Pragmatic Professional: Herbert Hoover's Formative Years as a Mining Engineer, 1895-1908

By Ron Limbaugh

This paper attempts to identify and explain the discrepancies between Herbert Hoover's image as a professional engineer, and the reality of his engineering experience in the American West and in Western Australia between the 1890s and World War I.

Even if we ignore the opprobrious title, "Depression President," Hoover's place in history has suffered because of the diminished status of engineers in postmodern western culture. Some social critics have portrayed Hoover as the archetypal professional engineer: a humorless technocrat high on energy coefficients, flow charts, and cost accounting, but low on social skills and indifferent to the needs of labor. Hoover himself helped promote his lofty, one-dimensional professional image in Australasia and later in London during his pre-World War I years as a "doctor of sick mines." His early professional publications emphasized the need for "technical training" over "practical instruction," "executive work" over fieldwork, and lab work "of a purely theoretical and investigatory character" rather than "practical demonstration." Later, his advisors and campaign managers glamorized his corporate engineering skills and embellished his popular image as a business manager and problem-solver.

Despite these perceptions, Hoover's early career in the American West and in Western Australia does not square with the public persona reflected in the views of his postmodern critics and even in his own published statements. What emerges from a careful examination of the evidence is a more complex personality and a more pragmatic approach to engineering and management than either Hoover or his biographers would have us believe.

Preparing for a Career in Mining Engineering

The engineering profession was still in transition when Herbert Hoover entered Stanford University in 1891, the school's inaugural year. Engineering was not even offered as a major at Stanford during Hoover's student years. David Starr Jordan, the school's first president, established the Department of Geology and placed its leadership in the hands of Dr. John Caspar Branner, a geologist with extensive field experience. Though not an engineer, Branner had excellent connections with practicing professionals in engineering, mining, and geology. Branner's students benefited from this professional network by landing summer jobs or piecework as cartographers, surveyors, assayers, evaluators, and inspectors. This emphasis on applied geology during the Branner years met the needs of the mining industry as well as of students. Even the department's name changed from Geology to Geology and Mining during Branner's tenure. Up to 1919, half of its students focused on mining or metallurgy. A formal engineering track was not added until 1918, after Branner retired.[1]

Hoover's detractors later made an issue of his lack of engineering credentials, implying that he had deceived the public. Walter Liggett, a Midwestern journalist bitterly opposed to Hoover's bid for reelection in 1932, labeled him

a "mine scout" rather than an engineer during the time Hoover worked in Western Australia.[2] Guido Marx, a credentialed engineer and professor of machine design who came to Stanford after Hoover graduated, was not impressed by Hoover's undergraduate engineering record:

> I have the transcript of his record card before me . . . [he wrote in his memoirs] and while it shows that he took practically all of the courses offered in the Geology department, as well as elementary Mathematics and Chemistry, the only subjects qualifying as 'engineering' were Shopwork (4 units), Linear Drawing (2 units), Freehand Drawing (2 units), Assaying (2 units), [and] Surveying and Economic theory of Railway Location (8 units).[3]

Marx was a progressive liberal, later a leader of the ACLU on the West Coast, and a champion of labor rights. Understandably, after Hoover became a Stanford regent, Marx found himself philosophically opposed to many of Hoover's efforts to improve the efficiency and productivity of the Stanford faculty.

Curiously, Marx didn't mention the semester of calculus Hoover took at Stanford. Today calculus is a fundamental requirement for undergraduate engineering students, but in Hoover's day some engineering educators still considered it a "cultural" embellishment.[4] This ambivalence was a reflection of the European bifurcation in engineering education. The British model, influenced by the demands of British industry, limited technical training to basic principles and encouraged practical training while still in school. Higher math had little practical use to most British engineers.[5] On the Continent, however, theoretical training in higher math and science had been a central part of engineering education since the late eighteenth century.[6]

Hoover may have felt a semester of calculus insufficient for his own professional development, but Professor Branner offered practical advice:

> As for the engineering problems, look as far ahead as you can and remember that they are mainly mathematical problems in their scientific features, and problems of experience in their practical hearings. If you anticipate any hitches on any subject just write me as long ahead as you can and if I can't suggest help for you I'll see [Professors] Wing or Marx or Wm. Smith in your behalf and get their suggestions.[7]

However limited Hoover's formal math training, as the Great Engineer his public image took on almost superhuman qualities. During the 1928 presidential campaign, for example, an admirer said Hoover would make a good leader because of his "training in mathematics." The writer was convinced that the presidency was "highly mathematical in many of its aspects, and never emotional."[8]

Critics who later questioned Hoover's engineering credentials judged him by standards not widely adopted until the 1920s. Forty years earlier it was common practice, both in Britain and in the United States, to become an established mining engineer without ever having taken a single college-level course. To the mining public in the nineteenth century, experience counted more than background, education, or social status. College-trained engineers, fresh out of school, were thought impractical—too filled with book learning and lofty theories to have any common sense.

American nationalism had much to do with this attitude, for westerners retained a lingering suspicion of professionals trained at Freiberg or other European schools. Foreign engineers and metallurgists had played prominent roles in several early western hardrock mining and milling

ventures, often with very poor results. Others had been openly critical of American mining methods and technology, arrogantly rejecting American advice, only to be upstaged in the 1860s and 1870s by pragmatic Americans who adapted European technology to meet American needs.[9]

This point was made clear by one correspondent to the *Mining and Scientific Press*, one of America's most important mining journals. Discussing the poor results of British investment in western mines before the 1880s, the writer questioned the wisdom of so-called experts with impressive credentials. He asked if English investors would "be willing to work a Cornish mine simply on the recommendations of college professors or graduates?" The answer was obvious: in America, as in Cornwall, the odds of success were much better if mining investors consulted "men having practical knowledge of mines and mining affairs."[10]

Because of the lack of defined standards in the profession's formative years, engineers trained not in school but on the job assumed professional roles, often attaching the title "M.E." to their reports as if they had a degree. "M.E." might also mean "Mining Expert," a title used widely to infer expertise in a field still not well understood, especially among the general public. The result was a wide disparity in the quality of training and performance among practicing engineers and managers.

