

MINING PHOTOGRAPHS AND OTHER PICTURES

A Selection from the Negative Archives of Shedden Studio, Glace Bay, Cape Breton.

1948-1968



PHOTOGRAPHS BY LESLIE SHEDDEN

Essays by Don Macgillivráy and Allan Sekula, with an Introduction by Robert Wilkie

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Edited by Benjamin H.D. Buchloh and Robert Wilkie

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Photography Between Labour and Capital

By Allan Sekula

I

Introduction: Reading an Archive

Every image of the past that is not recognized by the present as one of its own threatens to disappear irretrievably.

Walter Benjamin¹

The invention of photography. For whom? against whom?

Jean-Luc Godard and Jean-Pierre Gorin²

Here is yet another book of photographs. All were made in the industrial and coal-mining regions of Cape Breton in the two decades between 1948 and 1968. All were made by one man, a commercial photographer named Leslie Shedden. At first glance, the economics of this work seem simple and common enough: proprietor of the biggest and only successful photographic studio in the town of Glace Bay, Shedden produced pictures on demand for a variety of clients. Thus in the range of his commissions we discover the limits of economic relations in a coal town. His largest single customer was the coal company. And prominent among the less official customers who walked in the door of Shedden Studios were the coal miners and their families. Somewhere in between the company and the workers were local shopkeepers who, like Shedden himself, depended on the miners' income for their own livelihood and who saw photography as a sensible means of local promotion.

Why stress these economic realities at the outset, as

if to flaunt the "crude thinking" often called for by Bertolt Brecht? Surely our understandings of these photographs cannot be reduced to a knowledge of economic conditions. This latter knowledge is necessary but insufficient; we also need to grasp the way in which photography constructs an imaginary world and passes it off as reality. The aim of this essay, then, is to try to understand something of the relationship between photographic culture and economic life. How does photography serve to legitimate and normalize existing power relationships? How does it serve as the voice of authority, while simultaneously claiming to constitute a token of exchange between equal partners? What havens and temporary escapes from the realm of necessity are provided by photographic means? What resistances are encouraged and strengthened? How is historical and social memory preserved, transformed, restricted and obliterated by photographs? What futures are promised; what futures are forgotten? In the broadest sense, these questions con-

cern the ways in which photography constructs an *imaginary economy*. From a materialist perspective, these are reasonable questions, well worth pursuing. Certainly they would seem to be unavoidable for an archive such as this one, assembled in answer to commercial and industrial demands in a region persistently suffering from economic troubles.³

Nonetheless, such questions are easily eclipsed, or simply left unasked. To understand this denial of politics, this depoliticization of photographic meaning, we need to examine some of the underlying problems of photographic culture. Before we can answer the questions just posed, we need to briefly consider what a photographic archive is, and how it might be interpreted, sampled or reconstructed in a book. The model of the archive, of the quantitative ensemble of images, is a powerful one in photographic discourse. This model exerts a basic influence on the character of the truths and pleasures experienced in looking at photographs, especially today, when photographic books and exhibitions are being assembled from archives at an unprecedented rate. We might even argue that archival ambitions and procedures are intrinsic to photographic practice.

There are all sorts of photographic archives: commercial archives like Shedden's, corporate archives, government archives, museum archives, historical society archives, amateur archives, family archives, artists' archives, private collectors' archives, and so on. Archives are property, either of individuals or institutions, and their ownership may or may not coincide with authorship. One characteristic of photography is that authorship of individual images and the control and ownership of archives do not commonly reside in the same individual. Photographers are detail workers when they are not artists or leisure-time amateurs, and thus it is not unreasonable for the legal theorist Bernard Edelman to label photographers the "proletarians of creation."⁴ Leslie Shedden, for his part, was a combination artisan and

small entrepreneur. He contributed to company and family archives while retaining his own file of negatives. As is common with commercial photographers, he included these negatives in the sale of his studio to a younger photographer upon retiring in 1977.

Archives, then, constitute a *territory of images*; the unity of an archive is first and foremost that imposed by ownership. Whether or not the photographs in a particular archive are offered for sale, the general condition of archives involves the subordination of use to the logic of exchange. Thus not only are the pictures in archives often *literally* for sale, but their meanings are up for grabs. New owners are invited, new interpretations are promised. The purchase of reproduction rights under copyright law is also the purchase of a certain semantic license. This *semantic availability* of pictures in archives exhibits the same abstract logic as that which characterizes goods on the marketplace.

In an archive, the possibility of meaning is "liberated" from the actual contingencies of use. But this liberation is also a loss, an *abstraction* from the complexity and richness of use, a loss of context. Thus the specificity of "original" uses and meanings can be avoided, and even made invisible, when photographs are selected from an archive and reproduced in a book. (In reverse fashion, photographs can be removed from books and entered into archives, with a similar loss of specificity.) So new meanings come to supplant old ones, with the archive serving as a kind of "clearing house" of meaning.

Consider this example: some of the photographs in this book were originally reproduced in the annual reports of the Dominion Steel and Coal Company, others were carried in miners' wallets or framed on the mantelpieces of working-class homes. Imagine two different gazes. Imagine the gaze of a stockholder (who may or may not have ever visited a coal mine) thumbing his way to the table of earn-

ings and lingering for a moment on the picture of a mining machine, presumably the concrete source of the abstract wealth being accounted for in those pages. Imagine the gaze of a miner, or of a miner's spouse, child, parent, sibling, lover, or friend drifting to a portrait during breaks or odd moments during the working day. Most mine workers would agree that the investments behind these looks — financial on the one hand, emotional on the other — are not compatible. But in an archive, the difference, the *radical antagonism* between these looks is eclipsed. Instead we have two carefully made negatives, available for reproduction in a book in which all their similarities and differences could easily be reduced to "purely visual" concerns. (And even visual differences can be homogenized out of existence when negatives first printed as industrial glossies and others printed on flat paper and tinted by hand are subjected to a uniform standard of printing for reproduction in a book. Thus the difference between a mode of pictorial address which is primarily "informational" and one which is "sentimental" is obscured.) In this sense, archives establish a relation of *abstract visual equivalence* between pictures. Within this regime of the sovereign image, the underlying currents of power are hard to detect, except through the shock of montage, when pictures from antagonistic categories are juxtaposed in a polemical and disorienting way.

Conventional wisdom would have it that photographs transmit immutable truths. But although the very notion of photographic reproduction would seem to suggest that very little is lost in translation, it is clear that photographic meaning depends largely on context. Despite the powerful impression of reality (imparted by the mechanical registration of a moment of reflected light according to the rules of normal perspective), photographs, in themselves, are fragmentary and incomplete utterances. Meaning is always directed by layout, captions, text, and site and mode

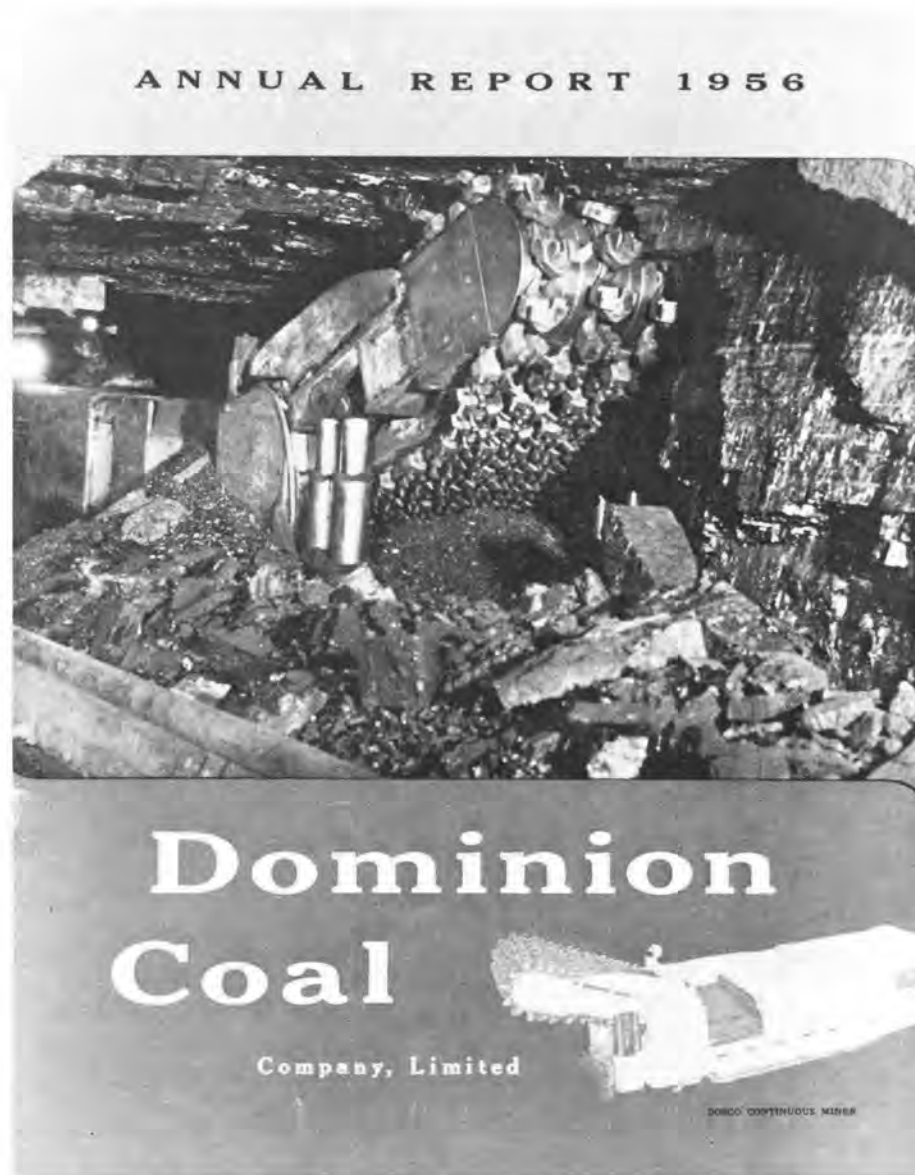


Figure 1. Cover of the 1956 *Dosco Annual Report* with a Shedden photograph of the Dosco miner in action. (*Dosco Annual Report*, 1956)



Figure 2. Glace Bay, 1940-41. Studio portrait of five brothers. Photograph by David Shedden. (Shedden Studios Archives)

of presentation, as the sample given above suggests. Thus, since photographic archives tend to suspend meaning and use; within the archive meaning exists in a state that is both residual and potential. The suggestion of past uses coexists with a plentitude of possibilities. In functional terms, an active archive is like a toolshed, a dormant archive like an abandoned toolshed. (Archives are not like coal mines; meaning is not extracted from nature, but from culture.) In terms borrowed from linguistics, the archive constitutes the paradigm or iconic system from which photographic "statements" are constructed. Archival potentials change over time; the keys are appropriated by different disciplines, discourse, "specialties". For example, the pictures in photo agency files become available to history when they are no longer useful to topical journalism. Similarly, the new art history of photography at its too prevalent worst rummages through archives of every sort in search of masterpieces to celebrate and sell.

Clearly archives are not neutral; they embody the power inherent in accumulation, collection, and hoarding as well as that power inherent in the command of the lexicon and rules of a language. Within bourgeois culture, the photographic project itself has from the very beginning been identified not only with the dream of a universal language, but also with the establishment of global archives and repositories according to models offered by libraries, encyclopedias, zoological and botanical gardens, museums, police files, and banks. (Reciprocally, photography contributed to the modernization of information flows within most of these institutions.) Any photographic archive, no matter how small, appeals indirectly to these institutions for its authority. Not only the truths, but also the pleasures of photographic archives are linked to those enjoyed in these other sites. As for the truths, their philosophical basis lies in an aggressive empiricism, bent on achieving a universal inventory of appearance. Archival projects typically

manifest a compulsive desire for completeness, a faith in an ultimate coherence imposed by the sheer quantity of acquisitions. In practice, knowledge of this sort can only be organized according to bureaucratic means. Thus the archival perspective is closer to that of the capitalist, the professional positivist, the bureaucrat and the engineer — not to mention the connoisseur — than it is to that of the working class. Generally speaking, working class culture is not built on such high ground.

And so archives are contradictory in character. Within their confines meaning is liberated from use, and yet at a more general level an empiricist model of truth prevails. Pictures are atomized, isolated in one way and homogenized in another. (Alphabet soup comes to mind). But any archive that is not a complete mess establishes an order of some sort among its contents. Normal orders are either taxonomic or diachronic (sequential); in most archives both methods are used, but at different, often alternating levels of organization. Taxonomic orders might be based on sponsorship, authorship, genre, technique, iconography, subject matter, and so on, depending on the range of the archive. Diachronic orders follow a chronology of production or acquisition. Anyone who has sorted or simply sifted through a box of family snapshots understands the dilemmas (and perhaps the folly) inherent in these procedures. One is torn between narration and categorization, between chronology and inventory.

What should be recognized here is that photographic books (and exhibitions), frequently cannot help but reproduce these rudimentary ordering schemes, and in so doing implicitly claim a share in both the authority and illusory neutrality of the archive. Herein lies the "primitivism" of still photography in relation to the cinema. Unlike a film, a photographic book or exhibition can almost always be dissolved back into its component parts, back into the archive. The ensemble can seem to be both provisional and

artless. Thus, within the dominant culture of photography, we find a chain of dodges and denials: at any stage of photographic production the apparatus of selection and interpretation is liable to render itself invisible (or conversely to celebrate its own workings as a kind of moral crusade or creative magic). Photographer, archivist, editor and curator can all claim, when challenged about their interpretations, to be merely passing along a neutral reflection of an already established state of affairs. Underlying this process of professional denial is a commonsensical empiricism. The photograph reflects reality. The archive accurately catalogues the ensemble of reflections, and so on. Even if one admits — as is common enough nowadays — that the photograph interprets reality, it might still follow that the archive accurately catalogues the ensemble of interpretations, and so on again. Songs of the innocence of discovery can be snug at any point. Thus the “naturalization of the cultural,” that Roland Barthes saw as an essential characteristic of photographic discourse, is repeated and reinforced at virtually every level of the cultural apparatus — unless it is interrupted by criticism.⁵

In short, photographic archives by their very structure maintain a hidden connection between knowledge and power. Any discourse that appeals without scepticism to archival standards of truth might well be viewed with suspicion. But what narratives and inventories might be constructed, were we to interpret an archive such as this one in a normal fashion?

I can imagine two different sorts of books being made from Shedden's photographs, or for that matter from any similar archive of functional photographs. On the one hand, we might regard these pictures as “historical documents”. We might, on the other hand, treat these photographs as “esthetic objects”. Two more or less contradictory choices emerge. Are these photographs to be taken as a transparent means to a knowledge — intimate and detailed even if in-

complete — of industrial Cape Breton in the postwar decades? Or are we to look at these pictures “for their own sake”, as opaque ends-in-themselves? This second question has a corollary. Are these pictures products of an unexpected vernacular authorship; is Leslie Shedden a “discovery” worthy of a minor seat in an expanding pantheon of photographic artists?

Consider the first option. From the first decade of the this century, popular histories and especially schoolbook histories have increasingly relied on photographic reproductions. Mass culture and mass education lean heavily on photographic realism, mixing pedagogy and entertainment in an avalanche of images. The look of the past can be retrieved, preserved and disseminated in an unprecedented fashion. But awareness of history as an *interpretation* of the past succumbs to a faith in history as representation. The viewer is confronted, not by *historical-writing*, but by the appearance of *history itself*. Photography would seem to gratify the often quoted desire of that “father of modern historical scholarship”, Leopold von Ranke, to “show what actually happened.”⁶ Historical narration becomes a matter of appealing to the silent authority of the archive, of unobtrusively linking incontestable documents in a seamless account. (The very term “document” entails a notion of legal or official truth, as well as a notion *proximity to* and verification of an original event.) Historical narratives that rely primarily on photography almost invariably are both positivist and historicist in character. For positivism, the camera provides mechanical and thus “scientifically” objective evidence or “data”. Photographs are seen as sources of factual, positive knowledge, and thus are appropriate documents for a history that claims a place among the supposedly objective sciences of human behaviour. For historicism, the archive confirms the existence of a linear progression from past to present, and offers the possibility of an easy and unproblematic retrieval of the past from the

transcendent position offered by the present. At their worst, pictorial histories offer an extraordinarily reductive view of historical causality: the First World War "begins" with a glimpse of an assassination in Sarajevo, the entry of the United States in the Second World War "begins" with a view of wrecked battleships.

Thus, most visual and pictorial histories reproduce the established patterns of historical thought in bourgeois culture. By doing so in a "popular" fashion, they extend the hegemony of that culture, while exhibiting a thinly-veiled contempt and disregard for popular literacy. The idea that photography is a "universal language" contains a persistent element of condescension as well as pedagogical zeal.

The widespread use of photographs as historical illustrations suggests that significant events are those which can be pictured, and thus history takes on the character of *spectacle*.⁷ But this pictorial spectacle is a kind of rerun, since it depends on prior spectacles for its supposedly "raw" material.⁸ Since the nineteen twenties, the picture press, along with the apparatuses of corporate public relations, publicity, advertising and government propaganda have contributed to a regularized flow of images: of disasters, wars, revolutions, new products, celebrities, political leaders, official ceremonies, public appearances, and so on. For a historian to use such pictures without remarking on these initial uses is naive at best, and cynical at worst. What would it mean to construct a pictorial history of postwar coal mining in Cape Breton by using pictures from a company public relations archive without calling attention to the bias inherent in that source? What present interests might be served by such an oversight? We return to this question in the third part of this essay.

The viewer of standard pictorial histories loses any ground in the present from which to make critical evaluations. In retrieving a loose succession of fragmentary glimpses of the past, the spectator is flung into a condition of

imaginary temporal and geographical mobility. In this dislocated and disoriented state, the only coherence offered is that provided by the constantly shifting position of the camera, which provides the spectator with a kind of powerless omniscience. Thus the spectator comes to identify with the technical apparatus, with the authoritative institution of photography. In the face of this authority, all other forms of telling and remembering begin to fade. But the machine establishes its truth, not by logical argument, but by providing an *experience*. This experience characteristically veers between nostalgia, horror, and an overriding sense of the exoticism of the past, its irretrievable otherness for the viewer in the present. Ultimately then, when photographs are uncritically presented as historical documents, they are transformed into esthetic objects. Accordingly, the pretense to historical understanding remains, although that understanding has been replaced by esthetic experience.⁹

But what of our second option? Suppose we abandoned all pretense to historical explanation, and treated these photographs as artworks of one sort or another. This book would then be an inventory of esthetic achievement and/or an offering for disinterested esthetic perusal. The reader may well have been prepared for these likelihoods by the simple fact that this book has been published by a press with a history of exclusive concern with the contemporary vanguard art of the United States and Western Europe (and to a lesser extent, Canada). Further, as I've already suggested, in a more fundamental way the very removal of these photographs from their initial contexts invites estheticism.

I can imagine two ways of converting these photographs into "works of art", both a bit absurd, but neither without ample precedent in the current fever to assimilate photography into the discourse and market of the fine arts. The first path follows the traditional logic of romanticism, in its incessant search for esthetic origins in a coherent and

controlling authorial "voice." The second path might be labeled "post-romantic" and privileges the subjectivity of the collector, connoisseur, and viewer over that of any specific author. This latter mode of reception treats photographs as "found objects." Both strategies can be found in current photographic discourse; often they are intertwined in a single book, exhibition or magazine or journal article. The former tends to predominate, largely because of the continuing need to validate photography as a fine art, which requires an incessant appeal to the myth of authorship in order to wrest photography away from its reputation as a servile and mechanical medium. Photography needs to be won and rewon repeatedly for the ideology of romanticism to take hold.¹⁰

The very fact that this book reproduces photographs by a single author might seem to be an implicit concession to a romantic *auteurism*. But it would be difficult to make a credible argument for Shedden's autonomy as a maker of photographs. Like all commercial photographers, his work involved a negotiation between his own craft and the demands and expectations of his clients. Further, the presentation of his work was entirely beyond his control. One might hypothetically argue that Shedden was a hidden artist, producing an original *oeuvre* under unfavorable conditions. ("Originality" is the essential qualifying condition of genuine art under the terms dictated by romanticism. To the extent that photography was regarded as a copyist's medium by romantic art critics in the nineteenth century, it failed to achieve the status of the fine arts.) The problem with *auteurism*, as with so much else in photographic discourse, lies in its frequent misunderstanding of actual photographic practice. In the wish-fulfilling isolation of the "author", one loses sight of the social institutions — corporation, school, family — that are speaking by means of the commercial photographer's craft. One can still respect the craft work of the photographer, the skill inherent in work within a set

of formal conventions and economic constraints, while refusing to indulge in romantic hyperbole.

The possible "post-romantic" reception of these photographs is perhaps even more disturbing and more likely. To the extent that photography still occupies an uncertain and problematic position within the fine arts, it becomes possible to displace subjectivity, to find refined esthetic sensibility not in the maker of images, but in the viewer. Photographs such as these then become the objects of a secondary voyeurism, which preys on, and claims superiority to, a more naive primary act of looking. The strategy here is akin to that initiated and established by Pop Art in the early nineteen sixties. The esthetically informed viewer examines the artifacts of mass or "popular" culture with a detached, ironic, and even contemptuous air. For Pop Art and its derivatives, the look of the sophisticated viewer is always constructed in relations to the inferior look which preceded it. What disturbs me about this mode of reception is its covert elitism, its implicit claim to the status of "superior" spectatorship. A patronizing, touristic, and mock-critical attitude toward "kitsch" serves to authenticate a high culture that is increasingly indistinguishable from mass culture in many of its aspects, especially in its dependence on marketing and publicity and its fascination with stardom. The possibility of this kind of intellectual and esthetic arrogance needs to be avoided, especially when a book of photographs by a small town commercial photographer is published by a press that regularly represents the culture of an international and metropolitan avant-garde.

In general, then, the hidden imperatives of photographic culture drag us in two contradictory directions: toward "science" and a myth of "objective truth" on the one hand, and toward "art" and a cult of "subjective experience" on the other. This dualism haunts photography, lending a certain goofy inconsistency to most commonplace assertions about the medium. We repeated-

ly hear the following refrain. Photography is an art. Photography is a science (or at least constitutes a "scientific" way of seeing). Photography is both an art and a science. In response to these claims, it becomes important to argue that photography is neither art nor science, but is suspended between both the *discourse* of science and that of art, staking its claims to cultural value on both the model of truth upheld by empirical science and the model of pleasure and expressiveness offered by romantic esthetics. In its own erratic way, photographic discourse has attempted to bridge the extreme philosophical and institutional separation of scientific and artistic practice that has characterized bourgeois society since the late eighteenth century. As a mechanical medium which radically transformed and displaced earlier artisanal and manual modes of visual representation, photography is implicated in a sustained crisis at the very center of bourgeois culture, a crisis rooted in the emergence of science and technology as seemingly autonomous productive forces. At the heart of this crisis lies the question of the survival and deformation of human creative energies under the impact of mechanization. The institutional promotion of photography as a fine art serves to redeem technology by suggesting that subjectivity and the machine are easily compatible. Especially today, photography contributes to the illusion of a humanized technology, open both to "democratic" self expression and to the mysterious workings of genius. In this sense, the camera seems the exemplar of the benign machine, preserving a moment of creative autonomy that is systematically denied in the rest of most people's lives. The one-sided lyricism of this view is apparent when we consider the myriad ways in which photography has served as a tool of industrial and bureaucratic power.¹¹

If the position of photography within bourgeois culture is as problematic as I am suggesting here, then we might want to move away from the art historicist bias that governs

most contemporary discussions of the medium. We need to understand how photography works within everyday life in advanced industrial societies: the problem is one of cultural history rather than art history. This is a matter of beginning to figure out how to read the making and reception of ordinary pictures. Leslie Shedden's photographs would seem to allow for an exemplary insight into the diverse and contradictory ways in which photography effects the lives of working people.

Let's begin again by recognizing that we are confronting a curious archive — divided and yet connected elements of an imaginary social mechanism. Pictures that depict fixed moments in an interconnected economy of flows: of coal, money, machines, consumer goods, men, women, children. Pictures that are themselves elements in a unified symbolic economy — a traffic in photographs — a traffic made up of memories, commemorations, celebrations, testimonials, evidence, facts, fantasies. Here are official pictures, matter-of-factly committed to the charting and celebration of progress. A mechanical conveyor replaces a herd of ponies. A mechanical miner replaces ten human miners. A diesel engine replaces a locomotive. Here also are private pictures, personal pictures, family pictures: weddings, graduations, family groups. One is tempted at the outset to distinguish two distinct realisms, the *instrumental realism* of the industrial photograph and the *sentimental realism* of the family photograph. And yet it would seem clear that these are not mutually exclusive categories. Industrial photographs may well be commissioned, executed, displayed, and viewed in a spirit of calculation and rationality. Such pictures seem to offer unambiguous truths, the useful truths of applied science. But a zone of virtually unacknowledged *affects* can also be reached by photographs such as these, touching on an esthetics of power, mastery, and control. The public *optimism* that suffuses these pictures is merely a respectable, *sentimentally-acceptable*, and

ideologically necessary substitute for deeper feelings — the cloak for an esthetics of exploitation. In other words, even the blandest pronouncement in words and pictures from an office of corporate public relations has a subtext marked by threats and fear. (After all, under capitalism everyone's job is on the line.) Similarly, no family photograph succeeds in creating a haven of pure sentiment. This is especially true for people who feel the persistent pressures of economic distress, and for whom even the making of a photograph has to be carefully counted as an expense. Granted, there are moments in which the photograph overcomes separation and loss, therein lies much of the emotional power of photography. Especially in a mining community, the life of the emotions is persistently tied to the instrumental workings underground. More than elsewhere, a photograph can become without warning a tragic moment.

One aim of this essay, then, is to provide certain conceptual tools for unified understanding of the social workings of photography in an industrial environment. This project might take heed of some of Walter Benjamin's last advice, from his argument for a historical materialist alternative to a historicism that inevitably empathized "with the victors":

There is no document of civilization which is not at the same time a document of barbarism. And just as such a document is not free of barbarism, barbarism taints also the manner in which it was transmitted from one owner to another. A historical materialist therefore dissociates himself from it as far as possible. He regards it as his task to brush history against the grain.¹²

Benjamin's wording here is careful. Neither the contents, nor the forms, nor the many receptions and interpretations of the archive of human achievements can be assumed to be innocent. And further, even the concept of "human

achievements" has to be used with critical emphasis in an age of automation. The archive has to be read from below, from a position of solidarity with those displaced, deformed, silenced, or made invisible by the machineries of profit and progress.

II

The Emerging Picture-Language of Industrial Capitalism

Those things which we see with our eyes and understand by means of our senses are more clearly to be demonstrated than if learned by means of reasoning.

Agricola¹³

We have sent designers to the workshops. We have made sketches of the machines and of the tools, omitting nothing that could present them distinctly to the viewer.

Diderot¹⁴

Art historians of photography have sought variously to chart continuities and discontinuities between photography and earlier modes of pictorial representation. But these efforts have given too little critical thought to what I take to be a central question: the question of the machine. For our purposes here, we might ask the following questions. What has it meant, historically, to seek the truth of technical processes by means of pictures? And what has it meant that since the middle of the last century, technical processes that were increasingly subject to mechanization were increasingly represented by mechanical means, by means of photography? In short, what role has been played by scientific picture-making in the historical development of capitalism, in the construction of capitalist dominion over nature and human labour? Clearly, this essay can provide no more than partial and very tentative answers to these questions. Fortunately for us, mining is one of the first technical endeavors to be systematically represented by pictorial means. Thus a certain narrow but exemplary lineage of technical realism can be traced: from a sixteenth century illustrated text on mining and metallurgy, Agricola's *De Re Metallica*, to the plates on mineralogy in the eight-

eenth century *Encyclopédie* of Diderot and D'Alembert, and on to the mining photography of the nineteenth and twentieth centuries. But first something should be said about mining in general.

The history of mining is an interesting case study for both economic and symbolic reasons. The economic reasons are fairly obvious. Mining is central to the emergence and development of the capitalist mode of production between the sixteenth and nineteenth centuries. It was a metallurgically superior Europe that imposed its guns and armour on Latin America. In turn, gold and silver from the mines of Mexico and Peru financed the earliest stages of industrial capitalism, as Italian, Dutch, German, and English merchants came to control the loot collected by Spain. The new industrial economy was fueled, in its turn, by coal. Thus mining has been both the primary source of primitive accumulation of wealth, and the source of power for more developed forms of exploitation.¹⁵

The stark contradictions of mining are those of uneven economic development. Mining remains rural, "primitive," an activity of regions that are deliberately kept "backward" and economically underdeveloped. Although mining was

essential to other forms of industry, the technology of mining initially anticipated but finally lagged behind that of the factory system. The Newcomen and Watt steam engines found their first widespread application in English coal mines during the eighteenth century. With increased demand for coal, and the exhaustion of seams closer to the surface, steam power provided a way to pump water from new, deeper mines. But this use of the steam engine was not *in itself* productive, although it certainly anticipated the "universally applicable" engine patented by Watt in 1784 which would become the main motive power for nineteenth century industry. Mining proper continued to be entirely manual work well into the nineteenth century, combining the traditional skilled labour of the coal cutter with the sheer massive toil of the women and children who hauled the coal to the surface. (It was not until the 1860s that coal-cutting machines began to be used, and coal mining did not begin to be mechanized in earnest until the 1920s in the United States and the 1930s in Great Britain.)¹⁶

For eyes that were willing to overlook the underground expenditures of human energies and lives, focusing instead on the marvel of those first noisy, smoking, coal-fired pumping machines, it must have seemed that coal power begat coal. Here, in the imagination of the early industrial bourgeoisie, was the embryonic ideal of a self-sustaining, autonomous productive machine. And yet the mines were not factories; they served the Industrial Revolution but were not, in themselves, the site of its principal innovations.

