Brothers Professionally and Socially: The Rise of Local Engineering Clubs During the Gilded Age

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Abstract

Scholars in the history and sociology of engineering in the United States have commented critically on the unwillingness of twentieth century engineers to participate actively in politics. Alfred Chandler, for example, has noted the absence of engineers in Progressive Era reform movements, while Edwin T. Layton jr has criticized engineers in the 1920s for an excessive focus on sterile status seeking. This perceived lack of twentieth century engineering activism is especially puzzling given that nineteenth-century American engineers and engineering societies did not hesitate to lobby openly for clean water, smoke abatement, municipal reform, and numerous other issues.

Why, after several decades of public spirit and political activism, did American engineers withdraw from overt civic involvement? In this dissertation I propose one possible answer. An examination of the history of local, state, and regional engineering societies suggests that American engineers' involvement in political affairs served as part of the professionalization of engineering. That is, engineering societies used lobbying on issues such as legislation promoting good

roads to gain public acceptance of engineering as a profession rather than as a skilled trade. Paradoxically, once engineering acquired the sanction of the public and achieved the status it sought, the ideals of professionalism with its standard of disinterestedness and objectivity required that engineers refrain from further political discourse. By the turn of the century, as sociologists and philosophers increasingly referred to engineers as paradigm professionals, engineering involvement in influencing legislation, with the exception of engineering licensing laws, began to disappear.

For L.T.

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I also need to thank the people at the Smithsonian Institution's National Museum of American History, especially Jeffrey Stine and Bill Worthington. The archives in the Division of Engineering & Technology provided the first clues a significant research question needed to be answered. I'd like to thank my friend and former boss at the Historic American Engineering Record, Gray Fitzsimons, for the moral support he's provided over the years. Librarians and archivists all over the country provided invaluable help, but in particular the access to the Annex granted to me by library staff -- Dave, Greg, and Yvonne -- at Michigan Technological University stands out. Being able to search the stacks directly for obscure engineering journals probably shortened the research process by a year or two.

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The engineer is primarily a member of the social world; . . . its problems are his problems; and . . . he cannot avoid the responsibility of taking a share in their solution.

-- George Fillmore Swain, President,
American Society of Civil Engineers, 1913

Introduction

American engineers are often, in the words of historian Bruce Sinclair, portrayed as "politically inflexible, socially awkward, culturally limited, and ethically inert."[1] Few scholars have questioned the origins of this image. Most studies of American engineering have tended to examine the history of engineering education or the growth of large, national professional societies.[2] This dissertation examines the growth of other engineering organizations -- local, state, and regional -- during the

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[1] Bruce Sinclair, "Local history and national culture: notions on engineering professionalism in America," Technology and Culture 27(1986):683-93.

[2] See, for example, Sally Hacker, Pleasure, Power & Technology (Boston: Unwin Hyman, 1989) for contemporary images of engineering. Some of the standard histories of American engineering include Monte Calvert, The Mechanical Engineer in America 1830-1910: Professional Cultures in Conflict (Baltimore, MD: The Johns Hopkins University Press, 1967); ; A. Michal McMahon, The Making of a Profession: A Century of Electrical Engineering in America (New York: 1984); Raymond H. Merritt, Engineering in American Society 1850-1875 (Lexington, KY: University of Kentucky Press, 1969); Bruce Sinclair, A Centennial History of the American Society of Mechanical Engineers (Toronto: 1980).

Gilded Age and Progressive Era in the United States and their role in shaping the occupational identity of the professional engineer. In doing so it provides a possible answer to one puzzling question in the history of engineering: why, after several decades of unabashed political activity in the years leading up to the twentieth century, did the engineering profession become so self-consciously apolitical during the Progressive Era? Historians such as Edwin T. Layton jr have accused engineers of the 1920s of "sterile status seeking" while neglecting public responsibilities, but such behavior had not been typical of engineers only thirty years earlier.[3] Layton blames the national societies for playing internal prestige politics while ignoring the overall societal context. In this dissertation I demonstrate that more complex social factors were at work.

Local nonspecialized, or umbrella, engineering clubs and societies proliferated throughout the United States in the years following the American Civil War. Previous studies of local clubs, such as Carroll Pursell's "The Technical Society of the Pacific Coast," have implied that these groups faded away following the formation of local chapters of engineering societies organized along strict disciplinary lines, such as the

[3] Edwin T. Layton jr, The Revolt of the Engineers: Social Responsibility and the American Engineering Profession (Baltimore, MD: The Johns Hopkins University Press, 1986 [1971]), 252.

American Society of Mechanical Engineers.[4] Rather than disappearing, however, many local clubs were actually founded and thrived contemporaneously with the growth of the national societies. Organizations such as the Engineering Society of Milwaukee, the Engineering Society of Detroit, and the Washington Society of Engineers attracted as members engineers and technicians from across a wide range of occupational specialties. Many of these clubs, in fact, remain active over a century after their founding and continue to attract members from across a wide range of engineering specialties.[5]

In this dissertation I show that such engineering clubs flourished for several reasons. Local clubs inculcated young engineers with the evolving norms and values of what in the 1880s and 1890s was a relatively new profession. They helped to reduce friction between older engineers who had received their professional training through apprenticeship and younger engineers emerging from college programs. The clubs reinforced the emerging identity of the engineers as a scientist rather than as a tradesman or a mechanic. I suggest that active participation in political debates over a variety of issues, ranging from municipal reform to improved rural roads, assisted local, state, and regional societies in negotiating an identity with the public that

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[4] Carroll W. Pursell jr, "The Technical Society of the Pacific Coast," Technology and Culture 17(1976):702-717.

[5] The Rochester Society of Engineers, for example, celebrated its centennial in March, 1997. See Anonymous, "Cooper is 'Enginer of the Year'," Rochester [New York] Democrat and Chronicle March 1, 1997: 5B.

affirmed engineering ideology and established engineering as a learned profession. Finally, I conclude by explaining how the paradox of professionalism led to engineering disengaging from further overt political discourse.

The study begins in the years just following the Civil War and concludes in 1910. During the early years of Reconstruction, the number of new engineering organizations grew rapidly, with the number of clubs and societies growing from a mere handful in 1870 to over one hundred two decades later. Although new engineering societies, both local and national, have continued to be founded in the decades since, by 1910 the professional boundaries of engineering had been clearly delineated, the local and state engineering societies were firmly established, and the various engineering groups had settled into the roles they would continue to occupy for the remainder of their organizational life.

Despite the once widespread popularity of local engineering clubs, little is known about such organizations. A limited number of official histories written by club members to commemorate anniversaries provide bare-bones narratives, but few scholars in the history of engineering or science and technology studies have attempted to analyze the significance of these local clubs, either for their members or to engineering as a whole. Did local clubs play a role in the formation of an engineering culture or professional identity in the United States? Were they purely social clubs, a convenient gathering point for congenial interactions, or did they serve other functions, such as representing the engineering profession to their local community?

Although this dissertation does not claim to answer all possible questions regarding local engineering clubs, it does fill in some of the more important blanks. I will show that the monolithic portrait of an apolitical, homogeneous American engineering community plagued primarily by what sociologists refer to as generational problems breaks down when an analysis is performed at the local level.[6] City, state, and regional engineering societies did indeed serve as congenial social clubs. They also did much more. They served as clearinghouses for information, as employment bureaus, and as nascent political action committees. The level and the focus of activity varied from region to region. An issue, such as the municipalization of water plants or the construction of sewerage treatment facilities, that engineers in one city cared deeply about often went unnoticed in another. It has been said that all politics are local. This aphorism may have been particularly true for engineers. For members of engineering clubs in the 1890s and early 1900s the issues that prompted

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[6] Within an organization, generations are often linked by common experiences, not by age alone. Thus, engineers who received their training through apprenticeship could constitute one generation while graduates of engineering colleges could constitute another. Sociologists have long recognized that conflict often arises between different generations within organizations. See, for example, Joseph R. Gusfield, "The problems of generations in an organizational structure," Social Forces 35(1957):323-330.

the most heated discussion and led to focused action were those issues that most directly affected the local members, their city, or their state.

The Gilded Age and the Progressive Era

American's Gilded Age began with the end of the Reconstruction and lasted until the turn of the century. It was a time of rapid industrialization and urban growth. Financiers and industrialists flaunted their wealth, and America's middle class aped the conspicuous consumerism as best they could. This was the period of high Victorianism, when those who could afford it packed their houses with bric-a-brac and indulged in the new fad of bicycling. It was also a time of dramatic contrasts, with the poor and new immigrants crammed into squalid urban tenements that Jacob Riis would make infamous with his 1890 photographs in How the Other Half Lives. Political corruption and inefficient city government were commonplace, and it is not surprising that by the 1890s the beginnings of a reform movement had emerged.

The period of 1896 to 1920 is generally referred to as the Progressive Era in the United States. Historians have characterized this as a time period noted for burgeoning social and political activism. Reformers such as Wisconsin Governor Robert LaFollette and social activist Jane Addams of Chicago advocated applying scientific techniques to solve social problems. This belief cut across all levels of society. Many scholars, such as Carl N. Degler, have described how a general belief in the objectivity of science contributed both to significant social progress, such as reforms in public housing and sanitation, and to abuses, such as involuntary sterilization of criminals and the mentally ill, during the Progressive Era.[7] Although some scholars place the start of the Progressive Era as early as 1896 and the end as late as 1929, historians generally consider the period to have lasted approximately twenty years, beginning with the youthful optimism of Theodore Roosevelt's presidency and ending with the disillusionment surrounding the Wilson administration following World War I. A. Hunter Dupree, for example, comments that, "The beginning of Roosevelt's presidency is also the usual line of demarcation for the beginning of the Progressive Era, in which the prevailing mood favored an active policy toward the problems emerging from rapid industrialization."[8] Progressivism coincides with the transition of the United States from an isolationist nation to a potent force internationally, with rising literacy rates, with rapid industrialization and urbanization, and with the arrival of unprecedented numbers of foreign immigrants. Historians disagree in the conclusions they reach regarding Progressivism, but

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[7] See, for example, Layton, 66. Cf. Carl N. Degler, In Search of Human Nature (New York: Oxford University Press, 1991), pp. 14-16. See also Daniel H. Calhoun, The American Civil Engineer: Origins and Conflict (Cambridge, MA: The MIT Press, 1960); John Matthew Jordan, "Technic and Ideology: The Engineering Ideal and American Political Culture, 1892-1934," Unpublished dissertation, University of Michigan, 1989; and Cecilia Tichi, Shifting Gears: Technology, Literature, Culture in Modernist America (Chapel Hill: University of North Carolina Press, 1987).

[8] A. Hunter Dupree, Science in the Federal Government: A History of Policies and Activities (Baltimore, MD: The Johns Hopkins University Press, 1986 [1957]).

common elements can be found in many analyses. Most commentators would agree with George B. Tindall and David E. Shi that the "goals [of Progressivism] were greater democracy, honest government, more effective regulation of business, and greater social justice for the masses."[9] Scholars often differ, however, is in defining the causes underlying Progressivism, determining who the Progressives actually were, and assessing the overall legacy of the Progressive movement.[10]

Some of the more significant features of Progressivism as it relates to the history and growth of engineering include the rapid growth of federal and state government, the proliferation of professional societies, and the increasing reliance on experts to solve social problems. The Progressive Era also coincided with the growth of industry as the U.S. economy rebounded from the crippling recession of the early 1890s. In addition to increasing opportunities in private industry, engineers began to move into government employment in record numbers. Under President Theodore Roosevelt, Congress established or expanded regulatory agencies such as the

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[9] George B. Tindall and David E. Shi, America, brief 2nd edition (New York: W. W. Norton & Company, 1989), 597.

[10] For a variety of contrasting interpretations of the Progressive Era see, for example, J. Leonard Bates, The United States 1898-1928: Progressivism and a Society in Transition (New York: McGraw-Hill Book Company, 1976); John D. Buenker, John C. Burnham, and Robert M. Crunden, Progressivism (Cambridge, MA: Schenkman Publishing Company, Inc., 1977); Arthur S. Link and Richard L. McCormick, Progressivism (Arlington Heights, IL: Harland Davidson, Inc., 1983); Gerald W. McFarland, Mugwumps, Morals & Politics 1884-1920 (Amherst: University of Massachusetts Press, 1975).

Interstate Commerce Commission's Bureau of Valuation and the Bureau of Weights and Standards. Each piece of regulatory legislation, such as the Pure Food and Drug Act, entailed the creation of an agency to enforce the Act's provisions. Each agency thus created then had to recruit experts, that is, engineers and scientists, as staff. Similarly, state governments established agencies and bureaus, such as Wisconsin's Bureau of Experts, to help implement government policies.

Simultaneous with the rapid recruitment of engineers by government agencies, specialized engineering and scientific societies appeared. The American Institute of Chemical Engineers, the American Society of Agricultural Engineers, and numerous other organizations were founded during the Progressive Era. For engineers the Progressive Era was an exciting time, full of promise. News of exciting discoveries and inventions filled the pages of the popular press as well as the professional journals. The high visibility of successful American engineering projects, such as the Panama Canal, contributed to engineers and engineering clubs enjoying high status throughout the United States. As Andrew Ross notes, "It was a time when technological progress was raised to the status of a self-evident truth, and when the cults of efficiency and waste conservation presided over everyday life."[11]

Edwin T. Layton, John Matthew Jordan, and others have described how engineers during the Progressive Era also held a firm belief in the possibility of

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[11] Andrew Ross, Strange Weather: Culture, Science and Technology in the Age of Limits (London: Verso, 1991), 122.

scientific solutions to social problems. At the same time, Layton, Jordan, and others have noted that the national societies generally remained aloof from politics, as "[m]ost engineers held a detached and even superior attitude toward the social realm, preferring to remain untainted by such imprecise and 'political' issues."[12] Historian Alfred Chandler, for example, has commented on the absence of engineers among Progressive Era reformers. According to Layton, Meiksins, and others, the national engineering societies during this time period focused on internal disputes as the new generation of college-trained engineers challenged the leadership of previous generations who had received their training and socialization into the profession on the job. Such introspection may have been true on the national level, but was it also true locally? That is, were the local clubs as obsessed with status issues as the nationals, or did they focus on other questions? Further, did they in fact, to borrow Jordan's phrasing, hold deliberately a "detached and even superior attitude" or did engineering's distance from the political realm result from other social forces? In this dissertation I suggest the latter. Rather than being motivated by uniform or conscious disdain for political or civic involvement on local level, the degree of disengagement from politics varied from city to city and state to state and appears to have resulted not as a deliberate action but more as an inevitable outcome of the professionalization process.

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[12] Jordan, 138.

Engineering Clubs and Societies

In the United States the organization of engineering clubs and societies began in the 1830s and continued sporadically for the next eighty years. Technical societies and discussion groups, such as the Boston Philosophical Society, had been a feature of American life since Colonial times, but, as engineering became a more clearly delineated occupational group, engineers began to push for organizations devoted more exclusively to engineering subjects. In The American Civil Engineer: Origins and Conflicts Daniel C. Calhoun describes how the formation of the Institute of Civil Engineers in Great Britain encouraged influential American engineers to advocate the formation of a professional society that could, in a time when most engineers learned their trade on the job, help control engineer training and selection. Several attempts at forming a national society failed. In 1848, engineers in Massachusetts formed the Boston Society of Civil Engineers, "achieving a local, temporary success, "[13] and in 1851 the Boston Society of Engineers was officially incorporated in the Commonwealth of Massachusetts. Engineers in New York City attempted the organization of a purportedly national society, the American Society of Civil Engineers, in 1852, but did not succeed in creating a viable organization until after the Civil War. Other regional and local clubs followed, although not immediately. The earliest examples for which published documentation exists include the New York

[13] Calhoun, 189.

Society of Practical Engineering, organized in August 1868, the Engineers Club of St. Louis, organized in December of the same year, and the Civil Engineers Club of the Northwest, founded in Chicago the following spring. Most of these early local societies were founded by civil engineers and used similar membership criteria in an attempt to limit participation to members of the engineering profession.[14] The development of these and other local engineering societies will be discussed in detail in Chapter One.

Resources and Methodology

This study is an exercise in serendipity, a classic example of what began as an interesting sidebar for a different project turning into a research question of its own. While at the Smithsonian on a predoctoral fellowship to investigate the evolution of consulting engineering and hydroelectric development I discovered a treasure trove of primary archival material relating to the Washington Society of Engineers. It became clear as the project evolved that while the history of one local engineering society in isolation may be moderately interesting, it raised more questions than it answered. I then began the search for data on additional societies, a process that found me

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[14] In addition to Calhoun and Layton, see, for example, Ralph S. Bates, Scientific Societies in the United States, 3rd edition (Cambridge, MA: The MIT Press [1945], 1965); Carroll Pursell, "The Technical Society of the Pacific Coast," Technology and Culture 17(1976):702-717; Everett E. Carlson, "The Engineers Club of St. Louis: A Century of Its History, 1868-1968," Bulletin of the Missouri Historical Society 25 (July 1969): 307-320; and Nancy Smith Midgette, To Foster the Spirit of Professionalism: Southern Scientists and State Academies of Science (Tuscaloosa: The University of Alabama Press, 1991).

alternating between elation and despair. When I began researching local engineering societies, my initial thought had been one of disbelief. I could not believe no one had done a thorough study before. Having spent almost four years, thousands of miles, and untold frustrating days in various archives tracking down elusive records, I now know why.

I selected societies for inclusion in this study through a variation of what is known in sociology as snowball sampling. In snowball sampling the researcher asks informants for referrals to other possible informants with a similar profile. That is, if the researcher is interested in the issue of high school dropouts, she may find an initial pool of informants through referrals from public school guidance counselors, but will expand her sample by asking those informants for referrals to persons they know in similar circumstances. In the case of nineteenth century local engineering clubs and societies, having identified an initial pool of engineering organizations listed in notices published in periodicals such as Engineering News, I then expanded that pool through references given in the published proceedings of various clubs brought to my attention by the original list. Inevitably, this means potentially interesting or anomalous organizations may have been overlooked. Records for some organizations have vanished completely. Others have left fairly comprehensive documentation in the form of published proceedings and newsletters.

Resources utilized for this dissertation included primary data sources, such as archival material located at the Smithsonian Institution's National Museum of

American History, the Wisconsin State Historical Society, the Milwaukee County Historical Society, the Michigan Historical Center, as well as university libraries at Virginia Polytechnic Institute & State University, Michigan Technological University, the University of Michigan, and the University of Wisconsin. This archival material included items such as secretary's minutes from individual organizations as well as biographical data, such as membership records, along with publicity materials, recruitment flyers, correspondence; magazines and journals, such as The Proceedings of the Engineers' Club of Philadelphia, published by the individual clubs and societies; and personal papers of individual engineers such as Daniel Webster Mead. The amount of material available for each local club or society is unfortunately highly uneven. Some groups, such as the Engineers Society of Western Pennsylvania, began publishing their proceedings very early in their history and remain active to the present day. For those groups rich archival resources exist. Other groups appear only as brief descriptions in the meeting notices published in Engineering News. They are mentioned a few times and then vanish, leaving no other readily available evidence of their existence or influence.

In addition to the primary data, secondary sources included reports on club activities submitted to various publications, such as professional journals and trade magazines. Periodicals utilized for the dissertation included Cassier's Magazine, General Electric Review, Journal of the Association of Engineering Societies, as well as local newspapers such as the Milwaukee Journal and the Washington Star.

Overall Plan of the Dissertation

The dissertation consists of five chapters following the Introduction. The Introduction summarizes the research question -- i.e., what role or roles did local engineering clubs play in the United States during the Gilded Age and Progressive Era? The Introduction also includes a brief overview of engineering clubs, the historical context, and a description of resources utilized.

Chapter One establishes the significance of the research for Science and Technology Studies and provides a review of the pertinent literature in history of technology, engineering studies, and Gilded Age and Progressive Era scholarship. Having thus established a context for the dissertation, in "Chapter Two: The Growth of Local Engineering Clubs" I describe the growth of engineering societies in the United States and suggest a simple taxonomy to distinguish between the various groups that emerged in the 1880s and 1890s. The establishment and evolution of organizations such as the Engineering Society of Detroit and the Cleveland Club of Civil Engineers is compared and contrasted.

In "Chapter Three: Similarities and Differences" I provide more detailed histories of one or two organizations of four main types -- local umbrella societies, local single discipline, state societies, and special interest clubs -- mentioned in Chapter One. This is followed in "Chapter Four: Engineers As Activists" by an exploration of three issues that inspired local and state societies to adopt specific policies or assume activist positions: good roads, smoke abatement, and clean water.

I discuss briefly how differences in responses can be linked to variables such as frequency of society meetings. That is, groups which met on a biweekly or monthly basis appear to have been more likely to become involved in establishing committees to perform ongoing investigations of problems while groups meeting less frequently might limit their involvement to discussions of proposed legislation.

Finally, in Chapter Five "Conclusions" I argue that while local engineering clubs performed multiple roles for early twentieth century engineers, including socializing young engineers into the profession, their most important function in the 1880s and 1890s may have been that of helping to stabilize the boundaries of that profession. It was in the meetings, minutes, and interactions of the engineering clubs with the general public that the acceptance of engineering as a learned profession rather than a skilled trade was achieved. I will show that activities such as the willingness of local clubs to assume activist positions on a variety of issues reinforced the emerging occupational identity of engineers as unbiased, objective professionals, that is, the engineer as scientist rather than as industrialist. Membership in local and state societies allowed engineers both to influence the political process and to work toward the public good. Local clubs could educate, advise, and lobby where the individual engineer could not. More importantly, such civic involvement by engineering clubs emphasized the professional, cosmopolitan nature of engineering and helped to elevate the overall status of engineering. I conclude by explaining why achievement of professional status inevitably led to a diminishment of involvement by engineers in the very activities that had helped them gain that status. The paradox of professionalism is that it leaves practitioners trapped in a socially constructed cage of disinterestedness and rationality.

Chapter One: Significance and Context

Significance

This study of the rise of local engineering societies during the Gilded Age makes several significant contributions to scholarship in Science and Technology Studies, history of engineering and late nineteenth century history, and the sociology of organizations. First, studying professional engineers clubs expands our knowledge of the evolution of the engineering profession in the United States. While a great deal has been written about the national societies and the engineering elite instrumental in organizing and controlling those societies, little has been said about the ordinary engineer, the rank and file civil, mechanical, mining or electrical engineers whose beliefs and everyday practices helped shape the profession. Many of these ordinary engineers, the technicians and draftsmen who have remained anonymous while historians focused on personalities such as Morris Cooke or Frederic Haynes Newell, never bothered to join the national societies. If they did, they often limited their involvement to reading the journals. As early as 1882 ASCE members commented on the disparity between the numbers of men on the membership rolls and the number who actually attended the annual conventions. William Shinn noted that at a time when the membership stood at over five hundred, "the number of members we had in attendance at the conventions was rarely over fifty or sixty, . . ."[15] Shinn believed the low numbers were due to the conventions being held in New York and had been among those ASCE members advocating a more peripatetic plan, one that located the convention in a different city every year. Despite this plan, the proportion of members attending the conventions remained low. By the 1890s, as the membership of the American Society of Civil Engineers grew into the thousands, the percentage of members in attendance at regular meetings and conventions steadily decreased.

Involvement in local engineering clubs was a different matter. By the 1890s local engineering clubs and institutes were common in all the major cities of the United States. Beginning with a handful of small organizations in the early 1870s, by 1895 at least one hundred local clubs and societies had been founded, with more appearing each month. In the New York city area alone, the Brooklyn Engineers Club, the Engineers Club of New York, the Technischer Verein, and the Swedish Engineers club all thrived simultaneously with the growth of the four national "Founder Societies."[16]

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[15] Proceedings of the American Society of Civil Engineers 8(1882): 30. The actual membership of the ASCE in 1882 stood at 657 persons.

[16] The American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Institute of Electrical Engineers, and the American Society of Mechanical Engineers.

Despite the one-time popularity and possible influence of engineering clubs, historians and sociologists of engineering have paid them scant attention. Their existence, if acknowledged at all, is noted merely as part of the professional culture that, like the emergence of specialized journals, accompanies the professionalization of an occupation.[17] As a result, while the general history of engineering has been thoroughly documented, the role of local professional societies and engineering clubs is still not well understood by either historians of technology or organization theorists.

Only two examinations of local engineering clubs have been performed in recent years, both by historians. Seventeen years ago Carroll Pursell's "The Technical Society of the Pacific Coast" appeared. In this brief essay Pursell described a local society established in San Francisco in 1884 as part of an "island" community, a regional culture geographically isolated from national professional societies and mainstream intellectual life.[18] The Technical Society, according to Pursell, was established to "facilitate the intellectual intercourse" between pure science and practical mechanics. The TSPC drew its membership from a cross section of civil, mining, and mechanical engineers, architects, and others engaged in the technical

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[17] See, for example, Ernest Greenwood, "The elements of professionalization," pp. 9-19 in H. M. Vollmer and D. L. Mills, editors, Professionalization (Englewood Cliffs, NJ: Prentice-Hall, 1966).

[18] Cf. Robert H. Wiebe, The Search for Order 1877-1920 (Westport, CT: Greenwood Press, 1967), particularly Chapter 2.

arts.[19] Pursell concluded that the society gradually diminished in size and importance as national communications improved and the more specialized engineering societies such as the American Society of Mechanical Engineers established local chapters. Pursell concludes that with only limited time to devote to attending meetings Bay area engineers chose to affiliate with the national societies rather than continuing to support the TSPC. Members officially disbanded the TSPC in 1914.[20]

More recently (in 1987), Bruce Sinclair's "Local history and national culture" discussed differences in the occupational orientations of rank and file engineers from those of the engineering elite, the officers of a national society. Sinclair used a specific example to illustrate what he saw as key differences between the ordinary engineer and the national elite. His essay described a play put on by the Engineers Club of St. Louis in 1930 and contrasted it with the fiftieth anniversary pageant presented by the national office of the American Society of Mechanical Engineers in New York City in that same year. Despite the growing national despair created by the worsening economic climate, in New York the officers of the ASME staged a glittering tribute to industrialization and hailed the mechanical engineer as an agent of progress.

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[19] Pursell.

[20] See also Proceedings of the American Society of Civil Engineers 41(1915):215; or Anonymous, "The Technical Society of the Pacific Coast," Cassier's Magazine 2(1892):405-415.

According to Sinclair, the Engineers Club held a more cynical view.[21] The club's play, eerily prescient of Noble's critique of engineers as agents of capitalism, portrayed the typical engineer as cheerfully selling out to industry interests.[22] Sinclair argues that this is evidence that the image of engineering held by the rank and file engineers differed considerably from that cherished by the national offices. This one narrow example is, of course, a very slender reed upon which to base a claim for incongruity between a national ideology and local realities.

It is, however, typical in that most of what we presume to know about engineers and engineering is based upon similar examinations that are either extremely broad in scope or utilize examples from a very limited sample. Sinclair, for example, analyzes and contrasts two events occurring at the same time a thousand miles apart, an exercise he admits is useful primarily for emphasizing just how little we know about some facets of engineering and engineering's place in American society:

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[21] Sinclair, "Local history." For a contrasting interpretation, see Carlson, "The Engineers Club," previously cited, an official history of the St. Louis Engineers Club written by the then president of the society.

[22] David F. Noble, America by Design: Science, Technology, and the Rise of Corporate Capitalism (New York: Oxford University Press, 1977).

"Instead of the portrait of a profession, what we have is a grab bag of stereotypical images and they picture a group that seems politically inflexible, socially awkward, culturally limited, and ethically inert."[23]

Sinclair and others have argued that much of the scholarship that has discussed engineering in the past, such as Edwin T. Layton jr's Revolt of the Engineers: Social Responsibility and the American Engineering Profession, may be flawed in that the studies focused on the attitudes and behaviors of an engineering elite, that is, the officers and other more influential members of the large, national societies. As Sinclair has noted, "this extensive literature tells us mostly about the profession's central characters and the organizations those kinds of men established and perpetuated."[24] Sinclair argues that scholars need to take a closer look at engineering, both at the individuals within the profession and at the profession's relationships with American culture. Walter Vincenti has sounded a similar note in urging that engineering be studied as an "integral part of society" and not as an external or separate activity.[25] These gaps in our knowledge of some aspects of engineering are

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[23] Sinclair, "Local history."

[24] Sinclair, "Local history," Layton.

[25] Lynwood Bryant, "Review: Engineering as a Social Enterprise," Technology and Culture 33(1992):846-848.

particularly perplexing given the sheer volume of words that have been written about engineering.[26]

The dissertation is also significant in that it draws upon theory in an area long acknowledged to be an integral part of Science and Technology Studies. Numerous scholars have emphasized the importance of organizations for science, technology, and society. In The Technological Society, for example, Jacques Ellul argued that the organization of society, the way in which we structure our workplaces, our government agencies, our education, and so on, contributes to an overall loss of individual freedom and a diminishment in the quality of our lives. David F. Noble, Alfred Chandler, Harry Braverman, and others have examined the influence of corporate structure and bureaucratization on society as a whole. As Noble states in the Introduction to America by Design, "Since those who comprise society are at the same time the human material of which technology is composed, technology must

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[26] A few of the better known studies of engineering include Daniel H. Calhoun, The American Civil Engineer: Origins and Conflict (Cambridge, MA: The Technology Press, 1960); Monte Calvert, The Mechanical Engineer in America 1830-1910: Professional Cultures in Conflict (Baltimore: Johns Hopkins University Press, 1967); Sally Hacker, Pleasure, Power & Technology (Boston: Unwin Hyman, 1989); Raymond Merritt, Engineering in American Society 1850-1875 (Lexington, KY: University of Kentucky Press, 1969); Robert Perrucci and Joel Perstl, Profession Without Community: Engineers in American Society (NY: Random House, 1969); and Terry S. Reynolds, editor, The Engineer in America (Chicago: University of Chicago Press, 1991). For a comprehensive review of recent literature in engineering studies see Gary Downey and Juan Lucena, "Engineering studies," in Sheila Jasanoff and others, editors, Handbook of Science and Technology Studies, 1991.

inescapably reflect the contours of that particular social order which has produced and sustained it."[27]

Similarly, in Autonomous Technology Langdon Winner defined technology as frequently referring to "some (but not all) varieties of social organization -- factories, workshops, bureaucracies, armies, research and development teams, and the like. . . .the term organization will signify all varieties of technical (rational-productive) social arrangements."[28] By focusing on the actions and interactions of individuals and on the construction of informal networks and alliances in laboratory settings -- such as Bruno Latour's Science in Action or Peter Galison's How Experiments End -- while ignoring existing social structures, scholars in science and technology studies may have presented an incomplete picture of both science and the scientists. A world exists outside the laboratories and the journals, a world that includes membership and participation in multiple formal organizations: employers, government agencies, professional societies.[29]

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[27] Noble, xxii. See also Jacques Ellul, The Technological Society (New York: Vintage Books, 1967); Harry Braverman, Labor and Monopoly Capital (New York: Monthly Review Press, 1974); Alfred Chandler, The Visible Hand (Cambridge, MA: Belknap Press, 1977).

[28] Langdon Winner, Autonomous Technology (Cambridge, MA: MIT Press, 1977), 12.

[29] Peter Galison, How Experiments End (Chicago: University of Chicago Press, 1987); Bruno Latour, Science in Action (Cambridge, MA: Harvard University Press, 1987). See also Stephan Fuchs, The Professional Quest for Truth (Albany, NY: SUNY Press, 1992).

Professional societies, which can serve as an interface between multiple social worlds,[30] as well as linking the business arena with the larger social context, straddle a boundary area between multiple organizational affiliations. As J. Miller McPherson notes, "the affiliations of individuals with many organizations is a well-known feature of modern society."[31] Still, the affiliations that are most often studied are the economic ones, the boardrooms and assembly lines, not the more nebulous social ties. An immense body of literature exists in the study of work organizations while comparatively little attention has been paid to voluntary associations. We need to know more about the influence various organizations exert on scientists and technologists and, in turn, what type of power individuals possess to shape both the organizations and the organizations' goals.[32] Looking at the creation and evolution of local engineering clubs may help us to better understand why some organizations succeed while others fail. This is an especially important issue in Science and Technology Studies for practical as well as theoretical considerations. Citizen

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[30] See Howard Becker, Art Worlds (Berkeley: University of California Press,1982), Elihu Gerson, "Scientific Work and Social Worlds," Knowledge 4(1983). 357-77, or Anselm Strauss, "A Social Worlds Perspective," Studies in Symbolic Interaction I (1978). 119-28 for a discussion of the concept of social worlds in sociological research.

[31] J. Miller McPherson, "An ecology of affiliation," American Sociological Review 48(1983).519-532.

[32] Cf. Fuchs.

participation has become a major theme in STS in recent years, yet little attention has been paid to the way in which voluntary associations actually function.

Finally, this dissertation can shed new light on aspects of Gilded Age and Progressive Era history that have puzzled historians in the past. Alfred Chandler has commented on the absence of engineers among Progressive Era reformers.[33] In this dissertation I show that engineers were not absent from reform movements. Indeed, the activities of professional engineers during the Gilded Age anticipated the Progressives as local clubs lobbied for efficiency in government and reforms of municipal administrations.[34]

The Gilded Age, Progressivism, and Engineers

Although some scholars place the beginning as early as 1896 and the end as late as 1929, historians generally consider the Progressive Era to have lasted approximately twenty years, beginning with the youthful optimism of Theodore Roosevelt's presidency and ending with the disillusionment surrounding the Wilson administration following World War I. A. Hunter Dupree, for example, comments that, "The beginning of Roosevelt's presidency is also the usual line of demarcation

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[33] Alfred Chandler, "The origins of Progressive leadership," pp. 74-78 in David M. Kennedy, Progressivism, The Critical Issues (Boston: Little, Brown and Company, 1971).

[34] Cf. Stanley K. Schultz and Clay McShane, "To engineer the metropolis: sewers, sanitation, and city planning in late-nineteenth-century America," The Journal of American History LXV(1978): 389-411.

for the beginning of the Progressive Era, in which the prevailing mood favored an active policy toward the problems emerging from rapid industrialization."[35] Progressivism coincides with the transition of the United States from an isolationist nation to a potent force internationally, with rising literacy rates, with rapid industrialization and urbanization, and with the arrival of unprecedented numbers of foreign immigrants. Historians disagree in the conclusions they reach regarding Progressivism, but a few common elements can be found in most analyses. The voices of analysts such as noted historian Richard Hofstadter, who argued that the underlying framework of so-called Progressive reform actually served to preserve the status quo and the interests of big business, have been muted by a plethora of commentators promoting the period as a high point in American participatory democracy. Hoftstadter, in fact, has emphasized that one alleged aspect often touted in general histories reviewing the Progressive Era -- trust busting -- never happened.[36] Nonetheless, most commentators continue to generally agree with George B. Tindall and David E. Shi's assertion that the "goals [of Progressivism] were greater

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[35] A. Hunter Dupree, Science in the Federal Government: A History of Policies and Activities (Baltimore, MD: The Johns Hopkins University Press, 1986 [1957]).

[36] See Richard Hofstadter, "What happened to the the antitrust movement?," pp. 188-237 in Richard Hoftstadter, The Paranoid Style in American Politics and Other Essays (New York: Vintage Books, 1967). Cf. Tindall and Shi, 604-605. Tindall and Shi note that the administration of Theodore Roosevelt filed twenty-five anti-trust suits against big business interests, but do not report the number of these suits that were resolved in favor of the government.

democracy, honest government, more effective regulation of business, and greater social justice for the masses."[37] Where they differ, as the example of Hoftstadter's work illustrates, is in defining the causes underlying Progressivism, determining who the Progressives actually were, and assessing the overall legacy of the Progressive movement.[38]

In Progressivism, The Critical Issues, for example, editor David M. Kennedy presents a selection of essays to illustrate his belief that all studies of Progressivism have been affected by the authors' individual frames of reference, that is, what they found depended a great deal on what they sought. As sociologist Ben Agger has noted, "there is no such thing as unmediated writing," and, while most historians consciously stive for objectivity, personal biases inevitably creep in to any research project.[39] According to Kennedy, both Samuel P. Hays and Wiebe "ascribe Progressive reform to the relatively benign desires of certain elites to bring order out of chaos,"[40] a position also popular with other commentators. Scholars who assumed

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[37] Tindall and Shi, 597.

[38] For a variety of contrasting interpretations of the Progressive Era see, for example, Bates; Buenker, Burnham, and Crunden; Samuel P. Hays, The Response to Industrialism 1885-1914 (Chicago: University of Chicago Press, [1957] 1995); Link and McCormick; or McFarland.

[39] Ben Agger, Socio(onto)logy: A Disciplinary Reading (Urbana: University of Illinois Press, 1989), 130.

[40] Kennedy, xi.

middle class altruism not surprisingly have assembled evidence to support middle class altruism. To emphasize that the truth about who the Progressives were is not quite that simple, the essays which follow Kennedy's introduction claim to find Progressives among such diverse groups as urban immigrants and California businessmen.

John D. Buenker, John C. Burnham, and Robert M. Crunden also attempt to illustrate a few of the many facets of the era in their book, Progressivism. They argue that Progressivism consisted of more than political reform. They believe that the movement included practical evangelism such as the campaign to eradicate hookworm in the Southern states. Crunden, in fact, sees Progressivism in general as having resulted from internalized Protestant values. He cites the examples of the work of Jane Addams and John Dewey to support this claim. The settlement houses of Chicago and New York were Christianity made real, the principle of practical charity carried out to its logical extreme. Staffed by middle and upper class volunteers, settlement houses attempted to help the poor by providing both practical services, such as sewing classes, and social integration through the encouragement of neighborhood associations that transcended ethnic lines. According to Buenker, "The progressive movement in turn accelerated the general trend toward professionalization in all of American life by popularizing the goal of disinterested service and coupling it with social approbation, most dramatically in social work and engineering."[41]

Crundens' conclusions, particularly regarding the professionalization of engineering, contrast sharply both with those drawn by Schultz and McShane and by this dissertation. Schultz and McShane suggest that if there was indeed any sort of causal relationship between engineering, Progressivism, and professionalism, it was that the levels of efficiency and professional conduct achieved by municipal engineers in the 1880s and 1890s influenced the Progressive reformers of the turn of the century and not vice versa.[42] Eugene Ferguson has noted that while "Many engineers deny their influence [on policy], insisting that they merely carry out the orders of others -- politicians, for instance. Yet in fact it is the engineers who draw up the politicians' shopping lists by furnishing specific solutions to particular problems. . ."[43] This was as true during the Progressive Era as it is today. My research concurs with the conclusions drawn by Schultz and McShane. I will, in fact, demonstrate in this

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[41] Buenker et al., 18. See also Joseph P. Lash, Eleanor and Franklin (New York: W. W. Norton & Company, Inc., 1971), particularly 4-19, 88-100; or David McCullough, Mornings on Horseback (New York: Simon and Schuster, 1981). Both authors provide good, concise descriptions of the development of formal philanthropic organizations among upper class New Yorkers, as well as discussing the impact active involvement in such charitable work had upon the later careers of both Theodore Roosevelt jr and Eleanor Roosevelt.

[42] See Schultz and McShane, previously cited.

[43] Eugene S. Ferguson, Engineering and the Mind's Eye (Cambridge, MA: The MIT Press, 1992), 2.

dissertation that the professionalization of engineering was essentially complete before the first decade of the twentieth century began and that engineering thus served as a model for other would-be professions, such as social work, to follow. Thus, while the general tone of the Progressive Era with its focus on efficiency and reliance on experts may have affirmed engineering professionalism, Progressivism in itself did not cause the professionalization of engineering.

Historians such as Hofstadter have noted that Progressive reformers, like many of their contemporaries, were strongly influenced by the intellectual trends of their time, such as the Herbert Spencer's social Darwinism and Henry Drummond's more moderate reform Darwinism.[44] Politicians, engineers, sociologists, social workers, novelists, and philosophers all read, absorbed, debated, and modified Darwinian ideas about human nature and the social environment. Where Darwin himself had been careful not to attribute motives, social scientists quickly grafted Lamarckian ideas of ends directed evolution into their theorizing about society, nor were they alone in doing so. Although much of the progressive ideology clearly borrowed from Darwinian roots, the idea of progress toward organizational efficiency quickly acquired a teleological inevitability.

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[44] Richard Hofstadter, Social Darwinism in American Thought 1860-1915 (Philadelphia: University of Pennsylvania Press, 1944). Cf. David Mark Chalmers, The Muckrake Years (New York: Van Nostrand Company, 1974), 6; Arthur A. Ekirch jr, Progressivism in America (New York: New Viewpoints, 1974), 15-23.

Carl N. Degler summarized the conflicting influences of social Darwinism, reform Darwinism, Lamarckism, and Mendelian genetics at the turn of the century in his book, In Search of Human Nature. Degler writes that many social scientists, such as Charles Ellwood and Franklin Giddings, rejected the social Darwinism of Herbert Spencer because it glorified competition and supported the status quo. They found Darwin's theories persuasive but rather than seeing in them the basis for a justification of continued exploitation or neglect of the poor and mentally unfit, the reform Darwinists believed that "if one changed the social environment human behavior would adapt or adjust to it."[45]

If the environment changed, so would mankind. The photographs of Jacob Riis had revealed the deplorable living conditions the immigrant poor endured.[46] Poorly lighted and overcrowded tenement apartments included minimal sanitary facilities. Ruth Schwartz Cowan cites studies indicating that at the turn of the century

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[45] Degler, 14. Cf. Hofstadter, Social Darwinism, 94-98. Hofstadter shows how Americans of all intellectual and political persuasions, from conservatives to socialists, helped themselves to the parts of Darwin or Spencer that best fit their own particular ideologies while conveniently ignoring the rest. See also Ellsworth R. Fuhrman, The Sociology of Knowledge in America 1883-1915 (Charlottesville: University Press of Virginia, 1980).

[46] Jacob Riis, How the Other Half Lives (New York: Dover, 1971 [1890]). See also Anonymous, "New York's Great Movement for Housing Reform," Review of Reviews December 1896; Anonymous, "The tenement house competition," Engineering Record June 6, 1896; S. Parks Cadman, "The tenement house reform in New York City," Chatuaquan September 1897; or Hugh R. Jones, "Uninhabitable dwellings," Sanitary Record April 30, 1897.

only one out of every five working class families in New York City had a bathroom in its home.[47] People lived in environments of appalling filth. As Cowan notes,

> "Poor people carried into their dwellings the water that they needed for cooking and cleaning, and they heated it by the potful on their stoves. Living as they did in the filthiest districts, and laboring as they did in the occupations most likely to produce dirt and grime, their homes . . . frequently required cleaning. Some women, determined to keep their homes as orderly and healthful as they could make them, exhausted themselves at the task; while large numbers of others -- perhaps less optimistic, perhaps less brave, perhaps more realistic -- just gave up and rarely attempted it."[48]

Reformers, both social workers and politicians, wanted to clean up the urban squalor. Both saw education as a way for the poor to rise above their lot. Public education, which had been compulsory in only six states in 1871, had spread to most Northern and Western states by 1900. The South lagged behind in this regard, possibly because it had attracted fewer immigrants than the industrialized North, more likely for segregationist reasons.[49] Degler reminds us that "the most prevalent form of social Darwinism at the turn of the century was actually racism, that is, the idea that one

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[47] Ruth Schwartz Cowan, More Work for Mother (New York: Basic Books, Inc., 1983), 162.

[48] Cowan, 163.

[49] See Richard Kluger, Simple Justice (New York: Alfred A. Knopf, Inc., 1975), for a comprehensive history of segregation and education in the United States, particularly pages 51-88, which describe the history of the Supreme Court's Plessy decision which legitimated the doctrine of "separate but equal."

people might be superior to another because of differences in their biological natures."[50]

When Mendelian genetics disproved the notion of the inheritability of acquired characteristics the balance in the nature versus nurture debate was tipped in favor of nature. The idea of reform through education began to shift to a different view. Scientists proposed that the only sure way to reform humanity was through selective breeding. By 1914 eugenics had become "a fashionable social reform movement on both sides of the Atlantic,"[51] a movement that attracted many well-known public figures, including Jane Addams, Gifford Pinchot, and Woodrow Wilson. The involuntary sterilization of criminals and the mentally deficient quickly became commonplace as reformers seized upon what seemed to be a quick technological fix for many of society's woes. The Progressive administration in Wisconsin passed some of the first laws in the nation permitting state officials to perform vasectomies and hysterectomies on inmates of prisons and state hospitals without their consent. Within the span of one generation Progressive reform went from trying to change the environment to fit humanity to trying to change humanity to fit the social environment.

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[50] Degler, 15.

[51] Degler, 43.

The Engineer's Role

And what was the role of the engineer in the Progressive Era? As John Matthew Jordan notes, "To the nineteenth century American, the scientist was not the man of the laboratory, but the man who built the bridges and brought development to the land."[52] This view still held true during the Progressive years. Politicians, reformers and conservatives alike, turned to the engineers to see their dreams made real: engineers would clear the slums, build the electrical power plants and sanitation systems, reclaim the desert to allow city dwellers to live out a Jeffersonian agrarian ideal.[53] Spectacular civil engineering projects such as the construction of the Roosevelt Dam in Arizona and the Panama Canal in Central America coupled with innumerable mechanical, chemical, and electrical innovations presented American engineers with both a seemingly never-ending series of challenges and a continuing sense of accomplishment. The popular press as well as the professional journals were replete with descriptions of new engineering marvels. Each new issue of Scientific

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[52] Jordan, 4. Cf. Daniel Bell, The Winding Passage (New York: Basic Books, 1980), 248-259; Ross, 122; and Tichi, 97-137.

[53] Numerous historians have documented various aspects of engineering during the Progressive Era. See, for example, Donald Worster, Rivers of Empire (New York: Oxford University Press, 1992 [1985]) for an extensive discussion of the ideology and political maneuvering that drove much of the reclamation and irrigation work in the American West.

American, Cosmopolitan, Cassier's Magazine, or Collier's Magazine served to remind engineers of the technological progress they were making possible.[54]

At the same time, the industrialization and urbanization that accompanied technological progress often had undesirable side effects. Thus, while the insurgent progressive movement generally is seen as emerging from citizens' frustrations with machine politics and corrupt local, state, and federal government, those frustrations often arose out of real concerns regarding health and safety. While it is no doubt true, as Buenker has argued, that some elements of progressivism emerged from a middle class desire to regulate big business, it is important to remember that corporate greed and mismanagement had tangible consequences.[55] Foods processed in unsanitary conditions transmitted illnesses such as tuberculosis, bridges constructed by corrupt contractors fell down, industrial waste polluted rivers, and toxic ingredients in tonics

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[54] See, for example, Anonymous, "Harnessing the Mississippi," World Today 11(1906):755-7; Anonymous, "Largest dam in the world," Scientific American 93(September 23, 1905):239; J. A. Baer, "Achievements of the army engineer corps," Harper's Weekly April 27, 1907:602-5; B. Brooks, "Web-foot engineer," McClure's May 1909:73-84; L. Denison, "Making good at Panama," Everybody's Magazine 14(May 1906):579-90; A. D. Flinn, "World's greatest aqueduct; from the Catskill mountains to the city of New York," Century 78(September 1909):707-21; W. C. Hamms, "Great engineering projects," Cosmopolitan 28(1902):163+; W. Inglis, "Progress and promise of the work at Panama," Harper's Weekly 50(December 22, 1906):1852-5; B. E. Linehan, "Building of the Panama Canal," Catholic World 81(May 1905):176-84; F. W. Skinner, "Queensborough Bridge, New York," Collier's Magazine 43(April 1909):30-2; F. Strothers, "Engineer of world-wide successes," World's Work 12(1906):7983-8; H. C. Weir, "How the canal builders make the dirt fly," Putnam's 5(December 1908):286-94.