Distrust of book-taught engineers continued well into the twentieth century. Despite the steady outpouring of young graduates from a growing number of American engineering schools after 1880, practical engineers still had influence. But the focus of concern had shifted. By the eve of World War I, the question was not whether college training was valuable, but how to find the right balance between theory and practice in mining education.

Engineering societies arose in the nineteenth century, both in the United States and abroad, in an effort to organize and standardize the profession, but even among practicing engineers there was little consensus before the 1920s. The American Society of Civil Engineers (ASCE), earliest on the scene, claimed to represent all engineers, but restricted membership to college-trained professionals. It also tried to distance its members from the low ethical standards of the Gilded Age by classifying engineering as a profession, not a business. But not all practicing engineers agreed. In 1880 the American Institute of Mining Engineers (AIME) emerged with more open enrollment standards and more friendly business views. Rossiter Raymond, editor of the *Engineering and Mining Journal* and the Society's most distinguished member, considered the mining engineer, in Edwin Layton's words, as a "kind of businessman." Under Raymond's influence AIME assumed a promotional role, emphasizing the business aspects of the profession and opening its ranks to all mining engineers regardless of training.[11]

This lack of consensus on engineering qualifications and training provided Herbert Hoover with an opportunity to set his own standards as he completed work for a bachelor of arts degree in geology at Stanford in 1895. In the summer of 1894, with Branner's help, he worked as field assistant to Waldemar Lindgren of the U.S. Geological Survey. The next summer, after Hoover graduated, Lindgren invited him back to help map the Mother Lode gold belt.[12] One scholar concluded that Hoover's work with the Geological Survey was important field training for mining engineering, but that he served more as a technician than an engineer.[13] Later Hoover made clear distinctions between professional engineers with university degrees, and "skilled artisans" on the technical staff that he thought needed only on-the-job training.[14]

Hoover's own on-the-job training as a miner came in the fall of 1895, after he had finished mapping with Lindgren. For a few weeks he lived in Oakland with his older brother

Theodore, who had come to California earlier and was working in San Francisco. Evidently the two brothers discussed their future prospects at length. Whether it was "Tad's" influence or his own desire to gain experience and start earning some money, Hoover decided to go to Grass Valley. He was so pressed for cash that he couldn't get to the mines without borrowing the travel fare from his older brother.[15]

California experienced a gold boom in the mid-1890s, and Grass Valley was the most important gold district in the state. It was a logical place for a young geologist to look for work. Hoover later told audiences in the Great Depression that he personally knew the "bitter despair that comes to men from ceaseless hunting for a job only to be turned away time after time."[16] That may simply have been Depression hyperbole, yet good mining jobs were hard to get in the nineties, especially for young graduates looking for skilled positions in an active mining camp.[17]

The younger Hoover had an easier time than his brother rising in the engineering profession. He wrote various accounts of his first work experiences, all penned years later and filled with hindsight, as if everything he did was part of a master plan—the Great Engineer creating his own legend. In 1920, for instance, he wrote that immediately upon graduation in 1895 he went to Grass Valley and applied for a job as a "miner with pick and shovel" because he "wanted practical experience to back up his book knowledge."[18] This explanation, though inaccurate chronologically, complemented his well-known views on how engineers should be trained, which he had been publicly proclaiming since 1899.

He started literally at the bottom of a mine, not as an engineer or technician but a miner's assistant, pushing ore cars for two dollars for a ten-hour shift. Among the stories that circulated later about Hoover's greenhorn days was one claiming that rats ate his lunch on his first day on the job because he carried it underground in a paper bag. The superintendent allegedly felt sorry for him and gave him another lunch in a tin pail. The stories also describe him as an indefatigable worker and eager student, hanging around miners' bars on weekends to pick up casual mining information, and reading mining literature in his bunk at night beside a coal oil lamp.[19] Only after two or three months proving himself in the unskilled jobs, as he explained later, did he become "an acknowledged and real miner" by moving up to driller's assistant just before the mine shut down.[20]

Hoover learned basic mining skills not from books, but from practical experience. His teachers were Cornishmen, acknowledged experts in the fundamentals of hardrock mining and milling. Beginning in the 1850s and continuing for twenty years or more, experienced miners and millmen emigrated by the thousands from the declining tin and copper mines of Cornwall. They brought with them not only the tools and techniques that had made the Cornish the leaders in nineteenth-century mining technology, but also the customs and traditions of a pragmatic mining culture that believed in experience as the best teacher. Even Cornish technical schools were designed to maximize practical experience. Being close to the mines, they offered the equivalent of a trade school education, light on theory, but heavy on practical engineering. Herbert and Theodore later criticized this as a form of apprenticeship; good training for "artisans" and "mechanics," not professional engineers.[21]

Ironically, just as the Hoovers were beginning to cast aspersions at Cornish technical education, Stanford's president, David Starr Jordan, was using the Cornish approach in claiming that the school's location had advantages over Columbia University, the first engineering school in the United States. In an 1899 letter to a prospective donor—which incidentally bragged

about the high salary of one of its recent graduates, Herbert Hoover—Jordan wrote: "As compared with Columbia we are deficient in machinery, but we have a stronger corps of teachers, and have a large advantage, which far outweighs machinery and equipment: viz., immediate access to the great establishments in actual operation."[22]

