhibitions involved some of the most well-known designers from this period such as Charles and Ray Eames, George Nelson, and Buckminster Fuller. The use of exhibitions to present American democracy as coherent with economic prosperity goes back to the Marshall Plan implemented in 1947, and in the mid-century period, trade shows and world's fairs were a key component of international diplomacy and cultural competition.¹³⁴ Burtin's exhibition design strategies, with bold visual elements and modular organization, could be employed in this context to convey the very specific alliances between corporations, technology, and human freedom and innovation that were necessary to American interests during the Cold War.

In addition to an exhibition about community art centers, and one about amateur art in the

¹³⁴ For some history of the USIA's Cold War exhibitions, see Jack Masey and Conway Lloyd Morgan, *Cold War Confrontations: US Exhibitions and their role in the cultural Cold War*, (Baden: Lars Müller Publishers, 2008).

U.S., Burtin designed “Plastics in America” for the USIA, which opened in 1956. This exhibition was also supported by the Smithsonian Institution and the Society of the Plastics Industry, Inc. It was advertised as the first exhibition made entirely of plastic, aside from the steel support frames. This exhibit contained over 400 plastic objects used in daily life such as furniture, sponges, a clock, and signage, as well as fashion accessories, sports equipment, and industrial equipment, and was designed to be easily collapsed and rebuilt on tour. The press release described the overall effect of the display as light and airy with transparent and colorful plastics “to create a sensation of openness and freedom for which so many exhibit designers strive.”¹³⁵

In 1957, Burtin worked with the USIA on a touring exhibition designed to show British audiences a vision of life in a typical American town, entitled “Kalamazoo...and How it Grew!” The next year, Jack Masey of the USIA then asked Burtin to develop a version for the Marshall House in West Berlin, which was titled “Kalamazoo...ein Mittelstadt im Mittelwesten.”¹³⁶ The USIA specifically wanted these exhibits to show that “the gains and changes of the last fifty years that have brought to the American worker and his family increasing shares in the good things in life, have improved their diet and comfort, and have broadened their cultural horizons.” Planning documents also outline that the exhibition demonstrated that “the ‘ordinary citizen’ in industrial America has more than a high wage and high standard of living. His values and opinions have altered profoundly, his understanding of the productive process of industry has increased and his status in the community has been enhanced.” Furthermore, exhibition materials should “emphasize, via a medium-sized corporation in Kalamazoo, the concept of labor-

¹³⁵ Press release from Gramercy Advertising Company, Inc. “Outstanding Effect Achieved in “Plastics in America” Exhibitions Constructed Almost Entirely of Plastic.” Box 9, Folder 12, Will Burtin Papers, RIT Libraries: Graphic Design Archives, Rochester Institute of Technology (hereafter Will Burtin Papers).

¹³⁶ Letter from Masey to Burtin, February 26, 1958, Box 9, Folder 13, Will Burtin Papers. This was part of the West Berlin Industrial Fair in 1958.

management relations, product development, consumer research, productivity, and labor union activities.”¹³⁷ Masey has written that Kalamazoo was chosen for “the whimsy of its name” and because it was a typical midsize American town but it seems likely that the “medium-sized corporation” in question was always envisioned as Upjohn, which was featured as part of the display.¹³⁸

The exhibition had sections on work, education, family, religious activities, industry, and leisure. The exhibit also included “Practicing Democracy in the Classroom,” a film by Encyclopedia Britannica Films, the Educational Film Service, and Kalamazoo Public Schools that explained ways to encourage students to become good democratic citizens who discuss issues and form opinions.¹³⁹ Burtin’s own exhibit at the Kalamazoo Art Center about Upjohn’s advertising program was also featured.¹⁴⁰ Dozens of photographs were arrayed on large structures, in the Bauhaus-influenced exhibition style of this period that Fred Turner has termed the “democratic surround.” As Turner points out, the USIA embraced this style of exhibition design, which offered the impression of options by encouraging movement and allowing the viewer to choose where to direct their attention.¹⁴¹

The Kalamazoo exhibitions demonstrate Burtin’s take on this. Its design appears to invite viewers to become immersed in a visual media-rich environment, make choices about what to

¹³⁷ Planning and contract documents in Box 9, Folder 13, Will Burtin Papers.

¹³⁸ Masey and Morgan, 104.

¹³⁹ Letter about Burtin requesting this from T.T. Herrick, Kalamazoo Public Schools, October 9, 1957, and letter from Encyclopedia Britannica Films, October 18, 1957, Box 9, Folder 15, Will Burtin Papers.

¹⁴⁰ Letter to Richard L. Gregg, Director of Kalamazoo Art Center, May 24, 1957, Box 9, Folder 14, Will Burtin Papers.

¹⁴¹ Fred Turner, *The Democratic Surround: Multimedia and American Liberalism from World War II to the Psychedelic Sixties*. Chicago: The University of Chicago Press, 2013, 4-6. See also Olivier Lugon on how Bauhaus strategies of exhibition design that encouraged a viewer to move were based on the power that was perceived to come from the unfolding of images over time to a more involved viewer, as in cinema. Olivier Lugon, “Dynamic Paths of Thought: Exhibition Design, Photography and Circulation in the Work of Herbert Bayer” in *Cinema Beyond Film: Media Epistemology in the Modern Era*, François Albera and Maria Tortajada, eds., Amsterdam: Amsterdam University Press, 2010, 117-144.

look at and synthesize their own overall impression. We can also observe how Burtin incorporates prominent sculptural and visual elements that relate to the content, such as large round moving display panels that have the appearance of a clock, used for a section that describes the average person's typical day, hour by hour. For the British tour, a hexagonal support structure was designed for the exhibit materials, with six triangular sections displaying photographs taken in Kalamazoo by Suzanne Szasz and Ezra Stoller.¹⁴²

In Berlin, Burtin seems to have had the opportunity to take some of these design principles even further. The gallery was dominated by a large transparent sculpture in a guitar shape, a two-story tower made of pills, and a huge ticker tape that wound around the two-story space and down an adjoining hallway and displayed a series of photographs.¹⁴³ Large disks with photographs on one side rotated on poles. In these exhibits we see an emphasis on layering of textures, geometric shapes, primary colors, kinetic architectural elements and photography. Throughout his practice Burtin described his approach as finding a visual metaphor that will clearly and simply convey a main idea to a viewer. The spatial and visual environment should, themselves, "communicate." Moreover, it should stimulate the senses. In Burtin's approach, visual objects have an active role to play in synthesizing and interpreting content for a viewer. At the same time, through the use of a proliferation of visual elements, as well as the multi-faceted architecture of the exhibition space, viewers were meant to feel as if they were doing synthesis and interpretation themselves. Even though the tools in use are quite different, it is possible to see here that Burtin's strategies bring the principles of visual pedagogy that underwrote Abbott's work for the PSSC into an entirely different sphere. The viewer is expected to use visual technology, in this case photography but also the medium of the exhibition, as tools for actively

¹⁴² Photographs of model, Box 27, Folders 5 and 6, c. 1957, Will Burtin Papers.

¹⁴³ Installation shots, Box 27, Folder 7, c. 1958, Will Burtin Papers.

unlocking knowledge that would not otherwise be easily comprehensible but that has great value for the viewer's understanding of their civic role.

I recount these projects of Burtin's to demonstrate how he traversed corporate and federal domains and found ways in each instance to implement his notion of visual design as a progressive and democratizing force. In the rest of this chapter, I will investigate how he further developed these strategies in his science models in the context of corporate marketing, mainly on biological subjects for Upjohn. For Burtin, a model's effectiveness came from the degree to which it could immerse the viewer in a multi-sensory experience, and his exhibits drew on discussions of visual media from education, psychology, and marketing that continued to shape design in the subsequent years. In Burtin's papers housed at the Rochester Institute is a copy of a 1970 article written by Charles Vento for *Audiovisual Instruction* discussing possible pedagogical and therapeutic uses of immersive media environments such as Disney's 360-degree multi-screen room. Vento describes an inflatable room "designed to solve a special communications problem in marketing" for the Dade-Hudson Company, in which seven screens would "'bombard' the viewer-listener with 'the message.'" In the article Vento explains that reactions to these audio-visual tools ranged from horror at their potential for propaganda, to excitement about their potential uses in teaching and to help "psychologically disturbed children." In Burtin's copy are underlined sentences describing the technical particulars of one of the 360-degree environments, suggesting that still in 1970 he was paying attention to these kinds of exhibits as a potential model or context for his own experiments.¹⁴⁴ In the science models Burtin designed over the course of the 1960s, he pursued the idea that viewers will "feel" what it is like to be microscopic entities for themselves, rooting his design strategies in both sensory

¹⁴⁴ Box 6, Folder 12, Will Burtin Papers. Charles J. Vento, "Creative Experimental and Total Environmental Immersion," *Audiovisual Instruction* (June-July 1970), 48-49.

immersion and viewer agency in relation to scientific knowledge, and drawing on the new fields of communication theory and educational technology.

3.2 THE UPJOHN MODELS

In his 1960 piece for *Neue Grafik*, Burtin wrote that the Upjohn cell model was conceived in 1957 as a result of the company's request for him to come up with "a visual method of explaining new knowledge," in order to make a lasting impression of their brand on audiences.¹⁴⁵ In a draft manuscript for his article for *Industrial Design*, also in 1960, Burtin explains that the cell (and his subsequent model of the human brain) grew out of the need for pharmaceutical companies to counter skepticism about the "veracity" of their product advertisements. Companies needed to show that while their work is indeed for profit, their "basic interests are intimately linked with the progress of science on all fronts."¹⁴⁶ He cites other concerns such as the need for the public to have access to complex scientific information. Visual representations of general science allowed for a variety of motivations to be pushed forward simultaneously. Companies in various fields were noting the benefits of defining a brand and investing in marketing that did not necessarily promote specific products. The Upjohn cell promoted the pharmaceutical brand and conveyed its association with modern scientific progress without having to navigate the complicated territory of drug advertising. An exhibition could also reach the general public, in the vein of what would later be called direct-to-consumer advertising, rather than just doctors, who were the more typical audience for pharmaceutical marketing at this

¹⁴⁵ Will Burtin, "The Challenge of Science to Visual Design," *Neue Grafik* no. 7 (September 1960): 46.

¹⁴⁶ Typewritten manuscript, Box 12, Folder 3, Will Burtin Papers. This section was omitted from the published article, "The Brain," *Industrial Design* vol. 7, no. 8, (August 1960): 66–69.

time.¹⁴⁷ During this period, science visuals often subtly advanced corporate interests, as part of what Flora Lysen has referred to a “general iconic language” of science.¹⁴⁸ Images could be powerful but ambiguous in the exact way that was needed, not advertising specific research but science in general. In the context of the cell’s appearance in a BBC program, a letter to Burtin indicates that the BBC was able to acknowledge the role of Upjohn in the cell even though they were not strictly allowed to advertise, presumably because no specific products were being promoted.¹⁴⁹

Again, we must note that Burtin’s priorities were good design and clear communication of scientific knowledge. Like other major designers of this era, Burtin was fundamentally optimistic about the intimacy between his work and the needs of the business world. For him, however, these values could easily go hand in hand with those of a company trying to create a brand and promote its products. Cooperation between businessmen and designers was widespread during this period, and Burtin and other designers seem to have seen this as a natural relationship that reflected the shifting conditions of modern life. In the catalogue for *Visual*

¹⁴⁷ Direct-to-consumer advertising was not the priority of American pharmaceutical companies for most of the twentieth century. The Pure Food and Drug Act of 1908 introduced the first rules about what a drug company could and could not claim, and the 1938 Food, Drug, and Cosmetic Act was driven by the attitude that it was dangerous for consumers to choose their own medications. In 1962, the Food and Drug Administration took over the regulation of advertising for prescription drugs, requiring that they be “fair and balanced” in indicating both effectiveness and risks. However, marketing targeted primarily at patients, rather than doctors, did not become widespread until the 1980s. For information about the complex history of pharmaceutical advertising and its regulation, see J. A. Greene and S. H. Podolsky, “Keeping Modern in Medicine: Pharmaceutical Promotion and Physician Education in Postwar America,” *Bulletin of the History of Medicine* 83, no.2 (2009): 331–377, and Jeremy A. Greene and David Herzberg, “Hidden in Plain Sight: Marketing Prescription Drugs to Consumers in the Twentieth Century,” *American Journal of Public Health* 100, no.5 (May 2010): 793–803. Burtin often downplayed tensions between effective advertising and the need for regulations to protect consumers, as in his letter to Upjohn responding to the fact that the FDA objected to an Upjohn ad for the drug Lincocin in 1966. On the contrary he seems to have been motivated by the challenge of finding new styles that reflected the needs of both industry and society. Letter to J.C. Gauntlett, November 9, 1966, Box 3, Folder 7, Will Burtin Papers. See “Advertising: Upjohn Drops \$300,000 of Ads,” *The New York Times*, November 9, 1966, 54.

¹⁴⁸ Flora Lysen, “Blinking Brains, Corporate Spectacle, and the Atom Man: Visual Aspects of Science at the Stedelijk Museum (1962),” *Stedelijk Studies*, Issue 2 (2015).

¹⁴⁹ Letter from Aubrey Singer (BBC) to Garrard Macleod (Upjohn), June 2, 1959, Box 12, Folder 10, Will Burtin Papers.

Communications 1957 at the Kalamazoo Art Center, where the Upjohn exhibition displayed its “visual design program,” Burtin wrote that the modern “flood of scientific and technical communications,” which are “more complex and visually abstract,” requires an approach to design that lets the consumer quickly and easily gain a positive impression of the character of the Upjohn brand. In linking communication and art theory with the goals of advertising, which was here being presented in the context of an art gallery, Burtin suggests that the value of communication for marketing purposes has to do with the broader conditions of society and human progress.¹⁵⁰ He shared this idea with the many designers and businessmen who came together in the 1950s and 1960s at the Aspen Design Conferences for example, an event launched by Walter Paepcke, chairman of the Container Corporation and patron of László Moholy-Nagy’s New Bauhaus. Burtin spoke at even more industry-specific events such as a 1958 conference entitled Integrated Design for Corporate Identification at the Boston Institute of Contemporary Art, and later, organized his own conferences on design and communication: Vision 65, Vision 67, and Vision 69. These were sponsored by the International Center for Typographic Arts with the help of Lou Dorfsman of CBS and Bruce MacKenzie of IBM.¹⁵¹ These events indicate the degree to which the field of design bridged corporate and artistic spheres, and Burtin’s involvement indicates his interest in these interconnections.

The first of Burtin’s large-scale, immersive, multimedia models for Upjohn depicted a “basic cell.” The cell structure, unveiled at the 1958 American Medical Association meeting in San Francisco, was a 24-by-24 foot domed web of clear plastic tubes lit by pulsing lights. These lights were positioned below the floor and shined through holes up through the plastic tubes so

¹⁵⁰ *Visual Communications 1957* catalogue, Box 84, Folder 3, Will Burtin Papers.

¹⁵¹ Letter from director of Center for Design Studies to Burtin, November 19, 1958, Box 3, Folder 4, Will Burtin Papers. This letter asks Burtin to help get Upjohn to contribute money to the organization. Vision 65 and 67 conference publications, Box 41, Folder 3, and Vision 69, see Box 107, Folder 8. Will Burtin Papers.

that the whole structure glowed. Visitors to the exhibit could actually enter and circumambulate the cell, walking on a platform above a mirrored floor that visually turned the hemispherical structure into a full sphere. While the dome shape was perhaps chosen because it was much easier to build than a full sphere, it would have also allowed the structure to be linked in the minds of many with Buckminster Fuller's geodesic dome, the epitome of a modern design based on technical efficiency and sophisticated materials.¹⁵² Burtin built three-dimensional models of cell parts that were installed inside the dome, including a nucleus that contained the nucleolus and chromosomes, a centrosome (later described as "sputnik-like" in a Chicago Museum of Science and Industry press release and subsequently by the media), mitochondria and endoplasmic reticula.¹⁵³ In developing his design for the cell, Burtin sought the advice of several scientists.¹⁵⁴ The construction was based on two-dimensional electron micrographs, which themselves were displayed inside the cell, showing the design process of translation from two dimensions to three to the audience, and adding scientific authority to the model's form, which was rooted in recent developments in cytology but certainly abstracted and generalized a cell's structure and function.¹⁵⁵ After its first unveiling at the American Medical Association meeting

¹⁵² Fuller first presented his geodesic dome in 1954. See Daniel López-Pérez, ed., *R. Buckminster Fuller: World Man* (New York, NY, USA: Princeton Architectural Press, 2013), 12–31.

¹⁵³ Press Release, January 30th 1959, Archives of the Chicago Museum of Science and Industry, The *Science News Letter* and the *Society of Industrial Artists Journal* referred to the centrosome as sputnik-like in 1959. In general, visual and verbal references to *Sputnik* were very prevalent during this time, when the space race strongly shaped American popular culture. The "sputnik-like" look of the cell parts would have given the exhibit a cutting-edge feel.

¹⁵⁴ It is likely that Burtin drew from C.C. Lindegren's diagramming of the cell, in his 1959 article, "The Integrated Cell" in the *International Journal of Psychology*. There are letters in Burtin's archive to indicate that the two met in Carbondale in 1959. Box 3, Folder 5, Will Burtin Papers. Burtin wrote in 1961 that he had worked with Dr. Leonard C. Hamilton of the Sloan-Kettering Institute who connected him to many other scientists, as well as Dr. Keith Porter, Dr. Moses, and Dr. Mirsky of the Rockefeller Institute who were involved specifically with the basic cell. He also mentions Dr. Girard of University of Michigan and Dr. Starr of Boston General Hospital as having helped with the cell. Letter to John Dixon, April 12, 1961, Box 10, Folder 10, Will Burtin Papers.

¹⁵⁵ As Jason Weems points out in relation to the Eames film, "Powers of Ten," excitement about the new kinds of images made by electron microscopes was a major feature of popular science magazines in the 1950s and 60s. Weems explores the tension inherent in this time period's understanding of imaging technologies as an extension of human vision when in fact they relied on a complete detachment from the human sensorium. "Vision at California

in San Francisco in 1958, the cell was shown at the New York Health Show and the Mineola Fair and Industrial Exposition. It was then installed for permanent display at the Chicago Museum of Science and Industry in early 1959. In late 1959, it traveled to London to star in a two-part BBC science television program in which scientists used the model to discuss the human cell and cancer. It also appeared at the Royal Scottish Museum in Edinburgh for six weeks before returning to its place in Chicago, where it remained until 1967.¹⁵⁶ It was maintained by Upjohn through regular structural assessments, and if the audio narration reflected current science.¹⁵⁷ When visiting the model, viewers could press a button to hear detailed information about the cell parts and how they were represented, played over speakers. The narration invited the viewer to move to different “stations” inside the cell and direct their attention to certain parts, such as “the Golgi apparatus shown as both an electron micrograph on the wall plaque, and as a plastic model.”¹⁵⁸

Burtin’s goal was to show that artistic, interactive, technology-driven renderings of scientific subject matter were key to the public’s engagement with new scientific knowledge, and even to the progress of science itself. He argued that the model allowed understanding of multiple elements all at the same time, an experience enhanced by the visual appeal of the forms and colors, and the viewer’s movement through space. According to Burtin, “The completed model accomplished at a glance what the combination of existing means of information had

Scale: Charles and Ray Eames, *Systems Thinking, and the Diminishing Status of the Human Body after World War Two* in *Where Minds and Matters Meet: Technology in California and the West*, ed. Volker Janssen (Berkeley: Huntington Library and the University of California Press, 2012), 251-292, see note 11.

¹⁵⁶ “Basic Cell goes to Museum of Science and Industry,” *The Overflow* (March 1959): 113-115. See also Box 12, Folders 10, 11, and 13, Will Burtin Papers. Correspondence and documentation related to the cell can also be found in the accession files of the Chicago Museum of Science and Industry. The cell was removed and destroyed in 1967, after it was determined that it had suffered too much wear and tear and was becoming obsolete scientifically.

¹⁵⁷ Letter from W.H. Von Rosenstiel from Upjohn, 1965, Box 3, Folder 7, Will Burtin Papers, and correspondence in archives of the Chicago Museum of Science and Industry.

¹⁵⁸ “Upjohn Cell Tape Recordings, From Exhibits Dept.,” March 17, 1959, archives of the Chicago Museum of Science and Industry.

failed to do: it produced an immediate appreciation of a cell's logical structure and functioning. To this one had to add the visual attraction which resulted from the qualities of forms, materials, lights and colors; all integrated towards a clear understanding of the whole."¹⁵⁹ New technology was at the forefront of the cell's effect. The *Society of Industrial Artists Journal* noted in 1958 that "the design and structure itself would have been impossible without recent developments in electron micrography (which allowed more definite conclusions about the nature of basic structures), and recent improvements in the handling, strength and non-static properties of plastics."¹⁶⁰ As noted in drafts for exhibition panels, it was also the "light-transmitting characteristic of lucite plastics" that allowed for the overall pulsing glow.¹⁶¹

The cell was photographed by Ezra Stoller, an architectural photographer who worked with Upjohn and with Burtin on many of his projects. Upjohn used the cell model in various ways; they published a brochure using it to explain their research, published Stoller's images in magazine advertisements that appeared in *Time*, *Life* and *Newsweek*, and also created a set of teaching slides that used the cell model. Documentation appeared in industry publications such as Upjohn's *Scope*, *Scientific American*, *Science Newsletter*, and *IEEE Spectrum*, as well as in design journals such as *Neue Grafik* and *Industrial Design*. Interest in the cell came from a variety of parties in the U.S. and abroad, leading Burtin to design a smaller, more portable cell model to try to accommodate the demand. At least two of these were built; one appeared in Disneyland, inside the "Upjohn Pharmacy" on Main Street USA (which Burtin had designed),

¹⁵⁹ Will Burtin, "Design and Communication," Gyorgy Kepes, ed. *Education of Vision*, Vision + Value Series, (New York: Brazillier, 1965), 79.