[55] Buenker, previously cited.

and snake oil cures killed people.[56] Progressivism was not simply abstract social philosophy; it was a response to real problems.

As towns and cities grew, so did the demand for city services. The arrival of foreign immigrants coupled with the movement of workers from rural areas to the cities often taxed metropolitan facilities to their limit. The need to expand water lines and sewer systems, provide regular trash collection and streetcar service, and construct housing and factories created areas rife with opportunities for graft and corruption. Engineers concerned that incompetent practitioners were giving their

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[56] Engineers were well aware of these problems. See, for example, Anonymous, "Garbage utilization: The Arnold system as applied in Boston," Engineering News March 28, 1895; Anonymous, "An injunction against sewage pollution of a California stream," Engineering Record June 25, 1898; Anonymous, "The pollution of streams," Engineering Record August 7, 1909:69; Anonymous, "The prevention of water pollution in New Jersey," Engineering News April 5, 1900; Burton J. Ashley, "The cesspool and its dangers," Canadian Engineer October 15, 1909:87; F. H. Bass, "A notable typhoid epidemic at Mankato, Minnesota," Engineering News February 11, 1909; William H. Bryan, "The down draught furnace: its direct aid in smoke abatement," Cassier's Magazine 8.6(1895):572; Frank K. Chew, "Civic sanitation," Domestic Engineering September 11, 1909:77-8; Floyd Davis, "Impure and unwholesome water and its experimental improvement," Municipal Engineering August 1900; J. T. Fanning, "Incident in water supply tests," Engineering Record September 9, 1893:234; George W. Fuller, "Importance of the Proper Operations of Water and Sewage Purifications Plants," Engineering Record October 31, 1908:26; W. F. M. Goss, "Problem of the modern city," Proceedings of the Engineers Society of Western Pennsylvania 31(1915):229-37; John C. Hill, "Is our drinking water dangerous?" Proceedings of the American Waterworks Association 1893; G. R. Ide, "Smoke prevention in cities," Proceedings of the Engineers Club of Philadelphia 1892:141-52; Richard J. McCarty, "The smoke problem," Street Railway Journal December 1895; H. MacLean Wilson, "Conditions for the preliminary treatment of trade-waste water before its admission into public sewers," Journal of the Sanitary Institute, April 1898; Edward F. Willoughby, "Practical disinfection," Sanitary Record December 6, 1895.

profession a bad name had long pressed for reform in the manner in which contracts for construction were awarded and supervised. Many professional journals and trade publications, such as Engineering News and Cassier's Magazine, routinely published reports linking shoddy engineering and corrupt city officials. Engineering News, for example, did not hesitate to castigate both public officials and working engineers for their perceived failings. As early as 1877, shortly after Engineering News began publication, the magazine reported critically on design flaws in everything from municipal sewerage systems to railroad bridges. The staff writers pulled no punches in editorializing as to why those failures occurred. In commenting on defective work discovered in New York City in 1879, for example, Engineering News roundly denounced conflicts of interest. The writer noted that when the first chief engineer set standards for a city project that appeared "onerous to the contractor [the chief engineer] was displaced and more accommodating person appointed."[57] The editorial made it very clear that Engineering News believed a competent engineer would never give in to pressures from employers to lower standards and that to allow political interests to dictate how an engineering project should be undertaken was an open invitation to disaster.

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[57] Engineering News Record January 4, 1879:2. See also Ellis L. Armstrong,ed., History of Public Works in the United States 1776-1976 (Chicago: American Public Works Association, 1976); or G. Gray Fitzsimons, "The perils of public works engineering: the early development of utilities in Seattle, Washington, 1890-1912," M.A. thesis, University of Washington, 1992.

Thus, while the political reform movements came and went, as Mugwumps evolved into Progressives, the engineering press remained consistent in its advocacy of professionalism and municipal reform. While it is possible some of the stated concerns may have been prompted by a desire to restrict competition in a specialized labor market,[58] engineers were increasingly socialized into a professional ethic of public responsibility. They were, after all, men of science, not men of business.[59] Noted engineers, such as William P. Shinn, John Jervis, and others, had been emphasizing for the previous fifty years that engineering was applied science and that engineers themselves were scientists, not artisans nor craftsmen. A position statement, "On the Policy of the Society," published in the Volume 1 of the Proceedings of the American Society of Civil Engineers described engineers as "men of practical science." Twenty years later while speaking at the dedication of the new ASCE headquarters in New York City, B. M. Harrod reiterated that "engineering

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[58] See, for example, J. Berlant, Profession and Monopoly (Berkeley, CA: University of California Press, 1975); P. Foley, A. Shaked, and E. Sutton, "Economics of the professions: an introductory guide to the literature," ICERD Occasional Paper No. 1, International Center for Economics and Related Disciplines, London School of Economics, London, 1982; or H. Leland, "Quacks, lemons, and licensing: a theory of minimum quality standards," Journal of Policy and Economics 87(1974):1328-46, for a discussion of the relationship between professionalization and the labor market.

[59] As late as 1922 Engineering News-Record distinguished between "the practice of engineering and the business of contracting," noting in an anonymous editorial that "the engineer provides disinterested advice and service for which he is paid a stipulated fee. . ." Engineering News-Record 88(1922):350-351.

practice was always based on scientific knowledge."[60] Although exceptions to this ideal existed, in this dissertation I will demonstrate that by the turn of the century engineers had successfully crafted a professional identity which cast them in the role of disinterested men of science in both the eyes of the public and within the profession of engineering itself.

Further, regardless of the professional orientation of engineers, whether or not engineers as an occupational group were more or less active than the public as a whole in the Progressive movement is open to debate. It is true studies of known Progressive leaders on both the state and national level generally have found that most Progressives had backgrounds in business or the law. In his study of Progressive leaders, for example, Alfred Chandler examined a sample of 260 biographies and found few engineers. Businessmen made up over third of the sample with 95 persons represented. Lawyers, with 74, ran a close second. Chandler noted "a scattering . . . of civil and mining engineers,"[61] a scattering that upon closer scrutiny turns out to mean less than six individuals. In Technic and Ideology, Jordan suggests that "Most engineers held a detached and even superior attitude toward the social realm,

[60] Anonymous, "On the Policy of the Society," Proceedings of the American Society of Civil Engineers I(1873-75): 317-19; B. M. Harrod, "Address of B. M. Harrod, President, Am. Soc. C. E.," Proceedings of the American Society of Civil Engineers XXIII(1897): 527-530.

[61] Alfred Chandler, "The origins of progressive leadership," pages 74-78 in Kennedy.

preferring to remain untainted by such imprecise and 'political' issues."[62] Engineers themselves have suggested why engineering and politics rarely mix: the engineer "refuses to deal with anything unless he has proved that it will work."[63] Chandler's prosopographical analysis, however, is one of the few done of Progressive Era individuals and to date his conclusions remain generally untested by other scholars.

In any event, while the national engineering societies did not hesitate to lobby to support what they saw as engineering issues -- for example, the development of a standard steel rail for the use on the nation's railroads -- their involvement in wider social issues was less common. The public had greeted engineers' past efforts in even such an innocuous area as encouraging the adoption of a 24-hour clock with such resounding apathy as to discourage even the most optimistic would-be social activist.[64] The engineering ideal might be a rational, controlled environment, but, given the high prestige engineers enjoyed at the turn of the century, many engineers believed they could best contribute to progressive reform simply by doing their jobs. Andrew Ross

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[62] Jordan, 138.

[63] Jordan, 324. Cf.. Henry Petroski, "The invisible engineer," Civil Engineering November 1990: 46-49.

[64] See Proceedings of the ASCE X-XII (1884-1886), where most of the discussion at meetings centers around implementing standard time and a 24-hour clock. The national railroad system helped ensure the former, but the ASCE eventually gave up the latter as a lost cause. See also Carlene Stephens, "The most reliable time: William Bond, the New England railroads, and time-awareness in 19th century America," Technology & Culture 30(1989):1-24; and Ian R. Bartky, "The adoption of standard time," Technology & Culture 30(1989):25-56.

and Cecelia Tichi have argued that the image of engineering prevalent during the Progressive Era mirrored the desire of the engineers themselves to serve as agents of social progress and reform through the advancement of technology. The ideal of the engineer -- the consultant, the outside expert, the paladin in a white hard hat -- first gained wide circulation just as large numbers of engineers began to move into industrial organizations. This image of engineering, an image Bruce Sinclair has noted seemed based more on the ideal of the frontiersman of the previous century than the scientist of the twentieth, quickly became an internalized ideal.[65] The image may have already been anachronistic, but Tichi reminds us that novels such as The Winning of Barbara Worth with its engineer hero dominated the best seller lists for most of the Progressive Era. Reinforced both by articles in the popular press extolling a gospel of efficiency and by portrayals of the engineer as hero in pulp fiction, most working engineers may have found it easy to accept their role as objective

[65] See, for example, Bruce Sinclair, "Inventing a genteel tradition: MIT crosses the river," pp. 1-17 in Bruce Sinclair, editor, New Perspectives on Technology and American Culture (Philadelphia: American Philosophical Library, 1986).

professionals who left most national politics to the politicians.[66] As we shall see in the following chapters, however, local issues could be a different matter.

It is also worth noting that the Progressive Era coincides with a time when the demographic profile of the engineer was changing. The Morrill Act of 1864 led to the establishment of land grant colleges such as Virginia Polytechnic Institute and Michigan State University. The overall effects of increased educational opportunities on engineering have been ably documented by others.[67] As unprecedentedly large numbers of young men began entering the profession, fewer and fewer followed the apprenticeship routes traditional among civil and mechanical engineering. Books such as Frith's The Romance of Engineering and Church's Life of Ericsson had shaped their image of the image of the role of the engineer in society. Engineers solved real problems. As architect David Clarke has written,

> ". . . a revolution took place in engineering over the years from being task specific (military machines, fortifications, bridges, canals, etc.) to being process specific. Engineering became a professional cluster of algorithms (dedicated processes leading to closely nested goals). As the quiver of

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[66] Western novels such as Zane Grey's The U.P. Trail (New York: Gross & Dunlap, 1918) and adventure fantasies such as Edgar Rice Burroughs's At the Earth's Core (New York: Del Rey, 1990 [1914]) cast the engineer as hero, a tradition that continued in pulp fiction until quite recently. See Robert A. Heinlein, The Door into Summer (New York: Signet Books, 1957); Larry Niven and Jerry Pournelle, Lucifer's Hammer (Chicago, IL: Playboy Press, 1977); or Larry Niven, Jerry Pournelle, and Michael Barnes, Fallen Angels (New York: Baen Books, 1991), for examples of the evolution of the image of the engineer.

[67] See, for example, Merritt, Engineering.

> algorithms increased, first arithmetically, and then geometrically, engineers were increasingly led to believe they could do anything."[68]

If the influence of engineers on Progressivism is open to question, the impact of Progressive politics on engineering is more readily discernible. As the population grew, so, too, did the size and complexity of the federal government. Until the late nineteenth century the largest division of the federal bureaucracy, that is, the agency that employed the greatest number of civilians, was the post office. Most of those employees were, of course, not based in Washington, D.C. They staffed the hundreds of local post offices scattered across the nation. By the 1880s, however, the demand for increased federal regulation and services had led to the creation of agencies such as the Interstate Commerce Commission (1887) and the United States Forest Service (1876). These agencies often came into existence as small bureaus frequently manned by only one expert, but, as the German sociologist Max Weber noted, "once it is fully established, bureaucracy is among those social structures which are hardest to destroy."[69]

The Forest Service, for example, originated as an office within the Bureau of Land Organization in the Department of the Interior. Following the establishment of

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[68] David Clarke, Arguments in Favor of Sharpshooting (Portland, OR: Timber Press, 1984), 34. Cf. Eugene S. Ferguson, Engineering and the Mind's Eye (Cambridge, MA: MIT Press, 1992).

[69] S. N. Eisenstadt, ed., Max Weber on Charisma and Institution Building: Selected Papers (Chicago: University of Chicago Press, 1968), 75.

national forest reserves in the 1890s, its importance increased. By 1906 Chief Forester Gifford Pinchot had succeeded in establishing the forest service as an autonomous agency within the Department of Agriculture following Agriculture's assuming responsibility for managing the reserves. From one employee it had grown to hundreds. In 1898 the Congress budgeted $28,500 for Forestry's operations. Ten years later the Forest Service spent $3,572,922, an increase of over 12 thousand percent.[70]

Pinchot, in fact, had created such a mini-empire for himself within the government that he began to feel invulnerable. After Taft's election to the Presidency in 1908 Pinchot frequently clashed with members of the new administration. In 1909 he was fired. While some agencies displayed more aggression than others in expanding their scope -- Gifford Pinchot, first head of the Forest Service, has been described as "a bureaucratic empire-builder"[71] -- once in place, none ever seemed to shrink. As Watson comments, "the Department of Agriculture had been quietly extending its activities so that by 1913 probably no federal agency had greater power of a segment of the economy."[72]

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[70] Ekirch, 110-201; David F. Clary, Timber and the Forest Service (Lawrence: University Press of Kansas, 1986).

[71] John Milton Cooper jr, Pivotal Decades: The United States 1900-1920 (New York: W. W. Norton and Company, 1990), 48.

[72] Richard L. Watson jr, The Development of National Power: The United States 1900-1919 (Washington, DC: The University Press of America, 1982 [1976]), 166.

The USDA's quiet expansion was hardly atypical. In his study of the ongoing relationship between science and government, Dupree described many agencies that, once having been called into existence through legislation, began silently but steadily growing. Dupree concluded that government support of science has been most successful in the areas where the research was intended to meet a definite need, such as in surveying or in combating diseases such as yellow fever.[73] Each success, whether it be at building dams or at improving public hygiene, would naturally bolster arguments for increased funding and expansion of the responsible agencies.

In addition, the growth of the federal government was an almost inevitable outcome of the Progressive reforms. As noted earlier, Progressivism did not entail increased democracy or greater individual freedom. The goal of the Progressives, after all, was increased control -- control of big business and large corporations, control of immigration, control of education, and, through the creation of agencies such as the Forest Service and the Bureau of Reclamation, control over nature. Increased regulation -- the Hepburn Act of 1906, the Mann-Elkins Act of 1910, the Clayton Act of 1914, and numerous others -- required hiring and supervising a growing army of scientists and engineers, inspectors and analysts, file clerks and typists. As Chandler, Noble, and others have shown, the business world facilitated the transformation of the engineer from independent practitioner to organization man.

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[73] Dupree, previously cited.

Now a similar evolution occurred in the halls of government agencies as specialized bureaus grew from one or two experts who did their own fieldwork to complex bureaucracies complete with multiple levels of management.[74] Agencies such as the Interstate Commerce Commission and the Forest Service built laboratories, as did the military. A case could be made that the growth of federal engineering was simply the logical culmination of engineering's expansion in American government. Municipalities, such as New York and Chicago, had employed large city engineering staffs for decades. Counties and states also employed engineers to, among other things, oversee public works contracts. Engineers lobbied for decades for the creation of a national Department of Public Works analogous to the state and local bureaus to coordinate federal engineering projects.[75] They never succeeded, despite their ever-increasing numbers in federal employment. When American engineers first began advocating such a cabinet-level department, projects both within and outside the federal District of Columbia were few enough in number that Congress saw no reason to remove oversight from the Corps of Engineers. By the 1920s, when the political

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[74] See, for example, Donald C. Jackson, "Engineering in the Progressive Era: a new look at Frederick Haynes Newell and the U. S. Reclamation Service," Technology and Culture 34(1993): 539-574.

[75] See, for example, Anonymous, "Re-organization of the scientific bureaus of the general government," Engineering News and American Contract Journal February 13, 1886:104-6, or Anonymous, Editorial, Engineering News and American Railway Journal 1896:272.

climate would have been more open to arguments for increased efficiency, the engineering community had moved on to other concerns.

The preceding brief review of the Progressive Era is of necessity highly cursory. As Hays has noted in The Response to Industrialism, the period from 1885 to 1914 stands as one of the most turbulent in United States history. While many survey histories, such asTindall and Shi's America, point to examples such as the institution of the secret ballot in describing the time period as shining high point in participatory democracy, other historians have used examples such as the eugenics movement to emphasize that the underlying theme of Progressivism was not one of reform but rather one of control. In addition, the Gilded Age and Progressive Era were rife with contradictions. Numerous social movements competedfor the public's attention as the economic foundation of the nation shifted from agriculture to industry. The middle class viewed the burgeoning factory work forces, the teeming masses of immigrants, and the growing urbanization of American life with suspicion and distaste. Many reforms, such as the city manager movement, may have been touted as a response to municipal corruption but in fact had the effect of making the votes of working class city dwellers less important.[76]

Ruth Schwarz Cowan has described how changes in technology during the nineteenth century contributed to the disappearance or de-skilling of some

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[76] Cf. Kathryn Marie Dudley, The End of the Line (Chicago: University of Chicago Press, 1994), 6-10.

occupations while others, such as machinist, grew in importance.[77] Engineering was only one of a number of occupations that had either been unknown or limited in scope only a few decades previously. From referring to men who designed or supervised construction projects, by the start of the Progressive Era the term engineer had come to mean an expert at technical work, i.e., a person with access to technological knowledge not available to the general public. As I will demonstrate in the following chapters, regardless of what interpretations one draws about the Gilded Age and Progressive Era, one thing did stand out in the years following the end of the Civil War and preceding the Great Depression of the 1930s. A spirit of technological optimism permeated the country and helped elevate the emerging American engineer to the status of cultural hero. Chandler may have wondered where the engineers were during the Progressive Era, but, as Schultz and McShane remind us, engineers did not need toparticipate in political movements to support reform or contribute to social progress. In the following chapters I will show that in an age that increasingly worshipped efficiency and control, engineers negotiated successfully an identity for themselves that positioned their occupation to serve as an exemplar for the rest of society.[78]

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[77] Ruth Schwartz Cowan, A Social History of American Technology (Chicago: University of Chicago Press, 1997), pp. 178-193.

[78] See Cowan, Social History, pp. 209-213. Cf. Jordan, previously cited; Sinclair, "Inventing," previously cited; Ticchi, previously cited. See also Howard Segal, Technological Utopianism in American Thought (Chicago: University of

Chapter Two: The Growth of Local Engineering Clubs

The United States enjoys a reputation for being a nation of joiners. Americans join women's clubs, fraternal orders, youth groups, churches, hobby clubs, political interest groups, professional societies, and a bewildering variety of other voluntary associations. Beginning with toddlers' play groups and continuing on through school, work, and finally retirement, many Americans belong to multiple formal organizations for most of their lives. Still, as James Q. Wilson, Mayer N. Zald, and others have noted, this propensity for associating with voluntary organizations has not proceeded evenly.[79] Bursts of organizational proliferation follow decades of relative inactivity and decline, as well as varying from group to group, depending on variables such as

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Chicago Press, 1985).

[79] See, for example, James Q. Wilson, Political Organizations (New York: Basic Books, Inc., 1973); Mayer N. Zald, Organizational Change: The Political Economy of the YMCA (Chicago: University of Chicago Press, 1970). In "The ecology of organizational founding: American labor unions, 1836-1985," American Journal of Sociology 92(1987):910-43, Michael T. Hannan and John Freeman suggest that "legitimation of a form increases its founding rate." More recently, political scientist Robert D. Putnam has reported that his research indicates that Americans are again losing interest in affiliating with voluntary organizations. See, for example, Robert D. Putnam, "The Strange Disappearance of Civic America," The American Prospect no. 24(Winter 1996 [http://epn.org/prospect/24/24putn.html]).

social class, occupation, gender, ethnicity, and education. At different times blue collar workers have been more or less likely to join voluntary organizations than their white collar counterparts, women more or less likely than men.[80]

The 1870s and early 1880s witnessed the founding of national professional societies such as the American Society of Mechanical Engineers and the American Bar Association, as well as the resurgence of the labor movement in the form of the Knights of Labor and the temperance movement in the form of the Women's Christian Temperance Union. While those organizations staked claims to national membership, local organizations also proliferated. Robert H. Wiebe describes the people of the Gilded Age as being "like so many free floating particles, groups of worried citizens tossed about, attached themselves to a cause, then scattered again."[81] Engineers, doctors, lawyers, and other professionals were not immune to the urge to organize. While farmers formed local chapters of the Farmers Alliance or the Grange and church women flocked to the WCTU, engineers began organizing clubs where they, too, could meet to further causes or pursue issues of mutual interest. In 1870, as few as four local engineering clubs existed: the Boston Society of Engineers, the Civil

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[80] See Mark C. Carnes, Secret Ritual and Manhood in Victorian America (New Haven, CT: Yale University Press, 1989) for an extensive discussion of the popularity of one particular type of voluntary organization or Amitai Etzioni, editor, A Sociological Reader on Complex Organizations (New York: Holt, Rinehart and Winston, Inc., 1969 [1961]) for a more general discussion of formal organizations.

[81] Wiebe, 66.

Engineers Club of the Northwest, the Engineers Club of St. Louis, and the Rensselaer Society of Civil Engineers. Local clubs, such as the Brooklyn Wa-ca-ma-ha-ga Club, may have been founded earlier or flourished elsewhere, but left few records of their existence.[82] The March 15, 1870 issue of The Engineering and Mining Journal noted that, "It seems to be a difficult matter to maintain in this country active and mutually profitable associations of civil, mining, or mechanical engineers. They languish, or die, or run into the hands of a few men, who, . . . carry the burden of the whole."[83] Even the two national societies -- the American Institute of Mining Engineers and the American Society of Civil Engineers -- were still small and struggling, scarcely deserving their self-designation as national organizations. In the early years of Reconstruction, the ASCE was, in fact if not in name, essentially a local engineering club within New York City.

Within twenty years the number of readily documented local clubs had swollen to over fifty, with Engineering News reporting the formation of new clubs on almost a weekly basis, and national organizations had grown dramatically in size and influence as well as increased in number. The American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Association

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[82] See, for example, Anonymous, "The Oldest Engineering Society in the United States," Engineering News and American Railway Journal March 21, 1895:184.

[83] Anonymous, "Associations of Engineers," The Engineering and Mining Journal March 15, 1870.

of Irrigation Engineers, and other groups claiming a national membership appeared. From scarcely a dozen active members in the 1860s the ASCE grew to over a thousand members by the 1890s. As Figure 1 illustrates, the period from 1885 to

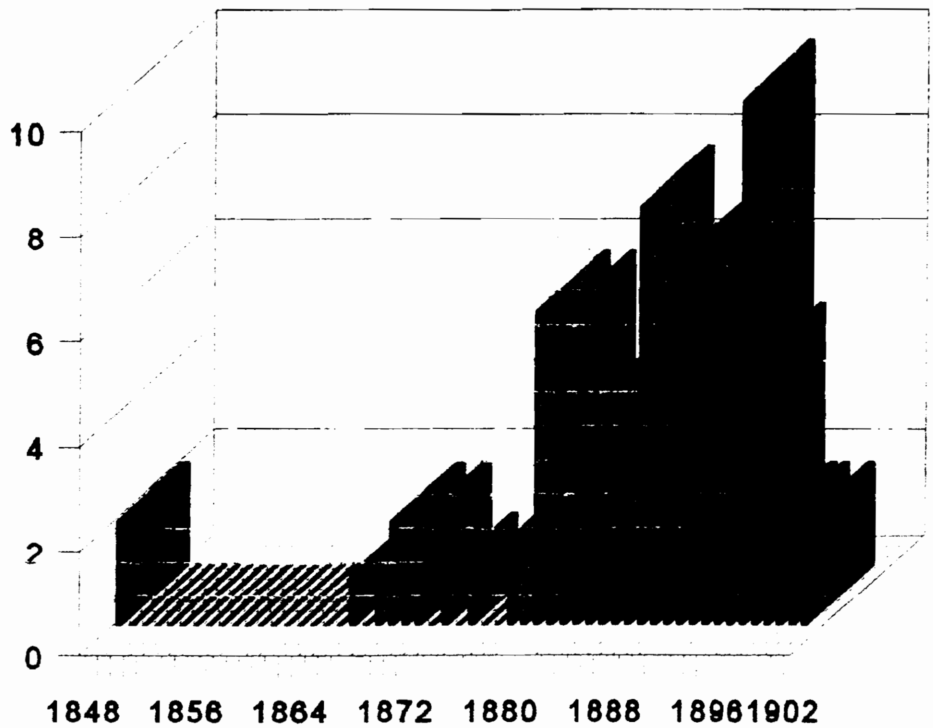

Figure 1 Growth of local engineering clubs in the United States, 1848-1902

1896 witnessed the appearance of numerous new engineering organizations.

The newly formed local clubs and associations ranged from small to large, from highly informal to tightly structured, with varying schedules of meetings. In 1884, for example, a sanitary engineer residing in New York City, Charles F. Wingate, organized what became known as the Twilight Club. There were no dues, no written rules or by-laws, no requirements for membership beyond the vague wish that a participant be a "clubbable fellow."[84] The group met one evening a week at a good restaurant to discuss a current topic in science and technology over dinner. The evening's topic and a chairperson to guide the discussion were designated in advance and diners paid for their own meals, but beyond that loose structure few rules applied. At the other extreme were groups, such as the Denver Society of Civil Enginners, that proposed a formal constitution and strict grades of membership almost before issuing a call for members. The editors of Engineering News occasionally warned nascent clubs and societies to "go slow on the subject of Constitutions and By-laws,"[85] as they had apparently seen many embryonic local clubs become so bogged down in the minutiae of a constitution that the organizations proved still-born.

The founders of engineering clubs and associations had two general models to select from when organizing local groups, the inclusive model similar to that of the American Institute of Mining Engineers or the exclusive example of the American Society of Civil Engineers. Table 1 on the following page illustrates the six general types of engineering clubs and societies that appeared between the Civil War and 1910.

The ASCE had from its inception viewed itself as being very much responsible for setting standards for engineering practice. The ASCE Constitution strictly defined

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[84] Anonymous, "Surveyors associations," Engineering News and American Contract Journal June 14, 1884: 300.

[85] Ibid.

the criteria for full membership. Layton, Meiksins, and others have criticized the ASCE for elitist tendencies, but that is exactly what many of the ASCE members strived for. In November 1875, at a time when the ASCE membership rolls were still

Table 1.-- Types of Engineering Clubs

	Exclusive	Inclusive
National	American Society of Civil Engineers	American Institute of Mining Engineers
State	Michigan Association of Surveyors & Civil Engineers	Montana Society of Civil Engineers
Special Interest		Lake Superior Mining Institute
Local Engineering	St. Paul Society of Civil Engineers	
Local Technical Society	Engineering Society of Milwaukee	
Ethnic		Technischer Verein von New York

fairly small and the organization faced competition for potential members from rapidly growing regional engineering clubs, such as the Civil Engineers Club of the Northwest and the Engineers Club of Philadelphia, the Committee on Society Policy declared:

> There is the objective method, or increasing the influence of the Society upon the public. As the Society becomes more and more known for the high professional standing of its members, for the extent and value of their works, and for the excellence of their technical papers and discussions, other engineers will be more anxious to join it; raising its standard of qualification for membership will become easier, the public will be more desirous of intrusting [sic] works to its members, and it will give character to those who

> belong to it, and credit to those who contribute to its physical resources, . . . The reflex action of these external influences will be of personal advantage to the members, and both the Society and the public will be benefited.[86]

Even when the ASCE was very clearly no longer the only professional organization available for working engineers to choose to join, the membership resisted loosening the membership criteria. As late as 1905, for example, discussions at the annual meeting revolved -- as they had for the previous twenty years and would continue to for the next twenty -- around the issue of amending the Constitution to allow less qualified engineers and other interested persons to join. While one group of members pushed for expanding the boundaries of the society and increasing its membership rolls, another group advocated the opposite position. Rather than allowing more persons to join, members such as B. R. Green believed the criteria needed to be made more restrictive, not less.

Green argued that "Membership in the American Society of Civil Engineers should be above all things, a credential of standing as an engineer. . ."[87] In a time when state legislatures viewed licensing engineers as a possible check on shoddy engineering practices, a legislative move the ASCE strenuously resisted, many members argued ASCE membership itself served as certification of competence. At the 1906 annual meeting, during the debate over proposed amendments to the society's

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[86] Proceedings of the ASCE 1(1875):317-318. See also Proceedings of the American Society of Civil Engineers 32(1906):211 passim. Cf. Henry Hansmann, "A theory of status organizations," Journal of Law, Economics, and Organization 2(1986):119-30; or James Q. Wilson, 41.

[87] Proceedings of the American Society of Civil Engineers XXXI (1905):291.

constitution, one member noted that "On account of these words which require that a man should be competent to practice engineering, the Chief of Engineers of our Department has made a rule that a man cannot be employed as Civil Engineer unless he is eligible to membership in the American Society of Civil Engineers."[88] Frank Elliott has noted that at the turn of the century many so-called engineers were men who had worked briefly in some subordinate capacity and then felt free to solicit work on their own. It is not surprising questions regarding competence were commonplace.[89]

Many observers considered the ASCE to be the most difficult society to join. The second oldest continuously functioning professional engineering society in the country, the ASCE consistently maintained rigorous membership criteria. The society had several different grades of membership: Junior, Associate, Associate Member, Member, and Fellow. Even the least rigorous category, Junior, required two years of engineering experience, although by 1905 the Society had -- after a number of years of rancorous debate -- agreed to substitute a degree in engineering from a reputable school for the work experience. Full membership required that the prospective member be of recognized standing in the engineering profession, a requirement generally interpreted to mean that the applicant be able to prove he had supervised a major engineering project. In addition, where other societies required that at least

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[88] Proceedings of the ASCE 32(1906):244-45.

[89] Frank Elliott, When The Railroad Was King (Lansing, MI: Bureau of History, Michigan Department of State, 1988 [1965]).

twenty-five percent of the membership reject prospective members, as few as three negative votes could bar an applicant from membership in the ASCE. Finally, as late as 1906 a proposed amendment to the constitution explicitly stated that an applicant for Member must "have been in the active practice of Civil Engineering for not less than ten years; shall have had responsible charge of engineering work of importance and merit for at least five years, and shall be qualified both to design and direct engineering works."[90] It was a requirement that many potential members, such as professors of engineering, were unable to meet, although the same proposed amendment did suggest that "the performance of the duties of professor in any of the branches of Civil Engineering in a technical school of high grade shall be considered equivalent to an equal number of years of active practice."[91]

During discussions regarding permitting engineers who belonged to local engineering clubs, such as the Engineering Club of Western New York, to link up automatically with the national society, as some members proposed, other members reminded the Society that such a move threatened to weaken the latter's much higher standards. As noted above, the ASCE saw membership in their society as being the equivalent of a certification of competence, and, in an era when engineering incompetence often contributed to disastrous accidents followed by unsavory

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[90] Proceedings of the ASCE 32(1906):243.

[91] Proceedings of the ASCE 32(1906):243. It was not until 1920 that the ASCE admitted academics as Members without the stipulation that they be able to prove responsible charge of project outside the academy. See Proceedings of the ASCE 46(1920).

scandals, lowering membership standards was clearly unacceptable. Even members of local societies admitted local standards were different from those of the national society. George A. Ricker, for example, expressed the "keen disappointment" he felt in regarding the local society he helped found:

> Our local society has lived, and at times it has prospered; but hast not a sufficiently high tone, it does not prescribe high enough standards for admission. It is too apt to be the policy of such local organizations to secure an extensive membership so that it may become successful financially,and unless it is successful financially of course it is doomed to fail finally.[92]

The debate within the ASCE highlights the differing views of the purposes of a professional society. While the members of a national society might disclaim any interest in furthering business connections, the views they expressed concerning local societies suggested they saw the locals functioning in just that way.

The local societies, however, would argue differently. Organizers of the Washington Society of Engineers, for example, stated their goals as being very similar to those expressed by the ASCE: to advance "engineering knowledge and practice, and the maintenance of a high professional standard among its members." On the other hand, the Washington Society of Engineers did invite literally anyone with an interest in engineering and the advancement of engineering science to join the organization. Rather than asking applicants to provide proof of professional competence as a requirement of membership, the WSE simply asked for references from three current members. Further, the society's secretary occasionally waived even

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[92] Proceedings of the ASCE 31(1905):288.

this nominal criterion for prospective members new to the Washington area. The memberships records of the WSE reveal that over the years it was fairly common practice for the secretary to attach a memo directed to the membership committee noting that the applicant obviously was qualified for membership by virtue of his place of employment. The other large national societies -- the American Institute of Electrical Engineers, for example, or the American Society of Mechanical Engineers -- raised fewer objections to the creation of local clubs than did the ASCE. Speaking before a meeting of the Schenectady Section of the AIEE on November 1, 1907, Past-President T. C. Martin commented that "never before was the establishment of branches carried on so strenuously," as it was during the preceding few years.[93] Established in 1882, the American Institute of Electrical Engineers, like the ASCE and other engineering societies, grew rapidly in the following decades. By 1907 it could boast of over 5,000 full members.[94]

Unlike the ASCE, which viewed membership as de facto certification of professional competence, the AIEE recognized early that "various organizations in most instances have been founded for special purposes."[95] An article reporting on Institute activities in a June 1886 issue of The Electrician and Electrical Worker listed

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[93] T. C. Martin, "Twenty-five years of Institute history," General Electric Review X.1(1907):18-21.

[94] Ibid.

[95] Anonymous, "The Institute Meeting," The Electrician and Electrical Worker 5(1886).

fifteen organizations AIEE might be active in, noting that "most of them are efficient societies. Many persons who are eligible are identified with several of them, . . ."[96] As time passed, the Institute exhibited few qualms about absorbing local clubs.

The Schenectady Section, for example, "grew from a small engineering club fostered by the General Electric Company and limited to its employees."[97] In 1903 the Schenectady Section became the ninth regional section to be organized by the AIEE; by 1915 thirty-one such sections existed.[98] Membership in a local section did not entail membership in the national organization, evidence that would seem to contradict ASCE fears that all members of local clubs would automatically expect to be associated with the national society. Of the 791 members of the Schenectady Section in 1915, only 336, or less than half, were national members of AIEE.[99]

In fact, the minutes of many ASCE meetings indicate that not all local clubs were anxious to be associated with the national societies. As late as 1916 many local engineers clubs were indicating they cherished their independence. Further, members of the local clubs recognized clearly the different roles entailed in being a member of,

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[96] Ibid.

[97] S. M. Crego, "History of the Schenectady Section of AIEE," General Electric Review 18(1915): 1006-1007.

[98] Ibid.

[99] Cf. Proceedings of the ASCE 31(1905):287-290 which contains an extensive discussion of local engineering clubs.

for example, the Engineers Club of Philadelphia as opposed to being a member of the American Society of Civil Engineers.[100]

In contrast with the ASCE's rigorous membership criteria, the American Institute of Mining Engineers welcomed into its ranks almost anyone with an interest, financial or working, in the mining industry. Rather than serving as a craft guild responsible for professional standards, the AIME shaped itself to provide an arena for shared discourse on a topic of mutual interest: the rapidly expanding mining industry and its technological requirements. At the AIME's organizational meeting, held in Wilkes-Barre, Pennsylvania, in 1871, the group set its goals as being to:

> . . .enable its members, comprising Mining Engineers and other persons interested in mining and metallurgy, to meet together at fixed periods for the purpose of reading papers upon and discussing subjects which have for their aim the economical production of the useful minerals and metals, and the safety and welfare of those employed in these industries, and to circulate among its members, by means of its publications, the information thus obtained.[101]

The AIME did establish grades of members, with full Members being those persons directly employed as mining engineers, and Associate Members as all other persons interested in mining and metallurgy. Associate members were entitled to all the privileges of membership open to Members with the exception of being ineligible to serve as the organization's president: in drafting the by-laws the organizers

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[100] See Proceedings of the ASCE 42(1916): 319-43.

[101] Anonymous, "The American Institute of Mining Engineers Wilkesbarre Meeting," The Engineering and Mining Journal XI.22(May 30, 1871): 337-338. Cf. Tammy M. Beazley, "It started in Wilkes-Barre: AIME celebrates its 125th anniversary," JOM 48(1996): 16-17.

specifically reserved the office of president for a Mining Engineer. In addition, the AIME was among the first engineering societies to accept women, listing Ellen Richards of Boston, Massachusetts, as a member in the 1870s. Overall, the primary orientation of the group is clearly that of a trade association, not that of a craft guild, and they declined to become involved in many of the issues that the societies with an exclusive orientation found important.

In 1882, for example, the AIME declined to become involved in establishing standards for engineering degrees at technical colleges and universities, a topic in which both the ASCE and ASME took an active interest.[102] The AIME's orientation as an industry interest group rather than as a restrictive craft guild occasionally provoked gibes from the other societies or its members. Editorial comments in Cassier's Magazine, a trade periodical specializing in mechanical engineering issues, often scoffed openly at the supposed incompetence of mining engineers or made them the butt of jokes. In 1891, for example, in the "Reflections and Observations" column the editor reported that popular opinion had it that there were "three degrees of liars, which are said to the be the liar, the d--d liar, and the mining engineer."[103]

As new organizations emerged, the model each group selected generally reflected the same contrast in goals. In general, those organizations that intended to limit membership to specific engineering disciplines, such as surveyors associations

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[102] Proceedings of the ASCE 8(1882):67.

[103] Anonymous, "Reflections and Observations," Cassier's Magazine 1891: 4.

or civil engineering clubs, followed the model established by the ASCE. These groups, such as the Michigan Association of Civil Engineers and Surveyors, organized in Lansing in 1880, focused on issues such as establishing professional competence and maintaining certain minimum standards. Similarly, the Minnesota State Surveyors and Engineers Association organized in St. Paul in 1895 with the explicit purpose of "securing uniformity in the records of county surveyors. . . ."[104] Most of these state societies of civil engineers and surveyors were prompted to organize because of a perceived need, as expressed in the call for members issued in Michigan fifteen years prior to that of Minnesota, "of greater uniformity in our methods of practice, and a demand for greater certainty in results in our work."[105] Fear of expensive lawsuits triggered by boundary disputes was an obvious factor, as the organizers of the Michigan society noted that "our results should always be such as will be sustained by the courts. With such results we can satisfy our patrons and avoid litigation by them."[106] Sixty-seven surveyors and engineers responded to this call to meet in Lansing, despite the difficulties of traveling in Michigan in the winter, and quickly agreed on the establishment of a committee to work with the state land office to develop a manual of standards of practice to be used statewide.

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[104] Anonymous, "Minnesota State Surveyors and Engineers Association," Engineering News and American Railway Journal February 14, 1895:50.

[105] Secretary's Report of the Proceedings, First Annual Meeting of the Michigan Association of Surveyors and Civil Engineers March 25, 1880.

[106] Ibid.

The pattern of growth exhibited by the Michigan society is typical of most state societies organized by surveyors and civil engineers. Members devoted most of the first annual meeting to organizational questions, formulating membership criteria, and agreeing on a constitution. Members of the new society then spent the remainder of the meeting to a general discussion of surveying practices, but no individual papers were presented. The second annual meeting, held in Lansing in March 1881, followed a similar pattern with discussions focusing on the proposed manual preceded the demonstration of new instruments that closed out the meeting. It was not until the fourth meeting, held at Lansing January 9-11, 1883, that a formal program of paper sessions emerged. By 1883 the initial fundamental questions regarding surveying apparently had been satisfactorily resolved by the state legislature as the tenor of the meeting shifted. Discussions of resolutions as to the best way to mark a corner were replaced by papers of more general civil engineering interest, such as a "Logging Railroads" and "Construction and Care of Waterworks Suitable for Small Cities in Michigan." Thus, surveying issues dominate the first few annual conventions and then, as the surveyors and civil engineers succeed in persuading state legislatures to regulate surveying practice, the societies' spheres of interest expand.

Other groups, particularly those that were open to all engineers and men of science, regardless of specialty, such as the Engineers Club of New York, founded in 1888, declared themselves unabashedly social in orientation and sought only to provide a convivial atmosphere for the discussion of technical topics of mutual interest. Like the Technical Club of Chicago, which stated its goals as being "to encourage fellowship among engineers and architects and promote by social influence the best interests of engineering and allied professions,"[107] these organizations sought to include as many engineers and scientists as possible in their membership.

The first local engineering club organized in the United States for which clear documentation is readily accessible was the Boston Society of Civil Engineers. Organized in 1848 and formally incorporated in the Commonwealth of Massachusetts three years later, the Boston club's founders included such eminent engineers as James Pugh Kirkwood and James Laurie, both of whom also helped organize the American Society of Civil Engineers in New York City a few years later. Membership numbers for the Boston organization increased slowly for the first three decades of its existence. As late as 1880 the secretary's annual report noted a membership roll of under one hundred. Compared to organizations such as the Civil Engineers Club of the Northwest,[108] founded in Chicago in 1868, or the Engineers Club of Philadelphia, the Boston club grew slowly and remained small, although membership did top 300 by the 1890s.

The Civil Engineers Club of the Northwest, in contrast with the Boston club, began small but grew rapidly. The initial membership of twenty-two civil engineers, which included nationally known figures such as Charles Paine, the General

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[107] Anonymous, "The Technical Club," Engineering News and American Railway Journal February 27, 1896: Supplement 61.

[108] In 1881 the society changed its name to the Western Society of Engineers.

Superintendent of the Lake Shore and Michigan Southern Railway, and E. S. Chesbrough, City Engineer for Chicago, quickly doubled, then trebled. Unlike the Boston club, however, the Northwestern organization enjoyed the advantage of extensive coverage of its activities by The Engineering News, a trade periodical published in Chicago in the early 1870s. Engineering News moved its offices to New York City a few years later, but not before serving as an unofficial recruiter for the Chicago club.[109]

The October 15, 1875, issue of Engineering News, for example, led off with a two column article describing the history of the Civil Engineers Club of the Northwest, and referred readers to a second article published in the same issue that reproduced in full the organization's constitution, as well as listing requirements for admission and membership dues. While the editor did not explicitly urge readers to associate with the Chicago club, he did note that "By an examination of the official list of names given in the last issue of Engineering News it will be seen that a considerable number are those of Engineers who rank with the highest class in their profession in the world, while with the names of many of the others are associated some of the most important engineering works in the country."[110] A few lines further

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[109] The Engineering News underwent a number of name changes as years passed. It began as Engineer and Surveyor, changed to Engineer, Architect and Surveyor, then to Engineering News, then Engineering News and Contract Journal, Engineering News and American Railway Journal, and finally, in 1914, merged with the Engineering Record to become Engineering News-Record.

[110] Anonymous, "The Civil Engineers Club of the N.W.," The Engineering News October 15, 1875: 132.

on in the same article, the editor declared "it is not indulging in statements of an over sanguine nature when we say that, with its present start, the Civil Engineers' Club of the Northwest would, within two or three years, rank with the most influential societies in the country." The article closed with an invitation to engineers and "scientific men" to consider joining the society, nonresident members being as welcome as resident. Over the years Engineering News regularly praised various local and national societies as well as publishing editorials urging engineers and scientists to join professional organizations, but only the Civil Engineers Club of the Northwest ever received quite so fulsome and explicit an endorsement.

The Constitution of the Civil Engineers Club of the Northwest initially limited membership to "such persons as have been, or may now be, engaged in the practice of the profession of Engineering, as may be elected, upon the written recommendation of two members of the Club."[111] In 1870 members amended the Constitution to include as Associate Members persons "engaged in engineering, or in kindred pursuits, but who are not eligible as members of the Club."[112] Associate members could not vote so at first were not required to pay dues. This changed in 1872. Associates were, however, welcome to participate fully in discussions and could present papers if they so chose. Candidates proposed for membership had to be approved by at least three-quarters of the ballots cast. This method of admitting new

[111] Anonymous, "Constitution of the Civil Engineers Club of the Northwest," The Engineering News October 15, 1875: 133.

[112] Ibid.

members was common practice in the early years of many engineering clubs. As the clubs grew, however, most amended their by-laws to permit a less cumbersome process. For example, the Washington Society of Engineers, organized in the District of Columbia in 1905, created a membership committee to review applications for admission to the society. Candidates had to provide references from three current members as well as giving a brief resume of professional education and experience.

If the Membership Committee approved the application, it was forwarded to the WSE Board of Direction with a recommendation that the candidate be admitted to the Society. The national societies, such as the ASCE, initially also asked the entire membership to vote on proposed new members, but as membership rolls grew amended their constitutions to permit the Board of Directors or Membership Committees to accept or reject candidates.

Engineers founded clubs in metropolitan areas and in smaller towns, from New York City to Phoenexville, Pennsylvania, and engaged in a variety of activities. By the 1890s six distinct types of engineering organizations had appeared: national single discipline societies, such as the American Society of Civil Engineers; national special interest groups, such as the American Society of Heating and Ventilating Engineers; state single discipline societies, such as the Association of Civil Engineers and Surveyors of Indiana; local single discipline engineering clubs, such as the Civil Engineers Club of Cleveland; local multi-discipline, or umbrella societies, such as the Technical Society of the Pacific Coast; and local ethnic engineering societies, such as all engineering and technical societies, and each individual society decided for itself what materials it wanted published in the AES journal. In recalling the origins fifteen years earlier of the AES in January 1895 J. B. Johnson wrote:

> The Association has been called into being by no narrow spirit. Many of its promoters believe that local engineering societies should be established and fostered in every center of population where the engineering profession is sufficiently strong to support one; . . . They also believe that these local societies should be brought into affiliation by association with some wider sphere of action."[114]

In 1895 constituent societies paid annual dues to the AES of 50 cents per individual member. Sales of advertising pages helped defray publication costs and kept required contributions from members relatively low. In giving his annual report as chairman, Professor Johnson noted that in the early years of the AES it had occasionally been difficult to find enough material to justify a monthly publication schedule, but by the mid-1890s the journal was widely recognized for the high quality of the technical papers in its pages.[115]

State and regional societies, such as the Association of County Surveyors and Civil Engineers of Indiana or the Illinois Society of Engineers and Surveyors generally limited their meetings to one annually. These annual meetings lasted one to three days and included many of the same features as the conventions of the national meetings, such as excursions to engineering projects, paper sessions, a business meeting, and a

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[114] J. B. Johnson, "Report of the Chairman," Journal of the Association of Engineering Societies January 1895: 100.

[115] Ibid.

banquet. Small societies might conduct all their business in only one day, while larger groups needed more time to take care of both paper sessions and society business. As societies grew in size, annual meetings grew, too. The February 1897 meeting of the West Virginia Society of Engineers lasted only one day, but by the following January required two as the number of papers presented doubled. Topics discussed at the January 26-27, 1898, meeting included "City Comforts in Rural Homes," "The Importance of Geology in Engineering Problems," "Modern Trends of Engineering Education," and "Professional Statics and Ethics."