After the Reward mine closed, Hoover hired on at the Mayflower mine "at full miner's wages," as he wrote in his *Memoirs*.[23] For the next several months, Hoover worked at the Mayflower under several supervisors. The shift boss, who has received the most attention from Hoover biographers, was a Cornish mine captain, Tommy Ninnis. Known locally as "the Professor" because he "claimed to know so much about everything," Ninnis bragged in later years that he "learned Bert Hoover everything he knew about mining."[24] Hoover didn't mention Ninnis in a 1935 speech he gave in Grass Valley, but he gave credit to "kindly Cousin Jacks" for teaching him the finer points of working underground, including how to warm a wheelbarrow by candle flame so it made a comfortable bed during lunch hour.[25] Curiously, the Ninnis anecdote was later garbled, either by journalists writing about Hoover in his senior years or perhaps by Hoover himself. Some accounts claim it was not Ninnis but Hoover who was known as the "professor" because he had a college degree and "knew a lot about geology."[26]

After a few months at the Mayflower, Hoover thought he had learned enough underground and was ready to move on—and up. In February 1896 he sought out Louis Janin, probably the best-known consulting engineer on the West Coast, and a graduate of the Royal Mining Academy at Freiberg, Europe's best technical school. Janin said at first that he didn't need any help, but Hoover offered to work for nothing, and Janin gave him some office typing chores. In a few weeks the young geologist had proven his worth by combining his Mayflower experience with his technical training to assist in drafting a report Janin needed as a consultant to the Mayflower's owners in a pending lawsuit. Soon Hoover was Janin's full-time assistant.[27]

The year that Hoover served as Janin's employee was invaluable, both for the experience and for the contacts that would jump-start his engineering career. For the first time, Hoover was personally involved in the upper management aspect of mining engineering. Janin sent him to five western mining areas outside of California to inspect and evaluate mines and prospects, study geology and economic conditions, consult with managers and technical staff, and prepare technical reports. The senior engineer taught Hoover valuable lessons in applied geology. It was Janin, for example, who pointed out the soft lenticular masses in the Grass Valley district known colloquially as "crossings," the subject of Hoover's first published professional article.[28] Hoover's work did not go unrewarded. By the summer of 1896 he was earning two hundred dollars a month, nearly three times the salary of a miner.[29]

While he was in New Mexico, a letter arrived from Lindgren offering him full-time work with the U.S. Geological Survey. Family and friends advised Hoover against it. His brother told him to "go into gold mining" because geology was "not a highly-paid" profession.[30] Professor Branner's advice was a model of pragmatic opportunism. Hoover should stay in mining, but with his "training and tastes and chances" he "ought not to give up scientific geology entirely." He could join the AIME, said his mentor, "publish occasionally," and "thus keep yourself known as a geologist as well as a mining engineer."[31] Janin seconded Branner's advice and Hoover adopted it wholeheartedly. He had already published his first professional paper, and membership in AIME followed shortly thereafter.[32] In less than a year he was on his way to Australia to pursue a "highly-paid" engineering career with Bewick, Moreing & Co.

Pragmatism in the Westralian Goldfields, 1897-1908

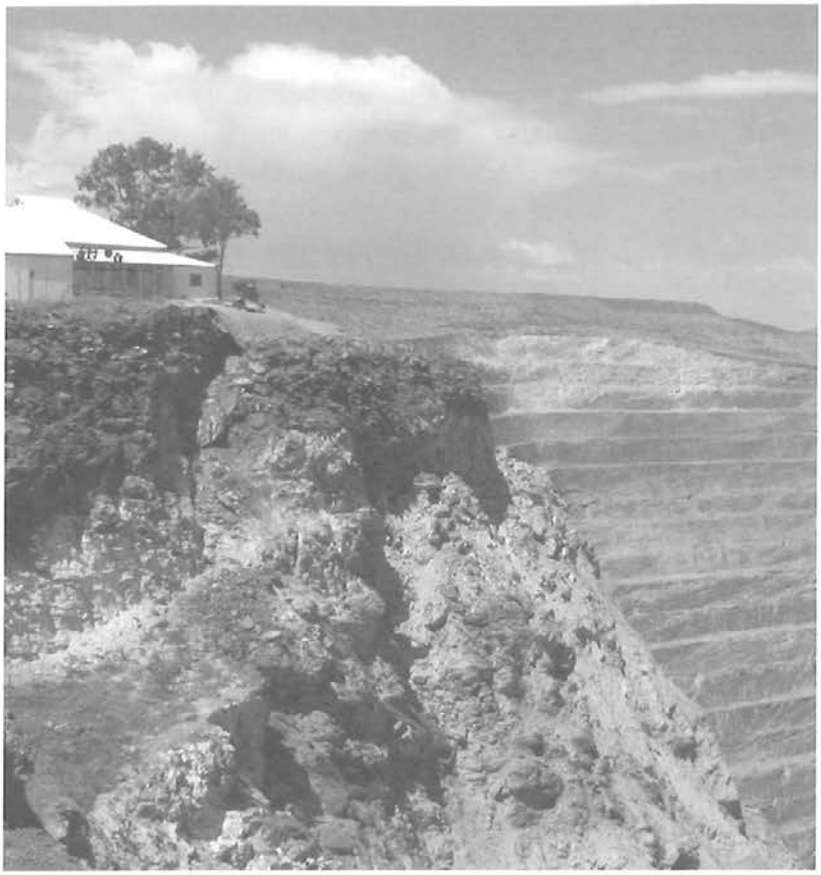
Hoover's career leapfrogged ahead in the spring of 1897, following more than a year of preparation as Janin's assistant. He accepted an offer from Bewick, Moreing and Company (BMC), a London-based engineering, consulting, and management firm, to serve as their field representative in Western Australia. Over the next nine years, except for a two-year interlude in China, Hoover was a driving force behind BMC's efforts to make Australian gold mining and milling more efficient, more productive, and more profitable. In the process Hoover enhanced his own reputation as engineer, manager, and modernizer.