While actual mining practices differed materially from the developed factory system, on a symbolic level mining represented the *prototypical* form of industry. More than any other practice, mining exemplifies the direct domination of nature, the extraction of value from nature by alien means. Mining is the symbolic antithesis of agriculture, the inorganic opposite of cultivation and husbandry. Lewis Mumford well understood the cultural significance of min-

ing; *Technics and Civilization* contains an intriguing passage on the metaphorical position of mining within Western culture. Mumford remarks that "the mine is nothing less than the concrete model of the conceptual world which was built up by the physicists of the seventeenth century."¹⁷ To know this world, a world of pure matter, was to engage in an intellectual procedure akin to mining. Thus, for Francis Bacon, the seventeenth century philosopher whose practical empiricism anticipated the Industrial Revolution, mining metaphorically corresponded to the "speculative" and inductive aspect of natural philosophy, while "operative" and constructive reason was akin to metal-smithing. For Bacon, scientific truth was found "in the bowels of Nature," only to be shaped "on an anvil" for practical purposes.¹⁸

Notwithstanding the long prevailing conception of mining as a paradigm for empirical and industrial science, this inorganic but rural occupation has sustained a folklore that is in part agrarian in its forms and meanings. The culture of mining communities is frequently both militantly proletarian and rich in a sense of rural continuity and resistance to industrial discipline. This culture has frequently collided with the logic of industrial rationalization. The discourse and practice of mining has come to be bracketed by two antagonistic figures: the underground toiler, "backward" and often militant, and the mining engineer. To understand this antagonism, we need to understand something of the way in which capitalism subordinates manual labour to the command and direction of intellectual labour. Mining is no exception to this rule.

The rationalization of mining begins in the sixteenth century. This process required that mining be systematically *represented* for the first time, by words and pictures. Mining, metallurgy, and medicine are among the first technical disciplines to be treated in this fashion. Georgius Agricola's *De Re Metallica*, published in 1556, is second only to *De*

Humani Corporis Fabrica of Andreas Vesalius, published in 1543, in its stature as a work of early modern empirical science based on the use of visual demonstration. Both authors sought to unite physical observation with theoretical understanding. Vesalius was vehement in his opposition to the prevailing separation of mental and manual labour in medical practice and education. The polemical frontispiece to the *Fabrica* shows Vesalius himself at the center of the medical amphitheatre. The anatomist has abandoned the professor's pulpit and displaced the barber-surgeons who previously performed the actual dissections. In this image, the power of discourse combines with physical demonstration: the anatomist is both a theorizing and practicing subject.¹⁹ Vesalian anatomy provided a model for other empirical sciences. Agricola, a physician and burgher in the German mining region of Saxony, sought to consider "the metallic arts as a whole . . . just as if I had been considering the whole of the human body," treating "the various parts of the subject like so many members of the body."²⁰ Like Vesalius, Agricola stressed the importance of direct empirical observation and the corresponding value of illustrations:

. . . with regard to the veins, tools, vessels, sluices, machines and furnaces, I have not only described them, but have also hired illustrators to delineate their forms, lest descriptions which are conveyed by words should either not be understood, or should cause difficulty to posterity, in the same way as to us difficulty is often caused by many names which the Ancients (because such names were familiar to all of them) have handed down to us without any explanation.

I have omitted all those things which I have not myself seen, or have not read or heard of from persons upon whom I can rely.²¹

For both Vesalius and Agricola illustrations served to place the reader in a position akin to that of direct obser-

vation; pictures provided a kind of surrogate presence of the object. The reader became a reader-viewer. As the historian of science George Sarton noted, "it became more and more objectionable to reproduce stereotyped words in the vicinity of correct images."²² (The "correctness" of these images was, of course, always an approximate matter, as well as a matter of emerging pictorial conventions. Visual empiricism required a certain essentialism, a willingness to cluster diversity around some standard or type. The anatomical illustrations commissioned by Vesalius frequently involved the "averaging" of sketches taken from numerous, diverse specimens.) Perhaps what is most remarkable about Agricola's thinking is his clear conception of the limits placed on linguistic comprehension by history: verbal meanings change, are lost, become opaque. In his comments, we can discern an early attempt to claim a compensatory universality for pictorial communication, a certain transhistorical clarity of meaning. While the image becomes the bearer of fragments of scientific truth, it also serves as a generalized *sign* of science, an emblem of the power of science to understand and dominate nature.

The development of scientific and technical illustration directly parallels, informs, and is informed by, the development of empirical and practical science. Picture-making itself had to become worldly before it could be applied to worldly problems. Picture-making also had to become a form of intellectual labour, grounded in mathematical principles. Thus, two fifteenth century inventions, printing and perspective, provided necessary technical and conceptual groundwork for sixteenth century illustrated books on anatomy and engineering. The development of printing, and especially the arts of wood-block printing and engraving, allowed for the making of what William Ivins called "exactly repeatable pictorial statements."²³ These early forms of mechanical reproduction permitted a new degree of consistency and certainty in the discourse of empirical science.

Perspective provided both a general ideology of pictorial realism and a model of spatial analysis based on geometrical procedures. Technical illustration did not often attempt the complete construction of the planar intersection of the visual pyramid, the construction first described in writing by Alberti in his *Treatise on Painting* of 1435. But the very notion of accurate scientific pictures required the institutionalization of Alberti's more general dictum that "the painter is concerned solely with representing what can be seen."²⁴ Since scientific illustration sought the truth of nature in its components, the analytic procedures of the perspectival painter were more important than the final synthetic illusion. As we will see shortly, there were valid reasons for scientific illustrators to ignore or reject the possibility of constructing proportionally-correct two-dimensional "windows" or "mirrors." Painting and scientific illustration did not share the same ultimate ends. For Leonardo, following Alberti, painting was "the only imitator of all the visible works of nature."²⁵ Scientific illustration, and particularly engineering illustration, was a means to an end, that end being the construction of a second, artificial nature that was more than pictorial illusion. (One aspect of the unity of the representational arts and applied sciences in the Renaissance lies in the coexistence of these two projects, painting and engineering, in single individuals: Brunelleschi, Alberti, Leonardo, and Dürer.)

What about *De Re Metallica*? Agricola wrote a book that is in many ways indicative of the *transitional* character of Renaissance culture, a culture that looked backward to the authority of the Ancients and forward to the possibility of a new universal scientific empiricism. Agricola's name itself — a Latinization of Georg Bauer — suggests something of the transitional character of his project, which he claimed was modeled on Columella's work on agriculture from the first century, *De Re Rustica*, a book that was printed in numerous editions during Agricola's lifetime.

With Agricola, the discourse of industry can be seen in embryonic form. The first book of *De Re Metallica* is an elaborate justification of mining, a striking example of the often explicitly polemical — and ideological — character of emerging discourses. Mining is defended against a variety of charges: that it is mere dumb toil based on luck rather than skill; that it is an unreliable source of wealth; that its products are useless; that its products inspire avarice and theft and war; that it brings disease and death to the miner; that it poisons streams and devastates forests and fields. Agricola's defense compares the disruptive aspects of mining to those necessary to other material pursuits: agriculture, hunting, and fishing. He absolves metals of any responsibility for the human evils they inspire. Mining permits a more civilized and efficient mercantile economy:

When ingenious and clever men considered carefully the system of barter, which ignorant men of old employed and which even to-day is used by certain uncivilized and barbarous races, it appeared to them so troublesome and laborious that they invented money. Indeed, nothing more useful could have been devised, because a small amount of gold and silver is of as great value as things cumbrous and heavy; and so peoples far distant from one another can, by the use of money, trade very easily in these things which civilized life can scarcely do without.²⁶

This statement is followed by a litany of barbarisms and distinctly non-metallic cruelties — hanging, burning, live burial, and so on — that would occur if mining were to be abolished. (This litany, worthy of illustration by Grünewald, is perhaps a veiled reference to the atrocities of the Peasant Wars.) For all its dark toil, mining is claimed here as a force of civilization and light.

Agricola's fundamental argument is prototypically utilitarian: "I see no reason why anything that is in itself

of use should not be placed in the class of good things."²⁷ But there are distant precapitalist limits to his thought. For example, Agricola contrasts the honourable wealth to be gained from investment in mining with that obtained dishonourably through usury.²⁸ In regarding mining as a legitimate source of wealth, he recognizes that wealth derives, not only from nature, but from dignified human labour. At least in his rhetoric, Agricola does not elevate the dignity of owners above that of wage-workers, or that of skilled labourers above that of common toilers. Not only would it "not be unseemly for the owners themselves to work with their own hands on the works or ore," but also "not even the common worker in the mines is vile and abject."²⁹ In understanding Agricola's thinking, we would do well to consider Agnes Heller's characterization of Renaissance attitudes toward work and wealth:

That age was the era of the birth of wealth. This wealth was regarded not as a starting point but as a result . . . men attributed it to wit, to cunning, to human cleverness, and it never entered their minds that wealth or money might become a value in itself, and the creator of values independent of man. This not yet fetishized thinking found expression also in the fact that when they spoke of the products, greatness, and dignity of human work (1) they never distinguished mental labour from physical, the 'mind' from the 'hands'; (2) they did not separate living and dead labour, the work process and the tools and objects produced in the course of earlier work processes; (3) they did not distinguish reified and non-reified forms of objectification.³⁰

But despite its respect for manual labour, *De Re Metallica* marks a transition from artisanal to engineering knowledge. A profound *political* difference can be seen between a text like Albrecht Dürer's *Course in the Art of Measurement (Unterweisung der Messung)*, published in 1525, and

Agricola's book. Dürer wrote in German and sought to instruct artisans and mechanics in a *practical* geometry. The Marxist philosopher Alfred Sohn-Rethel has seen Dürer's project as an important but ultimately unsuccessful attempt to resist the developing separation of intellectual and manual labour in the Renaissance.³¹ Agricola, on the other hand, sought to describe a new division and hierarchy of labour in the mines. He wrote in Latin, although an inadequate German edition of *De Re Metallica* quickly appeared. His book spoke primarily to mine owners, both nobles holding sovereign rights to claims and the new class of capitalist investors (to which Agricola himself belonged). *De Re Metallica* spoke also to the upper level of mine managers, foreman, and skilled artisans. The overall viewpoint of the book was a supervisory one, involving the novel attempt to construct a comprehensive textual description of the design and management of a complex labour process.

We should note here that with increased demand for metals in the late fifteenth and early sixteenth centuries, mining in middle Europe became increasingly subject to capitalization. The system of shared concessions worked by small groups of miners gave way to absentee ownership: the silver and copper mines of Saxony were commonly divided into 128 shares or more by the early sixteenth century. Miners responded by forming pitmen's associations, striking work when necessary. German miners were active allies of the peasants in the rebellion of 1525. But just as the forces of feudalism combined to smash that rebellion, so also did the nobility continue to assert ultimate control over mining through the exercise of sovereign rights, despite the appearance of capitalist forms of ownership and elements of modern class struggle.³²

How did Agricola use illustrations in *De Re Metallica*? With one exception, illustrations do not appear until the third of the twelve books. The isolated first illustration, presented near the end of the second book, provides a

negative example, depicting the use of a divining rod to locate veins of ore. Agricola condemns this practice as worthless, stressing that systematic visual inspection is more efficient than tactilely-inspired trial-and-error. Thus the subsequent illustrations attempt to show the miner "the natural indications of the veins which he can see for himself without the help of twigs."³³ These pictures are an early form of topographic illustration, often crude and confusing because of an attempt to graft a vertical cross-section of the earth onto a naturalistic landscape. The spatial codes are inconsistent, and often the reader must infer from definitions given in the text which veins are being shown in vertical cross-section, and which are being shown in alignment with the surface contours of the earth. Even with less ambiguous images, labeling is essential; these illustrations were not intended to be understood without reference to the accompanying text.

Indeed, Agricola's program is clearly a *physiognomic* one: the surface of the earth is to be read symptomatically for its indices of hidden wealth. The direction, type, and size of an underground vein can be assessed from surface seams. The intellectual skills employed are those of taxonomy and surveying: classification and a geometrically-based geography. Although these woodcuts fail to assume a unitary perspectival point-of-view (and in fact *must* deviate from a single viewpoint if they are to reveal simultaneously both the earth's surfaces and its depths), they nonetheless are in general accord with the fundamental axiom underlying perspectival representation. That axiom claims that nature in its essence consists of continuous and measurable space, and that all positions within this unitary space are relative.³⁴

The fourth book of *De Re Metallica* treats the method of delimiting claim boundaries, the hierarchy of mining officials, the legal obligations of share holders, and the general organization of work in the mines. In this book we

encounter an early form of abstract, industrial thinking, applied to both space and time. The only illustrations are nine rectangles of varying sizes and proportions, representing the various *meers*, or standard mining claims. Here mining is reduced to its economic essence. The bureaucracy of mine management is neatly described down to the level of foreman. Finally, Agricola describes a new time discipline, contrary to agricultural rhythms, a discipline which anticipates the continuous productive cycle of the factory. The "twenty-four hours of the day" are to be "divided into three shifts," although the foreman is not to impose the third, night shift "unless necessity demands it." In the one jarring passage among these pages of relentless, rational accounting, Agricola remarks that the miners on the night shift "lighten their long and arduous labours by singing, which is neither wholly untrained nor unpleasing."³⁵

The fifth book treats "the principles of underground mining and the art of surveying."³⁶ In these passages on the basic architecture and geometry of mining, the importance of intellectual labour is stressed. Further, the point-of-view established by the illustrations is an increasingly "abstract" one, a purely conceptual, supervisory overview which corresponds to no actual physical position. For illustrations which depict underground shafts and tunnels, a clearly decipherable system of cut-away views is established. The inner workings are pictured against a vertical mountainside scene. This vertical scenery could be read as the outcome of confused or conflated representational ambitions. On the one hand, these pictures employ spatial hyperbole to emphasize the characteristic mountainous geography of the German mining regions. (In German, a miner was traditionally a *bergmann*, a mountain man.) On the other hand, this "verticalization" is also an attempt to construct a diagrammatic space, a flat non-illusionistic space upon which the cross-section of the mine could be plotted. As with the earlier woodcuts that demonstrated the variety and

direction of ore deposits, here the viewer is expected to read the image as a composite of surface and interior views.

With these cut-away views, Agricola's illustrations begin to manifest an ontological similarity to mining itself. The eye digs away from the side, a metaphorical miner cutting at right angles to the actual diggings being pictured. The line of sight intersects the plane of physical toil. A hierarchy of labour and knowledge is charted here, at this intersection of "digging" and "looking;" the mole-like work of the diggers is subordinated to command from above and beyond the mine. As Agricola argued at an earlier point in his text, "the master's watchfulness in all things is of utmost importance."³⁶ Quite literally, the line of sight assumes the privileged status of *supervision*.

In accord with this emphasis on rational visual inspection, Agricola stresses the fundamental and preliminary importance of the intellectual skills of the surveyor, stating that "miners measure the solid mass of the mountain in order that the owners may lay out their plans, and that their workers may not encroach on other people's possessions."³⁷ If any one figure embodies intellectual labour in Agricola's schema, it is the surveyor, who stands between property and toil, between conception and execution, the master of what came to be called two centuries later in the *Encyclopedia*, "subterranean geometry." As evidence of this priority, Agricola describes and illustrates the instruments of the surveyor — compass, measuring rods, hemicycle, and plummet level — before treating any of the tools and machines necessary to mining itself. Agricola provides a long treatise on the practical geometry of surveying, moving from the principles and method of measurement by triangulation to a description of survey-plotting. We should note here that surveys were plotted on the above-ground "surveyor's field" of the same overall size as the underground mine. No reduced-scale maps or charts of underground mines were produced until after the sixteenth century. Thus one

condition of fully-developed technical illustration — the ability to make charts and diagrams from which accurate measurements could be taken — had not been met in Agricola's time. The diagrammatic elements of the woodcuts in *De Re Metallica* remain merely approximate, a matter of pedagogical demonstration rather than actual measurement. These are *models*, not *plans*; one more indication of the transitional character of this work.

Agricola's sixth book is devoted to the tools and machines used in mining. In the opening passages we find a clear separation of the representational roles assigned to word and image: the visual medium is reserved for static display and the text provides a narrative description of the work process. Thus, a visual inventory of the tools parallels a textual description of their uses. The overall order of the illustrations is taxonomic. Each object is more or less isolated, although similar or functionally related implements are included in the same illustration. Sometimes the order is one of *functional equivalence*: an array of hammers of different sizes, for example. In other illustrations an element of *functional contiguity* appears, suggesting the potential linkage of one tool to another: an array of buckets is shown in conjunction with iron hooks, for example. The pictorial rhetoric that emerges here underlies all realisms which treat the manufactured world as an ensemble of useful *objects*. To modern eyes, here is an early form of the illustrated catalogue void of all narrative or poetic elaboration: the object reduced to a condition of pure potentiality, waiting to be *used*.

These tools are displayed in a space which remains ambiguous, like that of the earlier woodcuts. Occasionally, two views or a disassembled view of a single implement are given, especially when a single view would have omitted important features. Tools are always shown in perspective; no attempt was made to isolate frontal, side, or overhead views. Again, these are not plans. In some pictures, the im-



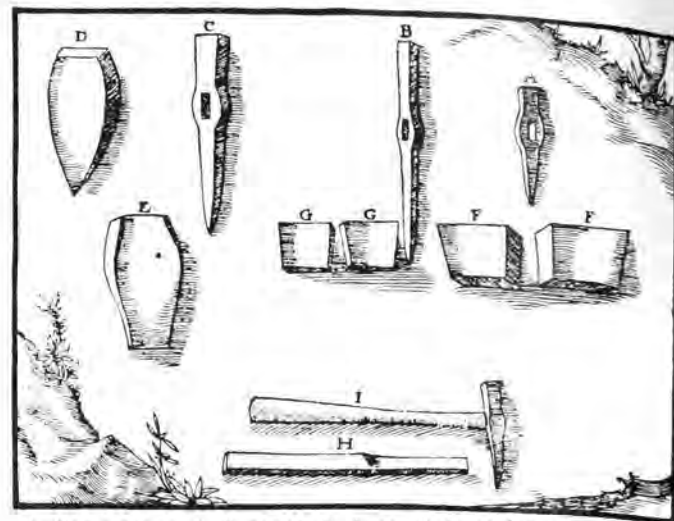
A—VEINS. C—TRANSVERSE STRINGER. D—OBLIQUE STRINGER.
E—ASSOCIATED STRINGER. F—*Libris dilatata*

Figure 3. From Book III



THREE HILLIARD-SHAFTS IN WHICH A DRY WET YET PLAIN THE TOWER, F. HILLIARD'S TOWER TO THE TOWER. F. THE TOWER HAS GOT YET BEEN TAKEN. G—TOWER.

Figure 4. From Book V



A—FIRST IRON TOOL. B—SECOND. C—THIRD. D—FOURTH. E—WEDGE. F—IRON BLOCK. G—IRON PLATE. H—WEDGES HANDLE. I—HANDLE INSERTED IN FIRST TOOL.

Figure 5. From Book VI

Figures 3-7. From Georgius Agricola, *De Re Metallica* (Froben, Basel) 1556, English translation by Herbert Clark Hoover and Lou Henry Hoover (*The Mining Magazine*, London) 1912.



Figure 6. From Book VI



A—IRON LAID FLAT ON THE GROUND. B—ITS BOTTOM WHICH IS MADE OF IRON WIRE. C—BOX INVERTED. D—IRON RODS. E—BOX SUSPENDED FROM A BEAM, THE INSIDE BEING VISIBLE. F—BOX SUSPENDED FROM A BEAM, THE OUTSIDE BEING VISIBLE.

Figure 7. From Book VIII

plements are shown arranged upon the ground, as if displayed by a workman to a viewer who looks down from an oblique angle. In others, the tools are shown suspended against yet another vertical mountainside scene. Thus, an abstract space, a space of display, is opened up within the naturalistic frame provided by marginal hints of shrubbery and rock. Even when tools are no longer shown upon the ground, the earth against which these tools will be used is indicated. Visual inspection and display remains in *touch* with the manual handling of tools. The abstract diagrammatic rhetoric of the engineer has not yet fully displaced the physically demonstrative rhetoric of the artisan.

More elaborate functional ensembles follow as the text of the sixth book moves from hand tools to machines. Cut-away views reappear: mechanical linkages are traced from the surface to the subterranean depths and back. The emphasis here is on the transmission of power for lifting, pumping, and ventilating. Agricola describes machines of increasing strength: hand-cranked windlasses are followed by horse and cattle-driven lifting engines. Waterwheels are shown connected to pumps; windmills are connected to ventilating fans and pipes. Power derives from no single source. Wind and water provide assistance, but the essential work is still the human toil of building mines and cutting away at the earth with pick and shovel. Here Agricola explicitly addresses the carpenter-engineer who constructs the mostly wooden machines. Thus, despite the complexity of these engines, the human figure continues to dominate the scene, physically, conceptually, and metaphorically. Technics and nature are anthropomorphized; remember that Agricola's epistemological model is anatomy. It is also worth noting that the wind is given a human face in these illustrations, following a cartographer's convention in vogue from the tenth to the eighteenth century. This anthropomorphism surfaces elsewhere in Agricola's belief in subterranean demons, or gnomes, who "mimic men" and are "clothed

like miners" and cause trouble.³⁹ (The remnants of this medieval mythology are visible in German kitsch statuary even today. The complementary view of the *miner* as a gnome-like, extra-human or even subhuman creature did not develop in Germany, but in England in the seventeenth century.)⁴⁰

The pictures in the sixth book underscore the division of labour outlined throughout Agricola's text. Human figures attend to different tasks, shoveling here, cranking there. And yet this labour remains sociable. Pairs of men are frequently shown engaged in conversation, as if to portray the discursive aspects of craft, and Agricola's own gleanings of verbally-transmitted craft wisdom.

The attention to mechanical linkages and sequentially-related tasks lends a certain narrativity to these pictures of work and machines, in contrast with those of tools. A single woodcut might show a machine under construction and in use. This representational strategy provides both an analysis of the machine — a delineation of its parts — and a description of the process of work. With these illustrations, the tasks of words and pictures are no longer so severely divided between visual display and verbal narrative. Now both words and pictures chart the temporal logic of cause and effect. A pictorial rhetoric of *production* emerges. In this sixth book, then, the mine is represented as a kind of *workshop*, in which manual tasks are assisted by machinery.

The subsequent books of *De Re Metallica* extend this treatment to the latter stages of ore processing: sorting, crushing, sifting, washing, smelting, refining and, finally, casting. Of these latter books, only the seventh, on assaying, describes an environment that differs from the workshop by being a site of measurement and evaluation rather than production. (In this assignment of a limited role to the laboratory, Agricola made a fundamental break with alchemy.)

I have devoted this much attention to *De Re Metallica*

because no other book of the Renaissance was as ambitious in attempting to describe the totality of an industry in words and pictures. Agricola's book was the repository and model of a new centralized knowledge, the knowledge of the engineer. This discourse assimilated, transcribed, rationalized, and transformed older artisanal knowledges that were transmitted both orally and by practical demonstration. Thus in the sixteenth century, the illustrated book (the technical treatise, the *manual*, the *handbook*) became the locus of a new discursive power — the power of supervision, of design, of scientifically-guided investment.

Herbert Hoover, a mining engineer and Republican president of the United States from 1929 until 1933, translated *De Re Metallica* into English between 1907 and 1912. His wife, Lou Henry Hoover, the better Latinist of the two, was the co-translator. Herbert Hoover offered the following assessment of Agricola's importance:

De Re Metallica . . . was the first important attempt to assemble systematically in print the world-knowledge on mining, metallurgy, and industrial chemistry. It was the great textbook of these industries for two centuries and had dominated thought and practice all that time. In many mining regions and camps, including the Spanish South American, it was chained to the church altar and translated by the priest to the miners between religious services.⁴¹

If we were to read Hoover's remarks with a degree of irony, we might think of *De Re Metallica* as a Bible of primitive accumulation; its truth presiding over what Marx termed the "extirpation, enslavement and entombment in mines of the indigenous population" of Latin America.⁴² Although labour conditions in German mines were markedly different from the horrors of Potosí, Agricola's text was of great technical value to the engineers of the massive New World mines. But Hoover perhaps overstates his case. *De*

Re Metallica was certainly the major text on mining until the eighteenth century, when steam power began to alter fundamentally the scale and character of mining operations in England. But between the sixteenth and eighteenth centuries, advanced German mining methods were also exported to the rest of continental Europe and to England by German miners themselves.⁴³ We might also recall that the quality of Agricola's observations had more than a little to do with the skill of his informants. If modern scientific empiricism begins in the fifteenth and sixteenth centuries with a respect for manual labour, it matures by forgetting and even inverting that initial respect. But that reversal is not complete until the very end of the nineteenth century, the beginning of the era of scientific management, when the labour-process becomes the object of rigorous scientific inspection and redefinition. As a principal American ideologue of professional engineering and champion of scientific management, Hoover stresses textual authority and underemphasizes the historical importance of artisanal forms of knowledge. In accord with Hoover's often-expressed belief in "rugged individualism," scientific truth is traced to a solitary author, rather than to any social nexus of technical knowledge. Thus, Hoover's translation was an attempt to construct a respectable intellectual genealogy for business-oriented engineering. He sought a classical "tradition" for an aggressive and youthful profession, a profession that was establishing its hegemony in American intellectual life during the early years of this century. Again, we need to read this genealogy against the grain.⁴⁴

And so Agricola was resurrected as a father of mining engineering at the beginning of this century, in what was yet another example of confident bourgeois historicism. But I want to pay more attention to the earlier stages of the rift between intellectual and manual labour, which means considering Agricola's influence on seventeenth and eighteenth century scientific thought. The line I want to trace runs from

Agricola to Diderot, from *De Re Metallica* to the *Encyclopedia*. The intermediary figure is Francis Bacon.

The Italian historian of science, Paolo Rossi, sees Agricola as one of a number of precursors to Baconian empiricism.⁴⁵ Along with Dürer, Vesalius, Rabelais, and other less well-remembered sixteenth century writer-artisans like Bernard Palissy and Robert Norman, Agricola stresses the dignity of manual work and the importance of learning from material practice. But it was Francis Bacon who first constructed a coherent philosophical program around this principle. Bacon's taxonomy of knowledge, outlined in *The Dignity and Advancement of Learning* of 1623, assigned a "most radical and fundamental" role to the study of the mechanical arts. As Bacon argued, the systematic study of "History Mechanical" prevented natural philosophy from vanishing "in the fumes of subtle or sublime speculation." In this Bacon echoed his predecessors. But Bacon also imagined a unified technical discourse, a discourse within which it might be possible to transfer the "observations of one art to the use of others."⁴⁶ For Bacon, cooperative technical knowledge was the source of truth, utility, and progress; its aim was the establishment of human dominion over nature. His utopian technological ambition was perhaps most clearly stated in his unfinished fable, *New Atlantis*:

*The End of our Foundation is the knowledge of Causes and secret motions of things, and the enlarging of the bonds of Human Empire, to the effecting of all things possible.*⁴⁷

Bacon's followers produced other, less fanciful models of technical education. William Petty proposed a *gymnasium mechanicum*, or "college of artisans," in 1648. The school was to make use of a book on the history of the mechanical arts:

*In this work bare words are not sufficient: all the tools and instruments should be painted and colored inasmuch as description, without colors, would turn out to be insufficient Young men, instead of reading difficult Hebrew words in the Bible, . . . or repeating like parrots nouns or irregular verbs, will be able to read and learn the history of human faculties From this work must needs derive a great progress of useful and honorable inventions since a man, at a glance, will be able to embrace all the work carried out by our predecessors and consequently be in a position to remedy all the deficiencies of an individual trade with the perfection of another.*⁴⁸

The text that sought to realize this ambition was the *Encyclopedia*.

The Encyclopedia; or Analytic Dictionary of Science, Arts, and Trades was published in twenty-seven volumes between 1751 and 1765. Eleven supplementary volumes of plates were published between 1762 and 1772.⁴⁹ This monumental compendium of universal knowledge was in many ways the emblematic textual product of the French Enlightenment. It was, in a sense, Leibniz' "republic of the mind" realized as a library. The editors, Diderot and D'Alembert, explicitly modeled their work on Bacon's inductive empiricism, his emphasis on the mechanical arts, his notion of collaborative science, and his organization of human knowledge.

Diderot, himself a cutler's son, sought an alliance of intellectual and manual labour, "a society of men of letters and of skilled workmen . . . men bound together by zeal for the best interests of the human race and by a feeling of mutual good will."⁵⁰ Although egalitarian on the surface, the relationship between thinker and artisan proposed by Diderot rested on a hidden hierarchy. In his "Prospectus" for the *Encyclopedia*, Diderot outlines, a virtual *circuit* of knowledge. Technical knowledge would flow from

artisans to intellectuals, from whom it would be returned to artisans in an altered and improved condition. In this schema, the intellectual was the *active* agent, the agent of change, while the worker was a more *passive* figure, a resource.