Many of the state societies, like the local groups, began with only a handful of members. Six men attended the 1881 first meeting of the Indiana society, for example, while less than a dozen were present at the 1880 organizational meeting that led to the formation of the Michigan Society of Surveyors and Civil Engineers. It sometimes required several efforts at organizing a state society before a viable organization was established. It was not uncommon for a state group to organize, hold one or two annual meetings, and then vanish. The peripatetic lifestyle of many of the most qualified and professionally active civil engineers meant they often did not stay in one locale for very long. If the impetus for organizing a state society lay in the inspiration of one energetic individual, when that individual's work took him to a different state, the fledgling engineering society he left behind risked dying from lack of a leader, particularly during the 1860s and 1870s when the overall numbers of engineers in any one area were still quite small. Local clubs often experienced similar problems. Many did well for a few years, and then faded away. Even the venerable Boston Society of Engineers, which claimed to be the oldest continually functioning engineering society in the country, experienced a period of such thorough dormancy following the Civil War that many engineers in the Boston area became aware of its existence only after they had attempted to incorporate a new organization with the same name.[116] By the 1890s, however, initial membership for any local group was more typically about two dozen. By the early 1900s a call for members in a new engineering club or society might draw one hundred or more interested persons. Even in the early 1890s new national organizations could draw hundreds of charter members. In New York City four hundred and thirty-five persons attended the 1893 founding convention of the Society of Naval Architects and Marine Engineers.

An alternative view of the influence of the traveling consulting engineer on the growth of engineering clubs is that extensive travel meant that one or two men could serve as catalysts for organizing clubs over a wide geographic area. Charles Paine, a well-known railroad engineer, was instrumental in founding both the Western Society of Engineers in Chicago and the Civil Engineers Club of Cleveland. Octave Chanute, famous among nineteenth century engineers for designing the first railroad bridge across the Missouri River, was a member not only of the ASCE (which he served as president in 1891, ten years prior to his presidency of the Western Society) but also of

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[116] Desmond Fitzgerald, "Historical Address," Journal of the Association of Engineering Societies XXI(1899): 268-280. See also Edgar Marburg, "Nineteenth-Century Engineering: Its Evolution, and Something of Its Beginnings in America," Proceedings of the Engineers Club of Philadelphia XVIII(1901): 1-21.

the St. Louis Engineers' Club, the Western Society of Engineers, and the Kansas City Engineers Club. Hunter McDonald, another future ASCE president, was active in the Engineering Association of the South and the ASCE. Given the strong belief in the value of professional societies among members of the engineering elite, it is not surprising to find many local club organizers and officers, such as George Pegram of the Technical Club of Omaha and Alexander Dow of Detroit, serving as directors or officers of national societies as well as local. For some of these men, recognition and responsibilities at the state or local level came many years prior to national recognition. Daniel Webster Mead, for example, helped organize and later served as president of the Illinois Society of Surveyors and Engineers many years prior to becoming nationally known among civil engineers for his work in hydroelectric development. As a young man, Mead served both as president of the Illinois Society and as a vice president of the Western Society. Many years later, in 1936, he served as president of the ASCE. For others, such as George H. Benzenberg of Milwaukee, helping to establish a strong local club like the Wisconsin Polytechnic Society followed after active involvement on the national level.

In any event, by the 1890s the rapid growth of other engineering specialties, such as electrical engineering and mechanical engineering, contributed to the establishment of umbrella, or nonspecialized, engineering clubs in many cities. These polytechnic clubs were organized, as the Engineering News noted in reporting on the April 8, 1897, creation of the Nebraska Engineers Club, in such a way as to encourage participation by all engineers regardless of specialized training.[117] The Polytechnic Society of Utah, organized in Salt Lake City in March 1890, declared itself open to all civil, mechanical, electrical, and mining engineers. The stated goals of the Society were the usual "professional improvement of members, the encouragement of social intercourse among men of practical science, advancement of scientific professions, [and] establishment of a central point of union and reference for its members."[118] Many members of local polytechnics also believed that their situation in a western state or in some other way well removed from the headquarters of the national societies provided them with unique perspectives on engineering problems and progress. George Dickie, president of the Technical Society of the Pacific Coast, addressed this theme of uniqueness in his 1904 speech to the club:

> To my mind, one of the best reasons why the engineers of the Pacific Coast should maintain and foster a strong local Society embracing the different branches of the profession lies in the fact that the work done here is in many cases original both in conception and execution. . . . Our engineers should record their experiences dealing with them in the transactions of the Society that represents them to the world. This, of course, requires meetings like the present. . .[119]

The organizing committees for these polytechnic clubs generally included representatives from several different engineering disciplines. When engineers in Washington, D.C., decided in 1905 to explore the possibility of forming a local

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[117] Engineering News Supplement April 15, 1897: 133.

[118] Engineering News April 5, 1890: 323.

[119] George W. Dickie, "The present and future of engineering on the Pacific Coast," Journal of the Association of Engineering Societies XXXIII(1904): 73-84.

engineers club the seven man committee included four distinct engineering specialties: mining, electrical, civil, and mechanical. The fact that these technical societies invited all engineers and men of science to join did not mean they were excessively liberal in their membership criteria. The Washington Society of Engineers required recommendations from three current members as well as a brief biographical sketch indicating training and work experience. Others, such as the Technical Society of the Pacific Coast, established in San Francisco in 1888, created membership guidelines as rigorous as those of the ASCE, with the major difference being the substitution of the phrase "technical work" for "engineering project":

> Application for admission to the society shall be indorsed by three (3) members, who shall certify that they personally know the candidate, and that he is worthy of acceptance. Art. VI: A member shall be one qualified to design as well as direct technical work, and who shall have been engaged professionally in the practical application of science for a period of seven (7) years, or for a period of (5) years if a graduate of a college or technical school.[120]

Table 2 on the following page was compiled from data provided in the Journal of the Association of Engineering Societies and compares the basic membership criteria for nine local societies in the mid-1890s. In addition to meeting the basic criteria, prospective members often had to provide references from current members. In the early years of engineering clubs, applications of new members would be voted on by the entire membership. As clubs grew in size, most established membership committees to screen applicants or had the Board of Directors review candidates for membership.

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[120] Anonymous, "Local engineering societies," Engineering News August 9, 1890: 128.

Local polytechnic clubs in which the charter members shared a common ethnic background were founded in many northern cities in the 1880s and 1890s. Engineers who had emigrated from Germany and Sweden organized technical societies modelled on the Technischer Verein they had left behind. These societies often had hundreds of members. As early as 1883 the Technischer Verein von New York reported a membership of 247 persons, with 140 actually in residence in the city. The Technischer Verein von New York, the Technischer Verein von Baltimore, and the Techniker Verband in Philadelphia all met regularly in their respective cities as well as cooperating in holding large national conventions of German engineers. An 1884 convention

Table 2.--Membership requirements of the constituent societies of the Association of Engineering Societies

	Boston	Virginia	Cleveland	St. Louis	St. Paul	Minneapolis	Denver	Montana	Pacific Coast
Civil	x	x	x	x	x	x	x	x	x
Mechanical	x	x	x	x	x	x	x	x	x
Mining	x	x	x	x	x	x	x	x	x
Electrical	x	x	x	x		x	x		x
Military	x		x	x		x		x	x
Geologists	x		x	x	x	x		x	
Architects	x	x	x					x	x
Surveyors	x	x	x				x		x
General Interest in Science			x	x				x	
Years of Practice Alone				3		5	2	5	5
College Degree & Years of Practice			x and 1		x and 3		x and 2	x	x and 3

held in Pittsburgh featured excursions to various factories and foundries as well as two days of paper sessions. Chicago also had a Swedish engineers' club, as did New York and Philadelphia.

Many of the German groups remained quite active well into the twentieth century. As Hans-Joachim Braun has reported, the German-American polytechnic organizations formed a highly effective mechanism for technology transfer between the United States and Europe for many years.[121] Others quietly disappeared as their founding members aged and younger, more assimilated engineers chose different groups with which to associate. In Milwaukee, for example, members of the old Vereines Deutscher Ingenieure changed the name of their organization to the Engineering Society of Milwaukee to broaden its membership base. Membership in many of the Technischer Verein had always been open to any qualified engineer or man of science and meetings were conducted in English. While some Technischer Verein appear to have been primarily oriented toward engineers, in other cities the organizations were definitely polytechnics. In 1883 the Technischer Verein von New York had four separate sections: civil engineering, mechanical engineering, architecture, and chemistry and physics.

Finally, the American Institute of Mining and Metallurgical Engineers (AIME) may have been among the first engineering societies to organize along the lines of

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[121] Hans-Joachim Braun, "The National Association of German-American Technologists and Technology Transfer Between Germany and the United States, 1884-1930," History of Technology 8(1983): 15-35.

specialized industry interests rather than as a craft guild, but it was hardly the last. Gasworks engineers, railroad engineers, and waterworks engineers all began organizing regional societies in the 1880s. The New England Roadmasters Association was founded in 1882, as was the New England Waterworks Association, followed rapidly by a host of others. Thus, by the 1890s engineers in many different areas of specialization had begun to organize national or regional societies. The Society of Naval Architects and Marine Engineers was founded in 1893, for example, followed by the American Society of Heating and Ventilating Engineers in 1894. Groups such as the Boston Aeronautical Society, the Lake Superior Mining Institute, and the Society of Automobile Engineers quickly followed. Each of these groups appeared after engineers in these fields began to feel that the clubs and societies already in existence could not meet their specific professional needs. In "Defining professional boundaries: chemical engineering in the early 20th century" Terry Reynolds ably documented the birth of the American Institute of Chemical Engineers, a group that carved out a professional identity after realizing that they did not fit comfortably into either the American Society of Mechanical Engineers or the American Chemical Society.[122]

As noted above, not all specialized groups were national in scope. The Lake Superior Mining Institute, for example, structured its meetings around topics relating to mining in the region surrounding Lake Superior. Annual meetings rotated around the mining towns of the Upper Midwest to allow members to see first-hand mining practice

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[122] Terry S. Reynolds, "Defining professional boundaries: chemical engineering in the early 20th century," Technology and Culture 27(1986): 694-716.

in Minnesota's Mesabi Iron Range, Michigan's Copper Country, and Michigan's Gogebic Range.

Local Club Activities

Many of the local engineering clubs followed similar formats in organizing their activities. The regular meeting, whether held weekly, biweekly, or monthly, featured a paper presentation, generally on a technical topic. Travelogues, particularly when accompanied by lantern slides or stereoptican views, were also popular, and speakers occasionally combined the technical with the exotic. Speaking before the Boston society on November 18, 1896, for example, E. L. Corthell described the Tampico Harbor Works in Mexico. His talk was illustrated with lantern slides. The author of a paper might read it himself, but in the early years of the local clubs it was also common practice for the club secretary to read a report appearing in one of the technical journals and then open the floor to discussion.

Speakers at the regular meetings included both members of the local clubs and invited guests. A number of engineers and scientists apparently enjoyed the opportunity to travel as they spoke on the same topic in a number of different cities. Between 1898 and 1900, for example, A. H. Sabin of New York City presented his research on the use of paints to protect metals to the Brooklyn Engineers Club, the Philadelphia Engineers Club, the Boston Society of Civil Engineers, and the Scranton Engineers Club. Similarly, Bernard E. Fernow spoke on the topic of forestry and engineering in both Chicago and Cleveland. Fernow, in fact, appears to have been engaged in a tour of the major cities to lobby for changes in forestry practice and to preach conservation. Although not as well remembered as Gifford Pinchot, Fernow was a major figure in the establishment of forestry as a science and wrote one of the early standard textbooks on forest resource management.[123]

Club organizers viewed the paper presentations and the discussions that followed as vital to professional development. As clubs grew in size and financial stability, some organizations leased or purchased houses and so were able to provide amenities comparable to any gentleman's club of the time, such as reading rooms, but the primary focus of the club remained that of serving as focus for exchanging technical information. Carl Hering, twenty-seventh president of the Engineers' Club of Philadelphia, emphasized this in an address given at the 1905 annual meeting:

> All the prominent engineers of this district should belong to the club, which should be the clearinghouse for their papers and opinions. This club should be the place where all the important engineering work in this neighborhood, and especially in this city, should be first described and discussed.[124]

Regular meetings were generally open to the public, which in the 1880s and 1890s was understood to mean well bred, educated, middle class white men. Local clubs used the regular meetings both as a method to recruit new members and to educate the public. The societies' secretaries placed notices, including an occasional box advertisement for especially notable topics or speakers, for upcoming lectures in

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[123] See, for example, Andrew Denny Rodgers III, Bernard Eduard Fernow: A Story of North American Forestry (Princeton: Princeton University Press, 1951).

[124] Carl Hering, "Address by the Retiring President," Proceedings of the Engineers Club of Philadelphia XXII(1905): 87-113.

local newspapers. A social hour featuring light refreshments followed the formal paper presentation at most local clubs. The Washington Society of Engineers, for example, provided cigars to its members and guests. A few club sponsored "ladies nights" several times per year. The ladies night meetings enjoyed especially high attendance but, perhaps because cigar smoking was forbidden when ladies were present, did not occur very often.

Ladies were, however, generally welcome to accompany club members on excursions to various sites of engineering interest. Excursions sponsored by local clubs ranged from relatively simple, as when the Washington Society of Engineers cooperated with the local chapter of the American Institute of Electrical Engineers in arranging a tour of the Patent Office facilities, a site they were able to reach with no extraordinary effort, to elaborate affairs requiring many months of advance planning. As an example of the latter, in September 1897 the Western Society of Engineers sponsored an excursion to the industrial areas of Pennsylvania and New York. Approximately 200 persons, i.e., members and their female guests, toured the hydroelectric facilities at Niagara Falls, foundries and steel mills in the Lehigh Valley, and even ventured into coal mines. The fact that a number of railroad officials were also society members no doubt helped the Western Society secure private cars and a favorable train schedule. The Western Society invited the St. Louis engineers, with whom they apparently maintained close ties,[125] to join them on the excursion. In a

[125] The Proceedings of both the Western Society of Engineers and the Engineers' Club of St. Louis include frequent references to correspondence between the

letter read to the St. Louis club in August 1897 the secretary of the Western Society assured the St. Louis engineers that there would be no difficulty in laying on another car if necessary.[126]

The Western Society appears to have been an exceptionally well-travelled club as it also sponsored excursions to Omaha and other sites well removed from Chicago, but almost all clubs endeavored to get out in the field for first hand inspections of engineering work in progress. The Louisiana Society of Engineers, based in New Orleans, found an excuse several times each year to cruise up or down the Mississippi inspecting levees and shipyards. The Minneapolis and St. Paul societies cooperated in traveling to Duluth to view the new Ship Canal. The Rochester (New York) engineers journeyed to Buffalo where their hosts, the Engineering Society of Western New York, treated them to a tour of local industries.

In addition to the serious business of engineering, which both paper presentations and excursions were meant to address, as time passed local clubs began to sponsor more purely social events, such as picnics. An annual banquet, usually held near the start of the new year, was a feature of most clubs almost from their founding, but the banquet not only combined business with pleasure -- e.g., the reading of annual reports by the secretary and treasurer -- it was a strictly stag affair. Summer picnics included wives and girlfriends.

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clubs or appearances of members of one society as speakers at a meeting of the other.

[126] Anonymous, "Engineers Club of St. Louis," Journal of the Association of Engineering Societies: Proceedings September 1897: 17-18.

Governance

Not surprisingly, all local engineering clubs in this study displayed very similar structures and methods of self governance. They may have differed in orientation, that is, in whether they chose to be inclusive or exclusive, but even the smallest groups almost immediately created an internal structure highly reminiscent of the line and staff systems developed by the railroads. After one or two fairly loosely structured organizational meetings, members quickly created Boards of Directors to deal with routine affairs away from the regular membership meetings. Figure 2 illustrates the typical governing structure of both local and national engineering societies.

Minor differences did, of course, exist between clubs. The terms of office for members of the Board of Directors, for example, varied. The entire board might serve for only one year, or terms could be staggered for up to four years. That is, depending on the individual club, the entire Board of Directors might be replaced annually or as few as one director's position go up for election in any one year. Typically, however, directors served a two year term with half the board members being up for election every other year. Officers, such as the president and secretary, generally served for one year, although a few clubs instituted two year terms of office. How vulnerable to dramatic changes the annual elections rendered the local societies thus varied widely from club to club.

In their study of a metropolitan bar association Terrence C. Halliday and Charles L. Cappell showed that even an ostensibly democratic process can allow a ruling elite to retain its control of an organization.[127] Similarly, the processes

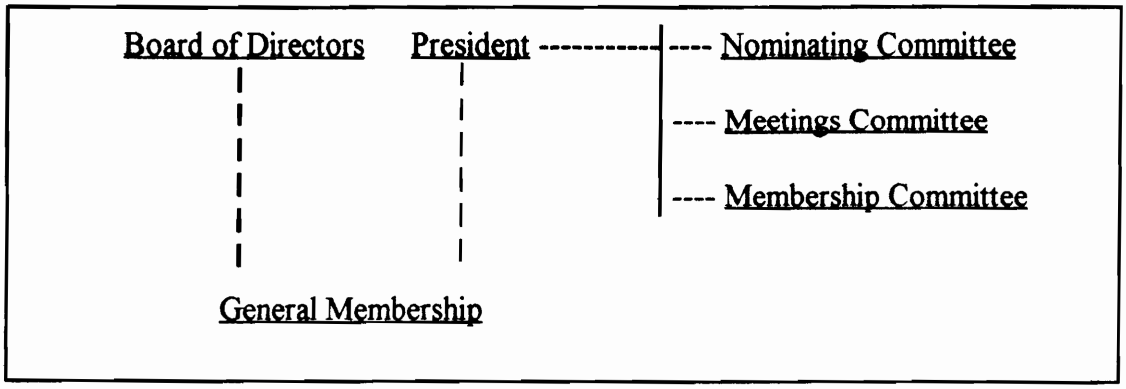

Figure 2: Typical engineering club organization structure

developed for election of officers and directors in local engineering societies often served to prevent sudden changes in governance of direction. Depending on the club, the person who served as president might be elected several years before actually taking office as president. That is, he would first be elected as a vice president, serve one year as second vice president, one year as first vice president, and then one or two years as president. Following his term as president, he would then automatically become a member of the Board of Directors for another one or two years. Agreeing to run for office in a local society could thus imply a minimum of a five year commitment to the organization.

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[127] Terence C. Halliday and Charles L. Cappell, "Indicators of Democracy in Professional Associations: Elite Recruitment, Turnover, and Decision-Making in a Metropolitan Bar Association," American Bar Foundation Research Journal 1979:694-767.

As Gusfield illustrated in his study of the WCTU, there is a danger of stagnation and eventual organizational decline if too little turnover takes place among a voluntary association's ruling elite.[128] While some clubs seemed relatively oblivious to the danger, others took active steps to ensure the infusion of occasional new blood. Many, including the Western Society of Engineers, while not setting explicit conditions in their constitution, adopted the tradition that no president served for more than one term. Other groups, such as the Washington Society of Engineers, amended their by-laws to limit the number of terms members of the Board of Directors could serve. By limiting Directors to two two-year terms the Washington club ensured that a complete turnover in the Board of Directors would occur on a regular basis. As the same time, by staggering the terms of office for directors and by having the two most recent club presidents serve on the Board, the Washington group never had a majority of new directors in any one year. Change was possible, but revolution unlikely.

Turnover rates for the secretary and treasurer positions in most clubs tended to be low. Having once found competent (or merely willing) members to fill those positions, local societies were slow to make changes.

Elections to office generally took place at the annual business meeting. A nominating committee appointed by the club president prepared a slate of candidates a month or two prior to the meeting. The committee would solicit nominations and suggestions from members and then contact prospective candidates to see if they were

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[128] Joseph R. Gusfield, "The problems of generations in an organization structure," Social Forces 35(1957): 323-330.

both willing and able to serve if elected. Although candidates in some clubs ran unopposed, as a general rule the nominating committees tried to present members with choices. The by-laws for many clubs, in fact, specified that at least two names had to be placed in nomination for each open office.[129] Write-in votes were also permitted. The club secretary mailed ballots to members who then turned the ballots in at the business meeting. With most clubs, only ballots turned in by members attending the business meeting counted toward the election: mail-in ballots were not permitted. Tellers would sort and count the ballots as the business meeting progressed. Announcement of the results constituted almost the final item on the agenda: the final item generally being a short acceptance speech by the newly elected club president. In the event that the nominating committee had been able to find only one person willing to run for each vacant office, election might be by voice vote -- unanimous acclamation -- rather than bothering with paper ballots. Whatever the specific methods of electing officers and managing the club, overall most members seemed to have been content to accept the direction provided by the club's elite. The data available in the records of various local societies all suggest that the business meeting was often the most poorly attended meeting of the year.

Local clubs vs. Local sections

Local sections or chapters of the national societies did not become common until the turn of the century. At that time, as noted above, the ASCE discussed the

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[129] See, for example, Journal of the Association of Engineering Societies Proceedings XIV(1895): 18-19.

notion of allowing local clubs to affilitate officially with the national society, but rejected it on grounds that such a move would lead to an overall diminishment in the quality of the members. Whether or not the local clubs actually wanted to affiliate with the ASCE is, of course, debatable. Local clubs had promptly rebuffed overtures initiated by the ASCE a decade earlier.[130] In contrast, the American Institute of Electrical Engineers created affiliations with local organizations with apparently little fuss or discussion.

In any case, the real push for the creation of local sections came well after the organization of most local clubs, i.e., not until the early 1900s. By then most major cities contained large enough populations of engineers who were already members of the national groups to support local chapters. The growth of college engineering programs may also have played a role. Engineering students, with the encouragement of their faculty, began forming student sections of the ASME, AIEE, and ASCE in the 1890s. Once the national societies endorsed local student sections, it was only natural for the idea of local sections to move off campus.

In general, relations between the new local sections and the established local and state societies appear to have been cordial. Local clubs co-sponsored excursions and lectures with the local sections. In a number of cities the established local club, whatever its own primary disciplinary orientation, evolved into a quasi-umbrella organization that co-ordinated joint efforts between local sections and encouraged

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[130] See, for example, Engineering News April 19, 1890: 371, or Engineering News May 24, 1890: 491.

interdisciplinary communication. In Milwaukee, as noted above, the need for interdisciplinary communication served as one of the primary motives for founding the Engineering Society of Milwaukee, as it did also in the District of Columbia with the Washington Society of Engineers, but clubs such as the ESM and the WSE which organized contemporaneously with local sections were the exception at the turn of the century, not the rule. More typical were groups such as the Engineers Club of Philadelphia.

The Engineers Club made its meeting rooms available for use by the local sections of the American Society of Mechanical Engineers, the American Society of Heating and Ventilating Engineers, and others, as well as publishing their minutes and meeting announcements as part of the Journal of the Engineers Club of Philadelphia. Similarly, in Cleveland the Cleveland Engineers Club joined with local sections and technical clubs in obtaining a building to be used by all the engineering organizations in the city. In Milwaukee the Engineering Society of Milwaukee eventually began publication of a monthly magazine, Milwaukee Engineer, that provided information on all the local sections and clubs within the city. Contrary to Pursell's hypothesis that the emergence of local sections of national societies would threaten the viability of local clubs, the case of the Technical Society of the Pacific Coast appears to have been a special case, not the rule.[131]

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[131] See Pursell, previously cited.

It was no doubt true that the typical engineer would behave as an active member in only one or two organizations. That is, he would attend meetings regularly, volunteer to serve on various committees, sign up for excursions, and so on for only the organization that interested him the most. However, that same engineer apparently felt few qualms about supporting multiple organizations financially, i.e., through the payment of membership fees and annual dues. For practitioners of an occupation that often referred to itself as not being as sociable as the average man, engineers were inveterate joiners.[132] The obituaries of any engineer except the most junior from the Gilded Age and Progressive Era list memberships in organization after organization: local sections, local clubs, fraternal orders, church societies, political parties, and so on.[133] As long as the dominant culture supported the practice of multiple memberships, that is, as long as it remained socially acceptable to join an organization without also participating fully in all of its activities, voluntary associations such as local sections and local clubs could exist and even thrive simultaneously. Being a member of the local chapter of the American Society of Civil Engineers would no more preclude an engineer from also joining the Western Society than it would inhibit him from becoming a Mason or serving as a church vestryman. The only constraint was financial: how

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[132] See, for example, Engineering News April 29, 1882: 139.

[133] See, for example, Anonymous, "William Powell Shinn, Past President Am. Soc. C. E.," Proceedings of the American Society Society of Civil Engineers 18(1892): 123-129; Anonymous, "Thomas Curtis Clarke, Past President Am. Soc. C. E.," Proceedings of the American Society Society of Civil Engineers 29(1903): 399-403; Anonymous, "Thomas Moore Jackson, M. Am. Soc. C. E.," Proceedings of the American Society Society of Civil Engineers 38(1912): 1650-51.

many different membership dues could the member afford to pay? The different organizations met different, occasionally contradictory, occasionally complementary needs.[134]

[134] Local clubs, local sections, and national societies still participate in mutually beneficial activities. In 1995, for example, the Engineers & Scientists of Milwaukee (the current name of the Engineering Society of Milwaukee) cooperated with the American Society of Mechanical Engineers in sponsoring an engineering convention attended by engineers from around the country. In 1994 the Engineers Society of Western Pennsylvania sponsored an international symposium in Pittsburgh on the topic of bridge safety. See also "Cooper is 'Enginer of the Year'," Rochester Democrat and Chronicle March 1, 1997: 5B for a brief description of centennial celebrations of the Rochester Engineering Society.

Chapter Three: Similarities and Differences

Introduction

In this chapter I provide brief histories of eight selected local and state engineering associations. These capsule histories, which focus on the initial founding and early years of each organization, help illustrate the similarities and differences between local and state societies, single discipline and multi-discipline (umbrella) clubs, and special interest societies and other groups. No one of the eight organizations described in this chapter can legitimately claim to be completely typical of all engineering clubs, but neither is any one totally atypical. I do not include histories of the national societies or the ethnic clubs. As I noted in Chapter One, the development of the nationals has been extensively documented by other scholars, and, unfortunately, too little substantive published or archival material relating to any of the German, Scandinavian, or Swedish polytechnic and engineers' clubs was available to me to provide the basis for a comprehensive analysis.

Local Single Discipline

Many of the early local engineering clubs referred to themselves specifically as "civil engineers clubs." In the mid-nineteenth century such a designation did not mean that all members were civil engineers in the sense of practicing only the type of engineering that would later come to be viewed as exclusively the area of expertise for civil engineers, e.g., bridge design and construction. In the 1860s many engineers still used the term "civil engineer" to distinguish the civilian engineer from his military counterpart. Thus, engineers in Chicago founded the Civil Engineers Club of the Northwest, those in Cleveland the Civil Engineers Club of Cleveland, and so on not to exclude engineers who as the century progressed would come to think of themselves as mechanical or mining or electrical engineers, but because to many nineteenth century engineers there still were only two kinds of engineers: military and every one else.

By the 1890s, however, when groups such as the Civil Engineers Club of Rochester (New York) organized, the lines of demarcation between disciplinary specialties were clearly delineated.[135] National societies such as the American Institute of Mining and Metallurgical Engineers as well as local clubs devoted to electrical or mechanical topics were well established. Most engineers recognized that increasing occupational specialization was leading to the development of distinctly separate disciplines within engineering. Ambrose Swasey, speaking at the annual meeting of the Civil Engineers Club of Cleveland, noted in 1895, "that the day of the Universal Engineer, who claims to have a thorough knowledge of all branches of engineering, is past. The high character of the work that is being done throughout the country shows conclusively that it is not the Universal Engineer, but the experienced specialist, who

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[135] See, for example, Raymond H. Merritt, Engineering in American Society: 1850-1875 (Lexington, KY: University Press of Kentucky, 1969) or Monte A. Calvert, The Mechanical Engineer in America 1830-1910: Professional Cultures in Conflict (Baltimore, MD: The Johns Hopkins University Press, 1967).

has charge of it."[136] The membership committee for the ASCE continued into the early decades of the twentieth century to argue that "the profession of Civil Engineering being here defined as including the branches commonly called Civil, Mechanical, Mining, Electrical, Military and Naval Engineering, and embracing Architecture and Naval Architecture," but the tenor of the extensive discussions published in the Society's Proceedings indicate the ASCE membership overall no longer cherished the illusion of civil engineering as an all-inclusive discipline.[137] As ASCE member William C. Furber noted during a debate of membership criteria at a meeting in New York in 1906, "the American Society of Civil Engineers are constantly narrowing themselves, so that instead of embracing the whole circle of engineering, they are liable to be railroad engineers and bridge engineers and surveyors."[138]

Whether the ASCE, as quoted above, was narrowing itself voluntarily or, more likely, being forced by external factors such as the rise of other societies into an unsought narrower niche, the fact remained that the national society changed over time. And, just as the national societies evolved as the nineteenth century drew to a close, so did local societies and clubs. Some clubs narrowed their focus while others became broader in scope and appeal. Thus, by the turn of the century groups such as the St.

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[136] Ambrose Swasey, "The Specialist in Engineering," Journal of the Association of Engineering Societies Proceedings XIV(1895): 58-61.

[137] Proceedings of the ASCE 32(1906): 241.

[138] Ibid.

Louis Engineers Club and the Engineers Club of Western Pennsylvania that had been founded as simple general engineering clubs often had evolved into almost purely civil (in the narrow sense of the word) or mechanical engineering organizations. In this section I describe two local single discipline clubs that began with similar orientations but followed slightly different trajectories: the Western Society of Engineers, located in Chicago, and the Engineers' Club of Philadelphia. Both were among the earliest engineering clubs founded, included nationally renowned engineers as founders and members, and exerted a great deal of influence both within engineering and within their respective communities and states.

Western Society of Engineers

The Western Society of Engineers, founded in Chicago in 1869 as the Civil Engineers Club of the Northwest, by the mid-1890s had grown into one of the pre-eminent local engineering clubs in the United States. In influence if not size it rivalled the national societies, and, in fact, in 1894 launched a serious effort to transform itself from a local civil engineers club into a national, multi-discipline professional engineering organization. That this effort failed at a time when numerous engineering societies were calling for increased cooperation and the creation of a unified, national voice serves as a classic example of what can go wrong when parochial interests conflict with cosmopolitan goals. The Western Society, which boasted such renowned members as Octave Chanute and Alfred Noble, seemed ideally situated to take on a role of national leadership. Unfortunately, the other engineering groups were not prepared to follow. Observers within the profession would later describe the Western Society as having fallen "an unhappy victim of the 'world-power' mania" for its perceived attempt to dominate rather than continue to cooperate as an equal with other local societies.[139] The Western Society's success in organizing the International Engineering Congress held as part of the 1893 Columbian Exposition had led the society to erroneously believe it was the logical candidate to become the country's first national umbrella society.

Engineers working in Chicago and the surrounding area founded the Western Society in 1869. Twenty-two civil engineers answered the initial call for members. Founders included a number of men who were already recognized by their contemporaries as some of the outstanding engineers of their day, such as Ellis S. Chesbrough. Chesbrough served as Chicago's city engineer for many years. He designed the canal system that reversed the flow of the Chicago River, a system that so effectively prevented sewerage from contaminating the city's water supply that the residents of Chicago were able to drink unfiltered water drawn from Lake Michigan until the 1940s, although the city did institute chlorination in 1912.[140]

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[139] John Trautwine, speaking at a meeting of the Engineers Club of Philadelphia, Proceedings of the Engineers Club of Philadelphia XXVIII(1903):39.

[140] Chesbrough's career has been examined by a number of historians. See, for example, Louis P. Cain, "Raising and Watering a City: Ellis Sylvester Chesbrough and Chicago's First Sanitation System," Technology & Culture 13(1972): 353-372; or James Charles O'Connell, "Technology and Pollution: Chicago's Water Policy, 1833-1930," Ph.D. dissertation, University of Chicago, 1980. See also J. Seymour Curry, Chicago: Its History and Its Builders (Chicago: The S. J. Clarke Publishing Co., 1912), particularly pp. 190-196 in Volume 2 and pp. 123-151 in Volume 3; and

As the years passed, the membership rolls swelled from the original twenty-two to four-hundred-forty-one in 1896. As noted above, members included such notable engineers as Octave Chanute, famous among nineteenth century civil engineers for overseeing the successful construction of the first railroad bridge across the Missouri River at Kansas City, Alfred Noble, and George S. Morison.[141] Membership in the Society was open to all practising engineers who had at least one year's experience or who had graduated from a recognized engineering school. Although (as noted in Chapter One) the Society had begun by distinguishing only between Full members and Associates, by the 1890s it had, like many local societies, also instituted a junior grade and a life member grade. Life members were exempt from paying dues after twenty years of continuous active membership.

Anonymous, "Ellis Sylvester Chesbrough, Past President Am. Soc. C. E.," Proceedings of the American Society of Civil Engineers 14(1888): 160-163.

[141] After retiring from active practice in 1890, Chanute directed his attention to solving the problem of developing a working aircraft. He compiled one of the first texts on advances in aviation, Progress in Aviation (1894), and is often better remembered as a pioneer in that field than for his many contributions to civil engineering. Chanute, in fact, used his expertise in bridge design in designing gliders. The Wright brothers later copied the Pratt trusses of Chanute's successful biplane glider for their powered aircraft. Although few recent text articles have been written about Chanute, he is the subject of several active Web sites. See, for example, "Octave Chanute," http://hawaii.cogsci.uiuc.edu/invent/Chanute/Chanute.html, or "Octave Chanute's Glider Flights of 1896," http://dodo.crown.net/-sspicer/chanute/chanute.html. See also Anonymous, "Octave Chanute, Past-President, Am. Soc. C. E.," Proceedings of the American Society of Civil Engineers 37(1911): 982-988; and Anonymous, "Alfred Noble, Past President, Am. Soc. C. E.," Proceedings of the American Society of Civil Engineers 41(1915): 1621-1682.

The Western Society, like many of its contemporary local societies, leased a suite of rooms to house its library, provide a lounging room in which members could socialize informally throughout the week, and to serve as a meeting place for regular meetings. Directors of the Society arranged for the use of an auditorium on those occasions when an unusually large crowd was anticipated, such as the irregularly scheduled "ladies nights" or on evenings when topics of wide popular interest were planned. According to reports in the Society's proceedings, an April 20, 1898, panel discussion comparing electrical, pneumatic, and mechanical power transmission in manufacturing attracted an expectionally large audience, as did Alfred Noble's February 2, 1898, talk on the proposed Nicaragua Canal. Speakers often illustrated their lectures with visual aids, including lantern slides, stereoptican views, and charts. Photographs might be passed around to members of the audience for their examination or copies of the lecture distributed to interested persons. If a lecture discussed developments in instrumentation, sample instruments might be set up for members to inspect following the question and answer period.

While almost all local societies included an occasional excursion, that is, a field trip, to examine sites of engineering interest, the Western Society, which included a large number of railroad engineers and managers as members, seems to have traveled farther and more often than other clubs. Special trains would be laid on to take members to Omaha or Louisville or the Lehigh Valley, field trips that entailed several days or even a full week of travel away from Chicago and that required multiple sleeping and dining cars. Short trips within the city were also common. Members inspected progress on the Chicago drainage canal, toured electric power plants, and inspected improvements to railroad bridges.

The last topic was of particular interest to the society throughout the 1890s. In 1892 the Society they had formed a committee to investigate the problem of bridge safety and provided recommendations to the state legislature on changes in laws intended to ensure safer bridges for both railroad and highway traffic. The committee reported periodically to the Society as a whole as well as providing state lawmakers with copies of their recommendations. On October 8, 1898, and October 15, 1898, for example, members spent the day examining railroads and track elevation work in Chicago. The arrangements committee split the excursion into two meetings as members felt there was too much to see to properly cover it all in only one day.

The Western Society of Engineers elected officers annually. All officers -- the president, first and second vice president, secretary, treasurer, librarian, and trustee -- served for only one year. The organization's by-laws mandated that the names of at least two candidates be placed in nomination for each elective office, but elections were rarely closely contested. The January 6, 1892, election proved a rare exception and caused considerable consternation among the members. Votes were divided among three presidential candidates in such a way as to prevent any one from obtaining a clear majority of the ballots cast. Two-hundred-six total votes were cast, the by-laws required one-hundred-four for election, but the leading candidate, Isham Randolph, fell short by four votes, despite clearly outpolling the other two candidates. After a lengthy, and possibly heated, discussion Benezette Williams moved that "the Board of Directors be directed to call an election for President in the manner provided in the By-Law pertaining to the election of officers."[142] The issue was resolved a month later, at the February 3, 1892, meeting when Randolph received one-hundred-thirty-three votes out of the two-hundred-forty-one ballots cast.[143]

The Society's by-laws allowed officers to serve more than one term in office, and a number did so. L. E. Cooley, for example, served two terms as president in the 1890s, and most secretaries and treasurers served multiple consecutive terms. The Western Society had two vice presidents, a first and a second, but each office became vacant annually. This practice contrasted with that of some other societies, such as the Engineers Society of Western Pennsylvania, that had two vice presidents and elected one each year, each of whom served as second vice president the first year of his term and then moved up to first vice president the second year. Serving as vice president did not automatically result in being elected to the presidency, although a number of officers, including Alfred Noble, served first as second vice president, then as first vice president, and finally as president.

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[142] Journal of the Assocation of Engineering Societies Proceedings XI(1892): 100.

[143] Journal of the Assocation of Engineering Societies Proceedings XI(1892): 171.

Along with the St. Louis Engineers Club, the Boston Society of Civil Engineers, and the Civil Engineers Club of Cleveland, the Western Society had been among the four societies that agreed in 1880 to create the Association of Engineering Societies. By 1894, however, some members apparently felt that the Western Society received too little in return for its substantial financial contribution to the AES. Member societies were assessed at a rate based on the number of individual members overall. E.g., if the total membership of all the societies in the AES was twelve hundred and the annual publication costs of the Journal came to $3600, each society would be assessed at the rate of $3 per member. A large society, like the Western Society with 350 members, might pay $1050 annually while a small, like Montana with only 40 members, might pay only $120. Given that the cost to the individual members was identical from society to society regardless of size, why the Publications Committee should interpret this as an unfair burden on the Western Society is unclear.

The Society's Committee on Papers and Publications found that assessments to the AES for 1894 would total $1,377 while "but one of the Western Society's papers had been published in the Journal of the Association of Engineering Societies. . . "[144] The editor for the AES placed the blame squarely on the Western Society, noting that members failed to prepare their papers for publication in a timely fashion. Nonetheless, the three committee members -- George S. Morison, Robert W. Hunt, and David L. Barnes -- concluded in their report that the Western Society could publish its own

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[144] Journal of the Association of Engineering Societies Proceedings XIII(1894): 82.

journal more cheaply, allowing more members' papers to appear in print, as well as helping to build up the Society's library. The report noted that "Under the present arrangement we cannot secure for it any exchanges; if we publish our own Proceedings, many such could be obtained."[145] The ensuing discussion of the committee report, however, indicates that considerations other than money played a significant role in Western Society's decision to leave the AES. Status was also a factor.

Robert Hunt argued that the Society's publication of the its journal would "give ourselves more credit and greater standing among the societies of the country."[146] The desire for increased status may, in fact, have been actual motivation for breaking away from the AES. The Western Society had been successful in coordinating the international engineering congress held in conjunction with the 1893 Columbian Exposition in Chicago. The leadership role it assumed in organizing meetings and receptions for visiting engineers as well as coordinating the contributions and exhibitions provided by other engineering societies convinced many members the Western Society was ideally situated to serve as the nucleus of a new, national engineering society. The Western Society had begun organizing a General Association of Engineering Societies three years prior to the exposition's scheduled opening. In August, 1890, the Western Society wrote to other societies to propose that the leading American engineering societies cooperate in sponsoring an International Congress of

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145 Ibid.

146 Journal of the Association of Engineering Societies Proceedings XIII(1894): 83.

Engineering at the planned 1893 world's fair.[147] Although the participating societies formed a temporary General Association of Engineering Societies to arrange for necessary funds to be placed in trust accounts and oversee the Engineering Headquarters in the city, as a practical matter members of the Western Society assumed much of the responsibility for ensuring that events connected with the Exposition proceeded smoothly. Under the guidance of Octave Chanute, who served as Chairman of the General Committee, matters relating to the Engineering Headquarters at the Exposition ran so efficiently that the committee was able to declare a dividend of ten per cent when it closed out its accounts the following year. The comments of visiting engineers praising the efforts of the local society as well as the presence of representatives of the European national engineering societies, such as the German Society of Engineers, may have contributed to members of the Western Society believing the time was right for an umbrella national society.

Members conveniently forgot that not all engineers had shared the high opinion of the Western Society. Some state societies felt they had been treated rather rudely by the Western Society preceding the Exposition and were unlikely to support any ambitious plans for the Chicago group to expand.[148] Still, the idea of a truly national

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147 Engineering News August 23, 1890: 165.

148 See, for example, Proceedings of the Michigan Society of Engineers 1892: 184-85.

society had been a topic of discussion for many years. Even among civil engineers, many considered the ASCE as "local to New York."[149]

Thus, it is not surprising that at the January 1894 annual meeting the Society's newly elected president, Hiero B. Herr, reportedly

> addressed the members present in favor of a new national engineering society, to have its headquarters in Chicago, and to have a name signifying its national character, such as The American Society of Engineers, or The Engineering Institution of the United States, or the United States Institute of Engineering.
>
> He argued that the term 'Western,' as applied to a society with headquarters in Chicago was a misnomer, and that Chicago, by virtue of its central position, and of having demonstrated the justness of its claim to be the metropolis of America, was *par excellence* the city where this great national society should have its home.[150]

The Society appointed seven members to serve as a committee on re-organization to investigate how the Western Society would fit into the proposed national society. This action was followed a few months later by the report from the Publications Committee recommending that the Western Society leave the AES.

Despite the strong feelings towards independence within the Society, the initial attempt to break with the AES failed. Whatever the opinions of the Committee on Reorganization, the Committee on Publications and Papers, and the Library Committee, leaving the AES required approval by a majority of the Western Society's members. The various committees and the Board of Directors presented strong arguments in favor of standing alone, but in November 1894 the members voted by a

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149 Engineering News May 24, 1890: 491.

150 Anonymous, "Proposal for New National and International Engineering Societies," Journal of the Association of Engineering Societies XIII(1894): 138-139.

one-hundred-thirty-seven to seventy margin to continue the Society's membership in the Association of Engineering Societies. The editor of the Journal of the Association of Engineering Societies noted that "it is with profound satisfaction that the Box [a column of brief notices and editorial comments] records the result of the letter ballot by the Western Society of Engineers, continuing . . . the co-operation of that society in the work of the Association. It is needless to say that the loss of that co-operation would have been a serious one, . . . "[151]

The editor's relief proved short-lived. A financial shortfall within the AES caused it to request a special assessment from its member societies in the spring of 1895. Members of the Western Society responded with an eleven point memorandum to the AES Board of Managers strongly urging changes in the business operations of the Journal. The list included ideas that would have severely restricted the length of papers submitted to the Journal by the smaller societies, such as "The amount of matter which each Society is entitled to have published to be in direct proportion to the amount it contributes to the cost of publication," or that limited the power of the AES Secretary to act as editor. By the end of 1895, the Western Society had left the AES. In 1896 the society began publication of its own journal.

The Journal of the Western Society of Engineers may have satisfied members' longings for an increased individual identity or perceived higher status within the scientific community, but it does not seem to have helped the Society to realize its goal

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[151] Journal of the Association of Engineering Societies XIII(1894): 718.

of serving as the core of a new, national umbrella engineering society. In remarks presented at the 1895 annual meeting, George S. Morison had suggested the Western Society stood ready to become "the leading society which embraces all kinds of engineering."[152] However, as Thomas Appleton noted in concluding the Western Society's Secretary's report for that same year, "The Society is but a collective noun; it can only become what its members make it."[153] Despite the pride members felt in their local club, they could not transform it into a national society. The number of corresponding, or non-resident members, continued to be a small minority within the organization. The Western Society of Engineers remained one of the pre-eminent local societies in the United States, but it never achieved the national leadership role it sought.

Philadelphia Engineers Club

Twenty-one Philadelphia engineers met on December 17, 1877, to organize formally as the Engineers' Club of Philadelphia. Members of the group had held two informal meetings earlier in the year to discuss the possibility of creating a local engineers' club. According to Engineers' Club records, the idea for a local club had first arisen the previous year during the Centennial Exposition. The American Society of Civil Engineers and the American Institute of Mining Engineers had both established

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[152] Journal of the Association of Engineering Societies Proceedings XIV(1895): 26.

[153] Journal of the Association of Engineering Societies Proceedings XIV(1895): 31.

temporary headquarters in rooms near the Exposition site. The ASCE and AIME sponsored informal weekly meetings open to all visiting engineers. After the Exposition closed, the "pleasant recollections of these very delightful Thursday evenings" lingered on, inspiring Philadelphia engineers to attempt to create a similar venue for social intercourse.[154] The group of charter members elected three officers at the December meeting -- L. M. Haupt, a professor of engineering, president; Coleman Sellers jr., vice-president, and Charles E. Billin, secretary-treasurer -- and drafted a constitution and by-laws to be voted on at the next meeting.

Additional discussion at the January 8, 1878, meeting postponed ratification of the constitution until January 19. Members were apparently divided on two issues: limiting the total membership to only fifty persons, and taking active steps to discourage young men from entering the engineering professions. The latter idea was quickly voted down, while the former was first codified and then rejected before the year had ended.

The constitution as ratified set forth the usual goals of an engineers' club: "the professional improvement of its members, the encouragement of social intercourse among men of practical science, and the advancement of engineering in its several branches. . ."[155] Regular club meetings were set for the first and third Saturday of each month. A Committee of Information was established to collect items of engineering

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[154] Edgar Marburg, "A Historical Sketch of the Engineers' Club of Philadelphia," Proceedings of the Engineers' Club of Philadelphia XVIII(1901):61-67.

[155] Ibid.

interest for discussion at meetings. During the early years of the Club this meant scanning the engineering journals and trade papers for articles to be clipped and pasted into a scrapbook for the members to view, but quickly evolved into a committee responsible for securing speakers to present technical papers. Membership on this committee initially rotated among the members, with two members dropping off and two new ones being added at each regular meeting, but was later changed to having committee members serve a one year term with members being appointed annually by the Club president. The site for meetings inititially rotated among the members' homes, but moved into a more permanent location in April 1878. At that time the Club arranged to share rooms leased by the Philadelphia Chapter of the American Institute of Architects on Merrick Street.

As the club continued to grow, members urged the creation of a more exclusive headquarters where it would be possible to establish an engineering library similar to the collections enjoyed in New York by the ASCE and in Boston by the Boston Society of Civil Engineers. The Engineers' Club first leased an apartment and then a house. Although some local clubs resisted the idea of a physical headquarters or club house, preferring instead to rent a lecture hall or meeting room for their regular meetings, the Philadelphia club very early in its history committed itself to maintaining a society headquarters that would have all the customary accoutrements of any good quality gentlemen's club: a library and reading room, a lounge, dining facilities, and guest rooms. The reading room included "suitably engraved stationery for the personal use of the members."[156] That the members of the Engineers' Club considered their club as the equivalent of any other high status men's club was, in fact, evidenced by more than the creation of special stationery. In 1917, when a fund drive for building improvements was undertaken, the Building Committee published a comparison of their Philadelphia facility with the New York Athletic Club and the Chicago University Club.