¹⁶⁰ Herbert Spencer, *Society of Industrial Artists Journal* 66 (July 1958): n.p. This write-up in the newsletter is based on notes sent to Spencer by Burtin (Letter to Herbert Spencer, June 11, 1958, Box 12, Folder 10, "Cell Correspondence," Will Burtin Papers, RIT Libraries: Graphic Design Archives, Rochester Institute of Technology).

¹⁶¹ Box 94, Folder 7, "Captions: pre-March 1965," Will Burtin Papers.

and the other travelled to medical conventions in Atlantic City, Kansas City, and Chicago.¹⁶²

In 1959, Burtin marveled that photographs of the cell were apparently circulated in “a Dusseldorf medical school.”¹⁶³ Burtin was also invited to contribute an article that discussed the cell and its design and construction to *Medical and Biological Illustration*, a British publication.¹⁶⁴ An advertisement featuring the small cell appeared in the *Illustrated London News*.¹⁶⁵ In addition to the large cell’s BBC appearance, the smaller cell also appeared in a BBC film entitled “Man Against Cancer.” The Smithsonian Institution Travelling Exhibition Service sought to circulate the cell in 1960, but in the end did not, perhaps because of the cell’s already packed schedule.¹⁶⁶ Similarly, Gyorgy Kepes wanted to use the cell in a United States Information Agency exhibition on science in America that he was planning in 1960, but Burtin asked him if he could settle for photographs.¹⁶⁷ This range of situations in which the cell seemed appropriate – education, communication amongst scientists, mass media for the general public – indicate the extreme versatility of Burtin’s model, the easy slippage in disciplinary categories, and the degree to which many at the time sought objects like this, ones that could traverse the boundaries between specialized science and a general audience.

Stoller’s dramatic photographs of the cell often constituted somewhat independent visual forms for Burtin’s models. However, they furthered the work of the model, presenting the

¹⁶² The cell at Disneyland and the tour of its “sister” is described in an Upjohn newsletter that can be viewed in the archives of Jeremy Winkworth, an Upjohn and now Pfizer employee. “The Cell Goes to Disneyland,” c. 1959, <http://www.upjohn.net/disneyland/disney/disney.htm>, accessed 24 October 2016. Also, the six-foot cell travelled all over U.S, Latin America and Canada according to one document describing the cell in the Burtin archive. Cell Correspondence, Box 12, Folder 11, Will Burtin Papers.

¹⁶³ Letter to Fritz Bornemann, May 6, 1959, Box 3, Folder 5, Will Burtin Papers.

¹⁶⁴ Letters from C.E. Engel, editor of *Medical and Biological Illustration*, 1960-1961, Box 1, Folder 2, Will Burtin Papers.

¹⁶⁵ Unusual Photographs—No. 16: The Microcosm Multiplied. *Illustrated London News* 6278 (November 28, 1959), 767.

¹⁶⁶ Letter from Mrs. John A. Pope, January 27, 1960, Box 3, Folder 6, Will Burtin Papers.

¹⁶⁷ Letters between Kepes and Burtin, April 6 and April 8, 1960, Box 3, Folder 6, and from Nathan Sivin (Kepes’ assistant at MIT), July 11, 1961, Box 1, Folder 2, Will Burtin Papers.

progressiveness and modernity of Upjohn, the analogy between technology and the human, and the cohesiveness of business enterprise and science. The photographic medium allowed Stoller to create specific visual effects, and Burtin to use them to advantage in print or exhibition design. The cell reached a huge audience via these images and its television appearances, and Burtin was able to strategically integrate the entire program of its presentation in various visual media. In the case of the most widely used cell images, the model appears as a glowing red and blue form amidst a black void. Other images are closely cropped so that the plastic parts representing the cell interior fill the frame and seem endless. In the British advertisement, the image of the small cell includes the silhouette of a woman (Burtin's daughter, Carol) reaching out to touch the plastic surface. Stoller effectively generated here a visualization of the idea of human viewers interacting with microscopic entities. Photography held a primary place in Burtin's overall approach, as it did in the work of most graphic designers, and Burtin understood the circulation of models through photographic media as a given from the beginning of his projects. The specific use of photographs to increase public exposure to Burtin's work was also fundamental to the project's success as a financial investment for his clients.

Through visual material, advertising could easily coopt Burtin's rhetoric on communication and society easily, positioning marketing as simply participating in the inevitable world of modern communication, offering choices and information to an empowered democratic subject in the most efficient and sophisticated way. This cohered with Burtin's view of his job, which was to convey content in a manner that secured viewer mental agency, specifically inviting mental synthesis. The landscape of commercial design was always fraught at the same time, however, as we can see in some of Burtin's communications. Donald J. Fay, head of a design group for the U.S. Navy, wrote to Burtin in 1960 asking for advice about how to convince

other government officials that pursuing good design does not always entail “promotion.” He writes that he thought to contact Burtin because of his participation in the Aspen Design Conference. Burtin seems to understand an implicit concern about propaganda and advertising, and responds with an affirmation that design has far loftier goals than promotion, and writes that “the commercialization of design has produced a distrust of design as such.” Burtin invites Fay to refer to the gunnery manuals that he designed during World War II which he claims had reduced training time from three months to six weeks, and also mentions the cell model, which he claims biologists have described as doing the work of one year of study. The emphasis is on the speed of communication and the many non-commercial instances in which clarity of information, and “economy, impact, and beauty” have a self-evident value.¹⁶⁸

Burtin further describes the benefits of collaborations between designers and businessmen in the journal *Graphis*. He emphasized how business can achieve a “corporate image,” and could “appear before the public’s eye in a consistent, pleasing, and original way” by listening to designers who must acknowledge their “social meaning and individual responsibility” in modern times.¹⁶⁹ It is clear in Burtin’s writings that he sees design as a force for modernization and integrity in business success, and is much less concerned about any adverse effects of commercial needs on design. His and his colleagues’ projects could thus appear as progressive interventions, even when they served corporate goals. Burtin repeatedly described his efforts on projects such as the cell model as driven by the fact that a fast increase in scientific knowledge had left the general public unable to digest it. He also wrote in the catalogue for an exhibition that effectively surveyed his science work called “Visual Aspects of

¹⁶⁸ Letter from Fay, January 27, 1960, and Burtin’s response, February 8, 1960, Box 3, Folder 6, Will Burtin Papers. Burtin’s gunnery manuals, c. 1944, can be viewed in Box 64, Will Burtin Papers.

¹⁶⁹ Will Burtin, “On Corporate Images,” *Graphis* vol. 18 (November, 1962): 630-637.

Science” in 1962 at the Stedelijk Museum in Amsterdam that the “the development of a better understanding of the changed world image has been hindered greatly by an unlimited application of technology and the one-sided commercialization of all values, especially in mass communication.”¹⁷⁰ He clearly saw himself as working against this, as pushing forward the influence of design on business and not the influence of business on design. This was even easier in the growing 1960s context of high-level collaborations between cutting-edge designers and corporations. Such collaborations often involved projects that did not promote specific products, as in the case of Charles and Ray Eames’ exhibitions on math and computing for IBM.¹⁷¹

Burtin believed that design could actually be part of scientific research, and that to design a form for a scientific subject was a way of understanding the subject. In this sense, knowledge is represented and generated at the same time through the same means, in a specific formulation of visual pedagogy that was justified through the focus on the integral role of the visual in modern life. In a 1960 *Neue Grafik* article, Burtin wrote: “In this work I experienced a most gratifying understanding of the objective on the part of many leading American scientists who were consulted throughout the entire development of this project...their enthusiasm increased as it became apparent that all aspects of the exhibit began to form a coherent image. Colors, materials, opacity, transparency, shapes, lights, reflections, motion, photography – all elements were gradually integrated toward a disciplined, unified whole.”¹⁷² Burtin showed his excitement here about his ability to convince scientists of the value of visual material. Much like Abbott, Burtin was motivated to create an essential role for artists at the intersection of science, communication, and education.

¹⁷⁰ *Visual Aspects of Science*, exhibition catalogue (Dortmund: Fritz Busche, 1962), n.p.

¹⁷¹ In the 1960s and 70s these included *Mathematica: A World of Numbers...and Beyond*, *A Computer Perspective*, *Isaac Newton: Physics for a Moving Earth*, *Copernicus*, and *Fibonacci: Growth and Form*.

¹⁷² Will Burtin, “The Challenge of Science to Visual Design,” *Neue Grafik*, no. 7 (September 1960): 47.

Like others of his time, Burtin argued that because of modern technologies of communication, humans must adapt in order to keep up with their own inventions. Design is crucial to this project, as it is the connecting piece between humans and the world external to them. Burtin wrote, “from now on, humanity is in the situation of either “designing” its future or being destroyed by the tools of its intelligence.”¹⁷³ Burtin believed in the humanizing effects of the visual. In an investment he shared with the discourse of the New Bauhaus, he held that technology and its abilities must be integrated with “human values” in order for individuals and society to prosper. He argued that the three-dimensional exhibition had vital advantages over text in that it can be experienced more quickly by more people, and can surpass language barriers. These notions about the natural relationship between the visual and subjectivity in a technologically-enhanced environment also resonate with Jurgen Ruesch and Weldon Kees’ proposals about visual communication as less susceptible to malicious distortions of meaning because it is more naturally related to the ways humans already operate. Visual pedagogy in these years took shape around the idea that visual media function in ways that are inherently and naturally human. Their usage could thus be justified on the grounds that they forefronted human agency, and that they were in fact naturally conducive to human perceptual and cognitive faculties, even when intimate contact between viewers and media also meant the efficient conveyance of marketing messages.

Burtin’s next major project for Upjohn was a large-scale model of visual and auditory processes in the human brain. It was unveiled in 1960 in Miami, and in 1961 was shown in Turin, Italy, as part of the American pavilion at Italia ’61. This new model aimed not to show

¹⁷³ Will Burtin, “The Advantages of Three-Dimensional Communication” in *Internationale Ausstellungs-Gestaltung [Conceptions of International Exhibitions]* (Zurich: ABC Verlag, 1969), 19.

brain anatomy but “was organized around its functioning principles.”¹⁷⁴ In a letter, Burtin wrote that the brain model is a “symbolic motion, light and pictorial presentation of interactions between the sense sectors of the brain that produce, coordinate and direct emotional responses which we call thinking. The suggested center theme is therefore “How we think” or “How a thought is formed.”” He indicates in this letter that he is aiming to present a clear “visual and memorizable concept” and is less concerned with including small mechanical or anatomical details that can be better explained in a small panel to the side. He indicates that his experience with the cell leads him to believe in the value of emphasizing a “symbolic-key interpretation of the whole” that is not bogged down by confusing details. His approach involved creating a visual form that will synthesize and interpret complex information for the audience. This letter also gives a sense of how Burtin had to argue for this role as designer; that while he required the help of the scientists, it was he who could accomplish this task of visual synthesis.¹⁷⁵

Like the cell, the brain was a large, three-dimensional structure that emphasizes modern materials and new technology. The audience stood or sat on small round stools in front of the model, where they listened to an audio narration of the flashing lights and images in front of them. Round aluminum disks covered with fields of light bulbs representing the visual cortex, auditory cortex, and motor cortex as well as a “midbrain” at the bottom. Another round “consciousness screen,” containing an array of round photographic transparencies was situated in the middle. The narration told a step-by-step story to the audience about seeing and hearing a singer, comparing the singer to other examples of singers stored in the memory, and then appreciating the singer (manifested by the action of clapping). Strings of lights indicated signals going from eyes and ears to different parts of the brain and back. Abstract shapes appeared on

¹⁷⁴ “The Brain,” *Industrial Design* vol. 7, no. 8, (August 1960): 67.

¹⁷⁵ Letter to “Mac,” (presumably Garrard Macleod), January 30, 1960, Box, 12, Folder 3, Will Burtin Papers.

the cortices to represent the brain perceiving stimulus and doing a process of visual and auditory analysis, and photographs appear on the consciousness screen to represent the past visual experiences that the brain is bringing up for comparison. The screen then displayed a photograph representing the resulting conscious experience. While the abstract shapes seemed to stand in for parts of the perceptual process, the photographs stand in for the more fully formed thought.

According to descriptions written for the BBC, “The two large disks (left and right) are the memory cortices, on each of which the pattern of one audio-visual experience is deposited...The large center disk represents 18 actual visual experiences which light up in sequence and are recorded on the memory cortices. The auditory aspect of the experience (heard over an earphone) is represented by green lights, while the visual patterns are red.”¹⁷⁶ On the consciousness screen, the transparencies showed a beach umbrella, several paintings, fireworks, and image of sound waves, an apple, a birthday cake, various images of female singers, a choir, and a cellist. This idiosyncratic grouping of images of artworks and objects, some of which Burtin also used in other projects projects, flashed on and off in different combinations.

In the Upjohn brain, visual technologies – electric lights and photographic transparencies – were made to represent neural activity. This alignment of visual technology with human cognition appears frequently in Cold War visual pedagogy. Burtin presented visual technologies as analogies, as structurally similar to aspects of the brain, giving the viewer the impression that the brain can be understood, through the technology of the day, as a designed machine. In Burtin’s model, thoughts are presented as pictures on a screen. A description of photographic documentation of the brain sent to the Italian publication *Stile Industria* reads: “It shows the flashing visual fragmentary patterns that keep continually passing over the memory cortices,

¹⁷⁶ “Recorded commentary by Will Burtin, made for BBC telecast, used at the end of the July 3 “Horizon” program.” Box 4, Folder 16, Will Burtin Papers.

whether we are awake or asleep.”¹⁷⁷ Even though Burtin proclaimed that the structure was not meant to be anatomically related to the brain or to reflect actual spaces or forms in the brain, in the model’s performance, the images are described as physically present on the cortices, and the large metal disks are positioned to correspond to actual parts of the brain. The consciousness screen, however, is meant merely as a symbol, corresponding not to a brain part but to the mystery of conscious thought more broadly. The narration written for the 1961 Turin display explains that the screen “symbolizes our being conscious of what we see, hear, and otherwise experience.”¹⁷⁸ The visual presentation of a screen inside the brain suggested that thought could be imagined as a picturing process, figuratively if not anatomically.

Upjohn published a pamphlet to accompany the Brain exhibition entitled “A Moment at a Concert.”¹⁷⁹ Several things are notable about its contents; because this is an Upjohn project, the publication includes a section on drugs and how they affect the brain. However, the first section explains how mapping out the “course of visual impulses” in physical space will shed light on human perception in general. Visual and auditory functions are presented as exemplary of brain function or perception, but more crucially, it is their modeling in space that will serve not only to communicate but to offer further insights about brain function. The brochure explains:

A single moment of perception as the author conceives of it involves (a) the impinging of various physical stimuli on specialized sense organs to produce nerve impulses, (b) the traveling of these impulses along nerve pathways through various way-stations and to the specific cortical receiving areas, (c) their shuttling through various systems of neurons within the cortex and in sub-cortical structures to give rise to intellectual judgement and emotional coloring, (d) eventually integrating all this information in preparation for recording of the experience as a memory, and possibly, (e) initiating an action appropriate to the occasion.

¹⁷⁷ Letter from Burtin to Alberto Rosselli of *Stile Industria*, August 23, 1960, Box 1, Folder 2, Will Burtin Papers.

¹⁷⁸ “Revised Script,” June 23, 1961, Box 46, Folder 13, Will Burtin Papers.

¹⁷⁹ “Moment at a Concert,” Box 67, Folder 6, Will Burtin Papers.

It also states: “This model is actually a three-dimensional animated diagram rather than a realistic anatomical representation. However, anatomical relationships have been roughly maintained and most of the structures mentioned in this text are readily identifiable in the illustrations.” It notes that fragments of memories are indicated by “arbitrary” patterns flashing on the cortices, green for auditory and red for visual. The visual ones are split in half to reflect how each eye sends different impulses, while the auditory ones are the same, but not symmetrical to reflect that each ear hears something slightly different. Perception appears as a multi-step process of stimulus and synthesis. Technology and biology are aligned as body processes are transformed into red and green electric lights, and what we would call thoughts are presented as visual shapes and photographic transparencies.

Physical components of perception – the adjustments of the irises to the level of light and the tympanic membranes in response to the intensity of sound – are incorporated, as well as aspects for which no physical object is available, such as our experiences of audio and visual stimuli. Some parts of the model stand in for known structures in the brain, others for ideas like memory or consciousness. It is notable that these very different kinds of representation become somewhat leveled visually. All are represented by the same materials, and by the same type of geometric shapes and lights that dash around from one side of the body to the opposite side of the brain. It is important to note that aspects of perception for which spatial or physical correlates are not available are given physical stand-ins; for example, the reticular system (which is located in the mid-brain and so in the middle of the model), and the “memory-association areas” and consciousness, which were completely unknown. The model was then praised for how it inadvertently arrived at some correct anatomy, just by making choices driven by clarity. Burtin claimed in an interview at the Hall of Science at the 1964 New York World’s Fair, that:

[...] we had to reject the idea that we were re-building an anatomy, because the anatomy is so intricately planned, and so economically planned in space that everything is packed very tight...we need to put spaces in between, you know, so that one would comprehend...but we found later that by following the dictate of clarity, we found that by some coincidence, a doctor from Western University sent me photograph back which he had taken of this model while it was shown in San Francisco, and he had superimposed his photograph into the human brain, and then he pointed out to me that all visual cortices, and all auditory cortices, and the memory cortices were almost placed the same as they were in the human brain...so in a sense we can say...for nature that it's very logical.

He also says in this interview that a key part of the brain model is that “in order to think, that there has to be some order, somehow, as soon as you have that idea that there is order, then one started to organize it in space, that's what architecture is all about, nature is a great architect.”¹⁸⁰ Burtin noted in his correspondence to *Stile Industria* that the model was intended to show a progression from consciousness of external stimuli to a thought, and that seeing and hearing were the focus because they seemed most important to this process. He wrote that the overall design was not planned from the outset but arose in a sort of natural, accidental fashion out of the need for a clear presentation of the brain process in question.¹⁸¹ Burtin often put forward this idea that his design choices were all driven by clarity of information, and any formal or stylistic virtues were merely those of nature herself. Notably, Burtin asserted his role as designer, but specifically not on aesthetic grounds. The payoff here was that the process of visualization, in which non-scientists can be involved, has intellectual heft, and has a role to play in shaping knowledge.

¹⁸⁰ RCA interview recording, Hall of Science, New York World's Fair, Box 124, Folder 4, Will Burtin Papers. The brain was on view here as part of an Upjohn exhibition called *From Superstition to Science*. Burtin also worked on the pavilion for the State of Illinois at the 1964 New York World's Fair. Burtin's interest in the idea that in creating a functional visual model of the processes, we in fact learn something, or have new access to the object of investigation, was coherent with some contemporaneous discussions of models in philosophy of science. While previous philosophers saw models as reflective of theory, Max Black (*Models and Metaphors: Studies in Language and Philosophy*, Ithaca: Cornell University Press, 1962) and Mary Hesse (*Models and Analogies in Science*, Notre Dame: Notre Dame University Press, 1966) argued that there is also feedback from model to theory that scientists regularly use.

¹⁸¹ Letter from Burtin to Alberto Rosselli of *Stile Industria*, June 16, 1960, Box 1, Folder 2, Will Burtin Papers.

The brain model and its accompanying literature reference both computing and communication theory. From a smaller Upjohn brochure sent to doctors: “There still is, for example, a tremendous field for exploration in the study of the single neuron. Fruitful studies in this field could lead to a delineation of the mechanism of memory. Unlike the electronic “memory” cell that depends on the permanent alteration of its electric or magnetic properties for its retention or “storage” mechanism, no permanent change in the neuron has as yet been discovered to account for memory.” We can sense here how the analogy of computer to brain has permeated the discussion. In a brochure in four languages likely published for the brain’s Turin appearance, brain activity is described in terms of signals, some of which are “coded electrical impulses.” It states: “Two-way traffic flows continuously to and from the brain. This traffic determines what we do and keeps us adjusted to events in a changing world.” In the next section: “Plain everyday living subjects us to a ceaseless barrage of information.” This is accompanied by an illustration in which arrows traverse the body to demonstrate signals and feedback between the body and the outside world.¹⁸²

Ezra Stoller’s photographs of the brain model develop Burtin’s interests. Detail shots in which the intersecting pathways of electric lights fill the frame makes the brain appear as an extensive and complex mass, simultaneously biological and machine-like. Images of illuminated sections in a darkened setting produce the impression of a mysterious void activated by nerve impulses. The machine appears to glow with life. There is also a diagram of the brain model that appeared as part of its exhibition and in publications which simplified the brain model into lines and circles, highlighting the two sense systems that the machine aims to show and transforming them into a modern graphic.