I'd like to consider this circuit, this *Enlightenment machine*, in a bit more detail. The characteristic eighteenth century man of letters was ignorant of the mechanical arts; thus, for Diderot, "everything impelled us to go directly to the workers."⁵¹ The skill of the worker was necessary for scientific progress, but in itself it was inert and incapable of development. For Diderot, workmen were by and large inarticulate and unreflective people:

Most of those who engage in the mechanical arts have embraced them only by necessity and work only by instinct. Hardly a dozen among a thousand can be found who are in a position to express themselves with some clarity upon the instrument they use and the things they manufacture. We have seen some workers who have worked for forty years without knowing anything about their machines. With them, it was necessary to exercise the function in which Socrates gloried, the painful and delicate function of being midwife of the mind, obstetrix animorum.⁵²

Doubtless there was some measure of truth in Diderot's assessment of his informants. But doubtless also there was another history, an unwritten and lost history of *artisanal resistance*, of stubborn and deliberate *dumbness* in the face of Diderot's probings. In contrast to Diderot, Marx, while commenting on the "petrification" of craft knowledge through the eighteenth century, at least conceded that the craft secrets, or "mysteries," were actively defended by protocols of silence.⁵³

The Encyclopedists considered traditional work as if it were nature, as if it were a submerged activity, beneath

reason. Work was specific, contingent, habitual, unchanging. For Diderot, the first part of the solution was the *active seizure* of work by empirical reason. Intellectuals who desired to become technical pedagogues not only had to observe the trades but also practice them in a limited fashion, to "become apprentices."⁵⁴

The second part of Diderot's program required that the new intellectual understanding of work be *represented*. His "Prospectus" treated traditional artisanal practices as if they were silent, lacking in all but the most primitive forms of language. (To be fair to Diderot, we should note that he also criticized the semantic poverty of intellectual discourse.) Workers learned "more by the repetition of contingent actions than by the use of terms." For Diderot, work-knowledge was bound to the specificity of its referent, and to the endless need to repeat the same actions. Accordingly, there was no such thing as an autonomous artisanal speech, no general language of work. Diderot stated this quite bluntly: "In the workshop it is the moment that speaks, and not the artisan."⁵⁵

A language had to be invented. Otherwise, work could not be liberated from the endless repetition of the "moment." Scientific language was to be the motor of progress, the means by which work could begin to "advance toward perfection."⁵⁶ It was precisely the *image* that could offer up the "moment" of work for scientific inspection. So, like Vesalius and Agricola, Diderot sought to construct a visual and verbal discourse for the communication of scientific truths. But unlike his sixteenth century predecessors, Diderot, following Bacon, explicitly sought to *universalize* the discourse of instrumental science. This goal of an all-embracing system of practical reason is the distinguishing feature of Enlightenment thought. Diderot's "Prospectus" is a metacommentary, a deliberate treatise on the *means* of representation; its object is not work as such, but work mediated by language.

Diderot proposed a uniform method of representation, applicable to all the mechanical arts. This method combined narration with analysis. The narrative of industry began with nature, with raw materials, and traced a sequence of linked productive steps. This path was intersected by a number of inventories; of raw materials, of tools, of finished products. The characteristic form of illustration used in the *Encyclopedia* involved the placement of a workshop tableau (or vignette) above an abstract inventory of tools or products. For Roland Barthes, the plates are a model of the Encyclopedic mind; and a preliminary diagram of the "thinking machine:"

Here we find prophetically formulated the very principle of cybernetic ensembles: the plate, the image of the machine, is indeed in its way a brain; we introduce substance into it and set up the "program;" the vignette (the syntagm) serves as a conclusion. This logical character of the image has another model, that of dialectics: the image analyzes, first enumerating the scattered elements of the object or of the operation and flinging them on the table before the reader's eyes, then recomposing them, even adding to them the density of the scene, i.e., of life.⁵⁷

I owe a lot to Barthes' essay on these plates; certainly he provides the essentials of a semiology of instrumental realism. But Barthes is more or less silent on one crucial issue: the division of labour. He argues that, "the Encyclopedic image is human not only because man is represented in it but also because it constitutes a structure of *information*."⁵⁸ Barthes fails to perceive the division of humanity into two camps, those who *work* and those who *know*. For ultimately, in the system of practical knowledge constructed by the Encyclopedists, the worker is the *object* but never the *subject* of knowledge. Barthes recognizes a certain violence in these images, but it is violence directed

at nature, not at those who work. He detects a logic of classification, appropriation, and domestication, but this power is embodied in an abstract human subject. His reading does not touch on the discursive power that places the spectator, the surveyor, in a superior position to the manual worker.

Consider this: many of the plates show "only the hand of the artisan in action" (Diderot).⁵⁹ For Barthes, these artisanal hands are "inevitably the inductive sign of the human essence." But in the century following the publication of the *Encyclopedia*, the hand was eclipsed by the machine; artisanal craft succumbed to machine industry. Nevertheless, the image of the hand lingers. Barthes notes that "our advertising constantly returns to this mysterious motif." (The imaginary replenishment of a lost essence?) He continues, "It is not easy to be done with a civilization of the hand."⁶⁰ But it is precisely the "cybernetic ensemble," intellectual labour, that facilitates the replacement of the hand by the machine, the replacement of living labour by dead labour.

Diderot proposed an instrumental mode of looking: an economy of the look. Like Vesalius, Agricola, and William Petty, he sought to replace vague terminologies with accurate pictures. But pictures were not only regarded as accurate and comprehensive records. Implicitly, pictures were *fast*, they offered an *accelerated* way of knowing. Like Petty, Diderot sought to know *at a glance*. As he put it: "A glance at the object or at its picture tells us more about it than a page of text."⁶² This is obviously an early formulation of what has become a modern cliché of the *worth* of pictures. Diderot claimed to have commissioned his illustrations with an eye toward efficiency:

As for the figures, we have restricted them to the important movements of the worker and to only those phases of the operation which it is very easy to portray and very difficult to explain. We have held

ourselves to essential circumstances, to those whose picture, if it is well executed, necessarily results in the knowledge of the other circumstances which one does not see.⁶²

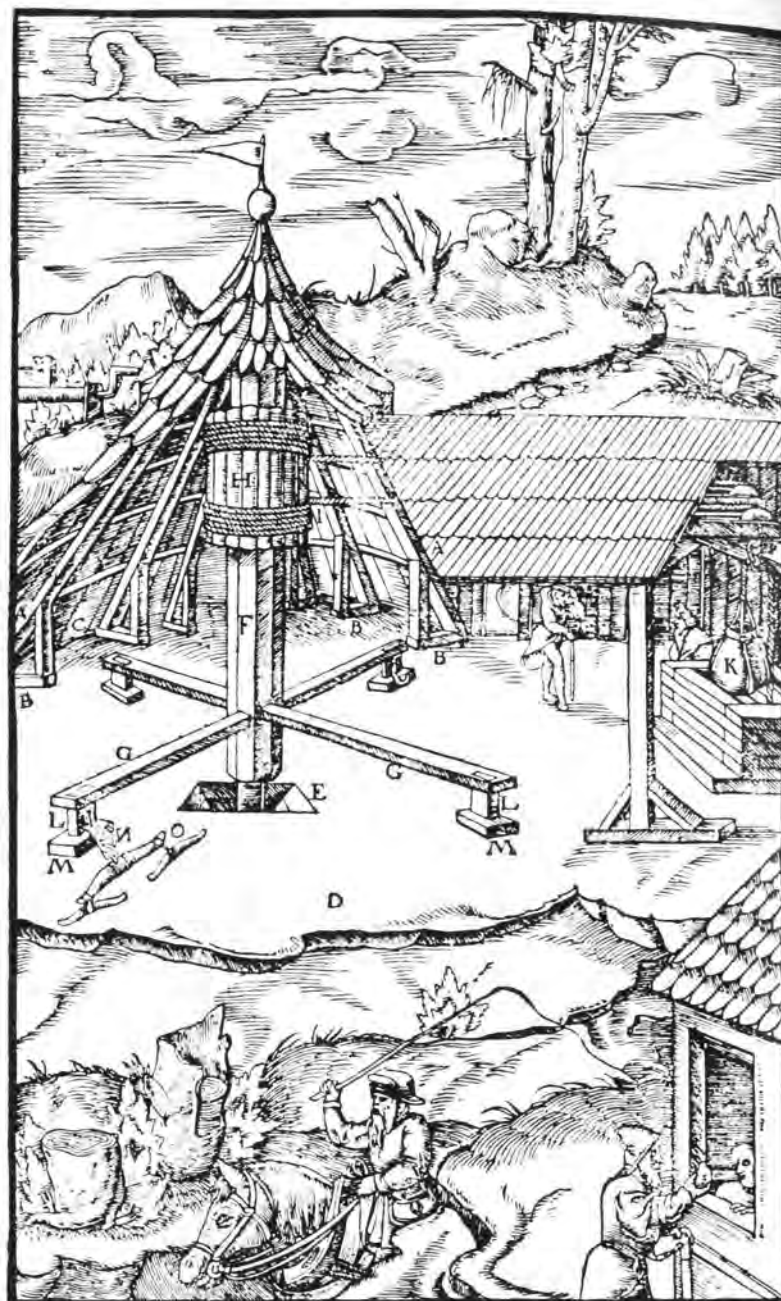
The strategy of pictorial selection that emerges here would become fundamental to the production of photographic archives in the next two centuries.

However, as I've already suggested in the first part of this essay, the instrumental pictorial archive can easily be severed from its moorings. For our purposes, one of Roland Barthes' most important insights is his understanding of the relationship between autonomous looking and estheticism, his understanding of the way in which *spectacle* emerges:

... technological purpose no doubt compelled the description of objects, but by separating image from text, the Encyclopedia committed itself to an autonomous iconography of the object whose power we enjoy today, since we no longer look at these illustrations with mere information in mind.⁶³

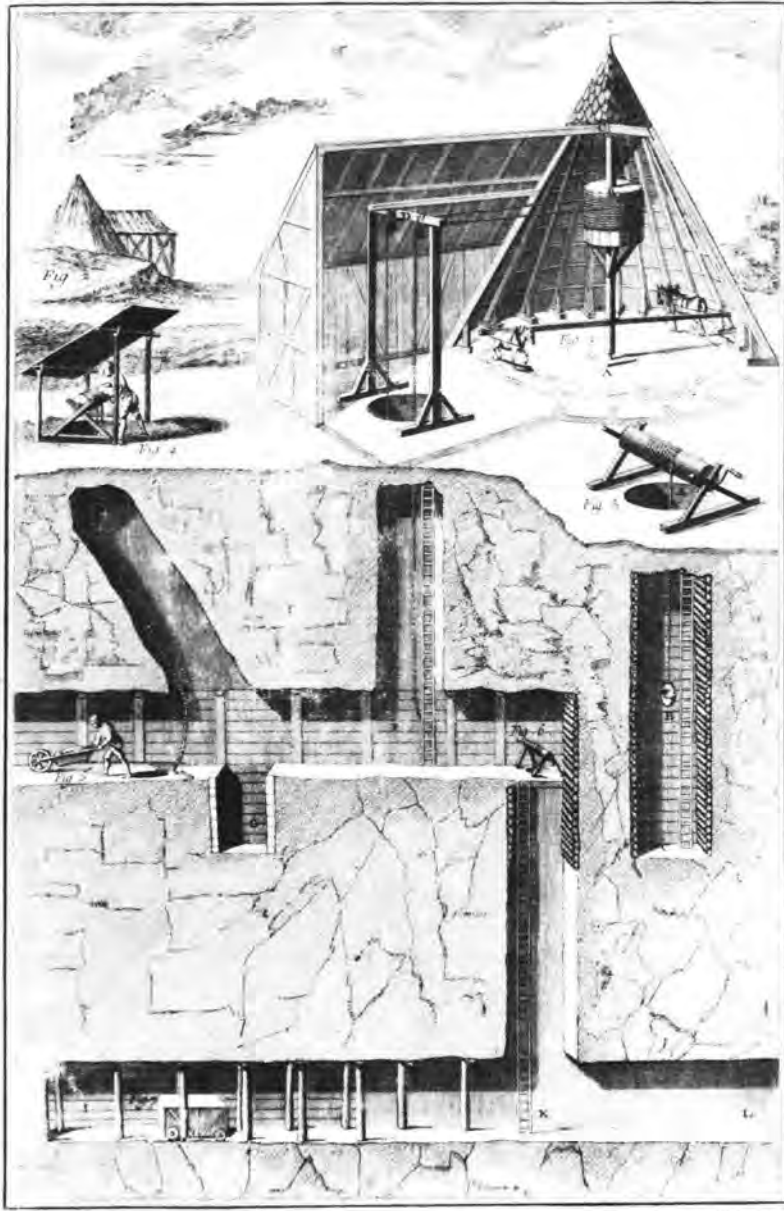
The figure of this "disinterested" spectator, this tourist, is already present in some of the mineralogical plates of the *Encyclopedia*. This figure does not survey instrumentally but merely looks at what becomes, by virtue of that act of looking, a *landscape*. For Barthes, the look invited by the *Encyclopedia* is ultimately fantastic and surreal; analytic reason never achieves its goal. What Barthes detects in these plates, although he doesn't name it as such, is the muted resonance of the *sublime*, an unnameable and awesome plenitude of nature.

The mineralogical plates of the *Encyclopedia* are the meeting ground of nature and culture. Nature is at first awesome; in the initial plates, Vesuvius erupts. Next, geological formations are shown being inspected by well-dressed spectators. Mining follows; nature is tamed. Then



A—UPRIGHT BEAMS. B—SILL—LAID FLAT UPON THE GROUND. C—POST. D—AREA. E—SILL SET AT THE BOTTOM OF THE HOLE. F—AXLE. G—DOUBLE CROSS-BEAMS. H—DRUM. I—WINDING-ROPE. K—DUCKET. L—SMALL PIECES OF WOOD HANGING FROM DOUBLE CROSS-BEAMS. M—SHORT WOODEN BLOCK. N—CHAIN. O—POLE BAR. P—GRAPPLING HOOK. (Some members mentioned in the text are not shown).

Figure 8. From Georgius Agricola, *De Re Metallica*, Book VI (Froben, Basel) 1556. English translation by Herbert Clark Hoover and Lou Henry Hoover (*The Mining Magazine*, London) 1912.



Pl. 19. Machines de la Mine de St. Etienne, Pl. II.

Figure 9. From Jean Le Rond d'Alembert and Denis Diderot, editors, *L'Encyclopédie, ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers* (Paris) 1751-1772.

the *Encyclopédie* follows the same sequence as *De Re Metallica*. The use of the divining rod is illustrated only to be condemned and replaced by surveying. The mines themselves are shown as if they were underground workshops: clean, geometrically-ordered spaces. The technology of mining remains more or less the same as that depicted in *De Re Metallica*. The steam engine, although used in English mines since 1712, does not appear. What is novel in the *Encyclopédie* is that mining has fallen into place within a universal taxonomy of industries. It becomes possible to imagine new linkages and substitutions, a new mobility of labour power, for example. A cyclopean eye — the eye of science and capital — inspects the whole of human industry. The *Encyclopédie* illustrates a world of production that can be engineered, made better, made to “advance toward perfection.” Thus the *Encyclopédie* is the conceptual guidebook to a mode of industrial production that was only just beginning to be forged in the eighteenth century.

* * *

Photography inherited and transformed the role assigned to illustration in the *Encyclopédie*. There was an explicit and enthusiastic element of encyclopedism in early photographic discourse; photography was frequently lauded as a “universal language” and as the new epitome of scientific representation. As I suggested in the first part of this essay, photography promised a global inventory or archive of appearances, appearances taken “directly from nature.” Accordingly, the triumph of photography involved changes in both the quantity and quality of visual “truth.” What sort of truth-claims were made for photography? Generally speaking, the enthusiasm for photographic truth was Baconian in character: photographs were seen as initial empirical moves in an inductive process. Unlike the hand-drawn illustrations in the

Encyclopedia, which were for the most part generalized or idealized *models* based on more direct empirical observation, photographs *invariably* traced the specificity of individual objects and events. Presumably, only a process of empirical sampling or a theatrical staging could allow a photograph to stand for a *typical* instance. As the American philosopher C.S. Peirce pointed out, photographs are physical traces of their objects; that is, they belong to the category of *indexical signs*, signs that are linked by a relation of physical causality or connection to their objects.⁶⁴ Because of this indexical property, photographs are fundamentally grounded in contingency, even if subsequent contextualizations and interpretations might obscure or even deny the contingency of the photograph's origins.

For a culture committed to an inductive model of scientific reasoning, the photographic plate could be seen as the meeting ground of nature and science; here was a preliminary, and physically direct, reception of nature. As a bearer of truth, the photograph exhibited a paradoxical double authority, an authority attributed to both "nature" and "science." The camera appropriated nature for science, and did so by scientific means; but unlike other machines it was passive, receptive. Thus photography, as a cultural practice, could signify both the domination and preservation of nature. The camera could preserve remnants of a pre-industrial world, while embodying the very essence of technological progress. Photography could offer its mid-nineteenth century audience both the past and the future. Nature (and the past) could be restored to an imaginary completeness by means of the mechanical perspectival synthesis effected by lens and light-sensitive surface. Or nature could be submitted to the logic of analysis; fragmented, dissected, measured. The tension between these two possibilities — between romanticism and scientism — pervades photographic discourse.

Daguerre's characterization of his inventions is instruc-

tive: "the DAGUERREOTYPE is not merely an instrument which serves to draw Nature; on the contrary it is a chemical and physical process which gives her the power to reproduce herself."⁶⁵ What grew in this *medium* was a *culture*, a decipherable nature, a nature reconstituted, re-presented as *language*. For many early observers, photography was a language that surpassed all other means of representation, precisely because of its transparency, its "identity of aspect" with its object. In an early description of the daguerreotype, written in 1840, Edgar Allan Poe argued in this vein:

*All language must fall short of conveying any just idea of the truth, and this will not appear so wonderful when we reflect that the source of vision itself has been, in this instance, the designer. Perhaps, if we imagine the distinctness with which an object is reflected in a positively perfect mirror, we come as near the reality as by any other means. For, in truth, the Daguerreotyped plate is infinitely (we use the term advisedly) is infinitely more accurate in its representation than any painting by human hands. If we examine a work of ordinary art, by means of a powerful microscope, all traces of resemblance to nature will disappear — but the closest scrutiny of the photogenic drawing discloses only a more absolute truth, a more perfect identity of aspect with the thing represented. The variations of shade, and the gradations of both linear and aerial perspective are those of truth itself in the supremacy of its perfection.*⁶⁶

Once captured in its infinitude, this nature could then be subjected to analysis. Poe continued in the next and final paragraph of his article to suggest that "among the obvious advantages" of the new medium was the possibility of measurement: "the height of inaccessible elevations may in many cases be immediately ascertained, since it will afford an absolute perspective of objects in such situations."⁶⁷

Poe seems to have borrowed this claim from François Arago who stressed the possibility of what would later be

called photogrammetry, or survey-plotting based on photographs, in his 1839 report to the French Chamber of Deputies on the virtues of Daguerre's invention. Arago's assessment of the objectivity and utility of photography was in many ways exemplary and was frequently echoed by other early promoters of photography. He welcomed photography as an *acceleration* and refinement of the encyclopedic project:

To copy the millions of hieroglyphics which cover even the exterior of the great monuments of Thebes, Memphis, Karnak, and others would require decades of time and legions of draughtsmen. By daguerreotype one person would suffice to accomplish this immense work successfully Since the invention follows the laws of geometry, it will be possible to re-establish with the aid of a small number of given factors the exact size of the highest points of the most inaccessible structures.⁶⁸

After an interlude in which he deferred to the authority of the painter Paul Delaroche for an opinion on photograph's usefulness to the arts, Arago turned to an even more abstract form of measurement: *photometry*. For Arago, who was a physicist and astronomer, here was the first practical method for comparing light intensities with some degree of rigour and consistency:

We do not hesitate to say that the reagents discovered by M. Daguerre will accelerate the progress of one of the sciences, which most honors the human spirit. With its aid the physicist will be able henceforth to proceed to the determination of absolute intensities; he will compare the various lights by their relative effects.⁶⁹

With this proposal, which might seem rather lacklustre to those of us who have come to regard photography as a medium which produces images, Arago's enthusiasm became boundless. His address went on to argue that future scien-

tific applications of photography were virtually impossible to predict, but likely to be numerous beyond belief.

As a physicist, Arago welcomed photography as yet another instrument for the mathematicization of nature. His comments on photometry suggest that he was able to isolate conceptually and even privilege the indexical properties of the photograph, envisioning a role for the new medium that was completely independent of any iconic, or picture-making, function. And photometrics aside, here was a pictorial medium from which exact mathematical data could be extracted, or as Arago put it, a medium "in which objects preserve mathematically their forms."⁷⁰ Photography doubly fulfilled the Enlightenment dream of a universal language: the universal *mimetic* language of pictures yielded up a higher truth, a truth that could be expressed in the universal *abstract* language of mathematics. For all its messy contingency, photography could be accommodated to a Galilean vision of the world as a "book . . . written in the language of mathematics."⁷¹

In another early commentary on photography, the notion of a photographically mathematicized nature took on an explicit *economic* character. The American physician, poet, and essayist Oliver Wendell Holmes proposed a grand encyclopedic archive, a global library of *exchangeable* images. For Holmes, the meaning and value of the photograph ultimately resided in its *exchangeable character*, its inclusion within this global archive which translated all sights, all visions, into relations of formal (and mathematical) equivalence. Holmes regarded photography as the stripping of form from matter, and foresaw "a universal currency of these banknotes . . . which the sun has engraved for the great Bank of Nature."⁷² Metaphorically, he made the connection between photographic representation, quantification, and commodity exchange. Photography submitted the world to a uniform logic of representation, just as the global market economy established a uniform logic of exchange. Holmes

was writing in 1859. Eight years later, Marx published his analysis of the theretofore obscure logic of capitalist exchange relations. With Marx's aid, we can understand that Holmes was proposing a system of communication that mirrored the logic of commodity fetishism. Just as exchange value came to eclipse the use value of commodities, so the very form of the photographic sign came to eclipse the contingency of its referent. Like the commodity (and, indeed, *as* a commodity) the photograph appeared to have a "life of its own." As Holmes put it with the characteristic optimism of his epoch and his class: "We have got the fruit of creation now, and need not trouble ourselves with the core."⁷³

The arguments of Arago and Holmes indicate that photography was quickly absorbed into what the German sociologist Georg Simmel termed in 1900 the "calculating character of modern times."⁷⁴ But photography was not promoted only as a positivist instrument for the further mathematicization of the world. Nor was it seen only as an encyclopedic machine for establishing a global archive of knowledge and a universal system of communication. Understandably, photography was also embraced in *utilitarian* terms: that is, in terms of a social calculus of pleasure and discipline. Especially in England, early promoters of photography struck up a Benthamite chorus. Here was a machine for supplying happiness on a mass scale, for providing in Jeremy Bentham's famous phrase, "the greatest happiness of the greatest number."⁷⁵ Photography, and particularly the photographic portrait, was welcomed as a socially ameliorative instrument. Jane Welsh Carlyle voiced characteristic hopes in 1859, when she described inexpensive portrait photography as a social palliative:

Blessed be the inventor of photography. I set him even above the inventor of chloroform! It has given more positive pleasure to poor suffering humanity than

*anything that has been "cast up" in my time . . . — this art, by which even the poor can possess themselves of tolerable likenesses of their absent dear ones.*⁷⁶

In the United States, similar but more ambitious utilitarian claims were made. A prominent American portrait photographer, Marcus Aurelius Root, published a book-length treatise on photography entitled *The Camera and the Pencil* in 1864. Root's rambling manual is interesting for a number of reasons. Writing in a country without a monumental cultural archive, he was able to make an unabashed claim for photography's status as a fine art. For Root, photography did not simply disseminate a remote high culture by means of reproduction, but also stood as an art in its own right. Furthermore, Root proposed a formal canon for commercial portrait practice, juggling instruction in the physiognomic interpretation of character with practical lessons in flattery. But what is most interesting for our purposes here is Root's persistent attention to the *moral effects* of photography. Like Carlyle, he stressed the salutary effects of photography on working-class family life. Photography provided the vicarious experience of travel and thus the means of cultural enlightenment for the working classes, so that, for example, "all forms and diversities of natural sublimity and beauty" might be "inspected in their minutest particulars by the day-laborer, surrounded by his family at his own fireside." Family photographs sustained sentimental ties in a nation of migrants. This "primal household affection" served a socially cohesive function. Root argued in a characteristically American vein: "a nation is virtuous and united according as the households composing it are well ordered and bound together by mutual regard." Furthermore, widely distributed portraits of the great filled daily life with a regular parade of moral exemplars.⁷⁷

After cataloguing these familial functions, Root moved on to list actual and potential scientific and industrial applications of photography, ranging from the illustration of

scientific specimens to the production of photographic advertisements for "machinery, mortuary monuments, and a multitude of articles besides." He then turned to industrial supervision and military reconnaissance:

Civil engineering, mining works, and all military operations may profit largely from photography In the construction of the Grand Trunk Railway of Canada, it is said that the chief engineers of Great Britain were able to supervise the work, virtually in person, without leaving their homes.

*In war the camera is variously useful in taking views of fortifications, or other places, to be attacked, and in exhibiting the effects of cannonfire upon breaches; in giving correct representations of the difficulties of any route to be traversed by troops; or in getting from a balloon a view of the enemy's forces. . . .*⁷⁸

Indeed, the first sophisticated applications of photography to engineering problems seem to have been made in military contexts. French military engineers developed practical photogrammetric methods during the 1850s. At least one of the several published works on "military topography" and "topographic reconnaissance" from that period explicitly acknowledged Arago's 1839 prediction of the value of the new medium for mathematically accurate rendering.⁷⁹ Photographs also seem to have played a role in the transfer of military technologies from the continent to the United States. Photographs made in 1855 in Crimea by James Robertson were reproduced as lithographs in an elaborate American volume entitled *The Art of War in Europe*.⁸⁰ These lithographic plates of intact and demolished fortifications were indexed to structural diagrams and maps. The author of this text was a military attaché and major in the Corps of Engineers. Appropriately enough this compendium of lessons from technologically superior European armies was published in 1861.

Having commended photography to the pursuit of politics by other means, our American portraitist Root returned to his chosen genre:

*Public order seems likely to be . . . secured by the custom lately adopted, of taking photographic likenesses of all criminals sentenced Such persons . . . will find it not easy to renew their criminal careers, while their faces and general aspects are familiar to so many, especially to the keen-sighted detective police.*⁸¹

And here Root's utilitarianism comes full circle. Beginning with cheaply-affordable esthetic pleasures and moral lessons, he ends with the photographic equivalent of that exemplary utilitarian social-machine, the Panopticon. The Panopticon, or Inspection House, was Jeremy Bentham's proposal, written in 1787, for an architectural system of social discipline, applicable to prison, factory, workhouse, asylum, and school. The operative principle of the Panopticon was total and perpetual surveillance; unable to see into the central observation tower, inmates were forced to assume that they were watched continually. (As Thomas Hobbes remarked over a century earlier, "the reputation of Power is Power.")⁸² The salutary effects of this program were trumpeted by Bentham in the famous opening remarks of his proposal:

*Morals reformed—health preserved—industry invigorated—instruction diffused—public burdens lightened—Economy seated, as it were, upon a rock—all by a simple idea of architecture.*⁸³

With Bentham, the principle of supervision, which we saw in embryonic form in the writings of Agricola, takes on an explicit industrial-capitalist character. Even Bentham's prisons were to function as profit-making establishments, based on the private contracting-out of convict labour. Within the Panopticon, every space, every operation, and every

human action was to be tailored to the logic of efficiency.⁸⁴

And so photography did not simply inherit and "democratize" the honorific functions of bourgeois portraiture. Photography served to introduce the Panopticon principle into daily life. Every portrait implicitly took its place within social and moral hierarchy. The *private* moment of sentimental individuation, the reception of the gaze-of-the-loved-one, was shadowed by two other, *public* looks: a look up, at one's "betters;" and a look down, at one's "inferiors." Nevertheless, photography could promote an imaginary mobility within this hierarchy; serving to honor the unhonored by granting them the momentary dignity of a conscious, isolated pose.

If I have dealt with Marcus Aurelius Root at length here, it is because the utilitarian program he described is essentially that which characterizes the institution of photography as it came to be practiced within mass culture. In a sense, he described a paradigm for everyday photographic realism, a realism that links sentimentalism and instrumentality, binding together familial happiness, social discipline, and a faith in science. This unity is fragile and fraught with contradictions.

Again, I want to stress the industrial character of this system of realism, its fundamental ground in large-scale mechanized production, not only of photographic materials, but of photographs themselves. Early observers of the American photographic portrait industry spoke of daguerreotype "factories" in New York City, establishments in which the process of portrait-making was subjected to an assembly-line style division of labour.⁸⁵ The triumph of photographic representation can be regarded as a particular instance of the more general economic transformations of the nineteenth century. Just as the artisanal mode of production gave way to what Marx called "machinofacture" in that century, so photography came to supplant hand-drawing, painting, and engraving as the dominant form of

visual culture. Photography mechanized both the primary act of representation and, ultimately, the means of pictorial reproductions as well. This displacement of pictorial handwork was not complete until after the development of high speed photomechanical reproduction in the eighteen nineties.

The advent of photography met resistance on many fronts. Charles Baudelaire articulated sentiments that were elitist, quasi-aristocratic and bohemian as well when he argued, "when industry erupts into the sphere of art, it becomes the latter's mortal enemy."⁸⁶ Photography also generated a distinct *artisanal resistance*. Honoré Daumier and Gérard Fontallard produced cartoons welcoming photography as an art of layabouts and dolts. Both regarded photography as an exercise in passive clock-watching. Fontallard depicted a daguerreotypist sleeping through a long exposure, watch in hand; the caption read, "Talent through sleep."⁸⁷ Daumier produced a lithograph of a photographer and customer waiting out an exposure. His caption read, "Patience is the virtue of asses."⁸⁸ The response of photography's defenders was to glory in the mechanical character of the medium when truth was at issue, and to repress that character when esthetic claims were being made. In a sense, the dominant culture of photography generated its own denial and its own alibi.

The bourgeois portrait gallery and studio in nineteenth century America was a deliberately anti-industrial space, a combination museum, parlour, and secular church: ornate, almost roccoco in its decorative embellishment. The "better" galleries stressed craftsmanship and leisurely comfort in their advertising, decor and finished products, thereby distinguishing their services from the overtly industrial operations of galleries patronized by the lower classes. The space of the gallery allowed for an imaginary flowering of the self, an expressive *completion* of the social ego. The time encapsulated in the formal portrait was distinct from industrial

and commercial time. In 1851, a French writer described the opulence of American studios and went on to suggest something of the relation between the portrait photograph and everyday life.