As the club grew, improvements and expansions were made. A full time janitor and housekeeper were hired to clean and maintain the house, while professional cooks and waiters staffed the kitchen and dining room. In 1907 the Club moved again to a building large enough to incorporate a meeting room with a seating capacity of 200. Audiences of 150 or more persons had become commonplace at regular meetings. The number of guest rooms was increased, and, in 1914, financial statements for the house indicated that the income received in lodging fees exceeded the expenses involved in operating the Club and paying off the mortgage.[157] Over the years the Engineers' Club executed renovations and expansion of this facility several times.

Although the Engineers' Club began with a simple governing structure, as it grew members amended the by-laws to provide first that Secretary and Treasurer be separate offices and then that a Board of Directors be elected to handle routine business affairs. The club held elections annually. No formal requirement existed mandating that candidates for president serve first as a vice president, although it was

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[156] Proceedings of the Engineers' Club of Philadelphia XVI(1898):63.

[157] Annual Report of the Treasurer, Proceedings of the Engineers' Club of Philadelphia XXXI(1914):114.

customary, as it was in many clubs, that presidential candidates demonstrate their commitment to the club through service on various committees prior to running for office. Presidents generally served only one term, although vice presidents occasionally held repeated terms of office.

The Engineers' Club of Philadelphia grew rapidly, and by the 1890s had instituted changes in membership grades to differentiate between members with varying levels of experience. The grade of Associate was added in 1886 and Junior in 1897. In addition to the regular members meetings the Club began holding Junior meetings at which the younger club members were encouraged to present their work. The regular meetings often featured nationally known figures, such as Stephen P. Mather, while the junior meetings drew on speakers internal to the club. The Engineers' Club awarded a prize annually for the best paper prepared by a Junior member.

Creation of the separate Juniors meeting had been strenuously debated within the Club. Some members argued that the Junior meetings could have the effect of making Junior members feel excluded or segregated. Other members pointed out that Junior members were still welcome at the regular meetings, although the converse was not true: Junior meetings were restricted to Junior members and their guests only to prevent more senior members from dominating them. The intent of the Junior meetings was not to separate the Juniors from the rest of the Club but instead to encourage them to become better acquainted with each other. That is, the hope of the Board of Directors in suggesting Junior meetings was that the meetings would strengthen Junior members' ties within the Club as well as provide them with a venue for formally presenting the results of their work or research. With membership in the Club exceeding 500 it was becoming increasingly difficult for members to get to know each other. At various time clubs outside Philadelphia also grappled with the question of holding separate junior members meetings. An 1899 Engineering Record article, for example, discussed the experiences of a number of engineering societies in instituting separate meetings.[158]

When the Engineers' Club of Philadelphia first began meeting in 1878, members did not hesitate to insert the Club into what might be considered public affairs or politics. This changed over time. Speaking in 1914, the retiring Club president, W. Purves Taylor, noted that:

> When the Club was first organized, resolutions relative to public matters were continually being proposed, and in the first issue of the Proceedings of the Club are given three resolutions, . . . This activity in public affairs, which was a matter of common occurrence in the early history of the Club, has greatly decreased, until, at the present time, I believe but two resolutions relative to matters of public importance had been passed by this Club in the past five years.[159]

Given the eagerness with which the young Philadelphia Engineers Club had entered into discussions of public policies in the 1880s and 1890s, Taylor's disappointment is understandable. At the banquet celebrating the club's twenty-fifth anniversary in 1902,

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158 See also Anonymous, "Junior meetings of engineering societies," Engineering Record March 18, 1899.

159 W. Purves Taylor, "Annual Address by the Retiring President," Proceedings of the Engineers' Club of Philadelphia XXXI(1914): 92-112.

L. Y. Schmermerhorn, an active member since 1892, noted that the club "has been prominently identified with important national, State, and municipal legislation upon subjects with which the engineer was in sympathy."[160] Schmermerhorn cited only one specific example in his brief remarks, that of "the geodetic survey of Pennsylvania, the need for which was emphasized by the fact that when the line was retraced between Pennsylvania and Delaware, it was found that a member of the Legislature of Pennsylvania lived in the State of Delaware."[161] He could have as easily drawn attention to the Club's efforts to promote safety regulations for steam boilers, its lobbying for more stringent building codes, or numerous other issues the Club discussed and acted upon in the 1880s and 1890s. In 1897, for example, the Club created a committee to investigate the building codes question. The committee prepared a comprehensive report, which was then reviewed by the members of the club and presented to the City Council for its information.

State and local officials did not always follow the recommendations provided by the Engineers Club, but, at least during the first twenty-five years of its existence, Club members believed the Club's opinions would meet with a respectful hearing. As the Club entered the twentieth century, however, its proactive orientation toward city and state affairs gradually faded. Past successes in advocating legislation and civic improvements may have resulted in fewer obvious problems to confront, or, as the

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160 Proceedings of the Engineers Club of Philadelphia XX(1903):8.

161 Ibid.

Club grew in size, an evolution in its orientation may have ocurred. It is a truism in organization theory that as organizations age they may become risk-aversive, often forgetting their original goals and focusing instead on activities intended to maximize their own survival. Thus, while individual members and officers such as President Taylor may have expressed a desire for increased civic participation, the organization as a whole would shy away from positions that appeared controversial or potentially divisive.[162] The Philadelphia club continued to grow steadily and would boast over two thousand members by 1920, but, as the membership rolls swelled the club became increasingly a purely social organization with only superficial interest in political activism or civic affairs of any sort.

Local Umbrella

In "The Technical Society of the Pacific Coast" Carroll Pursell described an umbrella society organized in San Francisco in 1884. Unlike the German polytechnic clubs and local academies of science increasingly common on the East Coast, the TSPC did not establish separate internal sections devoted to topics in engineering, physics, or chemistry. The objective of the TSPC was to bring men of science together, not to reinforce their differences. The TSPC remained almost alone as an overtly polytechnic society until the 1890s. As the Gilded Age ended and the Progressive Era began, other

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162 See, for example, Maren Lockwood Carden, "The institutionalization of social movements in voluntary organizations," Research in Social Movements, Conflicts and Change 11(1989): 143-162; Robert H. Salisbury, "An exchange theory of interest groups," Midwest Journal of Political Science 13(1969): 1-32; or James Q. Wilson, Political Organizations (New York: Basic Books, Inc., 1973).

polytechnic clubs, such as the Wisconsin Polytechnic Society, were founded and older engineering clubs began to recognize that their identities had changed over time. In 1895, for example, Ambrose Swasy, president of the Civil Engineers' Club of Cleveland, noted that the club's membership now included civil, mechanical, and electrical engineers, architects, and scientists. Swasey believed that the papers presented at meetings of societies like the CEC with similarly diverse members "provide . . . a variety [of subject matter] of interest to all."[163]

While a broader base in membership in the established engineering clubs may have been part of a natural evolution, new local clubs were founded with an explicitly multi-disciplinary orientation. The Engineering Society of Detroit, the Washington Society of Engineers, and others appealed to all engineers regardless of occupational specialty to join. In this section I describe two local umbrella clubs founded only a year apart, the Engineering Society of Milwaukee and the Washington Society of Engineers. The clubs were founded for similar reasons. In each case organizers believed that the growing specialization within engineering called for facilitated communication across disciplinary boundaries. The ESM and the WSE chose, however, to define their roles in their respective local communities in different ways. The WSE quickly became internally focused, standing aloof from the local community and remaining studiously apolitical, while the ESM chose to take an active role in civic affairs.

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163 Journal of the Association of Engineering Societies Proceedings XIV(1895): 59.

Washington Society of Engineers

On October 21, 1905, seven men gathered in a room in Washington, D.C., to discuss forming a local engineers' society. Informal discussions had taken place for some time, but this meeting apparently was the first at which the participants took notes and later provided formal minutes.[164] Four engineering specialties were represented -- mining, mechanical, civil, and electrical -- with those specialties split evenly between government and private employment. Motivated in part by a belief in engineering as objective knowledge, these men -- Winthrop Cole, D. S. Carll, Louis D. Bliss, W. A. McFarland, C. W. Hayes, E. W. Parker, and H. M. Wilson -- sought to form an organization where men of science could come together in a community of rational discourse.

Discussion at the meeting proved so fruitful that the participants agreed to circulate an open invitation to engineers in the District of Columbia to attend a general membership meeting to be held in November. A committee was organized to prepare a draft constitution and to suggest a slate of officers for the first election. A few weeks later, on November 23, 1905, an enthusiastic crowd of engineers and "others interested in the engineering arts" met to organize formally as the Washington Society of Engineers. The purposes of the society as spelled out in Article II of the Constitution were twofold:

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164 Minutes of the WSE, October 21, 1905:1, Washington Society of Engineers Collection, Division of Engineering and Industry Archives, National Museum of American History, Smithsonian Institution, Washington, D.C.(hereafter WSE Collection).

> Section I. The objects of this society shall be the advancement of engineering knowledge and practice, and the maintenance of a high professional standard among its members.
> Section II. Among the means to be employed for this purpose shall be meetings for the readings of papers and discussions of questions pertaining to the engineering professions and for social intercourse.[165]

That these goals are rather general is not surprising. As James Wilson notes, "the more specific the objective, the greater the likelihood there will be disagreement over it within the organization."[166] Dues were set at $5 annually and by January 1906 membership stood at 308. The WSE elected Admiral Charles W. Rae of the U.S. Coast and Geological Survey to serve as its first president. After the first burst of enthusiasm, membership dipped briefly, hitting a low of 282 in 1909, but then stabilized at approximately 300 members.

Membership numbers were in fact so stable year after year that the Board of Directors consistently recommended against broad-based recruiting drives. The Board recognized the necessity for some annual turnover in membership, along with the periodic infusion of fresh ideas and new viewpoints, but did not believe canvassing for members would become necessary. Word of mouth recruitment through existing members would ensure sufficient numbers of new members annually to maintain a healthy society. In 1911, for example, the Membership Committee reported that it had

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[165] WSE Constitution, approved December 19, 1905. Washington Society of Engineers Collection, Division of Engineering and Industry Archives, National Museum of American History, Smithsonian Institution, Washington, D.C.(hereafter WSE Collection).

[166] James Q. Wilson, 217.

"decided that if, through natural sources, the membership remained fairly constant the best interests of the Society would be served."[167] Thus, the official policy became ". . .not to make a systematic canvas for members, but rather to expect new members to seek the Society."[168] This membership recruitment policy remained in effect for more than sixty years, until the early 1970s.

The Washington Society of Engineers was organized as an umbrella society, an interdisciplinary club theoretically open to anyone with an interest in engineering subjects. The fact that all four major engineering specialties -- civil, electrical, mechanical, and mining -- were represented on the organizing committee was no accident. The composition of the organizing committee symbolized the desire of the WSE's founders to cut across growing disciplinary boundaries. Organizers recognized the ever-increasing diversity of engineering practice but at the same time felt many issues and potential lecture topics transcended strict disciplinary lines. Their intention was to create a society where all engineers could meet and discuss subjects of common interest. As the minutes of October 21, 1905, meeting stated, "it is the sense of this meeting that a society of Engineers be organized in Washington to include members of the civil, mechanical, electrical, mining, military and naval engineering professions."[169] A constitution committee was then selected that included one representative from each

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167 WSE Minutes Volume I:272, WSE Collection.

168 WSE Minutes Volume 2(1916):156, WSE Collection.

169 WSE Minutes 1906:1-2, WSE Collection.

of the engineering disciplines named: H. M. Wilson, civil engineer; Louis Bliss, electrical engineer; C. W. Hayes, mining engineer; W. A. McFarland, mechanical engineer; Colonel John Biddle, Engineering Commander, District of Columbia, military engineer; and Admiral Charles W. Rae, naval engineer.

At first glance, the demographic profile of the WSE suggests that the organizers succeeded in creating a truly multi-discipline engineering club. A preliminary examination of the biographical data provided on membership application forms revealed wide diversity in the occupations, employment, and educational backgrounds of prospective members. Over the years of its existence applicants provided 110 different job titles to describe their various occupations and indicated they worked for many different employers, indicating a cross section of American engineering practice. Applicants included entry-level ordnance draftsmen at the Naval Gun Factory, middle management engineers from private industry, and the commandant of the Lighthouse Service.

The level of education for prospective members also varied widely, ranging from applicants who had almost no formal education to a few who possessed doctorates. In 1912, for example, Winfield Scott Atkinson described himself as "graduated in the school of hard knocks."[170] Atkinson, born in 1865, had followed a typical nineteenth century civil engineering career trajectory, beginning his working life

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[170] WSE Membership Records, WSE Collection.

on a railroad survey crew and, having been trained on the job, proceeding from there to electrical railroads and then to hydroelectric development.

Despite being located in the District the WSE did not have an exceptionally high percentage of members who were either in the military or employed on military projects, with the exception of civilian engineers and technicians employed at the Navy Gun Factory. Only two percent of the members of the WSE were also active members of the armed services at the time of their membership application. Of those, most were junior officers in the Corps of Engineers, although one or two very senior officers also joined the Society upon being posted to the District. Overall membership in the society seems to have been fairly evenly split between civilian and federal employment, with the percentage of federal employees varying from as low as forty percent in some years to as high as seventy-five percent in others.

A high percentage of federal employees does not, however, entail either unanimity of interests or occupations as different departments were well-represented at different times. Even within the same cabinet department engineers might work in very different agencies with radically different orientations. As Donald Worster and others have noted, many federal agencies were and are prone to turf wars and partisan politics.[171]

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[171] Donald Worster, Rivers of Empire (New York: Oxford University Press, 1992 [1985]); Gene M. Gressley, "Arthur Powell Davis, reclamation, and the West," Agricultural History 42(1968):241-257. Both authors describe the turbulent and occasionally Byzantine politics of the federal agencies that have controlled water development policy for much of this century. See also Donald C. Jackson, "Engineering in the Progressive Era: A New Look at Frederick Haynes Newell and the

The distribution pattern of membership applications parallelled the rise or occasional decline or relocation of federal agencies. Thus, the early years of the century saw many employees of the Interstate Commerce Commission applying for membership while the 1930s saw a surge in applications from the newly expanded Federal Power Commission. The Interstate Commerce Commission may have been the largest single federal employer of engineers in the District with its multiple agencies: the Patent Office, the Coastal and Geodetic Survey, the Bureau of Valuation, and so on. Other agencies, such as the Department of Interior's Bureau of Reclamation and Department of Agriculture's Forest Service, were also well represented.

A number of the engineers who joined the WSE were well known in their respective fields before moving to Washington to serve as representatives of trade associations or national engineering societies or to work for the government. The Washington representative of the American Society of Civil Engineers, Emerson Chandler, also belonged to the WSE, as did lobbyists for the American Concrete Institute and writers for the Engineering News-Record. The presence of the federal government may actually have assured that the WSE membership represented a truer sampling of American engineering talent than many of the other local engineering clubs, such as the Detroit Engineers Club or the Engineers Club of St. Louis. The various agencies of the federal government recruited nationally where industry may have

U.S. Reclamation Service," Technology and Culture 34(1993):539-574; and Stephen P. Turner, "Forms of patronage," pp. 184-211 in Susan E. Cozzens and Thomas F. Gieryn, editors, Theories of Science in Society (Bloomington, IN: Indiana University Press, 1990).

limited its employee searches to a relatively small geographic region. The national engineering journals and trade press all published occasional articles urging young engineers to consider government service as a career.

Structure & Governance

Although the potential certainly existed for considerable turnover in the officers and board of directors during the early years of the WSE, conditions quickly stabilized. Four of the seven men who had formed the first organizing committee -- W. A. McFarland, D. S. Carll, C. W. Hayes, and Louis D. Bliss -- were elected to fill positions on the initial slate of officers elected in December 1905. Of the ten officers and directors elected in 1905, only two -- Bliss and D. E. McComb -- were re-elected to the same office, secretary and treasurer, respectively, the following year. Bliss held the office for only two years, but his successor, John Hoyt, served as secretary for five and established a pattern that saw most secretaries filling multiple terms. The office of Treasurer was prone to more rapid turnover.

The fact that the other eight men were not re-elected to the offices they had held for 1906 did not mean an almost clean sweep of the WSE power structure. Instead the election merely signified a reshuffling as Frederick Haynes Newell moved up from a director's position to President, accompanied by fellow director H. O. Tittman's move into the vice presidency. Six new directors were elected in 1906, and in 1907 seven out of ten officers and directors were replaced. With rare exceptions, however, annual turnover was generally limited to four or less new officers or directors annually, with only one new director being elected in 1908, four in 1909, four in 1910, and one in 1911.

As originally written, the WSE constitution did not ensure such continuity. The sections on membership and officers clearly stated that "the term of all officers shall be one year."[172] A complete change of leadership annually was theoretically possible, although apparently it never came close to being a reality. While many similar organizations, such as the American Society of Civil Engineers, treated the vice presidency as a step toward the presidency, a habit the WSE also fell into later in its history, this was never codified as an official requirement. There was simply an implicit expectation that prospective presidents would have put in some time working for the Society prior to aspiring to a leadership position. Thus, the typical path to the presidency involved serving on one of the various committees of the WSE, such as the Meetings or Nominating committees, then as a director or other officer, and finally as President.

Evidence exists that the WSE, like the ABA and AMA, valued obvious achieved status as a criterion for election to the presidency.[173] Frederick Haynes Newell, for example, was Director of the Federal Bureau of Reclamation when nominated to the presidency of the WSE. At the same time, some WSE presidents

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172 WSE Constitution as approved December 1905.

173 Cf. Albert P. Melone, Lawyers, Public Policy and Interest Group Politics (Washington, DC: University Press of America, 1979) in Melone describes recruitment patterns within the American Bar Association.

never gained fame outside the WSE, such as H. B. Gregory, a draftsman in the Navy Department whose education had ended in the eighth grade. Gregory was sixty-six years old and had been a member for over thirty years, however, before being elected to office. Most other officers generally were much younger and had been involved for shorter periods of time before achieving leadership positions.

Despite the naturally conservative pattern of the elections for officers and directors, in 1913 the Board of Directors decided to ensure that turnover would be further regulated. They recommended several amendments to the by-laws regarding the election of officers. The first proposed amendment added two members to the Board of Directors, "the last two living ex-presidents of the Society."[174] A second amendment changed the term of office for directors to two years, with three directors to be elected each year. The amended by-laws also prohibited directors from serving consecutive terms, but the Society records indicate this was not strictly enforced.

Having two past presidents and directors with overlapping terms meant that even if all seven incoming officers -- president, vice president, secretary, treasurer, and three directors -- were totally new to the Board of Directors the institutional memory of the Society would be preserved. It also had the practical effect, of course, of ensuring that enough fresh blood was now guaranteed to defuse potential accusations of cronyism or cliques.

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174 WSE Constitution as amended December 1913.

In addition to the Board of Directors, as the organizational chart in Figure 3 shows, the WSE had several standing committees: The Membership Committee, which reviewed applications; the Meetings Committee, which scheduled speakers and events;

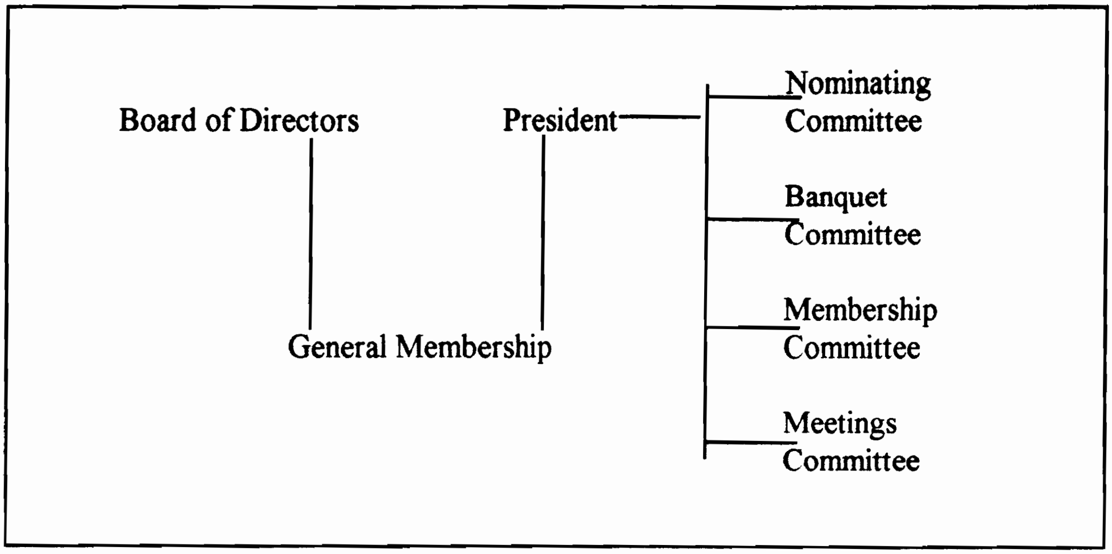

Figure 3 Organization Chart Washington Society of Engineers

the Banquet Committee, which arranged the annual membership meeting; and a Nominating Committee, which contacted potential candidates for office to determine their willingness to serve and recommended a slate for election annually. The Board of Directors occasionally requested that the President appoint other committees to perform various short-term tasks.

Given the often transient nature of much government and industry work some annual turnover in the WSE membership was inevitable. At the same time, the turnover in membership only gradually reflected changes in government and industry.

The numbers of members from the Bureau of Reclamation may have dropped off after the BRS built its laboratories in Colorado, but the District work force for other agencies -- at least as reflected in WSE membership records -- did not experience any such dramatic reductions. Of course, it is easy to see the creation of new agencies reflected in the application forms. It is more difficult to trace their downsizing or disappearance as, while the secretary annually listed the names of members who had resigned, the WSE records generally do not indicate why those members had left the society. Thus, often the only hint that a particular agency was perhaps diminishing in size is the decrease in new applications from employees of that agency.

Unless they were transferred away from the District or moved after retirement, however, many members apparently chose to remain members for life. Many application forms in the WSE Collection include pencilled-in notations recording the date of death or have obituaries taped to the back of the form indicating that the deceased had remained a member for thirty, forty, or even fifty years.

Goals & activities

The Washington Society of Engineers held its regular membership meetings on the first and third Tuesdays of each month during October through May. Summer meetings were rarely, if ever, convened due to the absence of many members from the District during the hot and humid months of June through September. After the first year or so of its existence the Society ceased conducting business at the regular monthly membership meetings and moved to a modified federalist, or corporate, form of government. Routine affairs were entrusted to the Board of Directors, required by the by-laws to meet at least four times throughout the year to attend to WSE business, and then reported on and, occasionally, put to a vote of the general membership at the annual business meeting in mid-December.

On average, the Board actually met eight or nine times over a year's time, including occasional special summer meetings. The Board served as a highly effective gatekeeper between the membership and other organizations and causes. The Minutes of the meetings of the Board of Directors contain numerous examples of issues being brought before the Board for the WSE to consider and promptly being rejected out of hand or tabled indefinitely without the membership as a whole ever being polled. In February 1910, for example, the Board rejected the idea of helping to establish a placement service for engineers, while in 1916 it rejected the notion of the WSE becoming involved in a movement to create a multidisciplinary national engineers association, two activities a number of other engineering societies, both local and national, had endorsed.[175] In addition, over the years the Board both rejected suggestions the WSE lobby Congress on some issues while unanimously endorsing lobbying on others, all without consulting the general membership until after the fact. Creation of a Public Affairs Committee in 1926 was presented to the membership as a *fait accompli* at the annual meeting, as were reports of its activities.

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[175] See, for example, Anonymous, "Forty-two societies represented at Chicago conference," Engineering Record 73(1916):561-2; Frederick Haynes Newell, "Cooperate, but to what end?," Engineering News 75(1916):956-7.

Elections were held annually in December with ballots being mailed to all members prior to the meeting. For four years the annual business meeting and the annual dinner and awards ceremonies were held simultaneously. Members had to be present to vote, however, as no ballots could be cast by mail. The ballots were tallied during the banquet with the results being verified and announced toward the end of the evening. The December business meeting also included reports from the various committees, such as Membership, and financial reports from the Treasurer.

Beginning in 1910 the banquet and business meetings became separate affairs. The Board of Direction for the Society decided that year to hold a banquet to celebrate the WSE's fifth anniversary. It proved so popular that a banquet became an annual event. Once separated from the business meeting, attendance at the banquet tripled, with an average of 350 members and guests enjoying the dinner and social hour while only 100 or so members bothered to turn out to vote at the business meeting held a few weeks later. These average attendances at both the banquet and the business meeting remained remarkably steady for the next fifty years, despite fluctuations in total Society membership.

The monthly meetings were meant to be, as the first constitution mandated, "for the reading of papers and discussion of questions pertaining to the engineering professions and for social intercourse."[176] The Meetings Committee chairman instructed paper presenters to limit their talks to twenty minutes to facilitate

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[176] WSE constitution, December 1905.

discussions, although talks accompanied by slides or moving pictures could run as long as forty minutes.

Lecture topics followed a similar mix for many years. Of the twelve to fourteen regular meetings held annually, the majority of the papers would be exhibitions of professional pride -- what James Q. Wilson might term "general solidary"[177] -- two or three would be of general interest, such as travelogues, and perhaps one would discuss government policy, either local or federal. Papers devoted to practical hints on improving specific skills, although popular the first year, quickly declined in number. The chairman of the meetings committee arranged for speakers, some of whom were WSE members, and occasionally requested funds to pay expenses or suggested that the meeting be "open to ladies." (The WSE membership did not include women until the late 1960s, although the society frequently welcomed women to attend meetings, first as guests -- wives and girlfriends, even an occasional colleague -- and later as speakers.) Joint meetings with other societies occurred relatively infrequently, but were not unheard of. The local sections of both the American Society of Mechanical Engineers and the American Institute of Electrical Engineers apparently maintained close ties with the WSE and cooperated regularly in sponsoring both field trips and special speakers for meetings.

Although "the ladies" were most likely to be invited to meetings of general interest, such as travelogues, the members also opened meetings of a more technical

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177 James Q. Wilson, 10 passim.

nature. Announcements for an excursion to the Bureau of Standards, for example, included an invitation to the ladies. The WSE co-sponsored the meeting with AIEE and found that 500 participants were attracted. A recurring theme in the minutes is, in fact, the desire for programs that it would be appropriate to invite ladies to attend as guests.

The one exception to the desire to have ladies present was the annual banquet. The yearly celebration of engineering evolved into a determinedly stag affair. Although the banquet apparently remained a relatively staid event with invited speakers discussing serious topics, WSE members nonetheless resisted having women present. Indeed, on at least one occasion board members cited the stag nature of the annual banquet as a reason not to admit female engineers to the Society. The Board apparently saw nothing contradictory in rejecting women as potential fellow members while at the same time inviting well-known female engineers, scientists, architects, and political figures to speak at meetings, including the banquet.[178]

WSE activities were not, of course, confined to formal meetings and paper presentations. The early years of the Society coincided with the building boom in Washington -- the various monuments, bridges, and buildings were all in various stages of construction for much of the first half of the century -- and so the WSE occasionally organized field trips to inspect progress on various projects.

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[178] The WSE finally began recruiting women as members in the 1960s when members' daughters started applying to the Society.

To facilitate social intercourse among the members one of the first actions of the society had been to lease and furnish a suite of rooms at 729 15th Street. Subscriptions to a number of engineering journals were ordered and members encouraged to use the rooms for reading and talking with other members. Following his election to the WSE presidency, Frederick Haynes Newell suggested that the members utilize the rooms even more "by holding weekly meetings of an informal character. . ."[179] These informal get-togethers apparently proved popular with the members as the Board voted to continue them following a summer hiatus.

The lease on the 15th Street rooms was allowed to lapse, however, when Newell, acting in his capacity as Director of Reclamation, offered the WSE the use of a room "at 12th and G Streets where meetings of the Society could be held without charge." The informal meetings seem to have ended with the lease. In their place the Board created a Fellowship Committee to act as hosts at formal meetings to encourage members to mingle while refreshments were being served following the paper presentations and question and answer period. This attempt to encourage members to mingle informally mirrored trends in local engineering societies across the nation. One of the editors of Engineering Record in 1914 noted that his recent visits to local societies had differed markedly from a few years previously. Although all the local clubs continued to emphasize paper presentations of high technical merit, they had also instituted fellowship committees to ensure that visitors and potential new members met

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[179] WSE Minutes, January 15, 1907, WSE Collection.

as many men as possible. In addition, many local engineering clubs and chapters of national societies were sponsoring picnics and other outings on a regular basis. The writer reported that, "The officers of the societies visited were practically unanimous in declaring that the expansion of the social features has been beneficial in cementing friendships and in increasing the membership."[180] Some societies began incorporating purely social features sooner than others. The 1899 "Proceedings of the Technical Society of the Pacific Coast" in the Journal of the Association of Engineering Societies include a description of a kite-flying expedition by members and guests.

Members were also encouraged to join each other for dinner prior to the meeting. These pre-meeting dinners were strictly up to the individual members to arrange. Other clubs, such as the Montana Society of Engineers and the Civil Engineers Club of St. Paul, often arranged for a dinner to precede the paper presentations, although such practices became rarer as clubs grew in size. Almost all clubs provided light refreshments following the formal meeting. The Washington Society of Engineers, along with a few others, passed out cigars following the paper presentations.

Politics and the WSE

Although the WSE initially attempted to maintain a thoroughly apolitical stance, by the 1920s the Society evidently felt more comfortable in making its collective opinion known. As I noted above, the Board of Directors was approached a number of

[180] Anonymous, "Social features in local societies," Engineering Record 69(1914):573-4.

times and asked to take an activist role in various issues. Indeed, the Society had made it clear very early in its organizational life that it would not hesitate to approach Congress if the proper occasion arose. One of the first actions of the Society as a group was in 1907 to lobby Congress advocating constructing a memorial to Pierre L'Enfant and removing L'Enfant's remains from an unmarked grave in Maryland to a new site in Arlington National Cemetery.[181] Memorializing an engineer who had been dead for almost a century, however, differed considerably from becoming involved in contemporary issues. In a city replete with monuments and memorials, suggesting the addition of one more was not likely to either embroil the WSE in controversy or create dissension within the Society.

When in 1908 the Society was asked to state an opinion regarding the best candidate for the position of Chief of the Navy's Bureau of Steam Engineering, a post that had fallen vacant with the death of the WSE's first president, Admiral Charles Rae, the Board of Directors demurred. The minutes for May 23, 1908, report that, "After considerable discussion in which the sentiment of the Board was that the Society should not lend itself to personal or political matters. . . ." the question was tabled.

As the years passed and the size of both the federal bureaucracy and the engineering population in Washington increased the WSE became less cautious, but it was not until the early 1920s that the Board appeared willing to play an active part in political matters, both national and local. Initial forays into the public policy arena

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181 Minutes of the WSE, November 19, 1907; April 21, 1908, WSE Collection.

generally focused on issues that had a clear technical or public welfare component, such as the standardization of street signs. Still, compared to other local societies, the WSE, despite being located in the heart of the country's political processes, remained remarkably apolitical for most of its history. One exception, notable in that it tended to come up annually, was an endorsement of "the principle of representation in Congress for the District." The peculiar governing structure of the District of Columbia irritated numerous other citizens, of course, but engineers working in or for the District may have had more occasions to be directly frustrated by the slow response times of an awkward bureaucracy.

It appears the WSE also remained remarkably oblivious to any turmoil in the engineering community. The minutes and annual reports contain few references to Newell's attempts to organize engineers, other than indicating that the Board never presented Newell's requests to the general membership, and even fewer references to the Federated American Engineering Societies until after its organization. Further, the American Association of Engineers, the society organized by young engineers in 1915 around issues such as employment compensation, is never mentioned at all in the WSE minutes. While the various engineering societies and journals debated issues such as cooperation, licensing, and lobbying for most of the decade, the WSE limited its external political activity to one issue -- water power -- an issue almost completely unrelated to the concerns creating turmoil within the other societies.[182] Only after it

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[182] Jordan, Layton, Meiskins, and others previously cited have all provided rich descriptions of these events. For a few first hand accounts, see Anonymous,

became clear that several national societies had endorsed the FAES and would provide financial support did the WSE also become involved.

In any case, the WSE's half-hearted fling with politics was short-lived. When the Great Depression hit in 1929 it took a year or two before the Society felt its effects. By 1931 membership was declining as members confessed their inability to pay the $5 annual dues. The Society survived but apparently lost interest in most external activities. The WSE continued to support the FAES, but the Public Affairs Committee within the Society quietly faded away.

Engineering Society of Milwaukee

The Engineering Society of Milwaukee's origins can be traced to an earlier local organization, the German Polytechnic Society (Verein Deutscher Ingenieure), founded in Milwaukee in 1889. It was, however, the growth of other specialized engineering societies that in 1904 prompted members of the Polytechnic Society such as George Benzenberg to again advocate the formation of a more general local engineers club. An earlier society, the Wisconsin Polytechnic Society, had lasted only a few years in the 1890s. The rapid growth of industry in the Milwaukee area was accompanied by the formation of local chapters of the ASME, AIEE, and others. Influential engineers in the community chose to counter the apparent increasing

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"Engineering bodies in civic affairs," Engineering Record 67(1913):114; Anonymous, "State of engineering organization in the United States,"Engineering Record 69(1914):680-1; Anonymous, "Time at hand when the engineering society should awake to its deficiencies," Engineering Record 72(1915):421-2; or Anonymous, "Will the Engineering Council satisfy the demand?," Engineering News-Record 78(1917):277-8.

fragmentation of the engineering profession by creating an umbrella society designed to facilitate communication between the more specialized organizations. From its beginning the ESM was meant to be both a clearinghouse for information and a common representative to the community for other, smaller engineering groups in the city. The founders envisioned the ESM functioning in much the same manner as later national umbrella groups such as the Federated American Engineering Societies were meant to function.[183] According to official accounts published in Milwaukee Engineering, the ESM was "formed to secure a desirable cooperative body, broad enough in scope the meet the needs of all engineers and technical men in the community."[184]

In the years following its founding, the ESM enjoyed slow but steady growth. The ESM had 140 members in 1909, 245 in 1924, and then remained at a level of under 300 members until the 1940s. At that time the growth of war-related industries contributed to an influx of engineers into the city and a concomitant expansion of the membership rolls. The data provided by the membership directories for the ESM indicate a wide distribution of occupations, educational backgrounds, and employers. The overall demographic profile reflects the predominance of engineers employed in a

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183 For additional information on the Federated American Engineering Societies see, for example, John Matthew Jordan, Technic and Ideology: The Engineering Ideal and American Political Culture 1892-1934. Ph.D. dissertation in American Culture, University of Michigan, 1989.

184 Anonymous, "Affiliate Societies of the ESM," Milwaukee Engineering October 15, 1954:13-15.

variety of private industries, such as Allis-Chalmers and A. O. Smith, unlike the Engineering Society of Detroit, where the auto industry dominated, or the Washington Society of Engineers in the District of Columbia, where government agencies where the most common employers. The ESM members included engineers who specialized in areas uncommon in other areas of the country, such as pulp mill engineers with the Marinette Paper Company.

Goals & activities

The activities of the Engineering Society of Milwaukee fall into two general categories: activities associated with group meetings, such as paper presentations or panel discussions, and activities undertaken by individuals serving as representatives of the ESM, for example, acting as a lobbyist to state and local government or sitting on committees of other organizations. During the first few years of its existence the Society focused primarily on activities intended to strengthen it as an organization by attracting more engineers to join the group, such as technical paper presentations or excursions to examine examples of engineering expertise. These activities included summer social events, such as a 1908 day trip by tally-ho coach to a resort at Whitefish Bay, as well as the usual visits to foundries and harbor improvements. In contrast with organizations such as the WSE that sought to increase the opportunities for ladies to attend meetings, during the early years of the Society the ESM did not invite female guests to accompany the members on day trips or excursions.

Regular meetings of the Engineering Society of Milwaukee included both lectures and panel discussions on a particular topic. The presentations, which were often illustrated with slides, were followed by a lively question and answer period. Many ESM meetings were devoted to problems specific to Milwaukee, such as the repair of the 16th Street Viaduct, just as other local groups enjoyed hearing reports on problems and developments specific to their part of the country.

Society activities were not, of course, confined to formal meetings, paper presentations, and excursions. As noted above, over the years the ESM undertook a variety of activities, some of which were designed to benefit directly Society members alone and others having a wider social and political scope. On its most basic level, the function of the WSE was more purely social than that of the national societies: the meetings were a place to talk shop and, to put it in today's terms, network with other engineers, scientists, and technically-oriented persons. In Milwaukee, the desire to have a central place for engineers to meet had been one of the primary motivations for organizing the ESM. However, low membership numbers prevented the Society from finding permanent quarters for a number of years. The Society eventually obtained a set of rooms at the Builders Club and, finally, following World War II purchased a building.

The ESM took an active interest in civic affairs as they pertained to engineering, such as street lighting or sewage disposal. Like their fellow engineers in the WSE, members of the ESM attempted to avoid "civic affairs which would cause the

Society to become involved in political entanglements."[185] At the same time, ESM members advocated taking an active role in city affairs that related engineering, such as sewage disposal and harbor development. An article in the October 15, 1954, issue of the official newsletter of the society, Milwaukee Engineering, commemorating fifty years of the ESM noted that the society had been active in "several important referenda relating to the city's acquisition of street railways and electric distribution systems" as well as in water filtration and street lighting.[186] In 1921 the ESM established a standing committee for civic affairs.

In addtion, the ESM proved less timorous than other local societies on some questions. For example, where other societies, such as the WSE, avoided direct involvement in hiring practices for municipal positions, the ESM did not hesitate to cooperate fully with the city's Civil Service Commission. In 1917, in response to a request from city administrators, the ESM created a Board of Engineers to examine applicants for city engineering positions.

As for questions being debated by both the national and local engineering societies, such as licensing, the Engineering Society of Milwaukee seems to have taken a slightly less active role in the licensing debate in Wisconsin than other groups did elsewhere. Other than noting that the ESM officially supported licensing engineers, there is little mention in ESM records of the licensing issue. Local problems such as

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[185] Anonymous, "Highlights of our first fifty years," Milwaukee Engineering October 15, 1954:6-11.

[186] Ibid.

smoke abatement and traffic control in the city apparently sparked greater interest among members.

State Societies

Engineers began organizing state societies in the late 1870s. Civil engineers and surveyors apparently felt compelled to organize as questions of land measurement and engineering competence became more widespread. During the years following the Civil War it was common practice for a man to work briefly in a relatively low position, such as rod man, on an engineering job and then move on to present himself to prospective employers as an actual engineer competent to lay out property lines or supervise bridge construction. These poorly trained so-called engineers left a trail of unhappy clients and pending litigation in their wake. Not surprisingly, reports in Engineering News indicate that the first item on the agenda for many nascent state associations of civil engineers and surveyors was a discussion of pending legislation regarding licensing surveyors.

Not all state organizations were motivated by concerns over competence, however. In this section I describe two state societies, one of which emerged from such concerns and another in which different factors drew engineers together. Engineers in Helena, Montana, founded the Montana Society of Engineers in 1887 to help counteract the dangers of professional isolation in an extremely large and sparsely populated state. Regular monthly meetings seem to have served as much to maintain morale as to share the latest technical information. In contrast, the Michigan

Association of Surveyors and Civil Engineers, founded in Lansing, Michigan, in 1880, focused immediately on issues of professional competency and avoiding lawsuits. Only later did the Michigan society begin to discuss a variety of engineering and technical topics.

Montana Society of Civil Engineers

A small group of Montana engineers organized the Montana Society of Civil Engineers at Helena in June 1887. Unlike many state associations, the Montana society does not seem to have been moved to organize by concerns regarding legal issues revolving around surveying or the competence of civil engineers. Organizers included engineers associated with the Montana Central Railroad, such as C. H. Beckler, and consulting mining engineers, such as James Keerl. Although the name indicated the society was an organization of civil engineers, membership in the Montana Society was open to qualified mechanical, mining, and military engineers as well as architects and geologists.

The official minutes from the early meetings, as published in the society's Proceedings or as reported in Engineering News, focus on discussions of the proposed national Department of Public Works or on specific technical papers. The April 28, 1888, meeting, for example, featured a paper presentation by J. H. Farmer, an engineer with the Montana Central Railroad, on the construction of the Wickes tunnel. Farmer provided engineering drawings showing views of longitudinal and cross sections to better illustrate construction methods. The report in Engineering News notes that "The paper proved a very interesting one to the members, who discussed its various features at some length."[187]

Even at the height of the mining boom Montana remained a sparsely populated state, thus, membership in the society was low compared to other state associations. Fifty-one engineers responded to the initial call for members, and the membership remained at approximately fifty for the following decade. Attendance at the regular monthly meetings was, in fact, generally so small that no special meeting hall had to be reserved. For many years members attending the monthly meeting simply congregated in the offices of various members.

In fairness to the Montana society, however, it must be noted that the percentage of members attending monthly meetings averaged higher than that of groups of a much more concentrated or urban nature. In his 1894 report to the Society President W. A. Haven noted that the annual meeting had been attended by "more than half of our entire membership, and, as they reside all over a State larger in area than all of New England and the State of New York combined, . . . such a meeting is something to be proud of. . ." Given that in the early years of its existence the Montana Society traditionally held its annual meeting in January and that travel conditions for members coming from the farther corners of the state were no doubt arduous, Haven's pride seems justified.

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187 Engineering News May 19, 1888:41.

The society held its second annual meeting at the Helena office of Chief Engineer Beckler of the Montana Central Railroad with only twelve members present. Those twelve members, however, packed as much activity into their two day meeting as any larger society. After conducting the necessary business on the society on Saturday, including election of officers for the coming year, the group adjourned until the following Monday morning.

On Monday morning the members boarded a special car of the Montana Central and proceeded to Butte, three hours away. Local members of the Society met their train in Butte and joined the group on a special train to inspect the copper mining complex thirty miles away at Anaconda. After a full day of touring the open pit mine, stamp mills, and smelters the party returned to Butte at 6 p.m. for a "hasty lunch" followed by several hours of paper sessions.[188] At 10 p.m. Society members adjourned to the Metropolitan hotel restaurant for a ten course banquet that lasted until 3 a.m. Engineering News reported that "The next day the Helena contingent returned home after voting the trip a grand success."[189]

By the late 1890s, ten years after its founding, the Montana society's total membership had more than doubled to a total of 112 members. Much of this growth in membership took place with the addition of new members from Butte and the surrounding area as the copper mines and smelters expanded their operations. In 1898

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188 Engineering News February 16, 1889.

189 Ibid.

members began pressing for an amendment to the Society's constitution which would allow the relocation of the Society's headquarters from Helena, the state capital, to Butte, the state's industrial center. Members approved the move in 1900.

Prior to the move to Butte, the Montana Society of Civil Engineers had taken a lively interest in state politics and pending legislation. Society president W. A. Haven had noted in 1894 that:

> The men who in thirty years have made this State what it is, men who have developed these mines, built these smelters and mills and reduction works, and who have made these beautiful cities where twenty-five years ago there were but barren hillsides and valleys and gulches, . . . when any question of public interest arises, they look to the engineer, hoping to be informed about the engineering law. The Montana Society of Civil Engineers is respected by the public, and only last winter, when an important question was before the legislature, dozens of its members asked me: 'What does the Montana Society of Civil Engineers think of this proposed law?' Already one or two laws have been passed solely on account of their being recommended by our Society,. . .[190]

An analysis of the meetings for which detailed data are available prior to the move to Butte indicates that approximately one third of the meetings included discussions and actions, such as the drafting of memorials (position statements) for presentation to the legislature. After the move to Butte, three hours by train removed from Helena and immediate access to state officials and legislators, political activity decreased significantly, from discussions at one in three meetings to perhaps one in ten. Whether this was a direct effect of distance or the result of other changes within the state or the society is, of course, impossible to determine with any degree of certainty.

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[190] Journal of Association of Engineering Societies Proceedings XIII(1894): 13.

Although the Society's interest in direct political intervention may have diminished over time, the Montana Society continued to prosper following relocation of its headquarters to Butte. When in 1914 the Society members voted to terminate their affiliation with the Association of Engineering Societies it did so because it had grown to the point of being financially strong enough to publish its own separate journal. The Society continued to hold regular monthly meetings in Butte, but moved the annual meeting to the summer when weather conditions made excursions to sites of engineering interest more feasible.

Governance of the Montana Society was similar to that of other engineering clubs. Elections for a president, vice-president, secretary, treasurer, three directors, and a representative to the Board of Managers of the Association of Engineering Societies were held annually. The three trustees served overlapping three year terms, with one trustee being elected annually. Officers could repeat in an office, but only occasionally did so when elected as president. Despite having a Board of Directors, as a small organization the society rarely delegated routine business to the Board or to an executive committee. Members discussed business pending before the society at the regular monthly meetings before listening to paper presentations. Members also voted on applications from prospective members rather than deferring to a membership committee. New members had to be approved by a three-quarters vote of the members present at a meeting. Applications were usually discussed at one meeting with the actual vote taking place the following month.

Not all monthly meetings of the Montana Society featured formal paper presentations. In the event of a shortage of technical papers to be given by either members or visitors, rather than read and discuss a paper appearing in a current issues of an engineering journal as some clubs did, the Montana engineers would simply discuss topics of general interest. A shortage of papers constituted an ongoing problem for the Montana Society as it did for many other smaller, geographically isolated engineering clubs. The large urban clubs, such as Philadelphia and Boston, had no shortage of prospective speakers, but the small, less prestigious organizations encountered difficulties both in securing outside speakers and in persuading their own members to present their work. Thus, in reviewing the minutes of the smaller clubs, such as Montana, it is common to find that certain members presented papers on a regular basis. J. H. Farmer, mentioned above for his presentation on tunnel construction in 1888, spoke to the Montana Society half a dozen times over the course of the following decade on topics including stamp mills, steam power, and mining. In contrast, the Western Society of Engineers in Chicago rarely had repeat speakers. The Montana Society may have reduced the social and professional isolation of individual members within the state, but the geographic isolation of the state of Montana itself served as a barrier to the Society regularly obtaining noteworthy outside speakers.

Michigan Association of Engineers and Surveyors

On March 24, 1880, a group of thirty-five civil engineers and surveyors met in Lansing, Michigan, to organize a society for "the purpose of improving ourselves in the knowledge of our profession and securing greater uniformity in our methods . . . "[191] The men gathered in response to a call for members placed in circulation the previous month by fourteen Michigan engineers, including Charles A. Greene, a professor of engineering at the University of Michigan. The authors of the call for organization began by noting the "urgent need for greater uniformity in our methods of practice," went on to say "that our state law with reference to surveys is grossly inadequate," and concluded by urging engineers and surveyors to

> Bring any questions arising in your practice that may be of interest to yourself or others -- any doubtful or difficult case. This is important; past experience must light the future. Bring your transit, or compass, and chain for comparison. Let us have a collection of old instruments, and new.[192]

As an added inducement, the organizers informed potential members that reduced rail fares and discount hotel rates had been arranged to "materially lessen the expense of coming."[193]

The organizational meeting was well-publicized, with notices appearing in state newspapers as well as in the national engineering press. Engineering News, for example, commented on the upcoming meeting in its February 21, 1880, issue. The editor urged all Michigan engineers to participate and expressed the hope that "the

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191 Preamble to the Constitution of the Michigan Association of Surveyors and Civil Engineers, Proceedings of the Michigan Association of Surveyors and Civil Engineers 1880:3.