¹⁸² These publications can be found in Box 67, Folder, 6, Will Burtin Papers.

In sum, pictures flash in the brain as if projected, and consciousness is represented by a screen. Burtin thus reinforces the relationship between modern design, modern technology, and knowledge. This connection between thoughts and technology that transmits signals should also be understood in the context of the Cold War and media culture, which often contained an anxiety about the vulnerability of the minds of the public to communication technology. Fear of fascist power in World War II transformed into fear of communist ideology, and a democratic citizen was defined as a person who could access multiple sources of information and interpret them, rather than be subject to a single message. By making technology seem to have a natural relationship with the independent thought process of an individual, Burtin made it seem less like an external weapon that could be used to brainwash the public. The exhibition also centralized the role of the independent human viewer. Even though in this case the audience is stationary, rather than moving around the model, they are actually part of the exhibit. Their presence is built into the display itself, and the act of technologically enhanced viewing is reinforced as an empowering activity. Moreover, they are encouraged to imagine their own minds as powerful machines that process input from the outside world and then take action based on the results.

After images of the brain were published in *Industrial Design* in 1960, Preston S. Parish, Executive Vice President of Upjohn, wrote to Burtin that he wished the role of Upjohn had been more emphasized in the article. Burtin responded with regret and said that it was the editors that had control over this, but that in future the role of Upjohn could be asserted more forcefully earlier in the process.¹⁸³ This interaction gives some sense of the specific delicacy of Burtin's relationship with his client. The popularity and authority of the brain model had much to do with an understanding of it as an art object, and of Burtin as an independent and creative thinker. At

¹⁸³ Letters between Burtin and Preston S. Parish, August 26, 1960 and August 29, 1960, Box 1, Folder 2, Will Burtin Papers.

the same time, Burtin had to navigate the wishes of the company that made this possible, and often seemed happy to do so, producing a complex initiative in which Upjohn, Burtin, and magazine publishers or museums had to figure out how to positively present Upjohn's role without making it look too much like an advertisement. It was a different story when the brain was presented at Italia '61, which was an international trade show specifically designed to show off the success of industry. Peter Corn of The Displayers, Inc., (the exhibition production firm with whom Burtin often worked to build the models) understood this priority completely and worked hard to make sure that Upjohn's name was featured prominently and visitors understood who this company was. In a letter to Burtin he noted that even if visitors did not understand the narration that accompanied the brain exhibit, "they still leave the exhibit quite impressed with Upjohn and apparently with the U.S. Government's exhibit there, as symbolized by the Upjohn "Brain."¹⁸⁴

3.3 VISUAL ASPECTS OF SCIENCE

Throughout Burtin's career, he thus dealt with a varied audience. On the one hand, it was American businessmen who had to be won over by the idea that scientific material needed to be treated from a visual design perspective, and that the values of corporate culture were reinforced when their products and industries appeared in the forms of modern art and design. The corporations, however, in many cases were targeting doctors, engineers, or other professionals, and Burtin's exhibitions were designed to argue the corporation's case, and appear legitimately

¹⁸⁴ Letter to Burtin from The Displayers, May 19, 1961, Box 5, Folder 14, Will Burtin Papers.

scientific, to these parties. In addition, it was in the interest of the corporations, of scientists, and of Burtin, to create visual narratives and iconography that would appeal to the general public. The exhibits had to convey clear information to the layman while presenting an overall tone and attitude suitable to a powerful, progressive industry and nation. Finally, the goal was also to speak to other graphic designers, art directors, and advertising professionals about changes in their field, and about the potential of connections between artists and scientists.

The exhibition “Visual Aspects of Science” at the Stedelijk Museum in Amsterdam, which followed up on the successes of the cell and brain models, especially indicates this multi-layered audience and Burtin’s unique professional position as an artist, researcher, and advertiser.¹⁸⁵ Curator Willem Sandberg was a close colleague of Burtin’s and very sympathetic to his interest in bridging disciplines and in applying modern design to modern science. The exhibition incorporated Burtin’s work for Upjohn, Kodak, and Union Carbide, and included models, Stoller’s photography, and the scientific source material that went with the various exhibits. Garrard Macleod of Upjohn wrote for the catalogue, as did Roy Tillotson of Union Carbide and Bruce MacKenzie of IBM. This exhibition opened in September 1962, and in the fall of 1963, it was shown at Gulbenkian Hall at the Royal College of Art in London. Appearances were also proposed in Paris and Brussels.¹⁸⁶ Accompanying the exhibition was a brochure of the same title printed in four languages. This project demonstrates in particular that Burtin saw himself as an artist, and at the same time, saw his priorities as cohesive with those of the clients who sponsored the show, embodying a particular 1960s brand of optimism about the

¹⁸⁵ Flora Lysen’s article treats this exhibition in more detail, puts it into the context of the Netherlands and Sandberg’s curatorial program as well as the “mythology” around science during the Cold War, and Burtin’s design practice. “Blinking Brains, Corporate Spectacle, and the Atom Man: Visual Aspects of Science at the Stedelijk Museum (1962),” *Stedelijk Studies*, Issue #2, 2015, n.p.

¹⁸⁶ See Box 17, Folders 6 and 7, and Box 1, Folder 3, for correspondence related to the planning of this exhibition, Will Burtin Papers.

relationship between design and industry. It strings his various projects together into an artistic oeuvre, while at the same time highlighting the roles of the corporations. The focal point was Burtin's brain model, which was already in Europe for the Turin exhibition. The cell, which Upjohn seems to have decided was too expensive to bring over from Chicago, was featured as a life-size photograph.¹⁸⁷ It is clear from this exhibition that Burtin's corporate connections did not prevent him from being seen as an artist, an intellectual, and an educator. To the contrary, through the visual objects, the exhibition intertwines modern design with scientific progress and corporate success.

For the installation at the Stedelijk Museum, a long rectangular space was divided into five sections. The first wall was covered by a mural-sized photograph by Ezra Stoller of the model of a uranium atom that Burtin built for his Union Carbide exhibition, discussed further below. In a time-lapse photograph the orbiting lights appeared as bright lines on a dark background. On the other side of this wall was biological photomicrography, alongside drawn graphic elements inspired by DNA, and a Stoller detail shot of the Upjohn cell. Presented together, these images set up a direct visual relationship between technology and biology. Turning around, the viewer encountered a wall covered by the life-size photograph of the cell. Also displayed was a small scale model of the large cell and a display that showed how the plastic parts of outside of the model fit together. In the next section, on the other side of this wall, was more photomicrography along with a visual portrayal of how it was used to create the three-dimensional plastic endoplasmic reticulum, and in the foreground, a model of an earlier version of the brain. The next section contained a Stoller photograph of the 6-foot cell model, more graphic elements and another detail shot. Then appeared a life-size photograph of the brain in a

¹⁸⁷ Letter from Burtin to Willem Sandberg, February 7, 1962, Box 17, Folder 4, Will Burtin Papers.

section along with the actual brain installation with its audience seats in front, which served as a sort of focal point for the show. Also displayed here was a small mock-up model of the brain, and behind the viewer, some history of brain research. The last section showed Burtin's work for Upjohn's in-house publication, *Scope*.¹⁸⁸

As a whole, on display was a large-scale interactive model, the design process for models, and the photographic circulation of models. Effectively it was an exhibition of Cold War visual pedagogy, focused on the same proposals that were the crux of Berenice Abbott's involvement with the PSSC: visualization methods as metaphors for thought, and expertise in visual technology as crucial to socially beneficial scientific progress. The audience received scientific information, but much more than that, experienced various kinds of new visual technology in combination, and an emphasis on Burtin's model-making as a communicative strategy. In addition, science was conflated with corporate identity and modern design, presented as a coherent unit. In the "Visual Aspects of Science" catalogue, which uses much of the same visual material as the show itself, we can note the use of papers with different textures, transparent overlays, sans serif typography with minimal punctuation, and text and graphics integrated with photographs, all of which spoke to the most modern trends in graphic design. The publication, which was how American designers and scientists might have been more likely to experience the exhibition, includes testimonials from representatives of the sponsoring corporations as well as from Burtin himself and reinforces the emphasis on new technology, simplified visual forms that reinforce the content being conveyed, and audience interaction. As mentioned above, a challenging part of Burtin's work was perhaps making corporate advertising and branding appear to to the public as an artistic practice, but because of the particular

¹⁸⁸ Installation photographs, 1962, Box 40, Folder 6, Will Burtin Papers.

curatorial attitude of Willem Sandberg, Burtin had an opportunity to do this in the setting of a progressive gallery. Visual pedagogy was thus implemented as a joint mission across corporate, artistic, and educational spheres.

The discourse of the visual in art and science in the 1950s and 1960s was partially driven by the idea that society was facing an increase in the amount and importance of visual material produced by imaging technologies, understood as new images otherwise inaccessible to the senses. To thinkers of the time, images produced by technology were an extension of the visual world. However, this was a complicated idea. On the one hand these new images were distinct because they were not part of the human visual world as traditionally defined, but on the other hand, they were imaged by technology specifically to fall into the human sensorium. The “newness” of this visual material allowed it to signal the expansion of human perception, even though it was defined specifically by not being accessible to it. This way of thinking about perception subsumes technology into the human, rendering it unthreatening and part of humanity’s natural evolution. Burtin’s methods of using technologies as models for nature draws power from this underlying trend.

Burtin’s design approach played on the exciting interplay between what is visible and what is not. His models, like many scientific images, had power based on the extension, but also transformation, of vision. In choosing new technologies that appeared to characterize modern life and human progress to visually serve as analogs for non-visual phenomena, his method of communication served to make viewers feel that they could employ technology to unlock a complex world. Burtin’s work suggested significant formal relationships between visual technologies and human bodies. In the case of the cell, electron micrography was the two-dimensional source material for a three-dimensional hypothesis, and Burtin brought the three-

dimensional version into being in an interpretive process that he framed as research as much as representation. The act of looking at the photographs stood in for looking at the actual cell, and the processes of photography and micrography stood in for seeing. Also, he suggested that the “intuitive” idea for depicting the endoplasmic reticulum as a web of transparent, interlocking plastic tubes, a design idea, actually turned out to be somewhat correct in terms of what was later observed in the body, writing: “An exciting aspect of the design development was the interpretation of the cell body and of the structure of its principal component, the cytoplasm, about which little was then known. The intuitive solution arrived at proved to be close to the biological reality established later.”¹⁸⁹ Plastic tubing is thus positioned as somehow being naturally related to cell parts. Burtin also repeatedly described the lighting as a “pulse” for the cell, giving this technology a biological character. In the Upjohn model of the brain, as discussed, photographs stood in for memories, and electronic lights stood in for thought. In this way, technology is securely harnessed into the realm of the human while also seeming to press on the frontier of what humans can access.

When presented as a product of American industry through Upjohn signage and promotional materials, the models also served as an argument for the natural ascendancy of a capitalist economy. In Burtin’s projects, the workings and products of corporate enterprise were linked with human access to scientific knowledge. These relations between designed technology and nature defined the discourse of Cold War visual pedagogy, in which visual media was thought to unlock natural realities, if handled properly. This suggestion of a positive, inevitable, and beneficial exchange between technology and subjectivity had the effect of bolstering the Western business activities that had developed the media in question.

¹⁸⁹ Draft exhibition texts are found in Box 94, Folder 7, “Captions pre- March 1968,” Will Burtin Papers.

A look at some of the other projects that Burtin undertook in the 1960s will further support the above claims. In 1961, Burtin's exhibit for Union Carbide, "The Atom in Action," opened in the lobby of the corporate headquarters in New York City. This project was constituted of several large sculptural elements and multiple sections of display that told a story about man's ideas about the atom from 500 BC to the present, culminating with peaceful uses of atomic energy for the future. This exhibition included murals, moving parts, and a model of a uranium atom that involved 92 tiny electric lights on long thin steel rods representing electrons that orbited a rotating nucleus, which was the subject of the time-lapse photograph featured in *Visual Aspects of Science*. Another large sculpture that had the appearance of a three-dimensional generic atom symbol anchored the other end of the installation. This structure was visible as one rode the escalators up to the mezzanine, and may have reminded viewers of the Atomium of Expo 58 in Brussels, for example. It was made up of strips of large photographic images that arced over a center orb. The whole exhibition was visible from the street through the large windows of the Union Carbide lobby.¹⁹⁰

The overall effect of this exhibition would have been to situate contemporary developments in atomic energy as the natural result of centuries of human progress. It framed atomic energy as peaceful rather than violent by using the formal idioms of modern design: geometric elements, primary colors, modern fonts, and sparse ornamentation, combined with the dynamism of moving parts and of a segmented display that a visitor moved through according to his or her own interest. In addition, the activities of Union Carbide are presented in the exhibition

¹⁹⁰ It should be noted here that there were negative responses to Burtin's exhibition design practice, unsurprisingly perhaps from contemporary artists, which Flora Lysen mentions in her article on *Visual Aspects of Science*. In 1966, Robert Smithson derided the Union Carbide exhibit as idealizing technology and its homogenizing effects, in contrast to the more honest use of new materials in artworks to critically engage with modern society. This response hints at the tension of design work in corporate contexts, and the ramifications of the fact that the same materials and visual forms could slide back and forth between constituting critique and propaganda. See Robert Smithson, "Entropy and the New Monuments," *Artforum*, June 1966.

as pushing forward this history of scientific development. Like other Burtin projects, this exhibition was a collaboration between his team of designers and builders, and Union Carbide scientists and engineers.¹⁹¹

“The Atom in Action” relied heavily on photography as a method of display and communication, and it should be noted that Burtin’s ideas about the ability of visual strategies to have significant power were rooted in Cold War-era discourse about the importance of photography. Graphic designers, educators, and advertising professionals were perhaps especially fixated on what they saw as the ways in which photography had changed human perceptual habits, expanded scientific possibilities, and molded modern society. The power and importance of photography relied on general ideas about its natural relationship with the human faculty of seeing and with the broad and flexible idea of “communication,” which we can see in Burtin’s work. This is especially apparent in his designs for the Eastman Kodak Company. Burtin signed on to help design the Kodak pavilion for the 1964 New York World’s Fair. Along with Saul Bass and Franc Ritter, Burtin set out to create a design that would not only explore the present and future of photography, but more broadly, contain “an estimate of the state and meaning of visual communication methods in 1964.” According to a draft proposal in the Burtin archive for a pavilion, the exhibit was designed to demonstrate the whole range of what photography can do, but more crucially, to inspire the viewer to make photographs herself. The proposal states; “The entire exhibit is designed as a photographic staging area – be it the exterior or interior of a building or a walk from the tower platforms to the “eye” theater.” Fountains and greenery, but also photographs (transparencies) of faraway places “reveal the all-presentness of everything around us at every moment we desire to take it in.” The impression is that through

¹⁹¹ Installation photographs by Ezra Stoller, c. 1961, Box 27, Folder 1, Will Burtin Papers. Notes and exhibit proposal drafts, c. 1958-1961, Box 9, Folder 6, Will Burtin Papers.

photography, each individual has a magic power to be everywhere all at once, and can command space and time. The building is designed to offer impressive views, and to itself become a “natural camera object.” There was also an area filled with props for parents to use in photographing their children.

The photographic tower, with its viewing platforms and exhibits, and an “eye” theater were the focal points of this first version of the design. The “eye” theater, which was not built, was intended to be used again after the Worlds’ Fair. Inside the spherical structure, the plan was to demonstrate “the inner workings of the human eye...how it perceived color, space, texture, etc.” As well, the idea was to have projections from the ceiling that would be thrown onto individual whiteboards held by up to three hundred viewers standing at the bottom. The projections “should certainly include the startling images of things that are beyond the range of the human eye, but which photography makes accessible.” Furthermore, the “eye” was to demonstrate perception, “the actual experience of an outside view of the fairgrounds as the human retina perceived it and how it records it...witness the iris of a human eye in action.” A 360-degree theater design was to be implemented. Based on a letter from a company, Cinetarium, from Germany, the design is made up of a semicircular screen 60 feet in diameter with a projector at the apex and a “mirror ball” that casts a 360-degree projection that is not disturbed by viewers moving around below. One can sense that Burtin wanted to extend the experiments of his large models, offering viewers the chance to step inside the human body, and using technology to suggest the expansion of perception.¹⁹²

The emphasis on encouraging people to use cameras is a clear marketing strategy intended to convince Kodak executives of the effectiveness of the design. Other suggested

¹⁹² Proposal manuscript, c. 1961, Box 5, Folder 15, Will Burtin Papers.

components include an exhibition of amateur photography, a camera and film store, a photographic school for adults and children, or a birdcage full of colorful birds for people to photograph. At some point Burtin and his team went back to the drawing board, presumably in response to requests from Kodak. The next design pursued similar ideas, still formulated around places designed to encourage people to take photographs, and suggesting a broad narrative about the relationship between photography and human progress. It had movie theaters inside, and included Saul Bass' film "The Searching Eye," but took the form of a building with an undulating poured concrete roof surface and a tower of enormous projection screens at one end. Burtin ended up stepping away from the project in late 1962 because he did not feel he had enough control, and was asked to perform the role of "advisor on exhibit design" rather than "designer of exhibits."¹⁹³ He still featured his design in his *Visual Aspects of Science* exhibition, writing that "every aspect of architecture and of all visual devices will be part of one coherent story plan which has a scope as wide as life itself and as intimate as the first opening of a baby's eyes."¹⁹⁴ Burtin both drew on and implemented a discourse of visual pedagogy that purported to unify the most utopic vision of human progress with the development of visual media technology, based on the idea that visual technologies are natural extensions of an enhanced human sensorium that could be understood using communication theory, and was inherently conducive to mental independence.

In 1966, Burtin unveiled his *Chromosome: Genes in Action* exhibit, including what he often referred to as the chromosome "puff," his third major model for Upjohn. The BBC was again interested in using it for a program called "What is Life?" According to Edgar Levy, Burtin's associate, like Burtin's other models, the chromosome puff was based on very new

¹⁹³ Letter to Misha Black, December 11, 1962, Box 1, Folder 3, Will Burtin Papers.

¹⁹⁴ *Visual Aspects of Science*, exhibition catalogue (Dortmund: Fritz Busche, 1962), n.p

science, “theories that are still to be thoroughly explained and accepted but which are nevertheless so logically consistent that we have incorporated them into our demonstrations.”¹⁹⁵ The chromosome puff was presented first to the 1966 AMA meeting in Chicago. The exhibit was around 18 feet high and 30 feet wide, and showed aspects related to DNA in blue, and to RNA in red. It consisted of curved aluminum tubes with plastic parts, suspended from steel plates in a twisted shape that moved up and down around a center piece that held electrical wiring. The moving structure represents how the chromosomal “puff” expands and contracts. Circular transparencies of electron micrographs were embedded into the wood floor. It was possible to walk into the structure, which also included “four light-color models in motion” that showed the four stages of the puffing process.¹⁹⁶

In a draft transcript for a 1966 BBC film on the chromosome, Burtin wrote:

I am reasonably confident about the value of these three-dimensional learning machines – or models – for achieving intensive and quick understanding of a problem in a lay viewer’s mind. But what is even more gratifying and encouraging about this endeavor is that scientists who contributed their knowledge to the various developmental states of the structure feel now that the model by its visual logic and order contributes to the clarification of their own views of their own science problems as well. In some instances they even expressed new and intuitive ideas about organic and chemical relationships to which the model gave rise in their minds. (underlining in original)¹⁹⁷

He goes on to explain that while the models are “generalized,” and thus not strictly science, and not strictly art because many aesthetic aspects are accidental, a crossed out sentence in the draft reads: “Whether and to what degree the impact of these models is one of art or science seems not pertinent to me as I am working out the problem.” He also argues that art is required to seize upon chance aesthetic occurrences. Furthermore, an artistic “sense” is required

¹⁹⁵ Letter from Edgar Levy to Gordon Taylor, Executive Producer of “Horizon” with BBC, February 11, 1966, Box 4, Folder 16. Will Burtin Papers.

¹⁹⁶ Typewritten manuscript, c. 1966, Box 4, Folder 16, Will Burtin Papers.

¹⁹⁷ Ibid.

to synthesize in scientific observation, to “sense abstract concepts of order.” On top of that, effective art making relies on concepts of order that are also part of science. Overall he seems defensive against those who think that beauty in good design undermines scientific value. This text concludes with the refrain of many designers of this time that good visual communication can bridge various fields, and bring to human scale the new vastness of knowledge that characterizes modern times – “the integrated employment of new data.”¹⁹⁸ Burtin continued to clearly draw on the work of Gyorgy Kepes, who positioned the visual as the salve to a fractured human and fractured society, where knowledge has increased to the point that extreme specialization, and thus separation, has occurred. At stake are human, emotional values that need to be “integrated” with technological and scientific ones, and integration of these things visually will lead to their integration in individual minds and in society.¹⁹⁹ This definition of the individual perceiving subject as a nexus for the organization of a multi-faceted world drove Burtin’s methods of visual pedagogy.