Everything is here united to distract the mind of the visitor from his cares and give to his countenance an expression of calm contentment. The merchant, the physician, the lawyer, the manufacturer, even the restless politician, here forget their labors. Surrounded thus, how is it possible to hesitate at the cost of a portrait.⁸⁹

The portrait was the suspended moment of what Thorstein Veblen was to term "conspicuous leisure," a leisure that harked back to pre-industrial civilization for its values.⁹⁰

Until the advent of photographic modernism in the second decade of the twentieth century, most culturally ambitious photographers studiously avoided the iconography of industrialism, preferring instead the pastoral, the baroque, the sentimental, and the romantic individualism of the portrait. (Alfred Stieglitz's photographs of steamships, dirigibles, and aeroplanes mark a watershed for self-conscious art photography.)⁹¹ Since photography mechanized both the manual and a good portion of the intellectual work of visual representation (that is, the intellectual work of perspectival construction), the figure of artistic genius had to be reconstructed. On the one hand, an attempt was made to reintroduce craft to photography through the appropriation of painterly methods and painterly styles of presentation. On the other hand, and this was the modernist tendency, artistic work came to be regarded as a primarily *intellectual* undertaking, more or less independent of the exercise of manual skill. Vision was disembodied, and was given priority over manual and mechanical skill. But here we are getting ahead of our story.

So much, for the moment, for the work of photographic

representation. What can be said about the photographic representation of work, and particularly, of work conducted underground? Perhaps the earliest underground photographs were those made by Nadar in the sewers and catacombs of Paris in 1861. Nadar combined serious esthetic ambition with technological bravado and a flair for publicity. In a famous and rather ironic lithograph, Daumier depicted Nadar "elevating photography to artistic heights" while photographing Paris from a balloon, floating above a city cluttered with lesser photographers' studios.⁹² Nadar seems to have persistently sought the technological limits of photographic representation by linking the camera with new sources of transport and illumination: before he gained his reputation as an aeronaut, he descended underground with electric lights, photographing first the city sewers, which were then being rebuilt as part of Haussmann's reconstruction of Paris.⁹³ Next Nadar photographed the city's catacombs. His projects underground seemed to have been planned with publicity in mind; the catacombs were already being opened up for tourists several times a year, and the new sewers were to become important tourist attractions by the time of the Paris Exposition of 1867. The sewer photographs can easily be read as pictorial expressions of technological optimism: the galvanic arc illuminated the underground architecture of a new urban hygiene. Electricity itself could be welcomed as a hygienic force. The catacomb pictures are a bit more complicated. Perhaps no more obvious metaphor than this necropolis could have been found for the old Paris that was being razed to make way for the "Paris of the sightseer."⁹⁴ Clearly, the catacombs were a spectacle, but they were a spectacle in the sublime mode, filled with darkness and death. Nadar's galvanic arc brought enlightenment into space, banishing, or at least domesticating the sublime, pushing it back into the shadows. His pictures, like the plates of the *Encyclopaedia*, depict what Barthes called "a world without fear."⁹⁵ In this light we might recall



Préparatifs d'un Bourrage.

Figure 10. Nadar. Preparation for a "jamming" of bones into the walls of the Paris catacombs. 1861.

Diderot's resolutely materialist commentary on the sublime:

Everything that astonishes the soul, everything that impresses it with a sensation of terror, leads to the sublime... Darkness adds to terror. . . Priests, raise your altars, erect your temples in the hearts of forests. . . Let your arcane, theurgic, bloody scenes be lit only by the fateful glare of torches. Light is useful when you wish to persuade; it is worthless for emotional effect.⁹⁶

Nadar, for his part, recalled his subterranean project as a kind of encyclopedic quest; this was an entirely rational endeavor, a triumph of science over the mysteries of death:

The world underground offered an infinite field of activity no less interesting than that of the top surface. We were going into it, to reveal the secrets of its deepest, most secret, caverns.⁹⁷

Again, it was electricity that illuminated this hidden place. Nadar seemed to have viewed exaggerated claims for electricity with skepticism, but at the same time, he shared the attitudes of his epoch in regarding electric power as a marvelous and *autonomous* force. In a passage in his memoirs (written in 1900) in which he described his skeptical but interested reception of a confidence-man with a scheme for taking "electric photographs" at a distance, Nadar celebrated electricity in terms that can only be described as characteristic of commodity fetishism:

We had seen it invisibly discharge all duties and perform all functions, realizing all the dreams of the human imagination. Obedient and ready to execute our commands, this all-powerful yet discreet servant is unrivaled in all its forms A first-class worker, a Jack-of-All-Trades — one at a time or all at once as you like. . . ⁹⁸

Now suppose we return to Nadar's photographs of the catacombs with this passage in mind. For some extraordinary reason, perhaps out of respect for the encyclopedic paradigm, Nadar felt compelled to introduce the figure of *human labour* into these scenes. Thus his photographs demonstrated a sequence of instrumental actions: the hauling, sorting, and "packing" of bones in the underground vaults. In this cold, bright, materialist light, such as process could only be seen as a kind of negative industry, as the reversal of mining. There was a tension in Nadar's project between the absolute novelty of revelation, and a recognition that the world underground was already the site of human labour. On the one hand: the seeing of that-which-has-not-been-seen-before, the muted appeal to morbid appetites, the momentary taming of the sublime by electric light. On the other hand: a routine. Nadar extracted a republican moral from this quasi-industrial dismantling of skeletons. Here, in the mixing, sorting, and packing of ordered ensembles of bones of "great men, saints, and criminals" he discovered an "egalitarian confusion of death."⁹⁹ The bourgeois observer of these pictures is invited to sit in two seats; the seat of the spectator, confronting a republican *memento-mori*, and the seat of the boss, dependent upon, but in command of, other people's labour and the scientifically-harnessed forces of nature.

There is a further irony in these pictures from the catacombs. Nadar was forced to expose his collodion-on-glass negatives for as long as eighteen minutes. Since no living worker could be expected to stand still for so long, the figures we see in these photographs are *mannequins*, clothed in workers garb. Nadar's dummies stood-in for their living counterparts, and in so doing indicated the future refinement of photographic technique, when living movement would be photographically recorded as apparent stasis. (That is, these pictures wistfully anticipate the motion studies of Muybridge and Marey.) Thus we can read this substitution

in a number of ways: as a compensation for technical inadequacy, as technological prophecy, and finally, as a comment on the artificiality, the perversity, of photographic representation. Nadar's overtly theatrical construction could be taken as a self-conscious demonstration of the already inherently static, arresting, and consequently anti-natural property of the photographic medium. Despite the flow of electricity, this underground produced nothing more than a still life, a *nature morte*. But perhaps this line of interpretation attributes to Nadar a proto-modernist sensibility that is otherwise contradicted by his faith in the progress of photographic realism. Nevertheless, this much can be said. Photographs such as these suggested that the naturalism of the static image was of a limited order. It was as if photography, with its manifest ability to arrest a fragment of temporal duration, challenged for the first time the apparent naturalism of the established pictorial arts. (More accurately, perhaps, this challenge had begun with the changing scenes of the diorama, if not with optical toys that produced the illusion of movement.) Thus photography undermined even its own authority by bringing to the foreground the issue of the representation of time. This lack, this absence of movement, could only be overcome by the invention of cinema.

There is more to be said about these curious photographs from the catacombs of Paris. The perversity of these pictures has another aspect, an economic and psychological dimension. Here was the visible, figurative complement to Nadar's anthropomorphized, workmanlike electricity. Just as the source of illumination was personified, so the figure of human labour was reduced to dumb static objectivity. In these pictures, living labour was figuratively consigned to the city of the dead. Inasmuch as Nadar's mannequins were iconic *substitutes* for living workers, they were also the signs of the *replacement* of living labour by "dead labour," by machinery. When we recall that Nadar obviously sought to illustrate a *sequence* of ac-

tions, it is possible to understand that the narrative linkage of these static mannequin positions was as much the model of a functioning automation as it was the description by fictional means of a process performed by living workers. Conversely, we might argue that Nadar sought to symbolically revivify an underground world of machines and death. These artificial "workers" compensated for the dead, and for the absent and problematic figure of the photographic artist. Thus, in the face of mortality and mechanization, the *image* of life is preserved.

With this ensemble of static, artificial *tableaux*, Nadar can be said to have revealed — more or less unwittingly — not only the *modus operandi* of photography, but that of capitalism as well. These photographs provide an exaggerated paradigm for the photographic realism of the industrial engineer (as well as that of the nineteenth-century maker of death portraits). The realism of the engineer frequently accords the worker the status of a prop — humanly "interesting" and useful for establishing the relative scale of inanimate objects, but ultimately replaceable by a machine. But the overt artifice and the morbidity of Nadar's pictures also suggests an undercurrent of another less optimistic paradigm — that of romantic anti-capitalism. I'm thinking here of that genre of horror fiction in which the proletariat appears as a marauding zombie or automaton, the genre which can be said to begin with Mary Shelley's *Frankenstein* and end with George Romero's *Dawn of the Dead*, a film in which the zombies emerge initially from the ranks of the permanently unemployed.

I am arguing here that Nadar's underground project generated photographic meaning along both the metonymic and metaphoric axes of linguistic expression. This rhetorical dualism was intentional. Nadar's metonymic ambition, his essential *realism*, led him to technologically extend the limits of photographic representation, to discover new vantage points, new illuminating powers. On the other hand,

Nadar sought to metaphorize his underground excursions; that much is clear from his autobiographical account. The world underground and especially the catacombs were conducive to allegorical suggestion, even without the overt theatricality of his staging, which further impells our reading in that direction.

In short, it is because of Nadar's presence as an *author* that we assign to these first underground photographs a rather unique allegorical status. The allegory involved a contradictory ideological movement: toward a materialist *demystification* of religion and aristocratic class privilege, and toward the *mystification* of material science. In this, the essentially bourgeois character of Nadar's republicanism and materialism is evident.

Moving from tombs to mines, I want to begin by examining the reception — both contemporary and historical — of one of the earliest examples of underground photography in a mine. To the extent that this reception has sought to invest these first mining pictures with cultural and artistic value, the industrial character of the enterprise has been suppressed, denied, or oddly distorted. Nadar sought, in part, to "materialize" death by portraying the processing of the dead as a variety of subterranean industry. Now we will examine the opposite tendency, the attempt to idealize subterranean industry (and photography itself) by interpreting underground photographs as a variety of religious icon or formal abstraction.

The photographs I have in mind were made by Timothy O'Sullivan in the silver mines of the Comstock Lode in Nevada in 1867. These were not the first pictures of underground mining operations; burning magnesium was used to expose stereo views of an English coal mine as early as 1864. O'Sullivan's pictures, which also employed magnesium light, were made in conjunction with the United States Geological Survey of the Fortieth Parallel. The survey was sponsored by the War Department, and directed *in*

absentia by the Chief of Army Engineers. However, unlike earlier surveys, this one was conceived, planned, and directed by a civilian geologist, and staffed by civilian scientists. Clarence King, the geologist-in-charge, was a young, aggressive, theoretically sophisticated and politically well-connected graduate of Yale's Sheffield Scientific School. King proposed a thorough mapping of the region bordered by the Sierras on the west and the front range of the Rockies on the east, encompassing the then virtually uncharted terrain of the Great Basin and the central Cordilleras.

The bulk of O'Sullivan's pictures were extraordinary views of geological formations and topographic features of the American West. On first consideration, the mining pictures would seem to be the novel products of a side excursion. Indeed, this is how they were presented to the public in the one contemporary journalistic account of the photographic aspects of the expedition, and this is also how they are now being re-presented by photographic historians.

Overall, O'Sullivan's photographs have been accorded a special status by historians of photography, and he himself has been assigned a prominent position in the pantheon of early photographic artists. Interpretations of these pictures tend to emphasize either their artistic or their scientific importance, although the former tendency predominates. This tension between estheticism and scientism is characteristic of the historiography of photography, and is especially evident in the reception of O'Sullivan.

On the one hand, various attempts have been made to assess O'Sullivan's "landscapes" in relation to the esthetics of the sublime, and in particular to establish continuity or discontinuity between his work and that of nineteenth century American landscape painters like Frederic Church and Albert Bierstadt. Ultimately, such readings assign a metaphorical meaning to the photographs. The most sophisticated and exhaustive version of this tendency is found in the recent monograph on O'Sullivan by Joel

Snyder, who finds in the photographer's work a rehabilitation of the quest for the sublime, a quest that — in Snyder's view — had been debased by painters dallying with the picturesque.¹⁰⁰

On the other hand, Rosalind Krauss has recently examined O'Sullivan's pictures in relation to what she terms, quite aptly, "the discourse of the survey." Krauss criticizes the art historical appropriation — and decontextualization — of photographs which are more correctly to be understood as metonymic fragments, as empirical elements in a vast scientific "mapping" project. Overall, Krauss is seeking to describe the two discursive formations — one metaphoric and the other metonymic — within which photographic meaning is generated.¹⁰¹

Krauss and — in less critical way — Snyder are both aware of the antinomy between artistic and scientific thought in nineteenth and twentieth century culture. (Snyder tries to diminish the tension by suggesting that O'Sullivan's pictures were "both documentary and expressive," a typical claim, and one that leads in this and most cases to a privileging of the expressive function.)¹⁰² Nevertheless, their work perpetuates this antinomy by failing to seriously consider the social and economic conditions of scientific and artistic work. They fail to address the *fundamentally instrumental* character of the Western surveys. Thus the spectres of "pure" art and "pure" science emerge from their meditations on O'Sullivan. Snyder seeks to describe a creative innovation, and thus to isolate a moment of autonomous artistic subjectivity. For Krauss, the photographer is an actor within an objectively-given discursive formation. Her approach assumes that the discourse of photographic realism, "the discourse of the survey," can be understood without addressing issues of ideology, interest, and power. The idealism inherent in these two critical approaches pivots, ultimately, on another famous "antinomy of bourgeois thought": that between subjec-

tivism and objectivism. As Marx argued, that antinomy can only be overcome in a *practical* way.¹⁰³

We can look at this problem in another way. The almost exclusive emphasis on O'Sullivan's "landscapes" or "topographical views" tends to strengthen the impression that the encounter between white men and "nature" was of a strictly contemplative order, and that this contemplative encounter took two forms for its human subject, that of esthetic awe and that of disciplined scientific curiosity. The mining photographs, however, present a nature that had *already* been radically altered by organized human energies. They introduce another spectre, that of industry. That spectre, because it raises the issue of practice, proves to be embarrassing for idealist historiography.

How *have* art historians regarded the mining photographs of Timothy O'Sullivan? Snyder, for his part, stresses the "technical achievement" of working underground with wet plates in mines where temperatures climbed to 130 Fahrenheit. He claims that "men could work for about one-half hour at most before returning to the surface." A labour historian, Richard Lingenfelter, agrees about the temperatures but disagrees about the length of miner's shifts in the Comstock Lode: "The miner usually worked a shift of from eight to ten hours."¹⁰⁴ Snyder, like many art historians, seems to have given little thought to the actual conditions experienced by those who live and work in the world depicted by artists. Whatever the source of his error, he manages to condense the time normally spent underground into a period roughly suitable for the making of a wet-plate photograph. For Snyder the artist's work overshadows all other work. And so he concludes that "the strong pictorial quality of the results make the accomplishment even more remarkable."¹⁰⁵

Perhaps the most curious assessment of the Comstock Lode photographs is found in the first extensive art-historical study of Western "landscape" photographs, an

exhibition and book entitled *Era of Exploration: The Rise of Landscape Photography in the American West, 1860-1885*.¹⁰⁶ This project, while rich in information, manifests its art-historicist bias in its reference to United States government-sponsored geographical and geological surveys as instances of "government patronage," as if we were talking about some nineteenth century version of the National Endowment for the Arts. Here is how James N. Wood, curator of the Albright-Knox Art Gallery which co-sponsored the exhibit along with the Metropolitan Museum of Art, describes O'Sullivan's underground pictorial work:

*At Virginia City O'Sullivan descended into the shafts of the Comstock Lode to photograph with an improvised magnesium flash apparatus. Taken hundreds of feet below sunlight, these were the earliest known photographs of mine interiors. O'Sullivan intuitively seized upon the structure of this subterranean world with its imprisoned population working within the shafts. Few photographers since have conveyed so intensely the claustrophobic experience underground. His image of miners waiting to descend the Curtis Shaft of the Savage Mine contains a sense of finality reminiscent of a Last Judgement while his image of a mine cave-in is simultaneously a factual record of the disaster and a strikingly abstract composition.*¹⁰⁷

Evidently, these photographs are all things to all viewers. By Wood's account, they fall into at least five generic categories: technological firsts ("earliest known photographs"), humanistic social documentary ("imprisoned population"), reportage ("factual record"), religious allegory ("Last Judgement"), and, last but not least, abstraction. Thus the move is made from religious idealism to the secular esthetic idealism of modernism.

Both Wood and Snyder fail to explain adequately what the King survey party was doing in the Comstock Lode.



Figure 11. Frontispiece and title page from *Mining Industry* by James D. Hague and Clarence King. Professional papers of the Engineer Department, U.S. Army, No. 18 (Washington, 1870). Lithograph by Julius Bien from photograph by Timothy O'Sullivan. Caption: "Shaft-landing of Savage Mine."

UNITED STATES GEOLOGICAL EXPLORATION OF THE FORTIETH PARALLEL.
CLARENCE KING, GEOLOGIST-IN-CHARGE.

MINING INDUSTRY

BY

JAMES D. HAGUE

WITH GEOLOGICAL CONTRIBUTIONS

BY

CLARENCE KING.

SCRIBED TO THE CHIEF OF ENGINEERS AND PUBLISHED BY ORDER OF THE SECRETARY OF WAR UNDER AUTHORITY OF CONGRESS.

ILLUSTRATED BY XXXVII PLATES AND ACCOMPANYING ATLAS.

AND STATE

UNIVERSITY

WASHINGTON

GOVERNMENT PRINTING OFFICE

1870

UNITED STATES GEOLOGICAL EXPLORATION OF THE FORTIETH PARALLEL.
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Figure 12. Frontispiece and title page from *Descriptive Geology* by Arnold Hague and S.F. Emmons. Professional Papers of the Engineer Department, U.S. Army, No. 18 (Washington, 1877). Lithograph by Julius Bien from photograph by Timothy O'Sullivan. Caption: "Eocene Bad-Lands—Washakie Basin—Wyoming."

What importance was attached to the study of mining by the survey? Furthermore, what role did O'Sullivan's mining pictures play in the official government documentation of the expedition? If we discount a very limited number of sets of albumen prints, O'Sullivan's pictures received their widest distribution in the form of lithographic copies in three of the seven volumes of the final survey reports. Here we can begin by noting that the photograph described by Wood as "reminiscent of a Last Judgement" was published an extraordinary *seven years* before any of the now better-known pictures of geological formations. This picture provided the frontispiece to *Mining Industry* (1870), the first of the volumes to be published. Thus, this comprehensive scientific report on the West began with an image full of industrial promise. O'Sullivan's "landscapes" and "topographic views" appeared in *Descriptive Geology* (1877) and in the theoretical *magnum opus* of the survey, King's *Systematic Geology* (1878).

Thus, topical priority was given to immediate problems of mining engineering and to the geological evaluation of mineral resources. King, however, reasserted the privileged position of geological science by assigning *Systematic Geology* a numerical position as the first volume of the series. The more empirical and less theoretical *Descriptive Geology* followed as volume two, and the practical *Mining Industry* followed in turn as volume three.¹⁰⁸

Clarence King outlined the goals of the project in terms that clearly revealed the conjunction of pure and applied science. The one hundred mile wide belt of land mapped by the survey team encompassed both the route of the Union Pacific Railroad and the Cordilleran mountain system: this choice of terrain was made "alike for the purposes of illustrating the leading natural resources of the country contiguous to the railroad and for purely scientific research."¹⁰⁹ The study of Comstock Lode mining methods had immediate practical results; King and his mining-

engineer colleagues Arnold Hague and James Hague proposed major improvements in ore smelting methods and correctly predicted that deeper mining would strike richer veins of silver.

Historian William Goetzmann has argued that King, more than any other individual, "incorporated the West into the realm of academic science."¹¹⁰ *Systematic Geology*, with its rigorous induction of the geological history of the Cordilleran system, was a masterpiece of nineteenth century American scientific thought. But despite the fact that King replaced the "solider-engineer" of earlier surveys with the scientific specialist, the Fortieth Parallel Survey was implicated from the beginning in larger strategies of conquest, colonization, and industrialization. We need to understand the relationship between King's voice and that of the state. Goetzmann, a cultural historian stresses a point art historians seem eager to forget:

He [Clarence King] intended to survey the land forms of the region, map them with a new degree of accuracy . . . and he planned to examine closely all the possibilities for economic development along the line of the railroad, particularly those having to do with mining. In addition, there was the added military increment not stated but clearly in the minds of those who were concerned with subduing the Indians and settling the West. General Sherman's overall military policy . . . depended upon pushing the railroad through Indian country and with it a wedge of settlers . . . eventually overwhelming the redmen with civilization and sheer population. King's survey contributed mightily to that long range strategy. Even his scientific findings were directly relevant to military considerations.¹¹¹

Goetzmann provides ample evidence that King was ideologically suited for this mission. As first director of the United States Geological Survey between 1880 and 1882,

King emphasized mining industry over all else; he resigned to pursue (unsuccessfully) his own mining interests. King "believed that mining and technology, rather than agriculture, were the keys to Western development." Furthermore, "he was a Whig who conceived of government as a means of helping business."¹¹²

One final point needs to be made about the reception of O'Sullivan's photographs. Art historians like Joel Snyder have sought to affiliate the formal severity of these pictures with King's catastrophic geological theory, which held that geological change was a matter of intermittent cataclysmic upheavals. For King, the "earth's surface-film" bore the evidence of ancient violence, and this record could be "read" as a historical narrative.¹¹³ Catastrophism rejected the uniformitarianism of Charles Lyell, who saw geological development as a gradual process. King gave his science a theological cast, and argued further that "moments of great catastrophe, thus translated into the language of life, became moments of creation, when out of plastic organisms something new and nobler is called into being."¹¹⁴ Snyder argues in turn that O'Sullivan was ideally suited to the task of recording the static, frozen evidence of geological upheaval: he had photographed corpses in the aftermath of Civil War battles. For Snyder, "the human counterpart of explosive, natural action is war."¹¹⁵ This analogy between organized political violence and geological upheaval is a commonplace yet remarkable mystification, a mystification in keeping with King's own metaphysics. How is it possible to construct a cultural history of the conquest of the American West without recognizing the instrumentality, the *social* violence, and the commercial interest inherent in that project? Snyder's interpretation is an example of the profoundly *conservative* character of photographic historiography in the United States.

Catastrophism provides Snyder with a theoretical ground upon which to effect the merger of science and the

artistic quest for the sublime. O'Sullivan is presented as an artist in the Burkean mold, confronting a nature that is terrifying and awe-inspiring. The search for sublimity is extended to the mining photographs, with their evidence of underground danger and disaster. Snyder emphasizes the hellish temperatures of the mines, and the claustrophobic experience underground. Similarly, James Wood's earlier essay on O'Sullivan stresses underground imprisonment, claustrophobia, and disaster. It is worth noting that the editors of *Mining Industry* did not include any of O'Sullivan's *underground* pictures in that volume, but selected instead a neatly symmetrical view that presented a disciplined work crew about to descend into the depths. The remaining illustrations were engineering drawings of the mining machineries and the timbering system used in the deep mines of the Comstock Lode. *Mining Industry* followed in the tradition of the *Encyclopedia* by presenting ordered arrangements of mechanical components. But, with the exception of the frontispiece, the tableau or "vignette" is absent, no image of human labour or of the sheer mass of the earth is anywhere to be found. These are technical drawings; elements are presented in a virtually abstract space. (To late-modernist eyes, the diagrams of timbering systems look remarkably like illustrations of sculptures by Sol Lewitt.) The reality was somewhat different: the major disaster in the Comstock Lode during the late 1860s was a fire which raged out of control in the extensive timbering underground. In fact, it was the intensive capitalization and industrialization of mining operations in the West that brought into being a new degree of risk and danger for miners. In this case, the "sublime" resided, not in nature, but in the character of the organized human intervention into nature. I would argue that King's catastrophism was ideologically in keeping with his vision of an industrially-harnessed Western landscape.

In order to understand the transformation of the

sublime, we ought to turn to the work of the English art historian Francis Klingender, whose *Art and the Industrial Revolution* is an intriguing study of the ways in which the rhetoric of the sublime was applied to industry in late eighteenth and early nineteenth century England. Klingender describes a new and complex fear experienced by observers of the new industrial environment. This fear, this experience of the "industrial" sublime, had a *social* dimension. One remark seems especially pertinent:

*The sense of awe and terror which the middle-class visitor was likely to experience at a mine was not, however, entirely due to the strangeness of the scene, the wild appearance of the men or the danger of their work. The effect produced was heightened by a growing consciousness that the miners, and indeed the industrial workers generally, were beginning to form a distinct, ever more numerous and hostile nation.*¹¹⁶

A similar fear did not develop in the United States until the 1870s. Militant miners, particularly the "Molly Maguires" of the Pennsylvania anthracite fields, were to become objects of hatred in the middle-class press. The Comstock Lode was another early site of militant industrial unionism, beginning in the years just before the visit by the King survey.¹¹⁷ As in Agricola's Saxony in the sixteenth century, here the making of pictures, capitalization, and the intensification of class struggle seem to have curiously coincided.

The invention of photographic dry plates in the 1880s permitted photographers to work underground with greater ease. The Smithsonian Institution commissioned a Pennsylvania commercial photographer, George Bretz, to make pictures inside anthracite mines. Bretz, like Nadar, used electric light. These photographs, and others commissioned later by the coal operators, were displayed at a number of international industrial expositions between 1884 and 1893. In

the late 1870s Bretz seems to have covered both sides of the class war in the Eastern Pennsylvania coal fields. He photographed Franklin B. Gowen, president of the Philadelphia Reading Coal and Iron Company and state prosecutor in the trial of a number of the Molly Maguires. Bretz also made formal portraits of the ten convicted unionists on the day before their execution by hanging; these pictures he sold as *cartes de visite*. In the 1890s Bretz gave lantern-slide lectures on mining, with catchy titles like "Black Diamonds." His career seems to be the earliest example of the kind of diversified work done in the 1950s by Leslie Shedden, combining a small-town commercial practice with documentation of the coal industry.¹¹⁸

* * *

Thus far I have discussed isolated and early examples of underground and mining photography, the sorts of examples that are easily enveloped in a mythology of origins. We need to explore the *institutionalization* of industrial photography.

Despite the fact that industrial photographs were made as early as 1850, and despite the fact that a lineage of technical realism can be traced back to the sixteenth century, the technological, economic, and ideological conditions for modern industrial documentation did not fully emerge until the very end of the nineteenth century. For our purposes here, I am defining as "modern" any system of documentation in which pictures are made available for circulation in mechanically-reproduced form. Before the 1890s photographic prints depicting machines and industrial operations were displayed chiefly on ceremonial occasions. At the international exhibitions, beginning with the London Crystal Palace Exhibition of 1851, the photographic print was a technological novelty in itself, and eventually a means of incorporating remote and untransportable industrial artifacts and sites (such as coal mines) into the spectacle of goods and inventions. Despite their modernity, their novel status as the



Figure 13. George Bretz, Face of breast, miner at work using Patent Drill or coal auger, Kobinoor Colliery; one of the first U.S. coal mine interior views by electric light, 1884.

ephemeral museums of the present, the mid-century Exhibitions adhered to an eighteenth century model of the museum. Walter Benjamin hints at the overlap of archaism and modernity in these displays: "World exhibitions were places of pilgrimage to the fetish Commodity."¹¹⁹ The more modern system of display would allow the commodity to embark on a pilgrimage of its own. One form of that pilgrimage began in the 1880s and 1890s with the development of the stereograph industry. Companies like Underwood and Underwood introduced Oliver Wendell Holmes' "universal currency" into the schoolrooms and middle-class parlours of the United States. Otherwise, industrial photographs usually were translated by hand into engravings in technical publications and journals of "popular" science like *La Nature* in France and *Scientific American* in the United States. Finally, with the invention and refinement of the half-tone process in the late 1880s and 1890s, the camera and the high-speed offset printing press were made compatible. By 1900, the photograph can be said to have become the dominant form of visual culture, a form that was capable of subsuming all previous modes of static visual representation. The traffic in photographs shifted into high gear.

Archives became "active" repositories of images. Photographs were commissioned with the expectation that they would be widely reproduced. In turn, the possibilities of reproduction began to determine the character of commissions. Clearly, other technical developments of the 1880s and 1890s were crucial to the progress of industrial documentation. Hand cameras, flash powder, as well as rapid dry plates permitted photographers to work in dim factory interiors, and to record clear images of moving workers and machinery.

However, it would be a mistake to assume that the work performed by Leslie Shedden and countless other photographers before him was grounded in technological innovation alone. What larger economic and social condi-

tions created specific and often conflicting needs for photographic documentation of industrial processes and environments?

Industrial documentation is fundamentally an outcome of the second industrial revolution, that is, of the emergence and triumph of the monopoly form of capitalism in the years between 1880 and 1920. I'm speaking here of the United States, although developments in the rest of the industrialized world more or less conformed to this pattern. The distinctive features of this transformation were these: the concentration of industrial ownership, the movement toward mechanized and largescale production, the harnessing of scientific research, the development of bureaucratic and "scientific" methods of management, and, historically last but not least, the intensified and "scientific" use of advertising to both legitimate and motivate mass consumption.