192 Proceedings Michigan Association of Surveyors and Civil Engineers 1880: 7-8. See also Anonymous, "Michigan Association of Surveyors and Civil Engineers," Engineering News April 10, 1880: 129.

193 Ibid.

Convention will be successful, and it will inaugurate a new era in the profession in Michigan."[194]

The Lansing meeting lasted for three days. After drafting articles of association and electing its first slate of officers, the thirty-five men present devoted the remainder of the meeting to discussing two questions: Should there be a state manual of standard practice? What was the most effective method of permanently marking corners? The latter had become a pressing issue for surveyors as the continuing destruction of witness trees and other evidence of the original United States survey had caused numerous corners to be lost. Lost corners created both ill-will and the potential for expensive litigation.[195] R. C. Carpenter of Lansing, Thomas Love of Avery, and George Steele of Elk Rapids agreed to serve on a committee to investigate the question of a manual and promised to report back to the Association at its next meeting. Other society members were asked to provide the committee members with field notes, diagrams, and other materials that might be useful in drawing up a manual of standard practice. After some discussion, members moved to also include the question of riparian rights in the manual.

When the Association convened in Lansing in January of the following year, the committee working on the manual reported that significant progress had been made, but a number of questions remained that they wanted to lay before the membership as a

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[194] Engineering News February 21, 1880: 65.

[195] See, for example, Proceedings Michigan Association of Surveyors and Civil Engineers 1881: 7.

whole for discussion and clarification. The committee believed the manual should exclude any information on the mathematics of surveying "so far as already supplied by text-books," but that it should clearly define the principles of surveying, including a history of how the United States rectangular system had come into use. The committee ended its report by noting "[we] have expressions of encouragement, and an active demand for the manual from surveyors, lawyers, etc., from all parts of the state and abroad. . . . the question of publication will be easy of solution whenever the manuscript is ready."[196] The society then discussed several questions of practice that the manual committee had presented as requiring clarification, including a case where an erroneously located center of a section caused roads to be run through quarter sections rather than along the legal lines. The legislation providing for the survey of federal lands had mandated that public roads would run along the edges of sections (a section is one square mile in size) as a convenience to potential homesteaders, but misplaced markers occasionally resulted in roads erroneously cutting across sections away from the legal lines.

Despite the stated need for the manual, the committee did not complete its assigned task until 1884. At the fifth annual meeting, held in Saginaw January 1-4, 1884, the committee turned the manuscript over to an examining committee for review. As prepared by the manual committee, the manual of standard practices would include six chapters. Four chapters would describe specific practices, such as the proper use of

[196] Michigan Association of Surveyors and Civil Engineers Proceedings 1881: 10-11.

instruments. One chapter would be devoted to discussing current laws and past significant legal decisions. The final section of the book would provide mathematical tables, such as natural sines and tangents. The examining committee approved the manual for publication. The society Proceedings for 1886 noted that it was available at $2 per copy and, in the opinion of the Secretary, R. C. Carpenter, "is without doubt the best publication on the subject ever prepared."[197]

The first meeting of the Michigan Association of Surveyors and Civil Engineers included no representatives from Michigan's Upper Peninsula, but the organizers apparently meant to reach out to that region of the state, too. Unlike some engineering societies, such as the Wisconsin Polytechnic Society, that carried state names but then drew all its members from one region or city within the state, the Michigan Association intended to represent all practicing surveyors and civil engineers statewide. At its first meeting the members agreed there would be nine vice presidents, one from each Congressional District within the state. The office of vice president from the First District was left vacant. Officers would serve for one year. Dues were set at $1 per annum. Members delegated routine business to an executive committee consisting of three Association members, the president, and the secretary. Members of the executive committee were appointed by the president and expected to serve for one year.

The first four annual meetings of the Association convened in Lansing. As noted above, the organizers called the first meeting to address specific legal and

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[197] Michigan Engineering Society Proceedings 1886: 11.

technical issues in civil engineering and surveying practices. Problems such as lost corners caused by a lack of standardization in instruments and practice had led to expensive litigation and damaged reputations. The programs for the first three meetings were devoted exclusively to resolving those issues. By January 1883, however, appreciable progress had evidently been recorded in eliminating the worst problems. The Association had formed a working relationship with the State Land Office as well as with the state legislature. A committee on legislation, created at the 1882 meeting, reported it had succeeded in having legislators review statutes regarding the practices of professional surveyors and to introduce legislation requiring surveyors to be bonded. The 1883 meeting was the first at which the program expanded to include formal paper presentations on topics beyond narrow considerations of engineering competency or surveying accuracy. The speakers included Charles B. Hyde describing the "Construction and Care of Water-works suitable for small cities in Michigan;" A. L. Reed's discussing "Construction and Operation of Narrow-Gauge Railroads;" and H. G. Rothwell presenting his thoughts on "Wooden Pavements."

The 1883 meeting was also the first at which it was suggested that other cities be used as sites for the annual meeting. After some discussion, members voted to meet in East Saginaw the following year. That meeting, held January 1-4, was noteworthy for several reasons.

It was at the East Saginaw convention that the members of the Michigan Association of Surveyors and Civil Engineers decided that both the composition and the orientation of the organization had changed to the point that amendments to the constitution were in order. The society established standing committees on Surveying, Railroad and Bridge Engineering, Mechanical Engineering, Mining Engineering, and Sanitary Engineering, a reflection of the increasing diversity of occupations among members. Following creation of the five new committees, the Executive committee suggested changing the name of the MASCE to the Michigan Engineering Society, a change readily endorsed by the membership. Finally, the society abandoned the practice of having nine vice presidents, adopting instead the more standard practice of having only one. The office of the vice president remained relatively free of specific duties or responsibilities as it was the only office excluded from the Executive Committee.

The by-laws did not specify either that a member serve in a lesser office, such as vice president, before being elected to the presidency or that the number of terms for any office be limited. Most presidents served only one term at a time, although several, such as as J. P. Davis, were elected president again after being out of office for a year or two. The size of the state of Michigan and difficulties in communications during the early years of the society did, however, lead to occasional misunderstandings with nominees for office. The Executive Committee apparently failed to receive assurances from prospective officers that they would indeed serve if elected. In 1892, for example, W. H. Durand received an overwhelming majority of votes for president before notifying the Executive Committee that he was unable to accept the office. The outgoing president agreed to stay on for another term rather than subject the membership to the nuisance of another election. Unlike many other societies, the MSE apparently neglected to include a provision in its by-laws that the consent of a nominee must be obtained before placing his name on a ballot.[198] Ballots were mailed to members following the annual meeting of the Executive Committee, usually held in October or November, and then election results announced at the membership meeting in January.

The Michigan Society of Engineers reached out to other engineering organizations as well as individual engineers very early in its history. The Proceedings from 1881 and 1882 include references to correspondence with state associations in the neighboring states of Ohio and Indiana. Surveyors from Ohio attended the 1883 convention. By 1884 the membership rolls included engineers who listed professional addresses in Iowa, New York, and Ohio. In his remarks before the 1885 meeting, president Joseph P. Davis said

> I look to see this Society gather into its membership the mass of "Persons engaged, or actively interested, in engineering" in this State. This Society, I believe, is to go on in its work, embracing, more and more, the broad field of engineering pursuits in Michigan. The membership will increase. It will be, increasingly, drawn from members following widely different branches of work. . . [N]one will ever cease to honor the band of faithful surveyors who first made all this possible.[199]

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198 Cf. Proceedings of the Lake Superior Mining Institute 7(1901): 3.

199 Michigan Society of Engineers Proceedings 1885: 9.

The society exchanged copies of its proceedings and technical reports with a number of other state societies, including Nebraska, Ohio, and Indiana, on a one-for-one basis. At one time smaller state societies were asked to send two copies of their reports for every one that the Michigan society sent to them, as the reports received were distributed to the membership, but this practice was halted in the early 1890s on grounds it was unfair to the small societies.[200]

In December 1885 the Michigan society sent delegates to a national convention organized by the Civil Engineers Club of Cleveland. Organizers declared the purpose of the convention was to "demand that the civil public works of this country be organized into a formal system."[201] Ten societies, including the Engineers' Club of Philadelphia and the Cornell University Association of Civil Engineers, sent accredited representatives, while another six organizations expressed their support of the overall goal of the meeting in letters. Engineers attending the meeting designated Joseph P. Davis, president of the Michigan society, to serve as chairman of a committee to prepare a report on the proposed creation of a Federal Civil Bureau of Public Works.

When Professor Davis reported back to the Michigan Society at its annual meeting held the following month, January 1886, in Ann Arbor, he requested that Michigan engineers show their support of the work of a permanent Civil Engineer's Committee on National Public Works by allocating funds to defray the committee's

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[200] Michigan Society of Engineers Proceedings 1888: 199.

[201] Michigan Society of Engineers Proceedings 1886: 18. Cf. Engineering News March 27, 1886: 233.

expenses. Davis suggested an assessment of 50 cents per member. He optimistically calculated that if all the members of all the participating societies each gave that amount over $1,000 could be raised.

The Michigan membership overall apparently did not share Davis's enthusiasm for either a national department of public works or a national engineers' committee. The MSE Executive Committee members decided to distribute a notice providing information on the committee's work and asking the men in the Michigan Society of Engineers to contribute $1 above their annual dues to support the national committee. The following year, at the 1887 annual meeting, Davis reported that while "Upwards of 200 of these circulars were sent. The result has, so far, been $20.00."[202] Davis, who had invested his time and effort in the activities of the Public Works committee, went on to note with a hint of bitterness,

> By this means your committee have been made aware of the interest of our members in this work. This sum has not been forwarded yet in the hope that it would be very materially increased as we certainly should bear our share in the labors for this much needed reform, otherwise the day will surely come when we shall regret it.[203]

The fact that the $20 came from only nine members, three of whom contributed more than the requested $1, probably exacerbated Davis's frustration. Having less than five per cent of the membership support a project he believed vital to the both the national interests of the country and the well-being of his profession had to be painful.

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[202] Michigan Society of Engineers Proceedings 1887:96.

[203] Ibid.

Although the Michigan society evidenced little interest in joining forces with other societies to influence national legislation, within the state the society continued to take an active role in formulating policy regarding engineering practice. An 1892 discussion of the wisdom of advocating licensing engineers reminded some members, such as George Steele, of annoying past snubs by politicians. Steele believed that preparing recommendations "would be an utter waste of time to spend it upon a legislature that would not do anything."[204] Other members disagreed. A Mr. Todd noted that both the senator and the representative from his home district held high opinions of the MSE. According to Todd, they had told him that "if there was anything they could do to advance the interests of the society, that was reasonable, they would willingly and gladly do it."[205]Todd suggested that MSE members take the the time to get to know the elected officials from their districts as "if every member of this society will take the member of his section in hand, he could manipulate him to good advantage."[206]

Local or Regional Special Interest

Local and regional societies organized around specific occupational interests or industries began to appear at the same time as the more general engineering clubs. Engineers involved in coal gas production, for example, formed the New England

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204 Michigan Society of Engineers Proceedings 1892:168.

205 Ibid.

206 Ibid

Association of Gas Engineers in 1870. As the technical components of urban infrastructure systems, such as sewerage, water, and gas and electrical lighting, became more complex engineers responsible for waterworks and other utilities found it increasingly useful to meet regularly with their peers to exchange ideas and knowledge. Engineers working in private industries involving complex systems or specialized technologies, such as mining, railroads, and irrigation, soon followed. These special interest societies might involve engineers residing within a fairly small geographic area, such as the Cincinnati Electric Club, or a large one, such as the New England Roadmasters Association. These more specialized associations were both broader and narrower than many engineering societies.

They were broader in that the membership criteria for a specialized society might be less restrictive than those for a society such as the Western Society of Engineers that specified that prospective members either be educated or working as engineers. A waterworks association could include plant owners, bacteriologists, and medical men as well as engineers. Similarly, a mining institute might number accountants and mine owners among its members. Specialized societies proved narrower, of course, in their orientation toward one specific industry or technology and its problems and applications. Where an organization such as the Louisiana Engineering Society would discuss topics of every sort, including advances in aviation, flood control, and the comparative merits of brick and wooden pavements, specialized societies considered issues only as they applied to their own industry. This held true for social as well as purely technical issues. Thus, while a speaker at a meeting of the St. Louis Engineers Club might argue for support of public education on the grounds of general good for the public welfare, a speaker discoursing on the same topic before an association of mining engineers would, as J. Parke Channing did in discussing building new schools in Ishpeming, Michigan, in 1905, ground his argument by saying that an educated public would better supply the quality of workers the industry required.[207]

In this section I describe two specialized societies, the Lake Superior Mining Institute and the New England Waterworks Association. The former, founded in 1893, was a professional society that emerged as part of a private industry, while the latter, organized ten years earlier, involved persons working in what would become a public utility.

Lake Superior Mining Institute

The Lake Superior Mining Institute, like the larger, national society, the American Institute of Mining Engineers, upon which the organization modeled itself, was founded "to promote the arts and sciences connected with the economical production of the useful minerals and metals . . . and the welfare of those employed in these industries . . . "[208] Organized in Lake Superior region in 1893 by mining superintendents working on the Menominee Range in Michigan's Upper Peninsula

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207 Proceedings of the Lake Superior Mining Institute 1905:

208 "Rules of the Institute," Proceedings of the Lake Superior Mining Institute VII(1901):1.

(U.P.), the Lake Superior Mining Institute drew members from four other major mining districts of the upper Midwest: Minnesota's Mesaba iron range, Michigan's Copper Country, and two other Michigan iron ore ranges, the Gogebic and the Marquette. The Gogebic, which was located at the extreme western end of the U.P., extended into northern Wisconsin.[209]

The Lake Superior Mining Institute, like the majority of local and state engineering clubs organized in the nineteenth century, resulted from a general call for prospective members. In mid-February, 1893, William Kelly, a mining superintendent from Vulcan, Michigan, circulated a letter throughout the mining regions of the upper Midwest. The letter appeared in various local newspapers as well as being mailed privately to 600 individual engineers and mine superintendents. By March 16, 1893, a week before the first official meeting, Kelly was anticipating an attendance of at least 150 persons.[210]

Although the letter went out over Kelly's signature, Kelly himself insisted credit for organizing the Institute lay properly with J. Parke Channing, a mining engineer on the Marquette range. According to Kelly, Channing had arranged for a meeting of mining men in Ironwood, Michigan, in early February, 1893, at which the engineers in

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209 See also James Edward Jopling, "The Lake Superior Mining Institute," Manuscript, 1928, Marquette County [Michigan] Historical Society.

210 Anonymous, "Meeting of Mining Men," Iron Mountain Range Tribune March 16, 1893: 1.

attendance made plans for a permanent organization.[211] The men present named Kelly to serve as acting secretary and directed him to distribute a letter announcing the March organizational meeting to be held in Iron Mountain.

After Kelly distributed the letter, newspapers throughout the mining districts reported favorably on the attempts to organize the industry. The Iron Mountain (Michigan) Range Tribune, for example, editorialized on February 23, 1893, that

> We trust this meeting will find a large attendance and the interest that should attach to an object of such importance as the one in view. It is certain that an association of this kind would result in much good to the mines of this region. There is much to be learned by closer association on the part of those who are connected with the operation of mines, and there are none so skilled or experienced that they cannot glean something from the consideration or work of their neighbors.[212]

Comments in some newspapers apparently alluding to the wisdom of banding together for economic reasons, e.g., to exert more control over the price of iron ore, prompted Kelly to write a second letter for publication. In it he said

> To prevent any misapprehension of the scope of the proposed miners association of Lake Superior, it seems proper to state its objects as outlined at the recent meeting at Ironwood. The plan is to meet two or three times a year in different districts, visit the neighboring mines, hold sessions for the reading and discussion of papers on practical mining engineering as applied to mining ores. . . . It is quite natural to expect that such opportunities for the interchange of ideas will be of great benefit to the mining interests as well as a pleasure to its members.

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211 Anonymous, "Mining Superintendents: Menominee and Gogebic Mining Men Meet," Iron Mountain Range Tribune February 9, 1893: 1.

212 Anonymous, "Organization important," Iron Mountain Range Tribune February 23, 1893: 3.

> It seems hardly necessary to add that it would be quite foreign to the plan of such an association to enter into the discussion of costs, marketing of product, and prices of labor and material. . . . The association is to promote education and social intercourse and not business and political interests and it is on such lines and such lines only that success is promised.[213]

The organizational meeting was indeed well attended. The Range Tribune on March 23, 1893, reported that "there are now in the neighborhood of two hundred members in attendance, every range and the copper country being represented."[214]

The men met on Wednesday evening to appoint committees to review the draft constitution and prepare a slate of permanent officers. The evening concluded with a paper presentation, "Soft Ore Mining," by Per Larsson of the Aragon mine near Norway, Michigan. The daylight hours on Thursday were devoted to excursions to iron ore mines in Iron Mountain and the surrounding area, such as the Chapin, Ludington, Curry, and East Vulcan mines. Approval of by-laws and formal election of officers highlighted the Thursday evening session, followed by a lecture by Dr. Nelson P. Hulst of Milwaukee on the geology of the eastern Menominee range. The meeting concluded officially at noon the next day after a tour of the Pewabic Mine.

Under the by-laws approved by those in attendance, the new organization would be known as the Lake Superior Mining Institute. Membership was open to "all

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213 William Kelly as quoted in Anonymous, "Meeting of Mining Men: Every Indication of A Large Attendance at Coming Meeting," Iron Mountain Range Tribune February 23, 1893: 1.

214 Anonymous, "Mining Men's Convention!," Iron Mountain Range Tribune March 23, 1893: 1.

person interested in mining on Lake Superior."[215] The Institute would have a total of thirteen officers: a president, secretary, and treasurer elected annually, and five vice presidents and five managers elected biennially. Each of the five major mining ranges of Michigan, Wisconsin, and Minnesota -- the Copper Country and Menominee, Marquette, Gogebic, and Mesabi iron ranges -- would be represented by one vice president and one manager. Terms would be staggered so that only half of the vice presidents and managers would leave office in any given year. Officers were allowed to serve consecutive terms if the membership so desired. A nominating committee prepared a slate of officers prior to each meeting. Candidates generally ran unopposed and were elected by acclamation.

This first meeting established the pattern for ensuing years. Members would convene on Wednesday, conduct society business and discuss technical papers on Wednesday and Thursday evenings, and enjoy excursions during the day on Thursday and Friday. Although Kelly had been explicit in rejecting politics, political discussions nonetheless occasionally crept into the program. In 1895, for example, LSMI President John Duncan spoke of the need for state legislators to act to toughen mine inspection laws and "cooperate in checking this unnecessary loss of life."[216] Other than discussing the problem of incompetent inspectors and inadequate statutes, however, the LSMI undertook no direct political action, such as drafting memorials for presentation to

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215 Proceedings of the Lake Superior Mining Institute 1(1893): 3.

216 Proceedings of the Lake Superior Mining Institute 3(1895): 48.

state officials. Local newspapers provided extensive coverage of the Institute meetings, reporting in depth on the content of paper sessions and even printing the entire text of technical papers presented. Weekly newspapers serialized reports so that news items relating to the Institute would still be appearing several weeks after a meeting ended.[217] Knowing that newspapers would give ample page space to his remarks Duncan and fellow LSMI members may have been confident that simply speaking bluntly in a public forum would help bring about the desired reforms.

The LSMI initially resisted efforts to expand its activities beyond its original scope. Members rejected proposals to set up special committees or panels to investigate specific technical questions. A number of both local and national engineering organizations established such committees in the 1890s, but the LSMI chose not to emulate those groups. The ASCE, for example, appointed a committee to determine the ideal size and shape of steel rails for railroads. When a member suggested in 1895 that the LSMI establish a committee to look into a specific technical question, William Kelly reminded him that "The object of our institute, as I understand it, is for the purpose of holding meetings where papers may be read and discussed. . ."[218] Kelly went on to explain that while certain technical questions did need to be answered, asking members to serve on committees was not the most effective means by

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217 See, for example, Anonymous, "Methods of Mining: Paper Read at the Convention of Mining Men by Supt. Per Larsson," Iron Mountain Range Tribune March 30, 1893: 3.

218 Proceedings of the Lake Superior Mining Institute 3(1895): 6.

which to pursue those issues. The LSMI eventually established five standing committees to review annual progress in specific areas -- Practice for Prevention of Accidents, Care and Handling of Hoisting Ropes, Papers and Publications, Bureau of Mines, and Mining Methods on the Mesabi Range. By 1912 when the members approved creating these committees total membership had grown to 486 persons.[219]

Members of the Lake Superior Mining Institute tended to be almost uniformly men active in the mining industry either as owners or engineers, although a number of railroad engineers also belonged to the LSMI. The very location of the Institute, the region around Lake Superior, precluded extensive involvement by academics. This contrasts sharply with the Michigan Society of Engineers, which was founded and strongly influenced by professors at the University of Michigan in Ann Arbor and Michigan State in East Lansing. Faculty members from the Michigan College of Mines in Houghton, Michigan, such as Marshman Edward Wadsworth, president of MCM from 1887 to 1899, and Frederick W. McNair, Wadsworth's successor, did join and take an active part in the LSMI, but professors of engineering constituted a small minority within the organization. Officers tended to be persons such as T. F. Cole, president of Oliver Mining in Minnesota; George H. Abeel, general manager of the Montreal Mining Company in Hurley, Wisconsin; and John M. Longyear, a mine owner and financier from Marquette, Michigan. Academics, such as McNair, served an infrequent two year term as a director or vice president, while mine superintendents,

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219 See Proceedings of the Lake Superior Mining Institute 17(1912).

such as Graham Pope, were elected to office as a manager, vice president, or president repeatedly. The LSMI membership, like many engineering societies, valued practical experience and achieved status.[220] John Duncan, a Scottish immigrant and assistant superintendent with Calumet & Hecla at the time of his election to the LSMI presidency, began his mining career as an ordinary carpenter and worked his way up to being placed in charge of all surface operations and lands.

From the original 160 members present in Iron Mountain in 1893, the LSMI grew rapidly to 315 members in 1901 and 507 members in 1910. As Figure 4 on the following page illustrates, membership numbers dipped briefly in 1894, but the organization survived. Prospective members had to provide references from three current members and were elected by a ballot requiring a three-fourths majority. According to the by-laws, "Any person interested in the objects of the Institute [was] eligible for membership."[221]

Attendance at annual meetings tended to be high. In March, 1901, for example, more than 200 members, over fifty percent of the membership, attended the annual meeting held in Houghton, Michigan. Members toured the copper mines and smelters of the Keweenaw Peninsula during the day while enjoying paper presentations in the evening.[222]

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220 See, for example, Melone.

221 Proceedings of the Lake Superior Mining Institute 7(1901): 1.

222 Anonymous, "Members of the Mining Institute Take in Calumet Sights," The Copper Country Evening News March 6, 1901: 3.

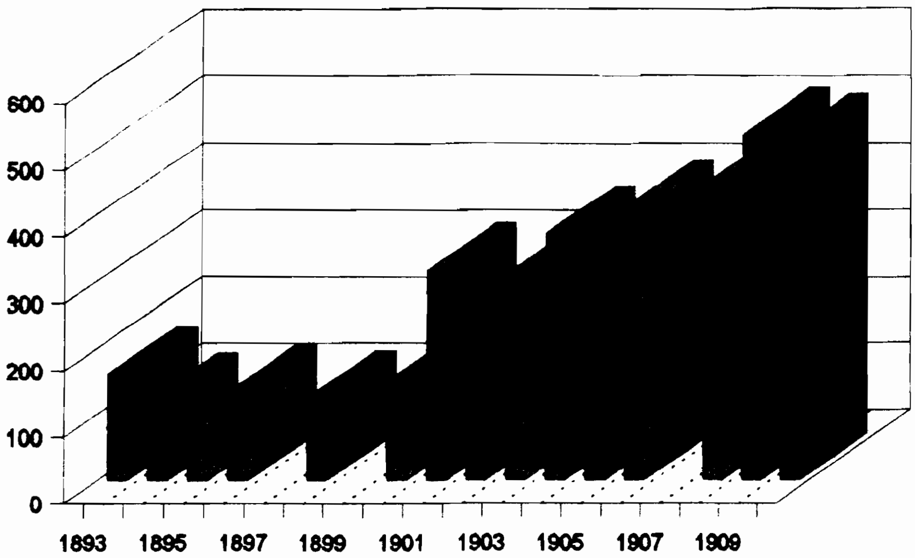

Figure 4 Growth of Lake Superior Mining Institute

Meetings of the Lake Superior Mining Institute often required logistical planning that would have taxed a military commander. Arranging lodging, dining, and meeting rooms for 200 men in the most recently developed mining ranges could not have been easy. Primitive conditions, muddy streets, poor sanitation, and few hotels were common problems. Visitors to the Gogebic Range in the 1890s, for example, were advised as they stepped off the train that their first stop should be at the local mercantile to purchase stout, knee-high rubber boots due to the depth of the mud that filled city streets in Ironwood and Hurley. Local arrangements committees worked closely with railroad companies, such as the Chicago & Northwestern and the Duluth, South Shore, & Atlantic, in co-ordinating transportation. Railroads would lay on special trains, often at minimal charge, for LSMI conventions. For the August, 1902, meeting on Minnesota's Mesabi and Vermillion Ranges, the local committee arranged for a private train consisting of eight Pullman cars, six sleepers, and two dining cars. The local towns -- Hibbing, Eveleth, Mountain Iron, and others -- had been developed so recently that they "had not yet the facilities to accomodate such a large number of people."[223] Even when meeting in older, more established cities, the local arrangements committee occasionally asked the railroads for their help. For 1903 meeting on Michigan's Marquette range, for example, Pullman cars were provided for members unable to obtain hotel accomodations in Ishpeming.[224]

Meals might be taken in the dining cars that were part of the convention's private train or arranged at restaurants in local communities. Private receptions and entertainments were also common. Before boarding the private train bound for the Mesabi Range in 1902, for example, Institute members had been feted at a dinner given at a Duluth country club. When the LSMI met in Crystal Falls, Michigan, in 1911 the local Commercial Club prepared a barbecue at Idlewild Park on Fortune Lake.

> Matt Foucault [a local resident], with a score or two of assistants, had a 650-pound ox roasted, ready to serve, in addition to 1,000 ears of green corn, several bushels of beans (baked in a bean hole) and other eatables of the kind. Six hundred people were fed at this barbecue. . . [225]

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[223] Proceedings of the Lake Superior Mining Institute 8(1902): 6.

[224] Proceedings of the Lake Superior Mining Institute 9(1903).

[225] Anonymous, "Mining Institute Entertained Here," The Diamond Drill August 26, 1911: 1+.

A musical quartet furnished entertainment while Institute members and guests picnicked in the park. The following evening over 300 Institute members and guests were treated to a clam bake featuring lobster, blue fin, milk-fed chicken, and clams organized at the lakeside cottage of a local businessman. Area residents organized the event to honor the outgoing LSMI president, W. J. Richards. The local newspaper noted that the work involved in hosting the convention and preparing both the barbecue and the clam bake had been "enthusiastically entered into by every man in the city."[226] Richards, a mining superintendent on the Menominee Range, was evidently well-liked (or at least respected) in the local community. Caterers served mid-day meals for the Crystal Falls convention on dining cars of the private train provided by the Chicago & Northwestern for use in touring various sites within the mining district.

By the early 1900s the LSMI was solidly established. Attendance at the annual meetings remained sufficiently high that in 1902 the members moved to appoint a committee to design name badges to be worn at future meetings. The Lake Superior mining districts had grown to where members no longer knew each other by sight and felt badges would help convention goers remember other members' names. The 1900s witnessed also the occasional shifting of the annual meeting away from the actual mining sites. Local arrangements committees scheduled special trains that allowed a meeting to take place in cities hundreds of miles apart. The 1904 meeting began in Ironwood,Michigan, and concluded in Milwaukee, Wisconsin, as LSMI members

[226] Ibid.

followed the ore from its source in the mine to the finished products in foundries and factories. Six years later, in 1910, a similar meeting schedule took members from their rendevous and business meeting in Ironwood to the steel mills of Gary, Indiana.

Convention programs also began to include a few lighter elements, such as time to watch a baseball game in Ishpeming, Michigan, between tours of local mines in 1909. Overall, however, the LSMI did not stray from its original path. The organization remained tightly focused on providing a forum for the exchange of technical information. Although social and political issues did occasionally creep into the discourse, it was always in the context of what would most benefit the mining industry. Rather than arguing that engineers should work to better society because it was their professional duty to do so, LSMI members argued for improved worker housing or safer working conditions because it would make it easier to recruit and retain skilled labor.[227]

Having successfully grown as a narrowly defined voluntary association with specific goals, the LSMI membership would see no reason to alter either its original objectives or its established methods for achieving them. By 1912, when the American

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[227] See, for example, W. H. Moulton, "The Sociological Side of Mining," Proceedings of the Lake Superior Mining Institute 14(1909). Cf. Desmond Fitzgerald, "Address of Past President, Meeting to Commemorate the Semi-Centennial of the Boston Society of Civil Engineers, November 11, 1898," Journal of the Association of Engineering Societies XXI(1898): 268-280; or H. J. Malochee, "The Engineering Society -- Its Relation to the Engineer and to the Profession," Journal of the Association of Engineering Societies XXVI(1901): 149-154, in which Malochee describes the engineer as "the leader in [society's] march toward the goal of universal happiness."

Institute of Mining and Metallurgical Engineers offered to allow the LSMI to combine its journal with that of the AIME, the LSMI felt comfortable in rejecting the offer.[228] Financially secure with a solid base of support provided by approximately 500 active members, the LSMI saw no need to relinquish any of its autonomy or identity to the larger national society.

New England Waterworks Association

The New England Waterworks Association was founded in 1882 by superintendents of waterworks in Connecticut, Massachusetts, Rhode Island, and New Hampshire. At the time engineers and city officials were coping with a number of different but all serious concerns regarding water supplies: technical questions revolving around equipment such as pumps; health questions regarding water purity; and financial concerns such as curtailing waste by water company customers. The American Waterworks Association, representing waterworks operators in large cities, organized in 1880, and the New England Waterworks Association, composed of representatives from the smaller industrialized cities of the Northeast, two years later. For members of the newly organized NEWA, waste led the list of problems to be addressed at its October 1882 meeting in Salem, Massachusetts.

The thirty-five men present represented twenty-six communities in Massachusetts, Rhode Island, Connecticut, and New Hampshire, with representatives from Massachusetts being the majority in attendance. Many of these towns, such as

[228] Proceedings of the Lake Superior Mining Institute 1912

Lowell, Massachusetts, and Manchester, New Hampshire, shared watersheds and drew water from the same rivers. Almost all, such as Fall River, Massachusetts, and Pawtucket, Rhode Island, were heavily industrialized and relied on rivers not just for drinking water but also for power for textile mills and other factories.[229] Unlike many local engineering societies that were organized for social as well as practical reasons, the members of the New England Waterworks Association came together almost exclusively to help each other find answers to specific technical questions.

At the Salem meeting, the members spent some time discussing the issue of water meters, listened to a presentation by a manufacturer's representative describing the specific merits of the meters his firm sold, took a brief dinner break, and then toured the Salem water works.[230] At the time the New England Waterworks Association was organized, most municipal water systems were owned and operated by private firms. According to historians Stanley K. Schultz and Clay McShane, as late as the turn of the nineteenth century only nine out of the fifty largest cities in the United States owned their own waterworks.[231] As private firms, their first concern had to be with profitability. Water meters had been discussed within the engineering and

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[229] See Robert B. Gordon and Patrick M. Malone, The Texture of Industry: An Archeological View of the Industrialization of North America (NY: Oxford University Press, 1994), pp. 57-115, for an overview of water and industry.

[230] Engineering News October 1882.

[231] Stanley K. Schultz and Clay McShane, "To Engineer the Metropolis: Sewers, Sanitation, and City Planning in Late-Nineteenth-Century America," The Journal of American History LXV(1978): 389-411.

waterworks community for some time as a method of curbing waste.[232] Thus, the initial meetings of the NEWA focused on measuring consumption, not on purification. During the 1870s and 1880s, many engineers still believed in the filth theory of disease. Operators of water works were often certain that the water they supplied was of good quality if it was drawn from a fast-flowing river and contained no obvious, i.e., visible to the naked eye, contamination. Undoubtedly, water from a central water plant could be more healthful than water drawn from the typical shallow well located in residential back yards close to privies and cesspools, at least as long as that water remained free from pollution from municipal sewerage systems and industrial waste. James P. Kirkwood, a pioneer in sanitary engineering, had demonstrated that rivers could clean themselves. Unfortunately, as discussions at ensuing NEWA meetings illustrated, rapidly expanding populations and industrial growth quickly overtaxed natural systems.[233]

Membership in the NEWA originally was limited to persons directly responsible for operating waterworks, such as waterworks plant superintendents, but quickly expanded to include anyone involved in the industry. Hydraulic engineers, sanitary engineers, city officials, and public health officials all became active in the NEWA.

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232 See, for example, Engineering News August 16, 1879: 257 for a description of new water meters.

233 See, for example, Anonymous, "Sixth annual convention of N. E. Water Works Association," Engineering News June 18, 1887: 401-402; or Anonymous, "New England Waterworks Association," Engineering News January 16, 1896: Supplement 13. Cf. Anonymous, "New Jersey Sanitary Association," Engineering News December 10, 1896: Supplement 212.

Governance was similar to that of most professional socities, with officers and directors elected annually. As the NEWA grew, funds were allocated to pay for clerical help in maintaining records and publishing the organization's journal.

The New England Waterworks Association expanded rapidly from its original small membership base. Within a few years, the association included waterworks operators and engineers from throughout the entire New England area and other states. As concerns about disease prevention became more prevalent, discussions of filtration and purification methods took their place on the program along with the discussions of the merits of various models of pumps and meters. The annual meeting grew from a one day affair to a convention lasting three days, but retained the familiar format of providing both paper sessions and excursion to sites of engineering interest. Like the LSMI, the NEWA published its own journal and, once firmly established, remained narrowly focused on its original goal of providing a forum for the exchange of information within the waterworks industry.

Discussion

In this chapter I provided brief histories of eight local, regional, and state societies. The two local single discipline clubs, the Western Society of Engineers and the Philadelphia Engineers' Club, both defined themselves simply as "engineers' clubs" without regard to specific discipline or occupational orientation at the time of their organization, but as the years passed the Western Society became increasingly focused on what most engineers would perceive as primarily civil engineering issues while the

Philadelphia club continued to examine a broad range of topics. Where the Table of Contents for the journal of the Western Society reveals paper after paper on railroads, bridges, waterworks, and sanitation, the Philadelphia club listened to speakers describing everything from the composition of paint to developments in telephony.

This contrast in evolutionary paths contains numerous piquant elements. The members of the Philadelphia club seem to have taken neither any special notice nor expanded much effort to be seen as an umbrella club rather than as a narrower, specifically civil engineering organization. The written record, as provided in news releases sent to the engineering press and in the official club Proceedings, indicates the membership roll grew naturally along with the rising population of engineers working within the city. As specialized national societies, such as the American Society of Mechanical Engineers, established local chapters in Philadelphia, the Engineers' Club invited those chapters to use the club meeting rooms and published their proceedings as part of the Engineers' Club journal. Without planning overtly to become an umbrella society, by the early 1900s that is what the Philadelphia club clearly was.

In contrast, the Western Society mirrored in many ways the mistakes and occasionally grandiose illusions exhibited during this same time period by the American Society of Civil Engineers. As noted elsewhere, the ASCE responded to the increasing fragmentation and specialization in engineering not by attempting realistic recruiting efforts, but instead by making its membership criteria more exclusive.[234] The ASCE

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[234] See also ASCE Proceedings 17(1891): 22-28. Cf. ASCE Proceedings 31(1905): 290-91.

engineering elite continued to refer to the ASCE as representing all branches of engineering while at the same time ensuring that many engineers, particularly those working in manufacturing, would never be eligible for full membership. While it would be unnecessarily harsh to use the same language John Trautwine jr employed when he referred to the "world-power mania" the society fell victim to in the 1890s, it is true the Western Society seems to have developed a higher opinion of itself than its actual status merited. In addition, like the ASCE, the officers of the Western Society seem to have believed that simply saying something would make it come true. That is, President Herr and other officers assumed that if they presented the Western Society as being the logical candidate to serve as the new national unified society, other engineers and engineering societies would agree. The consequent lack of action proved them mistaken in this belief. American engineers nationwide may have agreed that such a national umbrella society would be a good idea, but they were not about to meekly acquiesce with the Western Society's unilateral announcement that it would serve as the nucleus for that national society. Scholars in organization theory, such as Robert H. Salisbury, have posited that people generally affiliate with voluntary associations to meet one of three needs: solidary, purposive, or material benefits.[235] For engineers

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[235] Robert H. Salisbury, "An exchange theory of interest groups," Midwest Journal of Political Science 13(1969): 1-32; See also Edward Gross and Amitai Etzioni, Orgniazations in Society (Englwood Cliffs, NJ: Prentice-Hall, 1985); Peter Blau, Exchange and Power in Social Life, revised 2nd edition (NY: John Wiley & Sons, 1989 [1964]); Peter P. Ekeh, Social Exchange Theory: The Two Traditions (Cambridge, MA: Harvard University Press, 1974); or James Q. Wilson, Political Organizations (NY: Basic Books, 1973).

residing elsewhere than Chicago, other local or national organizations already met those needs.

Further, despite the Western Society's avowed interest in becoming the national voice for all engineers, as noted above, the society remained resolutely oriented toward addressing civil engineering issues almost to the exclusion of other topics. The society's elite consisted of aging engineers who had worked primarily on railroads, canals, and bridges. Many, such as Alfred Noble, George Morison, and Octave Chanute, were, in fact, members of the same elite that controlled the policies of the ASCE. Thus, it is hardly surprising that not only did the Western Society fail to become a national organization, it faced competition within Chicago as the nineteenth century drew to a close. Electrical clubs, a German polytechnic, and even a competing Chicago civil engineers' club all issued calls for members and published meeting announcements in Engineering News and elsewhere at the same time that the Western Society promoted itself as the foundation of a new national organization. Sociologists of organizations have long acknowledged that it can be difficult for an organization to grow in an environment that includes countervailing networks.[236]

The two local umbrella societies profiled, the Washington Society of Engineers and the Engineering Society of Milwaukee, also displayed significant differences as the years passed. Both were founded at approximately the same time, the early 1900s,

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[236] See, for example, David A. Snow, Louis A. Zurcher, jr, and Sheldon Ekland-Olson, "Social networks and social movements: a microstructural approach to differential recruitment," American Sociological Review 45(1990): 787-801.

with similar goals of facilitating social and professional intercourse between engineers in different disciplines. The Milwaukee society quickly became involved in local civic affairs, while the Washington Society chose to do the opposite. Where the Milwaukee engineers saw their society as providing the ideal medium for conveying their views on both technical and social problems within the city, their Washington, D.C., counterparts rapidly made it clear they believed it would be detrimental to the WSE to involve itself in political matters. Although the records of the WSE indicate that the WSE membership initially believed that the society would not hesitate to take a stand on matters of public concern, the Board of Direction wasted no time in becoming adept at avoiding any potentially controversial issues. In 1908 the WSE Board of Directors responded to suggestions that the society state a position on filling the post of the Navy's Chief of the Bureau of Steam Engineering by declaring it would not be in the best interests of the Society to make a recommendation one way or the other. The minutes of May 23, 1908, note that "After considerable discussion in which the sentiment of the Board was that the Society should not lend itself to personal or political matters. . . " the question was tabled.[237]

The Washington Society hesitated for many years to speak out on any but the most innocuous and hopefully noncontroversial matters, such as standardization in street signs, while the Milwaukee society jumped right into much more sensitive issues, including establishing civil service guidelines for city employees. The Washington

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[237] Minutes of the WSE, WSE Collection.

Society of Engineers, despite -- or perhaps because of -- its location in the District of Columbia remained studiously apolitical. In the 1920s the WSE did support positions taken by the Federation of American Engineering Societies, but even within the FAES the WSE seems to have maintained a very low profile. Members of the ESM, on the other hand, had no objection to their organization either co-operating with or making recommendations to the city council on a variety of issues, ranging from viaduct construction to civil service examination procedures.

The two state societies profiled, the Montana Society of Engineers and the Michigan Society of Engineers, differed significantly both in their foundings and in their trajectories. The Michigan organization came into being as a response to social pressures on the profession, that is, questions of engineering competence led Michigan engineers to join together out of mutual self-interest. By working together to achieve standard practices in surveying and engineering, Michigan engineers hoped to reduce the potential for expensive litigation. Only after these intitial concerns had been satisfactorily resolved did the Michigan Society broaden its scope and reach out to engineers less directed involved in survey work.

The Montana engineers seem to have been motivated more by a need for solidary, that is, for the fellowship of other engineers. When the Montana engineers organized their society in 1888, there were probably less than a hundred engineers in the entire state. In their monthly meetings Montana engineers not only stayed current with technical advances in engineering, they reinforced their individual identities as professionals and men of science. The proceedings of the Montana society report that members braved the rigors of the Montana winters to attend meetings, with some members traveling many miles on horseback. It seems unlikely that the desire to participate in a discussion of bridge design was the sole motivation driving members into Helena in January.

The Montana Society differed from the Michigan association in other ways. Where the Michigan society had a noticeable number of academics among its members, that is, professors of engineering who often held leadership positions in the society, the officers of the Montana society were uniformly working engineers, men employed either in mining or by the railroads within the state. In addition, where the Michigan society limited its attempts to lobby the legislature to very narrow questions of surveying practice, the Montana Society apparently enjoyed cordial relationships with lawmakers and provided them with advice on a number of topics. Following the Montana Society moving its headquarters from Helena, the state capital, to Butte its interest in influencing legislation gradually waned, but there never appears to have been any doubt that the state lawmakers valued the opinions of the Society.

All six of the societies mentioned above -- the Engineers Club of Philadelphia, the Western Society of Engineers, the Washington Society of Engineers, the Engineering Society of Milwaukee, the Michigan Society of Engineers, and the Montana Society of Engineers -- became what might be interpreted as increasingly disengaged from society as they matured. Theorists in organization ecology have posited that "once founded, organizations are subject to strong inertial pressures," with the result that an organization becomes more risk-averse in its behavior.[238] All six of these societies did indeed grow more conservative with time, although at different rates, concentrating more and more on questions internal to engineering and paying less attention to the large social context. Thus, by the end of World War I, all six of these societies had reached the point where the specialized societies, such as the Lake Superior Mining Institute, had been all along.

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[238] Jitendra Singh and Charles T. Lumsden, "Theory and research in organization ecology," annual Review of Sociology 16(1990): 161-95. See also Dawn Kelly and Terry L. Amburgey, "Organization inertia and momentum: a dynamic model of strategic change," Academy of Management Journal 34(1991): 591-612.

Chapter Four: Engineers as Activists

In this chapter I discuss three public health and welfare issues of the 1890s -- smoke abatement, good roads, and clean drinking water -- and describe the responses of various engineering organizations to these problems. I selected these particular issues for examination because all three were perceived by the general public to be among the vital issues of the time. In addition, all three were issues that most nineteenth century engineers were quite familiar with, either through personal experience or contemporary professional literature. In the days before specialization took hold, an engineer's career could easily include working on everything from road beds to steam plants. Noted civil engineer James P. Kirkwood, for example, began his career by building railroads, but switched to water works engineering in mid-life. Other scholars have provided detailed social and technical histories of all three topics, and I do not claim to provide a comprehensive study of any of these issues here. Instead I will look specifically at one aspect other researchers have neglected. That is, I will describe how local engineering societies and technical clubs responded when smoke, polluted water, or a lack of passable public roads became an issue in their city or state.[239]

Engineers were not alone in viewing the lack of good public roads, clean drinking water, and breathable air as serious social as well as technical problems. Women's groups, civic organizations, and public health officials also became involved in the search for solutions. In some cities these groups formed alliances with local engineering clubs while in others they occasionally found themselves in opposition. In addition, not all clubs viewed all three of these issues, or even any one, as a question that it was appropriate for their organization to address. For some clubs other technical or social issues, such as conservation or urban mass transit, may have proved more pressing, while other groups may have had reasons now lost in time to remain aloof. Nonetheless, in a world of increasing technological complexity, many leading engineers believed local clubs could play an important role in diminishing the growing distance between the public and the engineering profession. In 1893, for example, Walter A. Rice, retiring president of the Cleveland Engineers Club, urged local engineering societies to

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239 For detailed information on the history of public roads, see, for example, Bruce E. Seely, Building the American Highway System (Philadelphia: Temple University Press, 1987). Ellis L. Armstrong, editor, also provides a good overview of roads in the United States as well as summaries of other public engineering issues, such as waterworks, in History of Public Works in the United States (Chicago: American Public Works Association, 1976). For a detailed history of the development of waterworks, see M. N. Baker, The Quest for Pure Water: the History of Water Purification from the Earliest Records to the Twentieth Century (NY: American Waterworks Association, 1948).

exert their forces in the direction of public education, let them discuss live topics, local topics, in which the public are interested; let this go hand in hand with the cultivation of a fearless, truth seeking policy, and above all things, let the organizations assume the courage of their convictions. . .[240]

Looking at these three issues can provide ample evidence that, at least during the waning years of the Gilded Age, engineers were not the aloof, apolitical, disinterested professionals they would later claim to be.

Historians examining the United States during the Progressive Era have occasionally commented on the absence of engineers among the epoch's reformers. Chandler's prosopographical analysis of over two hundred notable activists, for example, revealed less than half a dozen individuals who could be identified as engineers.[241] My research suggests that while it may be true individual engineers rarely became politically engaged, this does not mean the engineering profession was negligent in addressing the numerous social problems of the time. Schultz and McShane have described in a general way the leadership role consulting engineers provided in the development of city sanitation systems in the nineteenth century, and credited national and local engineering societies for speeding the dissemination of technical information within the engineering profession. They argue that engineers in general served as exemplars of efficiency and competence in an era otherwise notable

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[240] Journal of the Association of Engineering Societies Proceedings XII: 375.

[241] Kennedy, previously cited.

for corruption and graft.[242] In this section of the dissertation I explore in greater detail the different activities local engineering clubs in the United States undertook as they attempted to promote public health and welfare during the final decades of the nineteenth century. I will show that as the Gilded Age was ending, membership in organizations such as the Engineers Club of St. Louis and the Engineers' Society of Western Pennsylvania allowed engineers to participate actively as a group in a political process that professional ideology and public opinion increasingly forbade them to engage in as individual professionals. As W. A. Haven, president of the Montana society noted in an 1894 address to the membership, "If engineers will not discuss public questions in the newspapers or in public meetings, let them do it in the society. The Montana Society is open for the fullest and freest discussions of any subject of interest to the citizens of Montana."[243]

Good Roads

As historian Bruce Seely notes, although some scholars attribute the development of decent rural roads and a national highway system to the invention of the automobile, the good roads movement actually began long before the horseless carriage became common.[244] The federal government recognized the need for decent surface transportation early in the nation's history. In the early 1800s Albert Gallatin's

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242 Schultz and McShane, previously cited.