Burtin’s last major model for Upjohn was presented at the opening of the 1969 AMA convention in New York. The topic was to be inflammation, and the processes the body uses to fight infection. As in the cell and chromosome models, Burtin took the approach of enlarging microscopic biology to massive proportions. As he had in the brain, he set up the model as a kind of performance, with audience members sitting in front in an amphitheater. While “Inflammation” was Burtin’s working title, the model was officially called “Defense of Life,” and again employed dynamic lighting and an accompanying audio narration. This model also involved a film, which was intended to work along with the three-dimensional model to provide the full picture, and continued Burtin’s strategy of combining different forms of visual media in

¹⁹⁸ Typewritten manuscript, c. 1966, Box 4, Folder 16, Will Burtin Papers.

¹⁹⁹ See for example Kepes’ introduction to *Education of Vision* (New York: Braziller, 1965).

his exhibits. The giant cluster of blood vessels was 37 x 15 x 15 feet and made out of Plexiglas and aluminum, and had ten sections that would light up one at a time to show a part of the process.²⁰⁰ The film played on a circular screen right in the middle of the model. Once again Burtin modeled the body through modern materials and multimedia techniques, pushing forward his vision of modern design. He proposed a way of synthesizing and visualizing the knowledge that was newly available through visual technology, but beyond human sensory experience, thus empowering his viewers in their encounters with the modern world.

Will Burtin's exhibition design was very much a product of the specific environment of corporate design that was unique to the 1960s. The culture of collaboration between artists and businessmen abruptly changed in the early 1970s for a variety of reasons, and Upjohn actually ended their relationship with Burtin in 1971. Burtin died of cancer (due to asbestos exposure) in 1972, and thus would never demonstrate how he would have navigated this shift and pursued his methods of visual pedagogy, which he had established as both effective and politically powerful, beyond the corporate sphere.

3.4 DESIGN, VISUAL TECHNOLOGY, AND LIBERAL DEMOCRACY

Burtin grew successful at the same time that the field of graphic design was growing and flourishing as a cultural force. For mid-century Americans, it seemed that a new level of access to visual material in popular media such as television, film and photography in mass print publications had redefined modern life, and mastery over visual media was clearly connected

²⁰⁰ Box 15, Folders 5-8, Will Burtin Papers. For more see Remington and Fripp, *Design and Science*, 135-141.

with power in the modern world. In addition, the combination of modern design with references to science was especially salient to American viewers during the Cold War. Technology and national identity were intertwined in such a way that to be interested in science was to be a good American. The glue of this relationship was often visual material. Images, exhibitions, and certain visual styles and tools served to allow the public to learn about science and to turn scientific material into the material of modern American design and patriotic feeling. In Burtin's work, the human body was an area in which design enabled American social values, corporate success and innovation, and scientific knowledge to seem inextricably linked.

The strong links between corporate America, the world of modern art and design, and the government at this time can be observed in corporate commissions and sponsorships, business executives on boards of museums, and government collaborations with corporations on international trade fairs. Through corporate celebrations of culture, the American liberal democratic citizen was positioned as the key to universal progress. These endeavors purported to aim for the well-being of all individuals, and when handled under the label of a corporation they cast business, and capitalism, as the bedrock of public good. If scientific knowledge or new technology could be made to appear as a crucial part of the equation, as it was via the field of design, it made for a powerful argument for a political and economic system based on corporate growth. As many historians have noted, in the Cold War, not only were cultural victories, meaning the convincing portrayal of ideological values through art, design, and exhibitions, crucial to preventing the escalation of conflict, they were more powerful than military action.²⁰¹

²⁰¹ See for example Masey and Morgan, as well as David Caute, *The Dancer Defects: The Struggle for Cultural Supremacy during the Cold War* (Oxford: Oxford University Press, 2003), Andrew James Wulf, *U.S. International Exhibitions During the Cold War: Winning Hearts and Minds through Cultural Diplomacy* (Lanham: Roman and Littlefield, 2015) and Robert Haddow, *Pavilions of Plenty: Exhibiting American Culture Abroad in the 1950s* (Washington DC: Smithsonian Institution Press, 1997).

Less discussed has been the specifics of how these visual tools operated, in particular how experts in visual media produced visual tools that contributed to a new definition of subjectivity in relation to visual technology.

Burtin's exhibits allowed the excitement of science and modernity to resolve any moral qualms about consumer culture, the exploitation of resources and people, and the persuasive power of advertising. If visual media were used in certain ways, corporations speaking to the public about science could count not as advertising but as education essential to the formation of democratic agents who could make decisions. More and more, these agents tended to be cast as consumers, who demonstrated their knowledge and their freedom by choosing among an array of products and by consuming visual media.

Burtin's models visually conflated modern science, modern design, and modern technology in such a way that suggested that viewers have the agency to discover science themselves, individually, and are thus empowered. The sponsorship by a corporation and the information they provide thus appears as natural and on the side of humanitarian progress. In the context of the Cold War, the intersection of modern design with corporate technology and science in cases like Burtin's cell worked to affirm American national identity and assuage anxiety about the threat of communism to freedom of expression, and the destructive potential of technology and scientific knowledge. The association of these exhibitions with companies created an analogy between empowerment through knowledge and the role of the consumer. Consumer power could appear to be the solution to the threat of government control. For example, while Soviet exhibitions in World's Fairs during this period centered around agriculture or industrial technology, American exhibitions focused on brands; cars, fashion, and celebrities, presenting a combination of the fruits of business enterprise and the aesthetic markers

of modernity, which happened to appear mostly in consumer products such as packaging, housewares, and clothing. In putting American design on display, the exhibit put consumer products on display. According to an article in *Industrial Design* on the 1958 Brussels World's Fair, written by designer and founding editor of the magazine, Jane Thompson (then Jane Fiske McCullough), it was design, rather than accomplishments or technologies, that was the major difference between the U.S.S.R. pavilion and those of other countries. Furthermore, the Soviet "indifference to design" was indicative of their disregard for the independent human being. In the U.S. and "the free world," the consumer had to be persuaded, not just directed, necessitating creative and original design that is based in human sensibilities, in contrast to the Soviets who rely on displays resulting in a viewer who is "impressed – but not necessarily convinced."²⁰²

I began this study with an analysis of how Abbott's approach to photography, and its place in the educational project of the PSSC, was significant because it tied photography together with the ideal of democratic access to scientific knowledge, and American citizenship in the twentieth century. I moved from Abbott to Burtin to show how this way of thinking about visual technology functioned in a more explicitly corporate context, and the ensuing effects. The idea that "the visual" was a universalizing, humanizing, progressive force allowed visual objects to tie capital together with the progress of science and freedom. For those interested in corporate design, emotionally and psychologically powerful visual material was merely the appropriate response to the needs of the human in the modern world, and thus only secondarily of benefit to corporations and governments seeking power. This is doubly supported by the rise of design approaches that create a viewer that is ostensibly active – physically moving, choosing what to look at, part of the display, accessing general visual material that can be recombined or

²⁰² Jane Fiske McCullough, "More Impressions of Expo '58" *Industrial Design*, Vol. 5, No. 8, August 1958, 55. In this issue, this article is directly followed by one on Burtin's cell.

interpreted in flexible ways, or material that is produced through a surrogate technology that appears to extend the human senses. This suggests that the technology being developed by corporations bears a natural relationship to human bodies and human functions such as seeing, thinking, or remembering. In the case of Will Burtin's large exhibits for Upjohn, these engagements targeted at the human viewer allowed a situation that strategically advertised a corporation's knowledge and power to appear to only demonstrate human power and generalized progress, creating a smooth analogy between the corporation and humanity at large. In the broader context of Cold War consumer culture, democratic subjecthood is constituted through a particular kind of science display that requires the viewer to be active in seeing connections between new technologies, the general progress of science, and a free market system.

Burtin's approach to pedagogy thus displayed a link between free-market capitalism and the progress of both science and culture, integrated together. For a corporation in Cold War America, the merging of art with science was also the merging of the humanitarian with large-scale power and control. Burtin's cell and his other models involved a specific approach to design, to communication, and to "the visual" that reflected a broader interest in his field. They also allowed corporations to promote themselves as on the cutting edge of science and technology, as using technology for moral purposes and the betterment of humanity, and as interested in the progressive idea that design should be integrated with these fields. When Burtin's exhibits traveled abroad, they participated in a Cold War effort to proclaim the superiority and progressiveness of the West. This was done partially by arguing that the U.S. was at the forefront of new scientific knowledge and on the moral high ground in a global context, but even more so by presenting new ways of communicating that knowledge, through immersive, multimedia exhibition strategies involving new materials and technologies. Burtin's

exhibits instantiate a broader visual method and a specific relation between design and science used at the time to reinforce the values of American democracy, in which a capitalist system is the manifestation of society of free-thinking individuals who make independent choices and indicate their ability to do so by buying products. It must be noted that Burtin did not see his work as an extension of corporate power or government propaganda in any negative way. He strongly believed in the benefits of providing people with interesting scientific information in the visual forms of modern design. The ability of corporations and the government to support his efforts while also working entirely for their own purposes, either in the form of business success or global power, is an indication of the layered complexity of the agency of visual media in sustaining these social and political forces.

Burtin's exhibits promoted new kinds of visual communication in order to advocate for the integration of visual, humanistic values with scientific and technological progress. Burtin was part of an international community that promoted an approach to the new field of graphic design that fit easily with the championing of market competition, consumer choice, and freedom of information. The ideas that interested Burtin and his colleagues were based in the conviction that visual design produced individuality, and brought technology into line with humanity in a world that had become much faster and more compressed. The effect of using these new techniques for modern design in science and technology, consumer products, and public education was that corporate success and American dominance could be displayed as cohesive with human well-being. They could be framed as an outcome of democracy, freedom of thought and commercial encouragement of creativity. Conversely, good design could be seen as pushing forward Western scientific progress. Ultimately, investigating Burtin's work helps to illuminate how connections between art and science, and the interest in "the visual" as a generalized communicative tool

helps to push forward a liberal democratic and capitalist project, both domestically and on a global stage.

The next chapter provides a final necessary piece to understanding the interaction between education, photography, and corporate enterprise that was so important to defining democratic citizenship and individual subjectivity in Cold War America: the Kodak-backed educational discourse of “visual literacy.” If Abbott’s practice was an instance of photography being yoked together with modern science education, and Burtin’s of this education with corporate enterprise, Kodak’s educational programs and the discourse of visual literacy fills out this picture by showing more fully how because of this secure relationship between visual technology and American freedom, corporations could go directly into the educational sphere. Moreover, corporate interventions in education, in the form of visual technology, could further solidify the idea that democratic citizenship, defined as freedom of thought and educated choice-making, is enacted through the use of visual media. Throughout the early twentieth century, corporations had become essential to technology, and technology had become essential to education. By the late 1960s, a space based on a growing belief in the idea of “visual literacy” was thus open for corporations to justifiably go directly into schools in support of the formation of a democratic citizenry.

4.0 JACK DEBES, KODAK, AND CAMERAS IN CLASSROOMS

By the 1960s, because of many factors including the influence of communication theory and cybernetics, the new role of television in daily life, and the tensions of the Cold War, visual pedagogical practices had taken on a new character. Experts in visual media found ways to make images pedagogically useful based on the potential for an individual to have control over how they used visual technology to unlock non-visual knowledge. These visual practices grew out of a postwar discourse, apparent in the previous two chapters, in which relationships between the sciences and the humanities were newly urgent, as was communication through modern media, allowing artists and designers to take on powerful roles in education and business. It also operated in ways that cohered with a mid-century vision of an American citizen, who was both individualistic and democratic, and who indicated their status through their skillful consumption of new visual media. The way this formulation of visual pedagogy traversed disparate spheres is of key importance. We have seen how Cold War approaches to visual pedagogy intersected with the concerns of industry, the government, and academia. In the late 1960s, discussions about the relationship between visual media, communication, and liberal democracy were mainstream, and this led to the formation of new discourses in the sphere of education. The Eastman Kodak Company began to promote the notion of “visual literacy,” which strengthened already developing links between the corporate and educational spheres.

Across education, design, and industry, we thus find photography and its relation to human perception taking a specific place in defining modern American citizenship based on its ability to secure the agency of human thinking. By the late 1960s, at the places where these realms intersected, a need had effectively been created for every American citizen to use photography more and more, if they were to succeed in democracy. This was not solely due to the work of corporations, but also to the intersecting voices of artists, philosophers, and intellectuals who were interested in reckoning with the ramifications of new technology and how it would change humanity. However, the industries of visual technology were certainly poised to benefit from this situation and helped to drive it forward. This chapter will focus on how Kodak worked to encourage the use of cameras in education, and supported the discourse of “visual literacy,” which transformed the broader impulses going back to the postwar era that drove work like Abbott’s and Burtin’s into a much more specific theory of visual communication that continues to be influential today.

I focus here on the birth of the visual literacy movement in Rochester, New York. Visual literacy has not been extensively studied as a historical phenomenon, although it has been an important sub-area of visual pedagogy since the 1960s. It emerged out of the same Cold War concerns about articulating democratic subjectivity in certain relationships between visual media and viewer that have been of concern in the previous chapters. I will parse out here how visual literacy educators drew on linguistics and communication theory to frame photographic images as having their own code of meaning, at the same time as they were rooted in a more natural mode of human thinking. This paradox functioned because it formulated a subject that could actively and democratically use visual technology as a productive tool for interpreting an expanded world.

Because of the involvement of institutions – corporations like Upjohn and Kodak, government agencies such as the NEA and USIA, and academic institutions like MIT – we can see that one of the reasons why this form of visual pedagogy had such traction was that it helped to define American citizenship during the Cold War era in a way that did not conflict with needs of corporate or political power. Kodak and other technology companies responded to the child-centered, individualized approaches to education that were gaining popularity during this period, merging the student with the customer. They did this by focusing on the way in which their products encouraged the individual use of visual tools, which as we have seen, were strongly associated by this point with independence and mental freedom. It had become productive to align thinking with picturing, to situate photography as central to many aspects of human life, and to think of visual technology as a democratizing force.

Kodak's efforts to get teachers and students using photography in school centered around Jack Debes, who is often cited as the father of the field of visual literacy.²⁰³ Debes had spent many years working on education for Kodak and had become more and more interested in describing how photography could be harnessed to support these changes and help children grow into modern democratic citizens. He began to promote the idea of “visual literacy” as a set of skills that children should be taught in schools. He argued that humans are actually naturally more inclined towards visual literacy than verbal literacy, and that because of television and photography, children now enter school already having more visual literacy than previous generations. He assembled a network of teachers and administrators around him who agreed that if education does not shape itself around the priority of instilling visual literacy in students, it will fail to produce adults who can cope with the modern world.

²⁰³ For example, in David M. Moore and Francis M. Dwyer, eds., *Visual Literacy: A Spectrum of Visual Learning* (New Jersey: Educational Technology Publications, 1994), 194.

Debes and Kodak ended up distributing materials for classroom use and curriculum design that were, in effect, lessons in looking at and creating photographs. This chapter addresses the fact that education initiatives at Kodak were effective sales tools, in the concrete sense of making products essential to education, but also in the abstract sense of making everyone into a photographer, and promoting the idea that photography was essential to everyday life and to human functioning. These efforts on the part of Kodak allowed corporate values to become intertwined with human ones, which had ramifications for the definition of modern American citizenship that continue to play out in our present time. This was possible because of the particular conditions of mid-century America and the Cold War, in which to follow the lead of corporations in the development of visual technology was both democratic and patriotic, meaning there was a clear space for corporate enterprise in education.

By the 1950s, as indicated by the focus of publications such as the *Audio-Visual Communication Review*, communication theory had become a profound influence on the field of educational technology, which was also absorbing ideas from both behavioral psychology and cognitive science. In his 1968 history of educational technology, Paul Saettler (a student of James Finn, president of the Department of Audio-Visual Instruction of the NEA and co-founder of the *Audio-Visual Communication Review*) argued that this interest in communications systems is what differentiated the field at mid-century from earlier approaches to visual instruction using films, museum display, and stereoscopy. In other words, specialists in educational media became focused on the whole exchange of messages between teacher and learner rather than just the nature of the medium in use. According to Saettler, the earlier field of visual education did not have as much of an influence on education in general as did the mid-century work in audiovisual

instruction, which successfully unified the use of different kinds of media under the more compelling discourse of communication.²⁰⁴

In this specific mid-century context, I will show how it was possible for visual literacy to establish a role for Kodak in education that helped to protect corporate visual media from seeming to have too much power. Visual literacy had a definite progressive inclination and strongly incorporated a counter-cultural impulse towards the critique of mass media. However, it maintained a 1960s optimism about technological and scientific progress, and an interest in discourses of cybernetics, communication theory, and the utopic possibilities of integration across artistic and scientific fields. The main critical strategy of visual literacy was for people to use more visual media, meaning that it was quite coherent with the promotion of the mass market products of the photographic industry. Visual media – as a broader category – was imbued with a definition of liberation formulated in a corporate-friendly context, providing the groundwork for corporate power in decades to come. These mid-century principles of visual pedagogy continue to inform the way in which institutions across education and the commercial sector affirm their participation in social progress by using visual technologies. Kodak had a hand in this field and made it work towards their needs, which is instructive for corporate efforts in communication and education more broadly. Moreover, visual literacy bears important relations to work such as Abbott's and Burtin's, other kinds of visual pedagogical practices during the Cold War which would not normally be brought under the umbrella of the history of education, or of educational technology, but which drew on the same sources and context. When treated in connection with

²⁰⁴ Paul Saettler, *The Evolution of American Educational Technology* (Englewood: Libraries Unlimited, 1990), 167-169. See also James D. Finn, *Extending Education Through Technology* (Washington, D. C.: Association for Educational Communications & Technology, 1972). Debes stated in 1971 to an AECT (previously DAVI) conference that he was greatly influenced by Finn, who consulted with Kodak and other companies in educational technology, and had been working for years towards the professionalization of this field. Box 2, Folder 2, John L. Debes III Collection, MSS-105. Arizona State University Library: Visual Literacy Collection (hereafter John L. Debes III Collection).

each other, we gain access to a more detailed history of the justifications of visual pedagogy in this context and the nature of the subject who receives visual instruction.

The history of the visual literacy discourse that solidified around Debes and Kodak in the late 1960s has not been extensively addressed by scholars, with the exception of a recent article by Josh Ellenbogen and Adam Jolles. They highlight visual literacy as crucial to understanding a particular milieu of photographers, curators, and critics in Rochester, New York, in the sense that an interest in photographic sequencing, which was essential to the promotion of visual literacy curricula, also underlies important photographic and curatorial practices of the time. As I will reference below, they analyze the visual literacy materials and point out the shifts that occurred from the late 1960s into the 1970s in the nuances of the discourse's formulation. I build on their observation that from the 1960s to the 1970s, there was a modification in how visual literacy was thought to change a viewer's interaction with visual media, from increasing the efficiency of visual communication, to preventing it from being too efficient and overpowering.²⁰⁵ However, I diverge from their work by connecting visual literacy and Kodak's interest in it to the historical context of educational technology during the Cold War, focusing on how this discourse and the images it engendered met the requirements of a liberal democracy, helping to define a Cold War American citizen as an individual and an active producer of visual meaning.

²⁰⁵ Josh Ellenbogen and Adams Jolles, "Visual Literacy and 1960s Photography." (forthcoming)

4.1 THE INTERNATIONAL VISUAL LITERACY ASSOCIATION

John L. Debes III was born in 1914 in Brooklyn. After studying at Syracuse University and working as a writer in a military aircraft plant during the war, he was hired as a writer by Kodak in 1946. There he helped to write books on photography for amateurs and worked on youth outreach, educational programs, and films.²⁰⁶ It was through his long career at Kodak that he became interested in intersections between education, communication, and photography, and from there formulated his theories about visual literacy.

His ideas were not without precedent. In postwar America, photography was often described as a new language, largely as a way to describe its newly widespread power in society. This formulation served a clear purpose in the sense that when it was necessary to describe how prevalent, essential, accessible, and complex photography had become, the idea of a language seemed to do the trick. The idea of a visual language was used to suggest that visual material could be broken down into components and that images had content that was both powerful and flexible. However, it was not until the 1960s that we see the emergence of a conversation that pushes “visual literacy” beyond a notion of a general facility with images to a much more specific extreme, and to the point when visual literacy becomes a synonym for educational technology, or more precisely, using cameras in classrooms. Debes took a nebulous idea, the same set of general instincts about the importance of “the visual” in modern times that runs through the work of Abbott and Burtin, and using certain theoretical writings to justify his ideas, molded it into a concrete set of principles about pictures and language. This resonated with the educators and media specialists who collaborated with him, even though they came to the events

²⁰⁶ John L. Debes III “autobiographical sketch,” c. 1974, Box 1, Folder 3, John L. Debes III Collection.

with their own preconceived notions of visual literacy. The idea that images constituted a specific shift in broader cultural norms was somewhat intuitive to people at this time and seemed to address what had changed in society for the new generation. Moreover, Kodak was not the only technology company to move into the field of curriculum development. The Polaroid Education Project, for example, did not employ the exact terminology of Debes' visual literacy, but grew out of the same context in the 1960s and 1970s, and produced photographic materials for classrooms that were based on the same notions of visual communication skills, except with a focus on the use of Polaroid's instant photography.²⁰⁷

As Ellenbogen and Jolles argue, Debes owed some of the roots of his thinking to photographer and curator Nathan Lyons of George Eastman House and the circle of educators, curators, and critics that formed the Society for Photographic Education, and Debes attended their conference in 1962 in which the term "visual literacy" was used. Adrian Terlouw, a colleague of Debes at Kodak, presented here, and Debes credits him with convincing him of the idea that "a picture is a statement" during the time that they worked together.²⁰⁸ In addition, Henry Holmes Smith and Minor White were proposing ideas about visual grammar and communication in their teaching and writing in the 1950s, and these are important sources for Debes even though the parameters and stakes of visual literacy changed as the IVLA circle developed. Smith and White were primarily motivated by the interpretation of artistic photography and did not actually apply parts of speech or linguistic theories to images.