These factors all contributed to a pressing *internal* demand for images of industry. Large firms began to accumulate archives, and to employ photographers on a regular basis. Within the industrial firm, photographs were used to document capital improvements, to illustrate catalogues of industrial equipment, and ultimately to intervene directly in the labour process. These "operational" documents were seen by engineers and managers. Applied photography also became an important adjunct to instruction in engineering. (I teach at a university where instruction in photography had its origins in 1891, within a college of engineering.) In these contexts—the industrial firm, the engineering college, the professional engineering journal—the role assigned to photography was primarily functional. The image served as a convenient empirical substitute for the object, as evidence, as demonstration, as model. But this functional realism had an ideological and political-economic dimension as well. We'll return to this last issue in a moment.

The simultaneous development of a highly competitive picture press based on advertising and directed at a broad

public created an *external* demand for photographs of industry, although it can be argued that the essential modernist iconography of the machine was not fully integrated into mass culture until the 1920s. It should also be noted that advertising, in keeping with the logic of commodity fetishism, tended (and still tends) to obliterate the industrial origins of goods. When the factory was visible, it was visible as "news," as esthetic spectacle, or as popular instruction in the wonders and workings of modernity. In these contexts, the meaning of the industrial photograph was more ideological than functional. Only in journals of popular mechanics do we find any pretense of useful instruction, a pretense made pathetic by the increasing scale and complexity of industrial production. Such journals reconstituted autonomous craftwork as a domestic hobby, but did so with a fascinated eye on the larger world of production.¹²⁰

By 1915, the external machinery of the media was being fed images and stories by the new internal machinery of corporate public relations. Concerted efforts were made to demonstrate the progressivism, public-spiritedness, and "humanity" of large-scale bureaucratic enterprise. The rise of public relations was in large measure a response to vehement criticism of industrialists by trade unionists, socialists, liberal journalists, and Progressive social reformers. (One of the earliest programs in public relations was orchestrated by a publicist named Ivy Lee, who began working in 1913 for John D. Rockefeller Sr. Lee's dime giveaway scheme is a well-known attempt to combine the lessons of corporate benevolence and petit-bourgeois thrift in a single avuncular gesture. Lee also fought mightily to restore the sullied reputation of John D. Rockefeller Jr. in the wake of the 1914 Ludlow Massacre of striking Colorado coal miners and their families. It is further worth noting, especially in this context, that Lee's external efforts at "image enhancement" had their internal complement in an early program of industrial relations. Rockefeller hired MacKenzie King, former Canadian

Secretary of Labour, to patch things up with the defeated miners. King led Rockefeller on a personal tour of the Ludlow area. In one mining town Rockefeller danced with the miners' wives and promised the residents a bandstand and dance pavillion. Ultimately King and Rockefeller were able to sell a majority of the miners on what amounted to a company union. King went on to become Prime Minister of Canada for all but five of the years between 1921 and 1948.)¹²¹

In social reform work especially, we find another sort of photographic investigation of the industrial environment, one that sought evidence of the social crisis engendered by the rise of monopoly capital. Historians of photography have tended to privilege this latter mode of documentation, in part because of the remarkable work of Lewis Hine, but also out of a persistent need to demonstrate the moral efficacy and essential humanism of a mechanical and instrumental medium. (This need to establish the ethical power of the photograph is almost as strong as the need to establish the esthetic credentials of the medium.) Consequently, the complex relationship between the realism of the social reformer and the realisms of the engineer and the public relations officer has been generally neglected. Especially overlooked has been the tendency of corporate officials to appropriate elements of the rhetoric and substance of social reform.

If we discount the less frequent and largely second-hand use of photographs by turn-of-the-century socialists and trade unionists (a subject which needs further study), the most obvious tension to be found in early twentieth century representations of industry existed between the discourse of the engineer and the discourse of the social reformer. Engineers worked directly for industry. Even though they were increasingly critical of antiquated methods of capitalist administration, and increasingly assertive of their own professional autonomy and expertise, engineers accepted private ownership of the means of production and viewed their own

profession in entrepreneurial terms. Social reformers were a more diverse group, largely a coalition of middle-class professionals—social workers, lawyers, and sociologists. Social reform groups also counted among their members some trade unionists, socialists, middle-class feminists, and even some women of the working class who had been rebuffed by the male-dominated trade union movement. The support for social reform work came indirectly from capital, through philanthropic organizations like the Russell Sage Foundation. The majority of social reformers implicitly accepted the logic of private ownership, but sought to extend civil protection to the working class.

Though engineers were distinguished from reformers by their relentless obsession with Efficiency, by the middle of the second decade of the century, these two discourses began to merge, or rather, the new science of management began to absorb lessons learned from the social reformer. What emerged finally was a new paradigm of social-engineering. This paradigm accepted the need for government regulation of industry, recognized the importance of public relations and acknowledged the value of sociological and psychological considerations in the management of labour. The social reformer, on the other hand, increasingly accepted the logic of efficiency promoted by the engineering professional.

Clearly what I'm presenting here is a very schematic overview of complex historical changes. This much should be recognized: Leslie Shedden's work for Dosco, like most other industrial photography done after 1940, is an amalgam of visual rhetorics which were once distinct, and even politically antagonistic. Shedden made pictures that can best be described as "technicist:" pictures that operated within the tradition of technical realism. But he also made pictures that could be described as "humanly-interesting," and—if the word wasn't automatically assumed to be an honorific—"humanist." These latter pictures were indebted to a tradi-

tion of social realism, that is, to the realism of the social reformer. By the 1920s, that social realism had begun to diffuse, its rhetoric no longer necessarily served a reformist purpose.

What can be said of this "realism" of the engineer? During the period in question—the years between 1880 and 1920—the engineering profession constituted itself as a new and powerful agent of capital. Gradually but forcefully, engineers seized technical and intellectual control of the labour process and effectively abolished an older system of production based on the knowledge and skills of the artisanal worker. The avatar and principal architect of this movement, which came to be called "scientific management," was a mechanical engineer from Philadelphia named Frederick Winslow Taylor.

More than any other individual, Taylor realized the project that was incipient in Diderot's writings on the mechanical arts over a century earlier. Diderot proposed an alliance of artisans and men of letters, but I have argued that this alliance favoured the potential power of the intellectual observer. It was the intellectual who was to become the master of empirical language and universal learning. Taylor established the power and authority of the practical and specialized intellectual in matters of production. He grounded that power in experiment, in the exercise of authority over work, and in professional pedagogy and polemic. In so doing, he declared open war on the very category of the artisan. Less openly, he—like others of his profession—waged war on the category of the universal intellectual. His unquestioning embrace of instrumental reason, his positivist attempt to discover the scientific laws of work were both the logical outcome and the final nosedive of enlightenment thought. Taylor proposed a world in which "thought" occupied a glassed-in booth, commanding the activities of those who had been robbed of thought. In this, as Daniel Bell has suggested, Taylor actually applied the Panopticon principle to

the modern factory.¹²²

Taylor's positivist revision of the encyclopedic project is evident in his description of the first principle of scientific management:

The first of the four groups of duties taken over by the management is the deliberate gathering in on the part of those on the management's side of all the great mass of traditional knowledge, which in the past has been in the heads of the workman, and in the physical skill and knack of the workman, which he has acquired through years of experience. The duty of gathering in all of this great mass of traditional knowledge and then recording it, tabulating it, and, in many cases finally reducing it to laws, rules, and even to mathematical formulas, is voluntarily assumed by the scientific managers.¹²³

For Taylor, the artisan's "rule of thumb" was overly empirical, mired in tradition, and both unwittingly and deliberately inefficient. Workers were both ignorant of the scientific bases of their work, and guilty of "systematic soldiering," or loafing under the piece-rate method of production.

Taylor's search for a science of work extended from the skilled trades to sheer toil. His most thorough experiments, which were conducted over a period of twenty-six years between 1880 and 1906, were devoted to the perfecting of machine tool work, one of the most highly-skilled of late-nineteenth century crafts. At the other extreme Taylor wanted to determine the brute quantity, in foot-pounds, of a "maximum day's work for a first-class workman" involved in unskilled labour. This "law" eluded Taylor's grasp, although his time-study and incentive "experiments" with pig-iron handlers were central to his reputation as a scientific accelerator of work.¹²⁴

Taylor's methods were essentially analytic: he divided work into elemental components, and used a stopwatch to

determine optimum times for each procedure. Once sufficient data was accumulated, Taylor sought to redefine the labour process in a more efficient and accelerated configuration. Increased production most frequently required a subdivision of tasks. He sought further to win the allegiance of workers to these new methods of work, over which they had no control, by a system of incentive payments. In the process, Taylor greatly widened the abyss between intellectual and manual labour; planning and execution were irrevocably separated. Work itself was deskilled, fragmented, rationalized, and subjected to regular inspection. The factory became the site of bureaucratically-administered routines. Taylor repeatedly emphasized the need to "enforce" his standards. Furthermore, he referred to his system of control as a "human managing machine."¹²⁵

I want to refer briefly here to Taylor's most exhaustive work, *On the Art of Cutting Metals*, published in 1906. This is only one of his texts which makes use of photographs. Although Taylor did not share the faith held by some of his followers in the analytic power of photography, he does seem to have recognized the demonstrative potential of the medium.

On the Art of Cutting Metals was the intellectual product of Taylor's quarter century of experimentation at Midvale Steel, Bethlehem Steel, and a number of other companies. A strict accountant, he recalled cutting up 800,000 pounds of steel in the process. The work began when Taylor, a newly appointed assistant foreman, encountered organized resistance to his efforts to increase production in the Midvale Steel machine shop. In order to win his struggle with recalcitrant machinists, Taylor developed a long-term strategy. He sought to know more than they knew, to understand the complex relationship between the factors that affected the metal-cutting process on the lathe, drill press, planer, and milling machine. He was able to isolate twelve variables, and developed an intellectual-machine for solv-

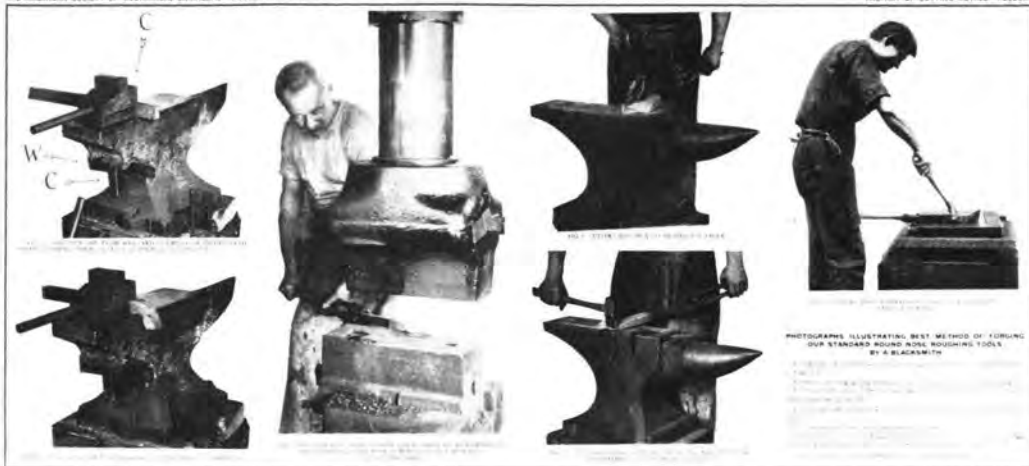


Figure 14. Folder 1. Process of Forging a Standard Tool, from Frederick Winslow Taylor *On the Art of Cutting Metals* (American Society of Mechanical Engineers, New York, 1906).

Modern Mining Practice

The machine is supplied with the usual rotating elements by which the ordinary steam-driven turntable, providing a new edge to the face of each revolution. This machine permits the machine to be used as a machine for cutting preparatory to blasting the rock. The machine from a coal cutter in a rock drill, or vice versa, can be used as a coal cutter. Used as a rock drill, the machine has a distinct advantage for finishing purposes. It can also be used to great advantage as a drill in sinking shafts and driving tunnels in rock,

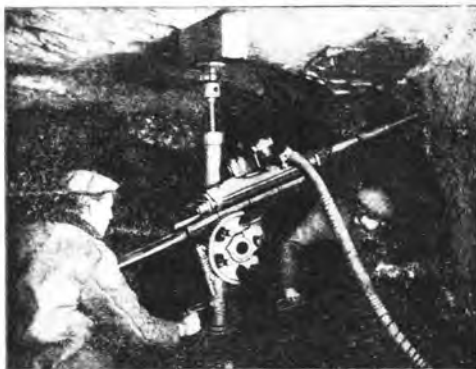


Figure 15

in cutting through clay seams, horobacks, spurs, etc. The machine operates with compressed air and gives its best performance under a pressure of from 50 to 80 pounds.

The "Radialax" cutter is in essentials a long-stroke piston drill provided with a method of mounting specially adapted for rock-mining work. The primary support is a standard single-column tripod, which can be furnished in various lengths from 4 to 12 feet. It has a base to be up and a heavy jack-screw with either, terminating in a rock restpiece. With the column is provided a long shaft column arm, upon which the

Modern Mining Practice

The "Radialax" is mounted upon a tripod support. When the air is under a slight supply of water is introduced in the column to keep it cool, being fed by a pipe, which is connected to a water supply without being attached to the column. With position properly adjusted, the air is supplied in place by means of a heavy cutting belt. The machine is used in the same manner as a rock drill or vice versa, by means of the cutting belt. The machine then mounted on the water column. It supports a cutting belt, front and rear, in one of which the same of the rock drill rests. Extension backward from the saddle is a tripod supporting a steel worm meshing with the water tooth on the spindle of which is mounted a hand wheel, which is used to rotate the "Radialax". The guide shell is perpendicular to the axis of the ordinary rock drill, carrying a level screw mechanism and a hand wheel on the screw. It has also a cone fitting into the top end on the saddle and is secured in place by a bolt and nut which passes through the same and, after a screw thread in a split washer below the base.

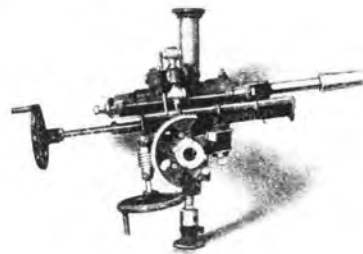


Figure 16

In operation the column is set up vertically about 1 1/2 or 2 feet from the rock face and at a distance of one or two feet from the air, when this setting is about 12 inches in diameter. A substantial block of wood about 4 inches thick is placed under the footpiece of the column and a small block of oak or other hard wood 1 inch or 1 1/2 inch thick is placed on top of its column

Figure 15. From G.M. Bailes and the Professional Staff of the Bennett College, *Modern Mining Practice: A Practical Work of Reference on Mining Engineering*, Vol. 4, (The Bennett College, Sheffield, 1909).

ing metal-cutting problems. This device, a slide rule, was the "embodiment" of his science. It is worth quoting his description of this invention:

*The development of an instrument (a slide rule) which embodies on the one hand, the laws of cutting metals, and on the other, the possibilities and limitations of the particular lathe or planer, etc., to which it applies and which can be used by a machinist without mathematical training to quickly indicate in each case the speed and feed which will do the work quickest and best.*¹²⁶

Despite the last part of this remark, Taylor went on to suggest that this instrument was something quite different from an intellectual aid to the workman. Rather, what he was proposing was a new division of labour and a new hierarchy of control:

*The slide rules cannot be left at the lathe to be banged about by the machinist. They must be used by a man with reasonably clean hands, and at a table or desk, and this man must write his instructions as to speed, depth of cut, etc., and send them to the machinist well in advance of the time the work is to be done.*¹²⁷

For Taylor, this privileged "embodiment" of the laws governing skilled work was essentially mathematical and abstract. The machine-shop was redesigned in terms of a new flow of representations: slide rule computations, instruction cards, work diagrams and so on. In his 1903 treatise on *Shop Management*, Taylor proposed a central archive or "information bureau" within the factory:

*The information bureau should include catalogues of drawings. . . as well as all records and reports for the whole establishment. The art of properly indexing information is by no means a simple one, and as far as possible should be centred in one man.*¹²⁸

The visual image was for Taylor a specialized form of representation, intended for the manager and engineer. In the machine shop, it was the instruction card that conveyed the predetermined job plan to workers, who had previously been able to design their own approach to problems of production. The machinist no longer worked from a drawing of the desired part, but from an analytic and quantified list of sequential moves.

It is worth noting that the photographic plates in *On the Art of Cutting Metals* are curiously peripheral to the actual process of machine tool work. Taylor, or his editors, chose to illustrate the preliminary work of the blacksmith. Six photographs, in each of which the background has been obliterated to show only the significant details of work, depict the "best method" of forging a standard cutting tool. The plates indicate that Taylor's twenty-six years of metallurgical research so thoroughly altered machine-shop practice that the basic tools had to be redesigned and forged in a new way. Although the transformations of machinist practice would have been difficult to represent photographically, blacksmithing provided a *visible* example of a newly rationalized craft. The other photographs in the book suggest something of the extent of Taylor's empiricism; these include detailed, sequential close-ups of cutting tools in the process of forging and in the process of wear from use and microphotographs of specimens of tool steel treated at various temperatures. (Taylor concluded that microphotography provided no evidence of a correlation between the microscopic structure and the high-speed cutting ability of steel. In this, he clearly recognized a limit to photographic empiricism.)

Taylor's illustrations in *On the Art of Cutting Metals* differ from earlier technical representation in one very important sense: the revised work models presented here are based on rigorous experiment. The "truth" of these images is the truth of the *laboratory*, of an active and interventionist,

rather than a contemplative, empiricism. But Taylor's metallurgical and mechanical experiments should not be viewed in isolation from the managerial imperative that drove his work. Taylor's "truth," despite its claim to universal scientific status, was grounded in a fundamentally capitalist logic. His search for "efficiency" bent mechanistic physics to the demands of bourgeois political economy. As Harry Braverman has argued, Taylor did not invent a "science of work." Rather, he invented a "*science of the management of other's work* under capitalist conditions."¹²⁹

Taylor's influence has been so pervasive that his project deserved some consideration in this essay. The general principles of Taylorism have been institutionalized within every modern industry. Nonetheless, since coal cutting and metal cutting are rather different occupations, I want to examine for a moment an early twentieth century work on mining engineering.

In 1909, while Herbert Hoover was busy as a consulting engineer and leisure-time translator of *De Re Metallica*, a standard reference work entitled *Modern Mining Practice* was published in England. Its five volumes attempt to consolidate all of the technical aspects of mining, from exploratory boring, to shaft-sinking, to timbering, ventilation and the machine-cutting of coal, and so on. Many of the photographs and diagrams in these volumes were taken from catalogues prepared by the manufacturers of mining equipment; in this connection the mining engineer functions as a purchasing agent of sorts, choosing among available technologies in accordance with specific mining conditions. *Modern Mining Practice* is symptomatic of the unique status of mining among industries. The text attempts to treat the coal mine as if it were a factory, subject to the same visibility and control. Nonetheless, there is no attempt to propose a "science" of coal-cutting as such, and clearly much of the knowledge of mine work presented is an appropriation of traditional miner's wisdom. Mining offered no "law," no

mathematically interrelated set of twelve variables. The mining engineer remained in essence an empiricist, balancing economic and technical considerations with a reading of the quantity and quality of coal to be gotten in any one situation. It is also evident that the orderly factory-like appearance of the mine is frequently shattered by disaster. Thus, disaster itself is rationalized and prepared for; casualties are regretted but expected:

Dead bodies can be put on one side and covered up until it is convenient to remove and take them out. If recognized, the name should be attached to each corpse, to save time and confusion after; and when brought out all identified bodies may be put together, and those not identified, kept apart.¹³⁰

In a sense, the mine is treated as a machine that is prone to breakdown; the mining engineer is an energetic master mechanic, committed to the prevention of avoidable failures and to the restoration of a smooth running condition after accidents happen.

The most "modern" feature of *Modern Mining Practice* is its promotion of mechanical methods of coal-cutting. Here the logic of efficiency is most pronounced:

A new era in the history of coal mining is rapidly developing and the hand pick is, under favourable conditions, being replaced, whenever possible, by more effective methods. The principal reasons for the installation of mining machinery are to reduce the cost of production, to increase the output, and to ensure a market by the production of a superior sample of round coal at a consequently higher selling price.¹³¹

Despite reassurances by these writers that mechanization involved "no desire to reduce the number of men," between 1920 and 1930 machine-based overproduction had led to a serious displacement of miners in the United States. (Britain and Canada lagged behind in introducing mechanization on

a large scale.) With the introduction of continuous coal-loading equipment during that decade, mining increasingly took on the character and rhythm of rationalized factory work. (We should note that the modernization of mining was less a matter of scientific management *per se*, than an effort to use machinery to institute a continuous flow of production. In this, mining took on the character of the assembly-line.) Miners who had worked with pick and shovel understood that a craft had disappeared. Homer Morris, an American economist who studied unemployment in the bituminous fields in the early 1930s, argued that "mechanization is thus reducing the miner to a mere coal loader, whose chief qualification is a strong back. This changes the position of the miner from that of a craftsman to an unskilled workman."¹³² He went on to quote an older miner:

It takes five years for a man to learn to be a real coal miner, and some men never learn it. I would rather use the pick and shovel than to load machine coal. Anyone with a weak head and a strong back can load machine coal. But a man has to think and study every day like you was studying a book if he is going to get the best of the coal when he uses only a pick.¹³³

Morris' book *The Plight of the Bituminous Coal Miner*, was published in 1934. Following a tradition established by social reformers over a quarter of a century earlier, he used photographs to illustrate his thesis. The frontispiece is a portrait of a miner, pick and lunch bucket in hand, standing near what is presumably his home. Morris's caption reads: "The miner wants to earn his living." Three years earlier a similarly dignified but artificially-lit close-up portrait of a miner appeared in an early issue of *Fortune* magazine, accompanying an article on the troubled anthracite business. The photograph was taken by Margaret Bourke-White. Here in this new modernist glamour magazine of industry, a more optimistic and harmonious note was struck:

A YOUNG MINER

He sees modernity coming to the mines. Besides the traditional art of his trade, he learns a new technique. Brawn he has and, more, machinery to help him.¹³⁴

The editors of *Fortune* were able to celebrate technological progress and animate the ghost of artisanal work in the same article, the same layout, occasionally—as here—in the same picture and caption. *Fortune* harmonized the rhetoric of modernism and the rhetoric of humanist documentary, combining an estheticized version of engineering realism with an estheticized version of the realism of the social reformer. In order to understand the corporate "humanization" of the worker, we need to return to the discourse of social reform, and to the role assigned to the portrait within that discourse.

What can be said, then, of the "realism" of the social reformer? I want to look briefly at the *Pittsburgh Survey*, which was published in six volumes between 1909 and 1914. One early model of this sort of urban investigation was Henry Mayhew's *London Labour and London Poor*, which was published in four volumes between 1851 and 1862. Both works relied heavily on pictures: Mayhew used engravings based on daguerreotypes; the *Pittsburgh Survey* used half-tone reproductions of photographs and drawings. In all, the latter work contained over four hundred illustrations; the vast majority were photographs.

The *Pittsburgh Survey* was one of the first projects to be funded by a newly-formed philanthropy, the Russell Sage Foundation. It's sponsors clearly saw the work as an exemplary study of the social conditions engendered by modern industrialism; the "facts" uncovered in Pittsburgh were assumed to be relatively typical of large American cities. The director of the Pittsburgh project was Paul Kellogg, who was editor and founder of the social work journal, *The Survey*. Kellogg's introduction to the first volume of the *Pittsburgh Survey* is revealing of the ambiguous tension between

progressive social reformers and engineers in the first decade of this century. Kellogg argued that the survey supplied "a record of labour adjustments and technique in factory work such as neither mechanical nor business training offered the individual manager." He went on to tell the story of a factory tour led by a "young, enthusiastic" manager "with engineering training," who grossly overestimated the wages paid to women machine operatives. Kellogg preferred to see this misinformation as the product of ignorance rather than duplicity, and drew his moral accordingly:

My point is not so much the meagreness of actual wages, as the disparity between the technical equipment of this official and his ignorance of the human factors in production. He had at his fingertips the threads, the measurements, the temper, the revolutions per second—all the factors that were going into the new turbine. Yet here was human machinery, more delicate, more sensitive, of finer metal than his propeller shaft. And of this he was ignorant.¹³⁵

Of course, the most progressive engineers of the period, the scientific managers, claimed to have taken this "human machine" into account. But Kellogg was establishing the authority of a new professional, the *social expert*.

On the basis of its findings—which Kellogg called a "blue print" of the city—The *Pittsburgh Survey* called for a living wage, for workmen's compensation and industrial safety standards, for vocational training for young men and women, for better housing and recreation, and for an equitable policy of civic taxation.¹³⁶

The survey sought to bridge the gap between industrial production and family life. Women were prominent among the authors of the survey, and the conditions experienced by working women and working-class families were of central importance to the study. The three volumes that were the work of single authors were all written by women:

Elizabeth Butler's *Women and the Trades*, Margaret Byington's *Homestead: The Households of a Mill Town*, and Crystal Eastman's *Work Accidents and the Law*. Butler and Byington were social workers, Eastman was a lawyer, and became a socialist as well as a feminist. Feminist concerns unite these three volumes: the economic exploitation of young women workers, the problems of household budgeting under conditions of scarcity, the pauperization of families that have lost their economic support due to the death or injury of a male worker.

If the characteristic visual images used by the engineer were diagrams, detail shorts, and excised fragments of bodies and machinery, the characteristic visual images of the social reformer were the environmental study and the portrait. We might also argue that the "social photographer" tended toward a sociologized version of family photography.

Byington's *Homestead* was introduced by Kellogg as "a portrayal of these two older social institutions, the family and the town, as they are brought into contact with this new insurgent third," the factory.¹³⁷ Accordingly, *Homestead* opens with a fold-out panoramic photograph, and establishing shot, taken from the hillside above the Carnegie Steel Works, showing clearly the worker's housing in the foreground between camera and factory. The caption reads: "To these mills and furnaces, the households of the community look for their livelihood." The spectator is placed in a position metaphorically analogous to that occupied by the working class of Homestead. It's worth comparing this view with a similar one provided in James Howard Bridge's *The Inside Story of the Carnegie Steel Company: A Romance of Millions*, an early unofficial celebration of corporate growth, published in 1903.¹³⁸ There, nestled between two other panoramas of Carnegie mills, is another view of the Homestead works. These earlier photographs were taken from positions on the opposite side of the Monongahela River from the mills. The mill towns on the hills behind are

obscured by smoke and haze. The spectator views the steel mill as it meets the river front: these pictures suggest the unceasing flow of steel and dividends.

Many of the photographs in the *Pittsburgh Survey* were taken from industrial archives. Some of these pictures simply illustrated industrial processes; others had originally been intended to exhibit measures already taken for the safety and welfare of wage earners. But many photographs had to be commissioned especially for the survey: photographers were dispatched to record family life, housing conditions, ethnic and occupational types, accident victims, conditions within the smaller workshops and conditions within the larger factories that were ignored by company photographers. The most prominent photographer who worked for the survey, the only one whose work was consistently credited, was Lewis Wickes Hine.

Hine was a sociologist by training. As a teacher at the Ethical Culture School in New York City, he began to use photography pedagogically in 1903 or 1904; he went on to photograph for reform agencies such as the National Child Labor Committee and later the Red Cross, and for the lineage of social work journals edited by Paul Kellogg: *Charities and Commons*, *Survey*, and *Survey Graphic*.¹³⁹

Hine believed in both the evidentiary and honorific powers of photography. His photographs provide testimony of industrial abuses and violence, but they also dignify and "humanize" the immigrant worker. Many of Hine's photographs for the *Pittsburgh Survey* fall into the latter category; in this they are similar in function to portrait sketches by Joseph Stella which were also commissioned by Kellogg.

If we consider only the photographic representation of coal mining within the six volumes of the *Pittsburgh Survey*, we discover a broad range of images. A few photographs from coal company archives depict the latest in coal-cutting machinery. Another uncredited photograph shows families

waiting at a pithead for news of a disaster. In yet another image, a miner is shown trudging wearily homeward through a mine tunnel. Thus the image of technological progress and efficiency is balanced by attention to family life, fatigue, and disaster. Hine's contribution here is especially striking. One of his portraits appears in a chapter on soft-coal mining in Crystal Eastman's *Work Accidents and the Law*. This portrait is captioned: "An English-speaking miner." (Elsewhere in the survey, the same photograph is captioned: "A Pittsburgh miner.") If we compare the reproduction with the original print, we realize that this miner has been given a bath by a retoucher, (In reality, no matter how hard a coal miner scrubs, a tattoo of coal dust remains in the creases of the skin.) Furthermore, Hine's original notes probably included mention of this miner's fluency in English, but this print has been reproduced in yet another instance with no other caption beyond an identification of the miner's Slavic background. This is perhaps a rather extreme example of one of the survey's main strategies. In a sense, the survey sought to *assimilate* this miner, to overcome his otherness for middle-class observers. Thus Hine's picture is the political and esthetic inverse of portraits of criminals and immigrants used by eugenicists and "scientific" racists during the same period, which were sometimes retouched to exaggerate physiognomic evidence of what was purported to be moral and intellectual inferiority and degeneracy.

Throughout his career, Hine remained committed to the dignity of manual work, and to the defense of artisanal values. In a stubborn and even conservative way, he resisted commodity fetishism. Late in his career, in 1932, he published his only book, a children's book called *Men at Work*. In his introduction, he argued that: "Cities do not build themselves, machines cannot make machines, unless back of them all are the brains and toil of men."¹⁴⁰ Hine's social realism provided a model for an American tradition of liberal and left social documentary. He also provided a model for



UNEMPLOYED MACHINE MEN

Electric drills and chain saws have revolutionized coal digging in the bituminous fields since the days of the pit miner.

Figure 16. Uncredited photograph from Paul U. Kellogg, editor, *Wage Earning Pittsburgh*, 1914.



A COAL MINER

Figure 17. Uncredited photograph from Crystal Eastman, *Work Accidents and the Law*, 1910.