243 Journal of the Association of Engineering Societies Proceedings XIII(1894): 13.

244 Seely, 11-12.

report to Congress recommended the construction of both canals and roads to link the interior of the nation with the eastern seaboard. In the 1820s Congress authorized construction of the National Road, a highway intended to facilitate freight traffic from the Ohio valley to the east coast. When funds for construction ran out in 1844, the National Road stretched from Cumberland, Maryland, to Vandalia, Illinois. Towns sprang up along its route, each serving as evidence that turnpikes and highways speeded development and commerce, but states rights issues as well as the rapid growth of railroads resulted in federal officials losing interest in any additional direct federal involvement in road construction. Federal authorities did continue to construct roads for military purposes, but as the railroads spread across the country, even many military roads were allowed to fall into disrepair.

In the years following the Civil War, however, it became increasingly evident that without good roads in rural areas, railroads and canals remained almost inaccessible to many farmers. In some states weather conditions made unimproved dirt roads effectively impassable for as much as half the year. An 1886 editorial in Engineering News noted that "no state in the country has roads that are in a worse condition than Illinois. . . . Except in a few localities, the only improvement (?) [sic] consists in making an embankment across the low places, the earth being taken from borrow pits on either side which are undrained and of course remain full of water during a large part of the year."[245] Farmers had difficulty moving their produce to

[245] Anonymous, "Highway engineering," Engineering News and American Contract Journal June 12, 1886: 376.

market; rural families lacked access to basic services, such as health care, that urbanites increasingly took for granted. In opening the western lands for settlement the federal government had required the property owners to yield a strip of land for a right of way for public roads, but allocated little funding for actual road construction. Congress did provide small grants to states based on a percentage of from 2 to 5 percent of revenues received from the sale of federal lands, with the funds to be used for improving transportation, but left it to the states to decide whether those improvements would be highways or canals. Thus, by the 1880s hundreds of thousands of miles of rural roads existed, but it was almost uniformly unimproved dirt. Privately financed turnpikes surfaced with crushed stone or planking were the exception, not the rule. There had been a brief boom in turnpike construction prior to the arrival of railroads, just as there had been in canal construction, but, as speculation in railway construction grew, interest in building and maintaining toll roads fell.[246] The condition of rural roads in the original thirteen colonies was frequently as wretched as that of roads in the western states. Often the only appreciable difference lay in the fact western roads, as noted in Chapter Three, ran straight down section lines, while eastern roads usually followed the line of least resistance winding around hills and meandering along stream banks. During an 1896 discussion of roads in Pennsylvania, Arthur Kirk, a member of the

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[246] In 1877 noted civil engineer John B. Jervis commented on the "great impulse to canal enterprise. . . . It is hardly necessary now to say some of these canals proved useless as commercial enterprises." John B. Jervis, "A memoir of American engineering," Transactions of the American Society of Civil Engineers VI(1877): 39-67.

Engineers Society of Western Pennsylvania, reminded fellow members that bad roads constituted a threat to national security and to public welfare. According to Kirk, it had been Pennsylvania's bad roads that prevented a detachment of troops from Philadelphia from reaching Pittsburgh in 1877 to help control civil disorder. Kirk noted that if rioters within the state "had known the Philadelphia troops could easily reach Pittsburg by a good road, they would not have been so ready to tear up the Pennsylvania Railroad."[247]

Beginning in the early 1880s a "good roads" movement slowly took shape. Meetings were held in Iowa and other midwestern states as early as 1883 to form special interest groups intended to lobby state legislatures for road improvements. Advocates of highway improvements founded organizations such as the Indiana Highway Improvement Association and the Missouri Good Roads Association and held conventions on a regular basis. Members of the early good roads associations tended to be primarily farmers and businessmen motivated by economic interests. The growing popularity of the bicycle and bicycle clubs in the late 1880s and early 1890s added a second, increasingly demanding voice to that of farmers' interest groups in pushing for rural road construction. As the good roads movement grew in momentum, a number of state and local engineers' clubs also took an active part in lobbying for highway improvements.

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[247] Proceedings of the Engineers Society of Western Pennsylvania 12(1896):114.

Not surprisingly, for engineers' clubs in frontier states, such as Montana, public road developments and improvements quickly attracted the societies' attention and often held it for many years. The Montana Society, for example, began debating roads questions shortly after the society's founding in 1888 and continued to do so on a regular basis for the next twenty years. The roads question, however, was not confined to any particular geographic region or limited to non-metropolitan organizations. The Chicago-based Western Society of Engineers, the Engineers Club of Philadelphia, and the Engineers Club of Cinncinati all considered the good roads issue, or various aspects of it, to be important.

In Chicago, for example, the members of the Western Society of Engineers chose to focus on the specific issue of bridge safety. Although their attention may have initially been drawn to the bridge question by the invovlement of many members in railroad bridge construction, the Society quickly expanded the scope of its investigations and discussions to include highway bridges. In 1891 the Society established a committee to investigate the bridge issue and prepare a comprehensive report. In discussing the need to investigate highway bridges, members in favor of establishing a committee and recommending changes in legislation argued that "It is with the highway bridge that the greater risks of disasters have been incurred," and "In the rural regions, highway bridges are constantly breaking down."[248] Members opposed to the idea were not convinced, pointing out that all the notable bridge

[248] Journal of the Association of Engineering Societies Proceedings XI(1892): 54.

disasters in recent memory, such as 1876 failure of the Ashtabula Bridge, involved railroad and not highway bridges.[249] One member noted sarcastically that no great skill or engineering expertise was required to construct the typical highway bridge that needed to support only "the farmer's team and two horse wagon."[250]

Nonetheless, the report when completed in 1892 formed the basis for recommendations for legislation and was presented to state representatives for their consideration. The Society recommended the state legislature set minimum standards for bridge design based on factors such as the proposed total length of the structure as well as appointing a State Engineer to serve as a highway bridge inspector. The four-man committee devoted over a year to its work, surveying various engineers engaged in bridge work as well as contacting public officials throughout Illinois, other states, and in Great Britain and continental Europe. The final report addressed both technical issues, e.g., how much weight was a typical highway bridge expected to bear, and financial. At the time no state regulated highway bridge construction, although a number had passed laws concerning railroad bridges following the Ashtabula disaster.

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[249] The Ashtabula bridge failure on December 29, 1876, had been a spectacular disaster, in which a passenger train plunged into a river only a few hundred yards from the train station, and generated considerable discussion in both the engineering and popular press for a number of years following the actual accident. See, for example, Anonymous, "The Ashtabula Disaster," Engineering News January 6, 1877: 1+; or Charles McDonald, "Ashtabula disaster: a careful description of the structure, and an account of the probable method of failure," Transactions of the American Society of Civil Engineers VI(1877): 74-87.

[250] Journal of the Associaton of Engineering Societies Proceedings XI(1892): 55.

The bridge safety committee hoped that Illinois would be the first to set a standard for highway bridge safety and serve as an example to the nation. Most European governments did regulate bridge construction, a fact that some Western Society members used to argue for similar legislation in the United States and others against.[251]

In Montana the activities of the state civil engineers society went well beyond simply making general suggestions to the state legislature. On January 14, 1893, the Montana Society of Engineers, like the Western Society two years previously, established a committee charged with investigating the current condition of roads and bridges within the state and with revising existing regulations regarding highways. The Montana Society recommended keeping the responsibility for road and bridge construction at the county level with the added requirement that each County Supervisor of Roads, an elected official, "be a competent engineer."[252] Any engineer running for the office of County Supervisor of Roads had to post a $1,000 bond upon election as a guarantee he would faithfully perform all the duties the office required, including directing all contract work and drawing up plans and specifications for any new road and bridge construction.

Road construction held a prominent position on the Society's agenda again in 1897. In March 1897 the Montana Society organized a public meeting in Helena that included all of the state's county surveyors and county commissioners. The state

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[251] Journal of the Association of Engineering Societies XI(1892): 8-20.

[252] Journal of the Association of Engineering Societies Proceedings XIII(1894): 117.

legislature had followed through on the Society's 1894 recommendations "by enacting laws radically changing almost every feature of previous regulations as to the maintenance of roads."[253] Among other changes, the new law provided for condemnation procedures to allow the county to cut directly through private property and required land owners to either pay an annual county roads tax or provide one day's labor each year. The Society organized the meeting to educate the county officials regarding provisions of the new legislation and to allay their fears that its requirements would result in "over-engineering."[254]

The commissioners, surveyors, and society members spent a full day debating various aspects of the new road law, enacted as Montana House Bill No. 266, and by the time the convention adjourned had achieved a consensus. The Society succeeded in convincing the county officials to formally endorse the legislation and to work toward its successful application in their home counties. The convention as a whole unanimously approved a resolution including the following provision:

> Whereas, It is expedient that the new law be given a full and fair trial; therefore be it Resolved, That the county surveyors and boards of county commissioners of different counties be called upon to use every endeavor to make a success of the said law by using special personal efforts to inaugurate a system of roads that will be a credit to each and every county and to the state, and to see that the funds of the counties are economically and judicially applied.[255]

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253 Journal of the Association of Engineering Societies Proceedings XIX(1897): 9.

254 Ibid.

255 Journal of the Association of Engineering Societies XIX(1897): 15. See also Engineering News March 35, 1897: Supplement 106.

Given that the Montana Society had campaigned actively for good roads for most of its existence, it is not surprising that the organization would be receptive to hearing from representatives of organizations with similar interests, such as the League of American Wheelmen. The League of American Wheelmen, a bicyclists' interest group, had local chapters throughout the United States. A paper read by an L.A.W. member, F. H. Ray, at the 1898 annual meeting engendered a lively discussion of the difficulties in constructing good roads in Montana. Ray expressed a hope that it would soon be possible to bicycle the length of the state on smooth, macadamized highways. Members responded that the problem was not one of a lack of will nor of materials, but one of funding. Paved roads would benefit everyone, but the tax revenues for most Montana counties were so low that the local county commissions could not afford to do more than maintain the most basic of dirt roads. Still, Frederick Whiteside, an L.A.W. member from Flathead County, praised the Montana society for the efforts it had expended on behalf of good roads, adding that "road building contained so much of the commonplace and so little of higher engineering that the matter was often overlooked by engineering Societies."[256] Mr. Whiteside described himself as "pleased that the Montana Society of Engineers had taken up the matter in earnest."[257]

The League of American Wheelmen apparently met with little success in general in attempting to enroll engineering societies as open allies in the good roads

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[256] Journal of the Association of Engineering Societies Proceedings XX(1898):10.

[257] Ibid.

movement. Indeed, the available evidence suggests that the Montana organization may have been one of a handful of engineers clubs to give the bicyclists time to speak at a meeting. I found no other group's minutes that refer directly to the wheelmen, although other local and state societies did discuss matters pertaining both to roads and to bicycles. The written record does not provide sufficient documentation to conclude whether the Wheelmen approached other the societies and were rebuffed deliberately or, alternatively, simply never bothered to ask to speak at engineers' meetings in cities such as Chicago or Philadelphia.

In Minnesota, for example, roads served as the dominant theme at annual meetings of the Minnesota Surveyors and Engineering Society for three years in a row, 1897, 1898, and 1899. Of the sixteen papers presented at the 1896 meeting, fully half were devoted to roads topics, ranging from the general to the specific. N. Y. Taylor presented "A Few Thoughts on the Road Question," George L. Wilson discussed "Bicycle Paths and Their Construction," and Fred Chamberlain gave suggestions for "County Road Improvement." The following year member W. M. Hays led the Minnesota engineers in a discussion of "Practical Road Legislation" while George L. Wilson again spoke on "Bicycle Paths." Although the League of American Wheelmen lobbied for the improvement of public roads, many engineers as well as members of the general public viewed bicycles as a dangerous nuisance. They believed that it would be in the best interests of society if cyclists were restricted to pathways separate from wagon traffic and, in urban areas such as Minneapolis, pedestrians.

The Engineers Club of Philadelphia, the St. Louis Engineers Club, and the Indiana Association of Civil Engineers and Surveyors were among other societies discussing or investigating roads questions in the 1890s. On February 17, 1898, for example, the Philadelphia club listened to a lecture on "Various phases of the Road Question." The engineers club at the opposite end of their state, the Pittsburgh based Engineers Society of Western Pennsylvania, took a more active interest in public roads than their Philadelphia counterparts. The Western Pennsylvania engineers established a Committee on Roads, and, in November 1897, referred proposed roads legislation to the committee for review and criticism.[258]

In addition, the committee members for the Engineers Society of Western Pennsylvania investigated specific technical questions, such as comparing the materials available for use in surfacing roads. In preparing their reports, the committee took into consideration suggestions that rapid transit companies, i.e., trolleys and interurbans, might be interested in using the improved roadbeds. The second report of the Committee on Roads, presented on October 19, 1897, included specific details and illustrations for incorporating either a flat rail tramway or a raised rail system into paved roadways.[259]

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[258] See Engineering News November 25, 1897: Supplement 195; Engineering News February 24, 1898: Supplement 67.

[259] Proceedings of the Engineers Society of Western Pennsylvania 13(1897): 431-444.

Thus, by the turn of the century, a number of engineering clubs had joined in the chorus of voices across the nation asking for action on the roads questions. Interestingly, all of the various clubs' suggestions and discussions focused on the local or state level. Unlike the discussions centered on river and harbor improvements a decade earlier that had united local societies in lobbying for a National Bureau of Public Works, no local engineering club pushed for a federal bureau of highways.[260] With control of road work still being seen in most states as a county or even a township responsibility, local clubs may have felt that simply lobbying for coordinated planning on a statewide level constituted a more realistic goal than any national campaign. Indeed, lobbying at the state level did begin to show results during the 1890s as states from Virginia to Montana passed new roads laws. Given that local engineers clubs were in most cases only one of many different interest groups involved in lobbying for legislation, it is impossible to credit them solely for consequent improvements in public roads.

On the other hand, it is true that in some select instances, engineering societies did not merely make suggestions. In Montana and perhaps elsewhere the local engineering club first wrote the improved legislation and then, following its passage, sponsored an educational meeting to help county commissioners learn how to comply with the new law. In this area, at least, engineering societies proved willing to serve as leaders. Groups such as the Montana Society of Engineers did not shy away from

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[260] See, for example, Anonymous, "The Council of Engineering Societies on National Public Works," Engineering News March 27, 1886: 233.

taking on what J. B. Johnson in 1898 termed the engineer's "responsibility of leading public sentiment on these questions instead of waiting till this has crystallized into a particular scheme, and then, when called upon, saying how the thing may be done."[261] Professor Johnson's paper referred specifically to questions of city sanitation, but his general theme of the engineer's responsibility to assume a leadership role for the public good expressed a sentiment that would continue to resonate with both societies and individual members for years to come.

Smoke Abatement

During a 1911 discussion of the problem of smoke in urban areas, a visitor to the Engineers Club of Philadelphia, Dr. T. Randall, argued that, "The only way to attack the problem [of smoke abatement] is from the engineering standpoint. It is all right to have a law, but the law alone cannot stop the smoke."[262] Randall's position marked a sharp reversal from the position many engineers had held only a few years previously. Pollution from coal smoke had become a major health and welfare issue in almost all industrialized areas by the turn of the century. The belching smokestacks that were still being included among the illustrations on stock certificates and bearer bonds as symbols of prosperity were also being increasingly recognized as a serious

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261 J. B. Johnson, "The Engineer as Guardian of the Public Health," Journal of the Association of Engineering Societies XXI(1898): 311-321.

262 "Smoke prevention -- a discussion," Proceedings of the Engineers Club of Philadelphia XXVIII(1911):52-67.

health hazard. At the very least, coal smoke constituted a major nuisance as soot coated buildings, clothing, and people with grime.

In his 1980 essay, "The Battle for Clean Air: The Smoke Problem in Post-Civil War America," R. Dale Grinder ably summarized the essence of the smoke abatement issue. Cities which relied heavily on soft bituminous coal for fuel, such as Milwaukee and St. Louis, suffered from severe smoke problems. In many cases geographic factors, such as a location in a river valley, made those cities prone to thermal inversions that held the dense cloudes of smoke over the city for days on end rather than allowing it to disperse. While most nineteenth century Americans saw the smoke as visible evidence of progress and prosperity, they also agreed it could make life in urban areas almost unbearable. Doctors believed smoke contributed to deaths from consumption, homemakers complained that falling soot made it impossible to dry laundry out-of-doors, and engineers knew accumulations of coal smoke hastened corrosion of both masonry and metal structures. Grinder quotes one Milwaukee architect who complained that city smoke peeled the paint from his house in less than two years. By the 1890s an active smoke abatement movement had appeared in many cities, a movement that often found upper class matrons allied with engineers and public health officials.[263]

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[263] R. Dale Grinder, "The Battle for Clean Air: The Smoke Problem in Post-Civil War America," pp. 83-103 in Martin V. Melosi, ed., Pollution and Reform in American Cities, 1870-1930 (Austin: University of Texas Press, 1980). See C. H. Benjamin, "Science of smoke prevention," Science March 25, 1894: 488-93; or Anonymous, "Smoke nuisance abated in Chicago," Scientific American April 25, 1891: 265 for nineteenth century views of the smoke problem.

At the time, engineers expressed confidence that the problem of pollution from smoke could be readily corrected with the proper use of existing technology. Contemporary research convinced engineers that the problem essentially was one of incomplete combustion. The evidence available in the 1890s indicated that the solution leading to smoke abatement lay in achieving complete combustion of the fuel in the furnace. Coal burned at a sufficiently high temperature produced little harmful smoke, or so the engineers believed. Thus, if users of the bituminous coal could be convinced to operate their boilers at maximum efficiency the smoke problem would be solved. In retrospect, this belief in the efficacy of the existing technology seems remarkably naive, but, based on the knowledge available to engineers in the 1890s, at the time there was no reason to doubt it. A report in the 1892 Proceedings of the St. Louis Engineers' Club stated matter of factly that while it was not possible "to say that the practical problem of smoke prevention, under St. Louis conditions, is fully solved, we can say that substantial progress in that direction has been made."[264]

The Engineers' Club of St. Louis, the Engineering Society of Western Pennsylvania, the Engineers Society of Western New York, and the Civil Engineers Club of Cleveland all attacked the smoke abatement problem in the 1890s, arguing that because technical solutions to the smoke problem existed it was possible to cure it through a combination of education and legislation. Legislation would force building owners to install smoke abatment devices, properly train their furnace operators, and

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[264] Journal of the Association of Engineering Societies Proceedings XI(1892): 322.

correct defective or inadequate boiler installations. By the early 1890s two major American cities did, in fact, have smoke prevention ordinances in place: Chicago and Cincinnati. Reports in engineering journals indicated these ordinances had been relatively successful.[265]

All four societies were located in cities acknowledged to be among the worst in the nation for coal smoke pollution. Both St. Louis and Pittsburgh sat in river valleys where high bluffs trapped the dense coal smoke, while residents of Cleveland and Buffalo suffered when prevailing breezes off Lake Erie drove the fumes and soot south from the lake side industries and office buildings toward residential neighborhoods.

Although Carroll Pursell refers in his book, The Machine in America, to the Cleveland Engineers Club's "long tradition of activism" and support of progressive causes within the city, in the 1890s the organization confined its efforts to curb smoke to primarily educational endeavors, such as devoting an occasional meeting to paper presentations and discussions on the topic.[266] On April 14, 1896, for example, the evening's program at the Civil Engineers Club featured C. F. Mabery, a club member, speaking on "Smoke Prevention." The engineering societies in the other three cities, however, assumed a more aggressive posture.

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[265] See, for example, Anonymous, "Smoke nuisance abated in Chicago," Scientific American April 25,1891: 265.

[266] Carroll Pursell, The Machine in America (Baltimore: The Johns Hopkins University Press, 1995).

The St. Louis club was the first local society to attack the problem. Coal smoke became a problem early in the city's history. The close proximity of the soft coal beds of southern Illinois meant cheap bituminous coal lay only twelve miles away to serve as fuel both for home heating and for industry. Members of the St. Louis engineers' club first discussed coal smoke as a community nuisance in 1876, but regretfully concluded "nothing had yet been found which would work with ignorant firemen."[267] Eight years later, in 1884, the club established a standing committee to investigate and report periodically on the smoke problem and smoke prevention devices.

St. Louis community leaders concerned about the possible detrimental effects of coal smoke approached representatives of the engineers' club in the early 1890s and enrolled the society as an ally in the crusade for smoke abatement. The Club responded by creating a four member committee to investigate the problem of smoke prevention. The four men on the committee -- E. D. Meier, William B. Porter, Robert E. McNath, and C. E. Jones -- proceeded to methodically and comprehensively document the extent of the smoke nuisance within St. Louis. They began with a detailed questionnaire, followed by visits to as many actual boilers as was possible. Their report took over a year to prepare, but when completed gave anti-smoke activists the technical data they needed to push a smoke abatement ordinance through the Municipal Assembly.

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267 William H. Bryan, "The Engineers Club of St. Louis; Its History and Work," Journal of the Association of Engineering Societies XXIV(1900):158-74.

Acting on authority granted them by the Mayor of St. Louis, Meier and fellow committee members began their research by devising a survey instrument, that is, a comprehensive questionnaire, addressed to coal users in metropolitan St. Louis. The survey asked local manufacturers and other coal burners, such as the owners of hotels and office buildings, to describe their fuel use practices in detail. Questions included "What kind of coal (name mine if possible) do you use, and is it 'Run of Mine,' 'Slack,' 'Nut,' or 'Lump'?" and "Please state the number and size of your boilers. . ."[268] The accompanying letter emphasized that responses would be considered confidential if the respondents so requested. After circulating the questionnaire, the committee then visited in person as many facilities as was practical. These inspection trips helped convince the committee that a great deal of the smoke nuisance could be traced to technical factors such as poor building design. The final report noted

> The modern business building nearly always contains a steam plant for heating and other incidental uses. This plant is not regarded as revenue producing direct, and architects as well as owners are disposed to place it so as to occupy the least possible space. Hence it is in most cases inconveniently located, cramped for room and but little regard paid to ventilating. Flues and chimneys are often unskillfully proportioned, and the comfort of attendants so little considered that they can do no better than stuff the furnace and go out to breathe.[269]

The members of the smoke prevention committee were convinced that the technical means existed to reduce significantly the amount of coal smoke polluting the St. Louis

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[268] Journal of the Association of Engineering Societies Proceedings XI(1892): 328.

[269] Ibid, 323. Cf. Proceedings of the Engineers Society of Western Pennsylvania 10(1894): 11.

area. They advocated a combination of regulation and inspection that would force boiler owners to fully utilize the available smoke prevention technology. Thus, in addition to compiling a comprehensive technical report, the committee prepared a draft of a smoke prevention ordinance. Soon after the committee submitted its report the St. Louis municipal government passed a smoke prevention ordinance, one of the first of its kind in the nation. Unfortunately, opponents of the ordinance soon succeeded in having it nullified by the State Supreme Court by using an argument that the ordinance unlawfully usurped powers reserved for the states.

In discussing the ordinance a few years after its nullification, club member William H. Bryant noted that "Every effort was made to induce compliance by friendly means," but nonetheless "a few obstructionists" opposed the ordinance. These obstructionists fought it in court, resulting ultimately in it being overturned only three years after its passage.[270] The city responded with a new ordinance to conform with the court's decision, but enforcement proved difficult. The original ordinance sought to control smoke due to its nature as a nuisance, but the court had ruled smoke must be shown to present a clear danger, a criterion that in 1899 was much harder to prove than it would be a few decades later.

The setback in the courts did not dampen the St. Louis club's interest in the issue, however. The club continued to include discussions of smoke prevention at

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[270] William H. Bryant, "Smoke Abatement in St. Louis," Journal of the Association of Engineering Societies XXVII(1901): 215-231.

regular meetings while working on achieving through education what it had failed to gain through regulation.

The Engineering Society of Western Pennsylvania was the next local club to take on the question of smoke abatement. The Pittsburgh engineers' club had a long history of civic involvement. The group had recently completed an investigation into water supply problems and was involved in an investigation of the roads question, but still found time to discuss smoke abatement at its monthly meetings. Residents of Pittsburgh found the smoke nuisance even harder to bear than their contemporaries in similarly polluted cities elsewhere because many recalled a period in the early 1890s when many boilers were fueled with natural gas rather than coal. For a few brief years, the air had been relatively clean. By 1893, however, in a discussion of fuels in use in the city, member Walter E. Koch noted that "Natural gas is departing."[271] Apparently fewer and fewer establishments were continuing to use it. Coal had become the cheaper and more readily available fuel. By mid-decade most Pittsburgh boiler operators had converted boilers from firing with natural gas to burning coal.

Many Pittsburgh engineers viewed the use of natural gas as impractical, as studies comparing fuel costs and efficiencies indicated coal mined in western Pennsylvania provided more BTUs with less waste than other fuels.[272] Perhaps even more than the members of the St. Louis club, the Pittsburgh engineers believed that the

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[271] Proceedings of the Engineers Society of Western Pennsylvania 9(1893):2.

[272] See, for example, F. Z. Schellenberg, "Comparative Value of Coal, Oil and Gas," Proceedings of the Engineers Society of Western Pennsylvania 10(1894): 8-13.

problem of nuisance smoke lay in the operation of the boilers and not in the fuel itself. In his 1894 presidential address to the society, Charles Davis reported that "Our hopes from relief [from smoke] are centered upon. . . Mr. Ashworth's reform movement for the higher education of furnace stokers."[273] Other members expressed similar beliefs throughout the decade, noting boilers would smoke one day and not the next, leading observers to conclude that problem lay in how the firemen applied the fuel and not the coal itself. Building design also played a role. When Daniel Ashworth spoke to the Society on "Losses in Boiler Operation" he noted that

> In power plants connected with city buildings, we are confronted on almost every hand with the utter lack of space and every condition that would be conducive to anything approaching proper results. . . . With bad flues in these city buildings, lack of room for proper blow-off conditions, improperly constructed furnaces, where the furnaces are made to suit the room, is it anywonder that we have great volumes of dense black smoke annoying the community, or that we have such poor results in generating steam in city buildings?[274]

In the discussion that followed Ashworth's paper, several members emphasized the importance of the firemen to proper boiler operation. One man commented it was time to "recognize that ordinary muscular work without brains is not sufficient to produce the results which can be obtained under other conditions."[275] Building superintendents

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[273] Proceedings of the Engineers Society of Western Pennsylvania 10(1894): 10.

[274] Daniel Ashworth, "Losses in Boiler Operations," Proceedings of the Engineers Society of Western Pennsylvania 10(1984): 1-10.

[275] Proceedings of the Engineers Society of Western Pennsylvania 10(1894): 11.

needed to learn to hire men for their intelligence and not just for their brawn. Obstacles to finding such good men to work as stokers included the need for higher wages than the majority of building owners were willing to pay as well as overcoming the wide-spread perception that operating a boiler required no skill other than the ability to lift a shovel.

Still, as the skies grew dirtier, the smoke abatement movement grew stronger. In 1895, while making an argument for a cental power plant to generate electricity for Pittsburgh, L. B. Stillwell denounced conditions in the city. Stillwell said that

> If a member of this society were to go up in a balloon one of these dark mornings he would doubtless be astonished to find the sun shining brightly not more than half a mile above the two cities. He would see Pittsburg [sic] simply as a black spot upon the face of the earth. It is a pity that we cannot all go up in balloons, for it is possible that much good might result from a thorough understanding and appreciation. . . of the fact that the sun does shine and that we are existing under atmospheric conditions (not to mention other conditions) which in this day of boasted science are little short of disgraceful.[276]

Despite the presence of heavy industry such as steel mills and foundries in the Pittsburgh area, many members of the Engineers Society of Western Pennsylvania were convinced a great deal of the smoke problem could be traced to individual steam plants in office buildings and small businesses. In the discussion following Stillwell's paper presentation, a Mr. Bole asserted confidently "that it is not the smoke that the Homestead Mill or Edgar Thomson Steelworks produce that makes Pittsburg unpleasant, but it is the smoke that comes from the little drygoods store plants, such as

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[276] L. B. Stillwell, "Possibilities of Electrical Transmission and Distribution of Power in Pittsburg," Proceedings of the Engineers Society of Western Pennsylvania 11(1895): 300-317. Pittsburgh was commonly spelled as Pittsburg in the 1890s.

are located along Fifth Avenue and Smithfield Street. The nuisance is largely due to the small plants that are in the location to do the greatest amount of damage."[277] These members agreed with Stillwell that developing a central plant to provide electricity to small businesses and manufacturers for powering motors for elevators and other machinery as well as providing electricity for lighting would eliminate much of the smoke nuisance. Boilers would still be necessary for steam heat, but the smoke problem would become a seasonal nuisance rather than a year-round headache.

Society members also believed it was important to emphasize publicly that the complete prevention of smoke was probably impossible. Too many devices had been marketed that claimed to prevent smoke when the reality was that the best they could do was abate the nuisance. When furnace owners realized the so-called smoke prevention devices did not perform as promised, too often the owners responded by eliminating them completely. At an 1894 meeting members discussed the need to educate the public about the actual facts concerning smoke abatement. While less satisfying than complete smoke prevention, abatement still constituted a considerable relief over no diminishment of smoke at all. Ashworth noted that unscrupulous entrepreneurs often tried to sell devices as "absolutely smokeless," a claim that was

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[277] Proceedings of the Engineers Society of Western Pennsylvania 11(1895): 323.

revealed quickly as false, and which then rendered the public skeptical toward all smoke prevention devices.[278]

Discussion of the smoke problem continued as the smoke grew thicker. In 1898, in response to a request from the Pittsburgh Chamber of Commerce, the Western Society re-established a committee investigate the smoke problem in the city.

Whether or not the Society would have appointed a new committee to investigate the smoke problem without being prompted by an external stimulus is debatable. As noted above, many Pittsburgh engineers saw the smoke nuisance as resulting from ignorant stokers and continued to believe the solution lay in education. Even those members who agreed smoke presented a problem were convinced "the common cook stove throws out more soot and dirt per ton of coal burned, by far, than does the tall [industrial] chimney."[279]

Members' attitudes toward nuisance occasionally reflected the ambivalence society as a whole felt regarding the problem. On the one hand, as E. Floyd Preston noted in a paper presented at the June 21, 1898, meeting, that residents complained that soot fell "like black snow down into our streets, flying in our faces, soiling our raiment, and entering our homes. . . . physicians tell us, this nuisance causes more

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[278] Proceedings of the Engineers Society of Western Pennsylvania 10(1894): 13.

[279] Proceedings of the Engineers Society of Western Pennsylvania 14(1898): 150.

throat and lung diseases than all other causes combined."[280] Preston urged the adoption of soot traps in chimneys to catch the worst of the particulates in smoke before it left the stack. To Preston smoke was a definite nuisance and should be addressed as such.

For member A. P. Kirtland, however, smoke held a different meaning. According to Kirtland, "it is smoke that makes Pittsburg the great city it is."[281] The "stack after stack belching forth volumes of smoke and fire"[282] provided evidence of the city's prosperity. Smoke was just something residents learned to live with as "Pittsburg would not be Pittsburg without it, and hence to be called the 'Smoky City' causes no feelings of resentment in us."[283] Soot-covered clothing was a small price to pay in exchange for economic well-being.

Nonetheless, despite members holding contradictory opinions, the Society agreed to help with the Chamber's investigation of the smoke problem. The Chamber of Commerce had requested five representatives from the Engineers Society to serve on a joint committee. A few Society members apparently held suspicions that the Chamber might attempt to co-opt the engineers in some way or try to use them as consultants to solve specific problems. After considerable discussion, the Society

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[280] E. Floyd Preston, "The Smoke Nuisance," Proceedings of the Engineers Society of Western Pennsylvania 14(1898):142-148.

[281] A. P. Kirland, "Pittsburg, With Its Black Diamonds," Proceedings of the Engineers Soicety of Western Pennsylvania 15(1899): 203-221.

[282] Ibid.

[283] Ibid.

voted to re-establish its own independent committee to "deal broadly with the scientific and engineering questions involved."[284] The Engineers Society cooperated with the Chamber, but it was not until 1910 that a smoke abatement ordinance was passed. Even then, as in so many other cities, the worst offenders frequently ignored the law.

Finally, in the early 1900s, Engineers Society of Western New York became concerned about the growing smoke problem in Buffalo. By the turn of the century, however, experiences such as that of St. Louis made it increasingly clear that while smoke prevention ordinances seemed good in theory they often proved impossible to enforce effectively in practice. The focus of the Buffalo club thus was to investigate and discuss smoke prevention technologies and the use of alternative fuels, such as oil, rather than on trying to influence legislation. In the 1890s a few engineers had hoped the development of hydroelectric generating plants at Niagara Falls would result in building owners and manufacturers in the city of Buffalo switching to centrally supplied electric power, but for a number of years the cost of hydroelectric power apparently remained higher than the cost of generating steam as a source of motive power within the city using coal. Members of the Engineers Society of Western Pennsylvania had, in fact, pointed to Buffalo and Niagara Falls as an example of why a central source of

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[284] Proceedings of the Engineers Society of Western Pennsylvania 15(1899): 25.

electricity could not be counted upon as an automatic panacea for the smoke nuisance.[285]

Officers of the Western New York club urged members to speak out at meetings, to create a lively discussion that would encourage the local newspapers to print full reports of the technical issues being considered. After all, engineers could not expect the profession to be "recognized as a force in the community" if members did not "come to the meetings and talk on subjects of current interest to the public of Western New York, and have such discussions published, . . ."[286] At the time, newspapers generally carried full reports of the meetings of local engineering societies, including occasionally printing the entire text of technical papers, if the editors believed there was sufficient interest by readers.

Despite the good efforts of the local engineering clubs, even allied with other citizens' groups the engineers proved unable to eliminate coal smoke pollution from the cities most troubled by it. Enforcement of smoke prevention ordinances proved difficult. As Grinder notes, fines levied were often too low to serve as effective deterrents while inspectors tended to be poorly trained political appointees easily susceptible to bribes.[287] St. Louis remained one of the nation's dirtiest cities well into

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[285] See, for example, Proceedings of the Engineers Society of Western Pennsylvania 11(1895): 324-326.

[286] Journal of the Association of Engineering Societies Proceedings XXVI(1901): 5-6.

[287] Grinder, 97-100.

the twentieth century, as did Pittsburgh, Buffalo, and Cleveland. In some cases, such as St. Louis, the engineering society could report modest progress. In others, positive results from either educational efforts or political lobbying were harder to discern. In either case, however, the members of the engineers clubs retained their optimistic faith that it was just a matter of time before the proper combination of education and technology solved the smoke problem.

Clean Drinking Water

The Gilded Age is well known as an age of excesses and contrasts. Wealthy financiers and industrialists flaunted their recently acquired wealth in ostentatious displays while new immigrants and the native poor suffered in filthy, congested urban slums. The same industries that provided the profits for robber barons and industrialists to build lavish mansions coated rich and poor alike in congested cities with soot and dirt. Coal smut on clothes or windows constituted a minor annoyance, however, when compared to other hazards increasingly common in the crowded urban landscape. As the *fin de siecle* approached, more and more Americans realized everyone shared a shared a common vulnerability to infectious diseases. Advances in bacteriology revealed that diseases which only a few years earlier had been considered as manifestations of only one disorder had to be recognized as separate illnesses. Even more disconcerting, diseases once thought to be the result of filthy habits or moral depravity were found to in fact be caused by micro-organisms that could attack anyone.

Water-borne diseases, such as typhoid, had come out into the open as equal opportunity killers.

The rapid growth of cities during the late nineteenth century overtaxed existing water and sewerage systems. Pollution from growing populations contaminated drinking water drawn from rivers and lakes. Water plants that had incorporated the latest advances in engineering only a few years before soon proved inadequate to protect the public. Deaths attributable to unsafe water supplies were widespread during the 1890s. Typhoid killed hundreds of people annually, with mortality being particularly high in towns and cities which depended on nearby rivers for water. In Typhoid and the Politics of Public Health in Nineteenth Century Philadelphia Michael P. McCarthy notes that an 1899 survey of the nation's eighteen largest cities revealed that the average annual death rate from typhoid was 34 persons per 100,000, but Philadelphia, which drew its water from the heavily polluted Schuylkill, had a death rate of 111.[288]

Typhoid is an acute infectious disease caused by the bacillus Salmonella typhi. A member of the same genus of bacteria as that salmonella responsible for a common form of food poisoning, typhi bacilli enter the body through contaminated food or water and undergo a 10 to 14 day incubation period. Unlike common food poisoning,

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[288] Michael P. McCarthy, Typhoid and the Politics of Public Health in Nineteenth Century Philadelphia (Philadelphia, PA: American Philosophical Association, 1987). For another perspective on the water supply problem see Stuart Galishoff, "Triumph and Failure: The American Response to the Urban Water Supply Problem, 1860-1923," pp. 35-57 in Martin V. Melosi, editor, Pollution and Reform in American Cities, 1870-1930 (Austin, TX: University of Texas Press, 1980).

which generally runs its course within a week and often needs no treatment other than over-the-counter anti-diarrhea medications, typhoid fever is a debilitating illness with a high risk of fatal complications. The disease can take a month or longer to run its course. Symptoms include headache, fever, severe diarrhea, nosebleeds, and intestinal hemorrhage. Complications such as peritonitis, meningitis, pneumonia, and heart failure often occur. Prior to the discovery of antibiotics mortality rates in some typhoid epidemics ran as high as 50 percent, although 12 percent seems to have been more typical.[289]

Typhoid epidemics struck large cities and small towns alike. Urban areas served by central water plants were no more immune to the danger of typhoid than villages where each house had its own well. At the same time that the city of Chicago was preparing to welcome thousands of visitors to the 1893 World's Fair designed to highlight progress in science and technology, publications such as Engineering News warned those potential visitors not to drink Chicago water for fear of contracting typhoid. In April 1892, for example, Engineering News noted that "beyond all doubt. . .typhoid fever at Chicago has reached truly alarming proportions."[290] Chicago, which drew its water from Lake Michigan, discharged sewerage into the lake too close to the

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[289] See, for example, George Chandler Whipple, Typhoid Fever: Its Causation, Transmission, and Prevention (New York: John Wiley & Sons, 1908).

[290] Anonymous, "The Chicago Water Supply and Typhoid Fever," Engineering News and American Railway Journal April 21, 1892: 404-405.

water intakes to be safe. While other cities, such as Philadelphia, had to cope with pollution generated upstream, Chicago created its own problems.[291]

By 1880 scientists had established clearly the cause of typhoid. Engineers and medical men alike knew the one sure way to prevent typhoid epidemics was to provide a city with safe drinking water. The public, however, often remained skeptical. When individual engineers spoke out in favor of constructing filtration plants or treating sewage before discharge into a river, politicians accused those engineers of attempting to create work for themselves.[292]

Scholars in the history of science and medicine have shown that responses to the dangers of typhoid varied widely from city to city. Despite increasing knowledge about the causes of disease, many members of the general public resisted the advice of both medical authorities and engineers. Polluters and victims alike had difficulty accepting that sewage released into a water supply at one location could lead to illness at another. The germ theory of disease was only a few decades old. Doctors were only beginning to accept that illnesses such as typhoid, typhus, yellow fever, and cholera were indeed separate diseases, not merely variations of one single miasmic illness, while members of the general public would retain beliefs in the ill effects of unhealthy humors or vapors well into the twentieth century. Ellis Chesbrough's

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[291] Between 1892 and 1900 Engineering News printed numerous reports on the Chicago water situation. See, for example, William T. Sedgwick and Allen Hazen, "Typhoid Fever in Chicago," Engineering News April 21, 1892: 399.

[292] See McCarthy for a thorough description of the problems John Trautwine encountered in trying to upgrade Philadelphia's water supply system.

proposed solution to the Chicago sewerage problem was, in fact, based on such outdated disease theories. Chesbrough, the city's chief engineer, designed the Chicago Drainage Canal to reverse the flow of the Chicago River. By having the contaminated sewerage flow away from Lake Michigan rather than into it, water flowing into intakes out in the lake would remain pure. Removing what Chesbrough believed to be the primary cause of disease, filth, coincidentally also removed the typhoid bacteria. Chesbrough's plan, completed many years after his death in 1888, did work. Chicago's untreated sewerage flowed away from the city toward the Mississippi River, a solution greeted with admiration by local engineers and with apprehension by the communities downstream.[293]

The belief that diseases such as typhoid were triggered by environmental factors such as evil smelling swampy ground or simple general filth remained widespread even into the twentieth century. When an epidemic struck a city it was often seen, as historian of medicine Charles E. Rosenberg has said, "the consequence of a unique configuration of circumstances, a disturbance in 'normal'. . . arrangement of climate, environment, and communal life."[294] A typhoid epidemic would be seen as the result of

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293 James C. O'Connell, "Technology and Pollution: Chicago's Water Policy, 1833-1930," Dissertation, University of Chicago, 1980. For an example of the thoughts of engineers downstream from Chicago, see J. B. Johnson, "The Engineer as a Guardian of Public Health," Journal of the Association of Engineering Societies XXIV(1898): 311-321, in which Johnson describes Chicago as having behaved unethically in changing "the face of nature to a neighbor's hurt."

294 Charles E. Rosenberg, Explaining Epidemics and Other Studies in the History of Medicine (Cambridge: Cambridge University Press, 1992).

unusually long winter or a particularly wet summer, not as a preventable contagious disease.[295]

Even when people accepted the general concept that micro-organisms might be responsible for disease, there was a tendency to misunderstand the actual science. In an 1894 article in the Journal of the Association of Engineering Societies E. A. Rudiger, a member of the Western Society of Engineers, described problems he encountered while investigating a typhoid epidemic which occurred at Ironwood, Michigan, in May 1893. Ironwood, a booming iron mining community of 12,000 people, was located in Michigan's Upper Peninsula about ten miles inland from Lake Superior. Following a long, bitter winter in which snow remained on the ground until mid-May, the city was struck by a severe outbreak of typhoid. Water drawn from the Montreal River by the local water company immediately came under suspicion, even though the neighboring city of Hurley, Wisconsin, which received its water from the same source, remained disease free.

Rudiger quickly concluded that the problem lay not in the river, which the local residents were eager to blame because organic matter from the cedar and hemlock swamps dyed it a deep brown, but in the numerous shallow wells townspeople persisted in using. Rapid melting of the snow pack had caused privies to overflow and contaminate ground water. Three separate bacteriological analyses, two conducted by

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[295] See Elisha Bartlett, The History, Diagnosis, and Treatment of Typhoid and of Typhus Fever (Philadelphia: Lea and Blanchard, 1842) for a fascinating description of medical beliefs prior to the discovery that bacteria were responsible for many diseases.

the Hygienic Laboratory of the University of Michigan and one by an independent chemist, found no typhoid bacilli or any other harmful matter in water from the Montreal, despite the discovery of the carcasses of six dead horses and cows on the banks of Norrie Creek, a stream feeding into the river just above the water plant intake. Rudiger recommended that to prevent future outbreaks of the disease the city move the intake for the waterworks far enough upstream to avoid any drainage from the city as well condemning and filling in all shallow wells, as he believed that the average person would never concede that water that looked and tasted good could still be teeming with disease. In his article in the Journal, incidentally, Rudiger devoted several pages to a thorough description of the etiology of typhoid, indicating that he recognized that many of his fellow engineers were possibly as ignorant of germ theory as the public they served. Rudiger in fact makes a point of explicitly refuting the filth theory of the disease of typhoid. He concludes his criticism of the filth theory by emphasizing that among the foreign inhabitants of Ironwood, "Poles, Italians, and Hungarians are probably as filthy in their habits as any people in existence, and yet hardly one of them had the fever."[296]

Further, as McCarthy has ably documented, politics frequently created impediments to the development of an improved water supply.[297] Any improvements to

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[296] E. A. Rudiger, "Typhoid Fever, and the Epidemic at Ironwood, Mich., in 1893," Journal of the Association of Engineering Societies XII(1894):474-487.

[297] See also Stuart Galishoff, "Triumph and Failure: The American Response to the Urban Water Supply Problem, 1860-1923," pp. 35-57 in Martin V. Melosi, editor, Pollution and Reform in American Cities, 1870-1930 (Austin:

city's water supply system entailed spending money and, despite the stories now common about the graft and corruption prevalent just prior to the Progressive era, politicians one hundred years ago were no more eager to spend money than they are today. City engineers were often elected officials or political appointees. Party affiliations meant that even when the engineers' recommendations were well-reasoned and scientifically sound, they met with loud partisan opposition. In McCarthy's example of Philadelphia, the director of the city waterworks, John Trautwine, was widely acknowledged as one of the most capable and effective civil engineers of the time, but he was still unable to convince a majority of the city council members to vote for funding construction of sand filtration beds for the water system. Trautwine, an active member of the Engineers Club of Philadelphia, enrolled the club in his efforts to obtain sand filtration for the city. The club sponsored numerous discussions of the water supply question as well as formally endorsing Trautwine's plans, but political resistance proved immutable.

In other cities, elected officials, either through ignorance or corruption, often refused to take even the first step in disease prevention, that of hiring a bacteriologist to test water supplies for contamination. The reports from meetings of the St. Paul engineers club from the 1890s, for example, contain a number of references to discussions regarding the city administration's refusal to adequately test the water

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University of Texas Press, 1980).

supply.[298] Editorials in the engineering press accused city administrators such as those in St. Paul of promoting willful ignorance: as long as waters remained untested cities could claim no problem existed no matter how high the death toll from typhoid rose.[299]

By the mid-1890s, as the typhoid problem showed few signs of improvement, local and regional engineering clubs began to assume a more active role in reducing health problems. Some engineering organizations became directly involved in finding solutions to local problems, while others pursued subtler remedies.

As noted in previous chapters, by the time the Gilded Age was ending, several distinct types of engineers clubs and societies had evolved. Local clubs, such as the Engineering Society of Detroit and the Engineers Club of St. Louis, drew their members primarily from one specific city or the area immediately surrounding it, although most accepted corresponding members, and met on a bi-weekly basis throughout most of the year. The program for a typical meeting would include the presentation of a short paper on a topic of engineering interest followed by a question and answer period and general discussion. Meetings were usually open to the public, either through word of mouth by members or notices printed in local newspapers and journals. Each week's issue of Engineering News included a list of all the upcoming

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298 Anonymous, “Civil Engineers Club of St. Paul,” Engineering News October 22, 1897: 177.

299 See, for example, Anonymous, "Concealment of the sanitary condition of cities," Engineering News and American Railway Journal July 28, 1892:84.

meetings of local and national societies and provided the name of a local contact person, usually the secretary, for each organization.