²⁰⁷ See for example Joan Goldsmith and Beth Farb, *Picture This! Cameras and You, a Self-Developing Curriculum*, (Cambridge: Polaroid Corporation, 1984). Polaroid also published a binder of material for teachers called the *Polaroid Education Project*. The Polaroid program suggested similar activities to the ones designed by Kodak, except using the SX-70, and emphasized similar benefits having to do with visual learning, the development of self-concept, the modernization and democratization of education, and the natural-ness of visual communication. Like Kodak, they organized workshops for teachers, and gave away some of the necessary photographic materials.

²⁰⁸ Ellenbogen and Jolles, "Visual Literacy and 1960s Photography."

In the 1960s, Debes searched for thinkers in various fields who could help elaborate on his interest in the relationship between photography and language, and ended up finding them in Ruesch and Kees, discussed above. He also drew on linguist Charles Carpenter Fries and philosopher Colin Murray Turbayne. Debes was in charge of the creation of visual literacy materials at Kodak, proactively convincing them of the value of the visual literacy program by emphasizing the creation of customers and a market for tomorrow, and selling photographic materials.²⁰⁹ At the same time, it may not have been a very hard sell, as Kodak had been investing in educational programs for years, and Debes was already producing a publication called *Photography in the School* that formed the basis for some of the visual literacy structures and procedures. Debes built on these initiatives to make visual literacy into a specific educational theory that could reach beyond the company. The resulting discourse was driven by his own feelings about what education needed, but appealed to Kodak's business model.

By the early 1970s, Debes was thoroughly committed to establishing his ideas about images and thinking in relation to contemporary psychology and linguistics, even going back to school for a bachelor's degree in general studies and a master's degree in education. Debes organized a conference in 1969, which became an annual affair and eventually formed the basis of the International Visual Literacy Association. Debes, along with colleague Clarence Williams, also launched the Center for Visual Literacy at the University of Rochester in 1971 and served as its director (while at the same time being continuously employed by Kodak). There were many other kinds of centers and departments around the country with whom Debes corresponded and established common ground. While audio-visual educational technology and departments in the

²⁰⁹ "Visual Literacy," c. 1969, Box 1, Folder 4, John L. Debes III Collection. Ellenbogen and Jolles argue that a major payoff of Debes' aggressive application of grammatical units to pictures was to justify incorporating photographic curricula in English class, increasing their reach.

U.S. go back to the 1920s (as soon as film and photography became practical for wide use), boomed in the postwar years, and again during the Cold War, still in the 1960s it was felt that education had not escaped the traditional restrictions of verbal tools, and Debes' ideas were of interest to many.

While visual literacy theory depended entirely on mid-century developments in visual media, the participants in the visual literacy conferences saw themselves as synthesizing a long history of humans as visual beings, and their work as the culmination of progressive march toward a modern relationship with the visual that was essential to education. Participants included media specialists, psychologists, communication theorists, and audio-visual technologists. There was a strong emphasis on interdisciplinarity and on finding ways to bring together what people were already doing in separate spheres. In his welcoming talk at the 1971 IVLA conference (the third), Debes used passionate words, calling his group an "elite core" that must take on the challenge of leading a national movement, with the stakes being no less than the well-being of the world's children. He cited grim statistics about rates of school dropout and illiteracy in America and suggested that new insights and knowledge about the role of the visual in learning are the key to rectifying the situation.²¹⁰

In this talk, Debes touted an increase in college degree programs in film (up to 68 in the U.S.) and the growth in visual literacy programs in schools (up to 300,000 students). He also noted that in 1971 the State Education Department of the State of New York held its own visual literacy conference.²¹¹ Also, in 1971, the Association for Educational Communications and Technology (AECT), previously the Division of Audio Visual Instruction of the National

²¹⁰ Debes, "The Challenge is Visual Literacy," Paper delivered at the National Conference on Visual Literacy, 1971, 3. Box 1, Folder 3, John L. Debes III Collection.

²¹¹ John Debes, "The Challenge is Visual Literacy," Paper delivered at the National Conference on Visual Literacy, 1971, 19. Box 1, Folder 3, John L. Debes III Collection.

Education Association but by this point, an independent organization, took over the official marketing of visual literacy materials.²¹² Kodak continued to provide support for research studies, curriculum development, and distribution of educational materials, and Debes worked on this in his capacity at Kodak until his retirement. Visual literacy persisted as an educational approach and as a basis on which teachers and administrators could correspond and work together. Debes was director of the Center for Visual Literacy until 1974. In 1975, Clarence Williams moved to Gallaudet College (a college for the deaf in Washington D.C.), and the center followed him there. Debes retired from Kodak in 1977, but until his death in 1986 was an active member of AECT and the IVLA, both of which still operate today.

4.2 TRAINING CHILDREN FOR A “MORE VISUAL WORLD”

By the late 1960s, Debes had established a series of materials that teachers could buy for use in classrooms, which were described in brochures and a periodical that teachers could subscribe to for free, *Visuals are a Language*.²¹³ Kodak also distributed cameras and projectors. Teachers did not necessarily have to buy these but could borrow them from the company, and Kodak still made money through the sale of film and processing. In fact, the payoff for Kodak was thought

²¹² Over the course of the 1960s, as the field of educational technology grew and became more complex, the DAVI diverged in its interests from the broader NEA, leading to its reformulation as the AECT. See http://aect.site-ym.com/page/aect_in_the_20th_cen. Debes had been working with them already for a few years, and it is likely that the adoption of the visual literacy materials by AECT constituted the proliferation of visual literacy beyond Kodak that Debes hoped for from the beginning. It was advantageous both for his interests and for those of the company if it was a priority for a “major educational organization,” not just for the business. John Debes, “The Challenge is Visual Literacy,” Paper delivered at the National Conference on Visual Literacy, 1971, 19. Box 1, Folder 3, John L. Debes III Collection.

²¹³ As advertised in “Materials for Teaching Visual Literacy,” Kodak Publication No. T-7, c. 1969, Box 14, Folder 23, International Visual Literacy Association Records, MSS-181. Arizona State University Library: Visual Literacy Collection (hereafter International Visual Literacy Association Records).

to come as much from the positive public relations that the company would receive for taking an interest in education, and from the creation of future markets, as it would from immediate sales.²¹⁴ At the same time, Kodak provided suggestions for how schools could raise money to buy visual literacy materials, such as the organization of a school film festival in which children share their work and parents pay to watch.²¹⁵ Kodak clearly saw visual literacy as a worthwhile avenue, going so far as to fund research into using photography with children, such as a study in 1969 at Eastern Illinois University in the Department of Speech Pathology and Audiology, in which the length and complexity of children's speech about photographs they had taken was measured after having been given "training in picture sequencing."²¹⁶

In the brochure "Materials for Teaching Visual Literacy," the text introduces the program of educational activities: "What is Visual Literacy? Right now, there's no single definition that we believe everyone should agree upon, but certainly any definition should include photography." It claims that students "need to learn to "read" visuals with skill, and to express themselves visually with comparable skill," and offers their materials which will help "equip young people to make the best of this ever more visual world."²¹⁷ Here are two important bedrock arguments of visual literacy: First, unsurprisingly, as it was a Kodak project, it has something obvious and fundamental to do with photography. Second, the world is more visual than it was before, and this trend is continuing. Versions of this notion appear consistently in the discourse amongst visual literacy enthusiasts. In psychophysicologist Thomas Mulholland's

²¹⁴ John Debes, "Visual Literacy," c. 1971, Box 1, Folder 4, John L. Debes III Collection. This document appears to be notes for a presentation to Kodak about the benefits of the visual literacy program to the company.

²¹⁵ John Debes, "Elephants of Visual Literacy" (supplement to *Visuals are a Language*), 11. Box 3, Folder 3, John L. Debes III Collection.

²¹⁶ John Debes, "A Study of the Effects of Training in Visual Literacy on Verbal Language Behaviour," Twila E. Strandberg and Jerry Griffith. Box 3, Folder 3, John L. Debes III Collection.

²¹⁷ "Materials for Teaching Visual Literacy," c. 1969, Box 14, Folder 23, International Visual Literacy Association Records.

presentation at the first conference in 1969, he argued for the importance of understanding attention scientifically, as this will be crucial to people successfully navigating a world newly saturated with images, opening his talk by stating that “America 1969 is a visually oriented culture.”²¹⁸ In 1973, in the Visual Literacy Newsletter, IVLA member Richard Ingalls gives photographic media, the “visual printing press,” credit for shifting society away from the linear thinking that was inaugurated by the invention of the moveable type printing press in the 15th century:

Less than one century after the inception of the visual printing press, the majority of the world’s people were accepting the visual media as the dominant mode of communication. People became changed because of this new communication revolution. Visual communication is not necessarily linear. There can be an explosion of information which is grasped as a total. One no longer had to gear his thought processes in a linear fashion. A free give-and-take of thought was again required after its five-hundred year absence.²¹⁹

This idea also constituted one of the “assumptions” of the group who came together at DAVI’s twenty-second Lake Okoboji Educational Media Leadership Conference in 1976, which Debes attended, and which focused on visual literacy. They wrote: “Assumption 77: We are living in an increasingly visual world.”²²⁰ The IVLA circle promoted the idea that photography and visual literacy were essential to an “age when people are visually oriented.”²²¹

These educators were far from the first to take this idea for granted and could state it as an urgent issue without much justification, as it appeared often in everything from advertising

²¹⁸ Thomas Mulholland, “Automatic Control of Visual Displays by the Attention of the Human Viewer,” in Clarence M. Williams and John L. Debes, eds., *Proceedings of the First National Conference on Visual Literacy*, New York: Pitman Publishing Corporation, 1970, 70. He describes various ways in which the idea that we can tell by reading people’s brain waves whether or not they are paying attention could be used to create visual material that, through computers, responds to the viewer. Mulholland later became known for arguing that advertisers take advantage of how watching television puts the brain in a semi-conscious state.

²¹⁹ John Debes, Visual Literacy Newsletter, February 1973, Vol 2. No. 1, Box 3, Folder 3, John L. Debes III Collection.

²²⁰ “The Identification and Analysis of Selected Assumptions Underlying the Concept of Visual Literacy,” marked with “Okoboji,” c. 1976, 22. Box 1, Folder 3, John L. Debes III Collection.

²²¹ “large manuscript” without title, 5, Box 12, Folder 14, International Visual Literacy Association Records.

and journalism to science and philosophy throughout the postwar and Cold War period. In her 1951 essay, “Photography at the Crossroads,” Abbott began by saying that “The world today has been conditioned, overwhelmingly, to visualize. The picture has almost replaced the word as a means of communication.” For her this led into her argument that photography has a special role to play because of how it deals with the “realistic” and the “present.”²²² Ernst Gombrich, in his essay “The Visual Image: Its Place in Communication,” published in *Scientific American* in 1972 (a special issue on communication) opened with the proclamation: “Ours is a visual age. We are bombarded with pictures from morning until night.”²²³ These speakers and others who made this claim were directly referring to the ever-increasing presence of visual media in the daily lives of Americans, and it may seem unremarkable that many at the time had noticed how photography and television had affected changes in society. Upon further reflection, however, the notion of a world that is “increasingly visual” in fact is quite mysterious. It might be more accurate to say that before these changes, individuals consumed the same amount of “visuals” each day, but they just were constituted by different things. It is very difficult to hold the argument that people use visual objects more or in more profound ways in the twentieth-century world, and yet it remains the case that individuals during this period unreservedly made this claim as a way to justify their projects.

These thinkers were clearly framing their arguments in terms of the changes brought on by specific new media technologies, even though they often used these technologies to stand in for the visual more broadly. They found it useful to take for granted a new kind of regular

²²² Originally published in the *Universal Photo Almanac*, 1951, republished in Liz Heron and Val Williams, eds., *Illuminations: Women Writing on Photography from the 1850s to the Present*, Durham: Duke University Press, 1996, 203.

²²³ E.H. Gombrich, *The Image and the Eye: Further Studies in the Psychology of Pictorial Representation* (Cornell University Press: Ithaca, New York, 1982), 137 – 161.

“bombardment” by print media and television that showed them things they had never seen before in a way that had emotional and political power. Moreover, the relevance of this idea for visual literacy was that education had not responded to this continuing change, but rather emphasized “print and oral skills,” which were understood as traditional, linear, and alienating to the human mind.²²⁴ In describing a world that contains more of certain kinds of visual media as a world that is “more visual,” visual literacy enthusiasts elided the distinctions between different kinds of things we experience visually, and naturalized the media in question as part of undifferentiated human visual experience. As we will see, this was important to justifying visual literacy as necessary to education.

Visual literacy was conceived of as encompassing not just a mental faculty but its usage through the production of media. Debes suggested that in theorizing about visual literacy we actually think about three terms: visual literacy, visual communication, and visual technology. He writes: “Visual literacy is an attribute of a person exposed to many opportunities for visual communications. Visual communications are the things he is exposed to. Visual technology is what all of this rests upon.”²²⁵ For Debes, technology determines how communication works, which then in turn determines the definition of literacy. This proposal requires further scrutiny because it conflates a human mental faculty, thought to be more natural and accessible to us than the verbal, with technologies that are entirely historically specific and contingent. In Debes’ formulation, in which a perceptual faculty develops in response to external stimulus (which also supposedly developed because of our nature) and in which this is thought to lead to the more

²²⁴ “The Identification and Analysis of Selected Assumptions Underlying the Concept of Visual Literacy,” marked with “Okoboji,” c. 1976, 22. Box 1, Folder 3, John L. Debes III Collection.

²²⁵ Group 2 report from 22nd Okoboji Conference, 98, Box 1, Folder 3, John L. Debes III Collection.

successful functioning of that person, technology has a contradictory role, both contributing to our development and resulting from it.

In relation to this convoluted set of premises, Debes argued for a specific and straightforward alignment of pictures with language. There is a particular photograph that Debes finds productive, which shows a dog and a turtle. In a conference presentation, in the filmstrip “How Does a Picture Mean,” and on the cover of a 1968 issue of *Visuals are a Language*, he argues that the picture is the statement “The playful dog challenged the angry turtle.” He even goes so far as to suggest that this picture is a particularly good example of visual communication because the dog is on the left and thus shows subject, predicate, object, left to right, which is the way we are used to them appearing in English sentences.²²⁶ That Debes places so much weight on such a selective reading is puzzling and indicates the radical degree to which he and others were convinced of the usefulness of grammatical metaphors. It is clear from the usage of this example in “How Does a Picture Mean” that viewers should understand that there is more than one right answer, but that it is nevertheless very useful to try to identify a workable verbal correspondent to the image. The basis of Debes’ proposals is that these grammatical “parallels” have significant power for improving how we use pictures. More specifically, he suggests that pictures can be “read” in appropriate and inappropriate ways.

With Kodak’s backing, Debes designed a curriculum for teachers to use that involved teaching students how cameras work and how to use images to tell stories or create “visual communications.”²²⁷ He set clear objectives having to do with preparing students for future careers and familiarizing them with visual technologies. The publication *Visuals are a Language*

²²⁶ John Debes address to National Convention of the Department of Audio-Visual Instruction, NEA, 1968, 2. Box 1, Folder 4, John L. Debes III Collection.

²²⁷ John Debes, “Notes for a Course in Visual Communications,” 1966, Box 1, Folder 4, John L. Debes III Collection.

suggests an example curriculum using the Kodak materials.²²⁸ The class begins by attempting to communicate with one another using only their bodies, then by using only objects. They then begin engaging with a tool called a Photo Story Discovery Set. These sets consist of 26 to 38 3.5” square cards with photographs on them that “represent common experiences in the lives of most American children.” The photographs show people in action or making facial expressions, objects, or scenes that combine both. According to the instructions, each set contained three to five sets of pictures that told stories, and students were to try to discover these stories as well as use them to tell stories of their own. They were not to be asked necessarily to explain their story in words. While the instructions indicated that the students were not to be told there are any right or wrong sequences, they suggested that some are “more reasonable or more logical than others,” and “if the idea of the child’s sequence isn’t obvious” to the teacher, the teacher “may want to have the child interviewed by an appropriate professional.”

Debes described the sets in a term paper he wrote for the class Advanced Educational Psychology while pursuing a bachelor’s degree at the University of Rochester:

The child working with these sets is, in effect, using a visual vocabulary. Each picture calls upon the synaptic traces of previously perceived stimulus configurations. Each picture in the set is what Gibson (1954) called a “surrogate for reality.” It is an abstraction of reality in somewhat the same way that a word is an abstraction of reality.²²⁹

²²⁸ Eastman Kodak Company, *Elements of Visual Literacy: Selected Articles from Kodak's Periodical, Visuals are a Language* (Rochester: Eastman Kodak Company, 1969), 15.

²²⁹ John Debes, “A Tool for Providing Visual Communication Learning Opportunities” Term Paper, School of Education, University of Rochester, 1968, 8. Box 1, Folder 5, John L. Debes III Collection. He is referring to psychologist J. J. Gibson, whom I will discuss further below. In 1954, as part of work on a theory of pictures, Gibson proposed the term “surrogate” for any “stimulus” that an individual produces and then another individual perceives as part of communication. This could be a sound or gesture, a word (spoken or written), an object or a picture. J.J. Gibson, A. A. Lumsdaine, and S. M. Roshal. "A Theory of Pictorial Perception." *Audio Visual Communication Review* 2, no. 1 (1954): 3-23.

Later in the text he states: “Arranging pictures permits a child, without recriminatory or frightening real consequences, to arrange and re-arrange reality until he is satisfied.”²³⁰ Debes suggests that visual literacy gives children a language with which to communicate that is more natural to them and does not initially rely on verbal skills. This will give them confidence and a sense that they know the world and can convey their ideas to others. In this paper it is more clear that the teacher is not supposed to correct a child’s sequence or necessarily judge them according to their own sense of logic, at least at first. At the same time, the sets are meant to be used as diagnostic tools, in the sense that teachers are encouraged to notice aspects of the child’s communication that could be problematic and look for whether the child can order the images in the expected ways. Debes acknowledges that the images only reflect a very small selection of things children would experience in their lives. However, he makes no mention of the choice of image sequences, or the photographic techniques, positioning the sets of photographs as natural manifestations of childhood thoughts and childhood experiences. The ideal of independent thinking, more under the viewer’s control, leading to a democratic society, which was perceived by visual literacy enthusiasts as inherent to photography, in practice turns out to involve the careful reinforcement of specific narratives about visual communication and social progress pursued through the increased use of mass-produced technology. These visual materials which encourage individuals to mediate their subjectivity through photographic technology tie Kodak’s program with the other practices discussed here under the framework of Cold War visual pedagogy.

The first photo set, introduced early in the suggested lesson plan, includes images of grade school children (notably, as this was 1968, a white child and a black child playing

²³⁰ Debes, “A Tool for Providing Visual Communication Learning Opportunities,” 14.

together) on a beach, playing baseball, boarding and riding a bus, and interacting with a police officer, as well as images of surf, clothing, and two images of a window (one with a baseball in the air in front of it, one with a baseball-sized hole in the glass).²³¹ As suggested by the instructions, a few possible stories emerge somewhat intuitively from these cards (two boys playing baseball break a window and have to talk to a police officer, two boys meet on the bus, two boys chase girl who stomped on their sandcastle) but one can also imagine variation and improvisation, and the images are in some ways frustrating in that they hint at a narrative but do not deliver one. The idea of the children filling in gaps themselves was likely very satisfying for the educators and made it possible for these to appear to elicit imaginative visual communication. Overall there is a clear idealistic attempt to situate the images in relation to the child's life. Children's activities are centered, and adults appear as supporting agents in the narrative. The cards are also heavy on facial expressions, hand gestures, and objects with obvious visual traces of an event or action, as these were the elements of a theory of visual communication that Debes was attempting to promote.