Hoover was not the first American engineer in Australia. British investment companies had been importing Americans to Australia for some years prior to 1897, and would continue do to so after he left BMC's employ in 1908. Yet Hoover was surely the most successful. He was the Yankee version of the "bush engineer," an Australian prototype that drew inspiration from British and American frontier models. In Roy MacLeod's words, bush engineers were the "independent-thinking, adaptive, adventurous and virtuous Anglo-Saxon archetype, excelling in native wit and endurance."[33]

To Americans at the turn of the twentieth century Hoover represented the pragmatic spirit of American adventure, the personification of progress and industry. Theodore Hoover said his younger brother "had from boyhood that happy American pioneer knack of adapting the means to the end, and the inspiration came almost instantaneously with the need." These natural gifts were bolstered by formal training, which few practicing mining engineers had received up to that time. The younger Hoover thus was supremely self-confident as a consulting engineer for Bewick Moreing.

Early nineteenth-century explorers and scientists accelerated American expansion by serving as "agents of empire," to paraphrase historian William H. Goetzmann.[34] Although a half-century beyond Manifest Destiny, Herbert Hoover might well fit Goetzmann's criteria because of

The manager's residence at the Sons of Gwalia Mine in Lenora, Western Australia. Hoover and his successors stayed here while they worked for Bewick, Moreing & Co. (Courtesy of the Author.)



The back of the manager's residence, showing the modern Gwalia pit that now threatens the structure. (Courtesy of the Author.)

his efforts to bring American mining technology and personnel to Australia and Southeast Asia.

Separating the facts of Hoover's approach to Americanization from the hyperbole of self-promotion during his years of transition from engineer to humanitarian to politician is a task made all the more difficult by time and distance. During his 1928 run for president, for example, his publicists touted Hoover's red-blooded Yankee faith and pride. One wrote, with more patriotism than accuracy, that "Hoover's first step" when he arrived in Australia was to "send for more American engineers," and that he later "saved Broken Hill—with American ideas and American machinery combined with American and Australian methods, administrated by American engineers."[35]

Hooverian anecdotes reinforce the view that American mining men and technology were ubiquitous and superior. Hoover gave a 1935 speech at Grass Valley, for instance, that stirred the nationalist fervor of a partisan crowd. He said a local friend had told him thirty years before about an English (or perhaps Australian?) miner who had applied for work in Johannesburg, South Africa, but was turned down. Dejected, the man exclaimed to his companion: "Mate, it is no use. If we [are] ever [to] get a job we have got to go and stay overnight in the place Grass Valley so we can say we came from there."[36]

Discounting much of this nationalist rhetoric still leaves a strong Yankee caste in Hoover's business agenda during the years before WWI. He made no apologies for trying to impose an American regime over the international mining industry by importing American personnel and methods to Australia, New Zealand, China, and Burma.[37] While in Australia he was known as "Hail Columbia Hoover" for his preference for American "experts and techniques."[38]

Ironically, by 1914 Hoover had become so overtly Anglicized himself that some parts of the mining world thought he was British. One colleague, writing from Burma, told him that "there is no need to discuss the fact that there is a certain prejudice against Americans, and that you being an Englishman and ranking with any American as to technical training and experience, would have a positive advantage."[39]

Why did Hoover favor Americans? One reason was his belief that they were better trained than any others to handle the economic and technical needs of a modern industry. He thought his own limited engineering education was superior to the training received by engineers in foreign programs. In his first published statement on engineering schools, written after two years of experience in Western Australia, Hoover felt qualified to speak his mind. He was especially critical of English schools for attempting to combine theory and practice by offering students on-the-job training. "I assume," he sniffed, "that the design of the University is the training of Engineers and not of Mechanics." Even in Germany the standard university model was to place "theory and practice hand in hand" by a form of apprenticeship that gave students fieldwork in nearby mines.

Hoover felt such plans were counterproductive. They shortened the amount of time spent on theoretical training in the college classroom, which he thought should be a minimum of four years. They emphasized mechanical skills, but provided no administrative experience. Finally, such training gave students a false sense of their own professional competence. What the mining industry needed, he said, was "men . . . who are soaked in theory and not befuddled with erroneous ideas of their practical worth." In Hoover's blunt assessment, such "play house methods are but a waste of time," a "drain on . . . resources" and "worse than useless."[40]

Another reason why Hoover favored Americans related to his concept of mining engineers as businessmen rather than technicians. His view was popular with the American Institute of Mining Engineers, at least before World War I. Although some members argued that engineers should not engage in activities that could be construed as crassly commercial, such as stock speculation or promotion, the majority accepted Rossiter Raymond's position. Under Raymond's leadership, AIME members "functioned much like the early civil engineers, as promoters, entrepreneurs, and company officials."[41] Hoover reflected AIME's views in a 1905 letter to Tad: "When it's all said and done an engineer's reputation does not depend on good technical work, but on his ability to do good business in securing mines."[42]

But Hoover also had broader vision: he recognized the implications of the mining industry's economic and technological transformation at the close of the nineteenth century. The decline of high-grade shallow deposits, the shift from precious to base metal production, the change from older gravity separation to newer chemical and electrolytic milling technologies, the increasing specialization of labor and management—all demanded a new type of leadership. Just as increasing size, complexity and specialization in other formative industries created the need for "systematic management," the mining industry by 1900 grew increasingly dependent on managers with both technical training and administrative skills.[43] As Hoover put it in his 1909 textbook, the mining engineer was then "becoming the foreman, manager, and president of the company, or as it may be contended by some, the executive head is coming to have technical qualifications."[44]

While Hoover never wavered in opposition to apprenticeship and other traditional forms of engineering education, he was less critical of practical engineers, especially those who had become successful mining executives. In a 1904 article describing BMC employees and comparing American and British educational values, he

said that he did not mean to "disparage the qualifications" of engineers who had "risen from the ranks to eminent positions," but that "even these men would be better men had they received a thorough technical training."[45] Five years later Hoover—or his textbook editor—fashioned an even more polite version of the same sentiment. Because engineering is so heavily involved in business, he began, it requires experience that cannot be taught in school. "Nor is it impossible to rise to great eminence in the profession without university training, as witness some of our greatest engineers."[46]

Hoover's ultimate test of a good engineer was not where he was from or how much technical education he had, but how well he performed on the job. The "engineering sense" that he believed characterized all good engineers, derived not from schooling but from experience. Even a university education has limitations, as he explained in his 1909 textbook. It can provide "a broad basis of knowledge and mental training, and can calculate moral feeling, which entitles men to lead their fellows. . . . It can teach the technical fundamentals. . . . But after the university must come a schooling in men and things equally thorough and more arduous."[47] Performance-based standards in engineering were characteristic of Cornwall and California, but for Hoover the proving ground was Western Australia. There, among fellow bush engineers, the realities of field operations did not always live up to ideals. In short, while he sought mining engineers with high-level theoretical training and extensive work experience, in practice he took what he could get.