Regional and state organizations, such as the Iowa Society of Civil Engineers and Surveyors, tended to be more exclusive in their membership profile than the local clubs and also met less frequently. Most state groups quickly established a tradition of the annual meeting or convention. These annual meetings generally featured one day of excursions to points of engineering interest, such as a new waterworks, one or two days of paper sessions, and concluded with a banquet. The differences in organization, scope, and focus are reflected in the activities in which the different groups engaged. While members of all engineering organizations would probably agree that the professional engineer served, as Professor J. B. Johnson noted in an 1898 talk at the St. Louis club, as guardian of the public health, the organizations themselves varied considerably in both levels of activity and extent of engagement.[300]

For some organizations, typhoid never became an issue. Members may have taken a detached, almost academic interest in sanitary engineering problems as described in papers and professional journals or been personally involved as part of their professional careers, but typhoid an as issue never engaged the club as a whole. The Detroit engineers, for example, never discussed the disease at meetings or indicated any interest as a group in typhoid as a problem. The fact that Detroit, despite

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300 Johnson, "The Civil Engineer."

being dependent on river water, never suffered from typhoid to the extent that many other cities did may have had some influence on this apparent lack of interest.

Similarly, despite Chicago's high typhoid rate early in the 1890s, the Western Society of Engineers rarely discussed the disease. Work on the city's drainage canal system was proceeding at a good pace -- the club members knew this from personal observation, having participated in a number of excursions to view progress on the work. Completion of the canal combined with the 1893 relocation of the water intake to a site two miles farther out in Lake Michigan would effectively eliminate the threat of typhoid in Chicago. Consequently, most members no doubt believed typhoid would soon cease to be a problem. Rudiger's paper, presented at the June 6, 1894, meeting, proved a rare exception, but it dealt with the disease in an isolated mining town, not in Chicago.

Pittsburgh, however, was a different story. The heavily industrialized city drew its water from two seriously polluted rivers, the Monongahela and the Allegheny, and suffered significant health problems as a result. Both rivers were fast flowing with high levels of turbidity. As towns and villages upstream grew in population, the amount of sewerage discharged untreated into the rivers increased. The Allegheny in particular moved too fast for natural processes of sedimentation and decomposition to remove disease bacteria before the water reached the intake for Pittsburgh's water plant. The plant did have a sedimentation pond at the intake, but as demands on the system grew, sedimentation became increasingly ineffective. For sedimentation to be effective, water had to remain in the holding pond for at least a week, but studies showed that the Pittsburgh reservoir generally held less than two days' supply of water. By the early 1890s typhoid rates were rising rapidly.[301]

Members of the local general engineers' club, the Engineers' Society of Western Pennsylvania, which opened its membership rolls to all engineering disciplines, decided to take an active role in fighting for clean water. The Engineers' Society had been founded in 1880 and included a number of nationally known civil and mechanical engineers among its members, such as William Metcalf. (Metcalf had a national reputation, was a founding member of the American Society of Mechanical Engineers, and at one point served as president of the American Society of Civil Engineers.) By the mid 1890s the society had grown to over 400 members and included a number of the city's prominent industrialists. The Society also had an established policy of active civic involvement. Unlike some local clubs, the Pittsburgh engineers' society seldom hesitated to offer its advice on technical questions. The Engineers Society of Western Pennsylvania, incidentally, is the only local society mentioned in this dissertation to have assumed an aggressive position on all three issues described in this chapter. A few members complained that the Society's public-spirited efforts too often went unnoticed or that its advice was ignored, but Emil Swensson, Society president in 1897, maintained that "The safety, health, comfort and business prosperity of the citizens of this city and end of the State are as much dependent upon our profession as

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[301] James Otis Handy, "Sand Filtration of a Public Water Supply," Proceedings of the Engineers Society of Western Pennsylvania 13(1897): 70-125.

upon any other class of men, if not more, which in itself is sufficient reason for us to take a very active part in the affairs of the community and State, and not simply do what we are told."[302]

The society's efforts to obtain clean water for Pittsburgh progressed through several stages. The Society began by scheduling papers on topics related to water purification to be read and discussed at its regular monthly meetings. These papers, which included descriptions of both sewage treatment and water purification plants, served to educate both the membership and the general public to the seriousness of the problem and what remedies might be available to correct it. Next, the Society created an internal committee to investigate the question of Pittsburgh's water and to prepare a report. After the Society heard the report, it then lobbied local government to appoint a special city commission to study the water question and prepare recommendations. The society succeeded in stacking the commission members to ensure sound scientific and engineering principles would prevail. Members included three members of the Engineers' Society, a doctor, and a representative of the city Chamber of Commerce.

The city eventually incorporated many of the commission's recommendations into improvements to its water system, although not immediately. Unfortunately, at least from the point of view of the residents of Pittsburgh, although the 1894 committee was united on the need for purification, they split on the question of specific methods. The majority of the committee favored sand filtration, but two members

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[302] Proceedings of the Engineers Society of Western Pennsylvania 13(1897): 133-34.

balked at the expense, voting instead for a cheaper mechanical system. Five years later the question of sand versus mechanical filtration was still unresolved, although the city had begun implementing a number of the commission's other suggestions, such as installing water meters to reduce waste and slow the passage of water through the system.[303]

Regional engineers' organizations also played a role in promoting public health, but, unlike local clubs, generally did so in an indirect fashion. Members of the Illinois Society of Civil Engineers and Surveyors fought for safe drinking water not through direct involvement solving specific problems in any one municipality, but instead through support of legislation that would create safer conditions state wide. State engineering societies first endorsed proposals to create state public health boards and later supported measures designed to strengthen them. In the 1890s it was a rare annual convention that failed to find engineers discussing and then voting to either support or oppose pending legislation on a variety of issues.

In 1896, for example, the Illinois Society under the leadership of Daniel Webster Mead lobbied for passage of legislation to establish a State Board of Health. A report of the convention proceedings in Engineering News indicates engineers clearly recognized the only effective way to eliminate contaminated drinking water was to pass and enforce laws requiring treatment of sewerage and, at the least, bacteriological

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[303] See, for example, "Editorial," Engineering News January 25, 1896: 6, and "The Report of the Pittsburg Water Filtration Commission," Engineering News February 23, 1899:123.

analysis of water for home consumption. The Michigan Society of Engineers, the Minnesota Association of Surveyors and Engineers, and the Connecticut Civil Engineers and Surveyors Association all included papers on water purification in their programs during the 1890s.

Conclusions

Not all societies believed either political lobbying or public education was necessary or desirable. Many engineers continued to assert that the most effective way of improving public health was to simply perform competently as engineers. Alexander Dow, president of the Detroit Engineering Society, stated bluntly in 1900 that "The Detroit Engineering Society has always avoided any semblance of political action. . . . the tendency of each discussion was toward the education of our members as individuals and away from any action or even expression of opinion by us as a Society."[304] This contrasted with the opinions of engineers such as J. B. Johnson, a professor of engineering and active member of both the St. Louis engineers club and the ASCE.

Johnson argued that the amount of scientific information that the engineer was privy to made it imperative that the engineer use that knowledge for the public good. According to Johnson, it was the engineer's responsibility "*to lead in the work of educating the public to the point of providing the necessary legislation and funds to*

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[304] Alexander Dow, "The Position of the Engineer in Municipal Service," Journal of The Association of Engineering Societies 1900: 199-214. Cf. Mike Davis, ed., The Technology Century: 100 Years of ESD -- the Engineering Society 1895-1995 (Detroit: Engineering Technology Publishing, Inc., 1995).

carry out such measures and to build such works as are required [emphasis in original]."[305] Engineers and engineering societies had to provide the leadership and education for a general public that did not yet fully understand the importance of sanitation, water purification, and sewage treatment in the prevention of contagious disease.

Historians of technology have at times criticized engineers as being politically inert or focused too narrowly on status issues. Edwin T. Layton jr, for example, in referring to the engineers of the early twentieth century, asserts that "the ideology of engineering . . . encouraged sterile status seeking and prestige politics."[306] Other scholars have suggested that engineers avoided reform politics or overt social activism because their professional training and orientation caused them to mistrust any activity where tangible results could be difficult to discern.[307] The brief examples provided in this chapter suggest a different picture: engineers did take seriously their responsibilities as members of the general public and larger society, but were constrained by social conventions and professional pragmatism from direct participation in the partisan politics of the time, which often pitted would-be reformers

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305 Johnson, "The Civil Engineer."

306 Edwin T. Layton jr, The Revolt of the Engineers: Social Responsibility and the American Engineering Profession (Baltimore: The Johns Hopkins University Press, 1986), 252.

307 Cf. John Matthew Jordan, Technic and Ideology: The Engineering Ideal and American Political Culture, 1892-1934. Ph.D. dissertation, University of Michigan, 1989.

against entrenched party machines. The professional image of the engineer being carefully constructed and nurtured during the Gilded Age was that of the rational, detached, totally objective man of science. Schultz and McShance have posited that the carefully constructed non-partisanship of municipal engineers not only allowed the engineers to serve successfully through changes in local administrations, but also provided a model for the rationalization of city operations beyond the waterworks and sewerage systems. They conclude that it was engineers who "provided a model of administrative skill that later-day progressives would use as a basis for the structural reform of urban government."[308]

Discussions published in the Proceedings of the Engineers Society of Western Pennsylvania, the Journal of the Association of Engineering Societies, and elsewhere indicate that engineers themselves were conscious of their potential to serve as role models for the public. Over and over the leaders of local societies reminded the members that, as Robert Gillham, president of the Engineers Club of Kansas City, said in 1893, "The opinions of the Engineers Club, *if based upon careful investigation* [emphasis added], will command respect in the community."[309] That same year, Walter P. Rice, retiring president of the Civil Engineers Club of Cleveland, exhorted the local societies to "exert their forces in the direction of public education. . . let the organizations assume the courage of their convictions and they will become powerful

[308] Schultz and McShane, 410.

[309] Robert Gillham, "Work For Our Engineers' Club," Journal of the Association of Engineering Societies 12(1893): 304-313.

factors in the advancement of professional interests and of their standing in the eyes of the community."[310] As noted in Chapter One, this picture of the engineer as rational and incorruptible did in fact, become a dominant feature of American popular culture for the following three decades.[311] Active membership in local clubs and state societies allowed engineers both to influence the political process and work towards the public good. Local clubs could educate, advise, and lobby where individual engineers might hesitate to. In this section I touched on three issues -- smoke abatement, good roads, and clean drinking water -- but they are only a few of the many public health and welfare issues local and state engineering organizations investigated and acted upon in the 1880s and 1890s. Many other issues, ranging from building codes to conservation, also inspired local groups to form committees, conduct investigations, and pressure local and state government to implement changes. Unfortunately, as I shall describe in the concluding chapter, as engineering became more widely recognized as a profession, involvement in civic affairs gradually diminished.

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[310] Journal of the Association of Engineering Societies Proceedings XII(1893): 374. See also Malochee, previously cited, or Fitzgerald, previously cited.

[311] See Tichi, previously cited.

Chapter Five: Conclusions

Man is an animal suspended in webs of significance he himself has spun .

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-- Clifford Geertz

Introduction

In the preceding four chapters I provided an overview of the growth of engineering clubs and societies during the Gilded Age, specific histories of a few of the better documented organizations, and descriptions of engineering club responses to three issues important in the 1890s. In "Chapter Two: The Growth of Local Engineering Clubs" I described the emergence of several different types of engineering organizations and suggested a simple taxonomy to distinguish among them. In "Chapter Three: Similarities and Differences" I provided more detailed histories of eight specific groups to compare and contrast differences and similarities in origins, motivations for organizing, and membership demographics. Finally, in "Chapter Four: Engineers as Activists," I discussed the responses of local engineering societies to three specific public health and welfare issues of the 1890s, i.e., nuisance smoke, unhealthy water supplies, and public roads. These narrative details and descriptive data provide the grounding for a more complete understanding of the role local engineering societies played in the evolution of engineering into the public perception of engineering as a learned profession rather than being viewed by both its practitioners and the general public as primarily a specialized trade or skilled craft. In this chapter I will explain how the activities of local, state, and regional engineering clubs and societies helped to solidify the boundaries of engineering as an occupation and to legitimize its status as a profession.

I begin by discussing the accepted definitions of "professional." I then examine how the leaders of engineering clubs negotiated a common definition of engineering as a learned profession rather than a business or a trade through their journals and club meetings. I show how these engineering leaders encouraged ordinary engineers to demonstrate their acceptance of the definition of the engineer as a disinterested professional through participation in professional societies and engineering clubs. I then describe a few of the methods used by the engineering clubs and societies to convince the general public to accept and support the engineering community's definition of themselves as autonomous professionals. Finally, I conclude by explaining the paradox of professionalism in engineering: although active involvement in political activity and civic affairs helped engineers gain the support of the general public in viewing engineers as professionals, that same newly acquired professional identity required engineers to become disengaged from most political discourse.

What does it mean to be a professional?

As Peter Meiskins has noted, sociologists of work have generally viewed the professions in terms of a set of structural characteristics rather asking historical questions about the process of professionalization.[312] That is, there are presumed to be certain markers or identifying characteristics that typify the professions, such as a systematic body of theory or specialized knowledge, authority (i.e., the professional decides what the client needs), sanction of the community, a code of ethics, a cosmopolitan rather than a parochial orientation, and the development of a professional culture. Some sociologists of work will emphasize certain attributes more than others. Randy Hodson and Teresa A. Sullivan, for example, describe a professional as a person who is involved in the production of a nonstandardized product, who has a great deal of personal involvement with her work, who possesses a wide knowledge of a specialized technique, has a sense of group identity and a sense of obligation to the profession, and who provides a significant service to society.[313]

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[312] Peter Meiksins, "Professionalism and conflict: the case of the American Association of Engineers," Journal of Social History 19(Spring 1986): 403-21.

[313] Randy Hodson and Teresa A. Sullivan, The Social Organization of Work, 2nd edition (Belmont, CA: Wadsworth, 1995). Cf. Ernest Greenwood, "The elements of professionalization," pp. 9-19 in Howard M. Vollmer and Donald L. Mills, eds., Professionalization (Englewood Cliffs, NJ: Prentice-Hall Inc., 1966). See also R. Dingwall and P. Lewis, eds., The Sociology of the Professions: Lawyers, Doctors, and Others (London: MacMillan); Eliot Freidson, Professional Powers: A Study of the Institutionalization of Formal Knowledge (Chicago: University of Chicago Press, 1986); Richard Hall, "The social construction of the professions," Sociology of Work and Occupations 6(1979):124-26; or Robert W. Meserve, The American Bar Association: A Brief History and Appreciation (New York: The Newcomen Society of America, 1973).

As Meiskins noted, none of these attributes arises spontaneously. All result from complex exchanges and interactions among the various actors in the social milieu. In addition, the recognition of an occupation as a profession represents the acceptance of a certain amount of order, i.e., the establishment of a discernible hierarchy or ranking within a society, and, as sociologist Gary Fine notes, "All social order is negotiated order."[314] Social order never simply appears. It is negotiated and created by social actors. Allies that will support changing role definitions must be overtly and covertly enrolled, boundaries must be first defined and then defended. Eventually, if the aspiring professional occupational group succeeds in its negotiations, the occupation enjoys a rise in status.

Convincing the public that a particular occupation merits the status of a profession can be difficult. After all, many occupations can lay claim to at least some of the attributes of professionalism. All work involves specialized knowledge. Most workers develop an occupational culture complete with its own jargon or slang. None of these attributes is by itself sufficient reason to declare any occupational group a profession. For example, scholars in the history of occupations and the sociology of work often include the development of a distinct professional culture among the criteria that distinguish the professions from ordinary workers. Evidence of a professional

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[314]1 Gary Fine, "Negotiated orders and organizational cultures," Annual Review of Sociology 10(1984): 239-62. See also Rue Bucher and Anselm Strauss, "Professions in process," American Journal of Sociology 66(1961): 325-34; or Anselm Strauss, Negotiations: Varieties, Contexts, Processes and Social Order (San Francisco: Jossey-Bass, 1979).

culture can include the founding of organizations which restrict membership to exclude non-professionals, the use of a specialized language or occupational jargon, and the publication of journals and other periodicals. However, the characteristics of an occupational culture taken in isolation, i.e, as distinct from the other attributes of professionalism, will not in themselves guarantee that an occupation will be accepted as a profession. Long haul truckers, for example, have developed a distinct occupational culture complete with a specialized jargon, yet few members of the public would be willing to accord the same respect to the driver of an 18-wheeler that they do to their local chiropractor. Members of numerous occupations, ranging from automobile mechanics to hair dressers, have attempted to elevate their areas of expertise to the status of professions and failed. While the practitioners may refer to themselves as professional barbers or mechanics, attend annual conventions, join professional associations, subscribe to specialized journals, and even post explicit codes of ethics, their occupations continue to lack the status of a true profession. The public sees not a professional mechanic but a certified technician. Although the workers attempt to emulate professional behavior, their occupations still lack the sanction of the public.[315]

Leaders in the engineering community themselves were cognizant of the fact that the sanction of the community had to be earned. Editorials in Engineering News as well as comments in the journals of local societies, such as the Proceedings of the

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[315] See David L. Torres, "Professionalism, variation, and organizational survival," American Sociological Review 53(1988): 380-94 for an interesting discussion of efforts to professionalize the funeral industry.

Engineers Society of Western Pennsylvania, occasionally discussed the historical origins of the professions. In 1880 Engineering News, for example, noted that "From old time there have been physicians, lawyers and clergymen . . . Out of these beginnings have grown the modern professions of medicine, law, and theology."[316] The writer noted that medicine had once had very little practical knowledge to draw upon, being composed of more superstition than fact, but nonetheless over time attained the status of a learned profession. If medicine, which began with "physicians . . . at first about as ignorant as the patients they pretended to heal," merited the status of a learned profession, then surely engineering, which dealt "with the grandest facts in nature," must also soon merit that designation.[317] According to the author, engineering, in fact, should be recognized as "the noblest of all professions."[318] Unlike the law, which allowed for ambiguities, differing interpretations of regulations, and built on precedent rather than hard facts, engineering used established truths, or so the engineers themselves firmly believed. If the incompetent practicing engineers could be weeded out and the public's attention drawn to the reliability of the majority of engineering practice, engineering could escape the label of being a merely a skilled trade and take its rightful place as the most learned of professions. Local societies would help engineering achieve both objectives.

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[316] Anonymous, "Engineering as a Profession," Engineering News December 25, 1880: 443.

[317] Ibid.

[318] Ibid.

Defining Engineering

Before the general public could be enrolled as allies in a social network which supported the notion of the professional nature of engineering authority and expertise, however, a majority of engineers themselves had to agree on what engineering was. We know what it means to be a professional engineer now, but what did it mean in the decades following the Civil War? Mid-nineteenth century American engineers could lay a tenuous claim to professionalism based on their access to specialized knowledge. Textbooks and engineering guides existed, but working engineers had yet to soundly establish their authority within the community as independent experts. The rich descriptions from local clubs of the discussions at meetings, their various excursions, and the correspondence with other organizations and government agencies allow us to view the social construction of a professional identity.

When American engineers first began organizing local engineering clubs in the mid-nineteenth century, the boundaries of engineering as an occupation as well as its place in the social hierarchy were still being negotiated. Unlike medicine and the law, which could easily trace their lineage into antiquity, engineering as a civilian occupation was relatively new, a product of the Industrial Revolution. The nineteenth century public was, in fact, so accustomed to the practice of almost all notable engineering works, from harbor improvements to highway bridges, being directed by military men that many influential engineers acquired honorifics such as "Colonel" or "Captain" without ever having enjoyed any connection with the military. Engineers still found themselves having to explain that "The term 'civil engineer' implies, therefore, an engineer who is a civilian, and it is intended to include all classes of engineers who do not belong to the military service."[319] Both the public and the engineers often were in the dark as to what the engineer's status was in relation to the public and vice versa. As large scale engineering works, such as railroads and canal systems, grew in size and complexity, it was clear that the engineer's work often affected the general public, either directly or indirectly, but where did the engineer's responsibilities lie in relation to that public? Should the men who oversaw the construction of the canals consider themselves merely employees of the financiers underwriting the project or did they possess a broader social mandate to safeguard the public's interests? Were they contractors or consultants?[320]

Other important questions included, Who owned an engineer's notes? Was engineering expertise analogous to scientific knowledge and therefore a public good to be freely shared, or was it a private good, a commodity to be use for personal profit? As technological systems became more complex and new areas of specialization in mechanics or electricity evolved, where did the new experts fit in relation to traditional civil engineers? These and other issues were negotiated not just as part of the growth of national societies, as documented by Calhoun, Calvert, et al., but also within the

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[319] J. W. C. Haldane, Civil and Mechanical Engineering: Popularly and Socially Considered, second edition. (London: E. & F. N. Spon, 1890), 96.

[320] See, for example, Anonymous, "Engineers and employers," Engineering News January 4, 1879: 2.

meetings and journal pages of the state and local engineering clubs and societies and as part of the clubs' interactions with the general public. Members of the national societies, such as William Metcalf and Octave Chanute, may have been influential in founding local clubs, but not enough similar role models existed to impose national attitudes toward engineering on all local societies. Nor were the national societies themselves so large and powerful in the 1880s and 1890s as to be able to dominate effectively the discourse in engineering. In the 1880s both the meetings and the proceedings of the national societies competed for the attention of engineers with dozens of local and state engineering societies and an ever-growing host of trade periodicals and journals. The Journal of the Association of Engineering Societies, the Journal of the Engineers Club of Philadelphia, and others all published technical papers comparable in quality and detail to those printed in the ASCE or ASME journals, along with the minutes of meetings at which issues important to engineers were thrashed out. In describing the growth of the national societies as a causal factor in the professionalization of engineering in America, Layton, Sinclair, and others have in a sense assigned more credit than those national societies merit. As noted in Chapter Two, the self-designated national societies' membership rolls included only a small percentage of the practicing engineers in Gilded Age America. The 1880 United States Census lists 8,261 working engineers and surveyors, of whom approximately one-eighth resided in New York State. At the same time, the ASCE listed only 601 men on its membership rolls, and the ASME had just begun to organize as an engineering society.

By 1890, the United States census recorded over 40,000 working engineers, but the ASCE claimed a membership of barely 1,000, most of whom resided in the New York City area. As noted in detail in Chapter Two, engineers residing in other parts of the country often referred to the society as being in essence a local club, no matter what pretensions it might cherish regarding a national membership base. The largest national and most geographically diverse society during the Gilded Age was, in fact, the group other engineers occasionally denigrated as the least professional: the American Institute of Mining and Metallurgical Engineers. With almost 2500 members, the AIME was easily twice the size of ASCE. At the same time, in 1890 the American Society of Mechanical Engineers had 1273 full members and the American Institute of Electrical Engineers a mere 195.

Further, although the national societies may have aspired to shape the profession, the acerbic comments contained within the pages of the proceedings of local clubs make it clear that local organizations found national organizations sadly deficient. On March 14, 1893, for example, Walter P. Rice of the Cleveland club noted that when it came to educating the public and advancing the engineering profession, "The conservatism of the National Society in this particular direction, forces us to look elsewhere, . . . so our trust must be largely placed in the hands of the local societies."[321] While the national societies may have served as a reference group for Gilded Age engineers, the ASCE, AIME, and AIEE were not necessarily the most influential of the groups to which individual engineers belonged. In sociology, the concept of reference group can be used either to indicate a group that an individual may aspire to join, or to indicate a group that an individual uses in gauging her own status of progress. A reference group thus can be normative or evaluative or both. As Robert K. Merton has pointed out, "Reference groups are, in principle, almost innumerable: any of the groups of which one is a member, and these are comparatively few, as well as groups of which one is not a member, and there are, of course, legion, can become points of reference for shaping one's attitudes, evaluations and behavior."[322] When engineers came together to organize a local club or a regional society, they were creating reference groups that had the potential to either reinforce or counteract the influence of the national societies. As Shibutani, Clarke, and others have noted, reference groups not only serve as mirrors, they generate shared perceptions and act as focii for social action.[323]

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[321] Walter P. Rice, "The Mission of a Local Civil Engineers' Society," Journal of the Association of Engineering Societies XII(1893): 373-376.

[322] Robert K. Merton and Alice Kitt Rossi, "Contributions to the Theory of Reference Groups," pp. 28-68 in Herbert H. Hyman and Eleanor Singer, editors, Readings in Reference Group Theory and Research (NY: The Free Press, 1968). See also Howard S. Becker, Outsiders: Studies in the Sociology of Deviance (NY: The Free Press, 1973).

[323] See, for example, Adele E. Clarke, "A Social Worlds Research Adventure: The Case of Reproductive Science," pp. 63-94 in Anselm Strauss and Juliet Corbin, editors, Grounded Theory in Practice (Thousand Oaks, CA: Sage, 1997); Tamotsu

By organizing local clubs engineers could participate actively in the creation of the image of engineering as a profession distinct from less learned trades, such as mechanic or carpenter, and in establishing an ideology to perpetuate that image both within the new profession and in the public mind. In 1884, George Frost, editor and publisher of Engineering News, printed a letter in which the writer commented on the low status of the engineer in the eyes of the public. The writer claimed that "Engineers, as a body, have been content to accept (and be thankful for it) the position assigned them by the general public: 'a little better than the village blacksmith and not quite so good as the village carpenter.'" The letter concluded by advocating collective action by engineers, noting that engineering deserved consideration as a profession but that it would never attain that status without the efforts of engineers themselves: "Engineering may yet rank as a learned profession, . . . but its energy must come from within."[324]

Articles in the engineering press made frequent reference to engineering as a new profession. W. Milnor Roberts, in an 1875 address to the American Society of Civil Engineers, noted civil engineering until only a few decades previously had been very narrow, concerned "chiefly in connection with canals and analogous works."[325] By the 1870s, however, the profession had grown into so many subspecialties --

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Shibutani, "Reference groups as perspectives," American Journal of Sociology 60(1955): 522-29.

[324] Engineering News March 8, 1884: 116.

[325] Engineering News July 15, 1875: 90.

railroads, waterworks, bridges, mining, and so on -- that there was no way one engineer could hope to know it all. Commentators argued that "There is no profession requiring a greater diversity of knowledge or a more intense study than does that of the engineer."Engineering News June 6, 1878: 177.

For much of the nineteenth century the traditional path to a career as a civil engineer was to serve for a time as a rodman or axeman with a survey crew for a canal or a railroad project and work one's way up from there. These entry-level positions were not only unpaid in many instances, but were ones that the would-be engineer was willing to pay a fee to the employer for an opportunity to try. Robert Ridgeway, ASCE President in 1925, began his career as an unpaid rodman in his teens and by the age of twenty-two was supervising construction crews building railroad tunnels through the Rockies. Frederic P. Stearns (ASCE President in 1906) apprenticed at eighteen and by age twenty-nine was division engineer for the city of Boston. In The Mechanical Engineer in America 1830-1910 Monte Calvert suggests that a similar pattern held true for early mechanical engineers, and uses the career path of the father of scientific management, Frederick W. Taylor, as a paradigmatic example. Taylor gained his technical skills as a mechanical engineer through apprenticeship in a machine shop. Even after the passage of the Morrill Act in 1862, which established state agricultural and mechanical colleges, young men interested in machinery would often begin their professional lives by working in a shop, not by pursuing a college degree. A young man with ambition and ability could advance quickly, due to the shortage of engineers for much of the nineteenth century, but both college graduates and non-graduates began at the bottom. Experienced engineers viewed the college curriculum, even at a technical school, as merely providing a solid grounding in the basics of a good classical education. Many regarding engineering colleges with suspicion, firmly believing that nothing could replace the traditional apprenticeship program.[326]

Entering engineering via an apprenticeship did not necessarily entail that the prospective engineer was unlettered. Many young men from upper middle class backgrounds and possessing what would now be considered a liberal arts education entered engineering for health reasons. Civil engineering was considered an ideal career for young men of delicate health since it exposed a person to the invigorating elements and a healthy lifestyle, and at least two ASCE past presidents pursued engineering careers for just that reason. Thomas Clarke, president in 1896, graduated from Harvard in 1848. His delicate health led his family to encourage him to seek outdoor employment for a time. His apprenticeship with various railroads led to a successful private practice, and he never did resume the career in law for which he had originally trained. Similarly, Elmer Corthell graduated from Brown University in 1867, but was considered sickly and apprenticed in civil engineering for health reasons.

Thus it was common for many of the leading engineers of the nineteenth century to be men who had enjoyed a solid classical education, including reading the works of Aristotle and Plato in the original Greek, and then acquired their engineering

[326] See, for example, Merritt, 53.

skills either through education or apprenticeship. Alphonse Fteley, an active member of the Boston Society of Civil Engineers and the New England Water Works Association, earned an academic degree from a French university before entering L'École Polytechnique. Similarly, George Morison, a president of the Western Society of Engineers received first a Bachelor of Arts from Harvard and then a law degree, before commencing on a career as an engineer, an occupation for which his memoir in the Proceedings of the American Society of Civil Engineers notes "he had no special education or training."[327]

As a consequence, the engineering elite in the nineteenth century included a significant number of men who were reasonably well-read in moral philosophy. Fteley, Morison, Chanute, and many of their contemporaries were undoubtedly familiar with Aristotle's arguments regarding values and happiness. According to Aristotle, the pursuit of money for its own sake was meaningless: "The life of money-making is undertaken under compulsion, and wealth is evidently not the good we are seeking, for it is merely useful for the sake of something else."[328]

Speaking in October 1876 at a meeting of the American Society of Civil Engineers, noted civil engineer John B. Jervis described what he believed constituted a good engineer. According to Jervis, a good engineer "is so immersed in his

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327 Anonymous, "George Shattuck Morison, Past-President, Am. Soc. C. E.," Proceedings of the American Society of Civil Engineers 31(1905): 172-180.

328 Aristotle as quoted in Paul E. Fink, Moral Philosophy (Encino, CA: Dickenson Publishing, 1973), 138.

profession that he has no occasion to seek other sources of amusements, and is therefore always at his post. He has no ambition to be rich, and therefore eschews all commissions that blind the eyes and impair fidelity to his trust."[329] Jervis argued that

> it is necessary to cultivate the profession so as to secure the qualifications and character before named, to carefully avoid all theories that are not based on well established and thoroughly analyzed facts, and to be very cautious before applying any theory, to see that all the facts involved are obtained, and that none are hastily and inconsiderately assumed. The profession is one of great importance to the public interest, and no pains should be spared to fully qualify those who pursue it for every engineering emergency, and to fit them for the discharge of every duty with scrupulous fidelity.[330]

According to Jervis, while it was true there were men engaged in work as engineers whose motivations lay in the potential profits of an engineering enterprise, their ranks included none of the truly great engineers. For Jervis a professional engineer was a man attracted by the challange of solving technical problems in the field of engineering and committed to doing so in an objective, efficient, and cautious manner. A good engineer avoid risks and questioned innovation for the sake of innovation. In short, "A true engineer considers his duties as a trust, and directs his whole energies to discharge the trust, with all the solemnity of a judge on the bench."[331]

Jervis's description of the ideal engineer not surprisingly bears a strong resemblance to the model of the professional in any occupational field. J. N. Moline,

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329 John B. Jervis, "A Memoir of American Engineering," Transactions of the American Society of Civil Engineers VI(1877): 39-67.

330 Ibid.

331 Ibid.

for example, writing in Social Science & Medicine posits that perhaps the truest indicator of professionalism is dedication. That is, for the professional the profession, whether it is medicine or engineering, becomes an entire way of life and not merely a time-consuming job. The profession becomes the professional's primary identity, e.g., "I am an engineer" rather than "I work as an engineer." In ideal practice, this internalization of professionalism means the professional always puts her clients' needs ahead of her own self-interest. This, as Moline puts it, "To call a person a professional in this sense is to honor the person."[332]

Jervis's description of the professional engineer also contains echoes of another lesson from the classics popular in the nineteenth century -- the story of the Roman general Lucius Quintus Cincinnatus. The story of the Roman general who, once the battles had been won, returned to the simple life as a farmer was one every American school child heard. Parallels had been drawn between Cincinnatus and George Washington, the nation's first president. It was fairly common for parents to name their children after Cincinnatus.[333] The moral lesson imparted with the story, that the best way in which a person could serve his country was not to seek the limelight or personal power but instead to do his quiet best at whatever his chosen occupation

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[332] J. N. Moline, "Professionals and nonprofessionals: a philosophical examination of an ideal," Social Science & Medicine 22.5(1986): 501-8.

[333] For example, Lucius Quintus Cincinnatus Lamar, Secretary of Interior under Grover Cleveland and later a Supreme Court associate justice.

might be was emphasized in William McGuffey's Eclectic Readers read by generations of nineteenth century future engineers.

Thus, it is not surprising we find the members of local engineering clubs engaging in two superficially mutually exclusive forms of rhetoric. First, speakers quoted in the proceedings of various clubs and in the engineering press emphasized repeatedly the need to educate the public regarding the technical marvels achieved by engineers. Engineers were unappreciated, unknown, unsung. People remembered the artifact, but not who designed it. Engineers needed to speak out, to promote aggressively the merits of their chosen profession. "'Engineering' can only make empty claims to a professional importance until its practitioners assert its professional dignity like those of law, medicine, and theology."[334] Unfortunately, according to the engineering press, too often it seemed that for the public that dignity was manifested in bridges and canals, not the men who designed them or oversaw their construction.

Cassier's, Van Nostrand's, and Engineering News as well as the professional journals of the late nineteenth and early twentieth century are replete with references to the fact that artifacts will be remembered long after their inventors, designers, and builders are forgotten. As Cassier's Magazine noted in 1891,

> How many are there outside of the engineering profession who can recall to mind without reference to books the name of the engineer through whose skill has been raised the great and famous structure over the Firth of Forth, in Scotland? Still fewer, perhaps, are those who are familiar with the genius

[334] Letter in Engineering News March 8, 1884: 116.

> whose fame one might say lies hidden in the cavernous recesses of the Thames Tunnel![335]

That this emphasis on the artifact rather than the inventor eventually became an integral part of engineering culture is not surprising. Sociologists have known for many years, as Peter M. Blau notes, that, "Group members who have achieved high status also tend to engage in self-deprecation."[336] The same ideals of professionalism that engineers strived to achieve as part of raising the status of engineering would, in fact, mitigate against the recognition of the accomplishments of individual engineers. Many books written by or for engineers often are prefaced with comments such as "the history of engineering is not studded with the names of outstanding geniuses,"a statement most historians of engineering would recognize as patently false.[337] In addition, while engineers of the nineteenth century may have regretted that the public seemed too unaware of the accomplishments of outstanding individual engineers, the culture of engineering that developed became one that inculcated a norm of anonymity, of being just another team player, not a star.

This happened because at the same time that the engineering press praised the technical achievements of important engineers, it also described the ideal engineer as

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[335] Anonymous, "American Society of Mechanical Engineers," Cassier's Magazine 1(1891):91+. The author, incidentally, while decrying the lack of appreciation of individual engineers does not bother to identify the individuals whose names he regrets no one now remembers.

[336] Blau, 49.

[337] Samuel Rapport and Helen Wright, editors, Engineering (New York: New York University Press, 1963), xii.

modest and self-effacing. Engineers were told they "are not a very 'pushing' class;"[338] are "exceedingly modest men;"[339] and posssess "an uncommon good nature."[340] Occasionally this modesty could be used to the disadvantage of the good engineer when the charlatans and incompetent blowhards pushed their way to front to win positions that rightfully belonged to better qualified men: "But all over our country are young and competent engineers, overshadowed and pushed aside by rude quacks and scheming humbugs."[341] The solution was not to push back, but instead to work on improving the profession to eliminate the quacks.

In addition to being modest, engineers were cautious and conservative, rejecting speculative theories in favor of facts. Engineers should always remember that the lives of the general public depend on the engineer not taking chances. They were told:

> Conservatism, in an engineer, is to be commended. It is this that gives him his eminence. All his work is built upon safe principle: untried elements are not admitted. In the interests of safety and true economy, he will always select that which he knows to be good, rather than that which is said to be so.[342]

Good engineers simply did not take chances.

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[338] Engineering News 1878:353.

[339] Engineering News February 21, 1880: 65.

[340] Engineering News February 19, 1884: 187.

[341] Engineering News May 1876: 153.

[342] Engineering News July 11, 1878: 218.

As detailed in Chapter Three, engineering societies such as the Michigan Association of Civil Engineers and Surveyors often stated "improvement of the profession" as an explicit goal. The Michigan Association worked at elevating the profession by attempting to improve the skills and knowledge of all engineers and surveyors working in Michigan. The 1880 United States census listed 273 land surveyors and civil engineers working in the state in that year. Sixty-three, or twenty-three percent of these known engineers, attended the Association's first meeting. By the following year, the Association could claim one-hundred-eleven members, meaning that more than one out of every three working engineers in Michigan belonged to the organization. Even if some members never attended a meeting, they all would receive copies of the society's proceedings, as well as exchange materials from other engineering and surveying associations. In the Secretary's Report for 1888, for example, Francis Hodgman mentions that "In July I sent out copies of the Michigan, Illinois, Missouri, Canada and Ohio reports, to all who were entitled to them . . ."[343] The state association could thus serve to improve the quality of engineering practice of even its most distant members. In addition, by including the full text of discussions as well as the text of technical papers in the Proceedings, the association ensured that absent members learned about the political, social, and legal issues confronting the profession. The proceedings not only provided examples of shoddy practice as part of

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[343] Proceedings of the Michigan Association of Surveyors and Civil Engineers 1888: 18.

discussions of what NOT to do, they also implicitly criticized the demeanor and habits of the untrained and incompetent surveyor or engineer.

A tension did exist between civil engineers and surveyors in the nineteenth century. Occasional articles in the engineering press indicated that, while the public might not be able to tell the difference, the engineers and surveyors themselves could. The perception within engineering was that engineers enjoyed a higher status, although an occasional article would mock both occupations as being equally unskilled, but with different instruments.[344] A correspondent to the Engineering News in 1875, however, minced no words in criticizing what he characterized as the typical county surveyor:

> too much cannot be said against the so called practical surveyor . . . whose knowledge professional, consists only of a smattering of the principles of surveying, barely enough to intelligently use a common compass, and who neither knows how to find the correct meridian of a place, or the variation of the needle. . .[345]

Editorials and letters denouncing poorly trained surveyors appeared on almost a weekly basis in the trade periodicals such as Engineering News.

In contrast with Engineering News, which pulled no punches in lambasting marginal practitioners, the proceedings of local and state societies exhibit, if not complete tolerance, understanding. The poorly trained engineer or surveyor is encouraged to join with his fellow engineers and raise himself up. By attending meetings, listening to the technical papers, and talking with representatives of the

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344 See, for example, Anonymous, “Concerning Surveys and Surveyors,” Engineering News V(1878): 353.

345 "Letter to Editor," Engineering News January 1875.

instrument manufacturers even the most poorly trained surveyor could improve his skills and knowledge. By the turn of the century, as more formally trained engineers and surveyors entered the profession, local and state societies did begin advocating strict licensing laws to eliminate incompetent engineers from practicing as independent consultants, but at the time when many state and local societies were first organized the majority of American engineers had acquired their skills on the job. Men who had come up via the traditional route of rodman and as a consequence had gaps in their expertise deserved the opportunity to better themselves, not be condemned out of hand.

The practical aspect of avoiding alienating potential allies in building what could become a powerful social network undoubtedly also played a role. Kleinman and Fine have argued that organizations use rhetoric to influence members to change their core selves. This certainly seems to be one of the implicit goals of most early engineering clubs. That is, the clubs and societies were trying to persuade members to internalize the norms and values consistent with professionalism, not always an easy task.[346]

Attempts to define the profession continued into the 1890s, but more and more the comments from practicing engineers reflected the belief that engineering was both a science and a profession. Most speakers and writers would agree with Professor J. B.

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[346] See Journal of the Association of Engineering Societies Proceedings XI(1892): 55-64 for a lively exchange between members that evidences clear differences in the understanding of whether engineering is a trade or a profession.

Johnson that engineering was a young profession, but a few still disputed whether it should be one. Speaking in December 1893 Johnson suggested

> We are now as a profession, I conceive, very much in that uncertain adolescent state in which we all found ourselves when our downy cheeks began to reveal the fact we were no longer children but when we could not claim to be men. We are sure we are more than mechanics and surveyors, and something different from the mathematicians and the pure scientists, and yet we cannot indicate any clear line of demarcation between ourselves and those other related classes.[347]

Engineers such as General William Sooy Smith of the Western Society of Engineers who held that engineering knowledge was a commodity that should never be dispensed freely were increasingly seen as anachronistic within the profession. In discussing a proposal to establish a committee to look into highway bridge safety, General Smith argued against the Western Society's undertaking any technical investigations gratis for the State of Illinois, saying that to do so was taking bread out of the mouths of members. No other members spoke out for the record to support Smith's view, and a number spoke against it. The prevailing opinion was that as an organization of professional engineers the Society had a civic duty to attempt to ensure public safety through advocating a system of highway bridge inspection.[348] Cosmopolitanism and communalism, two characteristics of professionalism, won out over parochialism and individual self-interest. Engineers who, as the Engineering News reported a decade

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[347] J. B. Johnson, "The Birth of a Profession," Journal of the Association of Engineering Societies XIII(1893): 78-87.

[348] Journal of the Association of Engineering Societies Proceedings XI(1892): 351-352.

earlier, "claim that the knowledge gained by hard work and experience, is private property, their capital in trade, which is not to be spread, even before their professional brethren . . ."[349] had become a minority within engineering societies. Most members of the Western Society apparently harbored no doubts about whether or not engineering was a profession. Similarly, members of the Michigan Society of Engineers (originally the Michigan Association of Surveyors and Civil Engineers) were confident they could see a discernible difference in the profession from what it had been at the time their organization was founded. By 1892, twelve years after its organization, members of the Association believed they could see the results of their attempts to elevate the quality of engineering within the state. At the annual meeting that year Francis Hodgman, a civil engineer from Kalamazoo and past Secretary of the society, asserted that "we went to work as a society with the principal aim to improve ourselves and to improve the profession. We have done good work in that line. Our work has made better surveyors and better engineers not only all over our State, but all over the United States."[350] As far as Hodgman was concerned, the efforts of the Michigan Society of Engineers had helped an occupation that a few years earlier had lacked a clear identity to elevate both the quality of its practice and its status in the eyes of the engineers themselves and the general public.

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[349] Engineering News May 17, 1884: 244.

[350] Proceedings of the Michigan Society of Engineers 1892: 166.

Convincing Engineers to Join Local Clubs

It was not an easy matter for engineers to join together in professional clubs and societies in the years following the Civil War. Engineering was a highly competitive business. As The Engineering and Mining Journal noted in 1870, it was "scarcely fair to expect a man, distinguished in some particular branch of engineering, . . . to go to a meeting where he sits next to his most dangerous rival -- a man, perhaps, who is contending with him for the superintendence of some large construction or the contract for some expensive machinery. . ."[351] This theme, that concerns regarding competition could inhibit engineers from gathering together to freely exchange technological knowledge and to socialize as equals, recurs in the technical literature throughout the nineteenth century. As late at 1900 speakers at engineering club meetings occasionally raised the issue of professional rivalries. Competition created barriers among engineers that membership in the local clubs was meant to remove. Colonel Jared Smith, president of the Cleveland club at the turn of the century, took time in his annual address to the membership to remind those present that "Our club life has for one of its main objects the breaking down of these barriers."[352]

Similarly, in speaking to the Engineers Society of Western Pennsylvania in 1894, Charles Davis reminded members that "It is by the candid and unreserved

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351 Anonymous, "Associations of Engineers," Engineering and Mining Journal March 15, 1870.

352 Journal of the Association of Engineering Societies Proceedings XXVI(1901): 41.

exchange of our views and experiences; by plain, outspoken but always friendly and unbiased criticisms, that we arrive at the truth; and by taking an active professional interest in the improvements in contemplation, or in progress around us, we will make our presence felt among our fellow-citizens. . ."[353] If engineers wanted to command the respect of the public they first had to respect each other.

As noted in Chapter Two, Engineering News emphasized repeatedly the value of joining an engineering society. Not surprisingly, considering that editor and publisher George Frost was an active ASCE member, editorials often urged readers to affiliate with the American Society of Civil Engineers, but the weekly magazine also praised local clubs in Chicago, Philadelphia, St. Louis, and elsewhere. Frost had, in fact, been quite effusive in praising the Chicago-based Civil Engineers Club of the Northwest (later known as the Western Society of Engineers) in the 1870s prior to his moving his publishing operations from the Windy City to New York. Editorials reminded readers

> One of the best methods of obliterating professional ruts is to cross it with others, until by their frequent intersection the general surface is made smooth. Engineers, to progress, must compare their experience with other engineers, weight their results by the results of other methods, hear the men of broader experience relate their trials and their triumphs. When this is done who can doubt the general gain?[354]

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[353] Proceedings of the Engineers Society of Western Pennsylvania 10(1894): 13.

[354] Engineering News May 3, 1884: 216.

In short, the good that came from sharing information surely outweighed petty concerns about other engineers becoming privy to one's personal trade secrets.

In countering fears about competition, the leaders of some local societies suggested that engineers actually had few reasons to worry. Speaking to the Western Society in 1882 Willard Pope emphasized that "It is the good fortune of our calling that there is not much personal rivalry or competition. The field is so large and capable of such great subdivision into specialties that there is room for all; . . . "[355] The engineering press reiterated what engineers themselves knew: each passing year witnessed new inventions, increased manufacturing development, more miles of railroad track being laid down, more elaborate sewerage and water supply systems being put in, bigger and bolder dams and bridges being built. Electricity, a minor scientific curiosity for most of the first half of the century, became a rapidly expanding engineering concern in the decades following the Civil War. Edison's work with electric illumination as well as other advances in the fields of telegraphy and telephony signaled the birth of new technical fields, but it would take a decade or more before engineering curricula reflected the emergence of new specialties.

On March 24, 1883, Engineering News posited that "To have a certain knowledge of electricity and its practical uses as regards his profession is therefore incumbent on the engineer of the present day." The month before expressing that editorial opinion, Engineering News had suggested that "one of the best fields for

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[355] Willard Pope, "Usefulness of Engineers' Societies," Engineering News April 20, 1882: 139.

young men to prepare for is that of electrical engineering," but noted that in general "Our colleges as yet have not taken up the subject except as it occurs in other studies."[356] The 1880 United States census did not include a category for electrical engineers. It did not, in fact, acknowledge the existence of any engineers other than "civil." The 1890 census included all engineers, including mechanical and electrical as well as civil, in the same category, for a total of 43,000. The 1900 census counted over 50,000 "electricians," including electrical engineers. A subdivision of engineering that scarcely existed when Pope spoke of subspecialties in 1882 mushroomed into its own distinct field not even twenty years later.