In the proposed curriculum, the introduction of Photo Story Discovery Set No. 1 is followed by "elementary camera instruction." Around 1969, Kodak suggested the Instamatic 134 for the children's use. This basic camera measured about 4 x 2 x 2.5 inches, and benefited from the recent introduction of the Kodapak, a film cartridge that could be loaded and unloaded with no risk of exposing the film. The Instamatic 134 had a 1/50 second shutter speed and an electric exposure. A 1968 ad in *Seventeen Magazine* pitched it as "the lowest price Instamatic camera

²³¹ In the context of the late 1960s, the portrayal of black children and white children playing together would have been understood as progressive and was in keeping with the political ideals of Debes and his colleagues. They argued that visual literacy could be part of making education responsive to a modern, more equitable society, which meant serving children of all racial and ethnic backgrounds, children who were learning English as a second language, or children with disabilities. While they often ended up reinforcing stereotypes about marginalized groups, we can observe in the visual literacy materials this specific interest in diversity. This will be discussed further later in this chapter.

with an electric eye that measures the light for you and sets the lens for you.”²³² It had a lever to manually advance the film and a socket for a flash cube. They were sold for \$25.50 (the equivalent of around \$180 today) and came with color film, batteries, wrist strap, and flash cube. The prints were 3.5” square, just like the cards in the photo sets. They were theoretically easy for children to hold and use, once they were shown how to click the shutter, advance the film, and could wink in order to use the viewfinder. In Debes’ 1971 conference address, he described how he wishes photographic materials would be improved in the service of visual literacy, which gives an indication of the role of the technology that he envisioned. One emphasis is on the simplicity of the photo-taking process. The Instamatic cameras involved a fixed focus, and fixed aperture and timing, so a fixed depth-of-field. The children have to shoot from about four feet away from their subjects, and their photographic process becomes one of attention and selection. For visual literacy educators, this would have fit with the analogy that they understood between photography and perception, which was being defined as the active shaping of one’s environment through looking and visualizing. Coming back again to the tension inherent in the use of visual media, a highly restricted image-making process is framed as the ultimate in individual power. In addition, for Kodak, the continuous simplification of cameras meant that photography could become more and more of an everyday activity conducted by as many people as possible, and that the company could mass produce the necessary technology. Debes hopes that things can be even further simplified, and that the exposure could be shortened so that the flash would not be needed. His other priorities are quick development, and easy reproduction and sharing. However, a Polaroid-style process (which would have been his competition) does not suit him because the child has to stop between each photograph. He also hopes for a system

²³² *Seventeen* Vol. 27, No. 12 (Dec 1968): 33.

where a child can easily add text to his images and then reproduce the whole thing for sharing with teachers or at home.²³³ These goals seem to foreshadow the ways in which digital images are produced and circulated today.

In the lesson plan from *Visuals are a Language*, the introduction of the cameras is followed by the presentation of the filmstrip “How Does a Picture Mean?” The voiceover on the accompanying audio introduces the relevant grammatical terms: subject element, predicate element, and object element. The dog and turtle example appears here, and the narrator explains that once you decide what the visual sentence is, you can identify the individual elements. There is some flexibility clearly introduced, but it ends up seeming somewhat disingenuous as the filmstrip continues. For example, a picture of the dog by itself is accompanied by the explanation that it “of course” does not have a predicate or an object. The filmstrip is interactive, and the class is meant to be responding constantly to the narrator’s questions. In addition, many of the slides are actually images of photographs that are similar in format to prints from the cameras and the cards in the Photo-Story Discovery Sets, meaning the students will have their hands on similar objects to those they see in the filmstrip, including some of their own making.

In this filmstrip we start to understand some important components of what constitutes a useful or good image in the discourse of visual literacy. The image of a dog running is said to have a predicate while the image of the dog sitting does not. However, an image of the dog scratching has both a predicate and object (“The dog scratched himself.”) Visible actions are thus highlighted as “predicate elements” while an image that follows close-up or portrait conventions more closely will be designated a subject without the other elements. Predicates thus mean primarily actions, not just verbs. They are not often non-physical things. The filmstrip identified

²³³ John Debes, “The Challenge is Visual Literacy,” Paper delivered at the National Conference on Visual Literacy, 1971, 20-21. Box 1, Folder 3, John L. Debes III Collection.

an image of a boy and a dog sitting together as having a “compound subject,” suggesting that the linguistic parameters are really secondary to the application of cultural tropes or conventions from other imagery. In this sense, formal qualities are made to a significant amount of work. We might assume that just as “a dog teased a turtle” emerges from the fact that the dog is on the left of the image, “boy and dog” seems appropriate as a compound subject because their forms merge together. There is also the suggestion that to take a picture of an unfamiliar thing, something outside of the viewers “visual vocabulary,” constitutes bad image-making. Clarity is the goal, achieved through established techniques and terminology from photography and film, such as point of view and cropping. While the overall pedagogical exercise is framed as one of visual communication, we can see that it is really one of camera use.

Between the above dramatic oversimplifications of what is communicated by an image, “How Does a Picture Mean” also prompts some undeniably effective image analysis, even if formulated in confusing terms. The narrator asks: “what are the visual clues that tell us what this picture says...what does this picture say and how did he [the “writer”] do it?” Without the literal references to grammar, we can take “say” more metaphorically, and the lesson would not be out of place in an introductory class in art history or communication. In a section on point of view, the narration asks a productive question: “how has the photographer changed the meaning of the picture by shifting the point of view?” The narrator points out how changes like this can create or remove “drama.” It is sections like this that make it clear why teachers responded so enthusiastically to the visual literacy materials, as this ability to understand how photographs produce their effects would have appeared incredibly useful.

Visuals are a Language then suggest that the teacher introduce another film strip, “Making Sense Visually,” after the students have experimented with taking their own

photographs. This filmstrip can be related to Ruesch and Kees' 1956 book *Nonverbal Communication*, as it explains ideas of body language, object language, and symbol language that seem drawn directly from their text. It then includes a section that seems to draw on broad notions from communication theories that were beginning to permeate many discussions of thought and perception, involving the ideas of encoding, "message carriers," presentation, reception, and feedback. This film strip moves beyond photography to visual objects more broadly, while at the same time reigning these other visual perceptions into the conventions of photography. The last section of this filmstrip is a story in which the students are not expected to analyze the photographs themselves, but to try to decide what visual languages (body, object, symbol) are relevant in the world that is depicted. The move from analyzing visual operations in the photographs themselves, to analyzing what is shown in the photographs using the same tools, reinforces an alignment between photographic representation and seeing. The "message" of a photograph could be the stop sign, or the photograph of the stop sign, the boy's hand signal, or the photograph of a boy waving his hand, and the students are not expected to differentiate between these. In addition, the story is meant to teach students how to tell their own stories using cameras, but the narrative is about how to communicate in visual ways in the physical world. Two boys get locked in a building and attempt to communicate that they are imprisoned by showing things they have found in the room to the adults outside. In an awkward allegory of information and feedback, they finally have success by showing them a picture of a key and a birdcage. The classroom experience is also meant to manifest this; the script for the teacher introducing the story sequence reads "I want you to feed back the message to me. I'm going to call on different members of the class..." One gets the sense that Debes took pleasure in these layered reinforcements of the subject at hand – teaching communication using the techniques

that were the subject of the lesson. More striking however is the elision between the analysis that one should perform on a photograph and that which one should perform when looking at things in the world. This reinforces for the students that photographs can be thought of in the same way they think about visual experience, naturalizing all aspects of photographic technique as simply the reproduction of observation or communication, which is striking in relation to the ways the materials also teach the specifics of photographic technique. The positioning of photography as an extension of human perception is embedded with the same tension mentioned above, as children obtain a tool that proposes to help them naturally communicate their thoughts while teaching them to define their thoughts through the framework of this tool. Ultimately, visual literacy offers freedom of expression within very specific boundaries.

The curriculum description then suggests moving from “Making Sense Visually” back to the Photo-Story Discovery Sets Nos. 2, 3, and 4. The whole series of lessons are meant to be stretched over time, and the filmstrips are divided into sections so they can be dealt with a little bit at a time if the teacher prefers. Photo-Story Discovery Set No. 2 features images of a boy blowing up a balloon, boys fishing and seeing a bicycle sunk in the water, the boy on a bicycle, the boy looking at photographs of himself on the bicycle, a TV set showing the boy on the bicycle, the boy falling asleep and a light switch. Set No. 3 includes a woman, boy, girl, and dog, a calendar page saying “Mother’s Day” and images that suggest the making of breakfast. Set No. 4 suggests events such as a girl buying a snow cone, buying groceries at the behest of her mother, playing hopscotch, talking to some boys, and having her hair ribbon pulled out. A notable card in this set shows the girl’s face blurred, as if in motion, which exemplifies my stance that these sets draw on and intentionally reinforce the child’s understanding of photographic technology. This blur, produced by a photograph with an exposure too slow for the

girl's face to register clearly, is not visible in the world, only in the photograph, and it is only after learning that this is how photography works would a person understand that this should be understood as a girl shaking her head "no." Visual signals linked to photographic technology are given a special role. When using the photo sets at this stage, the students are also supposed to improve the photo sequences they make with the sets by adding photographs they have made themselves. It is then suggested that the class work together to plan and shoot a "visual sequence."

Further materials teachers could order included "Rhetoric of the Movie," a set of six movies on super 8 film that teachers could use for teaching the basics of movie-making. Here a film is broken down using the metaphor of language, just as photographs are in other visual literacy materials. The films are titled "A Simple Movie Utterance," "A Simple Movie Sentence," "Complicated Movie Sentences," "Varying the Point of View," "Making Movie Sense," and "A Movie Paragraph." Verbal constructions are given counterparts in film format, and the curriculum presents them as building blocks. An utterance (which could be simple or complicated) corresponds to a shot. A sentence could be one shot (a simple sentence) but as we advance further, a few shots in sequence (a complicated sentence) are preferable according to the program. Movie shots are assigned subject, predicate, and object elements, in the same way that photography was in the two previously discussed film strips. A complicated movie sentence shows sentence "elements" one at a time each with a shot of their own, which is identified as clearer and more interesting. As with photography, the students are coached in understanding what utterances and sentence elements they should glean from each image, and that there are better and worse "readings," and better or worse choices on the part of the movie-maker. The narration draws an analogy between a close-up and a specific event. A long shot indicates many

events at the same time, without much detail. The demonstration of a complicated movie sentence is a series of shots showing a girl's face, and then something happening in the game, indicating that the girl is watching various events occur on the field. Again there is an elision of the act of looking in person with the act of representing the looked-at-thing. The camera is thus aligned with the viewer's looking activity, and the film with visual experiences in the world, reinforcing the idea that the photograph increases the viewer's power over their surroundings and providing the foundation for the belief that photography, in general, is conducive to individual agency.

The next unit develops this idea further. "We can be selective with a movie camera just as we can with our eyes," argues the narration, "...but a photographer, like an author, can shift his point of view many times in the course of describing an event. The camera can put you where the action is!" The next unit focuses on sequencing images so that they "flow logically" and have no "contradictory statements" such as a baseball players cap suddenly switching sides from one shot to the next, his uniform appearing suddenly dirty, or the point of view switching in a confusing way. The final section presents a "movie paragraph" using all the covered strategies for the class to analyze. As I suggested with photography, this lesson in the basics of filmmaking positions the camera as the basis of all communication. We must attend to the implications of a curriculum that presents this genre of photographs and films as communication in the broadest sense. These implications include the notion that the camera expands an individual's actual faculties of vision, and that good image-making is a component of growth and maturity. Photography is being used to very specifically reinforce these values through the use of visual media.

“The Simple Camera” was another set of filmstrips that could be used to teach photography to grades 3 through 12. It is related to the 4-H photograph programs that were designed by Debes in his earlier years at Kodak. Teachers could order several other print publications from Kodak about various aspects of filmmaking in the context of a visual literacy program, as well as copies of single articles from *Visuals are a Language*. Once AECT began distributing visual literacy materials in the early 1970s, they also produced at least one film, “Hey Look at Me” in which children in rural West Virginia use cameras to “gain a better understanding and appreciation of their surroundings.” An additional photo set called the Visual Categories Discovery Set was much like the Photo-Story Discovery Sets, except that instead of images that invite sequencing, it consists of images that the children were meant to sort into categories, improving their “conceptual abilities.” The categories are a mixture of formal qualities (squareness or roundness, colors), objects (plants, animals) and other things like friendliness, or movement. Debes here drew on Gestalt psychology, as filtered through psychologists of perception such as Rudolf Arnheim and J.J. Gibson, who described visual perception as a cognitive process of organization and categorization. Visual literacy relied a great deal on theories of perception that proposed that human visual faculties operated according to specific logical principles, and involved the active synthesis of chaotic surroundings.²³⁴ The Visual Categories Discovery Set, even more strongly than the Photo-Story Discovery Sets, positioned photography as a means by which perception could be structured.

²³⁴ I refer here to the school of Gestalt psychology that originated in the early twentieth century in Austria and Germany, and is often rooted in the work of Max Wertheimer, Wolfgang Köhler and Kurt Koffka, among others. It involves understanding perception as emerging from relationships between stimuli, not as reducible to physical stimuli, and a product of mental synthesis. Koffka’s famous phrase was that the whole is “other than its parts.” An example associated with this is “persistence of vision” (objects shown in rapid succession appear to move). Gestalt theories have gone through many shifts and critiques in subsequent decades, and continue as part of the field of perceptual psychology.

As noted in these film strips, sets of photographs, and curriculum design, visual literacy discourse was entirely built upon on teaching students how to use the specific still and movie cameras of the day. However, the curriculum positions these technologies as a culmination of human progress in the direction of individual mental freedom, individual control over a technologically-expanded experience of the world, and individual possession of the means by which to produce visual media that would help them self-actualize. It also positioned companies like Kodak as essential to this progress. In 1968, in a talk to the NEA, Debes argued that while “the verbally literate...appreciate well-known poems, prose, essays, plays, and novels” the visually literate appreciate “the photo essay, visual poem, documentary film, and film drama.” This list, which is clearly meant to be somewhat thorough (not just documentary film but drama also) actually represents an extremely limited selection out of the whole category of what might be called the visual products of human culture.²³⁵ Debes then moves on to suggest that while we may be surprised by the fact that visual literacy discourse has only come about now, this is due to the fact that it could not exist without the development of “certain” technologies. He makes it sound like the technologies caught up to some natural order of things, that the importance of visual literacy could be discovered (rather than designed) once we had produced the proper tools. As Debes describes the beginnings of his own interest in visual literacy, he states that we “needed TV” and “the whole technology of photography had to be created and begin to mature,” citing George Eastman’s early twentieth century interest in making the camera “as convenient as the pencil,” i.e. putting one in every single person’s hands.²³⁶ Debes thus positions visual literacy

²³⁵ National Convention of the Audio-Visual Department of the NEA, 1968, Box 1, Folder 4, John L. Debes III Collection.

²³⁶ Eastman used the metaphor of a pencil to suggest convenience and cheapness, not to compare photography to writing. However, the slippage between these associations worked well for Debes and others who sought to describe

both as a preceding, generative force behind photography and as a specific reaction to photography, a contradiction that united photography and human evolution into a package deal. Through these specific relations of photography to perception, photography served as a method of visualization that made modern technology essential to human well-being and independence.

In Debes' narrative, in which modern visual media have arisen in answer to a previously unsatisfied human need for specifically visual communication, photography, film, and television are assigned an enormous amount of power in relation to imaging and picturing in general. In an article in "Educators Guide to Media and Methods" in 1968 titled "A New Look at Seeing," Debes claims in the set-apart summary text that "purely visual communication is a lost art – or an art that was never found. Stimulated by movies and TV, today's kids display an aptitude for non-verbal communication that teachers should exploit."²³⁷ Debes seems to say here that pictures only started to be used for communication with the advent of twentieth-century technology. Debes was likely not this naïve, which makes it significant that he felt comfortable giving photography this position, and indicates the degree to which educators of the time saw a shift in their situation. While critics certainly made their skepticism known about these new theories about media, as well as about Debes's position as a Kodak man, in a broader sense, it was not controversial to argue that something about precisely how pictures were used for communication had radically changed because of changes in their technological nature.

At the heart of visual literacy discourse is another significant paradox. Educators drew on two conflicting principles. First, that pictures are related to meaning in the same way that language is, through conventions and structures, not through inherent universal content. This

the history of visuals. Debes quotes this from Samuel Crowther's interview with George Eastman, *System* 38 (Oct 1920): 607.

²³⁷ "A New Look at Seeing," *Educators Guide to Media and Methods*, (May 1968): 26-28. Box 1, Folder 4, John L. Debes III Collection.

idea resonated with educators because it meant that visuals could be broken down and brought within the realm of shared understanding and that visuals would not be conflated and confused with that which they represent. Second, however, is the idea that visual communication is more advantageous than verbal communication precisely because it operates outside of conventions, on a more basic, natural level. This notion was used to argue that the visual was more modern and democratic than the verbal, and would liberate communication and society from the archaic traditions that weigh down the verbal. I have pointed out in several examples above how photography ended up being conflated with visual experiences in the world, and the use of photography with the use of one's perceptual and cognitive faculties. According to a teacher at Green Chimneys, a special education school in New York where visual literacy methods were implemented in the 1960s, "By these pictures the children were making a direct communication. They were making visual statements. 'This is a horse.' 'This is a duck,' etc."²³⁸ It is notable that such a specific image-making process, one that would be alien to people without experience with it, could be described as "direct," but these educators seemed to feel they were cutting out the middleman for these children, that the students could share their observations of the world without having to master conventions of communication. Visual literacy enthusiasts framed the visual through the structure of language, which established images as legitimate communicative devices and specifically called upon the idea of conventional relationships between sign and signified in order to argue that it is a mistake to conflate an image with reality. At the same time, they argued that visual language was not a set of conventions (as language is), but rather a natural faculty.

²³⁸ Patrick J. Culhane, "A Visual Approach to Learning," First National Visual Literacy Association Conference," 1969, 4, Box 2, Folder 4, International Visual Literacy Association Records.

The visual literacy materials also create scenarios in which individuals ostensibly choose freely how to visually engage, but within a highly constrained set of options. I have pointed out above in the instructions for the Photo-Story Discovery Sets and in the film strips how students and teachers were presented with photographic tools with the suggestion that these tools will allow students to make natural, direct, communications driven by their own thoughts and individual agency, or to skillfully access the direct communications of others. At the same time, in each of these cases, the student's use of photographic technology was carefully structured around certain techniques for both making and viewing photography and film. The children were expected to tell their own stories with the photo sets, but through the format of the Instamatic and the images that were offered to them, in a way that makes sense to the teacher. The film strips instructed the students in very specific verbal correspondents to images that were in truth somewhat arbitrary, and also instructed the students in established conventions of movie making.

Contradictions such as this are crucial to understanding the foundations of visual literacy in the Cold War period, and the role that visual media played in defining American citizenship in a liberal democracy. Cold War politics called upon the educational system to help affirm the link between American values and the progress of humanity, and to show that a liberal democracy was more conducive to freedom than communism was by focusing on the values of individual thinking and creativity. During this period, educators suggested that the use of visual media was a way for individuals to indicate this freedom and individual subjectivity. This package was often delivered in a commercial context, or in a context driven by the overall priority of corporate success. The Kodak visual literacy materials manage to foreground individual agency while also teaching children to see in predetermined ways that required photography, and persuading teachers that corporations cared about education.

This method of visual pedagogy has common ground with the practices of Abbott and Burtin, and the longer history of the use of visual media to encourage individuals to feel they are consuming their surroundings, especially new science and technology, according to their own desires, while also making sure they “choose” within the boundaries of what was coherent with broader political needs. As referenced above, Fred Turner has argued that the postwar interest in the display of arrays of photographs requiring the viewer to move around and observe things in sequence, or “the democratic surround,” “represented the rise of a managerial mode of control: a mode in which people might be free to choose their experiences, but only from a menu written by experts.”²³⁹ He points out how well this works for a consumer culture, in which the illusion of choice between largely similar brands allows individual subjects to feel empowered and individualized while they behave in streamlined ways that are conducive to corporate growth. He also argues that this visual mode of active engagement within a curated scenario actually laid the groundwork for what we think of as the experimentation and radical rebelliousness that defined 1960s visual practices, and points out how a visual mode of choosing amongst an overstimulating array can pivot easily between being associated with democratic equity or openness, and capitalist consumer culture.

Kodak’s approach to visual pedagogy built on the active participation associated with the viewing of photographs in modern exhibition design and went a step further by encouraging viewers to make their own photographs. Furthermore, the program promoted this as emancipation in a late 1960s context. Visual literacy was pitched as being particularly beneficial for marginalized communities, and educators promoted a mid-century ideal of “democratic” avenues for engagement leading to individual agency and participation in civil discourse, but did

²³⁹ Fred Turner, *The Democratic Surround: Multimedia and American Liberalism from World War II to the Psychedelic Sixties* (University of Chicago Press: Chicago and London, 2013), 6.

so through a highly directed set of activities that required certain technological tools. In the case of visual literacy, sets of photographs were positioned as offering children the opportunity to shape their world, while actually suggesting to them a rather limited visual sphere. Specifically, visual literacy teaches children to think about the world as photographable. The children are offered photography as a tool to express themselves, but given a specific set of images to work with. They are then asked to make their own images, but given a somewhat inflexible camera with which to do it, and taught rules about what constitutes a good photograph. More importantly, visual literacy teaches that their ability to communicate their thoughts and function according to their own wishes in the world depends on their use of a camera and film.

4.3 PHOTOGRAPHIC THINKING AND FREEDOM

Visual literacy as a way of promoting photography relied on contemporary theories in psychology and communication about the integration of perception and cognition. In training the children in understanding photography as fundamentally related to their visual experience in the world, visual literacy was investing in something both more general and more specific – that perception and cognition could be thought of as a unified mental faculty. This way of thinking is both rooted in the already mentioned notions about visual media and human physiology coevolving, and crucial for understanding why the concepts of literacy and language were called into service here.