This utilitarian approach to what might be termed "executive engineering" does not always reveal itself in Hoover's publications. He came to political prominence in the Progressive Era, when technocrats supposedly knew all the answers. In the first three decades of the twentieth century pragmatic thinking seemed unfashionable for politicians, as if it was synonymous

An old headframe used at the Sons of Gwalia Mine during Hoover's tenure there. (Courtesy of the Author.)

with uncertainty and a lack of self-confidence.

It was also bad for business. As progressive engineer and financier, Hoover learned to cultivate public opinion. For example, despite signs of decline in the major Westralian lode mines by 1903, he reassured investors in a paper presented before the Institution of Mining and Metallurgy in London. "In the minds of the author and his associates in daily professional work at the mines," he wrote, "there is felt great confidence in the permanence of the Kalgoorlie deposits in depth."[48] Replace "mines" and "Kalgoorlie" with "economy" and the statement nearly matches some of Hoover's embarrassing presidential proclamations after the Great Crash. By glossing over difficulties and refusing to acknowledge mistakes, Hoover and his promoters generated the myth of the Great Engineer. The myth crashed along with the stock market. By the 1930s, pragmatic approaches to problem-solving were more compatible with Depression-era thinking.

Public opinion meant little to Hoover on his first trip abroad, however. He was brash and egotistical, an impatient young American disdainful of men and methods he considered old-fashioned or inefficient. Although critical of Australian labor standards that he felt lowered productivity by at least one-third compared to that of American miners, he complained loudest against mine management.[49] After an exhausting tour by horse cart and camel of BMC properties and prospects, he wrote that he had never before seen "such rank swindling and charlatan engineering."[50] "My predecessor was a rascal of the first water," he wrote Tad, "mines were being worked of no value, accounts all wrong, money short, rank staff and general hell."[51]

With a green light from London, he made sweeping changes in personnel at mines within his jurisdiction. "I have fired every man on the staff but the clerks, accountant and apprentices," he told Tad after about seven months on the job, "and have good men in now." At the Sons of Gwalia, which he had recommended for purchase and with which he had been rewarded with the field management, he was ruthlessly efficient. Touting "American machinery and technical practice," he gutted or revamped old milling equipment, opened new ore bodies, expanded production, and fired underground bosses and miners alike if they failed to perform to his standard.[52]

Under Hoover's supervision, Americans working for Bewick Moreing faced the same tough standards as Australians. Moreing, impressed by Hoover's ability to get the maximum work out of his men, described his young associate as a "slave-driver." Hoover was proud of the label. He told Tad that "my California friends need not think they're coming to soft snaps. Moreover they need not think they have any special pull on me. [One tried, but] after he gazed into the abyss beneath him he fairly crawled. . . . It simply comes to this; men hate me more after they work for me than before. They don't need think they are coming to a snap. They're coming to a perfect hell and I am the devil."[53]

The careers of three men Hoover brought over from the States in 1897-98 illustrate his demanding approach. All three were Stanford students in the mid-1890s, but only one earned a degree in geology. Deane P. Mitchell graduated the year after Hoover in geology and proved his worth in Western Australia and later in Victoria. After Hoover left BMC he hired Mitchell away from the British company to manage Zinc Corporation at Broken Hill.

James Arthur Diggles had gone duck hunting with the Hoovers in California when the two brothers had boarded at the Diggles' home in Palo Alto. Young Diggles studied geology and engineering at Stanford but never graduated. Hoover hired him anyway, but evidently the new recruit showed some reluctance to accept Hoover's initial assignments. Hoover's pique showed in a letter to Tad: "These men seem to think they are fitted for anything and I should send [for them] whenever I have a vacancy.

I have the responsibility of a business controlling the expenditure of $5,000,000 a year. I have to depend on my assistants and I have to choose them carefully for their special fitness."[54] The ill will soon passed, and Diggles proved his managerial talent. He remained in Australia supervising mines for Bewick Moreing until his untimely death in 1910.[55]

The third Stanford man was George Benton Wilson, a pre-law graduate with no training in geology or engineering. He began his mining career as Hoover's "low-paid" personal assistant. At first Hoover didn't "know what to do with him," but Wilson managed to meet his boss's high expectations. Placed in charge of the East Murchison United mine, he was ordered to sink a new shaft under Hoover's supervision. As Hoover reported to Tad, Wilson had to "get this shaft down quicker and cheaper than any shaft on the fields. He will, and in doing so will make not only his reputation but my own as managing engineer. He must do it. If he fails he will arrive in San Francisco so broke he won't know where to eat."[56] Wilson performed as expected. He rose quickly, proving himself a capable mine manager in Western Australia, China, and later in the States.

After Hoover's two-year term in China, he returned to Western Australia in 1901. In his absence he found that engineering standards had "lapsed." His response, as he explained in his *Memoirs*, was to send "to the United States for fifteen university-trained mine managers, metallurgists, and mechanical engineers" to "assure integrity and reliability in management, improve the equipment and the recoveries of metals and thus diminish working costs."[57]

Analysis of the education and careers of these fifteen men provides important empirical evidence to test Hoover's pragmatism. In a footnote, Hoover identified eleven of the fifteen and provided some background. From other sources it is possible to identify at least four other BMC engineer-managers who worked under Hoover between 1901 and 1904. A table listing these men appears on page 54.