A RECOVERED DEATH COMPENSATION PAYER

Figure 18. Uncredited photograph from Crystal Eastman, *Work Accidents and the Law*, 1910.



A PENNSYLVANIA MINER

Figure 19. Lewis Hine, an English-Speaking Miner, from Crystal Eastman, *Work Accidents and the Law*, 1910.



Figure 20. Lewis Hine, Pennsylvania Coal Miner, 1910.

Figures 16-19. From Paul U. Kellogg, edition, *The Pittsburgh Survey: Findings in Six Volumes* (The Russell Sage Foundation, New York, 1909-1914).

picture editors who were less sympathetic to these values, but who tacitly understood the ideological power of honorific images in a society that objectively degraded craft. Early in his career, in 1909, Hine invoked the energy of corporate advertising in an attempt to inspire the reformers' interest in the potential value of publicity. He argued that, unlike businessmen, social workers were "only beginning to realize the innumerable methods of reaching this great public." He went on to make a statement that in retrospect seems full of unintended irony:

I wonder sometimes, what an enterprising manufacturer would do if his wares, instead of being inanimate things, were the problems and activities of life itself, with all their possibilities of human appeal. Would we not grasp eagerly at such opportunities to play upon the sympathies of his customers as are afforded by the camera?²¹⁴¹

By 1915, corporate officials had begun to speak to their employees and to the public in a voice reminiscent of Hine and his Progressive colleagues.

With this we return to scientific management, and to the genesis of industrial psychology. Frank and Lillian Gilbreth were a husband-and-wife team of Taylor disciples. Frank Gilbreth had begun his career as a bricklayer, and had become a successful building contractor in the 1890s. His earliest efficiency studies had covered contracting, bricklaying, and concrete work. The Gilbreths improved upon Taylor's methods in two ways. Frank Gilbreth replaced the stop-watch with the camera, and thus replaced the rather crude time-study with a more precise mode of analysis, the motion-study. Secondly, Lillian Gilbreth supplemented the study of the physiology of work with a systematic concern for the psychology of the worker. Taken together, the Gilbreths' work involves a double movement, toward a more thorough treatment of the worker as a machine and toward a com-

pensatory "humanization" of the worker. That is, the Gilbreths attempted to convince workers that self-alienation was the key to happiness, although they wouldn't have described their project in those terms. Lillian Gilbreth saw the goals of management in this light:

The ultimate result of all this physical improvement, mental development and moral development is increased capacity; increased capacity not only for work, but for health, and for life in general.¹⁴²

In their writings, scientific management takes on the character of a *total system*, a system that extends beyond the factory and throughout the entirety of daily life. (According to two of their twelve children, who later wrote a genial family memoir, *Cheaper by the Dozen*, the Gilbreths sought to embody the principles of efficiency in nearly every aspect of their family life.)¹⁴³

Frank Gilbreth claimed in 1916 to "have found the photographs [to be] the most valuable of records, and to have used it continuously since 1892."¹⁴⁴ The context for this remark was their joint work on *Fatigue Study: The Elimination of Humanity's Greatest Unnecessary Waste*. The Gilbreths described a process remarkably similar in its general features to the work of the social reformer. "Fatigue study" began with a "fatigue survey;" this survey was the "systematic study of existing conditions" in the factory.¹⁴⁵ The Gilbreths acknowledged that "some managers are not willing to allow their work places to be photographed when they realize that such photographs will live as "before and after" records."¹⁴⁶ Like Lewis Hine, the Gilbreths recognized the need for written explanations to accompany the photograph. Furthermore, they understood the importance of archival ordering of survey findings. Again, like Lewis Hine and like Diderot, they regarded the visual image as a way of knowing efficiently, rapidly, "at a glance."¹⁴⁷ The prin-

ciple difference between the Gilbreths and the social reformers lay in their differing notions of "waste." The reformers had an expansive and profoundly social image of waste. Lewis Hine, for example, produced a montage-poster on child labour entitled "Making Human Junk." (We should note here that historically the abolition of child labour was a necessary and "efficient" step in the development of monopoly capitalism, even though the child labour debate was conducted largely on moral grounds. Even so, there is more than a hint of economism mixed in with the irony of Hine's metaphor.) The Gilbreths, on the other hand, viewed waste in reductive terms. Although they regarded fatigue as a problem involving physical, physiological, psychological, and environmental factors, the ultimate terms were economic, terms dictated by the capitalist need to increase relative surplus value. For the Gilbreths, of course, this imperative led to utopia. Increased productivity was the "one best way" to an era of permanent prosperity.

Between 1911 and 1912, Frank Gilbreth developed his method of photographic motion study. Essentially, his techniques refined and applied to industry the methods developed by Anglo-American photographer Eadweard Muybridge in the late 1870s and the French physiologist Etienne Jules Marey in the 1880s. Gilbreth used a geometrical grid, as did Muybridge, in his later work, to allow for precise measurements of motion paths. Implicitly, Gilbreth sought an analytic geometry of work: unlike the use of gridded "veils" by Alberti, Leonardo, and Durer as an aid to perspectival construction, the aim here was analysis rather than synthesis.¹⁴⁸ On the basis of this analysis, work would be reconstructed.¹⁴⁹

Gilbreth's *chronocyclegraph* was a modification of Marey's *geometrical chronophotography*. Both methods involved the recording of an abstract, geometrical trace of movement on a fixed plate. Marey had attached luminous tape to the black hooded costumes of his models, who went

through their paces in front of a black backdrop. Thus, a sequence of instantaneous, linear configurations was registered in white on a black field. For Marey, the geometrical chronophotograph provided the clearest evidence of the essentially *mechanical* character of human and animal movement. Along with less abstract, figurative chronophotographs, these images were seen by Marey as pedagogical as well as research tools:

In order to render chronophotographs of movement more instructive, these images should be taken from very strong and competent athletes. . . . These champions will thus betray the secret of their success, perhaps unconsciously acquired, and which they would doubtless be incapable of defining themselves.

The same method could equally well be applied to the teaching of movements necessary for the execution of various skilled industries. It would show how the stroke of a skilful blacksmith differed from that of a novice.¹⁵⁰

The echoes of Diderot are explicit here.

Marey's proposal was realized fifteen years later by Frank Gilbreth, with profound consequences for the "skilled industries." Instead of luminous tape, Gilbreth attached small lights to the hands of his experimental subjects. Gilbreth was able to digitalize this analogue trace by pulsing the electric current to the light: in effect, a sequence of directional "arrow heads" was registered. In the interest of temporal precision, and in order to combine time-study with motion study, he included a clock within the frame. He also used stereo cameras, so that movement could be perceived in three dimensions, and so that wire models of "paths of least waste" could be made for workers' edification. And, because some workers didn't like being watched, he invented a worker-activated automicro-motion device, a mode of self-surveillance. With a quasi-Germanic love for the splicing of words, Gilbreth named the most complicated of these

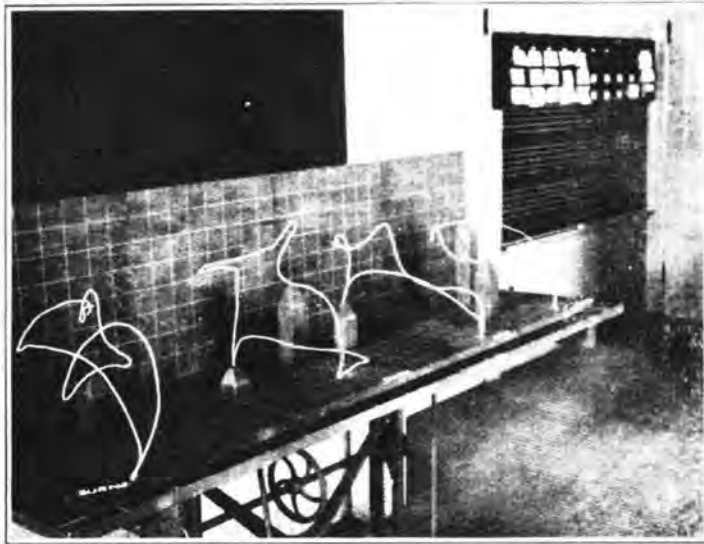


FIG. 16

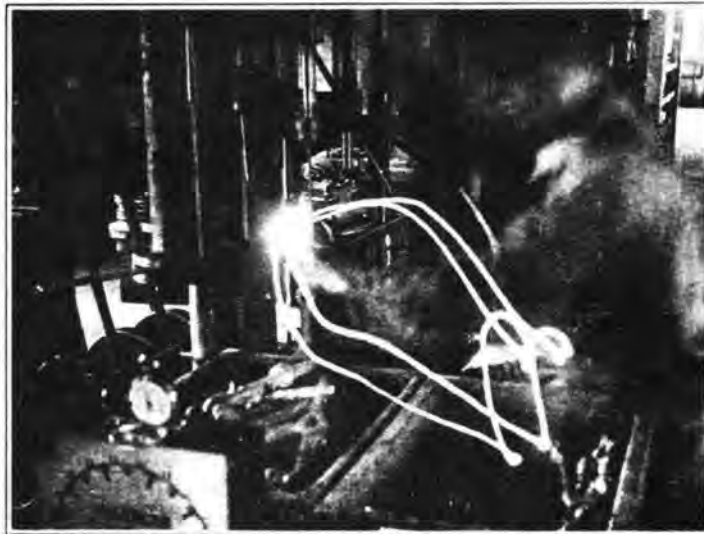


FIG. 17

Figure 21. Plate from Frank B. Gilbreth and L.M. Gilbreth. *Applied Motion Study* (Macmillan, New York) 1919.

Figure 16: "First photograph of wire models showing one man's progress in learning paths of least waste. These wire models represent the paths of the left hand of a manager on a drill press — a machine which he had not touched in twenty-five years."

Figure 17: "Chronocyclegraph showing two cycles of a foreman's left hand on the same machine — showing habits of 'positioning' before 'transporting load'."

machines the *autostereochronocyclegraph apparatus*.¹⁵¹

Micromotion study provided the Gilbreths with the basic elements of work. By 1916, they were able to identify seventeen basic movements which were taken to be constitutive of all human productive activity. They christened these elements, *therbligs*. Once work was analyzed in this fashion, the "one best way" of working could be determined. As Lillian Gilbreth put it, this process "functionalized" the worker:

*Under Scientific Management, the worker as well as the foreman is a specialist. This he becomes by being relieved of everything that he is not best fitted to do, and allowed to concentrate on doing according to exact and scientifically derived methods, that work at which he is an expert.*¹⁵²

But despite this celebration of expertise, she recognized one fundamental psychological difference between managers and workers:

*It is not every man who is filled by nature to observe closely, hence to plan. To observe is a condition precedent to visualizing. Practice in visualizing makes for increasing the faculty of constructive imagination. He with the best constructive imagination is the master planner.*¹⁵³

Photographs, films, and wire motion-models served a pedagogical role similar to that proposed by Marey. These images presented the worker's own capabilities as a "thing apart," and as an *abstraction*. Marx understood this process well in advance of its systematization by the Gilbreths:

What is lost by the specialized workers is concentrated in the capital which confronts them. It is as a result of the division of labour in manufacture that the worker is brought face to face with the intellectual potentialities of the material process of production as

*the property of another and as a power which rules over him. This process of separation . . . is completed in large-scale industry, which makes science a potentiality for production which is distinct from labour and presses it into the service of capital.*¹⁵⁴

Furthermore, the Gilbreths regarded workers as people who had to be *shown* possibilities that they themselves were incapable of thinking. (There is a distinct element of biological determinism in Lillian Gilbreth's hierarchy of "visualizers" and "non-visualizers.") It was the manager who controlled the abstract theory of work; the worker was left with a merely mimetic, imitative, visual empiricism. (Or, as Lillian Gilbreth put it: "Imitation is Expected of All.")¹⁵⁵ In Charles Saunders Peirce's terms, the worker was stuck in the realm of icons and indices, while the manager roamed the high ground of the symbolic. And, as in Peirce's hierarchy of signs, the worker could "assert nothing."¹⁵⁶

The Gilbreths' eagerness to fragment work was matched by a desire to treat the worker as an "individual." They argued that managerial selection of the proper worker for the job had to take into account as many as fifty or sixty variables, including "anatomy, brawn, contentment, and creed."¹⁵⁷ Lillian Gilbreth argued that the very process of industrial surveillance had a laudatory effect upon the worker. In one of the more fantastic passages in their writings, she claimed that the keeping of separate records on each worker fostered "the spirit of individuality;" as part of this argument, she drew an analogy with the performing arts:

*. . . the world's best actors and singers are now grasping the opportunity to make their best efforts permanent through the instrumentality of the motion picture films and the talking machine records. This same feeling, minus the glow of enthusiasm that at least attends the actor during the work, is present in more or less degree in the mind of the worker.*¹⁵⁸

Lillian Gilbreth seems to have seen records as a way of lending continuity, coherence, and a sense of self-worth to episodic and interrupted work histories:

*With the feeling that the work is recorded comes the feeling that work is really worth while, for even if the work itself does not last, the records of it are such as can go on.*¹⁵⁹

She was shrewd in portraying a mode of documentation that was in management's interest as a benefit to the worker. In a sense, the work record was a "positive" version of the criminal record perfected by Alphonse Bertillon in the 1880s. The worker had to assume that he or she was followed by this schematic biographical text. The work record had obvious utility when jobs were scarce and the employment office could pick and choose on the basis of documented work histories. But Gilbreth was writing her treatise on management in a decade when the reverse was true: jobs were plentiful and labour turnover was the bane of every manager committed to efficiency.

Quitting was one form of work resistance, an ultimate expression of dissatisfaction. David Montgomery has noted that quitting and the "celebration of national holidays in defiance of foreman's threats, 'blue Mondays' and binges . . . were not the only ways immigrants coped with the new industrial setting." Workers also resisted on the job in informal groups: "Older hands taught newcomers the techniques of survival and the covert forms of collective resistance — 'lift it like this, lotsa time, slow down, there's the boss, here's where we hide, what the hell!'"¹⁶⁰ Just as the criminal record was an archive, a "bringing to light" of aliases and past offenses, the work record was a potential register of incidents of soldiering and resistance. Like the Panopticon, the work record enforced its discipline simply by being known to the worker.

Lillian Gilbreth understood that stern disciplinary

measures would be met with resistance, and thus, she introduced an element of charm, an appeal to narcissism, into her program. (Frank Gilbreth also is remembered for his jovial relations with workers.)¹⁶¹ Significantly, photography was seen as a reward, a token of managerial approval, as well as a pedagogical instrument. The *operational* value of the photograph was supplemented by an *ideological* function. The motion study became an honorific portrait:

*The photographs of the "high priced men," copies of which may be given to the workers themselves, allow the worker to carry home a record and thus impress his family with what he has done. Too often the family is unable by themselves to understand the value of the worker's work, or to appreciate the effect of his home life, food, and rest conditions upon his life work, and this entire strong element of interest of the worker's family in his work is often lost.*¹⁶²

The photograph became a reward, a trophy, the visual equivalent of a gold watch.

Furthermore, Lillian Gilbreth saw the industrial photographs as a means of reintegrating factory-life and family-life, thus fusing together by industrial and imaginary means the two spheres of existence that had been separated by industrialism. Her utilitarianism could not resist the attempt to combine pleasure and pedagogy. And, her pedagogy extended to the family, and particularly to housewives. The photograph functioned as an advertisement of sorts, urging the housewife to consume in a rational and informed fashion. In this, her proposal intersects with attempts to apply the principles of efficiency to domestic economy.¹⁶³ Overall, the logic of social reform would seem to be operating in reverse. Industry is not being challenged to address the needs of working-class families, but rather working-class families are being asked to accommodate their habits to the demands of industry. In fact, this is not so much a reversal, as it is a *fantasy* of a new synthesis, a synthesis grounded in in-

creased production, an end to scarcity, and "the elimination of that most wasteful of all warfare — Industrial Warfare."¹⁶⁴

The double system of images employed by the Gilbreths, the engineer's abstraction and the psychologist's familial realism, can be seen as the modernist version of Marcus Aurelius Root's photographic program for nineteenth century America. Certainly their use of photographs combines surveillance and sentiment, reification and moral instruction, reification and pleasure. In this sense, the Gilbreths can be said to have completed the invention of the picture-language of industrial capitalism. In its "advanced" form, that language speaks with three overlapping voices: the voice of surveillance, the voice of advertising, and the voice of family photography.

III

Pictures from the Deep

Still pictures remain the surest way to attract the deserved share of public notice for an industry. Once obtained, the photographs are always available for use. To identify the subject and win understanding, each picture must be attractive and clean in details.

Many people were involved in attaining the photography standards of these catalogues. First to become involved are the employees whose common sense and interest and pride causes them to keep facilities and equipment attractive enough to photograph. There was planning for the picture, the photographer making the exposure and finally the printing. All deserve credit!

Full value and better exploitation of the industry's great picture-potential is only possible through maintenance of the service and through improvement. Your thoughts will therefore be welcomed.

Introduction to catalogue of Dosco photographs¹⁶⁵

If you go down there being the big "I am," the miners will tell you to go to hell: "Take your godamn pictures."

Leslie Shedden¹⁶⁶

Nova Scotia — Canada's Ocean Playground
License plate slogan

This essay is a triptych of sorts: two small panels flanking an historical panorama. A dangerous metaphor, one that I have tried to undermine: Can historical writing be so easily equated with the making of pictures? Another metaphor comes to mind, borrowed from the German novelist Alfred Döblin, who wrote in 1929 an introduction to a famous book of photographic portraits by August Sander, *Antlitz der Zeit* (Face of the Times). After a long discussion of the relationship between typology and individuation in portraiture, Döblin turned to some final specific comments on Sander's work. As he made this transition from the general to the

specific, Döblin commented: "This essay is like a huge balloon which is carrying a small gondola." Another dangerous metaphor, or one with hint or self-mockery. In English, of course, we think immediately of hot air.¹⁶⁷

But I had something other than a balloon in mind when I began this essay. I did not want this text to allow you to drift over these pictures, guided by an invisible force. (That's not what Döblin wanted either.) Rather, what, *we* had in mind—and it's important to stress the collaborative character of this project—was a picture book which allowed pictures to exercise their considerable power, to offer their density of meaning, *and* a picture book which developed the critique of picture books. We wanted the reader to be able to think differently about the history of work, industry and everyday life, and to be able to think differently about the ways in which history is normally represented. In Michel Foucault's sense, this book is a "tool kit" for the reader.

Class conflict is not simply economic and political in character. It is also a conflict of representations. (This is true of all dynamics of exploitation and resistance, especially those that are configured around gender, ethnicity, and race.) We might make a rough inventory. Every ruling class invents images of itself for its own entertainment and edification. Every ruling class invents images of itself for the entertainment and edification of the subordinate classes. Every ruling class invents two basic types of images of the subordinate classes: images for the ruling class' own entertainment and edification, and images for the entertainment and edification of the subordinate classes themselves. Finally, every subordinate class constructs an image of itself, and of the ruling class, which does not entirely conform to this invention from above. Something else, something resistant and resilient and hopeful, is retrieved from the slag heap of dominant culture, from tradition, from "popular memory," from political struggles and from everyday experience. These representations are, for the most part, invisible to the domi-

nant culture, although particles of gesture and mannerism are appropriated from time to time by an omnivorous culture industry, enjoyed upstairs, vitiated and fed-back to the people downstairs. (Yes, I know there's a utopian aspect to *Saturday Night Fever*, but when the anarchist Emma Goldman said quite sensibly that she didn't want to have anything to do with a revolution that didn't allow for dancing, she wasn't suggesting that the former be abandoned for the latter.)

This is a rather crude inventory of representations and it leaves out a vast middle ground, and a process of mediation. One of the marvels of advanced capitalism is the development of a huge "professional and managerial" sector. This sector, or "class," is made up of "experts" and "specialists:" teachers, engineers, social workers, health care professionals, media professionals, and so on. Some members of this group are high level corporate managers, and share in company profits. Others are small entrepreneurs, often organized in economically and politically powerful professional organizations. Still others, the vast majority, experience more or less proletarianized conditions of wage work. Two points have to be made here. First, the work of representation is grounded in this sector. Here are the administrators, entrepreneurs, and detail workers of sounds, images, texts. Here are writers, directors, graphic artists, photographers, and so on. Second, this sector takes on a central *imaginary* importance within the culture of advanced capitalism: advertising addresses everyone as if they were members of this vast "middle class." To the extent that if work is mentioned at all, it is always "expert" or "professional" work, with the possible exception of certain fantasies of male-bonding and brawny outdoors adventure. The photographer also has come to embody a certain professionalism. So in some senses, the photographer is obviously positioned between capital and labour, as a professional or small entrepreneur. Furthermore, the photographer mediates *between* capital and labour, acting as kind of middle-man in the unequal traffic in

representations. Finally, it is the work of the industrial photographer and the advertising photographer that helps construct the phantasmagoric middle ground, the ground upon which "we're-all-in-this-thing-together-and-our-interests-are-identical." We've seen the development of this program in the writings of the Gilbreths.¹⁶⁸

With the notion of a conflict of representations in mind, suppose we return to the archive. We need to know more about the photographic culture of Cape Breton. I have in mind a group of floating captions, short meditations on these pictures and their making, and on the reception of photographs in Cape Breton.

The Working-Class Sublime

The coal mines of Cape Breton are known as The Deepes. The bituminous fields around Glace Bay extend out beneath the ocean floor for several miles. So the distance between the miner and the sky is measured in salt water, as well as rock and earth. A story floats around industrial Cape Breton about a novice miner, making his first trip to the coal face. One of his companions, an experienced miner, smuggles a fresh fish along for the ride. I like to think that this fish is a flounder. When they reach the spot where the day's shift will be spent, the fish is surreptitiously deposited in a crack in the coal seam, somewhere up near the roof. Suddenly the trickster shines his lamp in that direction and remarks that the mine must be springing a leak.¹⁶⁹

Tricks like this are common to workplace culture, and serve as apprenticeship rituals of sorts. But there are other dimensions to this story. Mining may be the antithesis of farming, but coal mining in particular often occurs in farming regions. Historically, miners have often come from farming backgrounds, or have harboured the desire to farm. This has certainly been true in Cape Breton, but there another maritime mode of living and working has traditionally

beckoned. The flounder in the mines is a momentary recognition of that other mode of work, the work of the fisherman and coastal sailor: dangerous, often poorly rewarded, but open to the sky. But this is rather remote from the underlying purpose of this fish performance. That purpose is a kind of ritual exorcism of the terror inherent in underground work. The sublime is named, mocked, and invoked repeatedly in stories, gestures, and jokes. Again, this way of dealing with the ever-present dangers of industrial work is common to workplace culture. Stories of accidents and disasters may be told and retold in grim detail, and become part of an oral tradition. I'm not entirely sure how to think about this. There are strong elements of mourning, of rage, and even a certain fatalism in these stories. Clearly the essentially aristocratic and bourgeois concept of the sublime that we've inherited from the eighteenth century is inadequate to explain the experience of people whose lives are expended in the material domination of nature. The category of the awed spectator does not apply to those who live with the violence of machines and recalcitrant matter.¹⁷⁰

The Protocols of Disaster

Despite the facts that the verbal culture of mining communities may dwell on the grim aspects of industrial calamities, miners also respect certain protocols in times of crisis. In this, we can detect a certain resistance to the machineries of public spectacle. Miners actively resisted the making of what Roland Barthes called "shock photographs" or "traumatic photographs." I have one example in mind. In order to make this example worthwhile, I need to introduce another photographer, and describe the flow of local news photographs for one week in 1952.

During the 1950s, the major newspaper in Cape Breton was the *Post-Record* (now the *Cape Breton Post*) published in the steel-mill city of Sydney, a few miles from Glace Bay.

(A rival newspaper, the *Glace Bay Gazette*, was published by the United Mine Workers. This paper made only minimal use of local photographs.) Between 1942 and 1975 the chief photographer of the *Post-Record* was John Abbass, who operated a successful commercial studio in Sydney. He worked for the newspaper on retainer. In the newspaper, Abbass emerges as something of a local celebrity, his pictures were frequently captioned with more than a by-line. In effect, the *Post-Record* treated its news photographer not as an objective and invisible reporter, but as a prominent and energetic artist of the news. Example: On July 7, 1952, the paper's front page story treated a major freight derailment. The featured photograph depicted a flast-lit jumble of freight cars. The caption read:

Johnny Abbass, official photographer for the Post-Record, assisted by his brother Frank, shot this impressive picture at 11 o'clock last night. It was a time exposure multi-flash photographic job.¹⁷¹

Two days later, the major news was a communist victory in Korea. At home, the big story was a summer heat-wave. Abbass' cover photo depicted kids escaping the heat in a wading pool; one girl was caught "as the photographer snapped her stretching her bubble gum"¹⁷²

The next day, things got worse. There was an explosion in the Number 20 mine; six men were killed, another was injured and died shortly after. Abbass' front page photographs were a portrait of a miner who had risked his life in an attempt to reach the victims, and a group picture of the draegermen, or mine rescue team. The paper complained about the treatment of reporters:

Dosco and union officials kept last night's mine fatality a secret for nearly three hours, and when the grim news finally got to the press, reporters and photographers were given a rough reception. . .



Figure 22. Front page of the Sydney Post-Record, Wednesday, July 9, 1952. (Beaton Institute Archives).

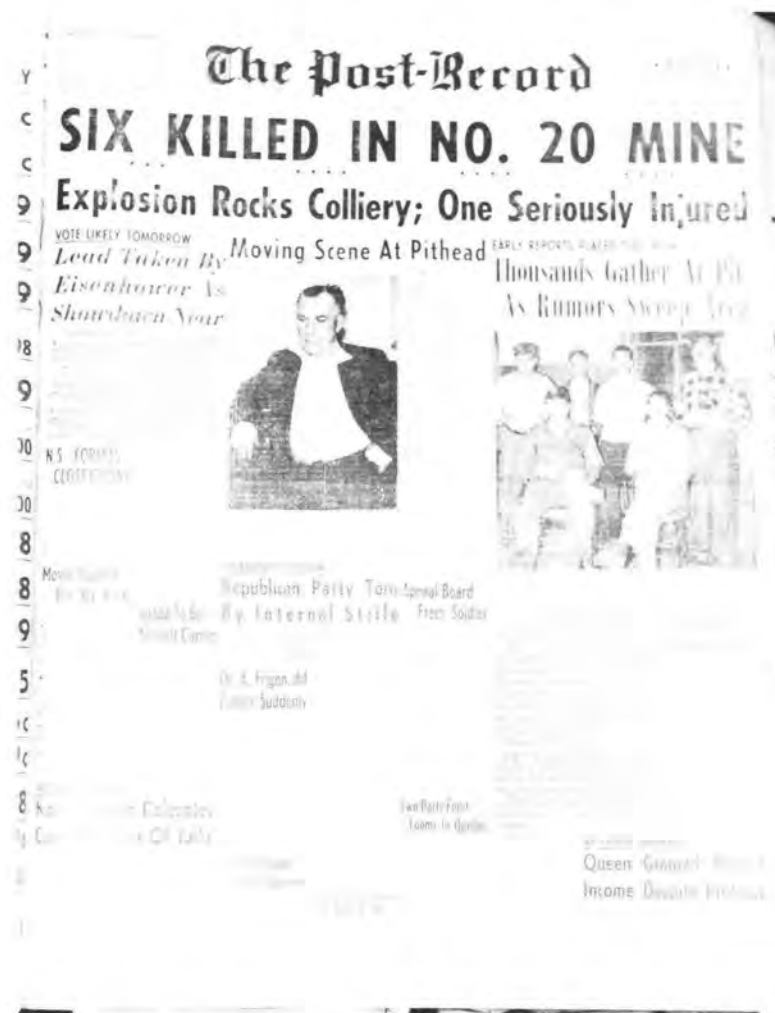


Figure 23. Front page of the Sydney Post-Record, Thursday, July 10, 1952. (Beaton Institute Archives).

Company police blocked off the privately-owned mine area and a reporter trying to gain the pit head said he was slightly manhandled.

*A company watchman relieved a Sydney Post-Record photographer of his camera and the only picture of the rescue activity. The camera-man was escorted behind the restricted area.*¹⁷³

The paper presented a picture of official obstruction, of a bureaucratic attempt to interfere with the public's right to know. Tactfully, the blame was distributed evenly between company and union. In a recent conversation a long-term resident of Glace Bay recalled the disaster, and recalled stories of that night's events at the pit-head. Five of the men who were killed were Black. As the bodies were brought up from the pit, pushy photographers met with anger from some of the assembled miners. A camera was confiscated, and someone threatened to "throw the son-of-a-bitch down the shaft."

On the occasion of even bigger mine disasters, such as the Springhill Mine explosion of 1956, in which thirty-eight miners died, the *Post-Record* printed its headlines in red ink, and Abbass' photographs were printed on a pink ground.¹⁷⁴

So, in certain moments of frustration, anger, and grief, relations between the picture press and working people in industrial Cape Breton seem to have been strained. But things quickly returned to normal. The day after the 1956 disaster the *Post* ran what seems to have been a regular advertisement:

POST-RECORD PHOTOGRAPHS

May be purchased from either Abbass Studios. . . or by ordering from the Post-Record Advertising Department.

*Appointments for picture-taking of weddings, parties, and other events may be made by contacting Abbass Studios, official photographers for the Post-Record.*¹⁷⁵

The combination of press work and commercial work by a simple photographer seems to have been a common practice in Nova Scotia during the 1950s. Also, John Abbass seems to have had a particular knack for combining news work with business promotion.