Similar, if perhaps less spectacular, growth occurred in mechanical, chemical, and other areas of engineering specialization. The Pittsburgh-based Engineers' Society of Western Pennsylvania, for example, established a chemical section in 1893. The establishment of the section reflected the growing importance of chemistry to the industries of that region. The section had sixty-three founding members, including a woman chemist, Mary L. Lynne, and grew rapidly. Thus, while competition undoubtedly existed and probably formed a valid concern for the younger, less established engineers, in a time of rapid technical advances for many engineers worries about rivalries constituted less of a problem than simply staying current with the latest literature. This need to stay caught up with the latest advances in engineering was one area where local societies could provide a service none of the nationals could. The

356 Engineering News February 17, 1883: 79.

local society library was often mentioned as a good reason to join the local engineering club.[357]

When it came to keeping abreast of developments in engineering, the local engineering societies, with their monthly meetings featuring lectures and discussions on topics of current interest augmented by the published transactions and proceedings containing full transcripts and illustrations of those discussions, could help individual engineers in a way that their simply subscribing to a few periodicals on their own could not. As noted above, most of the local clubs maintained a set of rooms that included a library. By the 1890s, those libraries typically housed several thousand books relating to engineering topics as well as bound volumes of numerous periodicals and journals. In 1897, for example, the Western Pennsylvania society reported its library received seventy-seven periodicals, transactions, and proceedings through exchanges with other organizations and subscribed to an additional eighteen publications. In addition to exchanging proceedings with various national, state, and local societies, the Western Pennsylvania engineers received reports from government agencies, departments of engineering at various colleges and universities, trade associations, scientific associations, and a number of foreign engineering and scientific societies. The well-established local societies could boast of engineering libraries more extensive than those of some university departments of engineering. The libraries represented a

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[357] See, for example, Journal of Association of Engineering Societies XIV(1894): 84.

resource that only the most successful of individual engineers could hope to duplicate on their own.[358]

Thus, by the mid-1890s, members of local societies had several powerful arguments they could employ in recruiting new members. In addition to the benefit of meeting and interacting with fellow engineers, the engineering society provided members with resources not readily available elsewhere. The publication of local transactions meant more engineers could have the satisfaction of seeing their research and progress reports in print. Society officers, in a subtle combination of appeals to both ego and pocketbook, frequently encouraged members to contribute more papers for publication as the more substantial a local journal became, the easier it would be to solicit outside advertising to support that journal. Some local societies managed to collect enough revenue from advertisers that their journals were in fact self-supporting.[359] Finally, the society's library and exchange services provided wider access to recent technical developments in all fields of engineering, not just one individual's specialized interest. In 1895 John Trautwine, the acting editor of the Journal of the Association of Engineering Societies, commented on the rapid growth of local societies,

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[358] See Proceedings of the Engineers' Society of Western Pennsylvania 13(1897): 26-28. Cf. "Library report of the Civil Engineers Club of Cleveland," Journal of the Association of Engineering Societies Proceedings XI(1892): 286-288.

[359] See, for example, John C. Trautwine jr, "Annual Report of the Secretary to the Board of Managers," Journal of the Association of Engineering Societies XXVIII(1902): 46-49.

> The increasing numbers and influence of these [local] societies, whose transactions represent the most modern thought and practice, testify to their great value in the education and advancement of the engineer.[360]

The successful establishment of an engineering society occasionally meant that organizations that began as inclusive evolved into exclusive groups, and vice versa. That is, having begun by trying to create as broad a base of support as possible at its founding, after a local club or society's members believed the organization was firmly established, questions of exclusivity often arose. Despite having organized by using the most inclusive membership criteria, once the organization appeared thoroughly viable, suggestions that the group should begin to discriminate more in admitting new members quickly found voice.[361] The Michigan Society, for example, began by issuing a general call for prospective members to all engineers and surveyors working within the state. The first set of formal by-laws required that all applicants for membership had to have the endorsement of a current member and that their applications must be approved by a seventy-five percent majority of the membership. By 1886, six years after the Association's founding, the Proceedings reported that "The members were quite unanimous in desiring to raise the standard of admission into the society. . . "[362]

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[360] Journal of the Association of Engineering Societies Proceedings XIV(1895): 59.

[361] Some organization theorists have posited that the value an individual perceives an organization as providing depends a great deal on how difficult it is to become a member of that organization. Cf. Henry Hansmann, "A status theory of organizations," Journal of Law, Economics, and Organization 2(1986): 119-30. See also James Q. Wilson, Political Organizations (NY: Basic Books, Inc., 1973), pf. 41.

[362] Proceedings of the Michigan Society of Engineers 1886: 13.

Members approved amendments to the by-laws that doubled the number of required endorsements, from one to two, and raised the membership fee from $2 to $5. In a time when a first-class hotel room could be had for $1.50 per night, this $3 fee hike represented a dramatic increase. The higher fee could effectively price the Society beyond the financial means of many junior engineers and rural surveyors, but the Secretary noted no objections from current members.

Other societies, however, once solidly established became more inclusive rather than less. In Chapter Three I described efforts by the Chicago-based Western Society of Engineers to broaden its scope beyond traditional civil engineering. Similarly, in 1898 members of the Montana Society of Civil Engineers voted to change their organization's name to reflect their desire to appeal to all engineers within the state. The society dropped the word "civil" from its name to indicate that membership in the group was not limited to any particular occupational specialty. The Montana Society had always been open to almost all practicing engineers but, as the lines of demarcation between different engineering specialties became more clearly drawn, members evidently wanted to eliminate the possibility that some potential members would perceive the Society as being more restrictive in its membership policies than was actually the case.[363]

As part of their recruiting efforts, all engineering clubs engaged to some extent in self-aggrandizement. Their assumed role of promoting a higher status for

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[363]Journal of the Association of Engineering Societies Proceedings XX(1898): 313.

engineering demanded that each club's official rhetoric praised the local society for the high quality of its membership. Thus, the literature is rife with declarations that the finest engineers in the country can be counted among the local club's members or that state or municipal officials looked to the local club for guidance in technical matters. How much actual truth lay behind those statements varied, of course, from club to club.

A few clubs may have done more than engage in the conventional hyperbole in attempting to emphasize their own importance, however. The attendance figures for meetings of the Boston Society of Civil Engineers as published in Engineering News and Journal of the Association of Engineering Societies, for example, exhibit an interesting pattern. The numbers published in Engineering News, a trade periodical seen by a much wider audience than the JAES, were consistently double the numbers reported in the Proceedings section of the Journal. The Journal of the Association of Engineering Societies was the official journal for the Boston Society in the 1890s. While it is always dangerous to speculate, one obvious explanation for the difference is that the Boston Society wanted to convince the engineering community overall that the Society was larger and consequently more important than in actual fact. Equally plausible explanations, of course, are that the editor of Engineering News inflated the numbers for reasons of his own; or that the secretary of the Boston Society recorded the data differently for the two publications. The Engineering News number may have counted everyone in attendance, including guests, while the Journal report reflected only the number of full members present at the meetings.

In any event, by the turn of the century a thriving local engineering or polytechnic society could be found in almost all major cities. Even smaller towns, such as Houghton, Michigan, and Phoenixville, Pennsylvania, became home to local technical or engineering clubs if local industry, such as mining, existed to bring more than a handful of engineers to the area. By the turn of the century, membership in at least one engineering organization had become almost *de rigueur* for American engineers entering the profession.

Convincing the Public

Engineers, particularly those specializing in fields such as electrical or mechanical engineering, could easily have failed to win the approbation of the public necessary to be recognized as a profession. It seems clear from the numerous exhortative speeches given by the presidents of the local clubs during the 1880s and 1890s that the engineering elite, e.g., George Morison, J. B. Johnson, and Desmond Fitzgerald, recognized clearly that it was not enough for engineers to reassure each other that they were professionals. They also had to convince the public.

Speaking to members of the St. Louis club in 1892, for example, J. B. Johnson noted that the engineering profession suffered from several "embarrassing external conditions," including "the universal confusion of mind on the part of the general public as between a surveyor and civil engineer, or between a mechanic or mechanical draughtsman and a mechanical engineer, or a mining Superintendent and a mining engineer; or between an electrical mechanic and an electrical engineer."[364] The public clearly had to be educated as to why engineering should be considered distinct from similar trades or skilled crafts. Johnson urged engineers to take an active part in the local society as one of its key roles was to show the public what engineering consisted of and why engineering work deserved the public's respect.

A few months later, Walter P. Rice, retiring president of the Cleveland club, sounded a similar theme when he told members "It is the ignorance of the public which fails to appreciate Engineering merit because it has no understanding of the Profession. . . . Place the information at its command, and the remedy is reached."[365] Engineering societies and individual engineers could employ several different but complementary strategies to teach the public about both the value of engineering and the high level of professionalism of its practitioners. These strategies included publicizing engineering society activities as widely as possible, holding meetings and conventions in a manner that would attract the notice of the general public, and assuming a leadership role in matters of public concern, such as sanitation, rather than simply waiting for city or state officials to solicit technical information. Activities that provided a direct benefit to the

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[364] J. B. Johnson, "The Birth of a Profession," Journal of the Association of Engineering Societies 1892: 78-87.

[365] Journal of the Association of Engineering Societies Proceedings 1893: 374.

members could also serve to educate the public and enlist their support of engineering as learned profession.

Thus, an activity such as the annual convention of the Lake Superior Mining Institute or the Michigan Society of Engineers fulfilled multiple purposes. First, within the meeting hall and on the excursion trains, it provided a space within which engineers reinforced their occupational identities and crafted a professional ideology. As anthropologist Clifford Geertz has noted, the "social structure of a group is strengthened and perpetuated through the ritualization or mythic symbolization of the underlying social values upon which it rests."[366] The paper presentations, question and answer periods, the tours of mines and foundries, even the toasts offered at the closing banquet, all became rituals that reminded participants of who they were and why what they did was important.

Second, the meetings became a potent symbol of emerging engineering professionalism to the general public. In the case of the Lake Superior Mining Institute, the annual meeting rotated among the mining ranges of northern Michigan, Wisconsin, and Minnesota. The descent of several hundred LSMI members on a community told local workers and businessmen alike that a mining engineer was a person of importance, a man of authority. The conventions reminded everyone that when the engineer spoke out on matters relating to mining he was not simply offering his individual opinion, but that the collective authority of a professional community

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[366] Clifford Geertz, The Interpretation of Cultures (New York: Basic Books, 1973), 143.

stood behind him. The local newspapers provided extensive news coverage that, in the tradition of Victorian prose, occasionally waxed excessively fulsome by 1990s standards in praising the accomplishments of LSMI members. Headlines on the front page of the Ironwood [Michigan] Daily Globe, for example, along with the presence of special trains standing on sidings near downtown depots, crowds of respectable-looking men in business suits, and an overall aura of seriousness all informed the general populace that a significant event was occurring. By implication, the engineers and mining officials involved in these proceedings were pillars of the community, men of science and thus worthy of respect and perhaps even deference. Other societies that met on an annual or semi-annual basis also rotated the location of their conventions around the state or region. The New England Water Works Association, the Michigan Society of Engineers, the Indiana Society of Engineers, and others all varied where they met for each meeting.

Similarly, the regular bi-weekly or monthly meetings of local clubs, while held more frequently and with less ostentation than annual conventions, re-inforced the public image of the engineer as an objective, respected professional. Local newspapers, intentionally or otherwise, often served as allies in this endeavor. The official proceedings from various clubs and societies occasionally expressed appreciation of the good coverage from the local press. In St. Louis, for example, for a number of years after the founding of the St. Louis engineers' club the local newspaper printed its meeting minutes in full.[367]

Participation in civic affairs, such as in lobbying for the passage of specific legislation to relieve the problems with nuisance smoke or to promote the development of good roads in rural areas, also served to reinforce the image of the engineer as a professional. While the general public might have questioned the motives of an individual engineer speaking out in favor of a new waterworks plant, the local engineering society could easily deflect accusations of self-promotion. If an individual engineer lobbied for bridge inspection, he could be accused of simply trying to create work for himself. When the engineering society suggested a particular course of action, however, they could disclaim any interest in creating positions for specific engineers. As a society, they could emphasize that their interests coincided with those that any responsible civic group would embrace. As experts in technical matters, they had a professional responsibility to draw attention to potential public health hazards as well as to promote anything that would help society overall, such as good roads to benefit commerce. Just as physicians had a moral responsibility as doctors to warn the public when there was an outbreak of a contagious disease, engineers had a responsibility to the public to advocate improvements in waterworks or sewerage treatment. As professionals, it would be irresponsible for them to wait to be asked to

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[367] See, for example, Journal of the Association of Engineering Societies XXIV(1900): 169 for a discussion of the friendly relationship between the St. Louis club and the press. See also Proceedings of the Michigan Society of Engineers 1892: 178.

investigate certain questions. Prominent engineers argued that by the time the public as a whole recognized the dangers of poor sanitation or excessive smoke, lives would have been lost needlessly and the overall cost to society would be much higher.[368]

When engineering clubs first began lobbying for specific legislation or making recommendations for technical improvements in waterworks or bridges, their advice was generally unsolicited. That is, the clubs decided on their own to investigate the problem and to publicize it. In St. Louis, for example, the club first looked into smoke abatement in 1878, long before city officials recognized it as a problem. Pittsburgh engineers began conducting investigations of water supplies, smoke, and good roads on their own initiative. By the 1890s, however, local and state governments as well as other organizations had started turning to the engineering clubs for advice. As noted in Chapter 4, in St. Louis the municipal assembly asked the Engineers Club of St. Louis to undertake a comprehensive examination of the smoke problem and then used the report the club compiled as the basis for new city ordinances. In Pittsburgh the local Chamber of Commerce asked the Engineers' Society to assist them with similar investigations. Within a remarkably short period of time, local and state engineers' societies succeeded in convincing most municipal and state officials of the societies' objectivity and professionalism. As Schultz and McShane have noted, by the mid-1890s engineers were serving as role models for reforms in city management.

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[368] See, for example, Robert Gilham, "Work for Our Engineers' Club," Journal of the Association of Engineering Societies XII(1893): 305-313.

Finally, books and magazine articles written by practicing or retired engineers and aimed at the general public reinforced efforts by local engineering clubs to elevate the status of the profession. These books often enjoyed brisk sales and wide circulation, such as Henry Frith's The Romance of Engineering (1892) and J. W. C. Haldane's Civil and Mechanical Engineering: Popularly and Socially Considered (1890), even as they reiterated the engineers' sentiment that the public did not understand engineering. Haldane, for example, suggests that while "People generally seem to have a pretty fair knowledge of the legal and medical professions. . . they also possess, so far as can be learned, somewhat limited ideas concerning the education and inner life of the engineer, . . ."[369]

Many of these books followed a now familiar pattern. These early explications of engineering were often biographical in nature. In his 1892 narrative, The Romance of Engineering, for example, Frith alternated expositions of the triumphs of engineering -- the steam engine, the ocean liner -- with reminisces about his own career, a career which began with a humble apprenticeship in a machine shop and eventually led to a position of responsibility. For Frith the "romance" of engineering lay in "the means in the past which secured the civilization of the present."[370] In an era where new technical marvels appeared on almost a daily basis, books such as Frith's found a receptive audience as they extolled the rewards of an engineering career. Both personal

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[369] Haldane, 1.

[370] Henry Frith, The Romance of Engineering (London: Ward, Locke, Bowden and Co., 1892), 2.

reminisces and biographies sold well to the general public. William Conant Church's The Life of John Ericsson, a biography of the then well-known but now almost forgotten designer of the iron-clad ship *Monitor*, enjoyed wide sales and was reprinted several times between 1890 and 1910. Ericsson's life, at least as presented by his biographer, embodied the popular image of the successful engineer. A Swedish immigrant, Ericsson rose from humble origins to an influential position as a naval architect. Church emphasized Ericsson's invention at the age of scarcely twenty-one of a new type of "flame engine"[371] and noted that within a few years Ericsson had secured more than thirty patents. These patents evidenced only a small part of Ericsson's ingenuity, however, as he often neglected to protect his intellectual property rights.[372] Ambitious but not materialistic, Ericsson as portrayed by Church was the archetypical hero who worked to advance civilization, not to line his own pockets.

Some authors, such as Haldane, cited the construction of Roman aqueducts or Egyptian temples when they proposed that engineering was among the world's oldest professions while trying to elevate the engineer to the status of hero. Haldane praised the engineer as an agent for technological progress and the rise of civilization. For these authors, "The engineer makes the desert bloom and the bowels of the earth give

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[371] William Conant Church, The Life of John Ericsson, Vol. I and II. (New York: Charles Scribner's Sons, 1906 [1890].) 35. One of Ericsson's on-going projects involved the perfection of this "flame engine," a device which utilized super heated air to turn a turbine rather than steam. Ericsson succeeded in building working models, but never perfected the engine to the point where it would have been commercially viable.

[372] Church, 261.

up their treasures."[373] Authors like Haldane started by cataloging irrigation systems in Mesopotamia, then described the pyramids, Roman aqueducts, Medieval cathedrals, and so on until concluding with the most recent technical developments at the time of publication. Histories of this type written in the nineteenth century praised major figures such as John Smeaton and concluded with descriptions of steamships or suspension bridges. In addition, working engineers did not hesitate to cooperate with periodicals such as Popular Mechanics and Scientific American. As noted in Chapter One, the American public proved to be avid readers of articles detailing developments in engineering, such as the construction of the Brooklyn Bridge or efforts to build a Panama Canal.[374]

By the late nineteenth century the image of the engineer as hero became widespread in popular culture. Genres of fiction, such as romance novels, that had once featured a doctor or clergyman as the hero began presenting engineers as paladins. Utopian novels, such as Edward Bellamy's Looking Backward, 2000-1887,

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[373] Rapport and Wright, xiii.

[374] See Footnote 54. The tradition in popularizing engineering continues into the twentieth century with laudatory histories that include individuals such as Vannevar Bush and conclude with the space program and computer chips. See, for example, J. W. C. Haldane, Civil and Mechanical Engineering: Popularly and Socially Considered, 2nd edition (London: E. & F. N. Spon, 1890); David P. Billington, The Tower and the Bridge (New York: Basic Books, Inc., 1983); Richard Shelton Kirby and others, Engineering in History (New York: McGraw-Hill Book Company, Inc., 1956); Ernest McCullough, Engineering as a Vocation (New York: David Williams Company, 1911); William T. O'Dea, The Meaning of Engineering (London: The Scientific Book Club, 1961); or Norman Smith, Man and Water: A History of Hydro-Technology (New York: Charles Scribner's Sons, 1975).

posited futures in which science had solved mankind's problems and skilled technical experts managed society. Bellamy's book went through multiple editions and inspired the formation of hundreds of local clubs intent on making his vision a reality. Popular writers such as Bellamy were not alone in advocating placing experts in charge of production and increasing government control over society. Political economist Thorstein Veblen praised engineers as members of the industrious class because Veblen believed the engineer cared more for his work than for status or profit. Veblen's writings, like Bellamy's, inspired the formation of local discussion groups and clubs intent on implementing Veblen's ideas in the early 1900s, and later influenced the Technocrat movement of the 1920s. Other scholars, such as J.G. Schurman, president of Cornell University, lauded engineers as ranking equally "with scholars, with the men who practice the learned professions."[375]

Within a few years the engineers' efforts to educate the public and to elevate the profession had worked so well that to the average citizen, "the scientist was not the man of the laboratory, but the man who built the bridges and brought development to the land."[376] According to John Matthew Jordan, by 1909 engineering had become a

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[375] Remarks of J. G.Schurman quoted in Proceedings of American Society of Engineers 23(1897): 538-40. See also Cowan, A Social History, 209-13; Howard Segal, Technological Utopianism in American Thought (Chicago: University of Chicago Press, 1985); and Donald R. Stabile, "Veblen and the Political Economy of the Engineer: The Radical Thinker and Engineering Leaders Came to Technocratic Ideas at the Same Time," American Journal of Economics and Sociology 45(1986): 41-52.

[376] Jordan, 4.

paradigm of professionalism.[377] As Ticchi and others have shown, engineers replaced doctors and clergymen as heroes in popular fiction. The fact that for most engineers the on-the-job realities of the occupation no longer matched the mythic imagery presented in novels was, as Sinclair has noted, irrelevant.[378] The engineering profession succeeded so thoroughly in elevating the status of the occupation that for many years the very title "engineer" was imbued with sufficiently high status that additional recognition would have been superfluous. Howard Becker's study of engineering students noted that as recently as the 1960s "The ideology tells them that anyone called 'engineer' has learned to reason so rationally and effectively that. . . it operates in any line of endeavor."[379] Indeed, until quite recently engineering culture tended to produce professionals who were a curious blend of arrogance and humility, persons who believed the profession as a whole could do anything but who shunned the limelight as individuals.[380]

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[377] See Jordan, 61. Cf. Schultz and McShane.

[378] Sinclair, "Inventing."

[379] Howard S. Becker and James Carper, "Professional identification," 101-109 in Howard M. Vollmer and Donald L. Mills, eds., Professionalization (Englewood Cliffs, NJ: Prentice-Hall, 1966).

[380] For a fuller description of how groups form subcultures and inculcate values in members see, for example, Howard S. Becker, Outsiders: Studies in the Sociology of Deviance (New York: The Free Press, 1973); or Hunter S. Thompson, Hell's Angels (New York: Ballantine, 1967).

Conclusions

In looking at why engineers established local clubs, it may be useful to review briefly general theories as to why any person chooses to associate with a voluntary organization. As noted in Chapter One, organization theorists have proposed four general motivations for why people join and remain in voluntary associations: material, general solidary, specific solidary,and purposive. That is, people join groups because they expect to get something in return for their involvement, they want to associate with a general class of people, they want to associate with specific friends, or they wish to support the goals the group promotes. In real life, of course, the reasons for voluntary associations usually involve a complex mixture of all four factors.

In addition, anthropologists and sociologists have long agreed that participation in group activities and established rituals help re-affirm a person's identity and proper place in society. Our individual identities are derived from cultural meanings and community memberships. Our definitions of the situation become tautological as we depend on how we perceive others perceiving us. As Clifford Geertz notes in describing the theoretical framework for the social-psychological approach, the "social structure of a group is strengthened and perpetuated through the ritualization or mythic symbolization of the underlying social values upon which it rests."[381] What we see in

[381] Clifford Geertz, The Interpretation of Cultures (NY: Basic Books, 1973), 143. See also Herbert Blumer, Symbolic Interactionism: Perspective and Method (Englewood Cliffs, NJ: Prentic Hall, 1969); Kathy Chamarz,"Identity dilemmas of chronically ill men," pp. 35-62 in Strauss and Corbin; or Sally Falk Moore and Barbara G. Myerhoff, editors, Symbol and Politics in Communal Ideology (Ithaca: Cornell University Press, 1975).

the organization and growth of local engineering clubs during the Gilded Age is the establishment of both the values and rituals that have informed the engineering profession for the past hundred years. Engineering clubs built boundaries around engineering and in doing so created an engineering culture that defined not only professional competence, i.e., who was qualified to be recognized as an engineer, but also the ancillary characteristics, e.g., conservative and self-effacing, of the practitioners.

Although the engineers involved in local engineering clubs often cited the desire to come together simply to listen to technical reports as a reason to organize local engineering clubs, this is a rationale that breaks down under close examination. At the time engineers began to found local clubs, states and even city academies of science existed that actively encouraged the discussion of topics related to engineering. Engineers did not need a totally separate venue to discuss bridge designs, waterworks construction, or steam boiler safety. As both Bates and Smith have documented, academies of sciences existed in most metropolitan areas prior to the Civil War. In New York City, for example, the New York Academy of Science sponsored a technical section devoted to what we would now consider primarily engineering topics. In Philadelphia the Franklin Institute had supported discussion of research in "the practical arts" since its founding in 1824. Proclamations by engineering club organizers that a local or national engineering society was necessary for the proper dissemination of technological knowledge ring rather hollow given the wide availability of alternatives to strictly engineering organizations.

What engineers did need was a social space in which they could craft an identity distinct from that of either pure scientists or pure technicians. Once they had that space established, American engineers could use it as a platform from which they could convince the general public to accept the validity of the professional identity they had crafted. Statements made by various leading engineers of the nineteenth century indicate that they recognized clearly both that many of their fellow engineers shared a desire for a distinct, professional identity and that engineering societies could help to obtain that identity. When John B. Jervis, Alfred Noble, William Metcalf, and other prominent engineers advocated the creation of local and national engineering societies, they were doing so not just to encourage the dissemination of engineering knowledge but also, and more importantly, to promote the advancement of engineering as a profession. This promotion of the advancement of engineering formed an explicit, stated goal for most of the nascent clubs and societies. In many cases, the first sentence in the statement of purpose for a new engineering club would read "the object for which [this society] is formed is the advancement of engineering knowledge and practice, and the maintenance of a high professional standard among its members."[382]

In an attempt to attain the status of professionals, engineers and engineering societies engaged in a variety of activities, as described in preceding sections in this

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[382] Certificate of Incorporation of the Washington Society of Engineers, WSE Collection.

chapter. They publicized their regular meetings and their conventions. They encouraged the publication of books and magazine articles that would help the public understand how thoroughly honest and reliable, i.e., how totally professional, the typical engineer was. As noted in preceding sections, their comments comparing engineering to the learned professions, e.g., medicine, helped establish a definition of engineering practice as having standards which set it apart from local politics or mundane profit motives. Just as physicians were increasingly being held accountable for the public's well-being, so too did engineers answer to a higher standard than a client's whims. Thus, leaders of engineering societies formed committees and special commissions to investigate problems they believed needed to be resolved in the interest of public good. Recommendations by local engineering clubs led to changes and reforms in municipal and state regulations. The local, state, and regional societies established highly visible profiles as civic-minded and politically active interest groups. Having succeeded in achieving this very visible identity, however, engineers clubs then became constrained by the role expectations embodied in the ideal of professionalism. They became ensnared by what might be termed professionalism's double bind.

The paradox of professionalism is, of course, that despite having used political activism as a tool to gain the sanction of the community and be recognized as professionals once a profession is recognized as such, the ideals of professionalism mandate that it must forego any further participation in political discourse. The ideal professional is rational, detached, and completely objective. Professionals do not make policy; they implement it. Within their own narrow range of expertise, professionals may speak out, but do so rarely. Within engineering, for example, the same ideology that serves to reinforce professional identities also reinforces the belief that the most effective way a professional engineer can serve society is by simply doing his or her job to the best of his or her ability.[383] Occasional disclaimers to the contrary by would-be reformers such as Morris Cooke could not prevail over both an occupational ideology and a public belief system that together encouraged typical engineers to believe their primary responsibility was to their profession and fellow engineers.[384] At the same time, because professionals are widely recognized as experts, there remains an expectation on the part of certain segments of the populace, or by certain individuals and social critics, that professionals and professional societies have an ethical obligation to engage actively in politics. The double bind goes unrecognized.

By the turn of the century the image of the engineer as a professional had gained wide currency. Young men entering the profession did so with much clearer role definitions and expectations than their predecessors of only one or two decades previously. The need to use local engineering clubs as a way to help engineers to embrace a new identity faded and many of the clubs assumed a more social aspect. Technical lectures and papers remained prominent features for the clubs, but other

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[383] See, for example, William McClellan, "Remarks of President-Elect," Journal of the American Institute of Electrical Engineers 40(1921): 531-2. McClellan spoke at length regarding engineers' responsibilities to the public, but emphasized it was their technical skills that the public relied upon.

[384] See Jordan or Layton for a discussion of Morris Cooke.

activities, including more excursions to which "the ladies" were invited, became common. In 1914 a writer for Engineering Record, in a description of a kite-flying outing sponsored by the Technical Society of the Pacific Coast for members and female guests, noted that the social aspect of local clubs was becoming increasingly apparent as different organizations sponsored similar picnics and other more relaxed gatherings.[385] The sense of urgency that had gripped the new societies in the 1880s and early 1890s had long since faded. The societies were well-established and respected, just as engineering as a profession was well-established and respected.

At the same time, increasing numbers of engineers joined local engineering clubs as well as the national societies without bothering to take a very active role in the internal affairs of the organizations. In almost every instance, the local clubs began with extremely high percentages of their members attending every meeting. As time passed, the overall membership rolls grew, but the numbers attending the meetings remained steady. That is, a club with a membership of one hundred men in 1885 might have an average meeting attendance of fifty members, or fifty percent. Ten years later, the membership roll might have tripled to three hundred, but meeting attendance was still hovering around fifty members, or only sixteen percent. Figure 5 on the following page, which uses data from the Engineers' Society of Western Pennsylvania, illustrates this trend. As noted above, engineers increasingly entered the profession with a clear sense of what an engineer was. They no longer needed to actively participate in an

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[385] Anonymous, "Social features in local societies," Engineering Record 69(1914): 573-574.

engineering club to reinforce that professional identity. They still enjoyed the benefits of belonging, such as using the club's library or attending the annual banquet, but more

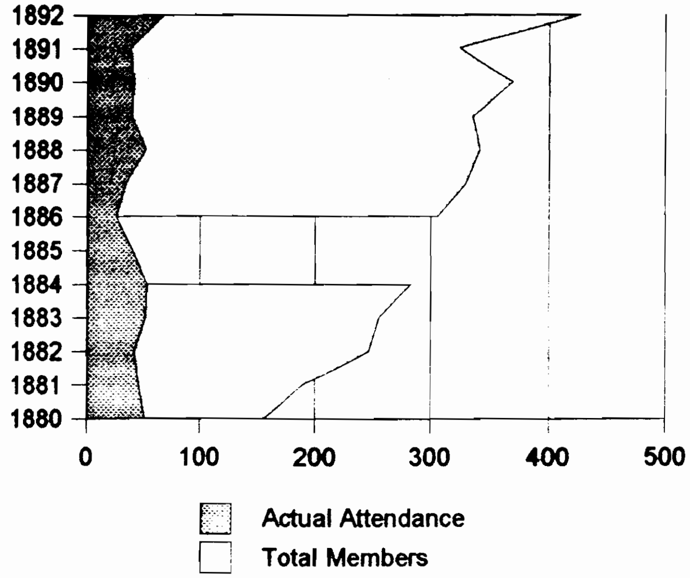

Figure 5. Attendance at Western Pennsylvania meetings

and more members were content to take a passive role in society affairs. This quiescence struck some engineering societies earlier than others, but by the early 1900s leaders had begun to worry about the lack of participation in meetings by younger members, as well as commenting on the diminishing interest in public affairs by the society as a whole. In Philadelphia, for example, as noted in Chapter 3, by 1914 the society's president was lamenting the lack of involvement by the society in civic affairs.

He noted that before the turn of the century the club had been active in a variety of legislative issues, including good roads and clean water, but had done nothing noteworthy in recent years.[386]

The reason clubs had grown quiescent was, of course, that they could afford to. They no longer needed to convince the public of anything. Even if a few members still believed that their local engineering society should assume activist positions, those members were becoming a minority. For example, as described in greater detail in Chapter 3 in discussing local society activities, members of the Washington Society of Engineers who attempted to get the WSE to take a definite position on a variety of public policy issues, ranging from municipal ownership of street railways to war preparedness, met with little success. Similarly, as noted above, while older members of the Engineers Club of Philadelphia wondered aloud why the club no longer took an active interest in civic affairs, younger engineers seemed content to leave policy questions to politicians.

The profession had, after all, carefully crafted an occupational ideology that portrayed the ideal engineer as a dispassionate, rational, and humble man of science who avoided political involvement like the plague. Sociologists have suggested that people tend to select occupations that reflect the values they already espouse. That is, once an occupation has a clear identity or set of values and norms associated with it, it

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[386] Taylor.

will attract persons who are already in agreement with those values.[387] If, as in the case of engineering, that professional identity is one of a practitioner who is self-effacing, conservative, and non-political, inevitably the occupation's ideology will be reinforced in a way that early leaders of the profession, such as Chanute and Jervis, neither anticipated nor desired. Where leaders of engineering societies in the 1880s and 1890s would avow strenuously that engineers and engineering were strictly non-political while at the same time being thoroughly embroiled in politics, after the turn of the century when an engineering society said it was non-political, it meant it. Younger engineers coming into the profession arrived with a set of expectations that included engineers steering clear of political entanglements. The declarations of non-involvement became a self-fulfilling prophecy. Thus, by 1910, engineering organizations were more likely to resemble the highly conservative Washington Society of Engineers, which consistently rejected any efforts on the part of members to insert

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[387] For example, recent research investigating why women are not entering engineering in the numbers hoped for by educators found that many high school students, men and women alike, perceived engineering as being too cold and pragmatic with minimal intrinsic rewards. See Lisa M. Frehill, "Education and occupational sex segregation: the decision to major in engineering," Sociological Quarterly 38(1997): 225-49. See also R. R. Bennett, "Becoming blue: a longitudinal study of police recruit occupational socialization," Journal of Police Science and Administration 12(March 1984): 47-58; Judith Bridges, "College females' perceptions of adult roles and occupational fields for women," Sex Roles 16(1987): 591-604; J. Gregg Robinson and Judith McIlwee, "Men, women, and the culture of engineering," Sociological Quarterly 32(1991): 403-21; William W. Snizek and L. Mayer, "Cosmopolitanism and localism among undergraduate college students: a study in anticipatory socialization," Acta Sociologica 27(March 1984): 19-29; or Jon E. Walker, Curt Tausky, and Donna Oliver, "Men and women at work: similarities and differences in work values within occupational groupings," Journal of Vocational Behavior 21(1982): 17-36.

the society into public affairs, than the Engineering Society of Milwaukee.[388] The latter, possibly because of the progressive tradition of the city where it was based, took an active interest in civic affairs much longer than most other local and state engineering societies.

The disengagement from political discourse on either a local or national level was an outcome the engineers of the Gilded Age could not anticipate when they began their drive to professionalize their chosen occupation. Engineers such as Fteley, Fitzgerald, Metcalf, and Berzenberg probably assumed that the recognition of engineering as a learned profession would result in engineers in general exerting more influence on the political process, not less. They all believed that engineers were ideally suited to provide leadership in a wide variety of arenas. Ironically, they succeeded too well in organizing engineering societies and clubs. Engineering gained the status it desired, but in doing so lost the motivation to exploit it. Rather than building on their achievements, many engineering clubs slid into complacency. They were content to devolve into primarily social clubs interested solely in topics internal to engineering. At the turn of the century, the American engineer was a hero to the public. Whether the engineer could have remained one had the profession chosen to lobby actively in areas less dramatic and clear-cut than city sanitation or smoke abatement is a question that

[388] See, for example, Minutes of the WSE, 1916, for a report on the Board of Directors' adamant refusal to follow up on suggestions that the WSE state a position on national preparedness in case the United States entered World War I.

cannot be answered. For one brief period in history engineering was positioned to challenge the paradox of professionalism, and it allowed that opportunity to slip away.

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Worster, Donald. Rivers of Empire. New York: Oxford University Press, 1992[1985].

Zald, Mayer N. Organizational Change: The Political Economy of the YMCA. Chicago: University of Chicago Press, 1970.

Curriculum Vitae

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Education:
Ph.D. in Science and Technology Studies, December 1997
Virginia Polytechnic Institute & State University, Blacksburg, Virginia
Dissertation: "Brothers Professionally and Socially: The Rise of Local Engineering Clubs During The Gilded Age"
Dissertation director: Richard F. Hirsh

M.S. in Science and Technology Studies, May 1990
Virginia Polytechnic Institute & State University
Master's thesis: "Technological Innovation in Forest Harvesting"
Master's advisor: Joseph C. Pitt
B.S. (magna cum laude) in Social Science with a Science, Technology, and Society option, May 1988, Michigan Technological University, Houghton, Michigan
A.S., May 1986, Gogegic Community College, Ironwood, Michigan

Selected Academic Honors and Awards:
1993 -- Society for the History of Technology Travel Scholarship; 1992 -- Society for the History of Technology Travel Scholarship; 1992 -- Virginia Social Science Association Graduate Student Essay Award; 1991 -- Smithsonian Institution Predoctoral Research Fellowship; 1991 -- Sigma Xi Research Award; 1990 -- Graduate Student Assembly Travel Scholarship; 1990 -- History of Science Society Travel Scholarship; 1990 -- Society for Industrial Archeology Travel Scholarship; 1989 -- Graduate Student Assembly Travel Scholarship; 1988 -- Outstanding Senior in Social Science; 1988 -- Phi Kappa Phi Honor Society; 1988 -- Lakehead Pipeline Company Scholarship; 1988 -- George A. Robbe Memorial Scholarship

Employment History:
Instructor (March 1997-), Department of Social Sciences, Michigan Technological University, Houghton, Michigan
Consultant (1994-) Walking Into the Past: Industrial Heritage Tours and Historic Preservation, L'Anse, Michigan
Instructor (Winter Term 1994-95), Department of Social Sciences, Michigan Technological University, Houghton, Michigan

Predoctoral Research Fellow (1992-93), Division of Engineering and Technology, National Museum of American History, Smithsonian Institution, Washington, DC
Graduate Assistant (1988-93), Science and Technology Studies Graduate Program, VPI&SU. Assignments included two years in the Department of Sociology (1988-89, 1990), one year in History (1989-90), and one semester in Humanities (1991).
Instructor (Fall Term 1991), Department of Social Sciences, Michigan Technological University, Houghton, Michigan
Researcher (1990), The Winthrop Group, Boston, Massachusetts. Assisted Richard F. Hirsh with research being performed on a consulting basis.
Historian (Summer 1989, Summer 1990), Historic American Engineering Record, Skagit Power Development, National Park Service, United States Department of the Interior
Student Assistant (1986-88), Instructional Resource Services, Michigan Technological University
Various other jobs (1966-85), including hotel maid, sports reporter, sales analyst, and dash waxer in a carwash.

Teaching Experience:
SS131: Contemporary Society, Spring 1997, Fall 1997, Michigan Technological University
SS161: Introduction to Science, Technology and Society, Winter 1994, Fall 1997, Michigan Technological University
SS232: Government, Science and Technology, Fall 1991, Michigan Technological University
HUM4304: Special Topics in Humanities, Science and Technology: Scientific Literacy, Spring 1991, Virginia Polytechnic Institute & State University

Publications:
"More to the picture than meets the eye? Edward Wegmann's use of illustrations in The Design and Construction of Dams." Virginia Social Science Journal 1993.
"If a tree falls in the forest: a refutation of technological determinism." Research in Philosophy and Technology 1992.
"Seattle City Light's Constant-Angle Arch Dam at Diablo Canyon." IA: Journal of the Society for Industrial Archeology 1991.
"Sawdust in the wind: a brief history of Tama Siding." Michigan History Sep/Oct 1991.
HAER WA-24: The Skagit Power Development, Historic American Engineering Record Division of the National Park Service, United States Department of the Interior, 1990.
"Nobody knows who we are: a participant-observer study of an agricultural engineering seminar." Proceedings of the 17th Annual AKD Sociological Research Symposium, Fall 1989.

Other Publications (Reference Works and Educational):
"Beaver Wars, 1642-1688," and "Presidency of Warren G. Harding." Both in Encyclopedia of North American History. Pasadena, CA: Salem Press, Inc. In press for 1997.
"Henny, David Christian," "Kirkwood, James Pugh," and "Stone, Charles Augustus and Edwin Sibley Webster." All in American National Biography. Oxford: Oxford University Press. In press for 1998.
"Stealth technology." In Magill's Survey of Science: Applied Science, Supplement. Pasadena, CA: Salem Press, Inc. In press for 1997.
"Buffon, Georges Louis Leclerc, Comte de," and " Cuvier, Georges Léopold Chrétien." Both in The Biographical Encyclopedia of Science. Pasadena, CA: Marshall Cavendish Corporation. In press for 1997.
"Open Pit Mining," "U.S. Coast and Geodetic Service," "Forest Service, U.S.," "Forests," "Hydroenergy," "Clear-cutting," "Slash-and-burn agriculture," "Reforestation," and "Federal Energy Regulatory Commission." All in Natural Resources. Pasadena, CA: Salem Press, Inc. In press for 1997.
"Housing discrimination," and "Workers, rights of." Both in Ready Reference: Civil Rights. Pasadena, CA: Magill Publishing, Inc. In press for 1997.
"Jacques Ellul," "Big Bill Haywood," "Public utilities." All in The Encyclopedia of Propaganda. Pasadena, CA: Salem Press. In press for 1997.
"Finland declares independence." Great Events from History: European Series, Revised Edition. Pasadena, CA: Salem Press, 1996.
"Global Positioning System" and "Tethered Satellite Systems." Both in USA in Space. Pasadena, CA: Salem Press, 1996.
"Drug education," "Lincoln Steffens," "Performance art," and "Prostitution, depictions of." All in Ready Reference: Censorship. Pasadena, CA: Salem Press, 1996.
"Welfare system and reform;" "Creationism and evolution teaching;" "Ergonomics;" "Underemployment;" "Blue-collar workers;" "Corporate culture;" "Labor and the job market;" "Employment benefits;" "Militia movement;" "Hiring practices," "Nursing homes;" "Earned income tax credit;" "Rural poverty;" "Agricultural subsidies;" and "Property rights." All in John K. Roth, editor, The Encyclopedia of Social Issues. New York: Marshall Cavendish Corp., 1997.
"Hip fracture repair," and "Occupational health." Magill's Medical Guide: Health and Illness, Supplement. Pasadena, CA: Salem Press, Inc, 1996.
"1923: Federal Power Commission disallows Kings River dams;" "1943: Sierra Club opposes repeal of the Antiquities Act;" "1969: Sierra Club blocks dams on the Colorado River;" "1972: Oregon enacts the first U.S. bottle bill;" "1977: Researchers develop an integrated solar energy system;" "1978: Public Utilities Regulatory Policies Act promotes renewable energy;" all in Great Events from History II: Ecology and the Environment. Pasadena, CA: Salem Press, Inc., 1995.
"1952: Electronic amplifiers as hearing aids are invented;" "1970: Philips introduces the videocassette recorder (vcr), which is put on the market in April 1972;" and "1985:

Norwegians begin construction of the first reactor to use wave energy," all in The Twentieth Century: Scientific Breakthroughs. Los Angeles: Magill Press, Inc., 1993.
"Dairies," "Flood Control," "Logging," "Silviculture," and "Video Recording," in Frank Magill, ed., Magill's Survey of Science: Applied Science, Los Angeles: Magill Press, Inc., 1993.
Six chapters of multiple choice questions in William E. Snizek, Testbook to Accompany Allan G. Johnson, Human Arrangements, 3rd edition. Fort Worth, TX: Harcourt Brace Jovanovich College Publishers, 1992.
"1924: Zworykin develops an early type of television;" "1925: Vannevar Bush and coworkers develop the first analog computer;" and "1959: Grace Hopper invents COBOL," in Frank N. Magill, ed., Great Events from History II: Science and Technology. Los Angeles: Salem Press, Inc., 1991.
Seven chapters of multiple choice questions in William E. Snizek, Test Bank to Accompany Light/Keller/Calhoun Sociology Fifth Edition. New York: Mc-Graw-Hill, 1989.

Works in Progress:
"From cant hooks to hydraulic tongs: mechanization in forest harvesting in the United States 1879-1964." Publication pending.
"Never too old to learn: the Lake Superior Mining Institute." In review.
"Last gasp of Progressivism? The Federal Water Power Act of 1920." In review.

Grants obtained:
Michigan Council for Arts and Cultural Affairs: "A Celebration of Traditional Fiber Arts." Application written for Herman Historical Society, Spring 1994.

Sessions organized:
"Industrial forestry in the twentieth century: some cross-cultural comparisons." Society for the History of Technology Annual Meeting, Uppsala, Sweden, August 1992.

Sessions chaired:
"Professional practice." Annual meeting of the Society for Industrial Archeology, Houghton, Michigan, May 1997.

Exhibits directed:
"Quilts and other comforts: a celebration of traditional needle arts." Herman Historical Society, L'Anse, MI. June 1994.

Selected presentations:
"The Lake Superior Mining Institute." Annual meeting of the Society for Industrial Archeology, Houghton, Michigan, May 1997

"Too low, too slow, and too late: Bill Lear's plastic airplane." Thursday Lunch Seminar Series, Center for the Study of Science in Society, Virginia Polytechnic Institute and State University, March 27, 1997

"Brothers socially and professionally: the rise of local engineering clubs during the Gilded Age," Wednesday Seminar Series, Center for the Study of Science in Society, Virginia Polytechnic Institute and State University, January 15, 1997

"Local engineering clubs and public health during the Gilded Age." INTERFACE '96, Marietta, Georgia, October 16-17, 1996.

With Tamar A. Männikkö. "Railroad logging in Michigan's Upper Peninsula: Tämä Siding." Annual meeting of the Society for Industrial Archeology, Sacramento, California, May 1996.

"Brothers professionally and socially: the role of local engineering clubs in America, 1860-1930." Annual meeting of Society for the History of Technology, Charlottesville, VA, October 1995.

"Engineering ideology and professional community: the Washington Society of Engineers, 1906-1965." Annual meeting of the Missouri Valley History Conference, Omaha, NE, March 1995.

"Change and continuity: the metamorphosis of a Women's Extension Club." Annual meeting of the Midwest Sociological Society, St. Louis, MO, March 1994.

"In search of 'zero discharge': pulpmill politics on the Great Lakes." Annual meeting of the Midwest Sociological Society, Chicago, IL, April 1993.

With Sue Hagedorn. "Juvenile fiction and technophobia." National Association for Science, Technology & Society Technological Literacy Conference, Arlington, VA, January 1993.

"Looking for the typical engineer: the Washington Society of Engineers, 1906-1976." Thursday Seminar Series, Center for the Study of Science in Society, Virginia Polytechnic Institute & State University, October 29, 1992.

"More to the picture than meets the eye? Edward Wegmann's use of illustrations in The Design and Construction of Dams." Tuesday Colloquium, National Museum of American History, Washington, DC, October 6, 1992.

"In search of 'zero discharge': pulpmill politics on the Great Lakes." Society for the History of Technology Annual Meeting Uppsala, Sweden, August 1992.

"In search of zero discharge: politics, pulpmills, and pollution." Virginia Social Science Association Annual Meeting, Fredericksburg, VA, March 1992.

"Hydroelectricity and regulation through negotiation: the Federal Water Power Act of 1920." Society for the Social Studies of Science Annual Meeting, Cambridge, MA, November 1991.

"Regulating the water wheels: hydroelectricity and the Federal Power Commission in the 1920s." American Society for Environmental History Conference on the Environment and the Mechanized World, Houston, TX, March 1991.

"Arch vs gravity: competing choices in civil engineering and dam design." 7th Annual Graduate Research Symposium, Virginia Polytechnic Institute & State University, March 1991.

"From an art to a science: the evolution of applied mathematics in civil engineering and arch dam design." History of Science Society Annual Meeting, Seattle, WA, October 1990.

"Beauty and utility hand in hand: Lars Jorgensen, the Constant Angle Arch Dam, and Seattle City Light." Society for Industrial Archeology Annual Meeting, Philadelphia, PA, June 1990.

"Beauty and utility hand in hand: James Dalmage Ross and the selling of the Skagit Hydroelectric Project to the people of Seattle," 6th Annual Graduate Research Symposium, Virginia Polytechnic Institute & State University, October 1989.

"From cant hooks to hydraulic tongs: invention and innovation in forest harvesting." Society for the History of Technology Annual Meeting, Sacramento, CA, October 1989.

"Nobody knows who we are: an observer-participant study of an agricultural engineering seminar," 17th Annual AKD Sociological Research Symposium, Greenville, North Carolina, February 1989.

"A multiple-career line analysis of past presidents of the American Society of Civil Engineers," Sigma XI Interdiscplinary Research Colloquium, Houghton, Michigan, April 1988.

Research interests:
Organization theory
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Professional Associations:
History of Science Society, Humanities & Technology Association, Michigan Historical Society, Midwest Sociological Society, Society, Society for the History of Technology, Society for Industrial Archeology, Society for Philosophy and Technology, Society for the Study of Social Problems

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