As the table indicates, Hoover's *Memoirs* is inaccurate when compared with data obtained from other sources. Instead of fifteen Americans, only twelve are confirmed to have been recruited from the United States, and at least one of those was foreign born. Only seven of the fifteen could be said to be "university-trained," and of those, only three held degrees in geology or engineering from four-year institutions. One of the fifteen, a New Zealander, had received a certificate from a two-year technical school; two others had taken on-the-job training at various Mother Lode mines.

Even Hoover's fellow "Stanford men" were not all that he implied. Two arrived and were working in Western Australia before 1899, only two held degrees in geology, one had an A.B. in history, and the fourth had studied in the Department of Geology and Mining, but did not graduate. On the other hand, four and possibly as many as eight of Hoover's fifteen were practical engineers, trained on the job or in the field. Like other practicing professionals, their success depended not on academic preparation but on proven performance.

Hoover selected men like himself: tough, demanding, adaptive to changing circumstances, and willing to take risks. One of his contemporaries, W. R. Ingalls—an American zinc specialist, later editor of the *Engineering and Mining Journal* and copy editor of Hoover's mining engineering textbook—described Hoover as "the manager who chose and aided technicians." Ingalls's account of Hoover's difficulties at Broken Hill illustrates the latter's pragmatic approach. Confronted by metallurgical problems his technical staff could not solve, Hoover sought help from American experts. When the first specialist he hired was unsuccessful, he tried others. Hearing of an experimental process in the States, he asked Ingalls to investigate and gave him a free hand.

Professional Backgounds of Hoover's BMC Management Personnel

NAME	HOOVER'S DESCRIPTION	DATA FROM OTHER SOURCES
Agnew, John	Recalled from China after 1901.	New Zealand native; held a certificate in mine management after two years of technical training at Thames, NZ.
Davey, J. M.	Not identified.	A practical mine engineer-manager; came with Pomeroy from King of Arizona mine; underground boss at Great Fingall, 1904-05 "A square, level-headed Yankee" recruited by Hoover or his brother.
Dennis, Frank	One of four "Stanford men."	A friend of Hoover at Grass Valley; son of supt. Mountaineer mine; Graduated 1892 with a B.A. in history at Stanford.
Diggles, James Arthur	One of four "Stanford men."	Attended Stanford Univ. as student in geology & mining engineering, 1891-96, but did not graduate. Was in Western Australia by 1898.
Goldstone, William	A "University of California man."	No record of UC attendance or graduation.
Grant, Robert J.	From "Colorado School of Mines."	No record of CSM attendance or graduation.
Loring, William Joseph	Mentioned by name only.	California elementary school education; practical training on southern Mother Lode.
Lovell, Gerard	Not identified.	Possibly American; worked for BMC in Western Australia 1904-07.
Mitchell, Deane P.	One of four "Stanford men."	A Stanford graduate in geology, 1896; recruited in 1897 for Western Australia.
Newberry, Wilfred	Recalled from China after 1901.	No background.
Pollard, William	Not identified.	Hired by TJ Hoover in California, ca. 1902 & sent to W.A.; a Cornish practical miner.
Pomeroy, William Arthur	Identified as "Thomas Pomeroy, a Columbia man."	Graduate of Columbia Univ. School of Mines; recruited from Arizona ca. 1904.
Prichard, William Anthony	Identified as "W.A. Pritchard," one of four "Stanford men."	Graduated from Stanford, 1898, with an A.B. in geology.
Shipman, Hervey A.	Identified as from the "Colorado School of Mines."	No record of CSM attendance or graduation.
Vail, Herbert Eugene	Not identified.	Attended California public schools; took a practical engineering course and technical training at two Mother Lode mines.

The Australian outback near Leonora. Note the foraging wild emus. Hoover crossed this country many times by wagon, horse, and camel. (Courtesy of the Author.)

After three months at considerable cost, Ingalls reported back. The process was "sound," he said, "but it did not offer any advantage for refining the base lead produced in Australia." To Ingalls, this demonstrated "Hoover's method for obtaining the best possible advice." As a practicing engineer, he gathered evidence and then drew conclusions that might change in the face of new evidence. But that process wouldn't work for a corporate executive, where decisions, not conclusions, were most important. In Ingalls's words, when Hoover "ordained to any of his boards of directors, argument and doubt were precluded."[58]

Pragmatic as Hoover's managerial characteristics might be, they are not unique to Americans. Dwelling on Hoover's Australasian career and the men he employed risks skewing the perspective on international mining in the formative years of exploration and development. Hoover's American biographers, for example, while critical of his technical mistakes at Broken Hill, accept the view that he and his fellow Americans were instrumental in shaping an industrial transformation in Australasia. Australian nationals, in contrast, argue that Americans did not dominate the Australian mining industry as Hoover implied. They cite counter evidence showing that Hoover had limited knowledge of Australian metallurgical problems, and that many of the major technological advances were led not by Americans, but by native Australians or by British and Continental engineers and financial leaders.[59]

Seen in larger context, American influence abroad coincided with transformations in the global mining economy at the turn of the twentieth century. The opening of new goldfields in the undeveloped hinterlands of Australia and South Africa triggered a temporary influx of experienced gold miners and managers from the American West. This foreign influence diminished as British nationals gained experience and as more and better regional engineering schools came into being. In the words of one Canadian geologist, "these changes [were] not due to different levels of skill and performance, but different economic conditions. . . . President Herbert Hoover's former connection with the [West Australian] field merely. . . [provides] the noticeable exception that proverbially proves the rule."[60]

Space does not permit a detailed examina-

tion of these contrasting views, but they caution us to be wary of one-dimensional approaches to biography and history. It is clear that Hoover and his biographers embellished the American role in international mining and diminished the importance of non-Americans. They exaggerated the significance of theoretical training and downplayed the importance of practical experience and on-the-job training. In truth, as we have seen, Hoover's business instincts kept his mind open to practical innovation and adaptation. Despite his public persona as the Great Engineer who solved problems with a slide rule, Hoover remained a pragmatic professional. Rather than holding to fixed formulas and traditional methods of mining and milling, he experimented widely with men and machinery. Modern engineers have better training, higher standards, more advanced technology at their disposal, and more complex challenges than in Hoover's day. Nevertheless, Hoover's early years as field geologist and "doctor of sick mines" provide an operational model that still influences the engineering profession today.