By the early 1970s, Debes had formulated his own theory about the perceptual-cognitive process called the “Analog-Metaphor Model of Cognition,” which borrows from thinkers like Gibson and Arnheim. This theory further demonstrates the thinking-as-picturing argument that

supported visual literacy teachings. In a talk given at the visual literacy conference in 1974, Debes explained that for his analog-metaphor model of cognition, analog and metaphor are both defined as having likenesses to the things to which they refer. However, an analog is something inside the mind that refers to something external, and a metaphor is expressly for the purposes of communicating about the external thing, using the analog, to another mind.²⁴⁰ Debes believed visual analogs were by far the most important, and were the basis for most of our thought and functioning. He included here a statistic that “90 percent of our information about the world” we receive through the eyes. Many at the time who were interested in visual communication made statements along these lines, although the number varied widely.²⁴¹ Visual literacy thus operated based on links between visual objects in the mind, and visual objects in the world, connected via a picturing process. This serves to make photography especially suitable as a kind of tool for thought.

Orit Halpern has argued that in the pedagogical projects of Gyorgy Kepes, as well as in those of Charles and Ray Eames, cybernetics and communication theory allowed for perception and cognition to become merged, and “the subject was envisioned as a smooth space for the transfer of information between the inner and the outer worlds, between the registers of analysis and stimulus.” Similarly, for Debes, this definition of perception as an intellectual faculty allowed him to justify his interest in the potential of photography to offer a connection between a human mind and the visible world, but specifically one that would empower the individual in

²⁴⁰ John Debes, “Analog-Metaphor Model of Cognition” 4th National Conference on Visual Literacy, 1972, 11-17. Box 1, Folder 3, John L. Debes III Collection.

²⁴¹ John Debes, “Analog-Metaphor Model of Cognition” 4th National Conference on Visual Literacy, 1972, 12. Box 1, Folder 3, John L. Debes III Collection. In the brochure for Burtin’s 1962 exhibition *Visual Aspects of Science*, Bruce MacKenzie of IBM wrote that “According to psychologists, 75 to 80% of all we know is acquired through sight or observation.” Thomas Mulholland also references this idea in the 1969 conference, although in his talk he says that “it had been calculated...that 38 percent of the nerve signals reaching the brain came from the eyes. Surely that percentage could be increased today.” (emphasis in original)

relation to technological mediation.²⁴² Throughout his writings and speeches, Debes positions photography as both an element of thought and an element of the world, making it a powerful tool for an individual mind in making sense and taking control of its surroundings. In the 1968 article, “Communications with Visuals,” Debes seems to argue that photographs can serve as physical manifestations of visual signs that can be used to catalog visual phenomena. Photographs are a way to “carry” and employ a visual “vocabulary.”²⁴³ He thus positions photographs as the individual units of visual communication. Furthermore, he collapses the photographic image with the visual thing that is represented by the photograph. By thinking of visual phenomena as a photographic image, and also thinking of a photographic image as analogous with mental constructs, a human is profoundly empowered, and photography is elevated in status and value. Moreover, in visual literacy curricula, photography is understood as inherently “selection, discrimination, and framing.”²⁴⁴ The point-and-shoot technology in use was in fact designed to make sure that the process involved only these things, and was understood by visual literacy promoters as leading to direct forms of visual communication.

The focus on these elements of picture-making make sense when thought of in relation to the way in which perception and cognition were defined in the work of thinkers that mattered to Debes, as a process of organizing a chaotic environment. As thrilling as technological progress was, mid-century Americans were anxious about overstimulating surroundings, and increasing interaction between humans and machines. Many thinkers in academic and artistic spheres felt that an over-mediated environment was alienating individuals, divorcing technology from human

²⁴² Orit Halpern, “Perceptual Machines: Communication, Archiving, and Vision in Post-War American Design,” *Journal of Visual Culture*, Vol 11 (3), 2012, 347.

²⁴³ John Debes, “Communications with Visuals,” *ECT: A Review of General Semantics*, Vol. 25 No. 1, (March 1968): 30. Box 1, Folder 3, John L. Debes III Collection.

²⁴⁴ “large manuscript” with no title page, Box 12, Folder 14, International Visual Literacy Association Records.

values, and allowing the machines too much power. In the 1969 visual literacy conference, sounding much like Abbott, Burtin, or Kepes, arts educator D. Alexander Severino argued that these negative effects of scientific and technological progress needed to be addressed by attending to the “esthetic needs of man” which would involve a balance of the sciences and the humanities, individuality, and personalization in education.²⁴⁵ In the 1972 Cincinnati conference, Dr. Robert E. Hedges, Professor in Elementary Education at Illinois State University, presented on his approach to “Self-Directed Photography” as a therapeutic activity. His practice of this is based on the notion, from Debes, that taking pictures contributes to asserting the agency of the individual, improving his “self-concept.” The resulting photographs serve as “surrogates of reality” that can then be discussed without the student feeling threatened, and the student is the “agent in deciding upon the nature of the change to be made in his phenomenal field.” In Hedges thinking, by taking photographs, a person is actually shaping their perceptual experience and gaining power over it.²⁴⁶

The integration of perception with cognition, which was of broad interest during this period, helped Debes create a specific role for photography in healthy human thinking. In addition, some of this rhetoric about the creation of visual surrogates in the mind clarifies Debes’ interest in a “code” for visuals that was set apart from the visual things themselves and could thus be instrumentalized by individual people. However, we can go further to understand how and why language specifically was employed in order to describe and define this code. The work of Abbott and Burtin has already helped us establish the relationship between visual technology

²⁴⁵ D. Alexander Severino, “Environmental Forces – Some Aesthetic Components,” 1969, 2. Box 2, Folder 4, International Visual Literacy Association Records.

²⁴⁶ Dr. Robert E. Hedges, “Photography and Self-Concept,” manuscript with note “4th conf. Cinci.”, 2-3. Box 2, Folder 6, International Visual Literacy Association Records.

and liberated thinking by relying on the idea of active engagement through bodily motion, the viewer's understanding of photography, or the act of choosing what to look at, which were all also part of visual literacy principles. However, it is specifically in the Kodak curriculum that the characteristics of language are applied to further suggest that technologically-produced images are inherently liberating. By examining visual literacy's debt to structural linguistics, we can see that the appeal of these ideas were not just based on theories on perception, but also on the use of semiotics to discuss the possibility of the liberation of individuals from their means of communication. This then shows how it was possible for visual literacy to sanction the power of photographic technology while simultaneously promoting individual resistance to the influence of media.

According to Debes, he happened upon Colin Murray Turbayne's work when searching for other people who could help solidify his instincts about images, and then it turned out that Turbayne was also based in Rochester. Turbayne presented at the first IVLA conference in 1969, and the two worked closely together. Debes wrote that Turbayne provided the "philosophical foundation" for visual literacy.²⁴⁷ A crux issue of Debes' visual literacy is the possibility of disrupting the notion that we can use the idea of "reality" to describe what we see, and that we must account for individual, subjective understandings of external stimuli. Turbayne's *Myth of Metaphor* provided substance to this for Debes, as he wrote that visual perception occurs via visual signs, which are linked with the real world in the same way in which words are linked with that which they signify. Turbayne's concern is actually the idea of a metaphor for the world and how we experience it, and the suitability of language rather than machine as this metaphor. He uses vision as his test example, arguing that the fact that vision can be understood as a

²⁴⁷ John Debes, Visual Literacy Newsletter, October 1971, Vol. 1, No. 1. Box 3, Folder 3, John L. Debes III Collection.

process more akin to language than something mechanical serves as proof of his broader theory. As in other cases, Debes draws somewhat idiosyncratically from Turbayne's work, but Turbayne seems to have been enthusiastic about visual literacy. Debes combines here two layers of Turbayne's book, that ideas are to world as sign is to signified (i.e. replacing a mechanistic model of our understanding of the world with the linguistic one) and the notion that we should not mistake a functional metaphor for truth (the argument which underlies Turbayne's effort at trying out the linguistic model in the first place). Nevertheless, the basic premise of questioning how perceptions relate to reality made sense to many in the context of the new amount of visual media that were present in daily life by the 1960s. In Debes' words: "Because of modern technology, many of today's children grow up surrounded by photo-visual surrogates, or representations, for reality. This has changed the child in drastic ways."²⁴⁸

Turbayne's writing could also cohere with the interest of visual literacy enthusiasts in securing individual agency in the modern world. He wrote that in using the linguistic metaphor for vision:

We shall be able to dispense with occult qualities and hidden forces and bring everything into the light of day, as it were. Minds will be those things that listen to the signs of a language so that they can do something about the things they signify. And minds, signs, and the things signified will have all the privacy and all the publicity that words and meanings have – privacy because no one interprets a noise or a color in quite the same way as I do, and publicity because the visual square and the visual kangaroo are given roughly the same meanings in Australia as they are in America.²⁴⁹

Debes used Turbayne's work to position visual literacy as applicable universally across diversity, creating a level playing field by centering individuality. Visual literacy was supposedly going to do this based on holding signs apart from the things they signify and providing tools

²⁴⁸ John Debes, "Some Semantics of Visual Communication," address to the International Conference on General Semantics, 1968, 1. Box 1, Folder 5, John L. Debes III Collection.

²⁴⁹ Colin Murray Turbayne, *The Myth of Metaphor*, (Yale University Press: New Haven and London, 1962), 216.

with which anyone could theoretically become “literate” in visual codes. My concern here is not whether Debes or Turbayne’s theories hold water, but rather to point out what the payoff was for them – individual agency in a diverse, technology-filled world. To frame visuals as a code, rather than emanating directly from reality, is to make them susceptible to the control of anyone who knows this code. However, while Debes and others were interested in Turbayne’s idea that relations between images and the world are arbitrary, not natural, they are also interested in the idea that people have natural abilities in dealing with images, as I have referenced above, and that photographs have natural relations with the visual world. This contradiction has a purpose because it allows the argument that if individuals can learn the codes that shape images produced using media, that power will also extend to their engagements with humans, objects, and spaces. It allowed Debes and his followers to argue that visual literacy would not only help people interpret images, it will help them interpret their surroundings more generally, and help them to be counted as citizens of a modern liberal democracy. While contradictions abound within Debes’ theorization of pictorial meaning, we can see here the payoffs that made them popular and persistent. Visual literacy proposes to make all individuals into active participants in a technology-driven march towards an equitable future.

Debes also drew on structural linguistics, and often cited Charles Carpenter Fries’ 1952 book *The Structure of English*. Debes was attracted to the theory that there are no natural parts of grammar, just utterances that we assign through convention to sentence elements. Fries is known for having endeavored to describe the English language not through traditional grammatical terms designating parts of speech, or as he wrote, through meaning, but through formal “devices” that signal “structural meaning.” These devices might be word order or an ending, for

example.²⁵⁰ What appealed to Debes was simply the idea that formal characteristics can dictate communications, not just content. Moreover, we can assume that he would agree with Fries in the concluding words of his book:

I believe fundamentally in *education* as distinct from *training*. Training seems to measure usefulness or value in terms of output or product, with the individual person as the means. His skills are developed so that he can do things. Education, in contrast with training, seems to stress the individual himself as the end, and measures usefulness and value in terms of contribution to the freedom and development of individual personality. From this point of view, I should insist that the chief value of a systematic analysis and description of the signals of structural meaning in English is the insight it can give concerning the way our language works, and, through English, into the nature and functioning of human languages.²⁵¹

Thus for Fries and Debes, understanding that formal structures shape meaning in communication was crucial to the difference between a passive person functioning by rote, and a person in more control of his world. While Fries was not working on images in any way, Debes used this idea in combination with the work of Turbayne and argued that this way of thinking about verbal language should also be applied to images. What seemed urgently relevant to Debes and in need of theorization was the idea that we approach images through a code. Since this had become of interest to linguists and semanticists, their work was full of useful analytical tools that could back visual literacy with scholarship. Furthermore, he made the same connection as Fries and Turbayne did between the values of democracy and the emphasis on structure over meaning. The theoretical investments of visual literacy show not only how photography was positioned as essential here, but exactly how this happened via ideas about decipherable visual codes and subjective mental picturing. Moreover, the theorists in question demonstrate that they actually shared Debes' interest in individualized education and the sanctity of democratic agency. At the

²⁵⁰ Charles Carpenter Fries, *The Structure of English*, (Harcourt, Brace and World, Inc: New York, 1952)

²⁵¹ Charles Carpenter Fries, *The Structure of English*, 296. Emphasis in original.

same time, the centrality of photographic technology made it easy for Kodak to support the implementation of these ideas in classrooms, taking on a role of providing a democratizing tool based on values coherent with corporate growth. In addition, Debes could do work that was entirely focused on educational goals while also benefitting his company in a win-win situation, as long as the deeper contradictions and implications of the intertwining of human thought and corporate-driven technology developments such as mass-market photography remained unquestioned.

In Debes' talk for the 1971 conference, he cited the work of philosopher Alfred Korzybski, and his claim that we can think about perception as the projection of things onto a "screen" in the mind, rather than thinking that we experience them directly.²⁵² The metaphor of projection is meant to emphasize the translation of the world into signs that then are used by our brains and the necessity of understanding the difference between the signs and reality. Debes also uses this to reinforce the idea that perception and cognition are one process, and that thinking is a process akin to mediated picturing. The metaphor of media coding transforms a situation in which viewers are faced with false "surrogates" instead of the real world, into one in which the viewer gains awareness of, and control over, the means by which they are receiving messages. The purchase of a camera thus becomes part of an essential process of understanding and interacting with the world.

In spite of the inherent paradoxes, visual literacy enthusiasts firmly embraced the idea of useful relations between pictures and language that Debes formed based on the above theoretical

²⁵² John Debes, "The Challenge is Visual Literacy," Paper delivered at the National Conference on Visual Literacy, 1971, 5. Box 1, Folder 3, John L. Debes III Collection. To cite Alfred Korzybski was to refer to the General Semantics movement, which arose before World War II specifically to combat fascist propaganda. Visual literacy often drew on this discourse, referencing S.I. Hayakawa as well, especially in relation to ideas about resisting the oppressiveness of the abstraction involved in language, or about the way that context and structures shape meaning. It is clear why Debes would respond positively to Korzybski's use of visual technology as a metaphor for a more liberated way of interpreting one's surroundings and incoming messages.

investments. The very first assumption in the list compiled by one group of educators at the 1976 Okoboji Educational Media Leadership Conference was that “a visual language exists and it is structurally analogous to verbal language in terms of parts of speech.” Number six states: “Visual language is universal to the extent that the persons in communication have common referents (just as in the case of verbal language).”²⁵³ In documents summarizing the results of another working group at this conference, “linguaging” is defined as “human activities in which symbols and/or signs are intentionally selected and arranged in culturally preferred patterns for the purpose of communication.”²⁵⁴ According to group five’s list, while “a universal visual language exists,” “aesthetic qualities are based on criteria which are culturally determined.” With respect to photography, however, assumption 64 states: “A given object could be matched with its photograph by any human being without having to learn laboriously a special vocabulary of photographs.” We can see that two conflicting ideas form the flexible but still persistent basis of visual literacy, the presence of visual codes, but also the idea that photographs circumvent codes. Again, the combination of these contradictory ideas served to give photography special power. If we can decipher the visual codes of media which relate significantly to human perception, then humans will have greater access to and control over an overstimulating environment.

The educators proclaimed that visual literacy will protect the ability of an individual to access truth while avoiding manipulation by external forces, by which the writers generally mean the mass media, and especially television. The educators also argued that visual literacy will contribute to an individual’s ability to communicate successfully with others. Visual literacy thus

²⁵³ The Identification and Analysis of Selected Assumptions Underlying the Concept of Visual Literacy,” marked with “Okoboji,” c. 1976, 18. Box 1, Folder 3, John L. Debes III Collection.

²⁵⁴ Group 2 report from 22nd Okoboji Conference, 1976, 106. Box 1, Folder 3, John L. Debes III Collection.

has components both of consumption and production and is deeply linked with both individualism and interconnection, rooted in the notion that self-awareness leads to better awareness of one's world. Assumption number eight states: "Visual literacy skills develop in direct proportion to one's contact with visual mass media. Also included in the list is the assumption that "physiological differences may perhaps exist between the past generation and the "TV" generation." This reiterates that the visual literacy advocates saw themselves as reacting to specific shifts in the world, and saw a powerful link between human biology and media technology. As I explored earlier in the chapter, rather than seeing television as an instance of humanity changing its surroundings, they understood television as having changed humanity – the technology is now part of us, an extension of ourselves. This allowed these educators to understand photography and cameras as emancipatory in this context, and as the natural answer to any negative effects of media. If television led to passive, vulnerable spectators, then the production of photographic images (or the arrangement or the analysis of them, all active engagements on the part of the viewer) could supposedly counteract this. The 1976 Okoboji participants were clearly concerned about relations between visual literacy and the question of individual freedom, as indicated by striking statements such as: "Television viewers will have free will concerning whether they watch television." Number thirteen proposes that those who know more "languages" have more "freedom."

Ultimately, this Okoboji conference, which took place a decade after Debes started working on these ideas, helps to clarify many of the consistent stakes of visual literacy and shows how they were defined even outside of IVLA events and publications. The group two participants cited a 1972 article by William F. Flynn, "Visual Literacy – A Way of Perceiving, Whose Time Has Come," in *Audiovisual Instruction*, in which visual literacy is defined not by

any reference to the visual, or to literacy, but to “the opportunity to record and interpret [the] world as it really is both objectively and subjectively.” Visual literacy is closely tied to the idea of individual agency, and specifically in relation to mass media and the individual production of one’s own visual media in response. The very next quote, from Donis A. Dondis’ *A Primer of Visual Literacy* reiterates this. Dondis argues that visual literacy is the ability “to make a visual message,” not just to understand one.²⁵⁵

I have mentioned a few times the work of Jurgen Ruesch and Weldon Kees, from whom Debes took the framework of symbol, body, and object languages, and the notion that society needed to analyze how we use images to communicate more responsibly. Ruesch and Kees were interested in images specifically because they were a form of resistance to power. In *Nonverbal Communication: Notes on the Visual Perception of Human Relations*, which draws on concepts from computing and information theory, they argued that images operate analogically, while words operate digitally, and digital operation (or the transformation of phenomena into discrete logical points) leads to the loss of certain content and nuance. Some things can only be expressed analogically, or non-discursively, and they were interested in resurrecting the value of this kind of communication because it is less susceptible to “distortions of signification.”²⁵⁶ Ruesch and Kees asserted that nonverbal communication has a certain power that can be used for social good or for propaganda, and is especially prone to insidious use when the visual and the verbal are not “checked against” each other. Ruesch and Kees also put forward the idea that nonverbal communication is more closely related to the integrity of an individual person, to personal thoughts and feelings that must be respected but are not easily translated into verbal language.

²⁵⁵ Group 2 report from 22nd Okoboji Conference. Box 1, Folder 3, 98, John L. Debes III Collection.

²⁵⁶ Jurgen Ruesch and Weldon Kees, *Nonverbal Communication: Notes on the Visual Perception of Human Relations*, (University of California Press: Berkely and Los Angeles, 1956), 193.

Finally, they position photography as absolutely key to the study of the nonverbal, arguing that in spite of the specific ways photographic technology “distorts,” it also shows how “people actually move and behave,” and that “the photographic technique is ideal for conveying to the observer topics, facts, and details of the “how” that words are incapable of expressing.”²⁵⁷ They thus set up an alignment between nonverbal communication and photographic images that was an essential foundation for Debes’ work, and Ruesch and Kees were important to many of the visual literacy enthusiasts. At the 1970 conference, Anthony Hodgkinson argued that “visual literacy” could just as well be described as “analogic education,” and Randall Harrison compared Gibson’s distinction between projection and convention to Ruesch and Kees’ analog and digital. What mattered to visual literacy thinkers about pictures was that they sidestepped some component of convention or coding that was necessary when dealing with words.²⁵⁸ At the same time, to think of the visual as its own kind of language offered the possibility of a different kind of code, one that allowed individual minds to exercise control over their perceptual-cognitive process. Debes directly addressed the question of individual freedom through visual literacy by explaining two important payoffs of his analog-metaphor model of cognition:

The first is that the more analog arrays a child has for a particular aspect of the world, the more choices he has in dealing with that set of ideas, processes, etc...The second aspect is that as the child accumulates additional arrays of analogs and has more and more ways in which to deal with a particular aspect of reality, the more independent he becomes of the mode of expression.²⁵⁹

²⁵⁷ Ruesch and Kees, *Nonverbal Communication*, 12.

²⁵⁸ See conference manuscripts in Box 3, Folder 5, John L. Debes III Collection.

²⁵⁹ John Debes, “The Challenge is Visual Literacy,” Paper delivered at the National Conference on Visual Literacy, 1971, 7-8. Box 1, Folder 3, John L. Debes III Collection.

Visual literacy consistently aligns itself with notions of individual agency through particular interactions between visual media and human mind. More specifically, the more visual media a person consumes, the freer he or she is.

4.4 SELLING DEMOCRATIC INDIVIDUALITY

Visual literacy was a way to define a modern American citizen in the context of the Cold War that also happened to position corporations as crucial to social progress. Debes' theory of visual literacy was a way to ensure healthy "self-concepts" in individuals from a young age. A healthy self-concept involved secure separation between the self and the "mode of expression," as this was protection from the potential brainwashing power of communication that Americans associated with the recent past's results of fascism and the present spectre of communism. In American education at this time, it was crucially important to define student learning and to cultivate nationalistic feeling in a way that protected the ideal of individual choice. The shift that Ellenbogen and Jolles point out in precisely how visual literacy was intended to liberate viewers makes sense in this context. In the 1960s, this occurred in step with the promotion of capitalism and liberal democracy, which was also founded on the ideal of informed individuals choosing freely amongst a range of options while using technology to help them make sense of things. By the 1970s, popular American wariness of communism was giving way in some ways to a growing skepticism of corporate culture and commercialism. However, the potential for new visual technologies as a tool of liberation in the face of power stuck. Visually literate Americans indicated their freedom through looking, which was framed as an active process, meaning that they were not subject to being overpowered. This notion that individuals were successfully

articulating their freedom and individuality by using visual media opened pathways for corporations to pursue unregulated influence in more and more sectors of society.