Craft, Commercial Optimism, and Hard Times

The demand for portraits is high in times of war, and in regions from which migration is common. Shedden Studio opened in 1916, and by 1942, when competing studios opened in the area, David Shedden was able to claim the virtues of experience in his advertisements. Like his father, Leslie Shedden considered himself primarily a portrait photographer; the technique and commerce of portraiture had provided the substance of his apprenticeship and training. In effect, Shedden came to regard portraiture as his *art*, in the older artisanal sense of that term. It was to portraits (and to landscapes) that the work of the hand applied. These were the pictures that, in their most refined and honorific form, were painstakingly hand-coloured. Within the hierarchy of offerings of a commercial portrait studio, these were the most labour-intensive, and hence the most expensive, items. As Thorstein Veblen has suggested, the honorific properties of such objects depend upon the display of gratuitous hand-work in an age of mechanization. Such pictures are a popular grasp at the pedestal occupied by traditional portrait painting. It's interesting to note that Shedden resisted the use of colour photographic materials even when they became widely available. In many ways, Shedden remained committed to a model of commercial photographic practice that developed during the nineteenth century. In this he was not at all unique. His industrial and advertising photographs accept the demands of realism, and sought the truth of well-lit and sharply-focused details. His portraits seek the ennobling effect of light and applied colour.

Shedden had a distinct sense of the division in his work, the boundary between *job* and *craft*:

Of course I was interested in every picture I took. I was interested in quality. After all, the people in the Dominion Coal Company hired me to take these pictures, and if after 2 or 3 trips in the mine I came up with mediocre results or even poor results, I was sure they wouldn't call me back. Artistic expression wasn't there at all. I was basically a portrait man, myself, and the artistic end of it came into that. I was definitely interested there. But not with the commercial work I did with the Dominion Coal Company.¹⁷⁶

Shedden moves here from the slight uneasiness of the *employee* to the confidence of the self-employed artisan. He remained the model of a photographic craftsman and small entrepreneur. In some ways his attitudes were characteristic of older ways, ways that have been eroded by franchise capitalism and the modern fragmentation and specialization of photographic work. The diversity of his work is rare nowadays; most commercial photographers specialize. But in a region of small towns and industry, Shedden and other photographers like John Abbass were provided with a wide range of commercial opportunities, thus combining genres that are separated in more urban areas.

There is another aspect to Shedden's traditionalism. As in many rural industrial regions, regions controlled economically by absentee corporations, small-business people in Glace Bay were traditionally sympathetic to the working class. The labour wars of the 1920s involved a remarkable unity of the local population against corporate power and military force. A similar unity was exhibited in the struggle to nationalize the steel and coal industry with the demise of Dosco in 1967. Leslie Shedden expressed a genuine respect for working people, and remembers his childhood glimpses of the troubles of the 1920s with a strong sympathy for the

miners. Shedden's vision of business was a restrained one. His status in Glace Bay was perhaps somewhere between that of a physician and a pharmacist. He understood his role as an archivist of family life, as someone to whom customers would return on commemorative occasions. Thus his attitudes toward business stressed continuity and professional good-will. He started with one studio, and ended with one studio, which continued with his family name under a new owner.

By way of contrast, Shedden's counterpart in Sydney, John Abbass, was the model of the expansionist small entrepreneur. Abbass recognized the drift in photographic markets toward home photography and commercial photo-finishing. By 1981, Abbass owned his one studio, three processing plants handling orders from five-hundred dealers throughout the Maritimes, and eighteen retail camera stores.¹⁷⁷ Studio photography itself is increasingly rationalized. The younger commercial photographers in Cape Breton advertise their "professional training." Nowadays, apprenticeships and summer school experiences like Shedden's have more or less disappeared in favour of costly and concentrated study of technique and business methods at commercial art academies. In general, this tendency leads to a further homogenization of photographic styles, and to a certain regularization of fashionable innovation in portrait work. Regional and individual mannerisms tend to fade, although young commercial photographers may seek out other avenues from those that beckon from their studio windows.

Leslie Shedden contributed to the promotion efforts of other local entrepreneurs. His photographs of store fronts, of shop displays, of posed merchandising gestures, of local trade fairs (the regional outgrowth of the nineteenth century world exhibitions) helped sustain a spirit of commercial optimism in a region with high unemployment and labour migration. Beginning in 1945, industrial Cape Breton was increasingly infused with Americanized consumer

culture, although the local version was more modest than that which took place in central and western Canada or in most of the United States itself. Shedden chronicled the arrival of television in Cape Breton, and even made stills for local television commercials. He also charted the appearance of chain-store and franchise economy, and he recorded the local versions of national brand-name promotion schemes.

It seems arguable that a once vocal and militant working-class culture was more or less submerged during the Cold War. Earlier, in 1942, when the United Mine Workers began publishing the *Glace Bay Gazette*, a notice ran:

*BROTHER: This is your newspaper. You have a vital stake in it. It is vital to your community. Don't let any misinformed person tell you differently. Ask your union officer anywhere. Your Paper—The People's Paper.*¹⁷⁸

By the late 1940s, this voice, while still present, was muted. The 1950s Sydney *Post-Record* was full of anti-communism and optimistic reports on the latest American weapons. The only movies showing at the new drive-in theatre and four older movie houses in Sydney in 1952 were Hollywood productions. A vision of modest affluence descended upon a region in which times were still tough, and jobs often could only be found by moving to the factories and offices of southern Ontario. A vision of a nuclear family, of a natural harmony between the waged work of men and the unpaid work of women descended upon a region in which women *had* worked at industrial jobs during the war and *still worked* in other areas of the local economy. This vision of the nuclear family also descended upon a region in which extended ethnic kinship ties remained strong, despite the pressures of migration.

It goes without saying that Leslie Shedden's advertising pictures address the workers of industrial Cape Breton as consumers. But this mode of address is also present in some

of his employee-relations pictures for Dosco. In these instances, he documents the giving of commodities—radios, ashtrays, luggage, lamps, cutlery sets and so on—as tokens of managerial approval. Office workers, and particularly women, seem to have been the main recipients of these gestures of good will. Often the occasion was the retirement of a woman who was about to be married, thus passing from the paid to the unpaid work force.

When working people came to Leslie Shedden for a portrait, it was always a special and honorific occasion. The studio provided an abstract but privileged ground for the presentation of the self. These photographs do not provide us with the same sense of everyday life and leisure that we might find in a collection of casual family snapshots. When these formal portraits are grouped anonymously in a book, their emotional effects are muted, or shifted to another *social* level of identification and projection. For those who know and remember these anonymous sitters, the original effects are, I would think, present once again, but in a fashion that is also transformed by this new, more widely social context. In this wider context, the *economic character* of ceremonial occasions becomes evident. Graduations, weddings, and the like are layered in sentiment, but underneath lies a bedrock of economic constraint. Young people enter the economy to find work, not to find work, to migrate, to marry. Weddings still ritualize what the anthropologist Claude Lévi-Strauss called the "exchange of women." The family, still the unit of social reproduction, is itself reproduced.

A number of ironies—the ironies of economic underdevelopment—emerge. Leslie Shedden made yearbook pictures for all six of Cape Breton's nursing schools, documenting the arrival of new students and making portraits of administrators, faculty, and graduates. Cape Breton exports nurses to the rest of Canada. Health care in the region itself remains inadequate. Serious cases have to be rushed to Halifax, over four hundred kilometres to the southwest

of industrial Cape Breton. Furthermore, the only major facilities for the treatment of industrial diseases are found in Halifax hospitals. Another irony is found in a 1956 decision by the Sydney school board, reported in the *Post-Record*:

A school board meeting decided last night to allow only group photographs to be taken in Sydney schools. In making the motion, alderman Carl Neville said the taking of individual photos was becoming too big a burden on parents. He also said the value of group photographs in later life was far greater.¹⁷⁹

And so here was another kind of community resistance to photography, directed this time at the pressures of the commercial photographer.

*Those in Darkness, Those in Light*¹⁸⁰

The actual experience of a coal mine is quite unlike anything that can be depicted in a still photograph. (But then the equation of the photographic images with "experience" is always problematic.) The darkness in mines is penetrated only intermittently and meagerly by miners' lights. The dangers of the mine are either invisible, or are compounded by the darkness. Literary descriptions and miners' stories are frequently more revealing of claustrophobia, darkness, and phenomenal duration than any photograph could be. I'm thinking here especially of George Orwell's *The Road to Wigan Pier*; with its rigorous attention to the heat, dust, noise, darkness, and, above all, the experience of time and exertion underground.¹⁸¹

Leslie Shedden's photographs of coal mines conform to the Encyclopedic paradigm. Here are clean, well-lit tableaux. There are two kinds of stasis, both uncharacteristic of normal events in the mine. First, there is the overt stasis of the "pose," of a group of managers or miners standing self-

consciously in front of the camera. For the miners it was a momentary break. For the managers it was a momentary performance as miners. Second, there is a duplicitous sort of stasis, a stasis which poses as movement. A machine is shown "in action," cutting into the coal face. But if this were true the camera would have registered a black fog of coal dust.

Shedden used light to introduce the codes of classical perspective into the mine. His tunnel and longwall-face photographs are quite remarkable in this regard. These were frequently multiple exposures, involving the incremental movement of lights away from the camera and toward a vanishing point. In one picture of a rectangular longwall-face, what we see is a receding series of luminous frames, diminishing in size as the vanishing point is approached. In another photograph, Shedden's method is revealed: we see the ghostly figure of his underground assistant repeated three times.

Why were so many photographs taken of machinery, and so few of miners? Shedden is very direct on this point: "We didn't go down in the mines to take pictures of workmen, we went down to take pictures of machinery, of equipment."¹⁸² It was only at the end of a picture session, which required the assistance of the miners in positioning cables and equipment and in occasionally posing behind the controls of a machine, that the mine manager would suggest that Shedden take a group portrait as a reward. Certainly, in most of these photographs, miners are either absent, or are seen as mere "appendages to the machine." Dosco, of course, was not just a colliery company, but was also a manufacturer of mining machines. Don Macgillivray's essay in this book describes well the problems of the Dosco Miner, the Edsel of continuous longwall mining machines. Nonetheless, during the 1950s and early 1960s, this machine was doubly important to the directors of the Dominion Steel and Coal Company. Here, they



Typical of the "mechanical monsters" which have turned "Fiber" and "Steel" into "Coal" is this modern mode of underground transport — 100 H.P. Diesel Locomotive, operated by the Mines Trading Station, Buxton, England, for use underground in coal mines. Thirty of these locomotives are in use in the Cape Breton, Nova Scotia, mines of the Dominion Coal Company, Limited. The introduction of these locomotives to increase transportation efficiency underground is part of Devco's extensive mines mechanization programme.

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A close-up view of the cutting jib of the "Desso Miner" which chews out a block of coal 5 ft. wide and 18 in. in depth. The cutting chains revolve as the jib moves in an arc from the bottom to the top of the coal seam, during which the "teeth" on the chains bite into the coal and throw it back onto a belt conveyor. This machine is capable of producing over 500 tons per 8-hour shift.

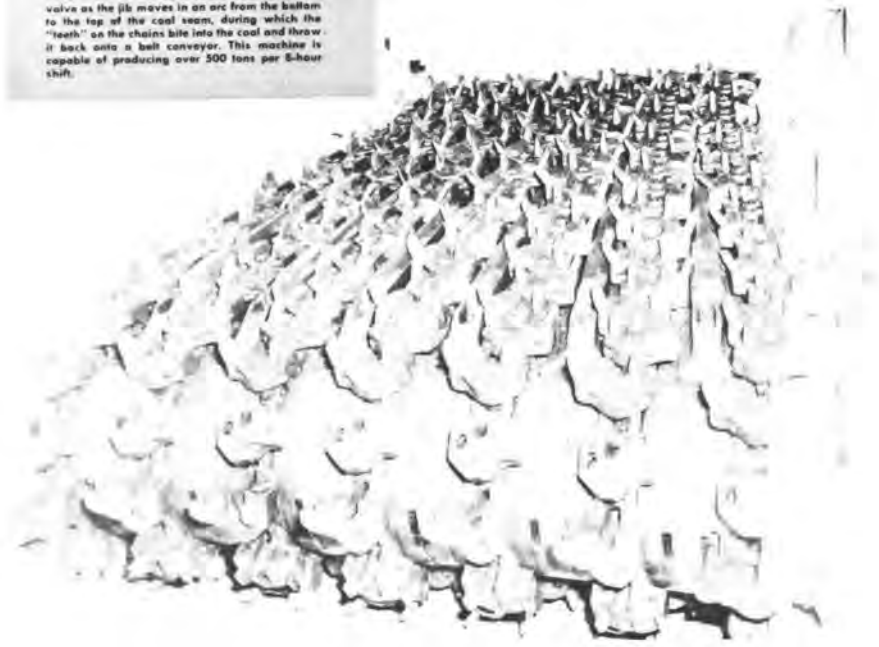


Figure 24. A page from the *Dominion Coal Annual Report*, 1956. (Devco Company Archives).

thought, was the key to increased production in the Cape Breton mines and a product to be aggressively marketed to other colliery operators. Generally speaking, coal companies *per se* are not so enthusiastic about commissioning underground photographs.

How were these underground photographs used? They appeared in technical reports, in engineering journals, and in mining industry magazines. Within the company, they were reproduced in the *Dominion Coal Annual Report* and in the two employee-relations magazines, the Montreal-produced *Dosco World* and the local *Teamwork*. (The latter's graphic motif was a cartoon of a worker and a manager pulling together for "quality, safety, efficiency, quantity.") Mining pictures also appeared in the local newspapers from time to time. And, as Shedden's installation photographs reveal, the company used his pictures at local trade fairs in Cape Breton.

In general, the *Annual Report* favoured machinery, while *Dosco World* and *Teamwork* favoured "human interest" pictures, showing miners at work. Robert Wilkie has discussed the paternalistic character of Dosco employee-relations in his introductory essay. Here's an example of the discourse of the stockholder.

The 1956 *Annual Report* touted the Dosco continuous miner. The cover includes a view of the machine "in action" with a more reserved shop photograph. Inside the report, a layout focuses on Dosco's "extensive mines mechanization programme." Another shop photograph of the continuous miner, its cutting jib ready to chew coal, accompanies a "before-and-after" narrative in two frames. The last of the pit horses is juxtaposed with a new underground locomotive. Interestingly enough, no equivalent antecedent is mentioned for the continuous miner. It is as if we were staring at a ratio with a missing term:

- Locomotive replaces horse.
- Continuous miner replaces X.

But this repressed entity returns in the form of an anthropomorphized horse. The caption beneath the horse picture reads as follows:

A Victim of Mechanization—Let out to pasture some time ago, "Fraser" will spend the rest of his days living the "life of Riley" after 16 years of continuous service underground—without losing any time due to injury or illness.¹⁸³

"Fraser" is named. The driver of the locomotive, like other miners who appear from time to time in the corporate report, is not named. The caption exhibits the same glibness that we find in *Fortune* magazine captions beginning in the 1930s, although here the tone is more folksy. Furthermore, the caption appropriates and trivializes any critique of mechanization. This "victim," this exemplary worker, is moving on to greener pastures. "Fraser" is a pet, the imaginary displacement of the displaced miner.

Shedden's photograph of Fraser-the-horse was popular in industrial Cape Breton as well. But here the meaning was rather different. This image of an aged horse, posed nobly against a pit head, suggested a pastoral ideal. Here then, was an expression of agrarian longing. Other photographs were popular as well. One in particular comes to mind. Among all of Shedden's mine photographs, only one portrays the exercise of brute physical strength. This picture shows a pair of miners securing roof supports behind a Dosco continuous miner. One of the men is almost invisible, but he assists a man who is kneeling and swinging a sledge with his bare arms. This latter action is reminiscent of the obsolete work of the coal shoveler, or pick handler, who had to exert the strength of the upper body while kneeling under a low roof. It was this photograph that was reproduced in the *Post-Record* on Labour Day. It was this photograph that embodied the dignity of manual labour for the residents of an industrial community.

Thus there were, in effect, two separate representations of mining emanating from the archives of Dosco. One, for stockholders, stressed efficiency and mechanization. The other, for workers, stressed the dignity of work, the need for cooperation and efficiency, and the benevolence of the company. However, sometimes these discourses got confused. In September, 1955, *Teamwork* ran an article entitled "Industry Can Be Beautiful." In this instance, the rhetoric of corporate modernism was brought within earshot of the workplace itself. An esthetic sensibility that had been previously reserved for managers and stockholders was now offered to the workers. In effect, the article seems to have been an attempt to explain and justify the presence of photographers within mine and steel mill. The article suggested that increased sales depended upon industry's ability to estheticize itself to the public. Furthermore, the industrial photographer was not an intrusive pest, but a genius *and* a worker:

It is far easier to picture cows in a field, or the cascading waters of a Niagara. Industrial photography requires a generous amount of artistic genius, in addition to a willingness to labor long and hard.¹⁸⁴

Implicitly this article is stressing the need for workers "to keep facilities and equipment attractive enough to photograph."¹⁸⁵ Even the industrial "landscape" contains an injunction.

Tourism and Industrial Decline

A tourist economy is eminently compatible with economic underdevelopment, as the Cuban critic Edmundo Desnoes has argued. Tourism seeks sites in which nature and the past still live, although it also seeks the cosmopolitanism and modernism of the city. Industrial



An aerial photograph of Doreys Hill Furnace Department in Sydney, operated by Dominion Iron & Steel Limited.

INDUSTRY CAN BE BEAUTIFUL

In 55 B. C. Julius Caesar said, "Nothing is great until it stands revealed." Several thousands of years before Caesar's day, a far-seeing Chinese, possibly with the instinct of a commercial photographer, observed, "One picture is worth 10,000 words." Combining the two systems, modern industry has come up with this merger: "The best way to reveal something great is — with pictures."

The surprising thing is that it took industry, which is traditionally lazing on initiative, so long to get around to this bit of wisdom. Years before, the trail for industrial photography had been blazed by such pioneers as John A. Mather, who in 1890 followed the oil rush to Titusville, Pennsylvania, and for forty years thereafter devoted his skill to creating a precious photographic record of industrial progress.

Only a few photographers, however, chose to follow the Mather example. Most of them were content to establish their studios and go on their usual routine. Those who did "go on the road" were mainly intent on pictorial propaganda, company, regional, historical, and other types of popular interest. They saw no reason to go out and

Today the story is different. Some of the nation's foremost photographers are specializing in pictures which reveal to the public the massiveness of industry, the wonders of its production facilities, the immenseness of its research efforts. In molten fire, in mighty hammers, in delicate instruments, in a thousand ways which the ingenuity of the photographer can choose from the endless panorama of industrial enterprise, the story is being revealed to the people.

All this is good advertising, and mighty good public relations, and as such it justifies the liberal allotments being made to this phase of industrial activity today, along with budget items for sales, production, research administration.

How big the job is to be depicted, on the size and scope of an industry's operations, and the immense practical value which the photographic medium is to add to the picture enterprise. A good deal may have been in contact with the sensitive public, and even, perhaps, its varied in knowing the company and the scope and quality of its products before millions of readers. Industry, which must sell its products through thousands of retail outlets, has further reason for the significance of the picture, even if it can be taken by the flashes of the business camera, and its record on advertisements, to give its customers complete satisfaction.

regions are frequently bypassed, driven through hastily, or mentioned with disdain.¹⁸⁶ And yet, on occasion, the factory, the coal mine, the industrial waterfront are converted into spectacle. With the decline of industry, or with the replacement of older forms of production, industrial zones can become the site of a new nostalgic and essentially touristic look at the past. This is especially true of the harbour cities, which have long sustained a romance of primitive accumulation, of piracy, and pre-industrial commerce and adventure. Recently, however, the replacement of older forms of longshoring by centralized and mechanized containerization depots has opened up old waterfront warehouses to boutiques and restaurants in which antique nautical motifs predominate. But what the tourist sees through the fishing net draped over the picture window, is a modern automated harbour, a harbour from which the small fisherman and the stevedore are increasingly absent. This is especially true in Los Angeles, in San Francisco, and in Halifax. In San Francisco, for example, the harbour itself does not function, but merely looks like it does. The real work goes on in Oakland, miles away.

Industrial Cape Breton has long been the logistical center of a tourist region. But the scenic beauties of the island are generally considered to reside elsewhere; in the highlands, in the rural countryside, and along the rugged coast. Nonetheless, the mines and the mills can be accommodated to a certain romance, a romance of the Industrial Revolution, a North American version of the industrial sublime. I believe this is happening in a more extreme fashion in a city like Pittsburgh, where massive unemployment in the steel industry parallels the "redevelopment" of the downtown area into the world's third largest concentration of corporate headquarters. The old, industrial Pittsburgh becomes a silent, hulking spectacle for a new breed of multinational managers. United States Steel runs its mills well below capacity, but buys out Marathon Oil.

Figure 25. "Industry Can Be Beautiful," a one page photo essay from the Dosco employee-relations magazine, *Teamwork*. (Beaton Institute Archives).

Cape Breton has been photographed a lot, by tourists and by professionals who sell their work to tourists. Virtually any bookstore in Nova Scotia will carry a number of coffee-table books, illustrated with colour photographs. Most of these books prefer the pictorial possibilities of rural and coastal Cape Breton. In this, they offer an updated version of Leslie Shedden's own sense of landscape. Within these books, landscape is offered as the antithesis of an industry that is not pictured. We should note, however, that the actual "landscape" of Cape Breton is not exempt from the pressures of industrial development. A Swedish multinational company is attempting to defoliate the hardwood forests of the island, in order to plant faster-growing evergreens for pulpwood. The chemical of choice is virtually the same as that used by the Americans in Vietnam. This form of organized ecological violence is being met with organized resistance by the people of Cape Breton, with native Canadians taking a leading role. And so perhaps, today, the very idea of a "landscape" has to be defended, but in a politically-organized and ecologically-sensitive fashion.

One recent book of colour pictures from Cape Breton is markedly different from the rest. I'm thinking here of Owen Fitzgerald's *Cape Breton*.¹⁸⁷ His pictures tend to be more casual, more snapshot like, and more interested in industrial Cape Breton than the careful pictorialist efforts of his colleagues. One photograph in particular is interesting, for what it reveals about one Cape Bretoner's ambivalence towards industry. Fitzgerald photographed the Sydney steel mill from behind a bed of yellow daisies, so that the blast furnaces emerge from an ocean of flowers. Here, as in Shedden's portrait of Fraser-the-horse, is an attempt to construct the industrial pastoral, to harmonize nature and industry. But we can also read this photograph as a lament for a troubled industry, an industry plagued by antique equipment and barely surviving despite nationalization. Fitzgerald's photograph is both lyrical and pessimistic, suggesting a funeral bouquet.



Figure 26. A black and white reproduction of a colour photograph of the Sydney steel plant from Owen Fitzgerald's book entitled *Cape Breton*. (Collection: Owen Fitzgerald).

The difficulty with this edge of pessimism is that it lends itself too easily to the economic development policies of those who would like to see tourism and pulpwood production replace steel and coal as the major industries of Cape Breton. The factory is remembered with nostalgia but abandoned. A similar commemoration could have enveloped Leslie Shedden's coal mining archive.

The Group Photograph

Recently, *Vanity Fair* magazine was resurrected from the dustbin of publishing history. This relic of leisure-class self promotion from the 1920s and 1930s was the complement to *Fortune*. *Fortune* celebrated corporate dynamism and the new captains of industry. Its characteristic visual image was the modernist industrial abstraction, of the sort produced by Margaret Bourke-White. *Vanity Fair* celebrated life at the top. Its characteristic visual image was the celebrity portrait, of the sort produced by Edward Steichen. Why am I telling you this? Because in the New *Vanity Fair* we discover the *post-modernist inversion* of the icon of the heroic worker, an icon that appeared—as I have already noted—in the pages of *Fortune* in the 1930s alongside the modernist industrial abstraction.

We are treated to a portfolio of Richard Avedon photographs: group portraits, taken against Avedon's trademark white backdrop, of coal miners and oil riggers from Wyoming, Colorado and Oklahoma.¹⁸⁸ Apparently these pictures are part of an exhibition project scheduled for 1985 at the Amon Carter Museum in Fort Worth, Texas. It's hard to know exactly what Avedon's up to with this larger work. The project's title is: "In the American West." Maybe we'll have portraits of the real-life counterparts of J.W. Ewing of *Dallas* fame installed next to these grimy workers, whose names are provided in Avedon's captions. Nonetheless, within the pages of the new *Vanity Fair* these

photographs seem appropriate to a cynical esthetics of Reaganism. Imagine a smooth managerial voice offering advice to unemployed workers of the Northeast: "That's where the jobs are, out West." In one foldout portrait in particular Avedon performs a bit of hackneyed cubist surgery, perhaps a deliberate attempt to offend what remains of humanist sensibilities in photographic circles. One miner is bisected by a black frame line, and given an extra nose. But Avedon, like many post-modernists, revels in an ambivalent relation to genre. Thus, on the other hand, these miners display an easy camaraderie, arms around shoulders, touching one another.

I want to end this essay by thinking of Leslie Shedden's group photographs of working people. The businessmen who commissioned these pictures sought to exhibit the virtues of "teamwork" in industry and of skilled and attentive service in small enterprise. They also sought, on occasion, to validate and reward their employees by means of portraiture. Leslie Shedden also photographed family groups, school groups and occasional clubs and civic organizations. We should not assume that herein lies a complete picture of social life in Glace Bay. The union, in particular, is markedly absent from this archive. Furthermore, more informal social groupings, which may or may not be pictured in amateur and snapshot photographs, are also absent. (Think also of how absent home life is from this archive, despite the various domestic advertisements. Do we learn or remember anything about miners' housing or unofficial leisure from these pictures?) Thus a restricted range of sociality is charted here.

Nonetheless, this archive acknowledges the *social* character of work, despite the fact that Dosco wanted Shedden to celebrate its search for an automated coal mine. To modify Roland Barthes' remark that: "It is hard to be done with a civilization of the hand," we might argue that it is hard to be done with a civilization of working people. The people of industrial Cape Breton have demonstrated this with

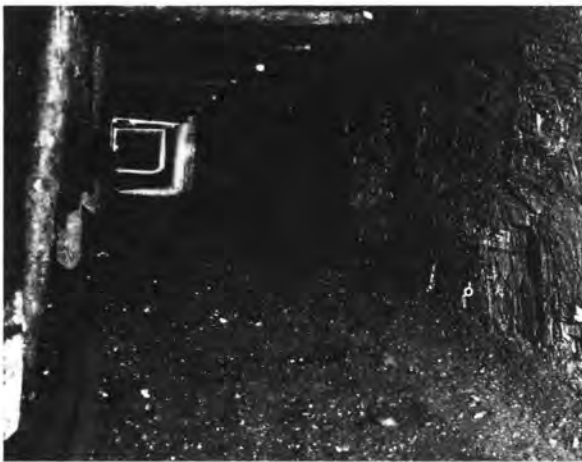


Figure 27. Long wall face.



Figure 28. Dosco continuous miner in action.



Figure 29. Fraser-the-horse; last of the 1-B pit ponies.



Figure 30. Miners installing roof supports.



Figure 31. Presentation of cutlery to an office worker.



Figure 32. Glace Bay, Manufacturers' Fair.



Figure 33. Group of miners after finishing shift.



Figure 34. Annie's Beauty Salon staff.

Figures 27-34. From the negative archives of Shedden Studio. All photographs taken by Leslie Shedden. (See plate sections for more detailed captions.)

their solidarity, their resilience, their strong sense of cultural continuity, and their willingness to struggle.

The group photograph, then, harbours another meaning, a meaning that contradicts the logic of management. Here, posed confidently around the instruments and materials of production, are people who could quite reasonably control those instruments and materials. Therein lies a promise and a hope for the future.

A final note: This essay is dedicated to my parents. It was helped along by a number of people. I'm grateful to David Paskin, a labour historian, for initial encouragement. Don Macgillivray and Robert Wilkie introduced me to Cape Breton and steered me in the right directions. Bob kept me going with encouragement and support. My biggest thanks is to Sally Stein, for everything.