Notes

1 Theodore J. Hoover, "Memoranda: Being a Statement by an Engineer" (typescript, Stanford, 1939), 244.

2 Walter W. Liggett, *The Rise of Herbert Hoover* (New York: The H.K. Fly Co., 1932), 48-65.

3 Guido Marx, [Memoirs], (Typed manuscript, ca. 1937), 87 in Guido Marx Papers, Box 2, Stanford University Archives.

4 Edwin T. Layton, *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession* (Baltimore: Johns Hopkins, 1986), 4.

5 T.J. Hoover, "Memoranda," 157-58. Robert R. Locke, *The End of the Practical Man: Entrepreneurship and Higher Education in Germany, France, and Great Britain, 1880-1940* (Greenwich & London: JAI Press Inc., 1983), 29-30. Bruce J. Hunt, "Practice vs. Theory: the British Electrical Debate, 1888-1891," *Isis* 74 (Sept. 1983): 341-55.

6 Locke, *End of the Practical Man*, 31-35.

7 Branner to Hoover, 27 Apr. 1896, Branner water press letter books, Stanford University Archives.

8 Kent Schofield, "The Public Image of Herbert Hoover in the 1928 Campaign," *Mid-America* 51, no. 4 (1969): 280.

9 Rossiter W. Raymond, "Condition of the Mining Industry - California," in *Statistics of Mines and Mining in the States and Territories West of the Rocky Mountains* [1871] (Washington: USGPO, 1873), 19. PL, "Anglo- Columbian," SF, 29 Apr. 1879, to editor, in *Mining and Scientific Press* XXXVIII (3 May 1879): 285. Clark C. Spence, *Mining Engineers & the American West: The Lace-Boot Brigade, 1849-1933* (New Haven: Yale University Press, 1970), 18-34, 70-74.

10 *Mining and Scientific Press* XXXVIII (3 May 1879): 285.

11 David F. Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (New York: Knopf, 1977), 36. Layton, *Revolt of the Engineers*, 29-34.

12 George H. Nash, *The Life of Herbert Hoover: The Engineer, 1874-1914* (New York: Norton, 1983), 42-44.

13 Francis Wilson Smith, "Herbert Hoover's *American Individualism* in the History of American Thought," Master's thesis, Univ. of Calif., Berkeley, 1948, 15.

14 Herbert C. Hoover, "The Training of the Mining Engineer," *Science* XX (25 Nov. 1904): 716-19.

15 T. Hoover, "Memoranda," 93-94.

16 Herbert Hoover, speech at Grass Valley, 4 July 1935, quoted in Peter W. Van der Pas, "Herbert Hoover and Nevada County," Nevada County Historical Society *Bulletin* 36 (Apr. 1982): 14.

17 A few years later, Hoover's brother Theodore, after following the younger Herbert's path through Stanford, struggled for months to enter the mining business at a technical level to match his training. After a year working odd jobs as examiner, assayer, sampler, and report writer, he landed a job as assistant manager of Standard Consolidated Gold Mines at Bodie in 1902. This turned out to be a stressful job trying to resolve serious technical and labor problems. Theodore spent four years there, gaining important experience in the development of non-ferrous metallurgy, but the labor problems left him with bitter memories. T. Hoover, "Memoranda," 117-134.

18 H.C. Hoover, [Information for Biographers, ca. 1920], in Benjamin S. Allen papers, Box 1, Hoover Institution, Stanford University (hereafter HI).

19 *Sacramento Bee*, 10 Aug. 1949, p. 18, col. 2-3.

20 Herbert Hoover, *Years of Adventure, 1874-1920*, vol. 1 of *The Memoirs of Herbert Hoover* (New York: Macmillan, 1952), 26 (hereafter *Memoirs*).

21 Herbert C. Hoover, "Training of Engineers," *The Stanford Sequoia*, in HC Hoover scrapbook, Box 230, HI. H.C. Hoover, London, to Dr. David Star [sic] Jordan, 29 June 1904, in Pre-Commerce Correspondence, Box 7, Herbert Hoover Presidential Library (hereafter HHPL). T. Hoover, "Memoranda," 157-58.

22 David S. Jordan to Mr. H. Z. Osborne, 10 July 1899, in Henry Z. Osborne misc. papers, 1899-1921, Stanford Special Collections.

23 H. Hoover, *Memoirs*, 26. The statement implies that Hoover had earned his spurs as a miner, but this may be another example of Hooverian hyperbole. In 1932, one of Hoover's shift bosses at the Mayflower, Randolph Crawford, volunteered to go on the stump for Hoover at a Mother Lode rally in Sonora. He said he had hired Hoover as a mucker, the equivalent of miner's assistant, for $2.50 a day, the going rate underground for mining men of all classes. Harry K. Wolff, Chairman, Republican State Committee, San Francisco, to Chas Segerstrom, Sonora, 24 Oct. 1932; Charles H. [Segerstrom], "Herbert Hoover, The Man Leading the Way to Recovery," [Introductory speech at Hoover Rally, Sonora, 3 Nov. 1932; in Segerstrom Papers, Holt-Atherton Library, University of the Pacific.

24 Carol Green Wilson, "Grass Valley and Nevada City, August 19-21, 1950," (typescript ca. 1950), Wilson Papers, Box 5, HI.

25 H. Hoover, speech at Grass Valley, 4 July 1935, in Van der Pas, "Herbert Hoover and Nevada County," 14.

26 *Sacramento Bee*, 7 Aug. 1958, p C5, col. 2-4. Van der Pas, "Herbert Hoover and Nevada County," 12.