It was photographic images, specifically, that had this power in visual literacy discourse. John Geraci, who was a speaker at first conference, argued that the negative effects of passively watching television could be counteracted by teaching children to use photography, and these sentiments are echoed elsewhere.²⁶⁰ These educators effectively argued that individuals should fight technology with technology, that the way to rescue individual agency from the power of visual media is to have individuals use visual media themselves. This idea remains present from the 1960s to the 1970s as the urgency of the Cold War morphs into a critique of global capitalism, and in which consumer culture and advertising lose some of their sheen. However, as this shift happens, and visual media go from positive signs of modernity to more ominous ones, the media themselves remain the answer to power.

Visual literacy discourse embraced corporate involvement, but was also part of the progressive, social justice-oriented wing of education, a situation that was especially possible in the context of 1960s economic optimism. The dream sold by corporations was of a society in which everyone has equal agency through his or her buying power. Visual literacy educators seem to have bought into this notion to some degree, assigning visual media the capacity to extend freedom and individual subjectivity to every American. We can see this especially by noting the manner in which visual literacy approached marginalized communities. Throughout visual literacy discourse, from the beginning in the late 1960s, Debes and his followers emphasized how visual literacy would be able to address injustices in the traditional educational

²⁶⁰ See John Geraci, "The Use of Photography to Stimulate Visual Literacy," in Clarence M. Williams and John L. Debes, eds., *Proceedings of the First National Conference on Visual Literacy*, New York: Pitman Publishing Corporation, 1970, 237-239.

system, and had particular relevance to underserved populations such as children of color, children living in poverty, children learning English as a second language, and children with physical or learning disabilities. As mentioned above, the fact that the Photo-Story Discovery Sets feature black children and white children playing together would have been significant in the context of the civil rights movement and recent desegregation. Debes and his colleagues argued that visual literacy could be part of making education responsive to a modern, more equitable society. In spite of this investment, the published visual literacy materials often took a somewhat condescending stance on the needs of underserved communities, and generally sounding a bit out of touch with the realities of their lives, not to mention the larger forces that had produced and enforced inequality.

The visual literacy menu of materials includes “The Growing of a Young Filmmaker,” targeted at teachers and administrators, in which Raymond Esquilin, a Latino teenager from the Lower East Side, who has dropped out of high school, talks about movies he has made. This filmstrip was intended to suggest that filmmaking shifted Esquilin from “apathy to zeal,” reinforcing the visual literacy ideal that visual communication with photographic media helps young people, specifically from marginalized communities, develop “self-concept,” be engaged with the world, and be enthusiastic about school.²⁶¹ A project in the USC School of Education called “The Camera as ‘the Eye of the Mind’” was specifically designed for the children of Spanish-speaking migrant workers. In this project, images were thought to help children be more

²⁶¹ “Materials for Teaching Visual Literacy,” Box 2, Folder 5, International Visual Literacy Association Records.

engaged and interactive, build on their own experiences, and develop their sense of self, which would then lead to them more quickly learning English.²⁶²

In the first IVLA conference in 1969, Gerald W. Jaromin, a Rochester high school English teacher, reported on his use of Kodak's teaching films (*Making Sense Visually, How Does a Picture Mean, Rhetoric of a Movie*), and Photo-Story Discovery Sets in a college prep class for 13-year-old "inner city" boys. Jaromin describes activities in which students apply grammatical terms to images, identifying subject, predicate, etc., critiquing the image based on how it fulfills this structure, and debating what visual part of the image constitutes each sentence element and why. The end claim is that while the students' grammar did not improve any more quickly than the control group, they were more enthusiastic about the process. In particular, while both groups learned composition, the group that wrote stories using the Photo-Story Discovery Sets, and then made their own home movies, were much more passionate about their work.²⁶³ Many speakers at early IVLA conferences emphasized the special usefulness of teaching visual literacy to "disadvantaged" or "inner city" youth. Using film or photography to teach was proposed as helpful when students reading skills were not strong, or when they had trouble with attention or behaviour in school. In Rochester in 1969, Kodak supported an experiment in which Black first-graders from a non-integrated inner-city school had their reading skills and "self-concept" assessed after doing activities in which they took photographs and made

²⁶² Patricia Heffernan-Cabrera, "The Camera as 'the Eye of the Mind,'" Notes for a pilot project, with handwritten note, "3rd conference, Alisomar." This was presumably collected by Debes. Box 2, Folder 6, International Visual Literacy Association Records.

²⁶³ "Teaching Grammar and Composition Using Cameras" in the conference proceedings, then published as "Higher Achievement Program Succeeds at McQuaid," in *Visuals are a Language*, Vol. 2, (1969): 6. Box 2, Folder 4, International Visual Literacy Association Records. Kodak's Education and Youth Section gave presentations to the teachers, one of which was the inspiration for this program.

movies.²⁶⁴ In the 1973 conference, there was a presentation on a study in Tennessee involving giving Instamatic cameras to teenage boys who were incarcerated, to improve their “self-concept.”²⁶⁵

While the use of cameras specifically to help students was the focus here, the idea that children learn best as part of an interactive community and when given independence can be identified as a much broader educational philosophy that was popular in this period. It worked very well for Kodak to base their involvement on these values, which easily allowed them to work towards the idea that we need as many people using cameras as possible. Moving into the 1970s, even though skepticism of capitalism, and of mass media, was now more widespread, and the stakes of the U.S. position in global politics had shifted, the possibility for corporate involvement to be associated with humanistic progress through the emancipatory power of visual technology was firmly established. Cold War visual pedagogy helped to define American citizens as free-thinking members of a democratic system that followed the lead of the modern technologies that were now shaping society. As visualized by the image of a diverse group of children holding cameras to their eyes that was used on the 1971 IVLA conference brochure, it was driven by the ideal that through the individual use of visual media, each person had the potential to access citizenship.

²⁶⁴ The statistics were analyzed by people at Kodak. “An Experimental Use of Motion-Pictures in a First Grade Classroom,” Keith E. Whitmore, 1969, Box 3, Folder 11, John L. Debes III Collection.

²⁶⁵ Report on study conducted at Spencer Youth Center, Nashville, Tennessee. Box 2, Folder 7, International Visual Literacy Association Records.

5.0 CONCLUSION

As I have shown in this project, from the 1950s through the 1970s, individual experimentations in visual pedagogy had a strong influence on the directions of corporate marketing, government initiatives, and educational values. For several reasons unique to the present moment, visual pedagogy continues to be of importance to educators in various spheres. However, the field retains certain investments that can be traced back to the context of mid-century America in the Cold War; the ideal of individuals being in control of how they use technology; the utopic potential of interconnections between the sciences and the humanities; and the realization of the link between visual media and democratic civic action. Consequently, an analysis of this earlier formulation of visual pedagogy and the detailing of its successes and failures are key to understanding aspects of the present.

In the proceedings of the very first visual literacy conference in 1969, there is a text by writer, film critic, and teacher Martin S. Dworkin that articulates the most pointed critique of Debes' project. Dworkin points out that visual literacy is driven by a specific ideology of reform, and he argues that "awareness of this ideological element is essential for developing safeguards against exaggerations, especially the rhetoric of Overclaim (a modality of Newspeak), serving interests trying to affect changes for their own purposes." He then makes his fears clear, mentioning Kodak and suggesting that we must be careful that we may next be discussing "olfactory" literacy at conferences sponsored by "manufacturers of perfume, glue or

fertilizer.”²⁶⁶ He argues that we should stay conscious of history, for example, to note that not so long ago it was text that was being promoted over image in education, and specifically by textbook publishers. He is careful to note that he is in no way suggesting that these parties have bad intentions or that the shift in education is a negative one, just that “responsible skepticism” is in order. Dworkin also notes that an interest in incorporating photography and motion pictures into the classroom should be understood in the context of power struggles between the “intelligentsia” and “popular ethos,” as new industries gained influence and established institutions attempted to bring them under their purview. Additionally, he points out the significance of the new attitude toward the visual in a longer history of struggle over the proper use of images, the association of “word culture” with archaic intellectual traditions and contrived social structures, and the suitability of a supposedly more natural, less pretentious “visual culture” to democracy. He is skeptical of advertising, of an “industrial-commercial-educational complex.” He refers to an idea of “integration” that again suggests the discourse of Kepes, Ruesch and Kees, Abbott, or Burtin: “We must not sharpen the senses without educating the spirit.” In this case, the value of “integration” can serve skepticism about “interests trying to affect change for their own purposes,” as well as it served enthusiasm about educational technology. We are brought back here to the anxiety that in the modern world, progress in one area must not be allowed to become separated from morals and “spiritual integrity.”

Dworkin’s inclusion as a keynote speaker in the 1969 conference may indicate that this perspective was welcomed and often discussed. At the same time, there is a letter from Dworkin in the IVLA archive that suggests he experienced tension with the organization, and that there

²⁶⁶ “Toward an Image Curriculum: Some Questions and Cautions,” *Journal of Aesthetic Education* (April 1970): 129-132. A note indicates that this article is a condensed version of Dworkin’s keynote address at the 1969 conference. Box 2, Folder 4, International Visual Literacy Association Records, MSS-181. Arizona State University Library: Visual Literacy Collection.

were difficulties related to the publication of his paper in the first conference proceedings. “There will be other occasions,” he writes, “to point out that the warnings and predictions made then, at the very beginning, were all-too-sadly borne out.”²⁶⁷

Debes was one of several Kodak employees who worked across the educational programs and sales, including William Flack (Graphic Communications Specialist), Jack Spring (Education Specialist), and Steven D. Barley. A page from a report in the IVLA files written by Barley states:

All of us are being forced to realize how important it is that a student be literate, not only verbally, but also visually. He must not only be able to read and interpret the printed and spoken word, but also to view analytically the slide program, the motion picture, and the TV commercial. Further, he should have the know-how to use the still and motion picture for his own communication purposes and to choose the words and pictures which will convey his meaning most effectively.²⁶⁸

Elsewhere Barley wrote: “the visually literate person will become that much more the master of his own destiny than his forebears were.”²⁶⁹ Statements like this are significant because they package commercial goals inside educational ones while framing the use of technology as conducive to freedom. Much like the interest that the corporations of Silicon Valley take today in educational initiatives, while it is difficult to write off as negative, it works to place a haze over the corporation as an ultimately self-serving entity.²⁷⁰ Across the 1950s and 1960s practices I have examined here, we can see a shift in how corporations employed this

²⁶⁷ Letter from Martin S. Dworkin to the IVLA, September 7, 1976. Box 2, Folder 4, International Visual Literacy Association Records.

²⁶⁸ No date, sometime in the 1970s. Box 12 Folder 14, International Visual Literacy Association Records.

²⁶⁹ S.D. Barley, Education Specialist with Kodak, “An Exploratory System: Precursor to Film Study” Box 8, Folder 3, John L. Debes III Collection.

²⁷⁰ See the recent New York Times series, “Education Disrupted: A series examining how Silicon Valley is gaining influence in public schools,” by Barbara Marcolini, Natasha Singer, and Danielle Ivory, made up of five articles published between May and November, 2017. There are many parallels to the corporate educational programs of the 1960s and 70s. Teachers complain that technology is being made to do their work for them and non-experts are being given too much influence in schools, but advocates basically argue that when teaching “digital natives,” we must embrace modern technology or else let it overtake us.

strategy. While MIT and the PSSC needed to discreetly handle the commercial aspects of their projects, and Burtin and Upjohn danced around the role of corporation as educator, in modern times, corporations openly and systematically market their technology to schools, offering incentives to encourage schools to allow them enter the educational space. In the case of visual literacy, Kodak orchestrated a situation in which educators all over the country could talk about what was good for children at the same time as they were talking about what was good for Kodak. Current situations should be examined in light of this earlier discourse

When corporations took on this role in the 1950s and 1960s, it was relatively easy for them to fall on the right side of global politics. In Cold War America, in spite of the presence of strong critiques of corporate capitalism, it was true for many that to believe in corporations was to be in favor of freedom, and this is important as background to the progressive, humanistic foundations of the visual literacy discourse and the history out of which it grew. What was decisive about visual literacy was the parts of the discourse that persisted even as the political framework shifted. As the 1970s progressed, the left-leaning educators of Debes' circle had a different relationship to Cold War ideological questions. Specifically, to talk about mass media by this point was more likely to mean acknowledging certain insidious effects of capitalism, the potentially oppressive effect of marketing, and the conflict between human rights and corporate interests. It was also to acknowledge how crucial mass media were to major social shifts in public opinion about political matters, such as the civil rights movement, or the Vietnam War. Across this shift, visual literacy described how technology empowered individual minds and suggested that the acts of consuming and producing visual media constituted a form of individual actualization and resistance. Debes incorporated this into his 1960s formulation, drawing on postwar and Cold War frameworks about what kinds of visual activity create a democratic

subject, and what the role of mass media should be in that process. By the mid-1970s, it was harder for corporate support to seem innocuous, but visual literacy had already been given this emancipatory dimension – through the idea of it being a language, that it was more natural, and that it resisted mechanized control – which made it workable in this context. Images were positioned as both the problem and the solution from the beginning. In the later 1970s’ visual literacy discourse, media critique and the production of one’s own visual material were perhaps more strongly emphasized over the aspect of visual literacy that involved the consumption of mass media, but they were there from the beginning. Also present were notions about the world becoming more and more visual, and the creation, through the individual mental faculty of vision, of utopian relations between photographic media and one’s environment that continued to have influence in the subsequent decades. Whereas in the 1950s and 1960s photographic imagery worked to humanize science and technology, and secure a progressive role for corporations, it then could satisfy a 1970s need for a critique of those corporations based on the very same qualities, in that photographs allow one to control one’s environment and articulate one’s individuality within it.

In the Visual Literacy Newsletter in 1973, Dr. Malcolm Fleming, professor of education, argued in an editorial that the role of photographs in mobilizing public outrage about Vietnam War can be framed through visual literacy. For him, visual literacy was a way to describe being aware of pictures and critical of how they relate to verbal formulations, and he is explicit here about relating this to protests against the war, not against communism. In the 1970s, the way in which visual literacy involved the empowerment of individual minds made it suitable for encompassing new skepticism about American values and how they were conveyed through media. Arnheim’s work was still important in this context, as Fleming referenced his idea that

perception is a high-level cognitive function that involves the active production of “new configurations,” “creative thought and problem solving.”²⁷¹

In addition, Richard P. Adler, of the Aspen Institute, known for his writings on television, advertising, children, and education, described in 1978 how the idea of media critique and the production as well as consumption of media were always good arguments against those who said that visual literacy was either not necessary, because children already get it outside of school, or destructive, because education is supposed to be rigorous, not pleasurable.²⁷² In the 1970s the media critique part of visual literacy was just as suitable for resisting capitalism as it had been for a resisting communism, and part of the effectiveness of technology corporations at securing power in the later twentieth century was their investment in the idea of individual liberty and American citizenship constituted through the use of visual media.

However, this essay was titled “What is Visual Literacy? Is there a true visual language, or are we using a catchphrase to attract educators and federal dollars?”²⁷³ Adler advocated caution with these ideas that grew out of the influence of Marshall McLuhan and the turmoil of the 1960s, pointing out that predictions about the end of print had failed to come true. He argues that “Kodak’s eagerness to popularize visual literacy (and sell cameras to the schools) produced some of the movement’s least defensible propositions about the role of pictures (especially photographs) in communications,” and that the use of the word “literacy” served to increase the prestige of the program. Like others, Adler finds Debes’ formulation of visual literacy to be oversimplified “to the point of absurdity,” preferring, for example, Donis A. Dondis’ acknowledgement that visual literacy is not clear-cut and logical like verbal literacy is. He

²⁷¹ Visual Literacy Newsletter, Vol 2. No. 3, Box 3, Folder 3, John L. Debes III Collection.

²⁷² Richard P. Adler, *American Film*, Vol. 3 Issue 8 (Jun 1, 1978): 22-25, 49.

²⁷³ Ibid. Debes kept this and other critiques in his files, Box 8, Folder 1, John L. Debes III Collection.

perhaps misses some of the nuances of Debes's work, suggesting that Debes thought visual literacy could actually replace verbal literacy, and that the use of movie-making as part of broader reading and writing activities in classrooms (rather than "ends in themselves") cannot be credited to Debes' proposals. Overall though, Adler is interested in the broad discourse of visual literacy, and cites with approval Susanne Langer, Rudolf Arnheim and Susan Sontag as sources on "the ways in which images communicate." He is far from wanting to scrap the idea of visual literacy, and ends his piece by suggesting we have just begun to develop a truly universal visual language. He also makes a pronouncement that I find instructive:

It may be the computer, not the camera, which proves to be the essential component in the creation of a universal iconic language. If so, our present media may simply be precursors which someday will seem as crude and cumbersome to us as a papyrus scroll or clay cuneiform tablet.

In fact, it is true that visual literacy researchers and those interested in the use of technology in education would in later years apply their discourse to computers, and to images produced digitally rather than with film, without much modification. Debes had already laid some groundwork for thinking about communication by mixing metaphors from photography and computing. Adler himself would work on the idea of "information literacy" in the 1990s. As exemplified in this abstract for a 2016 article in the *Journal of Visual Literacy*, educators' speech about visual literacy today is sometimes strikingly similar to speech from 1968, even though the technology to which it is applied has dramatically changed.

In this technologically advanced environment, users have become highly visual, with television, videos, web sites and images dominating the learning environment. These new forms of searching and learning are changing the perspective of what it means to be literate. Literacy can no longer solely rely on text-based materials, but should also incorporate digital images and sounds. Higher education seems to be lagging behind with incorporating visual literacy into their academic programs. This paper explores visual literacy, the digital

native, and the importance of integrating visual literacy into our learning curriculum, especially in instructional design programs.²⁷⁴

The consistency of visual literacy rhetoric, in both the specific and the more general sense, across this transformation in technologies, suggests that its historical origins might shed crucial light on more contemporary issues. The International Visual Literacy Association's current programs and publications show that visual literacy is used now to discuss the use of digital technology in art, education, and communication, but on the same grounds that image-rich media in learning environments are the inevitable way of the future. In "A Short History of Visual Literacy: The First Five Decades," Alan Michelson argues that 50 years later, Debes' core principles are still valued:

Writers on the topic of VL over nearly 50 years have continued to echo Debes's three underlying concepts arguing that: 1.) Critical analysis and documentation of images is increasingly important, 2.) New information technologies change childhood development and require new educational approaches, and 3.) Students need to exert greater activity in the learning process. Whether these premises are true or not, they have proven durable.²⁷⁵

In addition, as it did in the 1960s and 1970s, visual literacy discourse often revolves around continuing questions about the complex relationship between the visual and the verbal, and the continuing ambiguity of the term "visual literacy" itself.

Noting the methods used to argue for and implement visual pedagogy in the 1950s and 1960s can situate this current discourse in a broader context. Long before computers were commonplace in classrooms, Abbott, Burtin, and Debes all found ways to convince their audiences and their backers that by inviting the viewer to interpret the representational strategies

²⁷⁴ Michelle D. Ervine, Visual Literacy in Instructional Design Programs, *Journal of Visual Literacy*, vol. 35 no. 2, 2016, 104-113.

²⁷⁵ Alan Michelson, "A Short History of Visual Literacy: The First Five Decades," *Art Libraries Journal*, 42 (2), 2017, 98.

of new visual technologies, and adopt them as the framework for their own analytical faculties as they relate to the world around them, the images they produced were actually generating subjects of a modern liberal democracy. Abbott presented the visual traces of photography as mathematical tools, framing the mediation of the technology not as a distancing factor, but as intimacy, as a material encounter suitable to a digitally-enhanced world. Burtin argued that the process of visual design, which he also held up constantly for the viewer's appreciation, could serve in a similar fashion, to bring individuals into contact with that which was only available through the mediation of technology. It was the fact that this encounter was a visual one that made it modern, democratic, and open-ended. Debes then constructed an entire program around the goal of encouraging the understanding of visual technology and visual media, which was carefully framed as the understanding of one's self.

These three cases interconnect to show the contours of an approach to visual pedagogy that is unique to the context of Cold War America. All three display the influence of postwar interdisciplinary discourses that dealt with technology, communication, and psychology, as well as efforts to use visual means to unite the arts and sciences for the purposes of "integrating" modern society. They share a conception of the role of photography in the twentieth century, and a related set of ideas about responsible democratic citizenship. They also intertwined institutionally, operating across government initiatives, media corporations, and academic programs at a time when the stakes for the incorporation of technology into American education were very high. The study of visual pedagogy across federal, corporate, and educational goals reveals that it was instantiated in many forms, including textbooks, exhibitions, periodicals, films, and classroom materials. The success of the visual strategies depended on their valence across these various media, and were rooted in deeper notions of "the visual" that were based on

specific technologies, but very much transcended them. These strategies were part of defining individuality, subjectivity, agency, and citizenship in American culture in the twentieth century.

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