Notes

1. Walter Benjamin, "Theses on the Philosophy of History" (1940) in *Illuminations*, edited by Hannah Arendt and translated by Harry Zohn, (New York, 1969), p. 255.
2. Jean-Luc Godard and Jean-Pierre Gorin, *Vent d'Est* (Rome, Paris, Berlin) filmscript published in Jean-Luc Godard, *Weekend/Wind from the East*, (New York, 1972), p. 121.
3. "What is represented in ideology is therefore not the system of the real relations which govern the existence of individuals, but the imaginary relation of those individuals to the real relations in which they live." Louis Althusser, "Ideology and Ideological State Apparatuses", (1969) in *Lenin and Philosophy and Other Essays*, translated by Ben Brewster, (New York, 1971), p. 165. Althusser's model of ideology is based in part on Marx and in part on the work of the psychoanalyst Jacques Lacan. Without belabouring this lineage, or explaining it further, I would like to refer the Canadian reader especially to a work by Lacan's first English translator and critical interpreter, Anthony Wilden: *The Imaginary Canadian: An Examination for Discovery*, (Vancouver, 1980).
4. Bernard Edelman, *Ledroit saisi par la photographie* (Paris, 1973) translated by Elizabeth Kingdom, *Ownership of the Image: Elements for a Marxist Theory of Law*, (London, 1979), p. 45.
5. Roland Barthes, "Rhetorique de l'image," *Communications* 4, 1964, in *Image, Music, Text*, translated by Stephen Heath, (New York, 1977), p. 51.
6. Leopold von Ranke, preface to *Histories of the Latin and Germanic Nations from 1494-1514*, in *The Varieties of History*, edited by Fritz Stern, (New York, 1972), p. 57.
7. See Guy DeBord, *La société du spectacle*, (Editions Buchet-Chastel, Paris) 1967 unauthorized translation, *Society of the Spectacle*, (Detroit, 1970, revised edition, 1977).
8. We might think here of the reliance, by the executive branch of the United States government, on "photo opportunities." For a discussion of an unrelated example see Susan Sontag's dissection of Leni Riefenstahl's alibi that *Triumph of the Will* was merely an innocent documentary of the orchestrated-for-cinema 1934 Nuremberg Rally of the National Socialists. Sontag quotes Riefenstahl: "Everything is genuine . . . It is *history—pure history*." Susan Sontag, "Fascinating Fascism," *New York Review of Books*, Vol. XXII, No. 1, February, 1975, reprinted in *Under the Sign of Saturn*, (New York, 1980), p. 82.
9. Two recent books counter this prevailing tendency in "visual history" by directing attention to the power relationships behind the making of pictures: C. Heron, S. Hoffmitz, W. Roberts, R. Storey, *All That Our Hands Have Done: A Pictorial History of the Hamilton Workers* (Oakville, Ontario, 1981) and Sarah Graham-Brown *Palestinians and Their Society 1880-1946*, (London, 1980).
10. In the first category are books which discover unsung commercial photographers: e.g. Mike Disfarmer, *Disfarmer: The Heber Springs Portraits*, text by Julia Scully, (Danbury, New Hampshire, 1976). In the second category are books which testify to the esthetic sense of the collector: e.g. Sam Wagstaff, *A Book of Photographs from the Collection of Sam Wagstaff*, (New York, 1978).
11. This passage restates an argument made in my essay, "The Traffic in Photographs," *The Art Journal*, Vol. 41, No. 1, Spring 1981, pp. 15-16.
12. Walter Benjamin, "Theses on the Philosophy of History," pp. 256-257.
13. Georgius Agricola, *De Ortu et Causis Subterraneorum*, Book III (1546) quoted in Herbert Clark Hoover and Lou Henry Hoover, Introduction to *De Re Metallica*, (Original edition: Basel, 1556), translated by Herbert Clark Hoover and Lou Henry Hoover, (London, 1912), reprint edition, (New York, 1950), p. XIII.
14. Denis Diderot, "Prospectus" (1750) published as Part III of Jean le Rond d'Alembert and Denis Diderot, "Discours préliminaire de editeurs," in Volume I (1751) of *Encyclopédie, ou Dictionnaire raisonné des sciences, des arts et des métiers, par une société de gens de lettres*, (Paris, 1751) English translation by Richard N. Schwab in d'Alembert, *Preliminary Discourse to the Encyclopedia of Diderot*, (Indianapolis, 1963), p. 124.
15. See Andre Gunder Frank, *World Accumulation 1492-1789* (New York, 1978) and Eduardo Galeano, *Open Veins of Latin America: Five Centuries of the Pillage of a Continent*, (New York, 1973), pp. 21-70.
16. On the "universal applicability" of steam power, see Karl Marx *Capital*, Vol. I translated by Ben Fowkes, (New York, 1977), p. 499. For a very general history of mining since antiquity, see John Temple, *Mining: An International History*, (New York, 1972).
17. Lewis Mumford, *Technics and Civilization*, first edition 1934, (New York, 1963), p. 70.
18. Francis Bacon, *Of the Dignity and Advancement of Learning*, (De Dignitate et Augmentis Scientiarum, 1623), in *The Works of Francis Bacon*, (London, 1870), Vol. IV, p. 343.
19. Andreas Vesalius, *De Humani Corporis Fabrica*, (Basel, 1543). In his preface Vesalius argued: "After the barbarian invasions all the sciences . . . went to rack and ruin. At that time . . . fashionable doctors began to despise the work of the hand, in imitation of the ancient Romans. They assigned the manual treatment . . . to slaves and limited themselves to supervising . . . Thus it happened that this deplorable division of the medical arts has introduced into our schools the odious system, now in vogue, through which one individual performs the dissection of the human body and the other describes the parts . . . Thus everything is poorly taught, days are wasted in absurd questions . . ." (quoted in Paolo Rossi, *Philosophy, Technology and the Arts in the Early Modern Era*, translated by Salvator Atanasio, New York, 1970, p. 8).
20. Agricola, *De Re Metallica*, p. xxv.
21. *Ibid.*, p. xxx.

22. George Sarton, *The Appreciation of Ancient and Medieval Science During The Renaissance*, (Philadelphia, 1955), p. 93.

23. William Ivins, *Prints and Visual Communication*, (Cambridge, Massachusetts, 1953), p. 3. See also Elizabeth L. Eisenstein, *The Printing Press as an Agent of Change*, (Cambridge, England, 1979) pp. 265-272, pp. 467-488.

24. Leon Battista Alberti, *Della pittura* (1435), translated by John R. Spencer, *On Painting*, (New Haven, 1966), p. 43.

25. Leonardo da Vinci, *The Notebooks of Leonardo da Vinci*, edited by Pamela Taylor, (New York, 1960), p. 73.

26. Agricola, *De Re Metallica*, p. 17.

27. *Ibid.*, p. 18.

28. It is worth noting here that Agricola remained an ardent Roman Catholic in the midst of the Reformation, in a region politically dominated by Protestants. The principal intellectual opponent of the Reformation, Erasmus, was friendly with Agricola and contributed an introduction to his first book on mining and metallurgy, *Bermannus*, published in 1530. In that text Erasmus remarked that Agricola's description of veins of gold and silver "almost aroused a feeling of avarice in his own bosom." (Frank Adams, *The Birth and Development of the Geological Sciences*, New York, 1938, p. 190). But as Max Weber points out, Luther also resisted the logic of emerging capitalism, and explicitly attacked usury, (*The Protestant Ethic and the Spirit of Capitalism*, first published 1904-1905, translated by Talcott Parsons, New York, 1958, p. 82).

29. *De Re Metallica*, p. 23-24.

30. Agnes Heller, *Renaissance Man*, translated from Hungarian by Richard E. Allen, (London, 1978), p. 396.

31. Alfred Sohn-Rethel, *Intellectual and Manual Labour: A Critique of Epistemology*, (London, 1978), pp. 113-116. See also Erwin Panofsky, *The Life and Art of Albrecht Dürer*, (Princeton, 1954), p. 254.

32. John U. Nef, "Introductory: Mining and Metallurgy in Medieval Society," in *The Conquest of the Material World*, (Cleveland, 1967), p. 49. See also Friedrich Engels, "The Peasant War in Germany" (1850) in *The German Revolutions*, edited by Leonard Krieger, (Chicago, 1967), pp. 3-119.

33. *De Re Metallica*, p. 41.

34. William Ivins, *Art and Geometry*, (New York, 1946), pp. 64-86.

35. *De Re Metallica*, p. 99. On early industrial time-discipline see E.P. Thompson, "Time, Work-Discipline, and Industrial Capitalism," in *Past and Present*, No. 38, December 1967, pp. 56-97.

36. *De Re Metallica*, p. 101.

36. *Ibid.*, p. 26.

37. *Ibid.*, p. 129.

39. *Ibid.*, p. 217. On cartography see Lloyd A. Brown, *The Story of Maps*, (New York, 1949), p. 99-100.

40. Nef, *The Conquest of the Material World*, pp. 50-51.

41. Herbert Hoover, *The Memoirs of Herbert Hoover: Years of Adventure: 1874-1920*, (New York, 1951), p. 117.

42. Karl Marx, *Capital*, Vol. I, p. 915.

43. Mumford, *Technics and Civilization*, p. 74.

44. Edwin T. Layton, Jr., *The Revolt of the Engineers*, (Cleveland, 1971), p. 189. Layton argues that: "Mining engineers were more closely involved in management than any others. . . . Of all the technical fields, it was the least influenced by science. There was no parallel to the virtual merger with physics that had occurred in electrical engineering." In this light, Hoover's attempt to

reproduce the vellum binding, paper and typeface of Agricola's original text can be seen as both a historicist gesture and as an attempt to indicate the esthetic refinement of the engineer-businessman: "A limited edition is in effect a guarantee—somewhat crude, it is true—that this book is scarce and that it therefore is costly and lends pecuniary distinction to its consumer." (Thorstein Veblen, *The Theory of the Leisure Class*, first edition 1899, New York, 1934, pp. 163-164). On the rise of the engineering profession, see also David Noble, *American by Design: Science, Technology, and the Rise of Corporate Capitalism*, (New York, 1977).

45. Paolo Rossi, *Philosophy, Technology, and the Arts in the Early Modern Era*, pp. 2-15.

46. *Francis Bacon, A Selection of His Works*, edited by Sidney Warhaft, (Toronto, 1965), p. 400.

47. *Ibid.*, p. 447.

48. *The advice of William Petty to Mr. Samuel Hartlib for the Advancement of some particular Parts of Learning*, quoted in Rossi, p. 124.

49. See note 14.

50. Denis Diderot, "The Encyclopedia" (1775) in *Rameau's Newpew and Other Works*, translated by Jacques Barzun and Ralph H. Bowen, (New York, 1956), p. 298.

51. Diderot, in d'Alembert, *Preliminary Discourse*, p. 122.

52. *Ibid.*, p. 123.

53. Marx, *Capital*, Vol. I, p. 616. To be fair to Diderot, we should note another of his remarks on the secretive character of Parisian artisans: ". . . fear of the tax collector keeps them in a state of perpetual mistrust. . . they regard every man who questions them at all closely either as a spy for the farmers general (tax collectors) or as a rival craftsman who wants to set up shop." ("The Encyclopedia," p. 319).

54. *Preliminary Discourse*, p. 124.

55. *Ibid.*

56. *Ibid.*, p. 126.

57. Roland Barthes, "The Plates of the Encyclopedia," (1964) in *New Critical Essays*, translated by Richard Howard, (New York, 1980), p. 33.

58. *Ibid.*, p. 29.

59. *Preliminary Discourse*, p. 124.

60. Barthes, p. 29.

62. *Preliminary Discourse*, p. 124.

62. *Ibid.*, p. 125. It's worth noting that Diderot both borrowed from and improved upon earlier technological plates. On the controversy surrounding accusations of plagiarism see John Lough, *The Encyclopédie*, (London, 1971), pp. 85-91.

63. Barthes, p. 23.

64. Charles Saunders Peirce, *Philosophical Writings of Peirce*, edited by Justus Buchler, (New York, 1955), pp. 99-119. Peirce developed three trichotomies of signs. The second of these classified signs as Icons, Indices, or Symbols. Icons exhibit the qualities of an object. A drawing would be an icon. Indices exhibit the qualities of an object and are physically affected by, or connected to, that object. A photograph would be an index (and, in most cases, an icon as well). A symbol signifies by virtue of a law or convention. Verbal language would be considered symbolic in Peirce's system. Peirce argued that "icons and indices assert nothing. If an icon could be interpreted by a sentence, that sentence must be a 'potential mood', that is, it would merely say, 'suppose a figure has three

sides', etc. Were an index so interpreted, the mood must be imperative, or exclamatory, as 'See there!' or 'Look out!' " For Peirce, only symbols could register meaning in the "declarative" mood. (p. 111) Peirce's semiotics have had an important effect on recent photographic criticism in the United States, primarily through the work of Rosalind Krauss. See her "Notes on the Index: American Art in the 70s" *October* Nos. 3 and 4, Spring and Fall 1977.

65. Louis Jacques Mandé Daguerre, "Daguerreotype," (1839) in Helmut and Alison Gernsheim, *L.J.M. Daguerre: The History of the Diorama and the Daguerreotype*, (New York, 1968), p. 81.

66. Edgar Allan Poe, "The Daguerreotype" *Alexander's Weekly Messenger*, (January 15, 1840), p. 2, reprinted in Alan Trachtenberg, editor, *Classic Essays on Photography*, (New Haven, 1980), p. 38.

67. *Ibid.*, p. 38.

68. Francois Arago, "Report," in Josef Maria Eder, *History of Photography*, translated by Edward Epstean, (New York, 1945), pp. 234-235.

69. *Ibid.*, p. 238.

70. Arago, letter to Duchâtel, (June, 1839) in Gernsheim, *L.J.M. Daguerre*, p. 91.

71. Quoted in A. Rupert Hall, *From Galileo to Newton*, (New York, 1963), p. 84.

72. Oliver Wendell Holmes, "The Stereoscope and the Stereograph," *Atlantic Monthly* III, No. 20, June 1859, p. 748.

73. *Ibid.* See also Karl Marx, *Capital*, Vol. I, pp. 163-177. For a more developed reading of Holmes' equation of photography and money, see my "Traffic in Photographs," pp. 21-23.

74. Georg Simmel, *The Philosophy of Money*, translated by Tom Bottomore and David Firisby, (London, 1978), pp. 443-446.

75. Jeremy Bentham, "A Fragment on Government," (1776) in Mary Peter Mack, editor, *A Bentham Reader*, (New York, 1969), p. 45.

76. Quoted in Helmut and Alison Gernsheim, *The History of Photography*, (New York, 1969), p. 239.

77. Marcus A. Root, *The Camera and the Pencil*, (Philadelphia, 1864), pp. 413-414.

78. *Ibid.*, pp. 419-420.

79. See Eder, *History of Photography*, Chapter LV, "Photogrammetry," pp. 398-402. Also, see Jean Pierre Edouard Paté, *Application de la photographie à la topographie militaire*, (Paris, 1862).

80. U.S. Military Commission to Europe, *Report on the Art of War in Europe* by Colonel R. Delafield, U.S.A., (Washington, 1861).

81. *The Camera and the Pencil*, pp. 420-421.

82. Thomas Hobbes, *Leviathan* (1651), edited by C.B. Macpherson, (London, 1968), p. 150.

83. Jeremy Bentham, *Panopticon; or The Inspection House* (1787) in *The Works of Jeremy Bentham*, Vol. IV, edited by John Bowring, 1843, p. 39.

84. See Gertrude Himmelfarb, "The Haunted House of Jeremy Bentham," in *Victorian Minds*, (New York, 1968), pp. 32-81. See also Michel Foucault, "Panopticism," in *Discipline and Punish: The Birth of the Prison*, translated by Alan Sheridan, (New York, 1977), pp. 195-228.

85. See John Werge, "Rambles Among the Studios of America" (1865) in *The Evolution of Photography*, (London, 1890), pp. 200-201. For a history of the nineteenth century photographic industry in the United States, see Reese Jenkins, *Images and Enterprise: Technology and the American Photographic Industry, 1839 to 1925*, (Baltimore, 1975).

86. Charles Baudelaire, "The Modern Public and Photography" in *Classic Essays*

on Photography, p. 88. This was part of Baudelaire's review of the Salon of 1859, and was published in *Le Boulevard*, September 14, 1862.

87. Published in *Aujourd'hui*, March 15, 1840.

88. Published in *Le Charivari*, July 2, 1840.

89. La Lumiere, v. 1, p. 138 (1851) quoted in Robert Taft, *Photography and the American Scene*, (New York, 1938), p. 76.

90. Thorstein Veblen, *The Theory of the Leisure Class*, pp. 35-67.

91. These photographs appeared together in *Camera Work*, 36:5, October 1911. See my essay "On the Invention of Photographic Meaning," *Artforum* Vol. XIII, No. 5, January 1975, pp. 36-45.

92. Published in *Le Boulevard*, May 25, 1862.

93. See David H. Pinkney, *Napoleon III and the Rebuilding of Paris*, (Princeton, 1958), pp. 127-150. See also Nadar, "Paris, souterrain" in *Quand j'étais photographe*, (Paris, 1899), pp. 99-129.

94. The phrase is Marx's, from a passage on Haussmann's "Vandalism": Karl Marx and Friedrich Engels, *Writings on the Paris Commune*, edited by Hal Draper, (New York, 1971), p. 94.

95. Barthes, "The Plates of the Encyclopedia", p. 28.

96. Diderot, "Salon of 1767", in *Diderot's Selected Writings*, edited by Lester Crocker, translated by Derek Coltman, (New York, 1966), p. 174.

97. Nadar, *Quand j'étais photographe*, p. 116. Translation in Gail Buckland, *First Photographs*, (New York, 1980), p. 79.

98. Nadar, pp. 23-24. Translation by Thomas Repensek, "My Life as a Photographer," *October*, No. 5, 1978, p. 18.

99. Nadar, p. 104.

100. Joel Snyder, *American Frontiers: The Photographs of Timothy O'Sullivan 1867-1874*, (Millerton, New York), pp. 37-51.

101. Rosalind Krauss, "Photography's Discursive Spaces: Landscape/View," *Art Journal*, Winter 1982. As I write, her article has not yet appeared in print. My remarks are based on a version read in October 1982 at the National Gallery of Canada, at a symposium entitled *August Sander, His Work and His Time*. Krauss' paper, which dealt at length with O'Sullivan, was called "August Sander and the Discourse of the Survey."

The notion of metaphoric and metonymic poles of meaning is taken from Roman Jakobson, "Two Aspects of Language and Two Types of Aphasical Disturbances" in Jakobson and Halle, *Fundamentals of Language*, (The Hague, 1956), pp. 90-96. Metonymy involves the production of meaning on a contextual basis. Metonymic signification samples, selects, builds linkages and casual connections. For Jakobson, realism, and particularly the discourse of the novel, is essentially metonymic. Metaphor, on the other hand, involves the production of meaning on the basis of substitution. Metaphor involves a kind of linguistic play based on analogy and likeness. For Jakobson, poetry is essentially metaphoric. Certainly this would hold for symbolist poetry, which made a cult of metaphor. My essay "On the Invention of Photographic Meaning" applies this model to photographic practice, treating the work of Lewis Hine as emblematic of a realist, documentary, metonymic mode and the work of Alfred Stieglitz as emblematic of a symbolist, "artistic", metaphoric mode. I think we need to consider the way in which the realist image or the "scientific" image becomes metaphoric in certain contexts; we also need to think about the latent "realism" of the most abstract and expressionist images.

102. Snyder, p. 41.

103. Georg Lukacs, *History and Class Consciousness*, translated by Rodney Liv-

ingstone, (Cambridge, Massachusetts, 1971), pp. 110-148. Karl Marx, *Economic and Philosophic Manuscripts of 1844*, (Moscow, 1959), p. 102.

104. Snyder, p. 24. Richard Lingenfelter, *The Hardrock Miners: A History of the Mining Labor Movement in the American West, 1863-1893*, (Berkeley, 1974), p. 17.

105. Snyder, p. 24.

106. Weston Naef and James Wood, *Era of Exploration: The Rise of Landscape Photography in the American West, 1860-1885*, (Boston, 1975).

107. *Ibid.*, p. 127.

108. Clarence King, editor, Professional Papers of the Engineer Department U.S. Army, No. 18, (Washington, 1870-1880). In all, seven volumes and an atlas were published. The volumes in question, the only ones to contain lithographic reproductions of O'Sullivan's photographs, were:

I: Clarence King, *Systematic Geology* (1878).

II: A. Hague and S.F. Emmons, *Descriptive Geology* (1877).

III: J. Hague and Clarence King, *Mining Industry* (1870).

The remaining volumes treated paleontology, ornithology, botany, microscopical petrography, and odontornithes—extinct toothed birds.

109. Clarence King, *Systematic Geology*, p. 2

110. William Goetzmann, *Exploration and Empire: The Explorer and the Scientist in the Winning of the American West*, (New York, 1966), p. 466. This is by far the best source on the social and intellectual context of the surveys.

111. *Ibid.*, pp. 437-438.

112. *Ibid.*, pp. 593-594.

113. *Systematic Geology*, p. xi.

114. Clarence King, "Catastrophism and Evolution," *The American Naturalist*, Vol. XI, No. 8, August 1877, p. 470.

115. Snyder, p. 19.

116. Francis Klingender, *Art and the Industrial Revolution*, edited and revised by Arthur Elton, (New York, 1970), pp. 128-129.

117. Anthony Bimba, *The Molly Maguires*, (New York, 1932). Lingenfelter, *The Hardrock Miners*, pp. 31-65.

118. Tom Beck, *George M. Bretz: Photographer in the Mines*, (Baltimore, 1977).

119. Walter Benjamin, *Charles Baudelaire: A Lyric Poet in the Era of High Capitalism*, translated by Harry Zohn, (London, 1973), p. 165.

120. William Ivins, writing in 1953:

"Today the news counters in our smallest towns are piled with cheap illustrated magazines at which the self-consciously educated turn up their noses, but in those piles are prominently displayed long series of magazines devoted to mechanical problems and ways of doing things, and it would be well for the cultured if they but thought a little about the meaning of that.

I think it can be truthfully said that in 1800 no man anywhere, no matter how rich or highly placed, lived in such physical comfort or so healthily, or enjoyed such freedom of mind and body, as do the mechanics of today in my little Connecticut town."

If any one thing can be credited with this, it is the pervasion of the cheap usefully informative illustrated book."

(*Prints and Visual Communication*, p. 53).

121. Peter Collier and David Horowitz, *The Rockefellers: An American Dynasty*, (New York, 1976), pp. 66-129. Mackenzie King's major work on industrial relations is *Industry and Humanity*, (Boston, 1918).

122. Daniel Bell, "Work and its Discontents," in *The End of Ideology*, (New York,

1961), pp. 227-274. The best work on the social effects of Taylorism is Harry Braverman, *Labor and Monopoly Capital: The Degradation of Work in the Twentieth Century*, (New York, 1974). A detailed history of Taylor's career and be found in Daniel Nelson, *Taylor and Scientific Management*, (Madison, 1980). For a general overview of the period in question, I have relied upon Daniel Nelson, *Managers and Workers: Origins of the New Factory System in the United States 1880-1920*, (Madison, 1975); David Brody, "The American Worker in the Progressive Era," in *Workers in Industrial America*, (New York, 1980). The best history of workers' resistance to scientific management is found in David Montgomery, *Workers' Control in America*, (Cambridge, 1979). I have already cited Noble's book on the rise of corporate science, *America by Design*.

123. F.W. Taylor, "Testimony Before the Special House Committee," January 25, 1912, in *Scientific Management*, (New York, 1939), p. 40.

124. F.W. Taylor, "The Principles of Scientific Management" (1911) in *Scientific Management*, p. 55.

125. *On the Art of Cutting Metals*, (New York, 1906), p. 28. "Principles", p. 83.

126. *Art of Cutting Metals*, p. 5.

127. *Ibid.*, p. 25.

128. "Shop Management", in *Scientific Management*, p. 116.

129. Braverman, *Labor and Monopoly Capital*, p. 90.

130. G.M. Bailes and the professional staff of the Bennett College, *Modern Mining Practice: A Practical Work of Reference on Mining Engineering*, (Sheffield, 1909), Vol. 1, p. 83.

131. *Ibid.*, Vol. 4, p. 148.

132. Homer Morris, *The Plight of the Bituminous Coal Miner*, (Philadelphia, 1934), p. 83.

133. *Ibid.*

134. "Hard Coal", *Fortune*, Vol. III, No. 2, February 1931, p. 77.

135. Paul Kellogg, "Editor's Foreward," Elizabeth Butler, *Women and the Trades: Pittsburgh 1907-1908*, Pittsburgh Survey, Vol. I, (New York, 1909), pp. 4-5.

136. The blue-print metaphor is found in Paul Kellogg, "The Pittsburgh Survey", *Charities and Commons*, January 2, 1909, p. 517. One of the volumes of the survey was comprised of three issues of *Charities and Commons*: January 2, February 6, and March 6, 1909. Essentially, these issues offered a selection of materials that would appear later in the other five volumes.

137. Paul Kellogg, "Editor's Foreward," Margaret Byington, *Homestead: The Households of a Mill Town*, Pittsburgh Survey, Vol. IV, (New York, 1910), p. v.

138. James Howard Bridge, *The Inside Story of the Carnegie Steel Company: A Romance of Millions*, (New York, 1903), Plate X.

139. See Alan Trachtenberg "Ever—the Human Document," in *America and Lewis Hine: Photographs 1904-1940*, (Millerton, New York, 1977) for a critical biography of Hine.

140. Lewis Hine, *Men at Work*, (New York, 1932), Introduction. Trachtenberg's essay is particularly good on Hine's relation to craft values.

141. Lewis Hine, "Social Photography, How the Camera May Help in the Social Uplift," *Proceedings, National Conference of Charities and Corrections* (June, 1909) reprinted in Trachtenberg, ed., *Classic Essays on Photography*, p. 110.

142. Lillian Gilbreth, *Psychology of Management*, (New York, 1914), p. 329. This work originally was published in installments in *Industrial Engineering* between May 1912 and May 1913.

143. Frank B. Gilbreth, Jr. and Ernestine Gilbreth Carey, *Cheaper by the Dozen*, (New York, 1916), p. 31.

144. Frank B. Gilbreth and Lillian M. Gilbreth, *Fatigue Study*, (New York, 1916), p. 31.
145. *Ibid.*, p. 19.
146. *Ibid.*, p. 31.
147. *Ibid.*, p. 34. Trachtenberg points out Hine's repeatedly expressed interest in the pedagogical efficiency of photography. (*America and Lewis Hine*, p. 121).
148. Alberti, *On Painting*, p. 69, 121.
149. See Bruce Kaiper, "The Cyclegraph and Work Motion Model," in *Still Photography: The Problematic Model*, edited by Lew Thomas and Peter D'Agostino (San Francisco, 1981), pp. 57-63. I'm grateful to Bruce Kaiper for allowing me to read a longer, unpublished version of this essay, entitled "The Gilbreths: Work Films and Management Ideology" (1977). In 1975, Kaiper introduced me to the critique of scientific management, and to the work of Harry Braverman. A former machinist and union organizer, Kaiper is what Antonio Gramsci called "an organic intellectual" of the working class. I'm grateful to my colleague Thom Andersen for the recent opportunity to read his unpublished manuscript-in-progress "Cinema and its Discontents," which treats Marey, Taylor, and the Gilbreths in some detail. That essay—which builds on insights in Andersen's 1975 film, *Eadweard Muybridge: Zoopraxographer*—is an exceptional work, a materialist history of film and film theory.
150. Etienne Jules Marey, *Le mouvement*, (Paris, 1894), translated by Eric Pritchard, *Movement*, (New York, 1895), p. 139.
151. *Applied Motion Study*, pp. 58-72.
152. *Psychology of Management*, p. 76.
153. *Ibid.*, p. 77.
154. *Capital, Vol. I*, p. 482. See also Alfred Sohn-Rethel, *Intellectual and Manual Labour*.
155. *Psychology of Management*, p. 258.
156. See note 64.
157. *Psychology of Management*, p. 28, Frank B. Gilbreth, *Motion Study*, (New York, 1911), p. 7.
158. *Psychology of Management*, pp. 38-39.
159. *Ibid.*, p. 159.
160. David Montgomery, "Immigrant Workers and Managerial Reform," in *Worker's Control in America*, pp. 40-44.
161. Edna Yost, *Frank and Lillian Gilbreth: Partners for Life*, (New Brunswick, New Jersey, 1949), p. 224.
162. *Psychology of Management*, p. 42.
163. See Sally Stein, "The Composite Photographic Image and the Composition of Consumer Ideology," *Art Journal*, Vol. 41, No. 1, Spring 1981, pp. 39-45. Also see Stuart Ewen, *Captains of Consciousness: Advertising and the Social Roots of Consumer Culture*, (New York, 1976).
164. *Psychology of Management*, p. 332.
165. *Catalogue of Photographs and Artist's Drawings Showing the Coal Mining Operations and Facilities of the Dominion Coal Company Limited and Dosco Industries Limited in Nova Scotia* in Devco company archives, Glace Bay, Nova Scotia.
166. Conversation with Leslie Shedden, July 14, 1981.
167. Alfred Döblin, "Von geschichten bildern and ihrer wahrheit," in August Sander, *Antlitz der Zeit* (Berlin, 1929), p. 13; translation, "About Faces, Portraits and Their Reality," in David Mellor, editor, *Germany: The New Photography, 1927-1933* (London, 1978) p. 58.
168. For the debate on the class position of professionals, see Pat Walker, editor, *Between Labour and Capital: The Professional and Managerial Class* (Boston, 1979).
169. Lest I pretend falsely to be a folklorist or an oral historian or even to be very familiar with Cape Breton, I'll admit that I first heard this story on a record called the *Rise and Follies of Cape Breton*, made by a group of local singers, actors, and musicians. This was my first trip, and I was having occasional difficulty understanding the accent common to the island. The novice miner was referred to as the "new guy." Not quite catching the context, I asked who the "new guy" was and was told by someone in the room that the "new guy" was me.
170. See, for example, Roger David Brown, *Blood on the Coal: The Story of the Springhill Mining Disasters* (Hantsport, Nova Scotia, 1976).
171. *Sydney Post-Record*, Monday, July 7, 1952.
172. *Post-Record*, Wednesday, July 9, 1952.
173. *Post-Record*, Thursday, July 10, 1952.
174. *Post-Record*, Saturday, November 3, 1956.
175. *Post-Record*, Friday, July 4, 1952.
176. Leslie Shedden, interview with Ronald Caplan, *Cape Breton's Magazine* No. 32, Autumn, 1982. This interview was occasioned by plans for an exhibition of Shedden's photographs, curated by Robert Wilkie.
177. Conversation with John Abbass, July 14, 1981.
178. *Glace Bay Gazette*, September 23, 1942.
179. *Post-Record*, Tuesday, November 6, 1956.
180. This title is taken from Bertolt Brecht and Kurt Weill's opera *Die dreigroschenoper* (*The Threepenny Opera*) (Berlin, 1928). The lyric in question runs as follows:
- There are those who live in darkness/while the others live in light/we see those who live in daylight/those in darkness, out of sight.*
- This translation appears, very appropriately, at the beginning of Harry Braverman's *Labor and Monopoly Capital*.
181. George Orwell, *The Road to Wigan Pier*, first published 1937 (New York 1958) pp. 21-35.
182. Conversation with Leslie Shedden July 14, 1981.
183. *Dominion Coal Company Annual Report*, 1956, n.p.
184. *Teamwork*, September 1955, n.p.
185. See note 165.
186. Robert Wilkie tells me that a travel writer in the *Toronto Star Weekly* in the mid 1960s advised his readers not to linger in the "grimy and disheartened town of North Sydney." This comment caused a local uproar and the columnist was forced to publicly apologize.
187. Owen Fitzgerald *Cape Breton*, (Toronto, 1978).
188. Richard Avedon, "In the American West", *Vanity Fair*, Vol. 46, No. 1, March 1983 pp. 88-94.