27 H. Hoover, [Information for Biographers, ca. 1920], in Benjamin S. Allen papers, Box 1, HI. *Sacramento Bee*, 7 Aug. 1958, p C5, col. 2-4. Van der Pas, "Herbert Hoover and Nevada County," 12-14.

28 Herbert Hoover, "Some Notes on Crossings," *Mining and Scientific Press* 72 (29 Feb. 1896): 166.

29 David Bruner, *Herbert Hoover: A Public Life* (New York: Knopf, 1979), 24.

30 T. Hoover, "Memoranda," 93-94.

31 Branner to Hoover, 27 Apr. 1896, Branner water press letter books, Stanford University Archives.

32 Nash, *Life of Herbert Hoover*, 476.

33 Roy MacLeod, "Colonial Engineers and the 'Cult of Practicality': Themes and Dimensions in the History of Australian Engineering," *History and Technology* 12 (1995): 143-56.

34 William H. Goetzmann, *Exploration and Empire: The Explorer and the Scientist in the Winning of the American West* (New York: Knopf, 1966).

35 R. R. Updegraf, "Hoover's Seven American Business Pilgrimages," *Magazine of Business* 53, no. 4 (1928): 425-26.

36 H. Hoover, speech at Grass Valley, 4 July 1935, in Van der Pas, "Herbert Hoover and Nevada County," 14.

37 H. Hoover, [biographical sketch from dictation, 1928], in Pre-Commerce Subject File, Box 49, HHPL.

38 W. F. Robinson, *If I Remember Rightly: the Memoirs of W.S. Robinson, 1876-1963* (Geoffrey Blainey, ed.), (Melbourne: F.W. Cheshire Publishing, 1967), 39. Bruner, *Herbert Hoover*, 46.

39 A. H. Ackerman to Hoover, 7 Oct. 1914, in Pre-Commerce Subject File, Box 48, HHPL.

40 Herbert Hoover, "Training of Engineers," *The Stanford Sequoia* [1899], clipping in Hoover scrapbook, Box 230, HI.

41 Noble, *America by Design*, 36. See also Layton, *Revolt of the Engineers*, 33-35.

42 H. Hoover, London, to TJ Hoover, 1905, in HH-TJH Letters, London, 1901-1907/9?, HHPL.

43 Joseph A. Litterer, "Systematic Management: The Search for Order and Integration," *Business History Review* XXXV (Spr., 1961): 472-75.

44 Hoover, *Principles of Mining*, 190.

45 Hoover, "Training of the Mining Engineer" (1904), 2.

46 Herbert C. Hoover, *Principles of Mining: Valuation, Organization and Administration; Copper, Gold, Lead, Silver, Tin and Zinc* (London: Hill Pub. Co., 1909), 186-87.

47 Hoover, *Principles of Mining*, 187. Hoover's original manuscript was so poorly written that his editor rewrote it himself. Hoover didn't even look at the final version prior to publication. W.R. Ingalls to Hazel Lyman Nickel, 28 Aug. 1949, in Herbert Hoover Collection, Box 5, HHPL.

48 H.C. Hoover, "Permanence in Depth in Kalgoorlie," *Engineering and Mining Journal* 76 (31 Oct. 1903): 655.

49 Herbert Hoover, "Mining and Milling Gold Ores in Western Australia," *Engineering and Mining Journal* 66 (17 Dec. 1898): 725.

50 Herbert Hoover to R. A. F. Penrose, Jr., 2 Apr. 1898, in *Life and Letters of R.A.F. Penrose, Jr.* (Helen R. Fairbanks and Charles P. Berkey, eds.), (NY, [priv. print?] 1952), copy in Pre-Commerce Correspondence, Box 12, HHPL.

51 Herbert Hoover, Coolgardie Club, W. Australia to T. J. Hoover, Aug. 1897, in HH-TJH Letters, Australia 1897-1898, Box 1, HHPL.

52 Hoover, *Memoirs* I, 30. Nash, *Life of Herbert Hoover*, 63-77.

53 Herbert Hoover to T. J. Hoover, 15 Feb. 1898, in HH-TJH Letters, Australia 1897-1898, Box 1, HHPL.
54 Herbert Hoover to T. J. Hoover, 15 Feb. 1898, in HH-TJH Letters, Australia 1897-1898, Box 1, HHPL.
55 *Stanford University Alumni Directory and Ten Year Book* (Stanford: Stanford Univ., 1932), 225.
56 Herbert Hoover to T. J. Hoover, 15 Feb. 1898, in HH-TJH Letters, Australia 1897-1898, Box 1, HHPL.
57 Hoover, *Memoirs* I, 78.
58 W. R. Ingalls to Hazel Lyman Nickel, 28 Aug. 1949, in Herbert Hoover Collection, Box 5, HHPL.
59 See, for example: W. S. Robinson, *If I Remember Rightly*, 42. Geoffrey Blainey, "Herbert Hoover's Forgotten Years," *Business Archives and History* 3, no. 1 (Feb. 1973): 53-70. Geofffey Blainey, *The Rush That Never Ended: A History of Australian Mining* (Melbourne: Melbourne University Press, 1974), 259-71. Jeremy Mouat, "The Development of the Flotation Process: Technological Change and the Genesis of Modern Mining, 1898-1911," *Australian Economic History Review* XXXVI (March 1996). Richard Hartley, "A History of Technological Change in Kalgoorlie Gold Metallurgy, 1895-1915," Ph.D. diss., Murdoch University, 1998, ch. 5. For a contemporary challenge to Hoover's claim to have introduced single-jacking in Western Australia, see "Mr. Hoover and Single-Jacking," *Mining and Scientific Press* 122 (15 Jan. 1921): 80.
60 H. C. Boydell, "Status of the British Mining Engineer," *Canadian Mining Journal* 51 (14 Nov. 1930): 1100.